Luminant

Kincaid 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: Kincaid Power Plant Ash Pond; IEPA ID # W0218140002-01

Dear Mr. LeCrone:

In accordance with 35 I.A.C. § 845.200, Kincaid Generation, LLC is submitting an operating permit application for the Kincaid Power Plant Ash Pond (IEPA ID # W0218140002-01). One hardcopy and one digital copy are provided with this submittal.

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

Sincerely,

Cynthia Vodopivec
SVP-Environmental Health and Safety

Enclosures

Prepared for

Kincaid Generation, LLC
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

INITIAL OPERATING PERMIT

KINCAID POWER PLANT ASH POND

Prepared by

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

October 25, 2021

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1. INTRODUCTION

Kincaid Generation, LLC is operator of the coal-fired Kincaid Power Plant (Plant) located in Christian County near Kincaid, Illinois. The IEPA assigned identification number assigned to the Kincaid Ash Pond is: W0218140002-01. The National Inventory of Dams (NID) number assigned for the Kincaid Ash Pond by the Illinois Department of Natural Resources (IDNR) is IL50706.

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

This initial operating permit application is for the Ash Pond.

1.1. Facility Information

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

Facility:	Kincaid Ash Pond Kincaid Power Plant 10901 Baldwin Road Kincaid, IL 62540
Owner/Operator:	Kincaid 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 Kincaid 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 Kincaid 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.*

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

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

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

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

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

2.2. History of Construction

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

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

2.3. Chemical Constituents

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

An analysis of the chemical constituents found within the CCR placed within the Kincaid Ash Pond is provided in Attachment C.

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

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

2.4. Location Standards Demonstration

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

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

Section 845.230(d)(2)(D)(i): Placement Above the Uppermost Aquifer;

The previous upper aquifer demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.60. The requirements described in 40 C.F.R. § 257.60 are identical to the requirements contained in Section 845.300. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed upper aquifer demonstration is included in Attachment D1.

Section 845.230(d)(2)(D)(ii): Wetlands;

The previous wetlands demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.61. The requirements described in 40 C.F.R. § 257.61 are identical to the requirements contained in Section 845.310. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed wetlands demonstration is included in Attachment D2.

Section 845.230(d)(2)(D)(iii): Fault Areas;

The previous fault area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.62. The requirements described in 40 C.F.R. § 257.62 are identical to the requirements contained in Section 845.320. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed fault area demonstration is included in Attachment D3.

Section 845.230(d)(2)(D)(iv): Seismic Impact Zone; and

The previous seismic impact zone demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.63. The requirements described in 40 C.F.R. § 257.63 are identical to the requirements contained in Section 845.330. Pursuant to Section 845.210(d)(2), a certification is not required for this demonstration. The previously completed seismic impact zone demonstration is included in Attachment D4.

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

The previous unstable area demonstration was certified by a qualified professional engineer stating that the demonstration meets the requirements of 40 C.F.R. § 257.64. The requirements described in 40 C.F.R. § 257.64 are identical to the requirements contained in Section 845.340. Pursuant to Section 845.210(d)(2), a certification is not required for the unstable area demonstration. The previously completed unstable area demonstration is included in Attachment D5.

The boundaries of the impoundment were determined by a survey conducted by a professional surveyor licensed in the State of Illinois. The boundaries of the Bottom Ash Pond were compared to the existing FEMA floodplain map, and it was determined that the Bottom Ash Pond is not located within the floodplain. A certification attesting to this is provided in Attachment D5.

2.5. Permanent Markers

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

Evidence of permanent markers at the Kincaid Ash Pond as required by Section 845.130 is provided in Attachment E.

2.6. Slope Maintenance

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

The Kincaid Ash Pond is not incised. Documentation of slope protection as required by Section 845.430 is provided in Attachment J.

2.7. Initial Emergency Action Plan

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

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

2.8. Fugitive Dust Control Plan

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

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

2.9. Groundwater Monitoring

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

The groundwater monitoring information for the Kincaid Ash Pond are described in the following sections.

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

Hydrogeologic site characterization for the Kincaid Ash Pond is provided in Attachment H.

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

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

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

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

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

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

2.10. Initial Post-Closure Care Plan

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

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

2.11. History of Groundwater Exceedances

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

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

2.12. Financial Assurance Requirements

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

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

2.13. Hazard Potential Classification

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

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

2.14. Structural Stability Assessment

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

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

2.15. Safety Factor Assessment

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

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

2.16. Inflow Design Flood Control System Plan

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

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

2.17. Safety and Health Plan

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

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

2.18. Proposed Closure Priority Categorization

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

A CCR Surface Impoundment Category Designation and Justification letter was submitted to IEPA on May 19, 2021. The Kincaid Ash Pond was designated as Category 5 Existing CCR surface impoundment with exceedances of the groundwater protection standards in Section 845.600. This letter is provided in Attachment T.

3. PERMIT APPLICATION

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

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

Bureau of Water ID Number:
W0218140002

CCR Permit Number:
Initial Permit

Facility Name:
Kincaid 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		
	Kincaid Generation, LLC - Kincaid 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 4 miles west of Kincaid on IL RT 104		
	County name Christian	County code (if known)	
	City or town Kincaid	State IL	Zip Code 62540
1.6	Name of Owner/Operator		
	Kincaid Generation, LLC		

Facility, Operator, and Owner Info

1.7 Owner/Operator Contact Information

Name (first and last)	Title	Phone Number
Phil Morris	Senior Director - Environmental	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	State	Zip Code
Collinsville	IL	62234

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

Legal Description

2.1 Legal Description of the facility boundary

See Attachment A.

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

Internet Site

3.1 Web Address(es) to publicly accessible internet site(s) (CCR website)

www.luminant.com/ccr

3.2 Is/are the website(s) titled "Illinois CCR Rule Compliance Data and Information"

☑	Yes	☐	No

SECTION 4: IMPOUNDMENT IDENTIFICATION

Impoundment Identification

4.1 List all the impoundment identification numbers for your facility and check the corresponding box to indicate that you have attached a written description for each impoundment.

W0218140002-01 (see Attachment A)	☑	Attached written description
	☐	Attached written description
	☐	Attached written description
	☐	Attached written description
	☐	Attached written description
	☐	Attached written description

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

SECTION 5: CHECKLIST AND CERTIFICATION STATEMENT

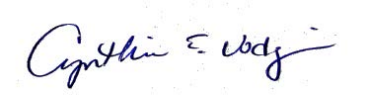
Checklist and Certification Statement

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

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

5.2 **Certification Statement**

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

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

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

Bureau of Water ID Number: W0218140002 **CCR Permit Number:** Initial Permit **Facility Name:** Kincaid Power Plant	For IEPA Use Only

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

Construction History	1.1	CCR surface impoundment name.
		Ash Pond
	1.2	Identification number of the CCR surface impoundment (if one has been assigned by the Agency).
		W0218140002
	1.3	Description of the boundaries of the CCR surface impoundment (35 Ill. Adm. Code 845.210(c)).
		See Attachment A.
	1.4	State the purpose for which the CCR surface impoundment is being used.
		See Attachment B.
	1.5	How long has the CCR surface impoundment been in operation?
		See Attachment B.
	1.6	List the types of CCR that have been placed in the CCR surface impoundment.
		See Attachment C.

Construction History (Continued)	1.7	List name of the watershed within which the CCR surface impoundment is located.			
		See Attachment B.			
	1.8	Size in acres of the watershed within which the CCR surface impoundment is located.			
		See Attachment B.			
	1.9	Check the corresponding box to indicate that you have attached the following:			
		☑	Description of the physical and engineering properties of the foundation and abutment materials on which the CCR surface impoundment is constructed.		
		☑	Description of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment.		
		☑	Describe the method of site preparation and construction of each zone of the CCR surface impoundment.		
		☑	A listing of the approximate dates of construction of each successive stage of construction of the CCR surface impoundment.		
		☑	Drawing satisfying the requirements of 35 Ill. Adm. Code 845.220(a)(1)(F).		
		☑	Description of the type, purpose, and location of existing instrumentation.		
		☑	Area capacity curves for the CCR Impoundment.		
		☑	Description of each spillway and diversion design features and capacities and provide the calculations used in their determination.		
		☑	Construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.		
	1.10.1	Is there any record or knowledge of structural instability of the CCR surface impoundment?			
		☐	Yes	☑	No
	1.10.2	If you answered yes to Item 1.10.1, provide detailed explanation of the structural instability.			

SECTION 2: ANALYSIS OF CHEMICAL CONSTITUENTS (35 Ill. Adm. Code 845.230(d)(2)(B))

Constituents	2.1	Check the corresponding boxes to indicate you have attached the following:	
		☑	An analysis of the chemical constituents found within the CCR to be placed in the CCR surface impoundment.
		☑	An analysis of the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in the CCR surface impoundment.

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

Demonstrations

3.1 Indicate whether you have attached a demonstration that the CCR surface impoundment, as built, meets, or an explanation of how the CCR surface impoundments fails to meet, the location standards in the following sections:

35 Ill. Adm. Code 845.300 (Placement Above the Uppermost Aquifer)	☑	Demonstration	☐	Explanation
35 Ill. Adm. Code 845.310 (Wetlands)	☑	Demonstration	☐	Explanation
35 Ill. Adm. Code 845.320 (Fault Areas)	☑	Demonstration	☐	Explanation
35 Ill. Adm. Code 845.330 (Seismic Impact Zones)	☑	Demonstration	☐	Explanation
35 Ill. Adm. Code 845.340 (Unstable Areas and Floodplains)	☑	Demonstration	☐	Explanation

SECTION 4: ATTACHMENTS

Attachments

4.1 Check the corresponding boxes to indicate that you have attached the following:

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

SECTION 5: GROUNDWATER MONITORING

Groundwater

5.1 Check the corresponding boxes to indicate you have attached the following groundwater monitoring information:

☑	A hydrogeologic site characterization meeting the requirements of 35 Ill. Adm. Code 845.620.
☑	Design and construction plans of a groundwater monitoring system meeting the requirements of 35 Ill. Adm. Code 845.630.

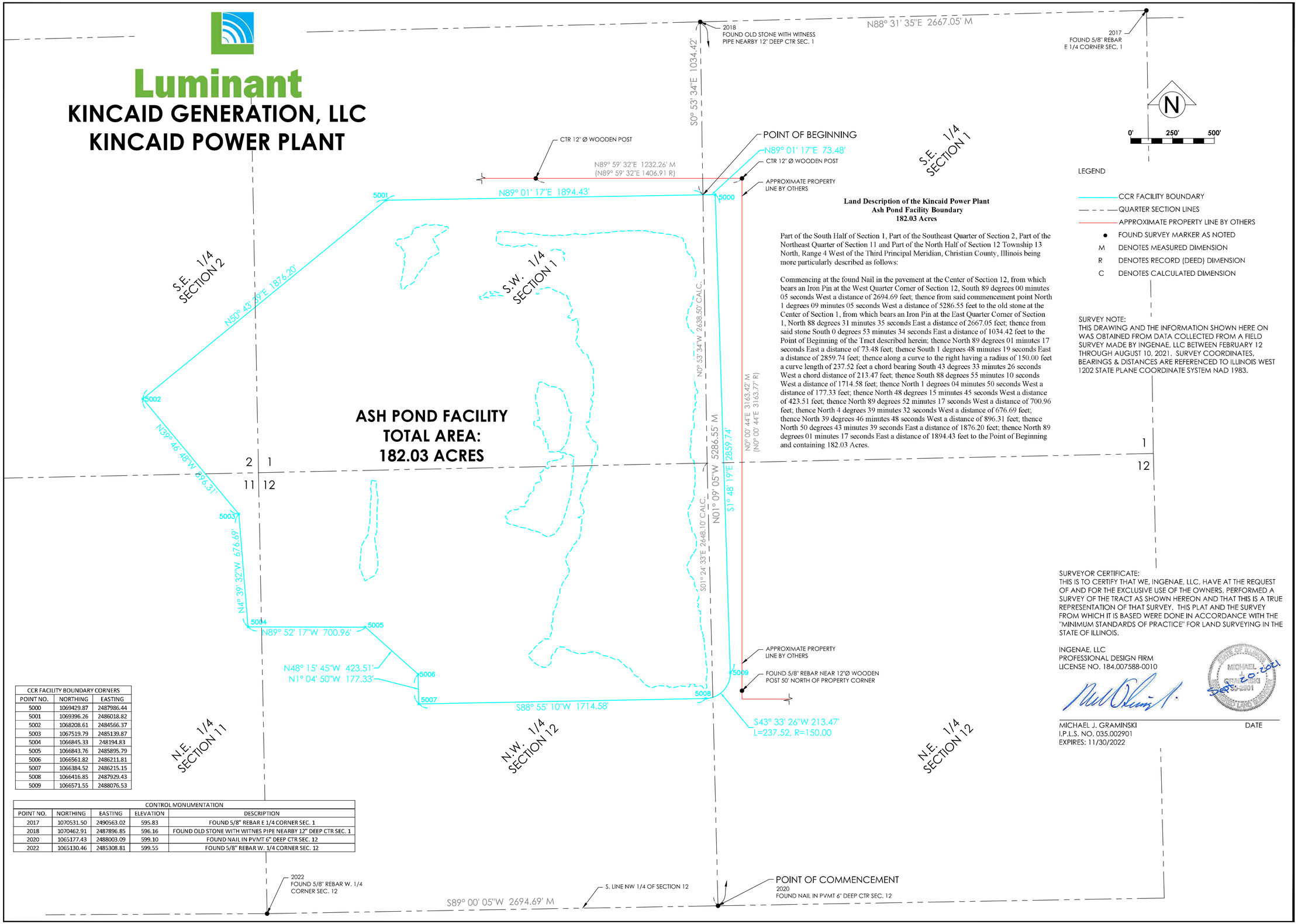
		☑	A groundwater sampling and analysis program that includes section of the statistical procedures to be used for evaluating groundwater monitoring data, required by 35 Ill. Adm. Code 845.640.
		☑	Proposed groundwater monitoring program that includes a minimum of eight independent samples for each background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

ATTACHMENT A

October 2021

Luminant

KINCAID GENERATION, LLC
KINCAID POWER PLANT



Land Description of the Kincaid Power Plant
Ash Pond Facility Boundary
182.03 Acres

Part of the South Half of Section 1, Part of the Southeast Quarter of Section 2, Part of the Northeast Quarter of Section 11 and Part of the North Half of Section 12 Township 13 North, Range 4 West of the Third Principal Meridian, Christian County, Illinois being more particularly described as follows:

Commencing at the found Nail in the pavement at the Center of Section 12, from which bears an Iron Pin at the West Quarter Corner of Section 12, South 89 degrees 00 minutes 05 seconds West a distance of 2694.69 feet; thence from said commencement point North 1 degrees 09 minutes 05 seconds West a distance of 5286.55 feet to the old stone at the Center of Section 1, from which bears an Iron Pin at the East Quarter Corner of Section 1, North 88 degrees 31 minutes 35 seconds East a distance of 2667.05 feet; thence from said stone South 0 degrees 53 minutes 34 seconds East a distance of 1034.42 feet to the Point of Beginning of the Tract described herein; thence North 89 degrees 01 minutes 17 seconds East a distance of 73.48 feet; thence South 1 degrees 48 minutes 19 seconds East a distance of 2859.74 feet; thence along a curve to the right having a radius of 150.00 feet a curve length of 237.52 feet a chord bearing South 43 degrees 33 minutes 26 seconds West a chord distance of 213.47 feet; thence South 88 degrees 55 minutes 10 seconds West a distance of 1714.58 feet; thence North 1 degrees 04 minutes 50 seconds West a distance of 177.33 feet; thence North 48 degrees 15 minutes 45 seconds West a distance of 423.51 feet; thence North 89 degrees 52 minutes 17 seconds West a distance of 700.96 feet; thence North 4 degrees 39 minutes 32 seconds West a distance of 676.69 feet; thence North 39 degrees 46 minutes 48 seconds West a distance of 896.31 feet; thence North 50 degrees 43 minutes 39 seconds East a distance of 1876.20 feet; thence North 89 degrees 01 minutes 17 seconds East a distance of 1894.43 feet to the Point of Beginning and containing 182.03 Acres.

LEGEND

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

SURVEY NOTE:
THIS DRAWING AND THE INFORMATION SHOWN HERE ON WAS OBTAINED FROM DATA COLLECTED FROM A FIELD SURVEY MADE BY INGENAE, LLC BETWEEN FEBRUARY 12 THROUGH AUGUST 10, 2021. SURVEY COORDINATES, BEARINGS & DISTANCES ARE REFERENCED TO ILLINOIS WEST 1202 STATE PLANE COORDINATE SYSTEM NAD 1983.

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

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

STATE OF ILLINOIS — MICHAEL GRAMINSKI — 035.002901 — LAND SURVEYOR — Sept 20, 2021

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

CCR FACILITY BOUNDARY CORNERS		
POINT NO.	NORTHING	EASTING
5000	1069429.87	2487986.44
5001	1069396.26	2486018.82
5002	1068208.61	2484566.37
5003	1067519.79	2485139.87
5004	1066845.33	248194.83
5005	1066843.76	2485895.79
5006	1066561.82	2486211.81
5007	1066384.52	2486215.15
5008	1066416.85	2487929.43
5009	1066571.55	2488076.53

CONTROL MONUMENTATION				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
2017	1070531.50	2490563.02	595.83	FOUND 5/8" REBAR E 1/4 CORNER SEC. 1
2018	1070462.91	2487896.85	596.16	FOUND OLD STONE WITH WITNES PIPE NEARBY 12" DEEP CTR SEC. 1
2020	1065177.43	2488003.09	599.10	FOUND NAIL IN PVMT 6" DEEP CTR SEC. 12
2022	1065130.46	2485308.81	599.55	FOUND 5/8" REBAR W. 1/4 CORNER SEC. 12

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:

KINCAID
POWER PLANT

199 ILLINOIS ROUTE 104
KINCAID, IL 62540

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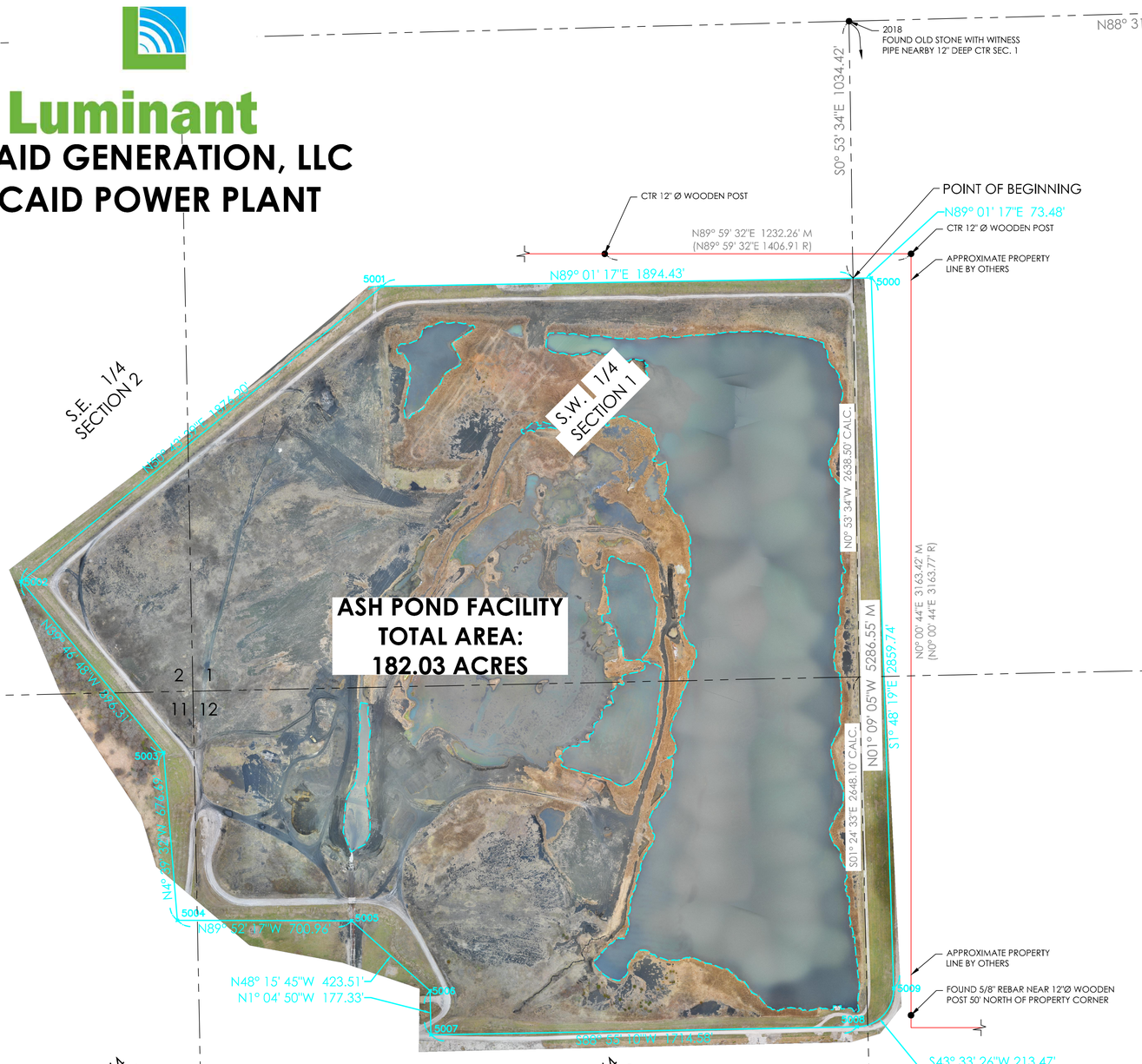
Drawing Name:

CCR FACILITY
BOUNDARY
EXHIBIT

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

Luminant

KINCAID GENERATION, LLC
KINCAID POWER PLANT



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0' 250' 500'

LEGEND

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

SURVEY NOTE:
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Submissions / Revisions:	Date:
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Luminant

Project Name & Location:

KINCAID
POWER PLANT

199 ILLINOIS ROUTE 104
KINCAID, IL 62540

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Drawing Name:

AERIAL
PHOTOGRAPHY

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

ATTACHMENT B

October 2021

AECOM

October 2016

Kincaid Generation, L.L.C.
199 Illinois 104
Kincaid, IL 62540

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

On behalf of Kincaid Generation, L.L.C., AECOM has prepared the following history of construction for the Ash Pond at the Kincaid 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 the Ash Pond at the Kincaid Power Station.

AECOM

HISTORY OF CONSTRUCTION

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

Owner: Kincaid Generation, L.L.C.

Address: 1500 Eastport Plaza Drive
Collinsville, IL 62234

CCR Unit: Ash Pond

The Ash Pond does not have a state assigned identification number.

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

The location of the Ash Pond has been identified on an USGS 7-1/2 minute topographic quadrangle map in **Appendix A**.

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

The Ash Pond is being used to store and dispose of sluiced bottom ash and to clarify other non-CCR waste streams to be used as recycled water for plant operations. Newly placed ash is recovered by a third party and recycled for beneficial use.

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

Most of the Kincaid Power Plant property including the entire Kincaid Ash Pond is located in the northeastern portion of the Sangchris Lake Watershed with a 12-digit Hydrologic Unit Code (HUC) of 071300070402 and a drainage area of 23,382 acres (USGS, 2016). The remaining portion of the Kincaid Power Station property is located in the northwestern portion of the Town of Tovey Watershed and a 12-digit Hydrologic Unit Code (HUC) of 071300070401 with a drainage area of 23,341 acres (USGS, 2016).

§ 257.73(c)(1)(v): A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is constructed.

The foundation materials consist of foundation clay overlying glacial till. The physical properties of the foundation clay for the Ash Pond are described as native fine grained soils of alluvial origin with occasional layers of coarse-grained soil. The fine-grained soils (clays) are generally classified as low to medium plasticity silty clay, sandy clay, clay with sand, or clay (CL) with trace amounts of sand or gravel; or high plasticity clay (CH). The CL and CH soils are soft to very stiff, very moist to very wet, and brown to gray with some occurrence of reddish brown silt seams. The coarse-grained soil is classified as clayey sand (SC), with a

trace amount of gravel, very loose, very wet, and brown to gray. The fines portion of the clayey sand is low plastic. The foundation clay is underlain by glacial till that is predominantly classified as sandy clay (CL) with some occurrences of clayey sand (SC) or silty sand (SM), usually with a trace amount of fine gravel, generally hard, low to medium plasticity, slightly moist to very wet, and brown to gray. An available summary of the engineering properties of the foundation materials is presented in **Table 1** below.

Table 1. Summary of Foundation Material Engineering Properties

Material	Unit Weight (pcf)	Peak Drained Shear Strength		Peak Undrained Shear Strength	Post-Earthquake Shear Strength
		Cohesion, c′ (psf)	Friction Angle, f ' (deg)	S_u/p'	S_{ur}/p'
Foundation Clay (Under Embankment)	125	0	32 *with curved envelope for* $s'_{ff} < 2160$ *psf*	$S_u/p' = 0.48$, Minimum $S_u = 800$ psf	$S_{ur}/p' = 0.30$, Minimum $S_u = 400$ psf
Foundation Clay (Free Field)	125	0	30	$S_u/p' = 0.30$, Minimum $S_u = 400$ psf	$S_{ur}/p' = 0.30$, Minimum $S_u = 400$ psf
Till	135	0	40	$S_u/p' = 0.64$, Minimum $S_u = 800$ psf	$S_u/p' = 0.64$, Minimum $S_u = 800$ psf

The Ash Pond is an enclosed impoundment with embankments and does not have abutments.

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

The physical properties of the materials used for embankment construction of the Ash Pond are described as low to medium plasticity sandy clay or clay with sand (CL), or high plasticity clay (CH). The CL and CH soils have occasional occurrences of trace levels of fine gravel, are medium stiff to very stiff with occasional soft zones, moist to very moist, and brown to gray. The embankment fill generally appears to be well-compacted. An available summary of the engineering properties of the embankment materials is presented in **Table 2** below.

Table 2. Summary of Construction Material Engineering Properties

Material	Unit Weight (pcf)	Peak Drained Shear Strength		Peak Undrained Shear Strength	Post-Earthquake Shear Strength
		Cohesion, c′ (psf)	Friction Angle, f ' (deg)	S_u/p'	S_{ur}/p'
Embankment Fill	135	0	40 *with curved envelope for* $s'_{ff} < 1440$ *psf*	$S_u/p' = 0.68$, Minimum $S_u = 575$ psf	$S_u/p' = 0.68$, Minimum $S_u = 575$ psf

The method of site preparation and construction for the Ash Pond is not reasonably and readily available.

The approximate dates of construction of each successive stage of construction of the Ash Pond are provided in **Table 3** below.

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

Date	Event
1964-1965	Construction of Ash Pond
1967	Ash Pond was put into service
1978-1980	Installation of Ash Pond recycle water intake structures and associated piping
Mid-1980's	Erosion repair along north embankment adjacent to Sangchris Lake
2006	Replacement of emergency outlet piping
2009-2010	Tree removal, grading, and vegetation re-established along the north and east embankment
2010	Riprap placement along the northwest Ash Pond embankment adjacent to Sangchris Lake

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

Drawings that contain items pertaining to the requested information for the Ash Pond are listed in **Table 4** below. Items marked as "Not Available" are items not found during a review of the reasonably and readily available record documentation.

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

	Ash Pond
Dimensional plan view (all zones)	B-32
Dimensional cross sections	B-32
Foundation Improvements	Not Applicable
Drainage Provisions	Not Applicable
Spillways and Outlets	869D4-C12A, 869D4-C36 to C37, 869D-M69
Diversion Ditches	Not Applicable
Instrument Locations	Figure 2A
Slope Protection	B-32
Normal Operating Pool Elevation	Not Available
Maximum Pool Elevation	Not Available
Approximate Maximum Depth of CCR in 2016	30 feet

All drawings referenced in **Table 4** above can be found in **Appendix B** and **Appendix C**.

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

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

Existing instrumentation within the Ash Pond consists of vibrating-wire and open standpipe piezometers and a water level gauge. The purpose of the piezometers is to measure the pore water pressures within the embankment. The purpose of the water level gauge is to measure the water surface level within the Ash Pond. Twelve (12) vibrating-wire and open-standpipe piezometers were installed in 2015 and the locations are presented on Figure 2A in **Appendix C**. Three (3) piezometers were installed in 2016 and the locations are presented on Figure 2A in **Appendix C**. The water level gauge is located adjacent to the emergency outlet structure in the southeast corner of the Ash Pond. A location map of the water level gauge is not reasonably and readily available.

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

The area-capacity curve for the Ash Pond is presented in **Figure 1** below. "Area-capacity curves", as defined by 40 CFR § 257.53, "means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations."

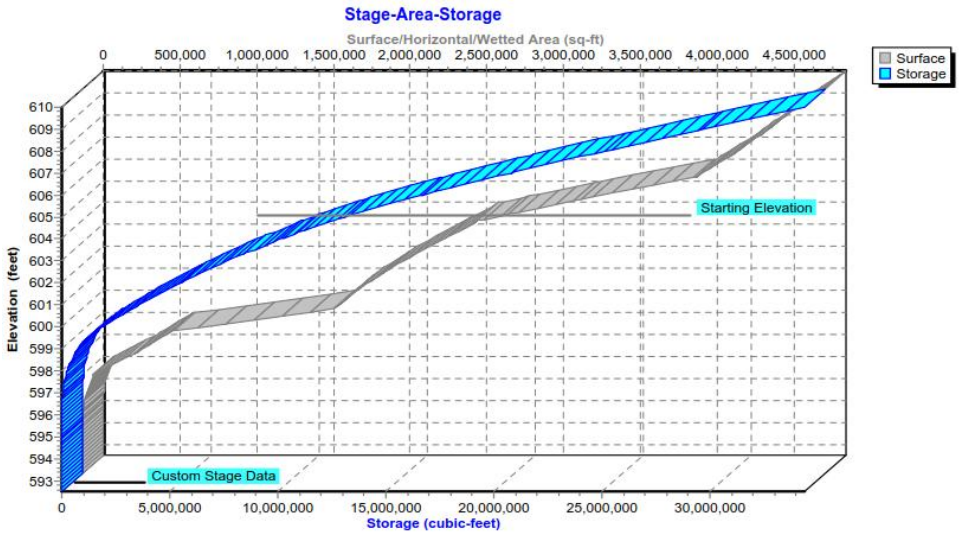


Figure 1. Area-capacity curve for Ash Pond

The area-capacity curve shown was taken from the pond modeling analysis. Actual pond capacity is limited to the approximate berm elevation listed in **Table 5** below. Any information above berm elevation should be disregarded.

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

A recycle water intake structure (screen house) is located in the southeast corner of the Ash Pond. Impounded water from the Ash Pond is screened through the intake structure and fed into a gated 60-inch diameter (dia.) pipe (Invert El. 592.3 feet.) where it flows to the recycle pump house. Design drawings indicate that the 60-inch dia. pipe is reinforced concrete pipe (RCP). The Ash Pond also contains an emergency outlet structure in the southeast corner of the pond. The emergency outlet structure consists of a sluice gate (Invert El. 597.5 feet.) and concrete overflow weir (Invert El. 604.3 feet.), with an ungated 48-inch dia. corrugated metal pipe (CMP) outlet. Unless otherwise noted, all elevations in this report are based on the NAVD88 datum.

In 2016, the discharge capacity of the Ash Pond was evaluated using HydroCAD 10 software modeling a 1,000-year, 24-hour rainfall event. The model results indicate that the Ash Pond has enough storage capacity above the existing placed CCR, 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 5**.

Table 5. Results of HydroCAD 10 analysis

	Ash Pond
Approximate Minimum Berm Elevation[1] (ft)	605.2
Approximate Emergency Spillway Elevation[1] (ft)	Not Applicable
Starting Pool Elevation[1] (ft)	603.3
Peak Elevation[1] (ft)	605.1
Time to Peak (hr)	21.9
Surface Area (ac)	75.5
Storage[2] (ac-ft)	110.7

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

Drawings for the Ash Pond refer to construction specification *Job Specification G-1943,* but that specification is not reasonably and readily available.

The operations and maintenance plans for the Ash Pond are currently being prepared by Kincaid Generation, L.L.C.

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

In 2013, minor subsidence of the embankment crest was observed along portions of the southwestern Ash Pond embankment. The subsidence was believed to have been caused by historical underground mining operations below the Ash Pond from the 1950s to the 1990s. Gravel and soil fill was placed in the settlement areas to restore the embankment crest elevation. The embankment is observed during the weekly inspections and no further evidence of subsidence has occurred since 2013. Information regarding the subsidence is presented in **Appendix D**.

There is no record or knowledge of any other structural instability of the Ash Pond at Kincaid Power Station.

LIMITATIONS

The signature of AECOM's authorized representative on this document represents that to the best of AECOM's knowledge, information and belief in the exercise of its professional judgment, it is AECOM's professional opinion that the aforementioned information is accurate as of the date of such signature. Any recommendation, opinion or decisions by AECOM are made on the basis of AECOM's experience, qualifications and professional judgment and are not to be construed as warranties or guaranties. In addition, opinions relating to environmental, geologic, and geotechnical conditions or other estimates are based on available data and that actual conditions may vary from those encountered at the times and locations where data are obtained, despite the use of due care.

Sincerely,

Claudia Prado
Project Manager

Victor Modeer, P.E., D.GE
Senior Project Manager

REFERENCES

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

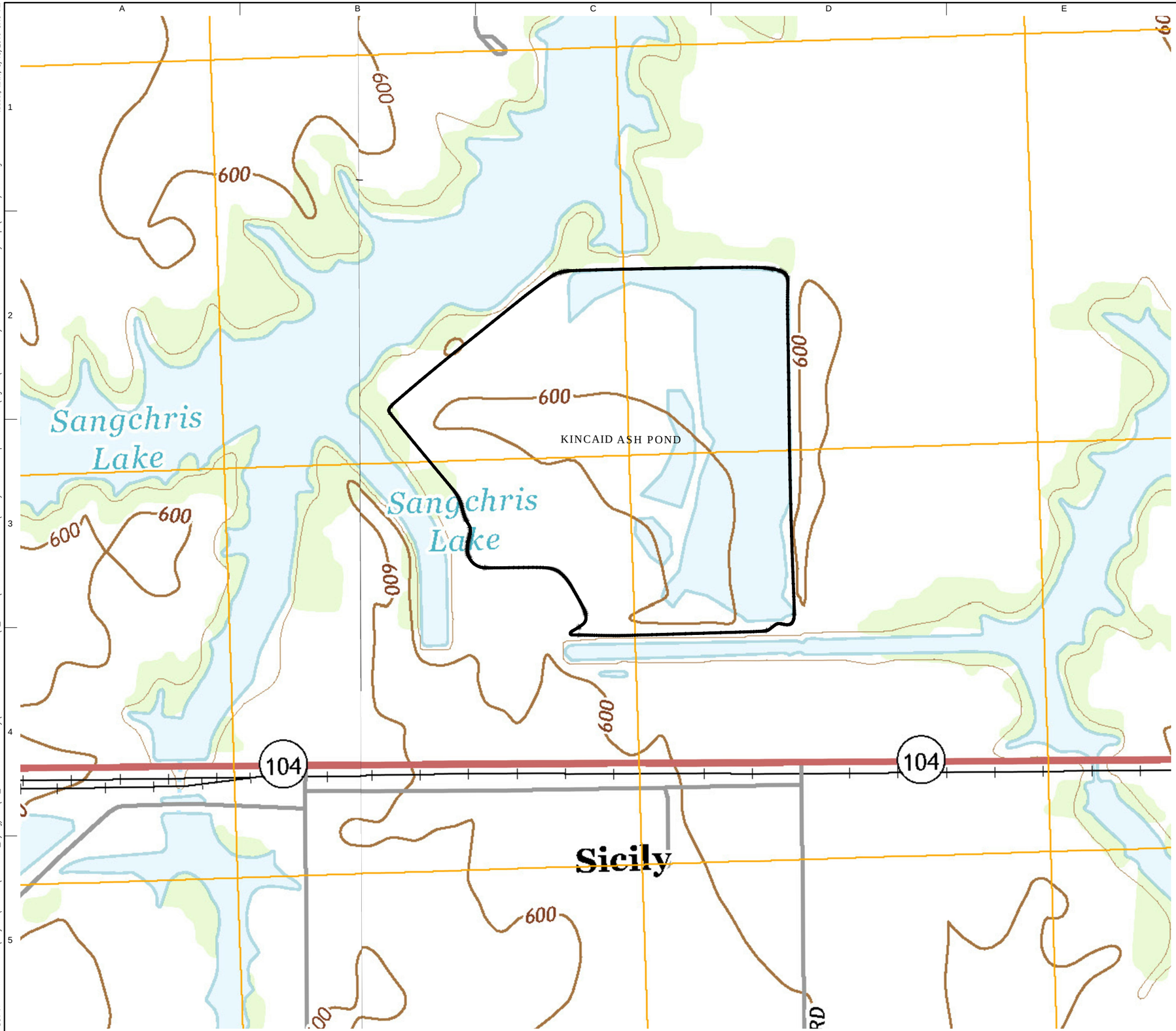
United States Geological Survey (USGS). (2016). The National Map Viewer. http://viewer.nationalmap.gov/viewer/. USGS data first accessed in March of 2016.

APPENDICES

Appendix A: History of Construction Vicinity Map
Appendix B: Kincaid Power Station Drawings
Appendix C: Kincaid Ash Pond Piezometer Locations
Appendix D: Ash Pond Embankment Settlement (2013)

AECOM

Appendix A: History of Construction Vicinity Map



LEGEND

CCR UNITS

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

QUADRANGLE LOCATION

N

0 400 800 1200

SCALE IN FEET

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

KINCAID
GENERATION, L.L.C.

199 Illinois 104
Kincaid, IL 62540

HISTORY OF
CONSTRUCTION

KINCAID
POWER STATION
KINCAID, 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

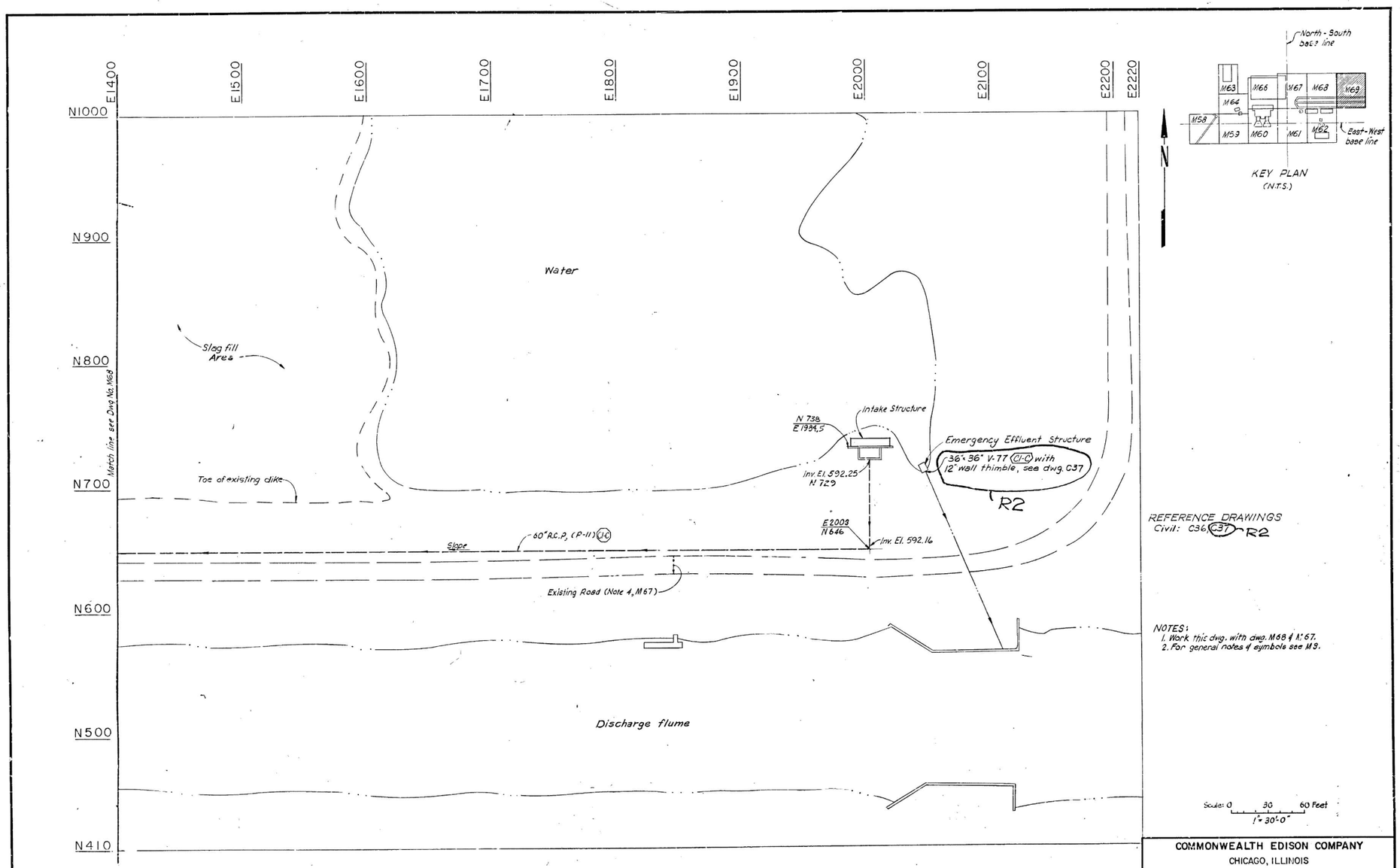
HISTORY OF
CONSTRUCTION
VICINITY MAP

01

AECOM DRAWING PATH: P:\Projects\Geotech\60428794_DynegyCCR\13_Construction History\04 Technical Production\5_Kincaid\Reference Documents\Vicinity Location Map References\Figures\C-01 History of Construction Vicinity Map (Kincaid) MJN.dwg NANAK, MATT, 8/15/2016 3:40 PM

Appendix B: Kincaid Power Station Drawings

1. “Outside Piping Sheet II”, Drawing No. 869D4-M69, Revision R2, 10 August, 1978, Harza Engineering Company.
2. “Ash Pond Dike Piping Prevention”, Drawing No. 869D4-C12A, Revision R1, 29 June, 1978, Harza Engineering Company.
3. “Ash Sluice Water Intake Structures”, Drawing No. 869D4-C36, Revision R2, 25 September, 1980, Harza Engineering Company.
4. “Ash Sluice Water Stilling Well and Emergency Effluent Sump Structures”, Drawing No. 869D4-C37, Revision R4, 8 May, 1979, Harza Engineering Company.
5. “Intake & Discharge Flumes, Plans & Sections”, Drawing No. B-32, Revision P, 2 December, 1965, Harza Engineering Company.



REFERENCE DRAWINGS
Civil: C36, C37 R2

NOTES:
1. Work this dwg. with dwg. M68 & M67.
2. For general notes & symbols see M3.

Scale: 0 30 60 Feet
1" = 30'-0"

REV. NO.	DWG. TRANSMITTAL LETTER NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
R2	DDR 869D4-C2 #8	8-10-78	Miscellaneous revisions	V.M.	[illegible]	[illegible]
R2	DDR 869D4-C1 #12	7-14-78	Contract 869D4-C1 & 869D4-C2			
R1		4-12-78	Issued for construction contract 869D4-C2	[illegible]	[illegible]	[illegible]
R1			Issued for construction Contract 869D4-C1	[illegible]	[illegible]	[illegible]
R.D.		12-5-77	Issued for Bid 869D4-C2			
R.O.		11-14-77	Issued for Bid 869D4-C1			

DSGN.	BL/OCR	REVIEWED	
CHKD.	S.S.	CIVIL	
DWN.	OCR	MECH.	[illegible]
CHKD.	S.S.	ELECT.	
SUBM.	[illegible]		

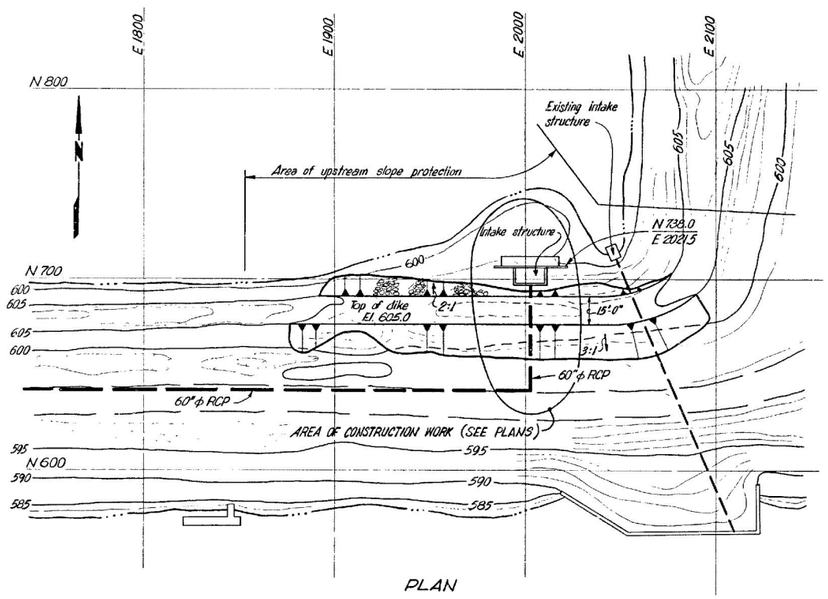
COMMONWEALTH EDISON COMPANY
CHICAGO, ILLINOIS

KINCAID STATION | WASTEWATER TREATMENT

OUTSIDE PIPING
SHEET II

CONSULTING ENGINEERS
HARZA ENGINEERING COMPANY
APPROVED [signature]

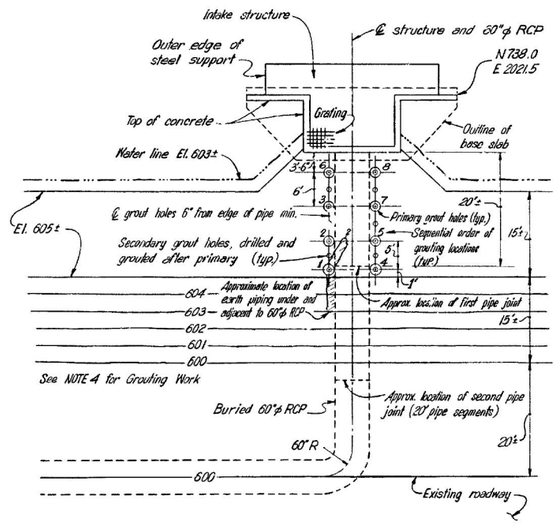
CHICAGO, ILLINOIS | DATE NOV. 1977 | DWG. NO. 869D4-M69



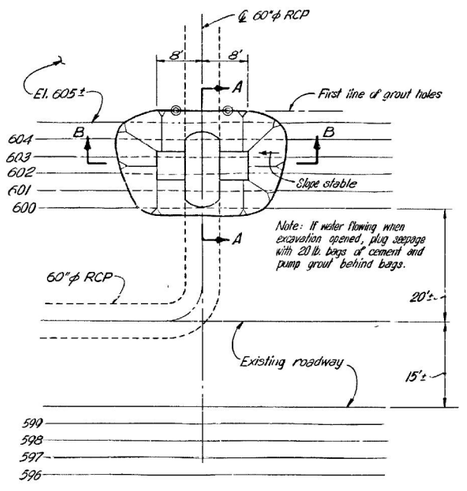
PLAN

ASH POND DIKE

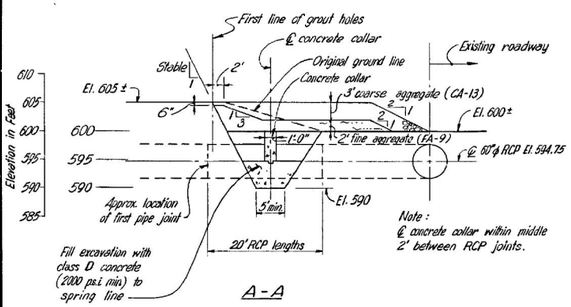
Scale 0 30 Feet



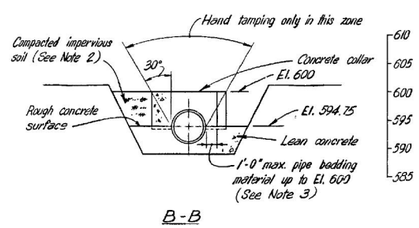
GROUTING PLAN



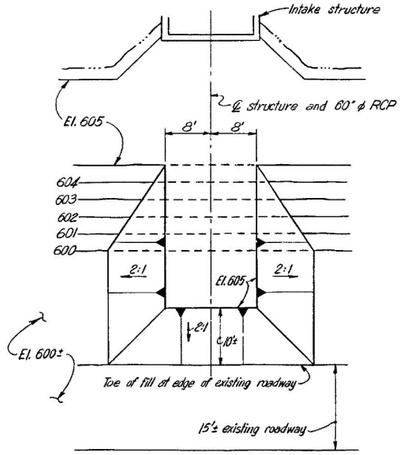
EXCAVATION PLAN



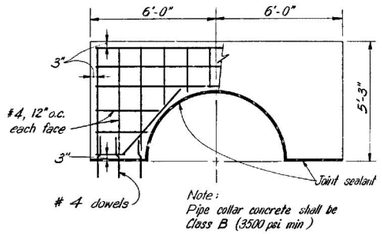
A-A



B-B

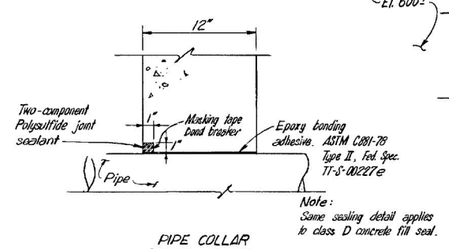


COMPLETED EARTHWORK PLAN



PIPE COLLAR
STEEL REINFORCEMENT

Scale 0 2 Feet



PIPE COLLAR
SEALING DETAIL

Scale 0 6 Inches

REFERENCE DRAWINGS:

No.	Title
869 D4-C36	Ash Sluice Water Intake Structures
869 D4-C12	Settling Ponds and And Ash Pond Dike

NOTE:

1. Contract 869 D4-C1 specifications shall be followed unless noted otherwise on this drawing.
2. Impervious soil shall pass the No. 4 sieve, and shall have at least 25 percent passing the No. 200 sieve.
3. Pipe bedding material shall consist of fine aggregate (FA-9 State of Illinois)
4. Grout shall consist of a sand-cement mixture with possibly pea gravel. The mixture and pressures shall be as determined by the Owner's Representative in the field.

FRANK M. SCOTT 27756 REGISTERED PROFESSIONAL ENGINEER OF ILLINOIS

Scale 0 20 Feet
Except as noted

DSGN.	AJF	REVIEWED	
CHKD.	YKC	CIVIL	
DWN.		MECH.	
CHKD.	AJF	ELECT.	
SUBM.	YKC		

REV. NO.	DWG. TRANSMITTAL LETTER NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
R1	DDR 869D4-C1	6-23-79	Issued for Construction-C1		YKC	YKC

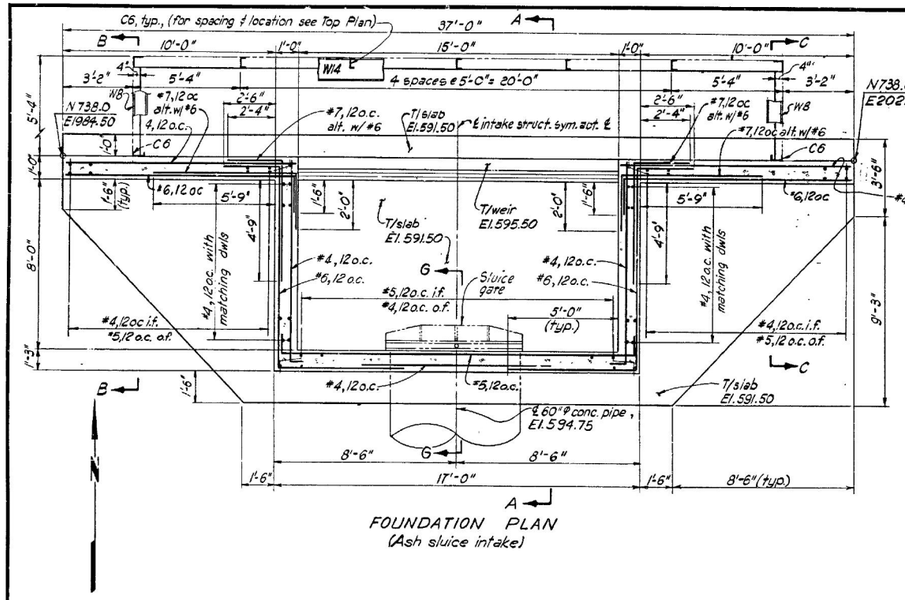
COMMONWEALTH EDISON COMPANY
CHICAGO, ILLINOIS

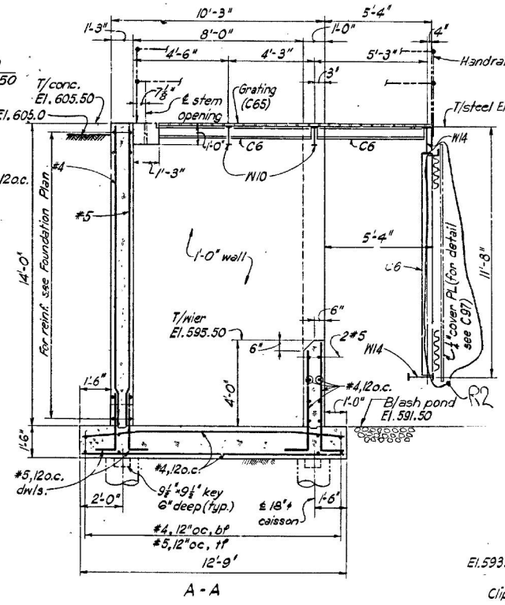
KINCAID STATION | WASTEWATER TREATMENT

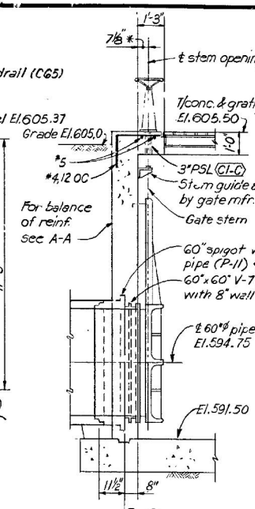
ASH POND DIKE
PIPING PREVENTION

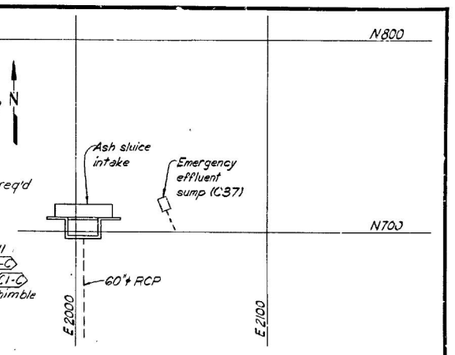
CONSULTING ENGINEERS
HARZA ENGINEERING COMPANY
APPROVED Frank M. Scott

CHICAGO, ILLINOIS | DATE JULY, 1979 | DWG. NO. 869 D4-C12A

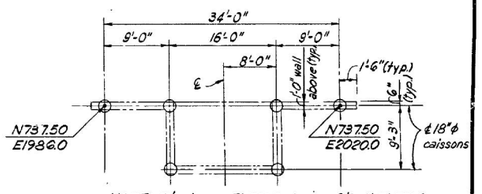






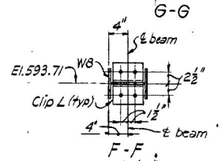


KEY PLAN
(NTS)

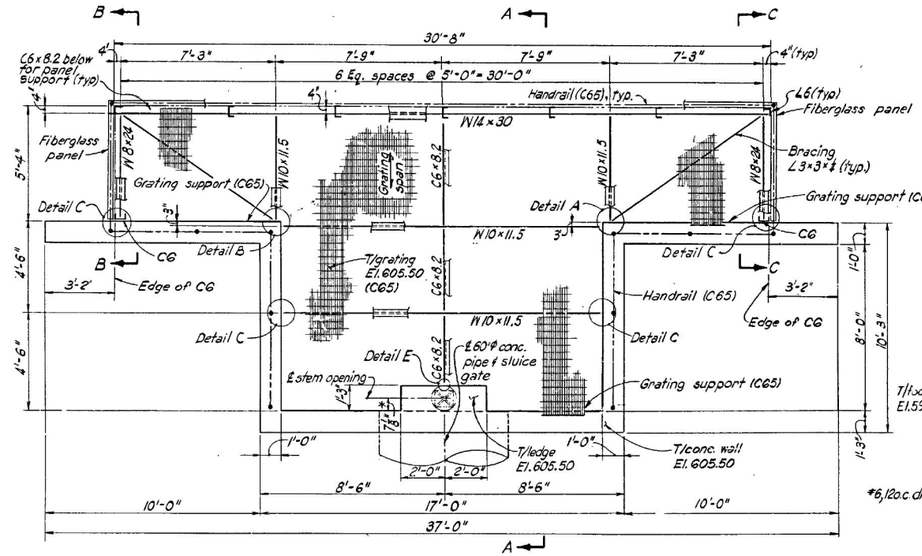


NOTE: T/caisson El. 590.0 Approx. B/bell El. 574.0
For caisson detail see dwg. C64.
All caisson shown are bearing type.

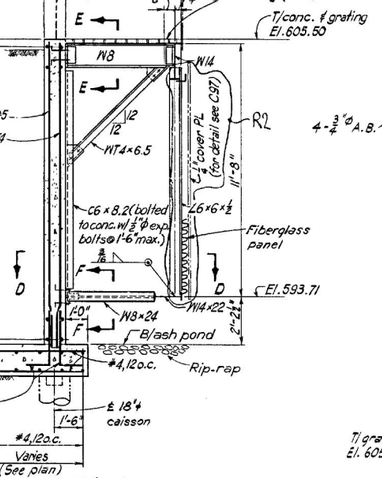
CAISSONS-PLAN
(Ash sluice intake)
(NTS)



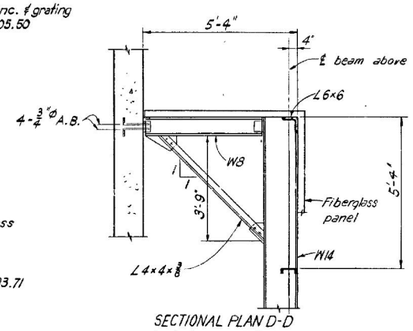
F-F
1"=1'-0"



TOP PLAN
(T/steel El. 605.37)



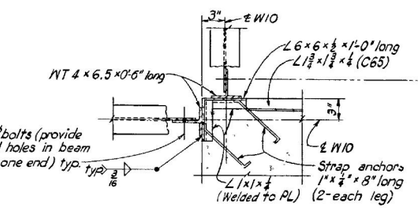
B - B (as shown)
C - C (opp. hand)



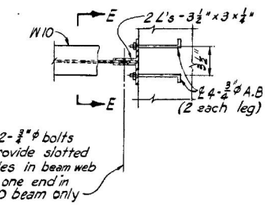
SECTIONAL PLAN D-D
Scale 0 2 Feet
½" = 1'-0"

REFERENCE DRAWINGS

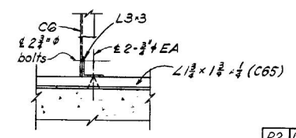
Work this drawing with	C97 R2
Standard Structural Details	C64
Mechanical	M69



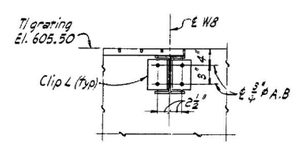
DETAIL A (as shown)
DETAIL B (same but opp. hand)
1½" = 1'-0"



DETAIL C
DETAIL D
1½" = 1'-0"



DETAIL E
Scale 0 1 Foot
1½" = 1'-0"



E - E
Scale 0 1 Foot
1" = 1'-0"

Scale 0 3 Feet
⅜" = 1'-0"
Except as noted

DSGN.	DBL
CHKD.	YCP
DWN.	GC
CHKD.	GMH/JW
SUBM.	EEG

REVIEWED
CIVIL: Approved
MECH.:
ELECT.:

REV. NO.	DWG. TRANSMITTAL LETTER NO.	DATE	NATURE OF REVISION	BY	CHKD.	APPD.
R2	DDR 869D4-C3 #1	9/25/80	Issued for Construction 869D4-C3	GMC	DD	EEG
R2	Issued for Bid 869D4-C3	4/15/80	Added intake cover PL	GMC	D.D.	Approved JEEG
R1	869D4-C1 DDR #3	5-31-78	Issued for Construction 869D4-C1	GC	GMH	EEG Approved
R0		12-5-77	Issued for Bids 869D4-C2			
R0		1/14/77	Issued for Bids 869D4-C1			

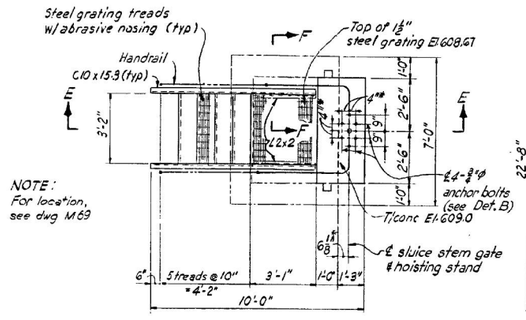
COMMONWEALTH EDISON COMPANY
CHICAGO, ILLINOIS

KINCAID STATION | WASTEWATER TREATMENT

ASH SLUICE WATER INTAKE STRUCTURES

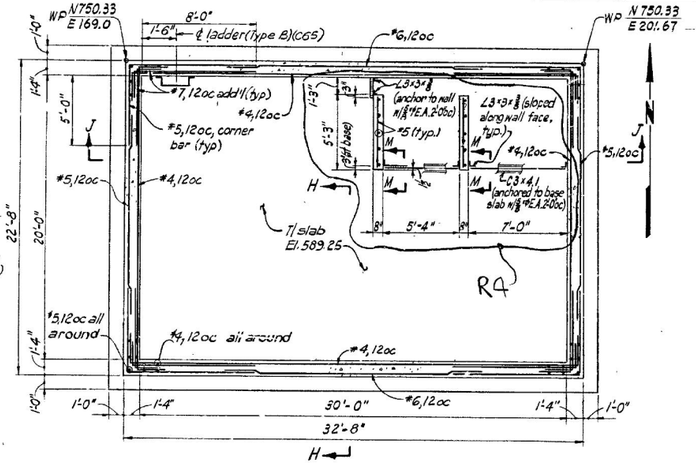
CONSULTING ENGINEERS
HARZA ENGINEERING COMPANY
APPROVED

CHICAGO, ILLINOIS | DATE NOV. 1977 | DWG. NO. 869D4-C36

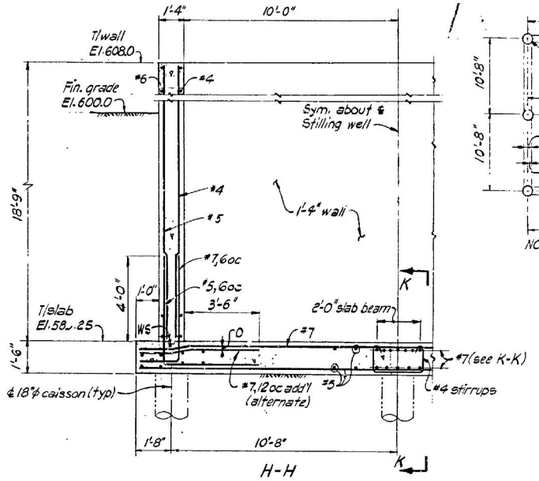


NOTE:
For location, see dwg M69

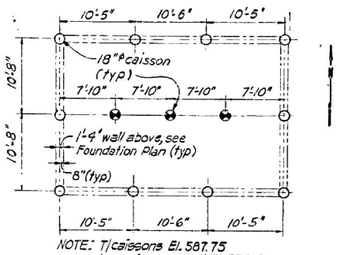
PLAN
(Emergency effluent sump)



FOUNDATION PLAN
(Ash sluice stilling well)

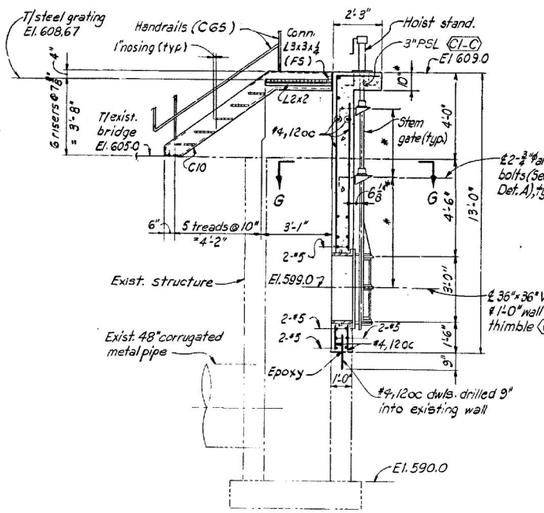


H-H

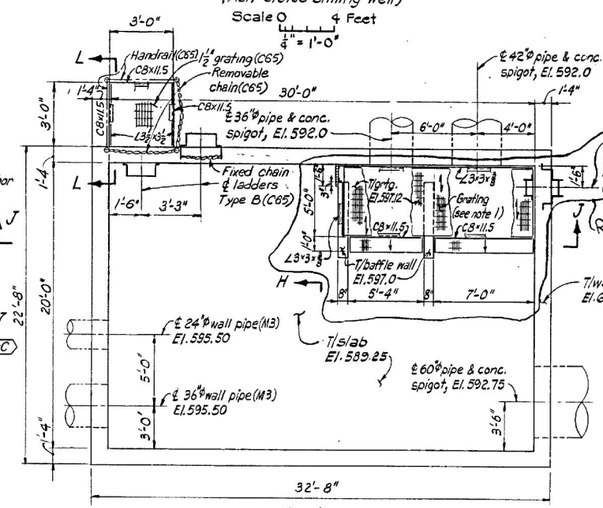


NOTE: T/caissons El. 587.75
Approximate B/bell El. 574.0
⊕ Tension caisson
○ Bearing caisson
For Typ Belled Caisson Detail see dwg C64

PLAN - CAISSONS
(Ash sluice stilling well)
N.T.S.

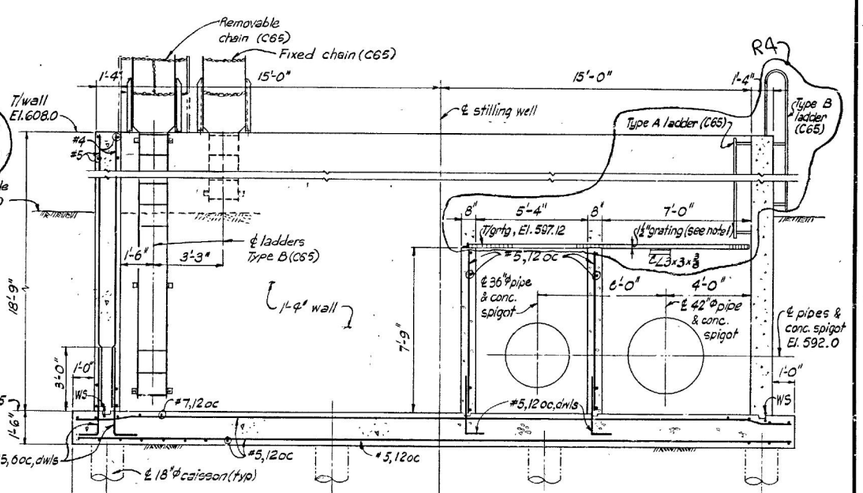


E-E

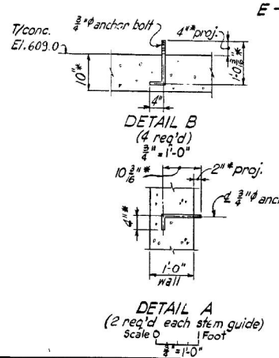


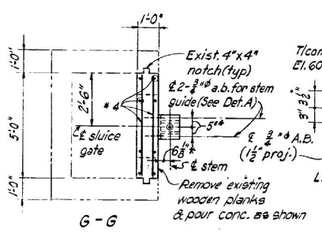
TOP PLAN
¼" = 1'-0"

Scale 0 4 Feet

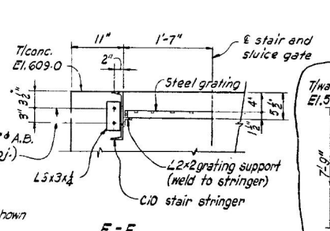


J-J

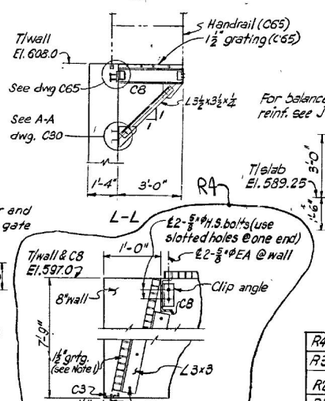




G-G

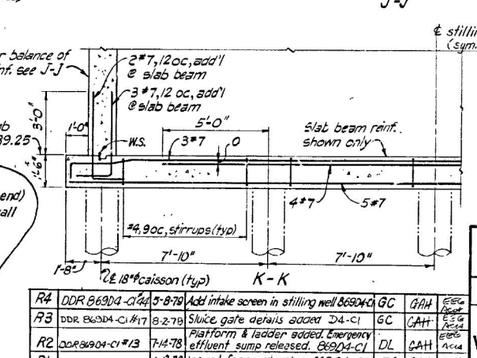


F-F
Scale 0 1 Foot
1" = 1'-0"



L-L

M-M
1" = 1'-0"



K-K

REFERENCE DRAWINGS:

Standard Structural Details	C64
Mechanical	M67, M69

Notes:
1. Grating for baffle wall to be Ryerson open steel, std. mesh 19-W-4, w/ ½"x⅛" bearing bars 1⅛" o.c. & ⅜" cross bars, 4" o.c. or equal. All steel for grating & supports should be galvanized.

R4

Scale 0 3 6 Feet
⅛" = 1'-0"
Except as noted

DSGN.	DBL	REVIEWED
CHKD.	YCP	CIVIL
DWN.	EE	MECH.
CHKD.	YCP	ELECT.
SUBM.	EEG	

REV. NO.	DWG. TRANSMITTAL LETTER NO.	DATE	NATURE OF REVISION	BY	CHKD.	APP'D
R4	DDR B69D4-C4&A	3-8-79	Add intake screen in stilling well B69D4-C1	GC	GAH	EEG
R3	DDR B69D4-C1 #17	8-2-78	Sluice gate details added D4-C1	GC	GAH	EEG
R2	DDR B69D4-C1 #13	7-14-78	Platform & ladder added. Emergency effluent sump released. B69D4-C1	DL	GAH	EEG
R1		4-12-78	Issued for construction B69D4-C2	FG	GAH	EEG
R1		3-29-78	Issued for construction B69D4-C1	FG	GAH	EEG
R1		12-12-77	Issued as Addendum B69D4-C1	EE	YCP	EEG
R0		12-5-77	Issued for Bids B69D4-C2			
R0		11-14-77	Issued for Bids B69D4-C1			

COMMONWEALTH EDISON COMPANY
CHICAGO, ILLINOIS

KINCAID STATION | WASTEWATER TREATMENT

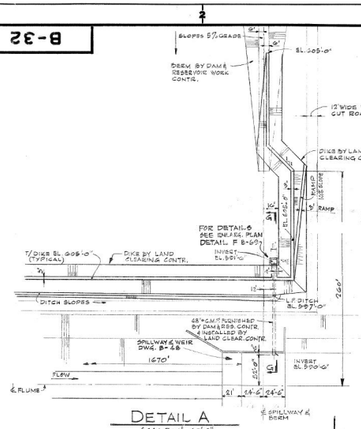
ASH SLUICE WATER STILLING WELL AND EMERGENCY EFFLUENT SUMP STRUCTURES

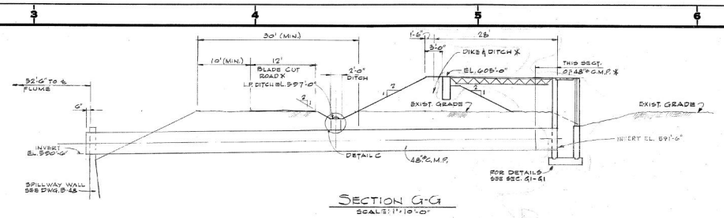
CONSULTING ENGINEERS
HARZA ENGINEERING COMPANY
APPROVED _____

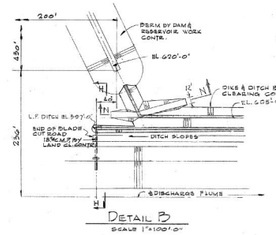
CHICAGO, ILLINOIS | DATE NOV. 1977 | DWG. NO. 869D4-C37

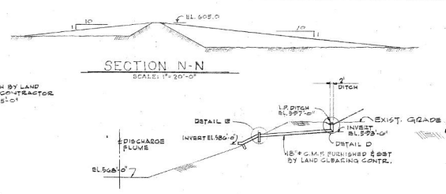
C1

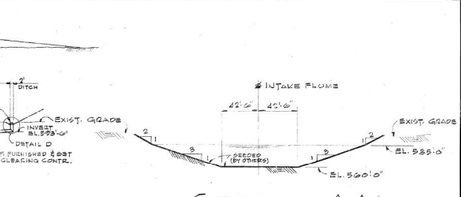
B-32

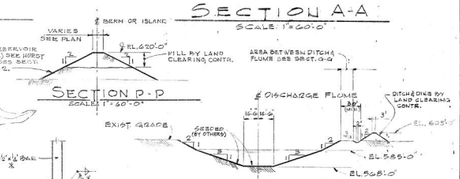


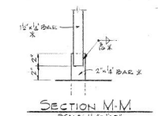


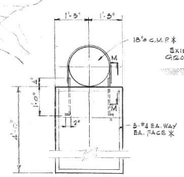


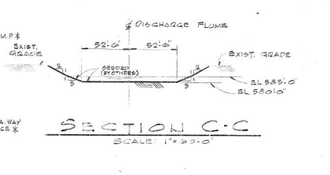


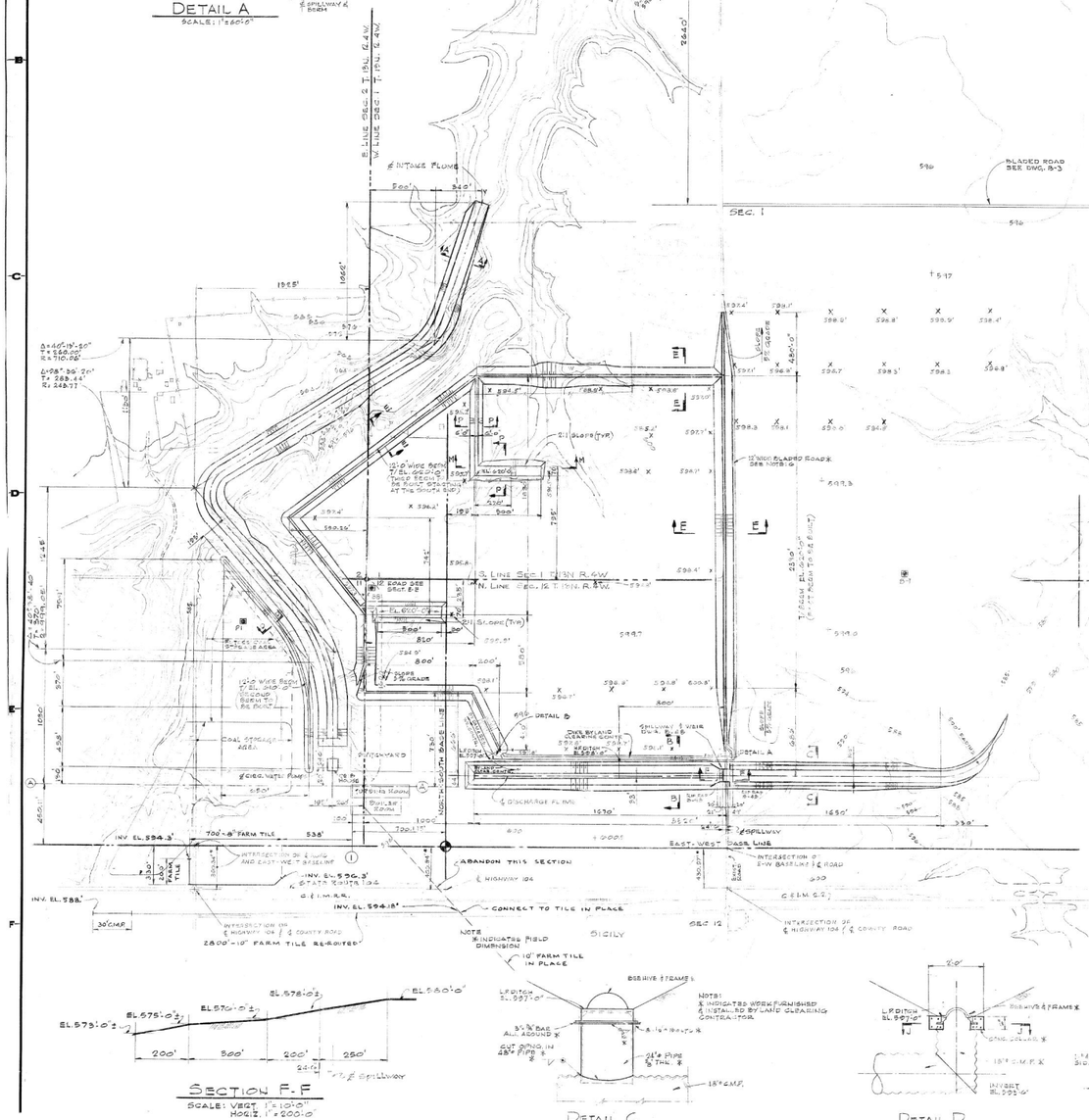


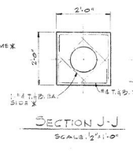


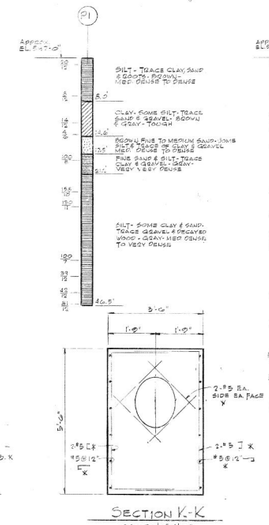


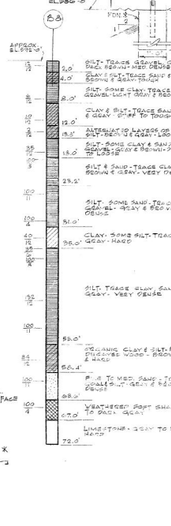












NOTES

1. FOR GENERAL LOCATION SEE DWG. B-3.
2. ALL WORK ON THIS DWG. SHALL BE FURNISHED & INSTALLED BY THE DAM & RESERVOIR WORK CONTRACTOR (UNLESS NOTED) IN ACCORDANCE WITH JOB SPEC. G-1 (1965).
3. ℄ INDICATES LOCATION OF BOLTS.
4. T.EOO INDICATES FIELD ELEVATIONS, REMAINING ELEVATIONS TAKEN FROM AERIAL SURVEY TOPOGRAPHY MAPS.
5. X INDICATES WORK FURNISHED & INSTALLED BY LAND CLEARING CONTRACTOR.
6. BLADED ROAD INDICATES AN AREA GRADED TO ELIMINATE SHARP CHANGES IN ELEVATION.

REFERENCE DRAWINGS

B-3	SITE IMPROVEMENT & LOCATION PLAN
B-69	OUTDOOR OIL SEPARATOR PLAN & SECTIONS UNIT 1 & 2

REVISIONS			
	12-17-64	VAC	ADDED ELEV. & DIM.
A	1-21-65	VAC	ADDED DIM.
B	4-13-65	VAC	ADDED DIM.
C	6-22-65	VAC	ADDED DIM.
D	10-19-65	GAC	ADDED DIM.
E	7-7-66	VAC	ADDED DIM.
F	7-12-66	VAC	ADDED DIM.
G	9-15-66		ADDED DIM.
H	12-16-66	GAC	CLAY COVERED
J	12-22-66	VAC	REVISED & ADDED
K	3-29-67	GAC	ADDED DIM.
L	1-30-68		ADDED DIM.
M	6-20-68	VAC	REVISED & ADDED
N	7-16-68		AS BUILT
P	12-7-68		REVISED & ADDED
Q			

INTAKE & DISCHARGE FLUMES PLAN & SECTIONS KINCAID STATION COMMONWEALTH EDISON CO. CHICAGO, ILLINOIS

SCALE 1"=500'-0" UNLESS NOTED

DRAWN G.V. 11-16-64

CHECKED G.M. CHAUVIN 3-27-64

ENGINEER J.A. Miller 4-9-64

APPROVED G.M. Chauvin 4-9-64

JOB NO. 5242

SARGENT & LUNDY ENGINEERS CHICAGO 3, ILLINOIS

DRAWING NO. B-32

AECOM

Appendix C: Kincaid Ash Pond Piezometer Locations

KIN-P009
KIN-P011
KIN-P008
KIN-P010
KIN-P012
KIN-P007
KINCAID ASH POND
KIN-P005
KIN-P006
PZ-4A
PZ-4B
PZ-4C
KIN-P003
KIN-P004
KIN-P002
KIN-P001

LEGEND

- AECOM PIEZOMETER LOCATION
- APPROXIMATE NRT PIEZOMETER LOCATION
- CCR UNIT BERM ALIGNMENT

SOURCE:
MAP PROVIDED BY GOOGLE EARTH PRO 2015

0 400
APPROXIMATE SCALE FEET

N

KINCAID GENERATION, L.L.C.	PROJECT NO. 60440697
AECOM	
DRN. BY: djd October 2015 DSGN. BY: eg CHKD. BY: eg	Kincaid Ash Pond Piezometer Locations
	FIG. NO. 2A

File: P:\PROJECTS\GEOTECH\60428794_DYNEGYCCR\04TASKS\00 PROGRAM TASKS\1.0 TASK 1 INITIAL UNIT ASSESSMENT\CCR FACT SHEETS\SITE MAPS\FIGURE 2A PIEZOMETER LOCATION PLAN (KINCAID ASH POND).DWG Last edited: NOV. 03, 15 @ 11:33 a.m. by: david_deguire

AECOM

Appendix D: Ash Pond Embankment Settlement (2013)

HANSON
Engineering | Architecture | Planning | Allied Services

Hanson Professional Services Inc.
1525 S. Sixth Street
Springfield, IL 62703
(217) 788-2450
Fax: (217) 788-2503
www.hanson-inc.com

August 2, 2013

Mr. Don Torricelli
Performance Specialist
Kincaid Power Station

RE: Ash Pond Embankment Settlement

Dear Mr. Torricelli:

After a call by Kincaid personnel on July 31, 2013 regarding transverse cracking of the crest of a portion of the southwest embankment section of the Kincaid Station Ash Pond, James P. Knutelski, P.E. of Hanson visited the site to observe the cracks. He was accompanied by Don Torricelli of the Kincaid Power Station. The following observations were made:

- The affected area was approximately 250 ft by 250 ft. The area is situated on the southwest side of the ash pond adjacent to the water intake channel for the power station. The location of the affected area is shown on the attached aerial photo and coal mine map.

- Surface features within the affected area include tension cracks, compression heaving, and apparent settlement. There is no survey data showing that settlement has occurred, however the crest of the dam is approximately 2 ft lower in the affected area than the adjacent crest.

- Tension cracks cross the embankment perpendicular to the embankment crest. On the upstream side of the embankment where ash has been filled to the elevation of the crest, the tension cracks change direction slightly.

- Compression heaving of the ground surface was observed along two lines near the center of the affected area and the lines of heaving were separated by about 12 ft. Compression heaving only occurred in the low area of the depression.

- The tension cracks were not visible more than 5 ft down the downstream slope of the embankment due to dense vegetative cover. A noticeable depression in the downstream slope was observed in the affected area.

- Cracks, settlement, or other surface features were not observed between the toe of the embankment and the inlet channel. They either did not exist, or were not visible due to dense vegetative cover.

- There were no wet areas, seepage, or evidence of seepage observed on the downstream slope of the embankment, the toe of the embankment, or the area between the embankment toe and the inlet channel.

The surficial features at the southwest embankment of the ash pond appear to be related to mine subsidence of the Peabody No. 10 coal mine that was active between 1951 and 1994. The following points indicate data or observations to support this conclusion:

- The affected area is undermined according to the available map.
- There are no utilities or other underground structures within the affected area that could be a source of leakage and underground erosion.
- The tension cracking and surface heaving that was observed transverse to the embankment crest are consistent with a sag subsidence above room and pillar mining.

The Peabody No. 10 mine is listed as blind room and pillar mine. Between 40% and 70% of the coal is removed in this type of mining. The Herrin coal seam was mined at depths between 300 ft and 380 ft. The average thickness of the coal seam was between 6.5 ft and 7.5 ft in this mine and the maximum thickness was 13.0 ft. The coal was mined beneath the Anna Shale or a limestone roof. Generally 6 ft to 7 ft of the coal was removed.

In Illinois, the maximum settlement for a sag type subsidence is generally situated near the center of the subsided area and the maximum settlement magnitude is generally between 2 ft and 4 ft. A review of the map of the coal mine for the affected area would allow a more precise estimate of maximum settlement magnitude.

Subsidence events can manifest rapidly in a manner of days, or slowly over several months or years. Prediction of future or continued subsidence is generally not economical or reliable with the technology available today.

In order to protect critical components of the Kincaid Power Station from additional or future subsidence, methods to prevent or minimize subsidence are probably the most feasible and economical.

Since injection of coal combustion byproduct (CCB) materials into the abandoned mine around the power station is currently part of the plant operation, it is recommended that CCB injection into areas beneath critical components of the power plant be given priority. Filling these areas would most likely result in greatly reduced, or eliminate future surface subsidence. Filling undermined areas that have already experienced subsidence may reduce or prevent additional subsidence.

Repair of the embankment does not appear to be necessary at this time because: there is no observed seepage or evidence of seepage in the embankment in this area, the depression in the embankment crest does detrimentally affect the freeboard of the impoundment, and the water detention within the impoundment is hundreds of feet from the affected embankment

This area should be observed daily for a week following the date of subsidence event and weekly thereafter for a period of 2 months. Noticeable additional cracking or settlement, seepage through the embankment, or wet areas near the toe of then embankment should be reported to Hanson immediately.

The portion of the coal mine that extends under Sangchris Lake was likely mined around the same time period as the two recently subsided areas near the power station. A similar event occurring under the lake has the potential to flood the mine. A significant loss of lake water into

the mine is unlikely; however, considering the consequences, it is prudent to be observant of unusual conditions on the lake. Non-typical surface disturbances such as bubbling, swirls, or whirlpools could be evidence of drainage into the abandoned mine. Hanson should be contacted if any of these occurrences are observed.

Please contact me at (217) 747-9380 if you have any questions concerning this letter or if you require additional information.

Sincerely,

HANSON PROFESSIONAL SERVICES INC.

James P. Knutelski, PE, GE
Geotechnical Engineer

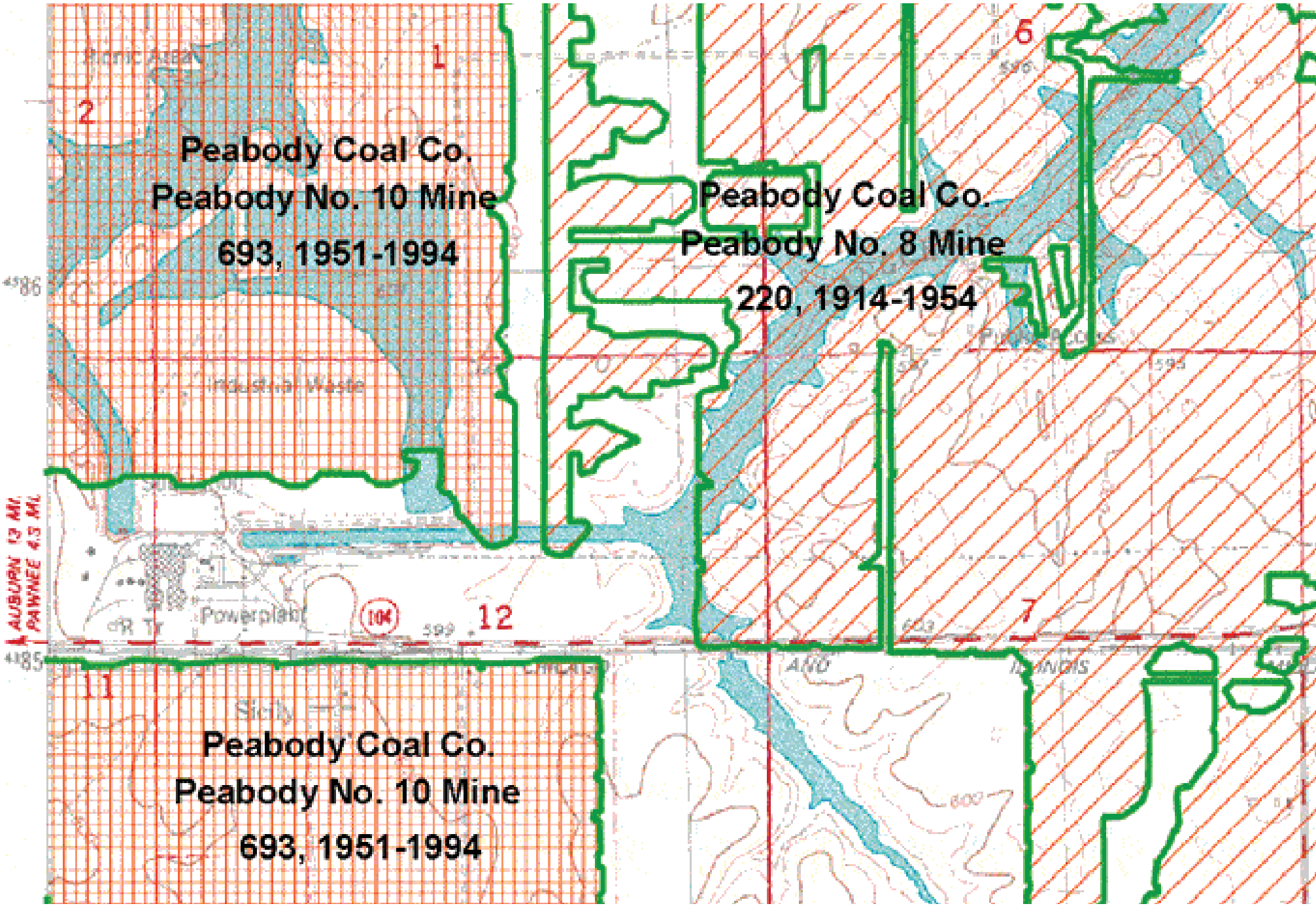
References

Coal Mines in Illinois, Kincaid Quadrangle retrieved July 31, 2013 from http://www.isgs.illinois.edu/maps-data-pub/coal-maps/topo-mines/kincaid.pdf

Mine Subsidence in Illinois: Facts for Homeowners, Bauer, Robert A., IDNR, ISGS Circular 569, 2006

Attachments

Aerial photo of affected area


Peabody Coal Co.
Peabody No. 10 Mine
693, 1951-1994
Peabody Coal Co.
Peabody No. 8 Mine
220, 1914-1954
Peabody Coal Co.
Peabody No. 10 Mine
693, 1951-1994
Plant Area
Industrial Waste
Powerplant
AUBURN 13 MI.
PAWNEE 4.5 MI.
1
2
5
6
7
11
12

Tension cracking in embankment crest

Compression heaving in crest of embankment

Depression in embankment crest and downstream slope, tension cracks visible

ATTACHMENT C

October 2021

Kincaid Power Plant – Ash Pond's Chemical Constituents

In accordance with 35 I.A.C. 845.230(d)(2)(C), Kincaid Generation L.L.C. is submitting available/existing analyses of "the chemical constituents of all waste streams, chemical additives and sorbent materials entering or contained in" the CCR impoundment, Ash Pond.

A list of the chemical constituents' analyses contained in the CCR surface impoundment can be found in Appendix A. As determined through antidegradation studies, this list contains chemical constituents found in the surface free liquid and the subsurface free liquids. Kincaid Generation L.L.C. is also including a list of chemical additives, sorbent materials and waste streams that were submitted in the facility's NPDES permit applications to IEPA within the past ten years at a minimum and/or listed in the current NPDES permit (IL0001554) in Appendix B.

Appendix A: Chemical Constituents Contained in the Ash Pond

Pollutant	Units	Surface Free Liquids Average Concentration	Subsurface Free Liquids Average Concentration
Acidity (total)	mg/L	< 20.0	< 20.0
Alkalinity (total)	mg/L	102	305
Ammonia Nitrogen	mg/L	0.10 U	0.3
Antimony (dissolved)	mg/L	< 0.00018	0.0008
Antimony (total)	mg/L	< 0.00021	0.0006
Arsenic (dissolved)	mg/L	0.0018	0.002
Arsenic (total)	mg/L	0.0023	0.0033
Barium (dissolved)	mg/L	0.215	0.123
Barium (total)	mg/L	0.258	0.12
Beryllium (dissolved)	mg/L	< 0.0005	< 0.0005
Beryllium (total)	mg/L	< 0.0005	0.0005
Boron (dissolved)	mg/L	1.33	2.4
Boron (total)	mg/L	1.34	2.4
Cadmium (dissolved)	mg/L	< 0.0005	0.0003
Cadmium (total)	mg/L	0.0003	0.0003
Calcium (total recoverable)	mg/L	51	104
Chemical Oxygen Demand	mg/L	< 6.7	9.2
Chloride (total)	mg/L	26.6	7.8
Chromium (dissolved)	mg/L	< 0.00067	< 0.00048
Chromium (hexavalent)	mg/L	0.00038	0.00013
Chromium (total)	mg/L	0.0009	0.0017
Cobalt (dissolved)	mg/L	0.001	0.001
Cobalt (total)	mg/L	< 0.00018	0.001
Copper (dissolved)	mg/L	< 0.00065	0.0005
Copper (total)	mg/L	0.0013	0.001
Cyanide (dissociable)	mg/L	< 0.0050	< 0.0050
Cyanide	mg/L	0.0045	< 0.0050
Fluoride	mg/L	0.63	0.4
Iron (dissolved)	mg/L	< 0.0312	9.72
Iron (Ferric)	mg/L	0.12	11.7
Iron (Ferrous)	mg/L	0.14	0.6
Iron (total)	mg/L	0.157	12.3
Kjeldahl Nitrogen (total)	mg/L	1.0	0.5
Lead (dissolved)	mg/L	< 0.001	< 0.001
Lead (total)	mg/L	0.001	0.001
Lithium (total recoverable)	mg/L	0.0170	0.02
Magnesium (total recoverable)	mg/L	30.3	30.4
Manganese (dissolved)	mg/L	0.0042	0.184
Manganese (total)	mg/L	0.0167	0.171
Mercury (dissolved)	mg/L	0.0000004	0.0000004
Mercury (total)	mg/L	7.295E-07	0.0000005

Pollutant	Units	Surface Free Liquids Average Concentration	Subsurface Free Liquids Average Concentration
Molybdenum (dissolved)	mg/L	0.0142	0.025
Molybdenum (total)	mg/L	0.016	0.0255
Nickel (dissolved) 2008 WD	mg/L	< 0.00061	0.0031
Nickel (dissolved) 6020 WD	mg/L	< 0.00059	0.004
Nickel (total)	mg/L	0.0009	0.004
Nitrate as N	mg/L	< 0.10	0.29
Nitrite as N	mg/L	< 0.10	0.09
Oil & grease	mg/L	< 5.3	4.8
Oxidation/Reduction Potential	mg/L	158.8	123
pH*	SU	8.0	7.3
Phenols	mg/L	< 0.050	< 0.050
Phosphorus	mg/L	< 0.31	0.8
Potassium (dissolved)	mg/L	7.19	9.70
Potassium (total recoverable)	mg/L	7.64	9.77
Radium - 226	mg/L	0.711	0.687
Radium - 228	mg/L	1.80	1.11
Radium (total)	mg/L	2.51	1.80
Selenium (total)	mg/L	< 0.00058	0.001
Silica	mg/L	4.35	23.9
Silver (dissolved)	mg/L	< 0.0005	0.0004
Silver (total)	mg/L	< 0.0005	< 0.0005
Sodium (total recoverable)	mg/L	74.0	77.9
Specific Conductance	mg/L	799	1015
Sulfate	mg/L	247	262
Sulfide (total)	mg/L	0.057	0.05
Thallium (dissolved)	mg/L	< 0.001	0.0007
Thallium (total)	mg/L	< 0.001	0.0007
Total dissolved solids	mg/L	563	710
Total Organic Carbon	mg/L	3.8	1.4
Total suspended solids	mg/L	19.8	47.5
Zinc (dissolved)	mg/L	< 0.01	< 0.01
Zinc (total)	mg/L	< 0.01	0.01

*Used https://calstormcompliance.com/ph-averaging-tool

Appendix B: List of Chemical Additives, Waste Streams and Sorbent Materials

Chemical Additives
Ammonia Hydroxide
Coal Dust Suppression Products*
Aqueous Ammonia
Anodamine
Potassium Iodide
Mill Scale

* Only a very small percentage of these chemicals would enter the ash pond. A high majority of the product would be consumed in the combustion process. Varying products may be used. While the products are comprised of different ingredients (e.g., lignosulfonates, acrylic and vinyl polymers, petroleum distillates), they all share the same inherent properties in that they adhere to solids for stabilization purposes and are not readily washed away during rainfall events.

Waste Streams and Sorbent Materials*
Bottom Ash and Economizer Ash sluice water
Air Heater Ash water
Tunnel Ground Water Sump
Coal Pile Runoff
Slag Tank Cooling Water
Intake Pump House Sump
Ammonia Storage Tank Sump
Building low Volume Wastewater
Condensate Storage Area and Overflows
Station Basement Sumps
Stormwater Sources
Boiler Drain Water

*No sorbent materials

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Bottom Ash
Synonyms:	Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids.
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause respiratory irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*20 - 40%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen. Category 1A*
Aluminosilicates[2]	*Various, see Footnote 2*	*10 - 60%*	*Single Exposure STOT, Category 3*
Calcium oxide (CaO)	*1305-78-8*	*10 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Manganese dioxide (MnO_2)	*1313-13-9*	*<2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1 - 10%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant Category 2* *Eye Irritant Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*

[1]The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.

[2]Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable	0.05	0.05	0.025	0.05
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): 8 - 11	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point and boiling range (°C): Not applicable	**Partition coefficient: n-octane/water:** Not determined
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined)
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L
Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13
Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO_2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
******* *Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

ATTACHMENT D

October 2021

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Placement Above the Uppermost Aquifer Location Demonstration for Ash Pond at the Kincaid Power Plant

Kincaid Generation, LLC operates the coal fired Kincaid Power Plant located in Christian County, Illinois. The Kincaid Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Kincaid Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This memorandum addresses the requirements of Section 845.300 Placement Above the Uppermost Aquifer, which states:

Section 845.300 Placement Above the Uppermost Aquifer

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must, be constructed with a base that is located at least 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR surface impoundment and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

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

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

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Placement Above Uppermost Aquifer
Ash Pond
Kincaid Power Station
Kincaid, Illinois

Kincaid Generation, LLC operates the coal-fired Kincaid Power Station (Plant) located near Kincaid, Illinois. The Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.60 *(Placement above the uppermost aquifer)* of the US Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.60); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.60).

§257.60(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must be constructed with a base that is located no less than 1.52 meters (five feet) above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the CCR unit and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table). The owner or operator must demonstrate by the dates specified in paragraph (c) of this section that the CCR unit meets the minimum requirements for placement above the uppermost aquifer.

Haley & Aldrich reviewed available information provided by Vistra including historic design reference documents, field investigations, and laboratory reports, and based on review and evaluation of the information provided, the results do not demonstrate compliance with the requirements of 40 CFR §257.60(a).

Kincaid

§257.60(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify that the above-referenced CCR Unit does not meet the requirements of 40 CFR §257.60(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:

Kincaid

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 I.A.C. Admin. Code Part 845 - Wetland Location Demonstration for Ash Pond at Kincaid Power Plant

Kincaid Generation, LLC operates the coal fired Kincaid Power Plant located in Christian County, Illinois. The Kincaid Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Kincaid Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.310 Wetlands, which states:

Section 845.310 Wetlands

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in wetlands unless the owner or operator demonstrates* [that the requirements listed in 845.310(a)(1) through (5) are met.]

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

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

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

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration - Wetland Areas
Kincaid Power Station
Ash Pond
Kincaid, Illinois

Kincaid Generating, LLC operates the coal-fired Kincaid Power Station (Plant) located near Kincaid, Illinois. The Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.61 *(Wetlands)* of the US Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities.* 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.63); Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.63).

§257.61(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in wetlands, as defined in §232.2 of this chapter, unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that the CCR unit meets the requirements of paragraphs (a)(1) through (5) of this section.

Based on a review of the U.S. Fish and Wildlife Service's National Wetland Inventory mapping, 0.5-meter resolution aerial imagery (2015) and the results of on-site field assessments, the Unit is not located in wetlands as defined by 40 CFR §232.2.

Kincaid

§257.61(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the CCR Unit is not located in wetlands as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 and, therefore, meets the requirements of 40 CFR §257.61(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:

Kincaid

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 - Fault Area Location Demonstration for Ash Pond at the Kincaid Power Plant

Kincaid Generation, LLC operates the coal fired Kincaid Power Plant located in Christian County, Illinois. The Kincaid Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Kincaid Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) Part 845 (Part 845).

This memorandum addresses the requirements of Section 845.320 Fault Areas, which states:

Section 845.320 Fault Areas

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR surface impoundment.*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

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

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

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration - Fault Areas
Kincaid Power Station
Ash Pond
Kincaid, Illinois

Dynegy operates the coal-fired Kincaid Power Station (Plant) located approximately 3 miles west of the City of Kincaid, Christian County, Illinois. The Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment at the Plant. This demonstration addresses the requirements of 40 CFR §257.62 *(Fault Areas)* of the US Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.62); 83 Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.62)

§257.62(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located within 60 meters (200 feet) of the outermost damage zone of a fault that has had displacement in Holocene time unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that an alternative setback distance of less than 60 meters (200 feet) will prevent damage to the structural integrity of the CCR unit.

A review of available data from the U.S. Geologic Survey, the Illinois State Geological Survey, and other available information was completed for this demonstration. The nearest known mapped fault is the Sicily Fault which is located approximately 2 miles east and the known timeframe of the most recent activity on this fault is not known. Based on the available published geologic data and information reviewed, there are no active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the Unit.

Kincaid

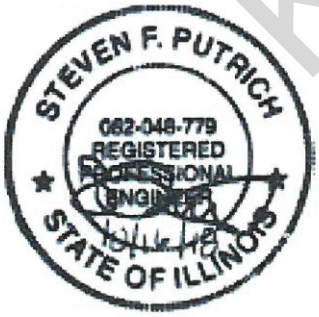
§257.62(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the demonstration that the CCR Unit is not located within 60 meters (200 feet) of the outermost damage zone of a fault that has had a displacement in Holocene time as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 meets the requirements of 40 CFR §257.62(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:



Kincaid

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – Seismic Impact Zone Location Demonstration for Ash Pond at the Kincaid Power Plant

Kincaid Generation, LLC operates the coal fired Kincaid Power Plant located in Christian County, Illinois. The Kincaid Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Kincaid Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845 (Part 845).

This memorandum addresses the requirements of Section 845.330 Seismic Impact Zones, which states:

Section 845.330 Seismic Impact Zones

a) *Existing and new CCR surface impoundments, and all lateral expansions of CCR surface impoundments must not be located in seismic impact zones unless the owner or operator demonstrates that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.*

b) *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsection (a).*

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

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

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Seismic Impact Zone
Kincaid Power Station
Ash Pond
Kincaid, Illinois

Kincaid Generation, LLC operates the coal-fired Newton Power Station (Plant) located near Kincaid, Illinois. The Primary Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment. This demonstration addresses the requirements of 40 CFR §257.63 *(Seismic Impact Zones)* of the U.S. Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.63); Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.63).

Kincaid

§257.63(a): New CCR landfills, existing and new CCR surface impoundments, and all lateral expansions of CCR units must not be located in seismic impact zones unless the owner or operator demonstrates by the dates specified in paragraph (c) of this section that all structural components including liners, leachate collection and removal systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

The results of our evaluation indicate that the Unit is in compliance with 40 CFR §257.63(a). Although the Unit is located in a seismic impact zone, it satisfies the demonstration requirements of 40 CFR §257.63(a). The AECOM report entitled "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for the Kincaid Ash Pond at Kincaid Power Station" dated October 2016 (AECOM Report), includes engineering analysis, calculations, and findings that support the requirements of 40 CFR §257.63(a), and provides documentation that those requirements have been evaluated by AECOM for the subject CCR unit.

§257.63(b): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify that the CCR Unit is located in a seismic impact zone as included in the CCR Rule Location Restriction Evaluation memorandum dated 12 October 2018 and satisfies all requirements of 40 CFR §257.63(a).

By providing this certification demonstration statement, we are not stating or inferring that we have verified or certified the details, assumptions, calculations and/or site condition models developed by AECOM in the subject report; those elements of the report are considered the professional opinions and determinations of AECOM.

Signed: _____
Consulting Engineer

Print Name: Steven F. Putrich
Illinois License No.: 62048779
Title: Vice President
Company: Haley & Aldrich, Inc.

Professional Engineer's Seal:

Kincaid

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 Ill. Admin. Code Part 845 – Unstable Areas and Floodplains Location Standard Demonstration for the Ash Pond at Kincaid Power Plant

Kincaid Generation, LLC is the owner of the coal fired Kincaid Power Plant (Plant) located in Christian County, Illinois. The Ash Pond is an existing surface impoundment storing coal combustion residuals (CCR). The requirements for the Ash Pond are found in 35 Ill. Admin. Code (I.A.C.) 845, Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments (Part 845).

This certification addresses the requirements of Part 845, Section 845.340 Unstable Areas and Floodplains, which states:

> *Section 845.340 (a): An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment must not be located in an unstable area unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the integrity of the structural components of the CCR surface impoundment will not be disrupted.*
>
> *Section 845.340 (b): The owner or operator must consider all the following factors, at a minimum, when determining whether an area is unstable: 1) On-site or local soil conditions, including but not limited to liquefaction, that may result in significant differential settling; 2) On-site or local geologic or geomorphologic features; and 3) On-site or local human-made features or events (both surface and subsurface).*

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

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

> *Section 845.340 (c):* *An existing or new CCR surface impoundment, or any lateral expansion of a CCR surface impoundment, must not be located in a floodplain unless the owner or operator demonstrates that recognized and generally accepted engineering practices have been incorporated into the design of the CCR surface impoundment to ensure that the CCR surface impoundment will not restrict the flow of the base flood, reduce the temporary water storage capacity of a floodplain , or result in washout of CCR, so as to pose a hazard to human life, wildlife, or land or water resources.*

The boundaries of the impoundment were determined by a survey conducted by a professional surveyor licensed in the State of Illinois. The surveyed boundaries were compared to the existing floodplain boundary from the effective FEMA Flood Insurance Rate Map (FIRM) Number 17021C0250D, dated June 16, 2011. The location of the Kincaid Ash Pond is outside of the FEMA 100-year floodplain, therefore, it was determined that the Kincaid Ash Pond is not located within the floodplain.

> *Section 845.340 (d):* *The owner or operator of the CCR surface impoundment must obtain a certification from a qualified professional engineer stating that the demonstration meets the requirements of subsections (a) and (c).*

Pursuant to Section 845.210(d)(2), for existing CCR surface impoundments, the owner or operator of the CCR surface impoundment may use a previously completed location restriction demonstration required by Section 845.340 (Unstable Areas) and demonstrated in Attachment D. Therefore, a new certification is not included for Section 845.340 (a). Certification for Section 845.340 (c) is included below.

35 Illinois Administration Code Part 845:
Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments
Section 845.340 (c): Certification

I, *Sarah Espinosa*, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that this floodplain demonstration meets the requirements of 35 Ill. Adm. Code 845.340(c).

Sarah Espinosa, P.E.

Printed Name

October 21, 2021

Date

HALEY & ALDRICH, INC.
6500 Rockside Road
Suite 200
Cleveland, OH 44131
216.739.0555

MEMORANDUM

16 October 2018
File No. 129788

SUBJECT: Location Restriction Demonstration – Unstable Areas
Kincaid Power Station
Ash Pond
Kincaid, Illinois

Vistra Energy/Dynegy operates the coal-fired Kincaid Power Station (Plant) located near Kincaid, Illinois. The Ash Pond (Unit) is an existing coal combustion residuals (CCR) surface impoundment at the Plant. This demonstration addresses the requirements of 40 CFR §257.64 *(Unstable Areas)* of the US Environmental Protection Agency's (EPA) rule entitled *Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities*. 80 Fed. Reg. 21,302 (Apr. 17, 2015) (promulgating 40 CFR §257.63); Fed. Reg. 36,435 (July 30, 2018) (amending 40 CFR §257.63).

§257.64(a): An existing or new CCR landfill, existing or new CCR surface impoundment, or any lateral expansion of a CCR unit must not be located in an unstable area unless the owner or operator demonstrates by the dates specified in paragraph (d) of this section that recognized and generally accepted good engineering practices have been incorporated into the design of the CCR unit to ensure that the integrity of the structural components of the CCR unit will not be disrupted.

§257.64(b): The owner or operator must consider all of the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;
(2) On-site or local geologic or geomorphologic features; and
(3) On-site or local human-made features or events (both surface and subsurface).

Determination of compliance with §257.64(b)(1) - Conditions associated with the potential for significant differential settlement were not identified in the area where the Plant is located. A separate report completed by AECOM entitled "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for the Kincaid Ash Pond at Kincaid Power Station" dated October 2016 concluded that the soils under the Unit are not susceptible to liquefaction.

Determination of compliance with §257.64(b)(2) - Based on available United States Geological Survey (USGS) and Illinois State Geological Survey (ISGS) information, karst topography or physiographic features such as sinkholes, vertical shafts, sinking streams, caves, large springs, or blind valleys do not exist at the Plant. In addition, communication with ISGS indicated that karst features are not common in Christian County, where the Unit is located. To evaluate the susceptibility of landslides, we reviewed readily available USGS and Illinois Department of Energy and Natural Resources (IDENR) data. The USGS

Kincaid

data indicates that the Plant is in an area of low landslide incidence. A review of IDENR data indicated that there has not been a landslide occurrence at or near the Unit. Accordingly, it is our opinion that the Unit is not located in an area that has high susceptibility to landslides.

Determination of compliance with §257.64(b)(3) - An inactive underground mine is located below the Unit, however an evaluation by AECOM (2016) concluded that the presence of this underground mine does not negatively affect the stability of the Unit.

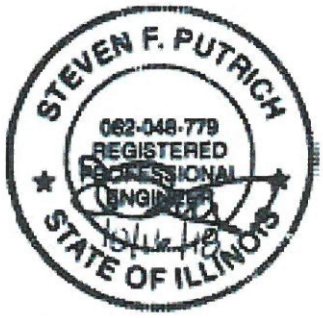
§257.64(c): The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer or approval from the Participating State Director or approval from EPA where EPA is the permitting authority stating that the demonstration meets the requirements of paragraph (a) of this section.

I, Steven F. Putrich, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the demonstration indicating the CCR Unit is not located in an unstable area as included in the CCR Rule Location Restrictions Evaluation memorandum dated 12 October 2018 meets the requirements of 40 CFR §257.64(a).

Signed: _____
Consulting Engineer

Print Name:	Steven F. Putrich
Illinois License No.:	62048779
Title:	Vice President
Company:	Haley & Aldrich, Inc.

Professional Engineer's Seal:



Kincaid

ATTACHMENT E

October 2021

KINCAID
ASH POND
ID #: W0218140002-01
KINCAID
GENERATION, LLC

ATTACHMENT F

October 2021

Kincaid Generation, LLC

KINCAID POWER PLANT

KINCAID, CHRISTIAN COUNTY, ILLINOIS

Emergency Action Plan (EAP)

40 C.F.R. § 257.73(a)(3), Ill. Adm. Code 845.520
Coal Combustion Residual (CCR) Impoundment
& Related Facilities

- Ash Pond (NID # IL50706) (IEPA # W0218140002-01)

Revision Date: September 16, 2021

Qualified Professional Engineer Certification; Emergency Action Plan for the Kincaid Power Plant Ash Pond

In accordance with 40 C.F.R. § 257.73(a)(3)(iv) and 35 Ill. Adm. Code 845.520(e), the owner or operator of a CCR unit that is required to prepare a written Emergency Action Plan under 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520(a) must obtain a certification from a qualified professional engineer stating that the written Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

I, Phil Morris, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that:

1. the information contained in this Emergency Action Plan was prepared in accordance with the accepted practice of engineering; and

2. this Emergency Action Plan meets the requirements of 40 C.F.R. § 257.73(a)(3) and 35 Ill. Adm. Code 845.520.

Phil Morris
Senior Director, Corporate Environmental

9/27/21

Date

KINCAID POWER PLANT
EMERGENCY ACTION PLAN
CCR IMPOUNDMENT & RELATED FACILITIES

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KINCAID POWER PLANT
EMERGENCY ACTION PLAN
CCR IMPOUNDMENT & RELATED FACILITIES

1 STATEMENT OF PURPOSE

The Kincaid Power Plant (Power Plant) is located near the City of Kincaid in Christian County, Illinois. The location is shown in Figure 1-1. The Power Plant is a coal-fired electricity producing power plant owned and operated by Kincaid Generation, LLC, a subsidiary of Dynegy. This Emergency Action Plan (EAP) was prepared in accordance with 40 CFR § 257.73(a)(3) and covers the following Coal Combustion Residual (CCR) surface impoundment located at the site:

- Ash Pond (NID # IL50706) (IEPA # W0218140002-01)

The location of this impoundment is shown in Figure 1-2. Section 6 of this EAP includes a description of the impoundment.

The purpose of this Emergency Action Plan (EAP) is to:

1. Safeguard the lives, as well as to reduce property damage, of citizens living within potential downstream flood inundation areas of the CCR impoundment and related facilities at the Kincaid Power Plant.
2. Define the events or circumstances involving the CCR impoundment and related facilities at the Kincaid Power Plant that represent atypical operating conditions that pose a safety hazard or emergency and how to identify those conditions.
3. Define responsible persons, their responsibilities, and notification procedures in the event of a safety emergency.
4. Provide contact information of emergency responders.
5. Identify emergency actions in the event of a potential or imminent failure of the impoundment.
6. Identify the downstream area that would be affected by failure of the impoundment.
7. Provide for effective facility surveillance, prompt notification to local Emergency Management Agencies, citizen warning and notification responses, and preparation should an emergency occur.

Information provided by Kincaid Generation, LLC was utilized and relied upon in preparation of this report.

Figure 1-1. Kincaid Power Plant Location Map

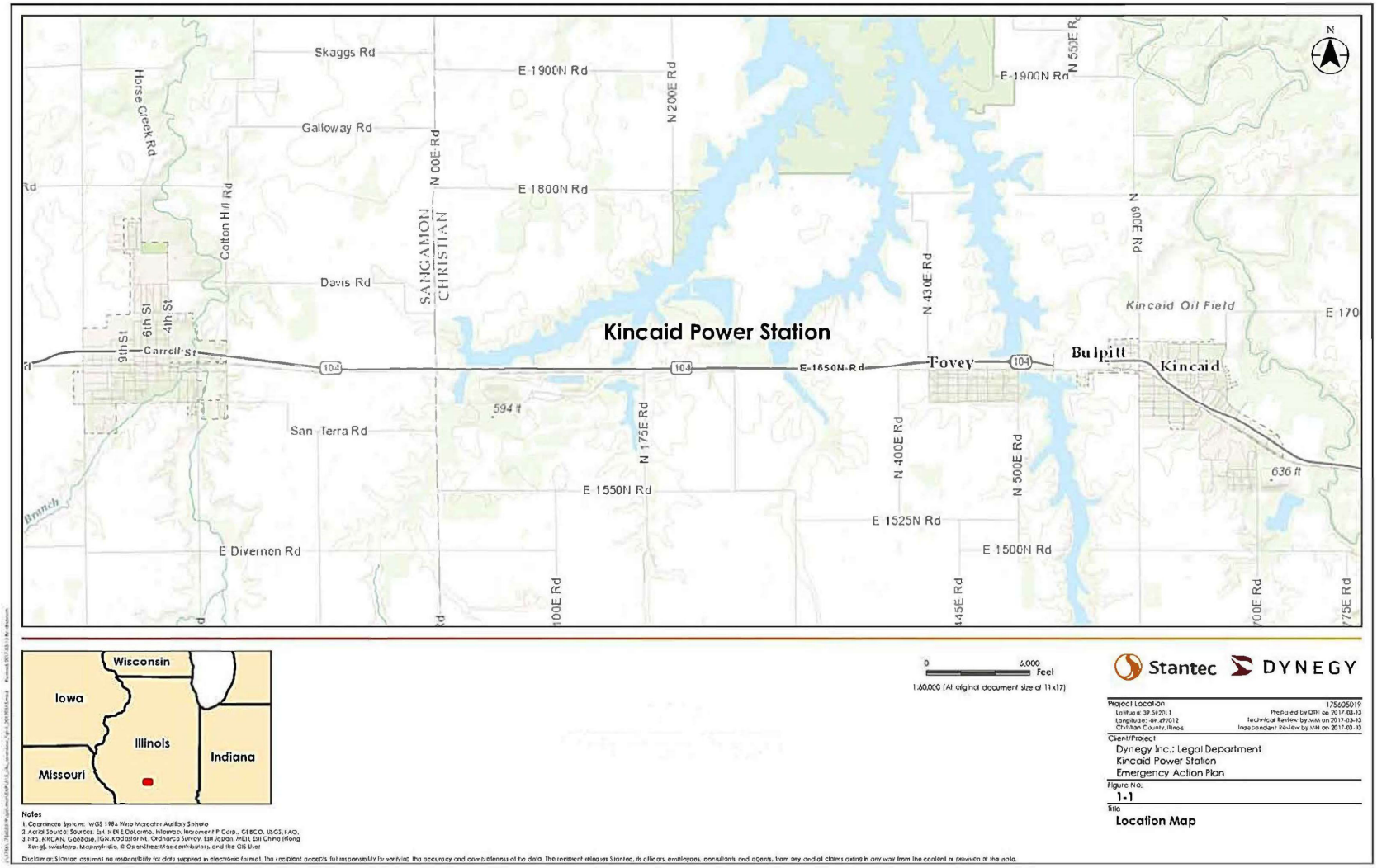
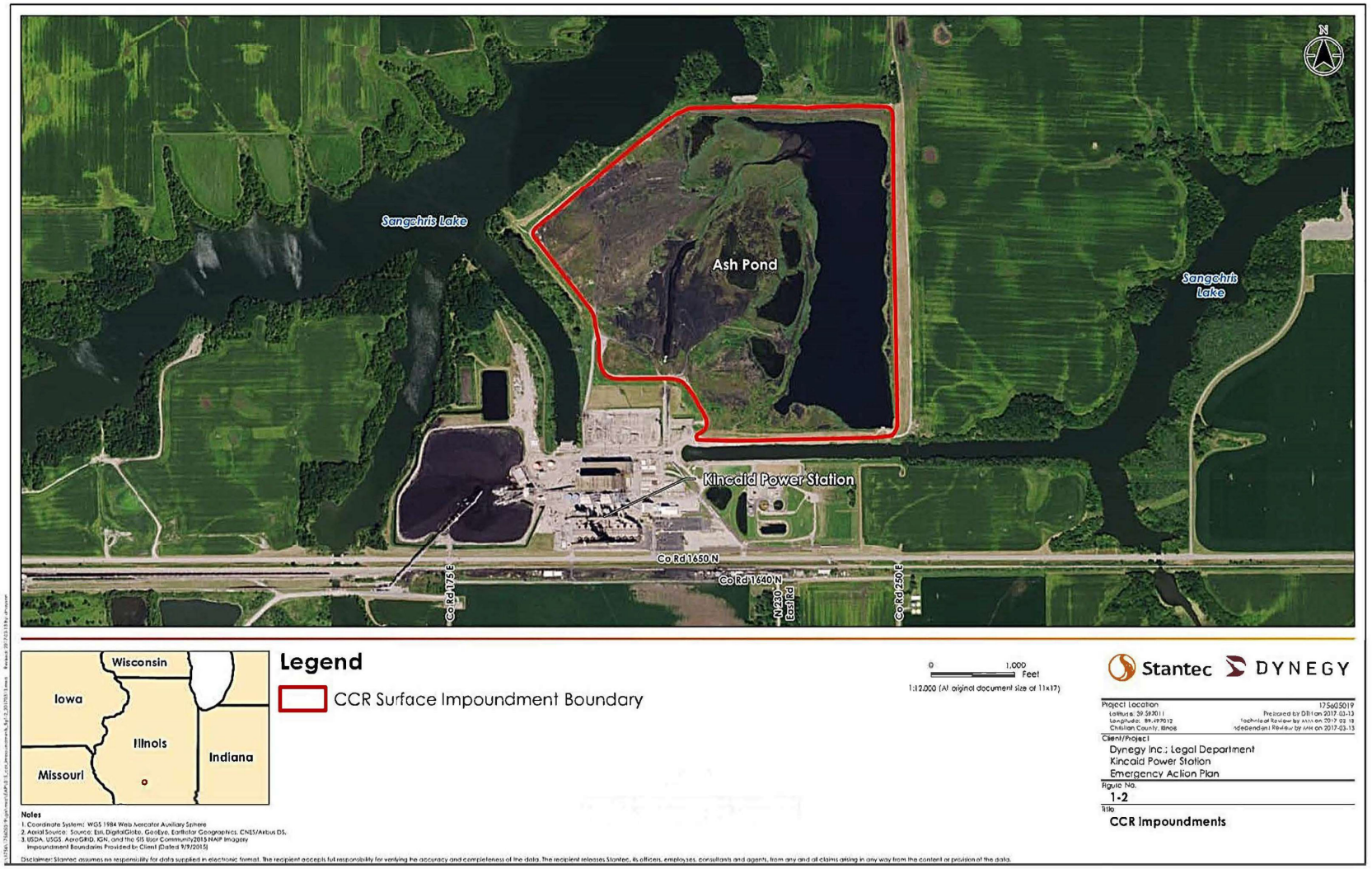


Figure 1-2. Kincaid Power Plant CCR Impoundment & Related Facilities



2 COMMUNICATION

To facilitate understanding among everyone involved in implementing this EAP, four response levels are used to identify the condition of an impoundment. These are:

Response Levels:

- **Level 0:** Normal conditions and routine operations, including surveillance and initial investigation of unusual conditions and effects of storm events.
- **Level 1:** Potentially hazardous condition exists, requiring investigation and possible corrective action.
- **Level 2:** Potential failure situation is developing; possible mode of failure is being assessed; corrective measures are underway.
- **Level 3:** Failure is occurring or is imminent, public protective actions are required.

The 4-Step Incident Response Process is outlined in Figure 2-1. This should be used in conjunction with the Notification Flowchart (Figure 2-2) and EAP Decision Tree (Figure 2-3). Section 4 provides guidance tables for determining Response Levels and a table providing emergency actions to be taken given various situations. Table 2-1 lists contact information for the emergency responders.

Figure 2-1. Summary/Sequence of Tasks 4-Step Incident Response Process

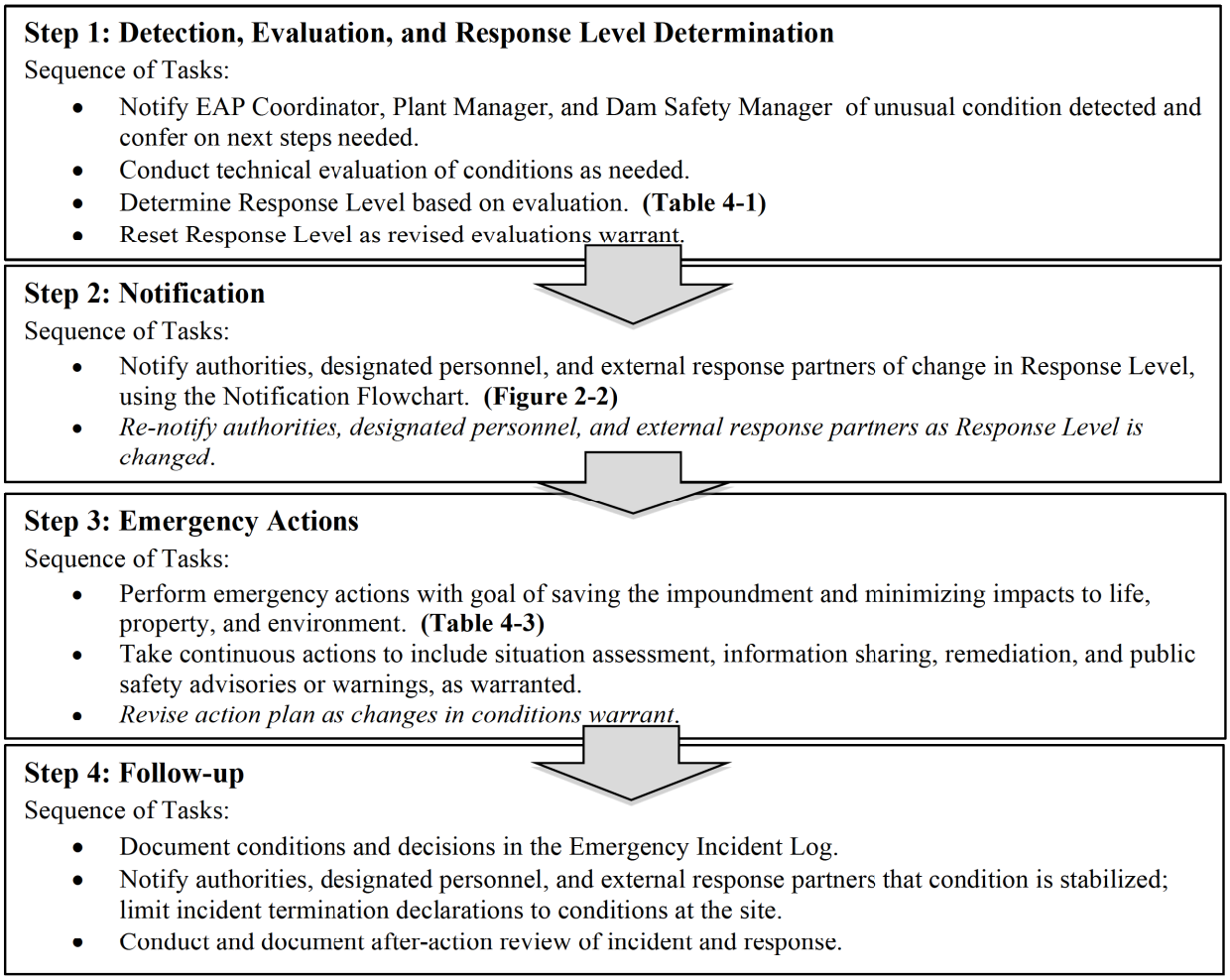


Figure 2-2. Notification Flowchart

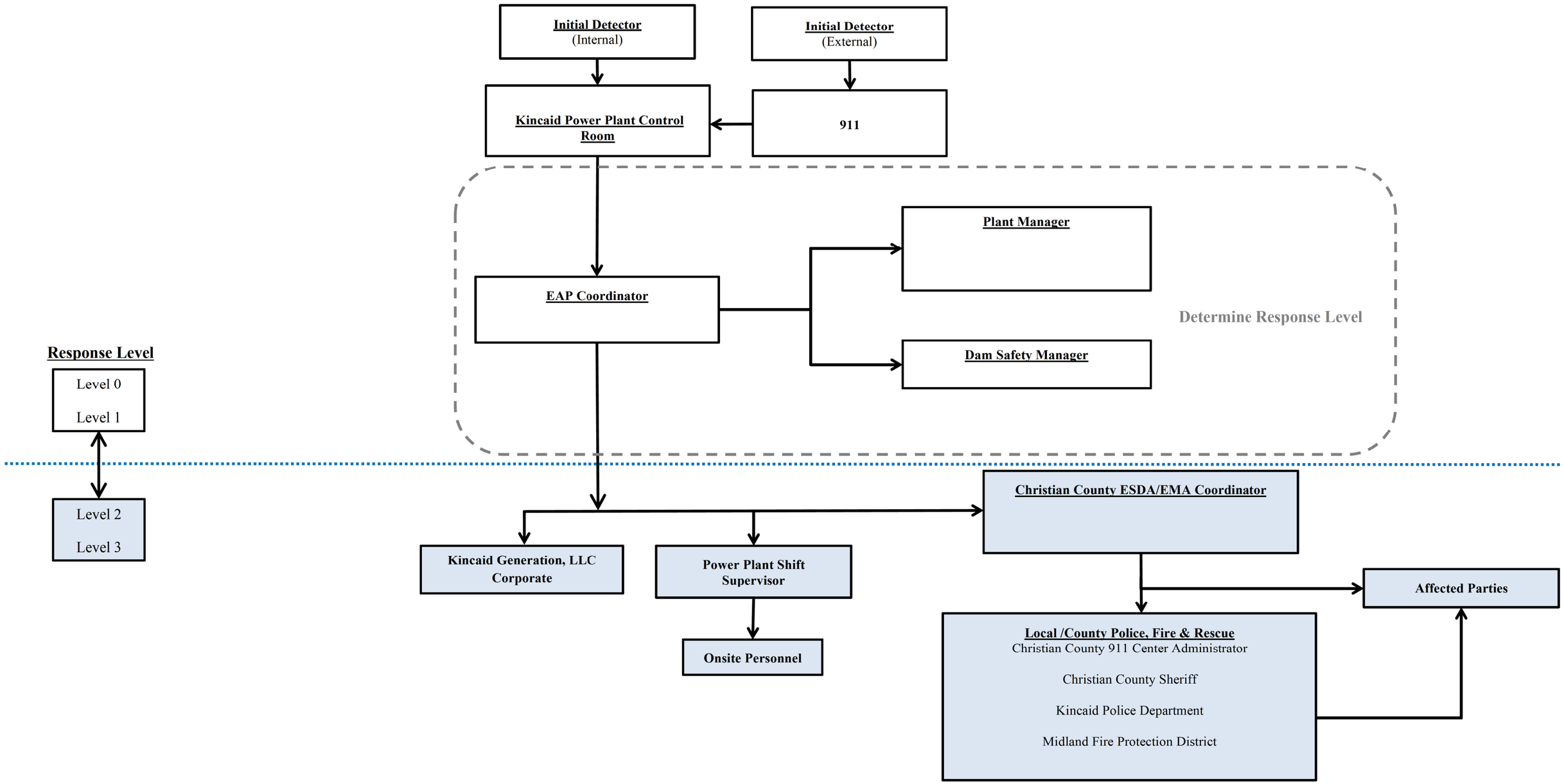


Figure 2-3. EAP Response Process Decision Tree

Note: At any given below, if failure is imminent or actively occurring **CALL 911 IMMEDIATELY** to notify emergency responders and then continue with process afterwards.

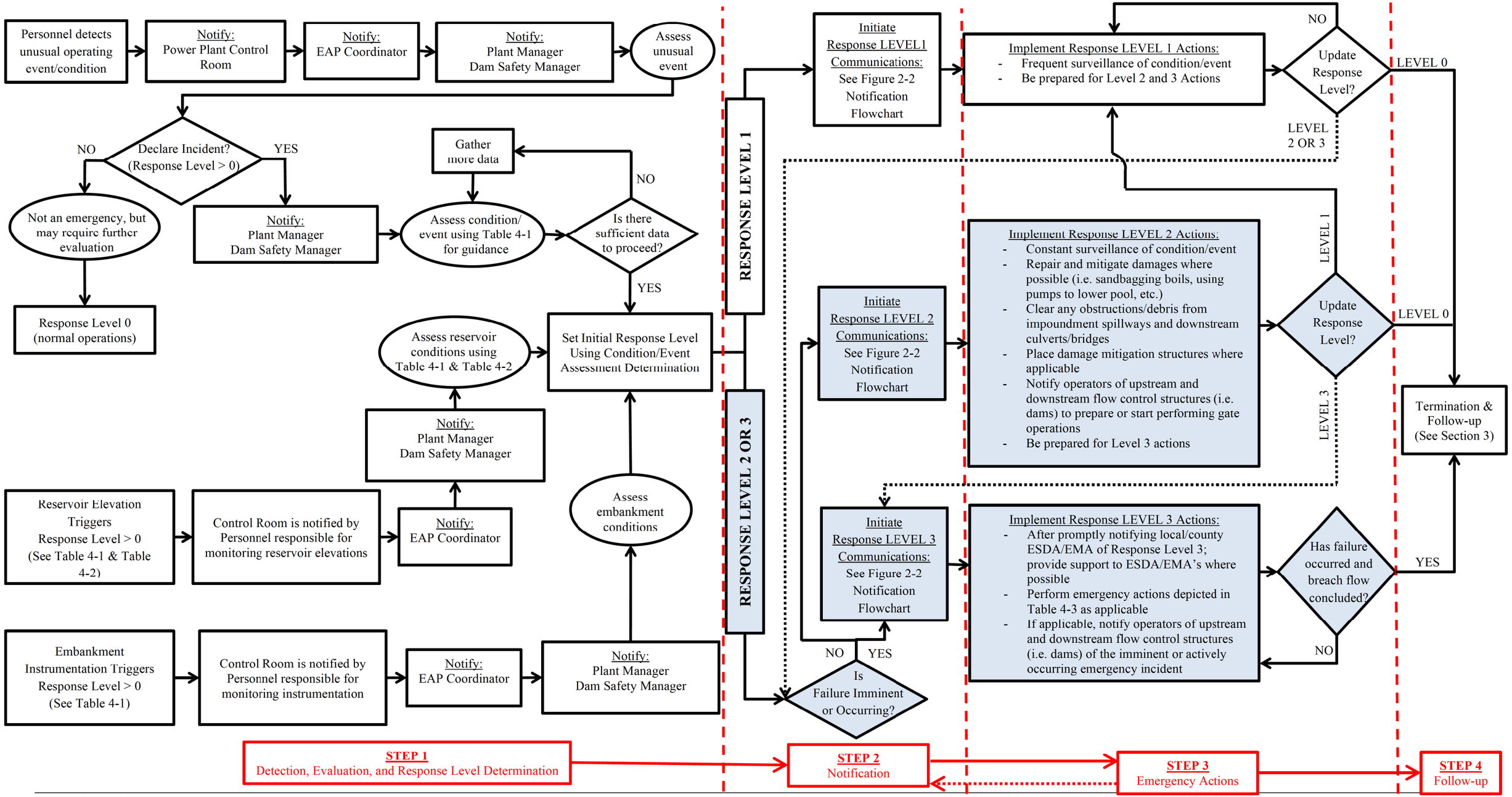


Table 2-1. EAP Emergency Responders

Position / Entity	Contact Information	
Internal Contacts		
Kincaid Power Plant	**Phone #**	
Plant Manager		
EAP Coordinator	(618) 225-9043	
Control Room	(217) 237-0209	
Corporate Operations		
Dam Safety Manager	(618) 792-8488	
External Contacts		
Local/County ESDA/EMA, Police, & Fire	**Phone #**	**Alternate Phone #**
Christian County 911 Emergency Communication Center	911	(217) 287-7911
Christian County ESDA/EMA	(217) 287-7227	
Christian County Sheriff Department	(217) 824-4961	
Kincaid Police Department	(217) 237-5568	
Midland Fire Department	(217) 237-4449	
State Emergency Management Agencies & Organizations	**Phone #**	**Alternate Phone #**
IDNR-OWR Dam Safety Section Manager	(217) 782-4427	
Sangchris Lake State Park - Park Information	(217) 498-9208	
Illinois Conservation Police - Office of Law Enforcement	(217) 782-6302	
Illinois State Police - District Commander	(217) 786-7107	

3 EAP ROLES AND RESPONSIBILITIES

Table 3-1 provides a summary of the EAP roles during an emergency event.

Table 3-1. Summary of EAP Roles

Entity	Role Description
Emergency Response Team (ERT)	**ERT:** personnel responsible for EAP implementation, distribution, updates/maintenance, and training activities. The *ERT* is comprised of the following roles; 1. **Corporate:** corporate entity, committee, team, or position with relevant responsibility for a given generating power plant. 2. **Power Plant Management:** Personnel responsible for day-to-day operation and management of the Power Plant. 3. **Dam Safety Manager:** Personnel that is most knowledgeable about the design and technical operation of facilities at a given power plant. 4. **EAP Coordinator:** Personnel responsible for implementing the EAP and associated activities. **Emergency Event – EAP Responsibilities** 1. Respond to emergencies at the Power Plant. 2. Verify and assess emergency conditions. 3. Notify and coordinate as appropriate with participating emergency services disaster agencies or emergency management agencies (ESDA/EMA's), emergency responders, regulatory agencies, and all other entities involved or affected by this EAP. 4. Take corrective action at the Power Plant. 5. Declare termination of emergencies at the Power Plant.
Christian County ESDA/EMA	1. Receive Response Level reports from *Corporate* through *EAP Coordinator*. 2. Coordinate emergency response activities with local authorities: police, fire and rescue, etc. 3. Coordinate notification of public as necessary through established channels, which may include door-to-door contact. 4. Coordinate notification activities to affected parties within inundation areas. 5. Evaluate risk to areas beyond the inundation areas, communicate needs to *Corporate* and/or *EAP Coordinator*, and coordinate aid as appropriate. 6. Responsible for declaring termination of an emergency condition off-site upon receiving notification of an emergency status termination from *Corporate*. 7. If necessary, coordinate with *State ESDA/EMA*.
Kincaid Police, Fire, and Rescue	1. Receive alert status reports from the *ERT* or the *County ESDA/EMA*. 2. If necessary, notify affected parties and general public within inundation areas (see Section 7). 3. Render assistance to Christian County ESDA/EMA, as necessary. 4. Render assistance to *Corporate* and *Power Plant Management*, as necessary.
Christian County Police, Fire and Rescue, and Emergency Services	1. Receive alert status reports from the *ERT* or the *County ESDA/EMA*. 2. If necessary, notify affected parties within the inundation area. 3. Provide mutual aid to other affected areas, if requested and able.

4 EAP RESPONSE

The 4-Step Incident Response Process is shown in Figure 2-1. The Decision Tree shown in Figure 2-3 provides a flowchart for the various elements of the response process. Upon reaching Step 4 of the response process (termination and follow-up), the EAP Coordinator is responsible for notifying the ESDA/EMA's that the condition of the dam/impoundment has been stabilized. The purpose of this section is to provide specific information that can be used during a response. This information is provided in the following tables:

- Table 4-1 provides guidance for determining the response level.
- Table 4-2 provides impoundment pool level trigger elevations.
- Table 4-3 lists emergency actions to be taken depending on the situation.

Table 4-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Spillway flow (See Table 4-2 for relevant elevations)	Primary spillway flow is not causing active erosion and impoundment water surface elevation is below emergency auxiliary crest elevation (if equipped).	Level 0
	Impoundment water surface elevation is at or above auxiliary spillway crest elevation (if equipped). No active erosion caused by spillway flow.	Level 1
	Spillway flow actively causing minor erosion that is not threatening the control section or dam/impoundment stability.	Level 2
	Spillway flow that could result in flooding of people downstream if the reservoir level continues to rise.	Level 2
	Abnormal operation of the spillway system due to blockage or damage that could lead to flooding.	Level 2
	Spillway flow actively eroding the soil around the spillway that is threatening the control section (e.g. undermining) or dam/impoundment stability.	Level 3
	Spillway flow that is flooding people downstream.	Level 3
Embankment overtopping (See Table 4-2 for relevant elevations)	Impoundment water surface elevation at or below typical normal pool fluctuation elevation.	Level 0
	Impoundment water surface elevation above typical normal pool fluctuation elevation.	Level 1
	Impoundment water surface elevation above high normal pool fluctuation elevation.	Level 2
	Impoundment water surface elevation at or above embankment crest elevation.	Level 3
Seepage	New seepage areas in or near the dam/impoundment with clear flow.	Level 1
	New seepage areas with cloudy discharge or increasing flow rate.	Level 2
	Heavy seepage with active erosion, muddy flow, and/or sand boils.	Level 3
Sinkholes	Observation of new sinkhole in impoundment area or on embankment.	Level 2
	Rapidly enlarging sinkhole and/or whirlpool in the impoundment.	Level 3

Table 4-1. Guidance for Determining the Response Level

Event	Situation	Response Level
Embankment cracking	New cracks in the embankment greater than ¼ inch wide without seepage.	Level 1
	Any crack in the embankment with seepage.	Level 2
	Enlarging cracks with muddy seepage.	Level 3
Embankment movement	Visual signs of movement/slippage of the embankment slope.	Level 1
	Detectable active movement/slippage of the embankment slope or other related effects (tension cracking, bulges/heaves, etc.) that could threaten the integrity of the embankment.	Level 2
	Sudden or rapidly proceeding slides of the embankment slopes.	Level 3
Embankment Monitoring Equipment (piezometers, inclinometers, surface displacement mounts, etc.)	Instrumentation readings beyond historic normal.	Level 1
	Instrumentation readings indicate the embankment is susceptible to failure.	Level 2
	Instrumentation readings indicate embankment is at threshold of failure or is currently failing.	Level 3
Earthquake or other event	Measurable earthquake felt or reported on or within 100 miles of the impoundment.	Level 1
	Earthquake or other event resulting in visible damage to the impoundment or appurtenances.	Level 2
	Earthquake or other event resulting in uncontrolled release of water or materials from the impoundment.	Level 3
Security threat	Verified bomb threat or other physical threat that, if carried out, could result in damage to the impoundment.	Level 2
	Detonated bomb or other physical damage that has resulted in damage to the impoundment or appurtenances.	Level 3
Sabotage/ vandalism	Damage to impoundment or appurtenance with no impact to the functioning of the impoundment.	Level 1
	Modification to the impoundment or appurtenances that could adversely impact the functioning of the impoundment. This would include unauthorized operation of spillway facilities.	Level 2
	Damage to impoundment or appurtenances that has resulted in seepage flow.	Level 2
	Damage to impoundment or appurtenances that has resulted in uncontrolled water release.	Level 3

Table 4-2. Impoundment Trigger Elevations

Impoundment	Embankment Crest Elevation	Auxiliary Spillway Crest Elevation	Normal Pool Fluctuation	
			Typical	High
Ash Pond	605 ft.	Not Applicable	601.8-603.3 ft.	604 ft.

Notes:
Source: "Dam Safety Assessment of CCW Impoundments – Kincaid Generation Slag Field", March 24, 2011.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
High Water Level/ Large Spillway Release	See Table 4-1 and Table 4-2 for elevations and triggering water levels associated with the impoundment and spillways covered by this EAP.	1. Assess cause of increased reservoir stage, especially during fair weather conditions. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Perform additional tasks as determined through consultation with the ERT. 5. Make notifications if condition worsens such that downstream flooding is imminent. **Response Level 0**: require enhanced surveillance 3 times per day **Response Level 1**: contact internal chain of command and external response partners as necessary; inspect impoundment minimum 1 time per hour **Response Level 2**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties. **Response Level 3**: contact internal chain of command; notify ESDA/EMA's and notify external response partners. ESDA/EMA's notify affected parties of emergency incident.
Seepage	Localized new seepage or boil(s) observed along downstream face / toe of earthen embankment with muddy discharge and increasing but controllable discharge of water.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Determine Response Level. 3. Make proper notifications as outlined in the Figure 2-2 Notification Flowchart. 4. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a) Place a ring of sand bags with a weir at the top towards the natural drainage path to monitor flow rate. If boil becomes too large to sand bag, place a blanket filter over the area using non-woven filter fabric and pea gravel. Attempt to contain flow in such a manner (without performing any excavations) that flow rates can be measured. Stockpile gravel and sand fill for later use, if necessary. b) Inspect the embankment and collect piezometer, water level and seepage flow data daily unless otherwise instructed by the Dam Safety Manager. Record any changes of conditions. Carefully observe embankment for signs of depressions, seepage, sinkholes, cracking or movement. c) Maintain continuous monitoring of feature. Record measured flow rate and any changes of condition, including presence or absence of muddy discharge. 5. Make notifications as outlined in the lower portion of the Notification Flowchart (Figure 2-2) if condition worsens such that failure is imminent.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
Sabotage and Miscellaneous Other Issues	Criminal action with significant damage to embankment or structures where significant repairs are required and the integrity of the facility is compromised—condition appears stable with time.	1. Contact law enforcement authorities and restrict all access (except emergency responders) to impoundment. Restrict traffic on embankment crest to essential emergency operations only. 2. Determine Response Level. 3. Make internal notifications as outlined in the upper portion of the Notification Flowchart (Figure 2-2). 4. In conjunction with the Dam Safety Manager, assess extent of damage and visually inspect entire embankment and ancillary structures for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the impoundment warrants a revised Response Level and additional notifications. 5. Perform additional tasks as directed by the ERT. 6. Make notifications if conditions worsen.
Embankment Deformation	**Cracks:** New longitudinal (along the embankment) or transverse (across the embankment) cracks more than 6 inches deep or more than 3 inches wide or increasing with time. New concave cracks on or near the embankment crest associated with slope movement.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine Response Level. 4. Make notifications as outlined in the Figure 2-2 Notification Flowchart 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. The following actions may apply: a) Place buttress fill against base of slope immediately below surface feature. Stock pile additional fill. b) Place sand bags as necessary around crack area to divert any storm water runoff from flowing into crack(s). 6. As directed by the Dam Safety Manager, additional inspection and monitoring of the dam may be required. Items may include; inspect the dam on a schedule determined by the engineers; collect piezometer and water level data; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.

Table 4-3. Step 3: Emergency Actions

Condition	Description of Condition	Action to be Taken
Embankment Deformation (cont.)	**Slides / Erosion:** Deep slide / erosion (greater than 2 feet deep) on the embankment that may also extend beyond the embankment toe but does not encroach onto the embankment crest and appears stable with time.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection report. 2. Restrict traffic on embankment crest to essential emergency operations only. 3. Determine the Response Level. 4. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 5. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items. a) Place sand bags as necessary around slide area to divert any storm water runoff from flowing into slide(s). b) Increase inspections of the dam; collect piezometer and water level data; and record any changes of condition. During inspections, carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 6. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
	Sinkholes: Small depression observed on the embankment or within 50 feet of the embankment toe that is less than 5 feet deep and 30 feet wide or which is increasing with time.	1. Slowly open drain gates to lower pool elevation. 2. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos. Document location on a site plan and in inspection notes. 3. Restrict traffic on embankment crest to essential emergency operations only. 4. Determine Response Level. 5. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 6. ERT (with Dam Safety Manager as lead) to determine mitigation actions. Additional actions may include the following items: a) Backfill the depression with relatively clean earth fill (free of organic materials) generally even with surrounding grade and slightly mounded (6 to 12 inches higher) in the center in order to shed storm water away from the depression. Stock pile additional fill. b) Increase inspections of the dam; collect piezometer and water level data daily unless otherwise instructed by Dam Safety Manager; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement. 7. Make notifications as outlined in the Figure 2-2 Notification Flowchart if conditions worsen such that failure is imminent.
Gate Malfunction or Failure	Sluice gate damaged structurally (sabotage, debris, etc.) with uncontrolled release of water at a constant volume. Condition appears stable.	1. Close any other gates, if open. 2. Determine Response Level. 3. Make notifications as outlined in the Figure 2-2 Notification Flowchart. 4. Obtain instructions from the Dam Safety Manager to determine if there are other methods to stop or slow down the flow of water. 5. If conditions worsen such that failure is imminent, make notifications as outlined in the lower portion of the Figure 2-2 Notification Flowchart.

5 PREPAREDNESS

The intent of this section is to provide information that will be utilized during a response. Established emergency supplies and locations, suppliers, and equipment are provided in Table 5-1. Suppliers contact information is listed in Table 5-2.

A coordination meeting shall be conducted annually between representatives of Kincaid Generation, LLC and local emergency responders. This meeting may be in the form of a face-to-face meeting, tabletop exercise, or additional training regarding the EAP.

Table 5-1. Emergency Supplies and Equipment

Item	On-site (Yes/No/Occasionally)	Remarks
Flashlights	Yes	Typically, at Kincaid Power Plant Maintenance Facility. Contact Shift Supervisor for location(s).
Generator		
Extension Cords		
Fire extinguishers		
Floodlights		
Backhoe	Yes	Contact Shift Supervisor for availability and location(s). Contact Roland Machinery, Sunbelt Rentals, Urban Rental Co. (see Table 5-2) and/or other nearby large equipment rental providers for additional large equipment as necessary.
Dozer	Yes	Contact Shift Supervisor for location(s). Contact Roland Machinery, Sunbelt Rentals, Urban Rental Co. (see Table 5-2) and/or other nearby large equipment rental providers for additional large equipment as necessary.
Large Equipment (Rental – including excavating equipment, pumps, lighting)	Yes	Contact Shift Supervisor for availability and location(s). Contact Roland Machinery, Sunbelt Rentals, Urban Rental Co. (see Table 5-2) and/or other nearby large equipment rental providers for additional large equipment as necessary.
Dump Truck	Yes	Contact Shift Supervisor for availability and location(s). Contact Roland Machinery, Sunbelt Rentals, Urban Rental Co. (see Table 5-2) and/or other nearby large equipment rental providers for additional large equipment as necessary.
Pump and Hoses	Yes	Contact Shift Supervisor for availability and location(s). Contact Sunbelt Rentals, Urban Rental Co. (see Table 5-2) for high capacity portable pumps as necessary.
Sandbags and Sand	Yes	Contact Shift Supervisor for availability and location(s). Contact Burkhart Sand & Gravel or Pawnee Lumber & Hardware (see Table 5-2) for additional sandbags as necessary.
Fill (Stone, aggregate, sand)	Yes	Contact Shift Supervisor for location(s). Contact listed suppliers in Table 5-2 for gravel, sand, and riprap fill as necessary.
Concrete/grout	No	Contact Shift Supervisor for availability and location(s). Contact Pawnee Lumber & Hardware or United Rentals (see Table 5-2) for concrete as necessary.
Geotextile Filter Fabric	No	
Plastic Sheeting	No	
Rope	No	
Personal Flotation Devices	Yes	Contact Shift Supervisor for location(s).

Table 5-2. Supplier Addresses

Supply/Rental Item(s)	Supplier Contact Information	Distance from Site (miles)	Address
Backhoe, Dozer Large, Dump Truck and Equipment (Rental – including excavating equipment, pumps, lighting)	**Roland Machinery Co.** (217) 789-7711	19.5	816 N Dirksen Parkway Springfield, IL 62702
	Sunbelt Rentals (217) 528-1065	18.8	3040 E Ash Street Springfield, IL 62703
	Urban Rental Company (217) 824-4023	12.4	615 E Main Cross Street Taylorville, IL 62568
Pump and Hoses	**Sunbelt Rentals** (217) 528-1065	18.8	3040 E Ash Street Springfield, IL 62703
	Urban Rental Company (217) 824-4023	12.4	615 E Main Cross Street Taylorville, IL 62568
Sandbags and Sand and Fill (Stone, aggregate, sand)	**Burkhart Sand & Gravel** (217) 498-7248	12.6	10499 Buckhart Road Rochester, IL 62563
	Pawnee Lumber & Hardware Co. (217) 625-2771	4.6	512 6th Street Pawnee, IL 62558
Concrete/grout	**Pawnee Lumber & Hardware Co.** (217) 625-2771	4.6	512 6th Street Pawnee, IL 62558
	United Rentals (217) 241-3440	18.2	1600 S Dirksen Parkway Springfield, IL 62703

6 FACILITY/IMPOUNDMENT DESCRIPTION

The impoundment included in this EAP is described as follows and illustrated in Figure 1-2. Table 6-1 contains additional geometric details for the impoundment.

Kincaid Power Plant is located near Highway 104 and the unincorporated community of Sicily in Christian County, south of the Sangchris Lake State Park and approximately 4 miles west of Kincaid, Illinois. The Ash Pond is a diked impoundment located northeast of the Kincaid Power Plant. The Ash Pond is bounded to the northwest and southeast by Sangchris Lake and to the northeast by farm land. The Ash Pond was constructed in the late 1960s when the Kincaid Power Plant was constructed using native glacial till, primarily silt and clay.

The main inflow into the Ash Pond is precipitation which is accumulated and transported through channels around the inside of the pond and discharge from the Power Plant. The Ash Pond contents are generally bottom ash (slag) and water. The Ash Pond is located at the upstream end of Sangchris Lake which is a reservoir created as a water supply for the Power Plant and a receiving body for thermal discharges. Pumping operations were added to recycle water back to the plant, in the 1970s. Water is generally recycled through the principal intake structure. A portion of the impoundment's interior storage has had ash material deposited and stabilized over time.

The Ash Pond is made of several embankment dikes forming a perimeter and a single impoundment. The crest elevations generally vary between 605 feet (at the southeast corner) and 620 feet. The water surface elevation is generally maintained around 603.5 feet at the crest of the recycle intake structure. The maximum dam height is approximately 35 feet. The total drainage area is approximately 168 acres. The auxiliary discharge to Sangchris Lake is permitted under NPDES permit #IL0002241 as Outfall E01.

Table 6-1. Plant Impoundment Characteristics

Feature/Parameter	Ash Pond
Maximum Embankment Height	*35 feet
Length of Dam	11,300 feet
Crest Width	12 feet
Crest Elevation	*605 feet
Reservoir Area at Top of Dam	87 acres
Storage Capacity at Top of Dam	321 acre-feet
Primary Spillway Type	*60" Reinforced concrete pipe at base of screen house
Primary Spillway Crest Elevation	*Approximately 603.5'
Storage Capacity at Primary Spillway Elevation	Approximately 213 acre-feet
Reservoir Area at Normal Water Surface Elevation	62 acres
Auxiliary Spillway Type	*3-sided concrete weir chamber (3' side lengths). Flow discharges from 48" CMP at base of weir chamber
Auxiliary Spillway Crest Elevation	*Concrete weir chamber – approximately 604.5'

Notes:

- *Source: "Dam Safety Assessment of CCW Impoundments – Kincaid Generation Slag Field", March 24, 2011. All remaining values are GIS estimated.
- Bathymetric Data obtained from (2015 – Kincaid Topography, prepared by Weaver Consultants Group – December, 2015)
- Elevations are in reference to Mean Sea Level (MSL), NAVD88.

7 BREACH INUNDATION MAP AND POTENTIAL IMPACTS

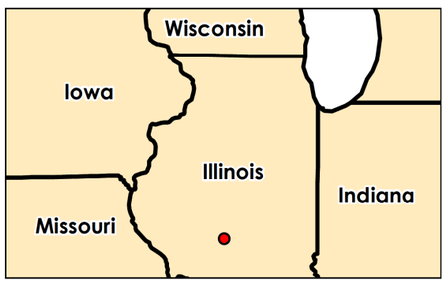
An inundation map for Ash Pond potential breach scenarios is provided in this section. It is the Christian County ESDA/EMA's responsibility to keep a current list of affected parties/properties to contact in the case of emergencies that result in Response Level 2 or 3. This list should encompass all properties within and adjacent to the probable inundation extents shown in the provided map.

The methodology used to identify probable inundation extents for potential breach scenarios varied as a function of the impoundment size, location, surrounding topography, and surrounding structures/facilities/waterbodies.

A 2-dimensional (2-D) dam breach analysis was performed for the Ash Pond facility to determine possible inundation limits for the "Sunny Day" and Probable Maximum Flood (PMF) event scenarios. The breach analysis included stormwater runoff calculations, reservoir pool routing and breach failure, and 2-D hydraulic routing of the floodwave into Sangchris Lake.

The inundation limits were mapped using the modeled maximum water surface elevations (WSE) and a combination of digital elevation data from the topographic survey prepared by Weaver Consultants Group – December, 2015 (2015 – Kincaid Topography) and 1/3 Arc Second DEM data downloaded from The National Map website.

The approximate inundation area is illustrated in Figure 7-1.



Legend

- CCR Surface Impoundment Boundary
- Expected Breach Inundation Area

0 1,000 2,000 Feet

1:20,000 (At original document size of 11x17)

Notes

1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO,
3. NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User

Stantec DYNEGY

Project Location	175605019
Latitude: 39.592011	Prepared by DTH on 2017-04-12
Longitude: -89.497012	Technical Review by MM on 2017-04-12
Christan County, Illinois	Independent Review by MH on 2017-04-12

Client/Project
Kincaid Power Station
Emergency Action Plan

Figure No.
7-1

Title
Inundation Map
Ash Pond

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

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ATTACHMENT G

October 2021

CCR Fugitive Dust Control Plan

for

Kincaid Power Plant

Prepared for:

Kincaid Generation, L.L.C.

Kincaid Power Plant
4 Miles West of Kincaid on Route 104
Kincaid, IL 62540

Prepared by:

Burns & McDonnell
Kansas City, Missouri

Amendment 1
October 2021

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1 Introduction

This Coal Combustion Residuals (CCR) fugitive dust control plan has been prepared for the Kincaid Power Plant, located in Christian County, Illinois. This plan addresses the air criteria in 40 C.F.R. § 257.80 of the United States Environmental Protection Agency's CCR rule, which requires the owner or operator of a CCR unit to "adopt measures that will effectively minimize CCR from becoming airborne at the facility" and to "prepare and operate in accordance with a CCR fugitive dust control plan." The plan also addresses the air criteria in 35 I.A.C. 845.500 of the Illinois Environmental Protection Agency's CCR rule, which contains similar requirements to the federal CCR rule.

1.1 Facility Information

- Facility Name: Kincaid Power Plant
- Facility Address: 4 Miles West of Kincaid on Route 104, Kincaid, IL 62540
- Owner: Kincaid Generation, L.L.C.

1.2 Certification

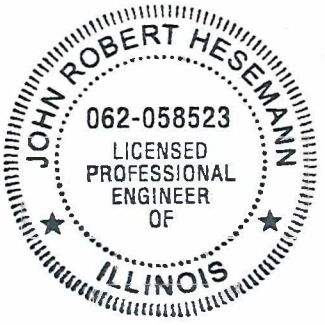
The owner or operator must obtain a certification from a qualified professional engineer that the initial CCR fugitive dust control plan, or any subsequent amendment of it, meets the requirements of 40 C.F.R. § 257.80 and 35 I.A.C. 845.500. See 40 C.F.R. § 257.80(b)(7); 35 I.A.C. 845.500(b)(7).

I certify under penalty of law that, to the best of my knowledge, this plan meets the requirements of 40 C.F.R. § 257.80 and 35 I.A.C. 845.500. This certification is based on my review of the document and conditions at the site and on my inquiry of the person or persons who managed the preparation of this document.

John R. Hesemann
Printed Name of Qualified Professional Engineer

J. R. Hesemann 9/09/2021
Signature of Qualified Professional Engineer and Date

062.058523 – Illinois – Expires 11/30/2021
Registration Number and State



2 CCR Fugitive Dust Control Measures and Appropriateness

CCR fugitive dust has the potential to become airborne at the facility during periods of CCR management in the CCR unit, CCR handling and CCR transport. Areas at the facility that have the potential for airborne CCR fugitive dust are the CCR surface impoundment, CCR handling equipment and CCR transport in trucks. This section identifies and describes the control measures selected and adopted by the facility to minimize CCR from becoming airborne at the facility and explains how the selected measures are applicable and appropriate for site conditions. The control measures may be adjusted or modified based on observed effectiveness of minimizing CCR from becoming airborne and weather conditions.

2.1 Management of CCR in the CCR Unit

The facility manages CCR in a surface impoundment located at the facility. Table 2-1 below identifies CCR fugitive dust control measures that have been selected for use by the facility during CCR management in the CCR unit, including placement of CCR into the CCR unit, and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures during CCR management in the CCR unit to minimize CCR from becoming airborne at the facility.

CCR Activity	CCR Fugitive Dust Control Measure	Applicability and Appropriateness of Control Measure
Management of CCR in the facility's CCR unit	Wet management of CCR bottom ash in the CCR surface impoundment.	Wet management of CCR minimizes the potential for CCR fugitive dust generation.
	Water areas of exposed CCR in the CCR unit, as necessary.	Water will be applied to areas of exposed CCR to maintain moisture content to minimize the potential for CCR fugitive dust generation in excessively dry or windy conditions.
	Naturally occurring grass vegetation in areas of exposed CCR in the CCR surface impoundment.	Vegetation provides a wind screen and/or cover to reduce wind entrainment of CCR.
	Reduce or halt operations during high wind events, as necessary.	Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation.

Table 2-1. Control Measures for CCR Management in the CCR Unit

2.2 Handling of CCR

CCR is regularly removed from the boiler system and conveyed to the CCR handling system, which includes silos and truck loading areas. CCR fly ash is pneumatically conveyed in an enclosed system from the boiler system to storage silos. CCR fly ash is loaded dry into bulk transporters utilizing a vented spout. CCR bottom ash is wet sluiced into a CCR surface impoundment. Bottom ash is periodically removed from the CCR surface impoundment and remains sufficiently wet during and after handling activities, including dewatering, associated with transfer of the CCR. Table 2-2 below identifies CCR fugitive dust control measures that have been selected for use by the facility during handling of CCR and explains how the selected measures are applicable and appropriate for site conditions. The facility will use the identified measures when handling CCR to minimize CCR from becoming airborne at the facility.

CCR Activity	CCR Fugitive Dust Control Measure	Applicability and Appropriateness of Control Measure
Handling of CCR at the facility	Wet sluice CCR bottom ash to the CCR surface impoundment.	Wet sluicing CCR minimizes the potential for CCR fugitive dust generation.
	CCR bottom ash removed from the CCR surface impoundment and loaded into trucks for transport remains conditioned during handling.	Conditioning CCR allows CCR to bind together and thus minimizes the potential for CCR fugitive dust generation when CCR is handled.
	Pneumatically convey dry CCR fly ash to storage silos in an enclosed system.	Conveying CCR fly ash in an enclosed system minimizes the potential for CCR fugitive dust generation.
	Load CCR transport trucks from the CCR fly ash silos in a partially enclosed area.	Partial enclosure of the CCR transport truck loading area reduces the potential for wind to cause CCR fugitive dust to become airborne.
	Perform housekeeping, as necessary, in the fly ash loading area.	Good housekeeping measures, such as sweeping or wetting the loading area, minimize the potential for CCR fugitive dust generation during handling activities.
	Operate fly ash handling system in accordance with good operating practices.	Operation in accordance with good operating practices minimizes the potential for CCR fugitive dust generation.
	Maintain and repair as necessary dust controls on the fly ash handling and truck load-out system.	Performing maintenance and repairs as needed to maintain dust controls in good operating condition minimizes the potential for CCR fugitive dust generation.
	Reduce or halt operations during high wind events, as necessary.	Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation.

Table 2-2. Control Measures for Handling CCR

2.3 Transportation of CCR

CCR is transported via truck at the facility using a combination of paved and unpaved facility roads. Table 2-3 below identifies CCR fugitive dust control measures that have been selected for use by the facility during transport of CCR. The facility will use the identified measures when transporting CCR to minimize CCR from becoming airborne at the facility.

CCR Activity	CCR Fugitive Dust Control Measure	Applicability and Appropriateness of Control Measure
Transportation of CCR at the facility	Cover or enclose trucks used to transport CCR fly ash.	Covering or enclosing trucks transporting CCR on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks.
	Limit the speed of vehicles to no more than 15 mph on facility roads.	Limiting the speed of vehicles traveling on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks.
	Cover or enclose trucks used to transport CCR other than fly ash, as necessary.	Covering or enclosing trucks transporting CCR on facility roads minimizes the potential for CCR fugitive dust generation from the CCR transport trucks.
	Watering roads used to transport CCR materials, as needed.	Watering CCR haul roads minimizes the potential for CCR fugitive dust generation in excessively dry or windy conditions.
	Sweep or rinse CCR off of the outside of the trucks transporting CCR, as necessary.	Removing CCR present on the outside of the truck minimizes the potential for movement of the truck or wind to cause CCR fugitive dust to become airborne.
	Remove CCR, as necessary, deposited on facility road surfaces during transport.	Removing CCR deposited on facility road surfaces as a result of transport minimizes the potential for CCR fugitive dust generation from vehicle traffic.
	Condition CCR haul roads with water or dust suppressant, as necessary.	Watering CCR haul roads minimizes the potential for dust generation to occur as a result of CCR hauling traffic and heavy equipment use.
	Reduce or halt operations during high wind events, as necessary.	Reducing or halting operations during high wind events minimizes the potential for CCR fugitive dust generation.

Table 2-3. Control Measures for Transportation of CCR

3 Procedures for Periodic Assessment of Effectiveness of the Plan

The facility conducts inspections associated with CCR fugitive dust control. The facility also uses the procedures identified in Section 5 of this plan to log every citizen complaint involving CCR fugitive dust events at the facility. These inspections and the investigations of citizen complaints will be used to periodically assess the effectiveness of the CCR fugitive dust control plan per 40 C.F.R. § 257.80(b)(4) and 35 I.A.C. 845.500(b)(3).

The facility routinely performs inspections to verify the effectiveness of the CCR fugitive dust control measures used at the facility. Inspections are conducted during daylight working hours and include observing for the presence of CCR fugitive dust emissions from vehicles transporting CCR on facility roads, CCR handling and CCR management activities, including CCR placement in the CCR unit. Inspection records include information such as the name of the person conducting the inspection, the date and time of the inspection, the results of the inspection, and any corrective action taken.

When a CCR fugitive dust event is observed or a citizen complaint involving a CCR fugitive dust event at the facility is received, current CCR management practices will be reviewed to see that the selected control measures are being properly implemented. If the control measures are not being properly implemented, relevant operating personnel will be notified and, as warranted, re-trained in the proper implementation of CCR fugitive dust control measures. If appropriate, use of revised and/or additional control measures will be evaluated. As warranted, revised and/or additional control measures found to be applicable and appropriate to control CCR fugitive dust emissions will be incorporated into an amended CCR fugitive dust control plan.

The plan also will be reassessed in the event of material changes in site conditions potentially resulting in CCR fugitive dust becoming airborne at the facility.

4 Recordkeeping, Notification, Internet Site

The written CCR fugitive dust control plan, any amendment of the written plan, and the annual CCR fugitive dust control report required by 40 C.F.R. § 257.80(c) and 35 I.A.C. 845.500(c) will be placed in the facility's written operating record and posted to the company's CCR website in accordance with 40 C.F.R. § 257.105(g), § 257.107(g) and 845.800(d)(7), (14) and 845.810(e). Notification of the availability of the CCR fugitive dust control plan, any amendment of the plan, and the annual CCR fugitive dust control report will be provided to IEPA in accordance with 40 C.F.R. § 257.106(g). Any amendment of the fugitive dust control plan will be submitted to IEPA in accordance with 845.500(b)(5).

Additionally, pursuant to 845.500(b)(6), this fugitive dust control plan is being placed in facility's operating record and posted to the company's CCR website prior to the submission of any permits for the Kincaid Power Plant.

5 Procedures to Log Citizen Complaints

In the event the owner or operator of the facility receives a citizen complaint involving a CCR fugitive dust event at the facility, relevant information about the complaint will be logged. Information that will be recorded includes, as applicable:

- Date/Time the complaint is received
- Date/Time and duration of the CCR fugitive dust event
- Description of the nature of the CCR fugitive dust event
- Name of the citizen entering the complaint
- Address & phone number of citizen entering the complaint
- Name of the personnel who took the complaint
- All actions taken to assess and resolve the complaint

All citizen complaints involving CCR fugitive dust events at the facility will be investigated promptly. As deemed appropriate or necessary, corrective measures will be taken and a follow-up response will be provided to the complainant.

Pursuant to 35 I.A.C. 845.500(b)(2), quarterly reports will be submitted to IEPA no later than 14 days from the end of the quarter for all complaints received in that quarter. At a minimum, the quarterly report will include the date of the complaint, the date of the incident, the name and contact information of the complainant (if given), and all actions taken to assess and resolve the complaint.

6 Amendments

The written CCR fugitive dust control plan may be amended at any time provided the revised plan is placed in the facility's operating record as required by 40 C.F.R. § 257.105(g)(1) and 35 I.A.C. 845.500(b)(6). Any amendment of the fugitive dust control plan will be submitted to IEPA in accordance with 845.500(b)(5). The written CCR fugitive dust control plan must be amended whenever there is a change in conditions that would substantially affect the written plan in effect.

Amendment Number and Date	Pages or Section	Description of Amendment	Professional Engineer Certifying Plan
Version 0 October 2015	--	Initial Plan	Wendy M. Pennington
Amendment 1 October 2021	Various	Administrative changes and adjustments to site condition controls as appropriate	John R. Hesemann

Table 6-1. CCR Fugitive Dust Control Plan Amendments

ATTACHMENT H

October 2021

Intended for
Kincaid Generation, LLC

Date
October 25, 2021

Project No.
1940100806-007

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT

ASH POND

KINCAID POWER PLANT

KINCAID, ILLINOIS

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT ASH POND

Project Name	**Kincaid Power Plant Ash Pond**
Project No.	**1940100806-007**
Recipient	**Kincaid Generation, LLC**
Document Type	**Hydrogeologic Site Characterization Report**
Revision	**FINAL**
Date	**October 25, 2021**

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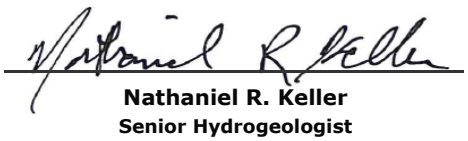

Nathaniel R. Keller
Senior Hydrogeologist

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
AP	Kincaid Ash Pond
BCU	bedrock confining unit
bgs	below ground surface
CEC	Civil & Environmental Consultants, Inc.
CCR	coal combustion residuals
cm/s	centimeters per second
CPT	cone penetrometer test
ESRI	Environmental Systems Research Institute
ft/day	feet per day
ft/ft	feet per feet
g	horizontal acceleration
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
HUC	Hydrologic Unit Code
ID	identification
IDNR	Illinois Department of Natural Resources
IEPA	Illinois Environmental Protection Agency
ILWATER	Illinois Water and Related Wells
ISAS	Illinois State Archaeological Survey
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
KPP	Kincaid Power Plant
LCU	lower confining unit
mg/L	milligrams per liter
msl	above mean sea level
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	Number
NRT/OBG	Natural Resource Technology, Inc., an OBG Company
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
pCi/L	picocuries per liter
pcf	Pound per cubic foot
PMP	Potential Migration Pathway
Ramboll	Ramboll Americas Engineering Solutions, Inc.
SI	Surface Impoundment
SSURGO	Soil Survey Geographic
SU	standard unit

TDS	total dissolved solids
USCS	Unified Soil Classification System
USCU	upper semi-confining unit
USFWS	United States Fish and Wildfire Service
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
Vandalia Till	Vandalia Till Member of the Glasford Formation

EXECUTIVE SUMMARY

This Hydrogeologic Site Characterization Report (HCR) for the Kincaid Ash Pond (AP) expands upon the hydrogeology and groundwater quality data presented in previous hydrogeologic investigation reports prepared for the AP (Civil & Environmental Consultants, Inc. [CEC], 2010; Cabeno Field Services, 2013). This report has been assembled to satisfy the information and analysis requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) Section (§) 845.620 as summarized in **Table ES-1**. The conceptual site model includes hydrogeologic and groundwater quality data specific to the AP, which has been collected between 2010 and 2021. The AP is part of the Kincaid Power Plant (KPP) which is located approximately four miles west of the Village of Kincaid in Christian County, Illinois.

The KPP operates as a coal-fired power plant and has a single coal combustion residuals (CCR) management unit, the AP (Vistra Identification [ID] Number [No.] 141, Illinois Environmental Protection Agency [IEPA] ID No. W0218140002-01, and National Inventory of Dams [NID] No. IL50706. The Kincaid Ash Pond is a 172-acre, unlined surface impoundment (SI) used to manage CCR and non-CCR waste streams at the KPP. Its total storage capacity is approximately 3,560 acre-feet.

The AP is located between two lobes of Sangchris Lake (**Figure 1-1**), which was formed in 1964 by damming Clear Creek, a tributary to the south fork of the Sangamon River. Sangchris Lake was created to provide a source of cooling water for the KPP. The western lobe of Sangchris Lake forms part of the western and the northern border of the AP and is connected to an intake flume for the KPP on the western edge of the AP. A discharge flume from the KPP forms the southern border of Kincaid Ash Pond and is connected to the eastern lobe of Sangchris Lake. The KPP property is surrounded by the lobes of Sangchris Lake and Sangchris Lake State Park to the north and east, and a combination of undeveloped land and surface support facilities associated with the former Peabody Coal Company #10 mine to the south and west.

In addition to the CCR, there are two principal types of unlithified material present above the bedrock in the vicinity of the AP. Underlying the constructed AP are the silts and clays of the Cahokia Formation and sandy, compact till of the Vandalia Till Member of the Glasford Formation (Vandalia Till). The Cahokia Formation contains thin layers of interbedded sand, most of which are laterally discontinuous, but a thin bed of sand was observed at the bottom of the Cahokia Formation in the majority of soil borings advanced near the AP. This sand unit comprises the uppermost aquifer. Bedrock beneath the AP consists of the Pennsylvanian-age Bond Formation, comprised mainly of limestone with lesser amounts of shale and sandstone. Flow of groundwater from the KPP to Sangchris Lake through the uppermost aquifer is the primary pathway for contaminant migration.

The unlithified materials were categorized into four hydrostratigraphic units in this report presented below in descending order:

- **CCR**: Saturated CCR, consisting primarily of bottom ash, and boiler slag.
- **Upper Semi-Confining Unit (USCU)**: Low-permeability clay with some silt and minor sand, silt layers, and occasional discontinuous sand lenses. Includes the lithologic layers identified as the Cahokia Formation. Sand lenses with higher permeability within the USCU have a

higher probability of contaminant transport and these materials are referred to as the potential migration pathways (PMP).

- **Uppermost Aquifer**: Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey sand and gravel units, which include the clays and silts of the Upper Cahokia Formation, where saturated, and the thin, moderate permeability sands and gravels of the Lower Cahokia Formation, which, at some locations, also includes the interface with the Vandalia Till.
- **Lower Confining Unit (LCU):** Underlying the aquifer unit is dense grey clay till; this till is easily distinguished during investigation by difficult drilling and/or refusal and is apparent on boring logs. The till was encountered at elevations ranging from approximately 570 to 583.5 feet NAVD88. The LCU is comprised of low permeability silt and clay with minor sand, silt layers, and occasional discontinuous sand lenses (more frequently near the top of the unit). Includes the lithologic layers identified as the Vandalia Till.

The water-bearing layer referred to as the bedrock confining unit (BCU) is composed of interbedded shale and limestone of the Pennsylvanian Age Bond Formation that underlie the Vandalia Till, and underlies the entire AP.

Groundwater flow in the uppermost aquifer is to the northwest toward Sangchris Lake. Groundwater elevations are primarily controlled by the surface water levels in the lobes of Sangchris Lake and the water level within the AP. An apparent groundwater divide trending southwest to northeast has been observed beneath the AP.

Part 845 parameters were monitored in the uppermost aquifer monitoring wells at the AP as part of the Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 and IEPA groundwater monitoring programs between 2015 and 2021. These data were supplemented with installation and sampling of additional locations installed in 2021. The results indicate the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Arsenic, cobalt, lead, pH, sulfate, total dissolved solids (TDS), and radium 226 and 228 combined were detected in the USCU wells (not including potential migration pathway [PMP] wells) downgradient of the AP.
- Arsenic, barium, beryllium, boron, chromium, cobalt, lead, lithium, pH, sulfate, thallium, TDS, and radium 226 and 228 combined were detected in PMP wells downgradient of the AP.
- Boron, chloride, cobalt, pH, sulfate, thallium, TDS were detected in the uppermost aquifer wells downgradient of the AP.
- Chloride and pH were detected in the bedrock wells downgradient of the AP.

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

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

Part 845 Reference	Individual Part 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)	**The hydrogeologic site characterization shall include but not be limited to the following:**	--
845.620(b)(1)	Geologic well logs/boring logs;	Table 3-1 Figure 3-1 Appendix C
845.620(b)(2)	Climatic aspects of the site, including seasonal and temporal fluctuations in groundwater flow;	Sections 3.2.4 & 3.3.1 Figures 3-3, 3-4 & 3-5
845.620(b)(3)	Identification of nearby surface water bodies and drinking water intakes;	Sections 3.3.2 & 5.2 Appendix B
845.620(b)(4)	Identification of nearby pumping wells and associated uses of the groundwater;	Section 5.1 Appendix B
845.620(b)(5)	Identification of nearby dedicated nature preserves;	Section 5.3 Appendix B
845.620(b)(6)	Geologic setting;	Section 2.4 & 2.5 Figures 2-2 through 2-4
845.620(b)(7)	Structural characteristics;	Section 2.4.3 Figure 2-4
845.620(b)(8)	Geologic cross-sections;	Figures 2-7 through 2-11
845.620(b)(9)	Soil characteristics;	Section 2.3 Figure 2-2 Tables 2-1 & 2-4
845.620(b)(10)	Identification of confining layers;	Section 3.2.1

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

Part 845 Reference	Individual Part 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)(11)	Identification of potential migration pathways;	Sections 3.2.1 & 3.2.3
845.620(b)(12)	Groundwater quality data;	Section 4.2 Table 4-1 & 4.2
845.620(b)(13)	Vertical and horizontal extent of the geologic layers to a minimum depth of 100 feet below land surface, including lithology and stratigraphy;	Section 2.5 Figures 2-7 through 2-11 Appendix C
845.620(b)(14)	A map displaying any known underground mines beneath a CCR surface impoundment;	Section 2.4.5 Appendix B
845.620(b)(15)	Chemical and physical properties of the geologic layers to a minimum depth of 100 feet below land surface;	Sections 2.5 & 3.2 Tables 2-1, 2-2, 2-4 Appendix D
845.620(b)(16)	Hydraulic characteristics of the geologic layers identified as migration pathways and geologic layers that limit migration, including:	Sections 3.2.4.1, 3.2.5, & 3.2.6 Tables 3-2 to 3-4 Appendices D & E
845.620(b)(16)(A)	water table depth;	Section 3.2.4 Figures 3-3 to 3-5 Appendix F
845.620(b)(16)(B)	hydraulic conductivities;	Section 3.2.5 Tables 2-1 and 3-3 Appendices D & E
845.620(b)(16)(C)	effective and total porosities;	Section 2.5.1 Table 2-1
845.620(b)(16)(D)	direction and velocity of groundwater flow; and	Sections 3.2.4 & 3.2.6 Tables 3-2 & 3-4 Figures 3-3 through 3-5 Appendix E

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

Part 845 Reference	Individual Part 845 Components Reviewed for Completeness	Location of Information in HCR
845.620(b)(16)(E)	map of the potentiometric surface;	Figures 3-3 through 3-5
845.620(b)(17)	Groundwater classification pursuant to 35 I.A.C. § 620; and	Section 3.2.7

Notes: [O: LDC 06/15/21, U: LDC 08/19/21; C: EJT 08/19/21; U: LDC 09/14/21; C: EJT 09/16/21]

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

1. INTRODUCTION

1.1 Overview

In accordance with requirements of the Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: 35 I.A.C. § 845 (Part 845) (IEPA, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this HCR on behalf of KPP, operated by Kincaid Generation, LLC, to provide content required by 35 I.A.C. § 845.620(b) (Hydrogeologic Site Characterization) for the CCR Unit referred to as the AP (see **Figure 1-1**).

1.2 Part 845 Description

CCR is commonly referred to as coal ash, and CCR SIs are commonly referred to as coal ash ponds. Part 845 contains comprehensive rules for the design, construction, operation, corrective action, closure, and post closure care of these SIs. This rule includes GWPSs applicable at the waste boundary at each CCR SI and requires each owner or operator to monitor groundwater. IEPA's rule includes a permitting program as well as all federal standards for CCR SIs promulgated by the United States Environmental Protection Agency (USEPA). In addition, the rules include procedures for public participation, closure alternatives analyses, closure prioritization, and provides access to records via public website. The rules also include financial assurance requirements for CCR SIs.

A checklist summarizing the specific requirements of 35 I.A.C. § 845.620 is included in **Table ES-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.620.

1.3 Previous Investigations and Reports

Numerous hydrogeologic investigations have been performed concerning the AP. The information presented in this HCR includes data collected in support of the monitoring well network established for development of the GMP and supplements comprehensive data collection and evaluations from prior hydrogeologic investigation reports (recent to oldest), including, but not limited to, the following:

- ***Ramboll, November 18, 2020. Illinois Administrative Code Part 845 Data Gap Analysis and Work Plan, Kincaid Ash Pond – CCR Unit 141***.
  A technical memorandum prepared to assess the AP for the minimum criteria outlined in Part 845. Includes a data gap analysis and work plan designed to resolve identified data gaps, categorized by desktop evaluations and a hydrogeologic field evaluation.
- ***Burns & McDonnell Engineering Company, Inc., September 28, 2020. CCR Surface Impoundment Demonstration for a Site-Specific Alternative to Initiation of Closure Deadline, Revision 0 – Kincaid Power Station, Project No. 122702***.
  Provides a demonstration that the requirements of 40 C.F.R. § 257.103(f)(2) are satisfied for the site-specific alternative closure deadline for the initiation of closure. The request is for authorization to receive CCR and non-CCR waste streams after April 11, 2021, and grant the alternative deadline of October 17, 2028, by which to complete closure of the impoundment.
- ***Natural Resource Technology, An OBG Company (NRT/OBG), October 17, 2017. Sampling and Analysis Plan, Kincaid Ash Pond – CCR Unit ID 141, Kincaid Power Station, Kincaid, Illinois.***

A sampling and analysis plan to document the procedures and techniques used to fulfill the groundwater sampling and analysis requirements of 40 C.F.R. § 257.93 for the AP.

- ***NRT/OBG, October 17, 2017. Hydrogeologic Monitoring Plan, Kincaid Ash Pond – CCR Unit ID 141, Kincaid Power Station, Kincaid, Illinois.***
  An assessment of the monitoring well network at the AP to provide background information in support of the groundwater monitoring system established to comply with 40 C.F.R. § 257.91. Included a review of the placement and number of monitoring wells with respect to individual and contiguous CCR units as well as potential locations for new monitoring wells.
- ***Kincaid Generation, LLC, August 8, 2017. Groundwater Monitoring Plan (GMP) for Kincaid Power Station Ash Impoundment, Revision 2.***
  The second revision to the 2010 groundwater monitoring plan for the AP.
- ***AECOM, October 2016. History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Kincaid Power Station, Kincaid, Illinois.***
  A history of construction for the AP at the KPP which included review of construction drawings, geotechnical investigations, operation and maintenance information, and AECOM's site experience.
- ***AECOM, January 14, 2016. 30% Design Data Report for Dynegy Kincaid Power Station, Ash Pond CCR Unit.***
  A geotechnical program consisting of installation of auger borings, cone penetrometer test (CPT) soundings, open standpipe piezometers, and vibratory wire piezometers to obtain information for compliance with requirements of the federal CCR rule.
- ***Cabeno Field Services, January 10, 2013. Groundwater Reclassification and Manganese Discussion Report, Ash Impoundment, Kincaid Power Station.***
  An evaluation to determine if shallow groundwater in the vicinity of the AP met IEPA Class I or Class II standards. Included a summary of slug testing at monitoring wells, a pump test at one well, and a discussion of naturally occurring manganese concentrations.
- ***Dominion Electric Environmental Services, October 2010. Groundwater Monitoring Plan (GMP) for the Kincaid Power Station Ash (Slag) Impoundment.***
  Plan to sample and analyze groundwater at the Kincaid Ash Pond. Included a description of the uppermost aquifer, groundwater monitoring system, including monitoring well construction and development, and groundwater sample collection, handling, and analysis procedures.
- ***CEC, June 22, 2010. Hydrogeologic Assessment Report, Kincaid Power Station, Ash Impoundment.***
  A hydrogeologic site investigation requested by the IEPA to characterize the shallow geologic materials, identify nearby locations with potable water supplies, and evaluate the potential for groundwater impacts from the impoundment.

A GMP meeting the requirements of Part 845 is being prepared for the AP in conjunction with this HCR.

1.4 Site Location and Description

The KPP is located in the southwest quarter of Section 1, and the northeast quarter of Section 12, Township 13 North, Range 4 West, along West Route 104, Christian County, Illinois and approximately four miles west of the Village of Kincaid. The AP is located between two lobes of

Sangchris Lake (**Figure 1-1**), which was formed in 1964 by damming Clear Creek, a tributary to the south fork of the Sangamon River. Sangchris Lake was created to provide a source of cooling water for the KPP. The western lobe of Sangchris Lake forms part of the western and northern border of the AP and is connected to an intake flume for the KPP on the western edge of the AP. A discharge flume from the KPP forms the southern border of Kincaid Ash Pond and is connected to the eastern lobe of Sangchris Lake. The KPP property is surrounded by the lobes of Sangchris Lake and Sangchris Lake State Park to the north and east, and a combination of undeveloped land and surface support facilities associated with the former Peabody Coal Company #10 mine to the south and west.

The KPP operates as a coal-fired power plant and has a single CCR management unit, the AP (**Figure 1-2**), a 172-acre, unlined SI used to manage CCR and non-CCR waste streams at the KPP with a total storage capacity of approximately 3,560 acre-feet.

1.5 Site History and Unit Description

Construction of the AP began in 1964 and it was commissioned for use in 1967. The AP primarily contains bottom ash and boiler slag, and other minor materials, including water and wastewater treatment solids, excavation spoils, and dredge spoils. The discharge for the AP is located at the southeast corner of the unit. The approximate dates of construction of each successive stage of the AP are summarized in **Table A** below (AECOM, 2016b).

Table A. History of Construction

Date	Event
1964-1965	Construction of Ash Pond
1967	Ash Pond was put into service
1978-1980	Installation of Ash Pond recycle water intake structures and associated piping
Mid-1980's	Erosion repair along north embankment adjacent to Sangchris Lake
2006	Replacement of emergency outlet piping
2009-2010	Tree removal, grading, and vegetation re-established along the north and east embankment
2010	Riprap placement along the northwest Ash Pond embankment adjacent to Sangchris Lake

2. REGIONAL AND SITE GEOLOGY

2.1 Topography

The AP and surrounding areas are relatively flat at an elevation of approximately 600 feet North American Vertical Datum of 1988 (NAVD88). Sangchris Lake constitutes the lowest topographic feature in the area at approximately 585 feet NAVD88 (see **Figure 1-1**).

A Plat of Survey Map (1966) shows the KPP intake flume at an elevation of 555 feet above mean sea level (msl) and the discharge flume at an elevation of 565 feet msl (**Appendix A**). In the northcentral portion of the site, a former drainage feature is present with the lowest mapped elevation of this feature at approximately 580 feet. The feature extends generally in a north-south direction and formerly connected with the western lobe of Sangchris Lake.

A topographic field survey from 2021 (IngenAE, 2021) measured an average surface water elevation within the AP of 602.36 feet NAVD88. The embankments surrounding the AP extend upward to an elevation of approximately 616 feet NAVD88 northwest of the AP, 615 feet NAVD88 northeast of the AP, 619 feet NAVD88 southwest of the AP, 624 feet NAVD88 south of the AP, and 606 feet NAVD88 southeast of the AP. Site surface topography is shown on **Figure 2-1**.

2.2 Regional Geomorphology

The KPP is located within Christian County, which has an area of 716 square miles, of which 709 square miles is land and 6.3 square miles is water. The county is bounded on the north by the Sangamon River. The south fork of the Sangamon River runs through the center of Christian County. The majority of the county lies within the Sangamon Drainage Basin, which has an area of 5,418 square miles. The Sangamon River is a tributary to the Illinois River.

The AP is located in the Springfield Plain, which is in the Till Plains Section of the Central Lowland Physiographic Province. The Springfield Plain is distinguished mainly by its flatness and by shallow entrenchment of drainage. The southern boundary is drawn along a line of which the drift thins and bedrock topography becomes a controlling factor; the western boundary follows the edge of the Illinoian drift. The greater part of the district is a flat till plain. The moraines are low and broad. Drainage systems are well developed. The Illinoian drift is moderately thick and is underlain by older drift, except in areas where the bedrock is close to the surface. Along the southeast side of the Illinois Valley, there is a belt of thick loess (Leighton et al., 1948).

The Herrin Coal Seam was historically mined in the area and occurs at a depth of approximately 300 to 380 feet below ground surface (bgs) in the vicinity of the AP. Mining activities are discussed in detail in Section 2.4.5.

2.3 Soils

Surficial soils at the AP and vicinity are shown on **Figure 2-2**, based on the soil survey data for Christian County available in the Soil Survey Geographic database (SSURGO) by the United States Department of Agriculture Natural Resources Conservation Service provided by the Environmental Systems Research Institute (ESRI) web-hosted layer. Surficial soils within the extents of the AP are classified as Mine dumps. Surficial soils in the vicinity of the AP consist of Assumption silt loam (5 to 10 percent slopes, eroded), Ipava silt loam (0 to 2 percent slopes), Denny silt loam (0 to 2 percent slopes, Loess, poorly drained), Virden silty clay loam (0 to 2

percent slopes, Loess, poorly drained), Orthents (loamy, undulating), and Osco silt loam (2 to 5 percent slopes). Additional information sourced from SSURGO describing surficial soils listed above at the AP and vicinity is available in **Appendix B**.

2.4 Regional Geology

2.4.1 Regional Unlithified Geology

The AP is located in the Illinois Valley where the general sequence of unlithified Quaternary deposits consists of poorly sorted sand, silt, and clay of the Cahokia Formation. The Upper Cahokia Formation consists of overbank silts and clays, while the coarser-textured Lower Cahokia Formation is mainly sandy channel and lateral accretion deposits. The Cahokia Formation is present along all Illinois streams, although locally absent where active stream erosion is occurring (Willman and Frye, 1970).

The Cahokia Formation is predominantly a silty deposit because much of it is derived from erosion of loess and till. Loess was still accumulating in the region when some of the alluvium was deposited. Although lenses of sand and gravel are locally common in the alluvium, these lenses generally have a relatively high silt content. The degree of sorting varies but is generally poor. A major part of the alluvium consists of materials transported down the valley and deposited in the floodplains during intervals of flooding, but it also includes sediments deposited directly by tributary streams. The latter sediments commonly consist of lenses of relatively coarse material interbedded with floodplain silts. The thickness varies greatly, but 10 to 20 feet is common along many valleys and 50 to 75 feet is found along major valleys (ISGS, 2021d). Where present, the Cahokia Formation deposits at the AP are comprised of silts and clays interbedded with thin sand lenses near Sangchris Lake and extend to depths of approximately 40 feet (NRT/OBG, 2017a).

Underlying the Cahokia Formation is the Vandalia Till Member of the Glasford Formation. The Vandalia Till is the lowermost and oldest unlithified geologic material in the region. The Vandalia Till is a relatively sandy, gray, compact till (*i.e.,* diamicton deposits), commonly 25 to 50 feet thick, but it is probably much thicker in some of the deep valleys. Its extent has not been determined, but it probably is the surface till throughout most of the area of Illinoian drift in southeastern Illinois (ISGS, 2021d). The Vandalia Till deposits at the AP are comprised of dense clay and silt with varying amounts of sand and gravel, and extend to depths of approximately 50 feet (NRT/OBG, 2017a).

Although not shown on available ISGS survey data which is mapped on a regional scale, the silts and clays of the Cahokia Formation have been identified adjacent to the former Clear Creek and underlying the constructed AP, in addition to the Vandalia Till. The regional surficial geologic deposits in the vicinity of the Site, as surveyed by ISGS, are shown on **Figure 2-3**.

2.4.2 Regional Bedrock Geology

Underlying the unlithified materials of the Vandalia Till is the Pennsylvanian-age Bond Formation consisting of a sequence of lithified marine sediments comprised mainly of limestone interbedded with lesser amounts of shale and sandstone. The top of bedrock surface in the vicinity of the site is approximately 550 feet msl (CEC, 2010).

2.4.3 Structure

The major geological structure features around Illinois are shown on **Figure 2-4**. The KPP is located within a relatively stable region within the central portion of the Illinois Basin. The AP on the southern end of the Kincaid Anticline that is prominent on a structure map of the top of the Mississippian Karnak Limestone Member. The Anticline is about 11 miles long and plunges S15E. Closure is mapped in the northern part of the fold; vertical relief is about 80 feet on both flanks. The fold is relatively flat topped and has equal dips on both flanks.

The Kincaid Anticline also is referenced in Nelson's (1995) structural features of Illinois. The anticline is more irregular in outline and lower in relief on the coal than it is on the Karnak Limestone. A normal fault, the Sicily Fault, offsets the Herrin Coal along the west flank of the Kincaid Anticline. The fault is parallel to the fold axis and is downthrown toward the crest of the anticline.

The upward loss of structural relief suggests that the Kincaid Anticline, like many anticlines in central Illinois, may have developed during late Mississippian to early Pennsylvanian time. The Edinburg West and Kincaid Consolidated Oil Field are situated on or close to the crest of the Kincaid Anticline.

2.4.4 Seismic Setting

A review of the available data from the United States Geological Survey (USGS), ISGS, and other available structural information was completed by Haley & Aldrich, Inc., (2018) for the Location Restriction Demonstration to address the requirements of 40 C.F.R. § 257.62 (Fault Areas). The review found that the nearest known mapped fault is the Sicily Fault referenced above, which is located approximately 2 miles east of the AP. The timeframe of the most recent activity on the Sicily Fault is unknown. There are no known active faults or fault damage zones that have had displacement in Holocene time reported or indicated within 200 feet of the AP (see **Figure 2-4**).

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

2.4.5 Mining Activities

Most of the areas immediately beneath and surrounding the facility have been mined underground by the Peabody Coal Company. Based on the directory of coal mines for Christian County, underground coal mines are located directly beneath most of the AP and throughout much of the region surrounding the KPP. The main power plant area and the southernmost edge of the AP are not underlain by a coal mine. The coal mined is referred to as the Herrin Seam and occurs at a depth of approximately 300 to 380 feet bgs in the vicinity of the AP. These mines,

identified as #8 and #10, are both abandoned underground shaft mines. Geological problems reported during mining activities included slips, sandstone rolls, and roof falls and failures. The #8 mine was active from 1914 to 1954. The mining method used was Room and Pillar Panel and the coal seam at this location ranged from 7 to 8 feet in thickness. The #10 mine operated from 1951 to 1994. Mine #10 used the Blind Room and Pillar mining method and the coal seam at this location had a maximum thickness of 13 feet (ISGS, 2019; ISGS, 2021b; ISGS, 2021c). The nearest coal mines to the AP are shown in **Figure B-1** of **Appendix B**.

In 2013, minor subsidence of the embankment crest was observed along portions of the southwestern embankment of the AP. The subsidence was believed to have been caused by historical underground mining operations from the 1950s to 1990s. Gravel and soil fill was placed in the settlement areas to restore the embankment crest elevation (AECOM, 2016b).

Karst topography or physiographic features, such as sinkholes, vertical shafts, sinking streams, caves, large springs, or blind valleys, do not exist at the KPP and karst features are not common in Christian County. Data reviews indicate that the KPP is in an area of low landslide incidence; there has not been a landslide occurrence at or near the AP (Haley & Aldrich, Inc., 2018).

2.5 Site Geology

A field investigation was performed in 2021 to collect additional data for the discussion of vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Field investigation locations are shown on **Figure 2-5**.

2.5.1 Site-Specific Unlithified Geology

The three principal types of unlithified materials present above the bedrock in the vicinity of the AP consist of the following in descending order:

- Fill, predominantly coal ash (bottom ash and slag) within the AP, but also including constructed berms and railroad embankments near the AP.
- Clays and silts of the Cahokia Formation, interbedded with thin sand lenses near Sangchris Lake, which extend to depths of less than 44 feet.
- Clay and silt with varying amounts of sand and gravel of the Vandalia Till, which extend to depths of up to 52 feet.

Soil boring logs and well construction logs are provided in **Appendix C**.

2.5.1.1 Fill and CCR

CCR within the AP is comprised predominantly of bottom ash. Ash is present within the AP at a thickness of up to 30 feet as measured in XPW01 (**Appendix C**). The AP overlies the Cahokia Formation, and the bottom of the ash was observed at a depth of 22 feet bgs, and elevation of 582.57 feet NAVD88, in the northern portion of the AP at XPW04. The bottom of ash elevation (**Figure 2-6)** was determined during the location restriction evaluation required by 40 C.F.R. § 257.60 and was compared to the historic topography (**Appendix A**). The base of ash elevation is consistent with the historic topography, *i.e.,* the bottom of the AP is the historic ground surface at the time the containment berms were constructed.

Eight samples were obtained from the ash within borings XPW01 through XPW04 (**Figure 2-5**) for geotechnical testing. Soil classifications using the Unified Soil Classification System (USCS) indicated poorly graded sand (SP) in XPW01 and XPW04, poorly graded sand/silty sand (SP-SM) in XPW02, and well graded sand, fine to coarse sand/silty sand (SW-SM) in XPW03. Geotechnical testing results are summarized in **Table 2-1**, and the geotechnical laboratory report is included in **Appendix D**. Geotechnical results from XPW01 through XPW04 indicated the following:

- The average moisture content was 23.3 percent and ranged from 11.8 to 36.4 percent.
- The average total porosity (calculated) was 54 percent and ranged from 46 to 64 percent.
- The average dry density was 80.7 pounds per cubic foot (pcf) and ranged from 62.7 to 93.9 pcf.
- The average specific gravity was 2.796 and ranged from 2.770 to 2.838.
- The distribution of particle sizes was 0 to 1.6 percent gravel, 91.4 to 98.4 percent sand, and 1.3 to 8.4 percent fines (silt and clay).
- The geometric mean vertical hydraulic conductivity was 1.4×10^{-3} centimeters per second (cm/s) and ranged from 3.5×10^{-4} to 4.3×10^{-3} cm/s.

Solids samples from XPW01 through XPW04 were also submitted to an analytical laboratory for chemical analysis. The results of the soil sample chemical analysis are summarized in **Table 2-2**.

Leachate wells were installed in XPW01 through XPW04 and porewater samples were collected for chemical analysis. The results of the porewater sample chemical analysis are summarized in **Table 2-3**.

2.5.1.2 Cahokia Formation

The Cahokia Formation was observed at boring locations MW-1 through MW-12, MW-8S, MW-12D, MW-12S, MW-20, MW-20S, MW-22 through MW-32, and MW-31S (**Appendix C**) and consists of predominantly clay and silt with some clayey sand and sandy clay intervals. Its color was described as pale brown, light yellowish brown, gray, brown, grayish brown, and dark yellowish brown. The thickness of the Cahokia Formation was observed to be up to 40 feet at MW-30 (**Figures 2-7 through 2-11**).

Three samples were collected from the Upper Cahokia Formation for geotechnical testing within borings MW-12D (5-7 feet bgs and 11.5-12 feet bgs) and MW-23 (15-17 feet bgs). USCS soil classifications indicated lean clay (CL) and clayey sand (SC). Boring locations are shown on **Figure 2-5**. The geotechnical testing results are summarized in **Table 2-1** and the geotechnical laboratory report is included in **Appendix D**. Geotechnical testing results from the Upper Cahokia Formation indicated the following:

- The average moisture content was 21.7 percent and ranged from 18.2 to 28.4 percent.
- The average total porosity (calculated) was 44 percent and ranged from 42 to 45 percent.
- The average dry density was 95.0 pcf and ranged from 92.7 to 97.8 pcf.
- The average specific gravity was 2.697 and ranged from 2.682 to 2.705.
- The distribution of particle sizes was 0 to 4.9 percent gravel, 2.5 to 49.8 percent sand, and 45.3 to 97.5 percent fines (silt and clay).

- The geometric mean vertical hydraulic conductivity was 1.2 x 10^{-7} cm/s and ranged from 7.2 x 10^{-8} to 3.2 x 10^{-7} cm/s.

Three samples were collected from the Lower Cahokia Formation for geotechnical testing within borings MW-12D (20.5-22.5 feet bgs), MW-20 (15-17 feet bgs), and MW-23 (25-27 feet bgs). USCS soil classifications indicated lean clay (CL) and clayey sand (SC). Boring locations are shown on **Figure 2-5**. The geotechnical testing results are summarized in **Table 2-1** and geotechnical laboratory report is included in **Appendix D**. Geotechnical testing results from the Lower Cahokia Formation indicated the following:

- The average moisture content was 16.2 percent and ranged from 14 to 18.9 percent.
- The average total porosity (calculated) was 35 percent and ranged from 34 to 36 percent.
- The average dry density was 109.0 pcf and ranged from 106.9 to 112.3 pcf.
- The average specific gravity was 2.701 and ranged from 2.672 to 2.731.
- The distribution of particle sizes was 0 to 6 percent gravel, 29.9 to 46.4 percent sand, and 47.6 to 69.5 percent fines (silt and clay).
- The geometric mean vertical hydraulic conductivity was 1.1 x 10^{-7} cm/s and ranged from 5.9 x 10^{-8} to 2.0 x 10^{-7} cm/s.

Soil samples collected from the Upper and Lower Cahokia Formation were also submitted to an analytical laboratory for chemical analysis. The results of this chemical analysis are summarized in **Table 2-4**.

2.5.1.3 Vandalia Till

The Vandalia Till was observed at boring locations MW-1 through MW-6, MW-8 through MW-10, MW-12, KIN-B001 through KIN-B012, MW-12D, MW-20, MW-20S, MW-23, MW-25, MW-26, MW-28, MW-30, MW-31, and MW-32 (**Appendix C**) and consists predominantly of dense clay and silt with varying amounts of sand and gravel. The lowermost portion may contain weathered limestone cobbles within a few feet of the top of bedrock. Field compressive strength readings on the Vandalia Till were 4.5 tons per square foot. The Vandalia Till is easily identified by difficult drilling and/or refusal and is apparent on boring logs.

Its color was variously described in the boring logs as brown and gray, brownish gray, light brown, and greenish gray and brown. The average thickness of the Vandalia Till observed in the soil borings was 7.5 feet with maximum thicknesses of 37.5 feet. The till was encountered at elevations ranging from approximately 570 to 583.5 feet NAVD88 (**Figures 2-7 through 2-11**).

Samples collected from the Vandalia Till were submitted to an analytical laboratory for chemical analysis, but were not submitted for geotechnical testing due to poor recovery. Boring locations are shown on **Figure 2-5**. The chemical analysis results are summarized in **Table 2-4**.

2.5.2 Site-Specific Bedrock Geology

Bedrock underlying the AP is the Pennsylvanian Age Bond Formation, which consists mainly of limestone with lesser amounts of shale and sandstone. Bedrock was encountered in borings MW-2, MW-5, B-12, KIN-B005, KIN-B010, MW-12D, and MW-20 (**Appendix C**). The elevation of the top of bedrock is highest at MW-20 (548.02 feet NAVD88) beneath the eastern portion of the AP and declines in elevation to the west toward MW-12D (540.68 feet NAVD88) and to the south

toward KIN-B005 (520 feet) (**Figures 2-7 through 2-11**). The top of bedrock was described as limestone overlaying shale in borings advanced to bedrock.

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

3. REGIONAL AND LOCAL HYDROGEOLOGY

3.1 Regional Hydrogeology

Potable groundwater resources in Christian County range from poor to good. Extensive testing, however, is commonly required to locate suitable sources of groundwater in the valley flats. Domestic and farm supplies are generally obtainable throughout Christian County except for an area south and west of Pana and in the western part of the county where the drift is thin. In this area, water is obtained locally from large diameter dug wells in the drift or from wells drilled into the bedrock. The Pennsylvanian bedrock below the drift is composed principally of shale. Locally, sandstone lenses are present and may yield small water supplies. Wells drilled into the bedrock are generally limited to a depth of 200 to 250 feet or less below land surface, as water quality diminishes at greater depths (Selkregg and Kempton, 1958).

3.2 Site Hydrogeology

In 2010, 10 groundwater monitoring wells (MW-1 through MW-10) were installed at the KPP within and around the AP to evaluate potential impacts from the AP. In 2015, a groundwater monitoring program was initiated at these locations to meet the requirements of 40 C.F.R. § 257. In 2021, additional wells were installed to supplement the existing well network and provide information to meet the requirements of Part 845. A summary of monitoring well locations and construction details are included in **Table 3-1** and depicted on **Figure 3-1**.

3.2.1 Hydrostratigraphic Units

Five distinct water-bearing layers have been identified at the AP based on stratigraphic relationships and common hydrogeologic characteristics, which are summarized below and discussed in subsequent sections.

- **CCR**: Saturated CCR, consisting primarily of bottom ash, and boiler slag.
- **USCU**: Low-permeability clay with some silt and minor sand, silt layers, and occasional discontinuous sand lenses. Includes the lithologic layers identified as the Cahokia Formation. Sand lenses with higher permeability within the USCU have a higher probability of contaminant transport and these materials are referred to as the PMPs.
- **Uppermost Aquifer**: Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey sand and gravel units, which include the clays and silts of the Upper Cahokia Formation, where saturated, and the thin, moderate permeability sands and gravels of the Lower Cahokia Formation, which, at some locations, also includes the interface with the Vandalia Till.
- **LCU:** Underlying the aquifer unit is dense grey clay till; this till is easily distinguished during investigation by difficult drilling and/or refusal and is apparent on boring logs. The till was encountered at elevations ranging from approximately 570 to 583.5 feet NAVD88. The LCU is comprised of low permeability silt and clay with minor sand, silt layers, and occasional discontinuous sand lenses (more frequently near the top of the unit). Includes the lithologic layers identified as the Vandalia Till.
- **BCU**: This unit is composed of interbedded shale and limestone of the Pennsylvanian Age Bond Formation that underlie the Vandalia Till, and underlies the entire AP.

3.2.2 Uppermost Aquifer

Underlying the USCU is a sandy unit which is considered the uppermost aquifer in the area. The lithologic description of the uppermost aquifer ranges from well graded sand to sandy clay, but in most locations, it is described as silty or clayey sand. Based on interpreted groundwater elevations, the top of the uppermost aquifer appears to decline in elevation to the northwest toward Sangchris Lake (**Figure 3-2**). Below the AP the uppermost aquifer was encountered at an elevation ranging from 577.1 to 582.2 feet NAVD88. This unit occurs directly above the Vandalia Till.

Although there may be other lenses of coarser grained material within the USCU, there is no evidence that they are laterally continuous across the Site. The determination that the sand unit is the uppermost aquifer is supported by a well search performed in the vicinity of the Site. Many of the nearby potable wells indicate the presence of this aquifer at a similar elevation to what was encountered at the Site. Potable well construction logs also identify this unit as the primary source of groundwater (**Appendix B**).

3.2.3 Potential Migration Pathway

The USCU, the Cahokia Formation, has been characterized with information collected from monitoring wells screened within both clay and silt and discontinuous sand lenses encountered during geologic investigations. The general discussion for the USCU, included below, includes all monitoring wells in this unit, but further subdivides the discussion to characterize PMPs based on information from wells screened within these materials. PMPs were interpreted using the lithologic composition and hydrogeologic properties (hydraulic conductivity and hydraulic position with respect to the unit) of the materials. In addition to the physical properties, the analytical results from baseline groundwater monitoring performed in wells screened in the USCU were used to identify PMPs. Monitoring wells are classified as follows:

- USCU monitoring locations: MW-7S, MW-8S, MW-11S, MW-12S, MW-20S, MW-25, MW-27, and MW-31S
- Interpreted PMP monitoring locations: MW-7S, MW-12S, MW-25, and MW27

3.2.4 Water Table Elevation and Groundwater Flow

The elevations of water within the AP (as observed in XPW-01 through XPW-04 and XSG-01) are greater than groundwater elevations in the surrounding areas, and, depending on the hydraulic connection between the AP and the surrounding aquifer, water may flow radially from the AP toward the lobes of Sangchris Lake. The phreatic surface within the AP between February and August 2021 averaged 603.29 feet NAVD88, ranging from 600.76 feet NAVD88 in XPW03 (in the northwest portion of the AP) to 607.38 feet NAVD88 in XSG-01 (in the southeast corner of the AP) (see **Figures 3-3 through 3-5**).

The groundwater elevation in wells within the USCU (MW-7S, MW-8S, MW-11S, MW-12S, MW-20S, MW-25, MW-27, and MW-31S) averaged 591.34 feet NAVD88 between February and August 2021, with a range from 583.38 feet NAVD88 in MW-27 (west of the AP) to 602.14 feet NAVD88 in MW-25 (southwest of the AP). The groundwater elevation in wells within the PMP (MW-7S, MW-12S, MW-25, and MW-27) averaged 589.99 feet NAVD88 between February and August 2021, with a range from 583.38 feet NAVD88 in MW-27 (west of the AP) to 602.14 feet NAVD88 in MW-25 (southwest of the AP). USCU well MW-11S was dry during all events with the

exception of the May 2021 event. Wells MW-12S and MW-27, located on the north side of the AP near the former drainage feature, consistently recorded the lowest groundwater elevation, while MW-8S and MW-20S had relatively equal groundwater elevations, and the highest elevations were measured at MW-25, suggesting that the predominant horizontal groundwater flow in the USCU in the area of the AP is toward the north and northwest toward the western lobe of Sangchris Lake. There also appears to be a component of groundwater flow to the south and east toward the discharge flume that flows to the eastern lobe of Sangchris Lake (see **Figures 3-3 through 3-5**), as evidenced by groundwater elevations on the southern side of the AP being consistently below the screen interval of MW-11S (591-595 feet NAVD88); this monitoring well was consistently dry during 2021 groundwater monitoring. These two components of groundwater flow suggest a groundwater divide beneath the AP.

The groundwater elevation in wells screened in the uppermost aquifer (MW-1 through MW-12, MW-20, MW-22 through MW-24, MW-26, MW-28 through MW-32, and PZ4C) averaged 592.82 feet NAVD88 between February and August 2021, with a range from 584.12 feet NAVD88 in MW-12 northwest of the AP to 598.93 feet NAVD88 in MW-20 east of the AP. As noted above, groundwater elevation contour maps suggest that there is a groundwater divide beneath the AP and horizontal groundwater flow in the uppermost aquifer is to the northwest and southeast toward the lobes of Sangchris Lake (see **Figures 3-3 through 3-5**).

The groundwater elevation in BCU well MW-12D averaged 586.23 feet NAVD88 between February and August 2021, with a range from 584.55 to 587.18 feet NAVD88 (see **Figures 3-3 through 3-5**).

3.2.4.1 Vertical Hydraulic Gradient

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

- BCU to uppermost aquifer:
  - Gradients calculated between MW-12D (BCU) and MW-12 (uppermost aquifer) were upward for all events.
- Uppermost aquifer to USCU/PMP:
  - Gradients between MW-12 (uppermost aquifer) and MW-12S (PMP) were downward for all events.
- Uppermost aquifer to USCU:
  - Gradients between MW-31 (uppermost aquifer) and MW-31S (USCU) were downward for seven events, and upward in the July 1, 2021 event.
  - Gradients between MW-8 (uppermost aquifer) and MW-8S (USCU) were variable, with upward gradient in three events (February through April 2021) and a downward gradient in two events (May and June 2021). Gradients were not calculated for the two events in July and one event in August because MW-8S was dry during those sampling events.
  - Gradients between MW-7 (uppermost aquifer) and MW-7S (USCU) were upward for seven events and downward in the June 2021 event.

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

3.2.4.2 Impact of Sangchris Lake on Groundwater Flow

Groundwater elevations are primarily controlled by the level in Sangchris Lake, and the water level within the AP. There is an apparent groundwater divide beneath the AP with groundwater flow to the northwest and southeast toward the western and eastern lobes of Sangchris Lake, respectively (**Figures 3-3** through **3-5** and **Appendix E).**

3.2.5 Hydraulic Conductivity

3.2.5.1 Field Hydraulic Conductivity

Results of field hydraulic conductivity tests conducted in 2021 in the CCR (XPW01 through XPW04) ranged from 2.09 x 10^{-2} to 2.64 x 10^{-1} cm/s, with a geometric mean of 8.57 x 10^{-2} cm/s.

Results of field hydraulic conductivity tests performed in 2021 in wells screened in the USCU (MW-12S, MW-25, MW-27, and MW-20S) ranged from 1.56 x 10^{-5} to 1.22 x 10^{-4} cm/s, with an overall geometric mean of 5.04 x 10^{-5} cm/s. Tests were not completed for all wells in the USCU, of the wells evaluated, two were screened in sandier zones of the USCU and the resulting geometric mean hydraulic conductivity for the unit is likely overestimated.

Field hydraulic conductivity tests performed in 2021 in wells screened within the uppermost aquifer (MW-20, MW-22, MW-23, MW-26, MW-28, MW-29, MW-30, MW-31, MW-32, and PZ-4C) ranged from 1.29 x 10^{-6} to 5.35 x 10^{-4} cm/s, with an overall geometric mean hydraulic conductivity of 4.14 x 10^{-5} cm/s. The geometric mean likely underestimates the hydraulic conductivity of the unit because it includes locations where sandier material was not present (MW-20, MW-32, and PZ-4C).

Field hydraulic conductivity tests were performed in BCU well MW-12D resulting in hydraulic conductivity of this unit is 1.69 x 10^{-3} cm/s. Well MW-12D was screened within the top 5 feet of the bedrock and the resulting hydraulic conductivity likely represents the weathered bedrock surface.

Field hydraulic conductivity test results are summarized on **Table 3-3** and the field hydraulic conductivity test data is included in **Appendix F**.

3.2.5.2 Laboratory Hydraulic Conductivity

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

- Eight samples were collected from ash borings XPW01 through XPW04. Laboratory falling head permeability test results in the ash indicated a geometric mean of 1.4 x 10^{-3} cm/s.
- Three USCU samples were collected from borings MW-12D and MW-23. Laboratory falling head permeability test results in the USCU indicated a geometric mean vertical hydraulic conductivity of 1.2 x 10^{-7} cm/s. No laboratory vertical hydraulic conductivity tests were performed on samples from the PMP wells.

- Three uppermost aquifer samples were collected from borings MW-12D, MW-20, and MW-23. Test results indicated a geometric mean of 1.1 x 10^{-7} cm/s.
- Laboratory hydraulic conductivity tests were not performed in the BCU.

3.2.6 Horizontal Groundwater Gradients and Groundwater Flow Velocity

Horizontal gradient and groundwater velocities for the uppermost aquifer were calculated based upon groundwater elevation measurements from February to August 2021 between MW-5 and MW-31, MW-6 and MW-12, and MW-8 and MW-26 (**Table 3-4**). Horizontal gradient between MW-5 and MW-31 averaged 0.015 feet per foot (ft/ft), between MW-6 and MW-12 it averaged 0.008 ft/ft, and between MW-8 and MW-26 it averaged 0.015 ft/ft. Average groundwater flow velocity in the uppermost aquifer between MW-5 and MW-31 was calculated to be 0.004 feet per day (ft/day), between MW-6 and MW-12 was calculated to be 0.002 ft/day, and between MW-8 and MW-26 was calculated to be 0.001 ft/day.

The horizontal gradient and groundwater velocities for the USCU/PMP was determined at wells MW-25 and MW-27 (**Table 3-4**). The horizontal gradient for the USCU/PMP averaged 0.010 ft/ft. Average groundwater flow velocity in the USCU/PMP was 0.010 ft/day as determined by the interpolated groundwater elevation contours from February to August 2021.

Horizontal hydraulic gradients and groundwater flow velocity calculations are summarized in **Table 3-4**. Groundwater flow velocity in the LCU could not be determined because there are no wells screened within the LCU well. Similarly, groundwater flow velocity in the BCU could not be determined because there is only one bedrock well (MW-12D).

3.2.7 Groundwater Classification

Groundwater at the AP does not meet the definition of Class I - Potable Resource Groundwater (35 I.A.C. § 620.210), based on the following criteria:

- Site investigations have determined that water bearing lenses contain more than 12 percent fines (see **Table 2-1**) and are less than five feet in thickness (Cabeno, 2013),
- Sustained groundwater yield, from a 12-inch borehole, of less than 150-gallons per day from a thickness of 15-feet or less.
- Field (horizontal) hydraulic conductivity tests and laboratory (vertical) hydraulic conductivity tests from wells screened within the uppermost aquifer resulted in an overall (geometric mean) of 5.07 x 10^{-5} cm/s and 1.07 x 10^{-7} cm/s, respectively (see **Table 2-1** and **Table 3-4**).

As set forth in 35 I.A.C. § 620.220, any geologic material with a hydraulic conductivity of less than 1 x 10^{-4} cm/s, and which does not meet the provisions of 35 I.A.C. § 620.210 (Class I), 35 I.A.C. § 620.230 (Class III), or 35 I.A.C. § 620.240 (Class IV), meets the definition of Class II: General Resource Groundwater. Based on the detailed geologic information provided for the unlithified materials and bedrock encountered at the AP and the hydrogeologic data, the groundwater in the uppermost aquifer can be classified as Class II groundwater: General Resource Groundwater. This is supported by results of the hydrogeologic study completed in 2013 (Cabeno, 2013), which concluded that the AP does not meet most criteria of Class I Groundwater and the data collected supported a Class II Groundwater Classification.

3.3 Surface Water Hydrology

3.3.1 Climate

Average climatic data was obtained from the Illinois State Water Survey (ISWS) records between 1981 and 2010 from Springfield, Illinois, located approximately 18 miles northwest of the AP. The data indicates that precipitation averages 37.43 inches per year. Monthly precipitation is greatest in April through August. On average, 20.9 inches of precipitation occur as snowfall.

As shown in **Table B** below, ISWS temperature records show average maximum daily temperatures for 1989 to 2010 ranging from above 70 degrees Fahrenheit (°F) May through September and minimum average daily temperatures that are below freezing December through February.

Table B. Average Monthly Temperature Extremes and Precipitation for Springfield, Illinois

	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Annual
Max Temperature (°F)	34.8	39.9	52.1	64.6	74.8	83.1	86.2	84.9	78.9	66.4	52.3	38.3	63.1
Min Temperature (°F)	18.7	22.6	32.2	42.4	52.6	61.9	65.4	63.6	54.6	43.8	33.9	22.5	43.0
Precipitation (inches)	1.82	1.81	2.63	3.51	4.24	4.46	3.94	3.24	2.90	3.15	3.21	2.52	37.43

https://www.isws.illinois.edu/statecli/newnormals/normals.USW00093822.txt

3.3.2 Surface Waters

The predominant surface water body in the region is Sangchris Lake. Sangchris Lake is located directly adjacent to the AP. Bordering the northwest perimeter of the AP, Sangchris Lake has a normal pool elevation of about 585 feet NAVD88 (see **Figure 1-1**). The surface water elevation of Sangchris Lake was measured on May 21 and June 9, 2021 and was 585.62 and 585.20 feet NAVD88, respectively. Surface water elevations in Sangchris Lake are not expected to fluctuate in the vicinity of the KPP as a result of the lake being controlled by a dam to provide cooling water for the KPP. The phreatic surface within the AP between February and August 2021 averaged 603.28 feet NAVD88, ranging from 600.76 feet NAVD88 in XPW03 (in the northwest portion of the AP) to 607.38 feet NAVD88 in XSG-01 (in the southeast corner of the AP). There is an apparent groundwater divide beneath the AP with groundwater flow to the northwest and southeast towards the western and eastern lobes of Sangchris Lake, respectively.

Other surface waters in the vicinity include various freshwater emergent wetlands on the property to the northwest, freshwater forested/shrub wetland to the west, a small riverine to the southeast, and several freshwater ponds directly south of the AP.

4. GROUNDWATER QUALITY

4.1 Summary of Groundwater Monitoring Activities

4.1.1 IEPA Monitoring Program

The current IEPA-required groundwater monitoring program associated with the AP consists of 12 groundwater monitoring wells used to monitor the uppermost aquifer, including four background monitoring wells (MW-1, MW-2, MW-9, and MW-10) and eight wells downgradient of the AP (MW-3 through MW-8, MW-11, and MW-12) in accordance with the Groundwater Monitoring Plan (GMP; Kincaid Generation, LLC, 2017). The boring logs, well construction forms, and other related monitoring well forms for the well network are included in **Appendix C** of this HCR. The well locations are shown on **Figure 3-1**.

Groundwater samples are collected semi-annually and analyzed for the parameters listed in 35 I.A.C. § 620.410 (Groundwater Quality Standards for Class I: Potable Resource Groundwater) with the exception of perchlorate, which is not required under the GMP. The parameters analyzed for the IEPA Monitoring Program are listed in **Table C** below.

Table C. IEPA Groundwater Monitoring Parameters at Kincaid Ash Pond

Water Pollution Control Board Permit Monitored Groundwater Parameters			
Field Parameters			
Groundwater Elevation	pH	Specific conductivity	Temperature
General Chemistry Parameters			
Chloride (total)	Fluoride (total)	Nitrate (total)	Total Dissolved Solids
Cyanide (total)	Nitrite (total)	Sulfate(total)	
Metals (total)			
Antimony	Cadmium	Lead	Silver
Arsenic	Chromium	Manganese	Thallium
Barium	Cobalt	Mercury	Vanadium
Beryllium	Copper	Nickel	Zinc
Boron	Iron	Selenium	Radium 226 and 228 combined

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

In 2015, additional well installation and groundwater sampling was initiated to meet the requirements of 40 C.F.R. § 257. The 40 C.F.R. § 257 monitoring well network consists of eight groundwater monitoring wells screened in the uppermost aquifer, including two background monitoring wells (MW-1 and MW-2) and six compliance wells (MW-5 through MW-8, MW-11, and MW-12). The boring logs, well construction forms, and other related monitoring well forms for the well network are included in **Appendix C** of this HCR. The well locations are shown on **Figure 3-1**.

Assessment monitoring in accordance with 40 C.F.R. § 257.95 was initiated on April 9, 2018. Details of the procedures and techniques used to fulfill the groundwater sampling and analysis

program requirements are found in the Sampling and Analysis Plan for the AP. Results are discussed in **Section 4.2**.

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

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

Field Parameters[1]			
Groundwater Elevation	pH		
Appendix III Parameters (Total, except TDS)			
Boron	Chloride	Sulfate	
Calcium	Fluoride	TDS	
Appendix IV Parameters (Total)			
Antimony	Cadmium	Lithium	Selenium
Arsenic	Chromium	Mercury	Thallium
Barium	Cobalt	Molybdenum	Radium 226 and 228 combined
Beryllium	Lead		

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

4.1.3 Part 845 Well Installation and Monitoring

In 2021, 19 additional monitoring wells (MW-7S, MW-8S, MW-11S, MW-12S, MW-12D, MW-20S, MW-20, MW-22, MW-23, MW-24, MW-25, MW-26, MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, and MW-31S) were installed along the perimeter of the AP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet bgs as specified in 35 I.A.C. § 845.620(b). Additionally, four leachate monitoring wells (XPW01, XPW02, XPW03, and XPW04) were installed within the AP unit to characterize CCR materials and leachate. These locations and samples were discussed in Section 2.5.1.1. The boring logs, well construction forms, and other related monitoring well forms for the well network are included in **Appendix C** of this HCR. The well locations are shown on **Figure 3-1**.

Prospective monitoring wells were sampled for eight rounds between February and August 2021 and the results were used to develop this HCR and assess well locations for inclusion in the AP Part 845 monitoring well network.

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

Table E. Part 845 Groundwater Monitoring Program Parameters

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

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

4.2 Groundwater Monitoring Results and Analysis

Groundwater data collected from the 40 C.F.R. § 257 network monitoring wells between 2015 and 2021 were supplemented with sampling of additional locations in 2021 and evaluated with respect to the standards included in 35 I.A.C. § 845.600(a)(1). This data set was selected because it includes parameters (total metals) consistent with the parameter list in 35 I.A.C. § 845.600(a)(1). Based on this data set, there were no consistent and/or significant concentrations of antimony, cadmium, mercury, molybdenum, selenium, and fluoride greater than the GWPSs. Results indicate that the parameters discussed in the following sections were detected at concentrations greater than the applicable 35 I.A.C. § 845.600(a)(1) standards and are considered potential exceedances[1]. A summary of groundwater analytical data is provided in **Table 4-1**. Groundwater elevations and field parameters are included in **Table 4-2**.

4.2.1 Arsenic

- Arsenic was detected at concentrations greater than the GWPS (0.01 milligrams per liter [mg/L]) in downgradient USCU well MW-31S (two events in June and July 2021). Arsenic concentrations in the USCU ranged from 0.002 to 0.020 mg/L, with a median concentration of 0.006 mg/L.
- Arsenic was detected at concentrations greater than the GWPS in downgradient PMP wells MW-7S (four events in February, June, July, and August 2021), MW-12S (two events in June and July 2021), and MW-27 (four events in February, June, and July 2021). Arsenic concentrations in PMP wells MW-7S, MW-12S, and MW-27 ranged from 0.003 to 0.175 mg/L, with a median of 0.008 mg/L.

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

- Arsenic was detected at concentrations greater than the GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Arsenic was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.2 Barium

- Barium was not detected at concentrations greater than the GWPS (2.0 mg/L) in USCU wells during groundwater monitoring events in 2021.
- Barium was detected at a concentration greater than the GWPS in downgradient PMP well MW-27 (one event in June 2021). Barium concentrations in MW-27 ranged from 0.092 to 2.660 mg/L, with a median concentration of 0.181 mg/L.
- Barium was not detected at concentrations greater than the GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Barium was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021. While not detected at concentrations greater than the GWPS, barium concentrations in BCU well MW-12D were consistently greater than concentrations observed from samples at wells in other units (ranging from 1.26 to 1.90 mg/L).

4.2.3 Beryllium

- Beryllium was not detected at concentrations greater than the GWPS (0.004 mg/L) in USCU wells during groundwater monitoring events in 2021.
- Beryllium was detected in concentrations greater than the GWPS in downgradient PMP well MW-27 (two events in February and June 2021). Beryllium concentrations in MW-27 ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.010 mg/L, with a median concentration of 0.001 mg/L. The reporting limit for the May 2021 sample from PMP well MW-7S was 0.005 mg/L, higher than the GWPS, but beryllium was not detected in that sample.
- Beryllium was not detected at concentrations greater than the GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Beryllium was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.4 Boron

- Boron was not detected at concentrations greater than the GWPS (2 mg/L) in USCU wells during groundwater monitoring events in 2021.
- Boron was detected at concentrations greater than the GWPS in downgradient PMP wells MW-7S (eight events between February and August 2021) and MW-12S (two events in June and July 2021). Boron concentrations in PMP well MW-7S ranged from 3.56 to 5.51 mg/L, with a median concentration of 4.030 mg/L. Boron concentrations in PMP well MW-12S ranged from 0.856 mg/L to 2.630 mg/L with a median concentration of 1.505 mg/L.
- Boron was detected at concentrations greater than the GWPS in five downgradient uppermost aquifer wells: MW-3 (two events in April and July 2021), MW-11 (one event in November

2018), MW-12 (20 events between 2015 and 2021), MW-23 (four events in February, May, June, and July 2021), and MW-28 (eight events between February and August 2021). Boron concentrations in uppermost aquifer wells ranged from 0.0488 to 10.90 mg/L, with a median concentration of 0.918 mg/L.

- Boron was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.5 Chloride

- Chloride was not detected at concentrations greater than the GWPS (200 mg/L) in USCU wells or PMP wells during groundwater monitoring events in 2021.
- Chloride was detected at concentrations greater than the GWPS in uppermost aquifer well MW-10 (one event in November 2017). Chloride concentrations in uppermost aquifer well MW-10 ranged from 1.0 to 245 mg/L, with a median concentration of 22.0 mg/L.
- Chloride was detected at concentrations greater than the GWPS in downgradient BCU well MW-12D (six events in February, March, May, July, and August 2021). Chloride concentrations in MW-12D ranged from 195 to 216 mg/L, with a median concentration of 209 mg/L.

4.2.6 Chromium

- Chromium was not detected at concentrations greater than the GWPS (0.1 mg/L) in USCU wells during groundwater monitoring events in 2021.
- Chromium was detected at concentrations greater than the GWPS in downgradient PMP well MW-27 (two events in February and June 2021). Chromium concentrations in PMP well MW-27 ranged from 0.0015 to 0.351 mg/L, with a median concentration of 0.0015 mg/L.
- Chromium was not detected at concentrations greater than the GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Chromium was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.7 Cobalt

- Cobalt was detected at concentrations greater than the GWPS (0.006 mg/L) in downgradient USCU well MW-31S (two events in June and July 2021). Cobalt concentrations in USCU well MW-31S ranged from 0.003 to 0.018 mg/L, with a median concentration of 0.005 mg/L.
- Cobalt was detected at concentrations greater than the GWPS in downgradient PMP wells MW-7S (one event in July 2021) and MW-27 (five events in February, March, June, and July 2021). Cobalt concentrations in PMP wells MW-7S and MW-27 ranged from 0.001 to 0.139 mg/L, with a median concentration of 0.003 mg/L.
- Cobalt was detected at concentrations greater than the GWPS in uppermost aquifer well MW-26 (one event in March 2021). Cobalt concentrations in uppermost aquifer well MW-26 ranged from 0.003 to 0.007 mg/L, with a median concentration of 0.0043 mg/L.
- Cobalt was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.8 Lead

- Lead was detected at concentrations greater than the GWPS (0.0075 mg/L) in downgradient USCU well MW-31S (two events in June and July 2021). Lead concentrations in USCU well MW-31S ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.029 mg/L, with a median concentration of 0.003 mg/L.
- Lead was detected at concentrations greater than the GWPS in downgradient PMP wells MW-7S (one event in July 2021) and MW-27 (three events in February, June, and July 2021). Lead concentrations in PMP wells MW-7S and MW-27 ranged from non-detect (at a reporting limit of 0.001 mg/L) to 0.254 mg/L, with a median concentration of 0.003 mg/L.
- Lead was not detected at concentrations greater than the GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Lead was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.9 Lithium

- Lithium was not detected at concentrations greater than the GWPS (0.04 mg/L) in USCU wells during groundwater monitoring events in 2021.
- Lithium was detected at concentrations greater than the GWPS in downgradient PMP well MW-27 (two events in February and June 2021). Lithium concentrations in PMP well MW-27 ranged from non-detect (at a reporting limit of 0.003 mg/L) to 0.178 mg/L, with a median concentration of 0.0071 mg/L.
- Lithium was not detected at concentrations greater than the GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Lithium was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.10 pH

- Measurements of pH were detected at less than the lower limit GWPS for pH (6.5 standard units [SU]) at USCU wells MW-31S (four events in April, May, June, and July 2021) and MW-8S (one event in May 2021). The upper limit standard for pH is 9.0 SU. Measurements of pH at USCU wells MW-31S and MW-8S ranged from 6.30 to 6.80 SU, with a median measurement of 6.55 SU.
- Measurements of pH were detected at less than the lower limit GWPS in PMP wells MW-7S (one event in April 2021), MW-12S (four events in April, June, and July 2021), MW-27 (one event in April 2021), MW-20S, (two events in April and June 2021), and MW-25 (two events in April and May 2021). Measurements of pH at PMP wells MW-7S, MW-12S, MW-27, MW-20S, and MW-25 ranged from 6.20 to 7.00 SU, with a median measurement of 6.57 SU.
- Measurements of pH were detected at less than the lower limit GWPS in uppermost aquifer wells MW-1 (nine events between 2015 and 2021), MW-10 (three events between 2015 and 2021), MW-12 (one event in March 2021), MW-23 (two events in June and July 2021), MW-24 (three events in March, April, and May 2021), MW-26 (two events in April and May 2021), MW-28 (one event in April 2021), MW-29 (one event in April 2021), MW-3 (one event in April 2021), MW-30 (five events in April, May, June, and July 2021), MW-31 (two events in April

and June 2021), MW-32 (seven events in March, April, May, June, July, and August 2021), MW-4 (one event in April 2021), MW-5 (one event in June 2021), MW-6 (one events in June 2021), MW-8 (one event in June 2021), and PZ-4C (two events in April and May 2021). Measurements of pH at uppermost aquifer wells MW-1, MW-10, MW-12, MW-23, MW-24, MW-26, MW-28, MW-29, MW-3, MW-30, MW-31, MW-32, MW-4, MW-5, MW-6, MW-8, and PZ-4C ranged from 6.00 to 7.60 SU, with a median measurement of 6.7 SU.

- Measurements of pH were detected at greater than the upper limit GWPS in BCU well MW-12D (one event in July 2021). Measurements of pH in BCU well MW-12D ranged from 6.70 to 9.9 SU, with a median measurement of 7.2 SU.

4.2.11 Sulfate

- Sulfate was detected at concentrations greater than the GWPS (400 mg/L) in downgradient USCU well MW-8S (four events in February, March, April, and May 2021). Sulfate concentrations within USCU well MW-8S ranged from 427 to 609 mg/L, with a median concentration of 576 mg/L.
- Sulfate was detected at concentrations greater than the GWPS in downgradient PMP well MW-7S (six events in February, March, June, July, and August 2021). Sulfate concentrations in PMP well MW-7S ranged from 343 to 577 mg/L, with a median concentration of 450 mg/L.
- Sulfate was detected at concentrations greater than the GWPS in uppermost aquifer wells MW-7 (one event in December 2015), MW-10 (nine events between 2015 and 2020), MW-12 (four events between 2017 and 2020), MW-28 (eight events between February and August 2021), and MW-32 (eight events between February and August 2021). Sulfate concentrations in uppermost aquifer wells MW-6, MW-7, MW-10, MW-12, MW-28, and MW-32, ranged from 10.0 to 929 mg/L, with a median concentration of 139 mg/L.
- Sulfate was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.12 Thallium

- Thallium was not detected at concentrations greater than the GWPS (0.002 mg/L) in USCU wells during groundwater monitoring events in 2021.
- Thallium was detected at concentrations greater than the GWPS in downgradient PMP well MW-27 (one event in June 2021). Thallium concentrations in PMP well MW-27 ranged from non-detect (at a reporting limit at the GWPS of 0.002 mg/L) to 0.0022 mg/L.
- Thallium was detected at concentrations greater than the GWPS in downgradient uppermost aquifer wells MW-3 (one event in July 2021) and MW-5 (one event in June 2021). Thallium concentrations in uppermost aquifer wells MW-3 and MW-5 ranged from non-detect (at reporting limit of 0.002 mg/L) to 0.0022 mg/L.
- Thallium was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.13 Total Dissolved Solids

- TDS was detected at concentrations greater than the GWPS (1,200 mg/L) in downgradient USCU well MW-8S (two events in April and May 2021). TDS concentrations in USCU well MW-8S ranged from 1,150 to 1,320 mg/L, with a median concentration of 1,200 mg/L.

- TDS was detected at concentrations greater than the GWPS in PMP well MW-7S (two events in July and August 2021) during groundwater monitoring events in 2021.
- TDS was detected at concentrations greater than the GWPS in uppermost aquifer wells MW-10 (three events between 2015 and 2018), MW-12 (two events in May and November 2018), and MW-28 (seven events between February and August 2021). TDS concentrations in uppermost aquifer wells MW-10, MW-12, and MW-28 ranged from 224 to 1,830 mg/L, with a median concentration of 620 mg/L.
- TDS was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

4.2.14 Radium 226 and 228 Combined

- Radium 226 and 228 combined was detected at concentrations greater than the GWPS (5 picocuries per liter [pCi/L]) in downgradient USCU well MW-31S (one event in June 2021). Radium 226 and 228 combined concentrations in USCU well MW-31S ranged from 0.340 to 5.29 pCi/L, with a median concentration of 2.8 pCi/L.
- Radium 226 and 228 combined was detected at concentrations greater than the GWPS in downgradient PMP well MW-27 (two events in June and July 2021). Radium 226 and 228 combined concentrations in PMP well MW-27 ranged from 0.318 to 9.25 pCi/L, with a median concentration of 0.897 pCi/L.
- Radium 226 and 228 combined was not detected at concentrations greater than GWPS in uppermost aquifer wells during groundwater monitoring events between 2015 and 2021.
- Radium 226 and 228 combined was not detected at concentrations greater than the GWPS in BCU wells during groundwater monitoring events in 2021.

5. EVALUATION OF POTENTIAL RECEPTORS

5.1 Water Well Survey

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

- ISGS Illinois Water and Related Wells (ILWATER) Map1

A search of the ILWATER Map identified nine wells located within 1,000-meters of the KPP. These included two dry wells, one Municipal Water Supply for the Sangchris State park, two farm/domestic wells, one water well for commercial Operation commonwealth, one coal test well, one engineering test, and one test hole. Two (120210003900 and 120212289800) of the nine wells are located downgradient of the AP. The water well potential receptors of the AP are detailed in **Figure B-2** of **Appendix B**.

5.2 Surface Water

A comprehensive search was performed utilizing the United States Fish and Wildlife Service (USFWS) Wetlands Mapper[2] and the USGS National Map[3] for surface water bodies within 1,000 meters of the AP.

As indicated on the USFWS Wetlands Mapper and USGS National Map, 21 surface water features were identified within a 1,000-meter radius of the AP, nine of which are located downgradient of the AP. The predominant surface water body in the region is Sangchris Lake (Hydrologic Unit Code [HUC] 07130007). Sangchris Lake is located directly adjacent to and down-gradient from the AP. Bordering the north perimeter of the AP, Sangchris Lake has a normal pool elevation of about 585 feet NAVD88 (see **Figure 1-1**). The surface water elevation of Sangchris Lake was measured on May 21 and June 9, 2021 and was 585.62 and 585.20 feet NAVD88, respectively. Surface water elevations in Sangchris Lake are not expected to fluctuate in the vicinity of the KPP as a result of the lake being controlled by a dam to provide cooling water for the KPP.

Additional surface water features in the vicinity of the AP include nine freshwater ponds located northwest and southwest; Clear Creek located northwest and southeast; six freshwater emergent wetlands located to the north, northwest, and southwest; three freshwater forested/shrub wetlands located east and southeast; and a small riverine located southeast. A map of wetlands and surface waters in the vicinity of the AP is presented in **Figure B-3** of **Appendix B**.

The USGS National Map places the AP within the Sangchris Lake-Clear Creek Watershed (HUC 071300070402). The HUC watershed location is presented in **Figure B-3** of **Appendix B**.

Based on groundwater elevation contour maps (see **Figures 3-2 and 3-4**), under normal conditions, groundwater predominantly flows to the northwest, towards Sangchris Lake. Due to

[1] ISGS ILWATER Map: https://prairieresearch.maps.arcgis.com/apps/webappviewer/index.html?id=e06b64ae0c814ef3a4e43a191cb57f87
[2] USFWS Wetlands Mapper: https://www.fws.gov/wetlands/data/mapper.html
[3] USGS National Map: https://apps.nationalmap.gov/viewer/

the downgradient location and proximity of Sangchris Lake to the AP, the Sangchris Lake is likely to be hydraulically connected to the uppermost aquifer beneath the AP.

5.3 Nature Preserves, Historic Sites, Endangered/Threatened Species

A search of the Illinois Department of Natural Resources (IDNR) Natural Heritage Database[4] for natural areas and protected areas within 1,000 meters of the AP was performed. No natural areas were identified within 1,000 meters of the AP. The AP is located within the Abraham Lincoln National Heritage Area, a 17-million-acre Category III Natural Historic Site (see **Figure B-4 in Appendix B**).

The IDNR Natural Heritage Database Threatened and Endangered Species by County[5] lists two endangered and three threatened species in Christian County. Listed threatened species include the Kirtland's Snake, American Orpine, and Franklin's Ground Squirrel, and listed endangered species include the Upland Sandpiper and the Loggerhead Shrike.

Additionally, a search of the IDNR Historic Preservation Division[6] database for historic sites in the vicinity of the Site yielded no results within 1,000 meters of the AP. The Illinois State Archaeological Survey (ISAS)[7] databases that do not require credentials to access were also searched and yielded no results within 1,000 meters of the AP.

[4] IDNR Natural Heritage Database: https://www2.illinois.gov/dnr/conservation/NaturalHeritage/Pages/NaturalHeritageDatabase.aspx
[5] Illinois Threatened and Endangered Species by County: https://www2.illinois.gov/dnr/ESPB/Documents/ET_by_County.pdf
[6] IDNR Historic Preservation Division: https://www2.illinois.gov/dnrhistoric/Pages/default.aspx
[7] ISAS: https://www.isas.illinois.edu/

6. CONCLUSIONS

Based on extensive site investigation and monitoring, the AP has been characterized and a detailed site conceptual model has been developed. Results of these hydrogeologic studies were reintroduced in this HCR and updated to include geologic, hydrogeologic, and groundwater quality data collected with a focus on the AP (Part 845 regulated CCR Unit and subject of this HCR).

The data were summarized and evaluated for changes in groundwater conditions since 2015; available groundwater quality data for the Ash Pond was compared to the Part 845 Standards.

The results of the hydrogeologic and groundwater quality evaluation are:

- There are three principal types of unlithified materials above the bedrock in the vicinity of the Ash Pond, these include the following in descending order:
  - Fill (predominantly coal ash within the AP, but also including constructed berms and railroad embankments around the AP).
  - Cahokia Formation (clays and silts interbedded with thin sand lenses near Sangchris Lake); Vandalia Till (clay and silt with varying amounts of sand and gravel).
  - Bedrock underlying the AP is the Bond Formation, which consists mainly of limestone with lesser amounts of shale and sandstone.
- Five distinct water bearing layers have been identified at the Ash Pond based on stratigraphic relationships and common hydrogeologic characteristics, these include the following in descending order:
  - CCR: saturated CCR, consisting primarily of fly ash and boiler slag.
  - USCU: low permeability clay with some silt and minor sand, silt layers, and occasional discontinuous sand lenses of the Cahokia Formation, as well as high-permeability sand lenses that have been identified as the PMPs.
  - Uppermost Aquifer: thin, generally less than 4 feet, moderate permeability sand, silty sand, and clayey sand and gravel units which includes the unconfined clays and silts of the Upper Cahokia Formation, where saturated, and the thin, moderate permeability sands and gravels of the Lower Cahokia Formation, which at some locations also includes the interface with the Vandalia Till.
  - LCU: low permeability silt and clay with minor sand, silt layers, and occasional discontinuous sand lenses of the Vandalia Till.
  - BCU: composed of interbedded shale and limestone of the Bond Formation.
- The elevations of water within the AP are greater than the surrounding areas and depending on the hydraulic connection between the AP and the surrounding aquifer water may flow radially from the AP toward the lobes of Sangchris Lake.
- Groundwater flow in the uppermost aquifer is to the northwest toward Sangchris Lake. Groundwater elevations are primarily controlled by the surface water level in Sangchris Lake, and the water level within the AP. Typically, groundwater from the AP flows from east to west

and discharges to Sangchris Lake, although there is an apparent groundwater divide located beneath the AP.

- As determined by the detailed geologic information provided for the Ash Pond geology, and the hydrogeologic and groundwater quality data, groundwater within the uppermost aquifer at the Ash Pond is classified as Class II: General Resource Groundwater.
- Potential exceedances of 35 I.A.C. § 845.600 GWPSs were detected in monitoring wells downgradient of the AP in the various hydrostratigraphic units as follows:
  - Arsenic, cobalt, lead, pH, sulfate, TDS, and radium 226 and 228 combined were detected in the USCU wells (not including PMP wells) downgradient of the AP.
  - Arsenic, barium, beryllium, boron, chromium, cobalt, lead, lithium, pH, sulfate, thallium, TDS, and radium 226 and 228 combined were detected in PMP wells downgradient of the AP.
  - Boron, chloride, cobalt, pH, sulfate, thallium, TDS were detected in the uppermost aquifer wells downgradient of the AP.
  - Chloride and pH were detected in the BCU wells downgradient of the AP.

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

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TABLES

TABLE 2-1. GEOTECHNICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample ID	Field Location ID	Top of Sample (ft bgs)	Bottom of Sample (ft bgs)	Moisture Content (%)	Dry Density (pcf)	Specific Gravity	Calculated Porosity [1] (%)	Vertical Hydraulic Conductivity (cm/s)	LL	PL	PI	Laboratory USCS	Gravel (%)	Sand (%)	Fines (%)
CCR															
XPW01 (8.5-9)	XPW01	8.5	9	19.4	74.8	2.790	57%	7.2E-04	12	14	NP	SP	0	97.4	2.6
XPW01 (20.5-21)	XPW01	20.5	21	26.8	79.2	2.838	55%	3.5E-04	17	15	2	SP	0	96.3	3.7
XPW02 (8.5-9)	XPW02	8.5	9	11.8	62.7	2.787	64%	4.0E-03	4	9	NP	SP-SM	0	94.1	5.9
XPW02 (21-21.5)	XPW02	21	21.5	13.9	93.9	2.799	46%	1.9E-03	8	11	NP	SP-SM	0	94.5	5.5
XPW03 (8-8.5)	XPW03	8	8.5	27.4	86.9	2.805	50%	4.3E-03	14	13	1	SW-SM	0.2	91.4	8.4
XPW03 (18-18.5)	XPW03	18	18.5	36.4	89.3	2.770	48%	3.5E-03	5	10	NP	SP	1.6	97.1	1.3
XPW04 (10.5-11)	XPW04	10.5	11	18.3	77.4	2.786	55%	9.2E-04	3	6	NP	SP	0.2	98.4	1.4
XPW04 (21-21.5)	XPW04	21	21.5	32.3	81.3	2.795	53%	5.5E-04	15	16	NP	SP	0	97.3	2.7
Upper Cahokia Formation															
MW-12D (5-7)	MW-12D	5	7	18.6	97.8	2.682	42%	3.2E-07	22	13	9	SC	4.9	49.8	45.3
MW-12D (11.5-12)	MW-12D	11.5	12	18.2	94.5	2.704	44%	7.2E-08	22	12	10	CL	1.1	34.7	64.2
MW-23 (15-17)	MW-23	15	17	28.4	92.7	2.705	45%	7.4E-08	43	17	26	CL	0	2.5	97.5
Lower Cahokia Formation															
MW-12D (20.5-22.5)	MW-12D	20.5	22.5	14.0	106.9	2.672	36%	2.0E-07	22	13	9	SC	6	46.4	47.6
MW-20 (15-17)	MW-20	15	17	18.9	107.7	2.701	36%	1.2E-07	32	14	18	CL	0.6	29.9	69.5
MW-23 (25-27)	MW-23	25	27	15.6	112.3	2.731	34%	5.9E-08	32	14	18	CL	0	41.6	58.4

[O: SSW 04/30/21; U: CJC 08/11/21; C: LDC 08/17/21; U: LDC 09/13/21; C: EJT 09/19/21]

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

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

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

Sample Location	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
XPW01	6-8	02/01/2021	1.12	1.84	83.8	2.31	107	<0.19	37.7	5.18	3.99	10.7	<0.011	3.35	<0.96	0.19
XPW01	16-18	02/01/2021	<0.73	0.63	34.4	0.74	30.1	<0.19	11.5	2.16	0.68	4.43	<0.012	1.55	<0.93	0.28
XPW01	26-28	02/01/2021	<0.77	1.4	22.7	0.53	21.7	<0.19	7.79	1.4	1.09	2.57	<0.012	1.52	<0.96	<0.19
XPW02	6-8	01/26/2021	0.84	1.36	60.6	1.49	77	0.19	23.4	3.9	5.84	6.75	<0.01	2.08	<0.93	<0.19
XPW02	16-18	01/26/2021	<0.8	2.26	57.7	1.39	69.1	0.26	21.3	4.54	5.68	6.02	<0.012	3.03	<0.96	0.31
XPW03	6-8	01/26/2021	<0.77	1.48	1580	1.23	82.4	0.25	20.6	6.39	4.32	11.1	<0.01	2.09	<0.93	<0.19
XPW03	16-18	01/26/2021	<0.75	1.31	470	2.59	106	<0.19	56.7	7.33	4.32	13.4	<0.01	3.07	<0.94	<0.19
XPW04	5-7	01/26/2021	<1.92	0.45	164	2.09	84.9	<0.2	48.8	5.44	1.93	10.3	<0.011	2.2	<0.98	<0.2
XPW04	20-20.5	01/26/2021	1.05	0.5	112	1.48	60.2	<0.19	23.9	3.81	1.54	7.28	<0.011	1.46	<0.93	<0.19

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

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TABLE 2-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)
XPW01	03/01/2021	<0.001	0.0019	0.056	<0.001	1.5	<0.001	76.8	29	<0.0015	<0.001	0.84	<0.001	0.0159	<0.0002	0.0154	7.5	0.239	0.0037	353	<0.002
XPW01	03/18/2021	<0.001	0.0036	0.0702	<0.001	1.58	<0.001	78.2	25	0.0065	0.0015	0.8	0.0017	0.0197	<0.0002	0.0161	7.3	1.06	0.0198	280	<0.002
XPW01	04/07/2021	<0.001	0.0013	0.0565	<0.001	1.53	<0.001	70.5	29	<0.0015	<0.001	0.73	<0.001	0.0179	<0.0002	0.0142	6.9	0.335	0.0178	295	<0.002
XPW01	05/21/2021	<0.001	0.0013	0.0557	<0.001	1.53	<0.001	89.9	28	<0.0015	<0.001	0.63	<0.001	0.0171	<0.0002	0.0147	7.0	0.141	0.0238	312	<0.002
XPW01	06/10/2021	<0.001	0.001	0.0475	<0.001	1.18	<0.001	80.1	29	<0.0015	<0.001	0.71	<0.001	0.0145	<0.0002	0.0131	7.3	0.729	0.0092	215	<0.002
XPW01	07/02/2021	<0.001	0.0012	0.0521	<0.001	1.2	<0.001	66.1	28	<0.0015	<0.001	0.64	<0.001	0.0124	<0.0002	0.0121	7.3	0.862	0.0042	202	<0.002
XPW01	07/22/2021	<0.001	0.0019	0.0487	<0.001	1.41	<0.001	64.8	29	<0.0015	<0.001	0.62	<0.001	0.0142	<0.0002	0.0147	7.3	0.263	0.0016	237	<0.002
XPW01	08/11/2021	<0.001	0.0013	0.0442	<0.001	1.3	<0.001	60.8	29	<0.0015	<0.001	0.61	<0.001	0.0111	<0.0002	0.0161	7.5	0	<0.001	267	<0.002
XPW02	03/01/2021	<0.001	0.0116	0.0638	<0.001	3.74	<0.001	160	6	0.0046	<0.001	0.45	0.0027	0.0529	<0.0002	0.0446	7.0	0.915	<0.001	437	<0.002
XPW02	03/18/2021	<0.001	0.0091	0.0567	<0.001	4.22	<0.001	169	4	<0.0015	<0.001	0.37	<0.001	0.0573	<0.0002	0.0429	6.7	0.625	<0.001	465	<0.002
XPW02	04/07/2021	<0.001	0.0148	0.0817	<0.001	4.22	<0.001	165	4	0.0075	0.001	0.37	0.004	0.057	<0.0002	0.0445	6.1	1.21	<0.001	435	<0.002
XPW02	05/21/2021	<0.001	0.0073	0.0742	<0.001	3.49	<0.001	145	3	<0.0015	<0.001	0.32	<0.001	0.041	<0.0002	0.0358	6.5	0.675	0.001	314	<0.002
XPW02	06/10/2021	<0.001	0.006	0.0657	<0.001	3.72	<0.001	158	3	<0.0015	<0.001	0.35	<0.001	0.0515	<0.0002	0.0364	6.4	0.532	<0.001	359	<0.002
XPW02	07/02/2021	<0.001	0.0087	0.0675	<0.001	4.23	<0.001	145	3	<0.0015	<0.001	0.33	<0.001	0.0556	<0.0002	0.0349	6.6	0.188	<0.001	359	<0.002
XPW02	07/22/2021	<0.001	0.006	0.0473	<0.001	3.11	<0.001	142	13	<0.0015	<0.001	0.31	<0.001	0.0437	<0.0002	0.0318	6.6	0.433	<0.001	330	<0.002
XPW02	08/11/2021	<0.001	0.0076	0.0579	<0.001	3.52	<0.001	138	3	<0.0015	<0.001	0.31	<0.001	0.0505	<0.0002	0.0364	6.7	0.318	<0.001	353	<0.002
XPW03	03/02/2021	<0.001	0.0037	0.0481	<0.001	2.92	<0.001	180	5	<0.0015	<0.001	0.69	<0.001	0.0299	<0.0002	0.0494	7.1	0.121	<0.001	937	<0.002
XPW03	03/18/2021	<0.001	0.0165	0.0894	<0.001	2.69	<0.001	154	4	0.0036	<0.001	0.62	<0.001	0.0304	<0.0002	0.0434	6.8	0.64	0.0043	745	<0.002
XPW03	04/07/2021	<0.001	0.0172	0.0823	<0.001	4.21	<0.001	153	4	0.0037	<0.001	0.78	<0.001	0.0308	<0.0002	0.0559	6.6	0.013	0.0088	1110	<0.002
XPW03	05/20/2021	<0.001	0.0025	0.0329	<0.001	2.81	<0.001	150	3	<0.0015	<0.001	0.58	<0.001	0.0256	<0.0002	0.0346	6.7	0.178	0.0028	715	<0.002
XPW03	06/10/2021	<0.001	0.0024	0.0356	<0.001	3.11	<0.001	140	4	<0.0015	<0.001	0.68	<0.001	0.0301	<0.0002	0.0383	6.7	0.0626	0.0023	751	<0.002
XPW03	07/01/2021	<0.001	0.005	0.0503	<0.001	3.1	<0.001	128	3	<0.0015	<0.001	0.65	<0.001	0.0272	<0.0002	0.0386	6.8	0.979	<0.001	537	<0.002
XPW03	07/22/2021	<0.001	0.0039	0.0389	<0.001	2.77	<0.001	156	3	<0.0015	<0.001	0.56	<0.001	0.0283	<0.0002	0.0441	6.8	0.11	<0.001	642	<0.002
XPW03	08/11/2021	<0.001	0.0027	0.0373	<0.001	2.85	<0.001	161	3	<0.0015	<0.001	0.51	<0.001	0.0271	<0.0002	0.0353	6.9	0.287	<0.001	684	<0.002

TABLE 2-3. POREWATER ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)
XPW04	03/02/2021	<0.001	<0.001	0.13	<0.001	1.5	<0.001	68.4	18	<0.0015	<0.001	0.46	<0.001	0.0315	<0.0002	0.0065	7.1	1.01	<0.001	51	<0.002
XPW04	03/18/2021	<0.001	<0.001	0.133	<0.001	1.54	<0.001	62.2	14	<0.0015	<0.001	0.5	<0.001	0.0289	<0.0002	0.0064	6.7	0.131	<0.001	44	<0.002
XPW04	04/07/2021	<0.001	0.0012	0.0946	<0.001	2.28	<0.001	63.7	15	<0.0015	<0.001	0.42	<0.001	0.0282	<0.0002	0.0088	6.3	0.235	<0.001	51	<0.002
XPW04	05/20/2021	<0.001	0.0022	0.0719	<0.001	1.26	<0.001	51.8	7	<0.0015	<0.001	0.42	<0.001	0.019	<0.0002	0.0068	6.7	1.07	<0.001	78	<0.002
XPW04	06/09/2021	<0.001	0.0034	0.0803	<0.001	1.5	<0.001	63	9	<0.0015	<0.001	0.5	<0.001	0.021	<0.0002	0.0099	6.6	0.337	<0.001	88	<0.002
XPW04	07/01/2021	<0.001	0.0048	0.0951	<0.001	1.87	<0.001	61.1	10	<0.0015	<0.001	0.49	<0.001	0.0217	<0.0002	0.0135	6.9	1.25	<0.001	87	<0.002
XPW04	07/22/2021	<0.001	0.0038	0.0718	<0.001	1.54	<0.001	65	10	<0.0015	<0.001	0.46	<0.001	0.0204	<0.0002	0.0107	6.7	0.248	<0.001	85	<0.002
XPW04	08/10/2021	<0.001	0.0018	0.0681	<0.001	1.94	<0.001	69.7	12	<0.0015	<0.001	0.48	<0.001	0.0212	<0.0002	0.0107	6.9	1.12	<0.001	104	0.0031

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
< = concentration is less than the concentration shown, which corresponds to the reporting limit for the method.
mg/L = milligrams per liter
pCi/L = picocuries per liter
SU = standard units
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TABLE 2-4. SOIL ANALYTICAL RESULTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	Geologic Unit	Sample Depth (ft BGS)	Sample Date	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Selenium (mg/kg)	Thallium (mg/kg)
MW-12D	Upper Cahokia Formation	3-5	01/26/2021	<0.37	8.46	127	0.59	9.36	<0.19	18	9.25	25.5	11.7	0.476	0.52	<0.94	<0.19
MW-12D	Upper Cahokia Formation	10.8-12.8	01/26/2021	<0.39	4.97	50	<0.29	7.02	<0.2	7.94	3.05	8.75	5.19	<0.012	0.58	<0.98	<0.2
MW-12D	Lower Cahokia Formation	33-35	01/26/2021	0.73	24.4	84.4	0.58	11.8	0.61	17.8	10	14.3	7.36	0.028	3.83	1.06	0.37
MW-12D	Bedrock	49-51	01/26/2021	<0.38	2.6	49.2	0.37	5.86	0.36	10.4	2.2	2.49	3.32	<0.01	<0.2	<1	<0.2
MW-20	Upper Cahokia Formation	13-15	01/26/2021	<0.73	8.21	98.6	0.82	<4.63	<0.19	21.7	7.42	13	13.4	0.014	0.35	<0.93	<0.19
MW-20	Lower Cahokia Formation	43-45	01/26/2021	<0.38	6.17	75.4	0.45	8.4	<0.18	14.8	7.16	9.57	15.6	0.014	1.71	<0.91	0.2
MW-23	Upper Cahokia Formation	13-15	02/02/2021	<0.37	6.36	204	0.94	6.19	<0.19	23.6	9.21	14.2	11.7	0.029	<0.19	<0.96	0.25
MW-23	Lower Cahokia Formation	25-27	02/02/2021	<0.39	6.42	74.5	0.59	9.61	<0.19	17.8	8.18	10.7	15.2	0.014	1.1	<0.93	<0.19

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

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TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
MW-1	UA	04/20/2010	604.71	604.71	Top of PVC	602.60	15.00	25.00	587.60	577.60	25.00	568.10	10	2	39.592051	-89.490283
MW-2	UA	04/21/2010	601.10	601.10	Top of PVC	598.88	10.00	20.00	588.90	578.90	20.00	541.40	10	2	39.590698	-89.488916
MW-3	UA	04/15/2010	601.46	601.46	Top of PVC	599.24	14.00	24.00	585.20	575.20	24.00	552.70	10	2	39.594458	-89.487173
MW-4	UA	04/14/2010	600.88	600.88	Top of PVC	598.46	12.00	22.00	586.50	576.50	22.00	560.50	10	2	39.600751	-89.487354
MW-5	UA	04/22/2010	619.44	619.44	Top of PVC	617.77	30.00	40.00	587.80	577.80	40.00	541.80	10	2	39.601296	-89.490402
MW-6	UA	04/16/2010	600.46	600.46	Top of PVC	598.44	10.00	20.00	588.40	578.40	20.00	572.90	10	2	39.598638	-89.498944
MW-7	UA	04/16/2010	597.75	597.75	Top of PVC	596.00	10.00	20.00	586.00	576.00	20.00	569.50	10	2	39.597637	-89.498959
MW-7S	USCU	02/02/2021	597.64	597.64	Top of PVC	595.59	6.00	11.00	589.59	584.59	11.00	580.59	5	2	39.59766	-89.498978
MW-8	UA	04/13/2010	603.14	603.14	Top of PVC	601.14	12.00	22.00	589.10	579.10	22.00	563.10	10	2	39.594399	-89.496829
MW-8S	USCU	02/02/2021	603.30	603.30	Top of PVC	600.57	4.00	7.00	596.57	593.57	7.00	580.57	3	2	39.594381	-89.496822
MW-9	UA	04/19/2010	599.39	599.39	Top of PVC	597.63	10.00	20.00	587.60	577.60	20.00	573.10	10	2	39.595204	-89.500968
MW-10	UA	04/19/2010	600.11	600.11	Top of PVC	598.22	10.00	20.00	588.20	578.20	20.00	575.20	10	2	39.590652	-89.503745
MW-11	UA	06/17/2015	601.81	601.81	Top of PVC	599.27	11.00	21.00	588.30	578.30	21.00	578.30	10	2	39.593104	-89.491115
MW-11S	USCU	01/26/2021	601.76	601.76	Top of PVC	599.43	4.00	8.00	595.43	591.43	8.00	591.43	4	2	39.593122	-89.491102
MW-12	UA	07/23/2015	591.40	591.40	Top of PVC	589.04	15.00	25.00	573.90	563.90	25.00	563.90	10	2	39.600208	-89.496381
MW-12S	USCU	01/27/2021	591.10	591.10	Top of PVC	588.62	5.00	9.00	583.62	579.62	9.00	579.12	4	2	39.600208	-89.496412
MW-12D	BCU	01/26/2021	590.96	590.96	Top of PVC	589.08	50.00	55.00	539.08	534.08	55.00	489.08	5	2	39.600194	-89.496418
MW-20	UA	01/26/2021	600.77	600.77	Top of PVC	598.52	14.00	24.00	584.52	574.52	24.00	547.52	10	2	39.598653	-89.48728
MW-20S	USCU	01/26/2021	600.64	600.64	Top of PVC	598.43	4.00	10.00	594.43	588.43	10.00	588.43	6	2	39.598665	-89.487279
MW-22	UA	02/03/2021	601.77	601.77	Top of PVC	599.51	15.00	19.00	584.51	580.51	19.00	579.51	4	2	39.593235	-89.487638
MW-23	UA	02/02/2021	610.32	610.32	Top of PVC	608.05	23.00	28.00	585.05	580.05	28.00	558.05	5	2	39.593293	-89.489352
MW-24	UA	02/02/2021	615.48	615.48	Top of PVC	613.01	27.00	32.00	586.01	581.01	32.00	581.01	5	2	39.593271	-89.493267
MW-25	USCU	02/02/2021	607.20	607.20	Top of PVC	604.60	9.00	14.00	595.60	590.60	14.00	579.60	5	2	39.594397	-89.495062

TABLE 3-1. MONITORING WELL LOCATIONS AND CONSTRUCTION DETAILS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Well Number	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
MW-26	UA	02/02/2021	596.16	596.16	Top of PVC	593.33	7.00	12.00	586.33	581.33	12.00	573.33	5	2	39.595584	-89.497582
MW-27	USCU	02/02/2021	600.05	600.05	Top of PVC	597.35	10.00	15.00	587.35	582.35	15.00	577.35	5	2	39.596694	-89.497927
MW-28	UA	02/02/2021	601.40	601.40	Top of PVC	598.33	12.00	22.00	586.33	576.33	22.00	573.33	10	2	39.599258	-89.497962
MW-29	UA	02/01/2021	599.94	599.94	Top of PVC	596.86	14.00	19.00	582.86	577.86	19.00	576.86	5	2	39.599691	-89.497249
MW-30	UA	02/03/2021	618.47	618.47	Top of PVC	616.00	35.00	40.00	581.00	576.00	40.00	571.00	5	2	39.601262	-89.493996
MW-31	UA	02/03/2021	617.34	617.34	Top of PVC	615.02	35.00	40.00	580.02	575.02	40.00	565.02	5	2	39.601301	-89.491702
MW-31S	USCU	02/03/2021	617.54	617.54	Top of PVC	615.13	25.00	30.00	590.13	585.13	30.00	585.13	5	2	39.601303	-89.491681
MW-32	UA	02/03/2021	619.49	619.49	Top of PVC	617.20	32.00	37.00	585.20	580.20	37.00	577.20	5	2	39.601279	-89.488643
PZ-4C	UA	03/30/2016	600.57	600.57	Top of PVC	597.89	15.50	20.50	582.39	577.39	20.50	577.39	5	2	39.596398	-89.487207
XPW01	CCR	02/01/2021	627.84	627.84	Top of PVC	625.48	22.00	32.00	603.48	593.48	32.00	593.48	10	2	39.594417	-89.493104
XPW02	CCR	01/26/2021	620.19	620.19	Top of PVC	617.91	13.00	23.00	604.91	594.91	23.00	595.91	10	2	39.597918	-89.49687
XPW03	CCR	01/26/2021	616.08	616.08	Top of PVC	616.08	10.00	20.00	606.08	596.08	20.00	596.08	10	2	39.599588	-89.495765
XPW04	CCR	01/26/2021	606.53	606.53	Top of PVC	604.57	13.00	23.00	591.57	581.57	23.00	580.57	10	2	39.600737	-89.492276
XSG-01	CCR	--	--	608.43	Staff gauge	--	--	--	--	--	--	--	--	--	39.593401	-89.48768
SG-02	SW	--	--	564.80	Staff gauge	--	--	--	--	--	--	--	--	--	39.593106	-89.498155

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
-- = data not available
BCU = bedrock confining unit
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer
USCU = upper semi-confining unit

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TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Date	MW-12 Groundwater Elevation (ft NAVD88)	MW-12D Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	UA	BCU				
2/23/2021	584.12	584.55	-0.43	32.46	-0.013	up
3/15/2021	584.70	585.36	-0.66	32.46	-0.020	up
4/5/2021	585.10	586.23	-1.13	32.46	-0.035	up
5/20/2021	586.59	587.18	-0.59	32.46	-0.018	up
6/10/2021	585.02	586.55	-1.53	32.46	-0.047	up
7/01/2021-7/02/2021	585.41	586.71	-1.30	32.46	-0.040	up
7/22/2021-7/23/2021	584.98	586.58	-1.60	32.46	-0.049	up
8/10/2021-8/11/2021	585.05	586.71	-1.66	32.46	-0.051	up
			Middle of screen elevation MW-12			569.0
			Middle of screen elevation MW-12D			536.6

Date	MW-12S Groundwater Elevation (ft NAVD88)	MW-12 Groundwater Elevation (ft NAVD88)	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
	PMP	UA				
2/23/2021	584.81	584.12	0.69	12.58	0.055	down
3/15/2021	585.43	584.70	0.73	12.58	0.058	down
4/5/2021	585.53	585.10	0.43	12.58	0.034	down
5/20/2021	587.19	586.59	0.60	12.58	0.048	down
6/10/2021	585.27	585.02	0.25	12.58	0.020	down
7/01/2021-7/02/2021	585.60	585.41	0.19	12.58	0.015	down
7/22/2021-7/23/2021	585.12	584.98	0.14	12.58	0.011	down
8/10/2021-8/11/2021	585.31	585.05	0.26	12.58	0.021	down
			Middle of screen elevation MW-12S			581.6
			Middle of screen elevation MW-12			569.0

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Date	MW-31S Groundwater Elevation (ft NAVD88) USCU	MW-31 Groundwater Elevation (ft NAVD88) UA	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/23/2021	591.18	587.68	3.50	10.11	0.346	down
3/15/2021	591.83	587.96	3.87	10.11	0.383	down
4/5/2021	590.92	587.86	3.06	10.11	0.303	down
5/20/2021	592.83	588.63	4.20	10.11	0.415	down
6/09/2021-6/10/2021	588.77	586.66	2.11	11.25	0.188	down
7/1/2021	588.55	594.19	-5.64	11.03	-0.511	up
7/22/2021-7/23/2021	588.55	586.69	1.86	11.03	0.169	down
8/10/2021	588.30	587.49	0.81	10.78	0.075	down
			Middle of screen elevation MW-31S			587.6
			Middle of screen elevation MW-31			577.5

Date	MW-8S Groundwater Elevation (ft NAVD88) USCU	MW-8 Groundwater Elevation (ft NAVD88) UA	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/23/2021	594.97	595.54	-0.57	10.83	-0.053	up
3/15/2021	594.85	595.97	-1.12	10.71	-0.105	up
4/5/2021	594.45	594.70	-0.25	10.31	-0.024	up
5/21/2021	597.46	597.33	0.13	10.93	0.012	down
6/10/2021	593.90	593.85	0.05	9.76	0.005	down
7/1/2021	--	598.50	--	--	--	--
7/22/2021	--	594.15	--	--	--	--
8/10/2021	--	596.10	--	--	--	--
			Middle of screen elevation MW-8S			595.1
			Middle of screen elevation MW-8			584.1

TABLE 3-2. VERTICAL HYDRAULIC GRADIENTS
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Date	MW-7S Groundwater Elevation (ft NAVD88) USCU	MW-7 Groundwater Elevation (ft NAVD88) UA	Head Change (ft)	Distance Change [1] (ft)	Vertical Hydraulic Gradient [2] (dh/dl)	
2/23/2021	587.18	589.45	-2.27	6.18	-0.367	up
3/15/2021	587.26	594.86	-7.60	6.26	-1.214	up
4/5/2021	587.12	588.64	-1.52	6.12	-0.248	up
5/21/2021	587.86	591.55	-3.69	6.86	-0.538	up
6/10/2021	587.44	586.86	0.58	6.44	0.090	down
7/01/2021-7/02/2021	587.34	592.54	-5.20	6.34	-0.820	up
7/22/2021-7/23/2021	587.33	587.73	-0.40	6.33	-0.063	up
8/10/2021-8/11/2021	587.73	595.40	-7.67	6.73	-1.140	up
			Middle of screen elevation MW-7S			587.1
			Middle of screen elevation MW-7			581.0

[O:SSW 06/09/21; U:LDC 08/18/21, C:CJC 08/18/21; U:LDC 09/13/21, C:EJT 09/15/21]

Notes:
[1] Distance change was calculated using the midpoint of the piezometer screen and water table surface. If the water table surface was above the top of the monitoring well screen, then distance change was calculated using the midpoint of both screens.
[2] Vertical gradients between ±0.0015 are considered flat, and typically have less than 0.02 foot difference in groundwater elevation between wells.
-- = data not available
BCU = bedrock confining unit
dh = head change
dl = distance change
ft = foot/feet
NAVD88 = North American Vertical Datum of 1988
PMP = potential migration pathway
UA = uppermost aquifer
USCU = upper semi-confining unit

TABLE 3-3. FIELD HYDRAULIC CONDUCTIVITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Well ID	Gradient Position	Bottom of Screen Elevation (ft NAVD88)	Screen Length [1] (ft)	Field Identified Screened Material (USCS)	Slug Type	Analysis Method	Number of Field Tests	Test Analyzed [2]	Hydraulic Conductivity (cm/s)	Minimum Hydraulic Conductivity (cm/s)	Maximum Hydraulic Conductivity (cm/s)	Hydraulic Conductivity Geometric Mean (cm/s)
USCU												
MW-12S*	D	579.62	5	CL	Solid	Kansas Geological Survey	4	FH-1	3.30E-05	1.56E-05	1.22E-04	5.04E-05
MW-25*	D	590.60	5	SW-SM/CL	Solid	Kansas Geological Survey	4	FH-1	1.03E-04			
MW-27*	D	582.35	5	CL/SC/ML	Solid	Bouwer-Rice	1	FH-1	1.56E-05			
MW-20S	U	588.43	6	ML/CL	Solid	Bouwer-Rice	4	FH-1	1.22E-04			
UA												
MW-20	U	574.52	10	ML/CL	Solid	Bouwer-Rice	1	FH-1	6.77E-06	1.29E-06	5.35E-04	4.14E-05
MW-22	D	580.51	4	SC/SP-SC	Solid	Bouwer-Rice	2	RH-1	3.80E-05			
MW-23	D	580.05	5	CL	Solid	Kansas Geological Survey	4	FH-1	5.35E-04			
MW-26	D	581.33	5	SC/ML	Solid	Bouwer-Rice	1	FH-1	1.29E-06			
MW-28	D	576.33	10	ML/SM	Solid	Bouwer-Rice	4	FH-1	1.34E-04			
MW-29	D	577.86	5	SW-SM	Solid	Cooper-Bredehoeft-Papadopulos	4	FH-1	1.18E-04			
MW-30	D	576.00	5	CL/ML/SM	Solid	Kansas Geological Survey	1	FH-1	7.07E-06			
MW-31	D	575.02	5	CL/ML/SC	Solid	Cooper-Bredehoeft-Papadopulos	2	FH-1	3.30E-05			
MW-32	D	580.20	5	CL/ML	Solid	Kansas Geological Survey	4	RH-1	4.61E-04			
PZ-4C	D	577.39	5	CL	Solid	Bouwer-Rice	2	FH-1	4.95E-05			
BCU												
MW-12D	D	534.08	5	BR	Solid	Kansas Geological Survey	4	FH-1	1.69E-03	1.69E-03	1.69E-03	1.69E-03
CCR												
XPW-01	NA	593.48	10	SW-SM	Solid	Springer-Gelhar	6	FH-1	2.64E-01	2.09E-02	2.64E-01	8.57E-02
XPW-02	NA	594.91	10	SW/SP	Solid	Springer-Gelhar	4	RH-1	2.09E-02			
XPW-03	NA	596.08	10	SW	Solid	Springer-Gelhar	4	RH-2	9.48E-02			
XPW-04	NA	581.57	10	SW	Solid	Springer-Gelhar	6	FH-1	1.03E-01			

[O: SSW 06/09/21; U:CJC 08/17/21; C: LDC 08/17/21; U: LDC 09/13/21; C: EJT 09/19/21]

Notes:
[1] All wells are constructed from 2 inch polyvinyl chloride (PVC) with 0.01 inch slotted screens.
[2] Test response data (elapsed time and corresponding changes in water levels) were plotted as normalized displacement to evaluate similarity among repeat test data within each well. A single test was selected for analysis at each well based on the quality of the test data (*i.e.,* smooth recovery curve) and coincidence of repeat test data.
* Well in the upper semi-confining unit that has been identified to monitor the potential migration pathway.
BCU = bedrock confining unit
CCR = coal combustion residuals
cm/s = centimeters per second
D = Downgradient
FH-1 = Falling Head 1 Test
ft = foot/feet
NAVD88 = North American Vertical Datum of 1988
RH-1 = Rising Head 1 Test
RH-2 = Rising Head 2 Test
U = Upgradient
UA = uppermost aquifer
USCU = upper semi-confining unit

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

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

$V = K i / n_e$ V = Groundwater Velocity [1]
K = Hydraulic Conductivity [2]
i = hydraulic gradient
n_e = Effective Porosity [3]

North of CCR Unit (MW-5 to MW-31): Uppermost Aquifer

Distance between Wells (ft): 360
Hydraulic Conductivity (ft/day): 0.05
Effective Porosity (%): 18.3 Assumes: sand, silt, and clay

Date	MW-5 Groundwater Elevation (ft NAVD88)	MW-31 Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/23/2021	594.09	587.68	6.41	0.018	0.005
3/15/2021	594.36	587.96	6.40	0.018	0.005
4/5/2021	593.84	587.86	5.98	0.017	0.004
5/20/2021	594.57	588.63	5.94	0.017	0.004
6/9/2021	593.15	586.66	6.49	0.018	0.005
7/1/2021	593.94	594.19	-0.25	-0.001	0.000
7/22/2021	593.09	586.69	6.40	0.018	0.005
8/10/2021	594.66	587.49	7.17	0.020	0.005
			Average	0.015	0.004

Northwest of CCR Unit (MW-6 to MW-12): Uppermost Aquifer

Distance between Wells (ft): 905
Hydraulic Conductivity (ft/day): 0.04
Effective Porosity (%): 18.3 Assumes: sand, silt, and clay

Date	MW-6 Groundwater Elevation (ft NAVD88)	MW-12 Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/23/2021	592.01	584.12	7.89	0.009	0.002
3/15/2021	592.27	584.70	7.57	0.008	0.002
3/30/2021	594.96	585.65	9.31	0.010	0.002
4/5/2021	593.71	585.10	8.61	0.010	0.002
5/20/2021-5/21/2021	595.26	586.59	8.67	0.010	0.002
6/10/2021	591.58	585.02	6.56	0.007	0.002
7/1/2021	590.43	585.41	5.02	0.006	0.001
7/22/2021	591.82	584.98	6.84	0.008	0.002
8/10/2021	592.67	585.05	7.62	0.008	0.002
			Average	0.008	0.002

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Southwest of CCR Unit (MW-8 to MW-26): Uppermost Aquifer

Distance between Wells (ft): 485
Hydraulic Conductivity (ft/day): 0.01
Effective Porosity (%): 18.3 Assumes: sand, silt, and clay

Date	MW-8 Groundwater Elevation (ft NAVD88)	MW-26 Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/23/2021	595.54	588.87	6.67	0.014	0.001
3/15/2021	595.97	589.61	6.36	0.013	0.001
4/5/2021	594.70	591.21	3.49	0.007	0.001
5/21/2021	597.33	592.50	4.83	0.010	0.001
6/9/2021-6/10/2021	593.85	589.04	4.81	0.010	0.001
7/1/2021	598.50	586.18	12.32	0.025	0.002
7/22/2021	594.15	585.02	9.13	0.019	0.001
8/10/2021	596.10	586.14	9.96	0.021	0.002
			Average	0.015	0.001

Southwest of CCR Unit (MW-25 to MW-27): Upper Semi-Confining Unit/Potential Migration Pathway

Distance between Wells (ft): 1165
Hydraulic Conductivity (ft/day): 0.17
Effective Porosity (%): 17.5 Assumes: sand and clay

Date	MW-25 Groundwater Elevation (ft NAVD88)	MW-27 Groundwater Elevation (ft NAVD88)	Change in Elevation (ft)	Horizontal Gradient (ft/ft)	Velocity (ft/day)
2/23/2021	601.41	586.05	15.36	0.013	0.013
3/15/2021	601.60	587.14	14.46	0.012	0.012
4/5/2021	601.24	591.44	9.80	0.008	0.008
5/21/2021	602.14	594.44	7.70	0.007	0.006
6/9/2021-6/10/2021	583.98	583.38	0.60	0.001	0.000
7/1/2021-7/2/2021	601.23	585.55	15.68	0.013	0.013
7/22/2021-7/23/2021	600.36	584.70	15.66	0.013	0.013
8/11/2021	601.24	585.72	15.52	0.013	0.013
			Average	0.010	0.010

[O: SSW 06/09/21; U: LDC 08/18/21, C: EJT 08/18/21; U: CJC 10/01/21; C: SSW 10/01/21]

TABLE 3-4. HORIZONTAL HYDRAULIC GRADIENTS AND GROUNDWATER FLOW VELOCITIES
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Notes:
[1] A negative groundwater velocity indicates a reversal of groundwater flow from normal conditions.
[2] Hydraulic conductivity values used above are average of the individual wells used in each velocity calculation as derived from slug tests completed in August 2015 and April 2021 by Ramboll.
[3] Effective porosity used in these calculations was derived from an average between estimated values of 0.20 for silt material, 0.267 for gravel, 0.07 for clay, and 0.28 for sand from Morris, D.A. and A.I. Johnson, 1967. *Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey,* U.S. Geological Survey Water-Supply Paper 1839-D, 42p. and Heath, R.C., 1983. *Basic ground-water hydrology,* U.S. Geological Survey Water-Supply Paper 2220, 86p. Effective porosity may be as high as maximum total porosity (45%) calculated in Table 2-1.
% = percent
ft= foot/feet
ft/day = feet per day
ft/ft = feet per foot
NAVD88 = North American Vertical Datum of 1988

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-1	06/03/2015	--	--	--	--	--	--	--	--	--	--	0.17	--	--	<0	--	--	--	--	--	--	--
MW-1	06/16/2015	<0.001	<0.025	0.0482	<0.0005	0.192	<0.002	--	10	<0.005	<0.005	0.16	<0.0075	--	<0.0002	--	6.8	--	<0.04	106	<0.001	358
MW-1	12/15/2015	<0.001	<0.001	0.0458	<0.001	0.255	<0.001	58.8	12	<0.001	<0.001	0.19	<0.001	0.0019	<0.0002	<0.001	6.6	0.47	<0.001	113	<0.001	314
MW-1	02/29/2016	<0.001	<0.001	0.0448	<0.001	0.203	<0.001	63.9	11	<0.001	<0.001	0.16	<0.001	0.0017	<0.0002	<0.001	6.6	0.537	<0.001	117	<0.001	292
MW-1	05/16/2016	<0.001	<0.001	0.0446	<0.001	0.229	<0.001	59.3	10	<0.001	<0.001	0.16	<0.001	0.0016	<0.0002	<0.001	6.9	0.34	<0.001	108	<0.001	336
MW-1	08/22/2016	<0.001	<0.001	0.0465	<0.001	0.269	<0.001	61.1	11	<0.001	<0.001	0.18	<0.001	0.0016	<0.0002	<0.001	6.8	1.03	<0.001	117	<0.001	358
MW-1	11/15/2016	<0.001	<0.001	0.0471	<0.001	0.271	<0.001	57.6	11	<0.001	<0.001	0.18	<0.001	0.0021	<0.0002	<0.001	7.0	0.16	<0.001	109	<0.001	390
MW-1	02/13/2017	<0.001	<0.001	0.0437	<0.001	0.228	<0.001	57.5	10	<0.001	<0.001	0.16	<0.001	0.0015	<0.0002	<0.001	6.8	0.58	<0.001	105	<0.001	326
MW-1	05/18/2017	<0.001	<0.001	0.0465	<0.001	0.256	<0.001	57	12	<0.001	<0.001	0.16	<0.001	0.0017	<0.0002	<0.001	6.7	0.41	<0.001	109	<0.001	370
MW-1	07/18/2017	<0.001	<0.001	0.0443	<0.001	0.273	<0.001	55.6	11	0.0018	<0.001	0.18	<0.001	0.002	<0.0002	<0.001	6.7	1.35	<0.001	101	<0.001	334
MW-1	11/06/2017	<0.001	<0.001	0.0487	<0.001	0.281	<0.001	60.3	11	<0.001	<0.001	0.18	<0.001	--	<0.0002	--	6.8	1.53	<0.001	104	<0.001	340
MW-1	05/31/2018	<0.001	<0.001	0.0444	<0.001	0.234	<0.001	59.1	12	0.0016	<0.001	0.19	<0.001	0.0017	<0.0002	<0.0015	6.5	1.72	<0.001	91	<0.002	356
MW-1	08/28/2018	--	<0.001	0.044	--	0.258	--	59.8	11	0.009	<0.001	0.18	<0.001	0.0026	--	0.0016	6.2	0.41	<0.001	94	--	374
MW-1	11/08/2018	<0.001	<0.001	0.0619	<0.001	0.352	<0.001	--	12	<0.0015	<0.001	0.19	<0.001	--	<0.0002	--	6.4	0.08	<0.001	95	<0.002	400
MW-1	02/14/2019	<0.001	<0.001	0.0498	<0.001	0.243	<0.001	66	10	<0.0015	<0.001	0.17	<0.001	0.0019	<0.0002	<0.0015	6.7	0.92	<0.001	92	<0.002	312
MW-1	05/14/2019	<0.001	<0.001	0.0451	<0.001	0.21	<0.001	--	11	<0.0015	<0.001	0.19	<0.001	--	<0.0002	--	6.4	0.26	<0.001	97	<0.002	364
MW-1	08/21/2019	--	<0.001	0.0489	--	0.29	--	60.2	10	<0.0015	<0.001	0.18	<0.001	<0.003	--	<0.0015	6.3	0.68	<0.001	80	--	334
MW-1	11/13/2019	<0.001	<0.001	0.0462	<0.001	0.278	<0.001	--	9	<0.0015	<0.001	0.19	<0.001	--	<0.0002	--	6.5	0.48	<0.001	101	<0.002	326
MW-1	02/11/2020	<0.001	<0.001	0.0466	<0.001	0.222	<0.001	59.6	8	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.6	2.38	<0.001	92	<0.002	366
MW-1	05/12/2020	<0.001	<0.001	0.0464	<0.001	0.223	<0.001	--	8	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.6	1.3	<0.001	102	<0.002	350
MW-1	08/26/2020	<0.001	<0.001	0.0463	<0.001	0.252	--	57.5	7	<0.0015	<0.001	0.23	<0.001	<0.003	--	<0.0015	6.6	2.55	<0.001	93	--	300
MW-1	12/02/2020	<0.001	<0.001	0.0459	<0.001	0.28	<0.001	--	7	<0.0015	<0.001	0.2	<0.001	--	<0.0002	--	6.6	1.31	<0.001	97	<0.002	302

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-1	02/24/2021	<0.001	<0.001	0.0475	<0.001	0.214	<0.001	57	7	<0.0015	<0.001	0.19	<0.001	<0.005	<0.0002	<0.0015	6.5	0.222	<0.001	93	<0.002	332
MW-1	03/15/2021	<0.001	<0.001	0.043	<0.001	0.195	<0.001	55.3	6	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.5	0.38	<0.001	89	<0.002	330
MW-1	03/30/2021	<0.001	<0.001	0.0445	<0.001	0.204	<0.001	57.8	6	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.5	0	<0.001	84	<0.002	298
MW-1	04/05/2021	<0.001	<0.001	0.0412	<0.001	0.204	<0.001	56.4	7	<0.0015	<0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.0	0.0782	<0.001	84	<0.002	304
MW-1	05/19/2021	<0.001	<0.001	0.0413	<0.001	0.218	<0.001	57.8	7	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.1	0.0767	<0.001	84	<0.002	310
MW-1	06/10/2021	<0.001	<0.001	0.0441	<0.001	0.217	<0.001	54.8	8	<0.0015	<0.001	0.21	<0.001	<0.003	<0.0002	<0.0015	6.2	0.416	<0.001	90	<0.002	306
MW-1	07/01/2021	<0.001	<0.001	0.0471	<0.001	0.226	<0.001	58.3	8	<0.0015	<0.001	0.2	<0.001	<0.003	<0.0002	<0.0015	6.2	0.54	<0.001	87	<0.002	306
MW-1	07/22/2021	<0.001	<0.001	0.0504	<0.001	0.296	<0.001	57.3	12	<0.0015	<0.001	0.2	<0.001	<0.003	<0.0002	<0.0015	6.3	0.265	<0.001	85	<0.002	302
MW-1	08/10/2021	<0.001	<0.001	0.0413	<0.001	0.266	<0.001	54.8	9	<0.0015	<0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.3	0.521	<0.001	86	<0.002	308
MW-1	09/01/2021	<0.001	<0.001	0.0466	<0.001	0.301	<0.001	55.2	9	<0.0015	<0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.5	0.456	<0.001	85	<0.002	302
MW-2	06/03/2015	--	--	--	--	--	--	--	--	--	--	0.49	--	--	<0	--	--	--	--	--	--	--
MW-2	06/16/2015	<0.001	<0.025	0.122	<0.0005	0.0608	<0.002	--	17	<0.005	<0.005	0.46	<0.0075	--	<0.0002	--	7.5	--	<0.04	150	<0.001	500
MW-2	12/15/2015	<0.001	0.0022	0.127	<0.001	0.11	<0.001	105	16	0.0025	0.0012	0.47	0.0014	0.0068	<0.0002	0.004	7.1	0.58	0.0048	171	<0.001	566
MW-2	02/29/2016	<0.001	<0.001	0.111	<0.001	0.0873	<0.001	104	17	<0.001	<0.001	0.43	<0.001	0.0063	<0.0002	0.0053	7.2	0.16	<0.001	143	<0.001	416
MW-2	05/16/2016	<0.001	0.0011	0.113	<0.001	0.0892	<0.001	101	15	<0.001	<0.001	0.45	<0.001	0.0056	<0.0002	0.0043	7.4	0.87	0.0016	159	<0.001	534
MW-2	08/22/2016	<0.001	<0.001	0.114	<0.001	0.0808	<0.001	97.3	14	<0.001	<0.001	0.47	<0.001	0.0055	<0.0002	0.0039	7.4	1.26	<0.001	169	<0.001	566
MW-2	11/15/2016	<0.001	0.0011	0.113	<0.001	0.102	<0.001	101	13	<0.001	<0.001	0.47	<0.001	0.0057	<0.0002	0.004	7.5	0.01	<0.001	161	<0.001	576
MW-2	02/13/2017	<0.001	<0.001	0.112	<0.001	0.101	<0.001	97.5	14	<0.001	<0.001	0.44	<0.001	0.0058	<0.0002	0.0043	7.2	0	<0.001	173	<0.001	520
MW-2	05/18/2017	<0.001	<0.001	0.112	<0.001	0.106	<0.001	104	14	<0.001	<0.001	0.43	<0.001	0.0051	<0.0002	0.0037	7.2	1.16	<0.001	178	<0.001	596
MW-2	07/18/2017	<0.001	0.0015	0.112	<0.001	0.111	<0.001	99.2	15	0.0019	<0.001	0.45	<0.001	0.0055	<0.0002	0.0042	7.3	1.72	<0.001	159	<0.001	512
MW-2	11/06/2017	<0.001	0.0015	0.114	<0.001	0.0848	<0.001	102	14	<0.001	<0.001	0.44	<0.001	--	<0.0002	--	7.1	0.62	<0.001	159	<0.001	506
MW-2	05/31/2018	<0.001	0.0058	0.163	<0.001	0.0787	<0.001	125	14	0.0139	0.0052	0.5	0.0067	0.016	<0.0002	0.0051	7.0	0.86	0.0026	142	<0.002	538

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-2	08/28/2018	--	0.0013	0.103	--	0.0907	--	104	14	0.0023	<0.001	0.44	<0.001	0.0043	--	0.0033	6.8	0.42	0.0023	145	--	558
MW-2	11/08/2018	<0.001	0.0024	0.156	<0.001	0.152	<0.001	--	14	0.0017	<0.001	0.45	<0.001	--	<0.0002	--	6.9	0.22	0.0056	139	<0.002	556
MW-2	02/14/2019	<0.001	0.0015	0.116	<0.001	0.0701	<0.001	104	18	<0.0015	<0.001	0.55	<0.001	0.007	<0.0002	0.0058	7.4	0.24	<0.001	136	<0.002	442
MW-2	05/14/2019	<0.001	0.001	0.107	<0.001	0.058	<0.001	--	18	<0.0015	<0.001	0.55	<0.001	--	<0.0002	--	7.2	0.61	<0.001	132	<0.002	516
MW-2	08/20/2019	--	0.001	0.107	--	0.0667	--	94.2	16	<0.0015	<0.001	0.48	<0.001	0.0051	--	0.0046	7.1	0.94	<0.001	119	--	488
MW-2	11/13/2019	<0.001	0.0022	0.12	<0.001	0.0571	<0.001	--	17	0.0029	0.0011	0.53	0.0012	--	<0.0002	--	7.3	0.42	<0.001	132	<0.002	464
MW-2	02/11/2020	<0.001	0.0021	0.117	<0.001	0.0565	<0.001	94.9	18	<0.0015	<0.001	0.52	<0.001	0.007	<0.0002	0.005	7.3	0.99	<0.001	138	<0.002	508
MW-2	05/12/2020	<0.001	<0.001	0.107	<0.001	0.0488	<0.001	--	18	<0.0015	<0.001	0.52	<0.001	--	<0.0002	--	7.4	0	<0.001	153	<0.002	490
MW-2	08/26/2020	<0.001	<0.001	0.106	<0.001	0.0576	--	96.6	17	<0.0015	<0.001	0.55	<0.001	0.0051	--	0.0047	7.3	0.92	<0.001	139	--	442
MW-2	12/02/2020	<0.001	<0.001	0.103	<0.001	0.0714	<0.001	--	15	<0.0015	<0.001	0.48	<0.001	--	<0.0002	--	7.3	1.32	<0.001	139	<0.002	474
MW-2	02/24/2021	<0.001	0.0016	0.113	<0.001	0.0571	<0.001	96.7	15	<0.0015	<0.001	0.46	<0.001	<0.005	<0.0002	0.0038	7.2	0.0315	<0.001	138	<0.002	490
MW-2	03/15/2021	<0.001	0.0014	0.115	<0.001	0.069	<0.001	97.3	17	<0.0015	<0.001	0.44	<0.001	0.0052	<0.0002	0.0037	7.3	0.178	<0.001	146	<0.002	494
MW-2	03/30/2021	<0.001	0.0013	0.113	<0.001	0.0609	<0.001	96.2	16	<0.0015	<0.001	0.47	<0.001	0.005	<0.0002	0.0036	7.1	0.662	<0.001	129	<0.002	458
MW-2	04/05/2021	<0.001	0.0048	0.15	<0.001	0.0711	<0.001	111	18	0.0095	0.0039	0.44	0.0051	0.0116	<0.0002	0.0041	6.7	0.103	0.0018	137	<0.002	482
MW-2	05/19/2021	<0.001	<0.001	0.0937	<0.001	0.0698	<0.001	95.4	16	<0.0015	<0.001	0.43	<0.001	0.0035	<0.0002	0.0035	7.0	0.114	<0.001	145	<0.002	464
MW-2	06/10/2021	<0.001	0.001	0.11	<0.001	0.0552	<0.001	92	18	<0.0015	<0.001	0.51	<0.001	0.0044	<0.0002	0.004	7.0	0.665	<0.001	150	<0.002	456
MW-2	07/01/2021	<0.001	0.0014	0.116	<0.001	0.0582	<0.001	96.6	17	<0.0015	<0.001	0.48	<0.001	0.0042	<0.0002	0.0033	6.5	0.206	<0.001	151	<0.002	470
MW-2	07/22/2021	<0.001	0.0014	0.126	<0.001	0.0852	<0.001	96.6	16	<0.0015	<0.001	0.46	<0.001	0.0048	<0.0002	0.0036	6.6	0.554	<0.001	146	<0.002	480
MW-2	08/10/2021	<0.001	0.0017	0.126	<0.001	0.0791	<0.001	106	16	<0.0015	<0.001	0.45	<0.001	0.0061	<0.0002	0.0062	6.9	1.03	<0.001	144	<0.002	490
MW-2	09/01/2021	<0.001	0.0014	0.101	<0.001	0.128	<0.001	93.4	15	<0.0015	<0.001	0.42	<0.001	0.004	<0.0002	0.0034	7.0	0.725	<0.001	133	<0.002	476
MW-3	06/03/2015	--	--	--	--	--	--	--	--	--	--	0.22	--	--	<0	--	--	--	--	--	--	--
MW-3	06/16/2015	<0.001	<0.025	0.065	<0.0005	1.5	<0.002	--	30	<0.005	<0.005	0.23	<0.0075	--	<0.0002	--	7.1	--	<0.04	209	<0.001	680

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-3	12/15/2015	<0.001	<0.001	0.0575	<0.001	1.68	<0.001	--	37	<0.001	<0.001	0.25	<0.001	--	<0.0002	--	7.0	--	<0.001	189	<0.001	686
MW-3	05/16/2016	<0.001	<0.001	0.0573	<0.001	1.44	<0.001	--	34	<0.001	<0.001	0.23	<0.001	--	<0.0002	--	7.1	--	<0.001	188	<0.001	672
MW-3	11/15/2016	<0.001	<0.001	0.0533	<0.001	1.66	<0.001	--	34	<0.001	<0.001	0.22	<0.001	--	<0.0002	--	7.3	--	<0.001	199	<0.001	708
MW-3	05/18/2017	<0.001	<0.001	0.0494	<0.001	1.71	<0.001	--	36	<0.001	<0.001	0.24	<0.001	--	<0.0002	--	6.7	--	<0.001	182	<0.001	684
MW-3	11/06/2017	<0.001	<0.001	0.0261	<0.001	1.02	<0.001	--	32	<0.001	<0.001	0.23	<0.001	--	<0.0002	--	7.1	0.04	<0.001	150	<0.001	618
MW-3	05/31/2018	<0.001	<0.001	0.0448	<0.001	1.67	<0.001	--	34	<0.0015	<0.001	0.26	<0.001	--	<0.0002	--	6.8	0.52	<0.001	152	<0.002	634
MW-3	11/08/2018	<0.001	<0.001	0.0461	<0.001	1.83	<0.001	--	32	<0.0015	<0.001	0.26	<0.001	--	<0.0002	--	7.0	0.52	<0.001	154	<0.002	656
MW-3	05/14/2019	<0.001	<0.001	0.0416	<0.001	1.57	<0.001	--	31	<0.0015	<0.001	0.27	<0.001	--	<0.0002	--	6.7	0.36	<0.001	122	<0.002	586
MW-3	11/13/2019	<0.001	<0.001	0.0466	<0.001	1.79	<0.001	--	26	<0.0015	<0.001	0.25	<0.001	--	<0.0002	--	6.8	0.73	<0.001	158	<0.002	584
MW-3	05/12/2020	<0.001	<0.001	0.0503	<0.001	1.73	<0.001	--	29	<0.0015	<0.001	0.25	<0.001	--	<0.0002	--	6.9	0.43	<0.001	156	<0.002	628
MW-3	12/02/2020	<0.001	<0.001	0.0453	<0.001	1.82	<0.001	--	29	<0.0015	<0.001	0.24	<0.001	--	<0.0002	--	6.8	0.4	<0.001	143	<0.002	582
MW-3	02/25/2021	<0.001	<0.001	0.0503	<0.001	1.58	<0.001	102	33	<0.0015	0.0014	0.25	<0.001	<0.005	<0.0002	<0.0015	6.8	0.195	<0.001	141	<0.002	610
MW-3	03/16/2021	<0.001	<0.001	0.0499	<0.001	1.58	<0.001	103	32	<0.0015	<0.001	0.24	<0.001	<0.003	<0.0002	<0.0015	6.7	0.387	<0.001	147	<0.002	616
MW-3	04/05/2021	<0.001	<0.001	0.0837	<0.001	2.4	<0.001	104	34	<0.0015	0.0012	0.25	<0.001	0.004	<0.0002	<0.0015	6.4	0.381	<0.001	142	<0.002	606
MW-3	05/18/2021	<0.001	<0.001	0.0479	<0.001	1.55	<0.001	104	31	<0.0015	<0.001	0.24	<0.001	<0.003	<0.0002	<0.0015	6.7	0.125	<0.001	145	<0.002	604
MW-3	06/09/2021	<0.001	<0.001	0.0513	<0.001	1.56	<0.001	98.7	32	<0.0015	<0.001	0.27	<0.001	<0.003	<0.0002	<0.0015	6.5	0.271	<0.001	141	<0.002	558
MW-3	07/01/2021	<0.001	<0.001	0.0491	<0.001	1.57	<0.001	101	31	<0.0015	<0.001	0.26	<0.001	<0.003	<0.0002	<0.0015	6.6	0.988	<0.001	138	0.0022	590
MW-3	07/22/2021	<0.001	<0.001	0.0626	<0.001	2.28	<0.001	102	32	<0.0015	<0.001	0.26	<0.001	<0.003	<0.0002	<0.0015	6.7	0.115	<0.001	139	<0.002	588
MW-3	08/10/2021	<0.001	<0.001	0.0471	<0.001	1.56	<0.001	98.3	32	<0.0015	<0.001	0.24	<0.001	<0.003	<0.0002	<0.0015	6.7	0	<0.001	139	<0.002	582
MW-4	06/03/2015	--	--	--	--	--	--	--	--	--	--	0.35	--	--	<0	--	--	--	--	--	--	--
MW-4	06/16/2015	<0.001	<0.025	0.172	<0.0005	0.339	<0.002	--	31	<0.005	<0.005	0.35	<0.0075	--	<0.0002	--	7.3	--	<0.04	35	<0.001	530
MW-4	12/15/2015	<0.001	<0.001	0.132	<0.001	0.627	<0.001	--	30	<0.001	<0.001	0.33	<0.001	--	<0.0002	--	6.9	--	<0.001	72	<0.001	514

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-4	05/16/2016	<0.001	<0.001	0.121	<0.001	0.602	<0.001	--	28	<0.001	<0.001	0.31	<0.001	--	<0.0002	--	7.1	--	<0.001	74	<0.001	496
MW-4	11/15/2016	<0.001	<0.001	0.171	<0.001	0.43	<0.001	--	30	<0.001	<0.001	0.35	<0.001	--	<0.0002	--	7.3	--	<0.001	35	<0.001	552
MW-4	05/18/2017	<0.001	<0.001	0.121	<0.001	0.661	<0.001	--	29	<0.001	<0.001	0.31	<0.001	--	<0.0002	--	6.8	--	<0.001	72	<0.001	544
MW-4	11/06/2017	<0.001	<0.001	0.0697	<0.001	0.4	<0.001	--	28	0.0015	<0.001	0.31	<0.001	--	<0.0002	--	7.1	0.59	<0.001	62	<0.001	506
MW-4	05/31/2018	<0.001	<0.001	0.145	<0.001	0.563	<0.001	--	29	<0.0015	<0.001	0.33	<0.001	--	<0.0002	--	6.8	0.68	<0.001	58	<0.002	492
MW-4	11/08/2018	<0.001	<0.001	0.14	<0.001	0.679	<0.001	--	27	<0.0015	<0.001	0.32	<0.001	--	<0.0002	--	7.0	0	<0.001	52	<0.002	546
MW-4	05/14/2019	<0.001	<0.001	0.112	<0.001	0.618	<0.001	--	26	<0.0015	<0.001	0.33	<0.001	--	<0.0002	--	6.7	0.1	<0.001	51	<0.002	496
MW-4	11/13/2019	<0.001	<0.001	0.152	<0.001	0.438	<0.001	--	28	<0.0015	<0.001	0.38	<0.001	--	<0.0002	--	6.9	0.35	<0.001	19	<0.002	458
MW-4	05/12/2020	<0.001	<0.001	0.115	<0.001	0.668	<0.001	--	26	<0.0015	<0.001	0.33	<0.001	--	<0.0002	--	7.0	0.07	<0.001	43	<0.002	484
MW-4	12/02/2020	<0.001	<0.001	0.146	<0.001	0.565	<0.001	--	28	<0.0015	<0.001	0.38	<0.001	--	<0.0002	--	7.2	0.13	<0.001	18	<0.002	432
MW-4	02/25/2021	<0.001	<0.001	0.129	<0.001	0.55	<0.001	85.1	30	<0.0015	<0.001	0.34	<0.001	<0.005	<0.0002	<0.0015	6.9	0.487	<0.001	35	<0.002	474
MW-4	03/16/2021	<0.001	<0.001	0.122	<0.001	0.567	<0.001	91.2	29	<0.0015	<0.001	0.32	<0.001	0.0031	<0.0002	<0.0015	6.9	0.0762	<0.001	34	<0.002	470
MW-4	04/06/2021	<0.001	<0.001	0.133	<0.001	0.715	<0.001	94.6	27	<0.0015	<0.001	0.31	<0.001	0.0034	<0.0002	<0.0015	6.4	0.191	<0.001	45	<0.002	474
MW-4	05/19/2021	<0.001	<0.001	0.0965	<0.001	0.843	<0.001	93.6	26	<0.0015	<0.001	0.29	<0.001	<0.003	<0.0002	<0.0015	6.6	0.685	<0.001	57	<0.002	478
MW-4	06/09/2021	<0.001	<0.001	0.12	<0.001	0.49	<0.001	--	30	<0.0015	<0.001	0.38	<0.001	--	<0.0002	--	6.6	0.324	<0.001	27	<0.002	478
MW-5	06/04/2015	--	--	--	--	--	--	--	--	--	--	0.16	--	--	<0	--	--	--	--	--	--	--
MW-5	06/16/2015	<0.001	<0.025	0.15	<0.0005	0.544	<0.002	--	32	<0.005	<0.005	0.15	<0.0075	--	<0.0002	--	7.0	--	<0.04	<10	<0.001	695
MW-5	12/15/2015	<0.001	<0.001	0.141	<0.001	0.573	<0.001	137	41	<0.001	0.0013	0.17	<0.001	0.0029	<0.0002	<0.001	6.6	0.78	<0.001	<10	<0.001	620
MW-5	02/29/2016	<0.001	<0.001	0.143	<0.001	0.555	<0.001	148	39	<0.001	0.001	0.15	<0.001	0.003	<0.0002	<0.001	6.6	0.35	<0.001	<10	<0.001	564
MW-5	05/16/2016	<0.001	<0.001	0.141	<0.001	0.588	<0.001	133	38	<0.001	<0.001	0.15	<0.001	0.0029	<0.0002	<0.001	7.0	0.89	<0.001	11	<0.001	646
MW-5	08/22/2016	<0.001	<0.001	0.137	<0.001	0.54	<0.001	135	41	<0.001	<0.001	0.16	<0.001	0.0027	<0.0002	<0.001	7.2	1.11	<0.001	11	<0.001	660
MW-5	11/15/2016	<0.001	<0.001	0.139	<0.001	0.507	<0.001	133	41	<0.001	<0.001	0.15	<0.001	0.0027	<0.0002	<0.001	7.2	1.08	<0.001	<10	<0.001	698

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-5	02/13/2017	<0.001	<0.001	0.14	<0.001	0.473	<0.001	130	39	<0.001	<0.001	0.15	<0.001	0.0029	<0.0002	<0.001	6.7	0.34	<0.001	<10	<0.001	624
MW-5	05/18/2017	<0.001	<0.001	0.145	<0.001	0.571	<0.001	136	43	<0.001	<0.001	0.18	<0.001	0.0031	<0.0002	<0.001	6.7	0.95	<0.001	10	<0.001	680
MW-5	07/18/2017	<0.001	<0.001	0.143	<0.001	0.574	<0.001	142	39	<0.001	<0.001	0.16	0.0013	0.0029	<0.0002	<0.001	6.8	2.41	<0.001	<10	<0.001	660
MW-5	11/06/2017	<0.001	<0.001	0.139	<0.001	0.515	<0.001	141	40	0.0023	<0.001	0.15	<0.001	--	<0.0002	--	7.1	0.63	<0.001	<10	<0.001	652
MW-5	05/31/2018	<0.001	<0.001	0.179	<0.001	0.657	<0.001	136	43	<0.0015	<0.001	0.18	<0.001	0.0033	<0.0002	<0.0015	6.7	0.61	<0.001	<10	<0.002	666
MW-5	08/28/2018	--	<0.001	0.132	--	0.567	--	135	41	<0.0015	<0.001	0.17	<0.001	0.0029	--	<0.0015	6.8	0.55	<0.001	12	--	696
MW-5	11/08/2018	<0.001	<0.001	0.146	<0.001	0.546	<0.001	--	42	<0.0015	<0.001	0.16	<0.001	--	<0.0002	--	6.9	0.37	<0.001	10	<0.002	712
MW-5	02/14/2019	<0.001	<0.001	0.156	<0.001	0.53	<0.001	147	42	<0.0015	<0.001	0.16	<0.001	0.0029	<0.0002	<0.0015	7.0	0.04	<0.001	12	<0.002	650
MW-5	05/14/2019	<0.001	<0.001	0.16	<0.001	0.536	<0.001	--	44	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.6	0.3	<0.001	12	<0.002	674
MW-5	08/21/2019	--	<0.001	0.15	--	0.547	--	150	41	<0.0015	<0.001	0.18	<0.001	<0.003	--	<0.0015	6.6	1.15	<0.001	<10	--	646
MW-5	11/14/2019	<0.001	<0.001	0.144	<0.001	0.521	<0.001	--	42	<0.0015	<0.001	0.16	<0.001	--	<0.0002	--	6.7	0.36	<0.001	12	<0.002	646
MW-5	02/11/2020	<0.001	<0.001	0.131	<0.001	0.542	<0.001	146	44	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.7	0.85	<0.001	<10	<0.002	684
MW-5	05/12/2020	<0.001	<0.001	0.149	<0.001	0.581	<0.001	--	45	<0.0015	<0.001	0.17	<0.001	--	<0.0002	--	6.8	0.16	<0.001	13	<0.002	680
MW-5	08/26/2020	<0.001	<0.001	0.151	<0.001	0.507	--	146	45	<0.0015	<0.001	<0.2	<0.001	<0.003	--	<0.0015	6.7	0.94	<0.001	14	--	622
MW-5	12/02/2020	<0.001	0.0016	0.163	<0.001	0.543	<0.001	--	43	<0.0015	0.001	0.17	<0.001	--	<0.0002	--	6.7	0.22	<0.001	10	<0.002	622
MW-5	03/30/2021	<0.001	<0.001	0.154	<0.001	0.555	<0.001	150	43	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.5	0	<0.001	13	<0.002	666
MW-5	06/09/2021	<0.001	<0.001	0.153	<0.001	0.543	<0.001	--	47	<0.0015	<0.001	0.19	<0.001	--	<0.0002	--	6.4	0.118	<0.001	13	0.0021	662
MW-5	09/01/2021	<0.001	0.0014	0.144	<0.001	0.625	<0.001	143	47	<0.0015	<0.001	0.16	<0.001	0.0031	<0.0002	<0.0015	6.6	0.0861	<0.001	<10	<0.002	652
MW-6	06/04/2015	--	--	--	--	--	--	--	--	--	--	0.19	--	--	<0	--	--	--	--	--	--	--
MW-6	06/16/2015	<0.001	<0.025	0.0306	<0.0005	1	<0.002	--	5	<0.005	<0.005	0.19	<0.0075	--	<0.0002	--	7.0	--	<0.04	161	<0.001	635
MW-6	12/15/2015	<0.001	<0.001	0.0316	<0.001	1.58	<0.001	113	7	<0.001	<0.001	0.18	<0.001	0.0012	<0.0002	<0.001	6.5	0.48	<0.001	287	<0.001	676
MW-6	02/29/2016	<0.001	<0.001	0.0274	<0.001	0.837	<0.001	101	5	<0.001	<0.001	0.17	<0.001	<0.001	<0.0002	<0.001	6.7	0.01	<0.001	164	<0.001	358

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-6	05/16/2016	<0.001	<0.001	0.0298	<0.001	0.874	<0.001	98.6	5	<0.001	<0.001	0.19	<0.001	<0.001	<0.0002	<0.001	7.0	0.91	<0.001	167	<0.001	484
MW-6	08/22/2016	<0.001	<0.001	0.0368	<0.001	1.16	<0.001	116	<5	<0.001	<0.001	0.2	<0.001	0.0012	<0.0002	<0.001	6.5	1.08	<0.001	187	<0.001	588
MW-6	11/15/2016	<0.001	<0.001	0.0343	<0.001	1.54	<0.001	113	7	<0.001	<0.001	0.17	<0.001	0.0012	<0.0002	<0.001	6.8	0.29	<0.001	275	<0.001	726
MW-6	02/13/2017	<0.001	<0.001	0.0286	<0.001	1.04	<0.001	100	<5	<0.001	<0.001	0.16	<0.001	<0.001	<0.0002	<0.001	6.6	0.35	<0.001	246	<0.001	624
MW-6	05/18/2017	<0.001	<0.001	0.0292	<0.001	1.02	<0.001	96	<5	<0.001	<0.001	0.19	<0.001	<0.001	<0.0002	<0.001	6.6	0.27	<0.001	153	<0.001	530
MW-6	07/18/2017	<0.001	<0.001	0.0597	<0.001	1.48	<0.001	105	<5	<0.001	<0.001	0.17	<0.001	<0.001	<0.0002	<0.001	6.5	3.14	<0.001	238	<0.001	622
MW-6	11/06/2017	<0.001	<0.001	0.0412	<0.001	1.91	<0.001	139	11	<0.001	<0.001	0.16	<0.001	--	<0.0002	--	6.7	0.73	<0.001	335	<0.001	780
MW-6	05/31/2018	<0.001	<0.001	0.0322	<0.001	1.07	<0.001	93.6	<5	<0.0015	<0.001	0.19	<0.001	<0.0015	<0.0002	<0.0015	6.5	1.97	<0.001	195	<0.002	554
MW-6	08/28/2018	--	<0.001	0.0436	--	1.16	--	122	<5	0.0016	<0.001	0.22	<0.001	<0.0015	--	<0.0015	6.6	0.53	0.001	133	--	544
MW-6	11/08/2018	<0.001	<0.001	0.0372	<0.001	1.45	<0.001	--	<5	0.0019	<0.001	0.19	<0.001	--	<0.0002	--	6.8	0.22	0.0013	159	<0.002	620
MW-6	02/15/2019	<0.001	<0.001	0.0366	<0.001	0.649	<0.001	101	<5	<0.0015	<0.001	0.19	<0.001	<0.0015	<0.0002	<0.0015	6.7	0.37	<0.001	106	<0.002	464
MW-6	05/14/2019	<0.001	<0.001	0.035	<0.001	0.792	<0.001	--	<4	<0.0015	<0.001	0.22	<0.001	--	<0.0002	--	6.6	0.03	<0.001	107	<0.002	532
MW-6	08/21/2019	--	<0.001	0.0395	--	1.32	--	113	<5	<0.0015	<0.001	0.19	<0.001	<0.003	--	<0.0015	6.4	0.75	<0.001	153	--	550
MW-6	11/13/2019	<0.001	<0.001	0.0389	<0.001	0.804	<0.001	--	<4	<0.0015	<0.001	0.2	<0.001	--	<0.0002	--	6.6	0.13	<0.001	114	<0.002	490
MW-6	02/11/2020	<0.001	<0.001	0.0267	<0.001	0.632	<0.001	90.9	<5	<0.0015	<0.001	0.2	<0.001	<0.003	<0.0002	<0.0015	6.7	1.25	<0.001	97	<0.002	478
MW-6	05/12/2020	<0.001	<0.001	0.0331	<0.001	0.836	<0.001	--	<4	<0.0015	<0.001	0.2	<0.001	--	<0.0002	--	6.7	0.63	<0.001	131	<0.002	500
MW-6	08/26/2020	<0.001	<0.001	0.0425	<0.001	1.09	--	103	<5	<0.0015	<0.001	0.24	<0.001	<0.003	--	<0.0015	6.6	1.02	<0.001	157	--	476
MW-6	12/02/2020	<0.001	<0.001	0.0422	<0.001	1.46	<0.001	--	7	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.6	1.15	<0.001	237	<0.002	608
MW-6	03/30/2021	<0.001	<0.001	0.0293	<0.001	0.64	<0.001	75.6	<5	<0.0015	<0.001	0.21	<0.001	<0.003	<0.0002	<0.0015	6.6	0.0547	<0.001	98	<0.002	368
MW-6	06/10/2021	<0.001	<0.001	0.0357	<0.001	0.906	<0.001	--	3	<0.0015	<0.001	0.22	<0.001	--	<0.0002	--	6.4	0.0391	<0.001	117	<0.002	442
MW-6	09/01/2021	<0.001	<0.001	0.0405	<0.001	1.28	<0.001	93.5	4	<0.0015	<0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.4	1.17	<0.001	173	<0.002	498
MW-7	06/04/2015	--	--	--	--	--	--	--	--	--	--	0.23	--	--	<0	--	--	--	--	--	--	--

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-7	06/17/2015	<0.001	<0.025	0.068	<0.0005	0.29	<0.002	--	<5	<0.005	<0.005	0.24	<0.0075	--	<0.0002	--	7.5	--	<0.04	149	<0.001	575
MW-7	12/15/2015	<0.001	<0.001	0.0848	<0.001	0.178	<0.001	145	<5	<0.001	<0.001	0.25	<0.001	0.0034	<0.0002	0.0033	7.1	1.29	<0.001	439	<0.001	766
MW-7	02/29/2016	<0.001	<0.001	0.0515	<0.001	0.103	<0.001	107	<5	<0.001	<0.001	0.22	<0.001	0.0023	<0.0002	0.0033	7.3	0.32	<0.001	249	<0.001	430
MW-7	05/16/2016	<0.001	<0.001	0.0572	<0.001	0.251	<0.001	105	<5	<0.001	<0.001	0.24	<0.001	0.003	<0.0002	0.0027	7.3	0.99	<0.001	170	<0.001	498
MW-7	08/22/2016	<0.001	0.0011	0.0656	<0.001	0.287	<0.001	115	<5	<0.001	<0.001	0.27	<0.001	0.0048	<0.0002	0.0037	6.9	1.74	<0.001	177	<0.001	610
MW-7	11/15/2016	<0.001	0.0015	0.0629	<0.001	0.648	<0.001	128	<5	0.0024	<0.001	0.32	<0.001	0.004	<0.0002	0.0032	7.3	2.16	<0.001	247	<0.001	740
MW-7	02/13/2017	<0.001	<0.001	0.0656	<0.001	0.139	<0.001	149	<5	<0.001	<0.001	0.23	<0.001	0.0031	<0.0002	0.0021	7.1	0.81	<0.001	395	<0.001	816
MW-7	05/19/2017	<0.001	<0.001	0.0505	<0.001	0.235	<0.001	105	<5	<0.001	<0.001	0.26	<0.001	0.0033	<0.0002	0.0028	7.0	0.64	<0.001	158	<0.001	504
MW-7	07/18/2017	<0.001	<0.001	0.0516	<0.001	0.36	<0.001	120	<5	<0.001	<0.001	0.31	<0.001	0.0029	<0.0002	0.0033	7.1	1.76	<0.001	201	<0.001	646
MW-7	11/07/2017	<0.001	<0.001	0.0505	<0.001	0.462	<0.001	127	<5	<0.001	<0.001	0.32	<0.001	--	<0.0002	--	7.0	1.58	<0.001	247	<0.001	674
MW-7	06/01/2018	<0.001	<0.001	0.0363	<0.001	0.24	<0.001	112	<5	<0.0015	<0.001	0.32	<0.001	0.0026	<0.0002	0.0029	7.0	0.95	<0.001	172	<0.002	602
MW-7	08/28/2018	--	0.0013	0.0349	--	0.276	--	104	<5	0.0029	<0.001	0.33	<0.001	0.0046	--	0.0046	7.0	0.41	<0.001	143	--	578
MW-7	11/08/2018	<0.001	0.0012	0.0451	<0.001	0.195	<0.001	--	<5	<0.0015	<0.001	0.32	<0.001	--	<0.0002	--	7.3	0.52	<0.001	230	<0.002	702
MW-7	02/15/2019	<0.001	<0.001	0.0681	<0.001	0.114	<0.001	170	<5	<0.0015	<0.001	0.22	<0.001	0.0044	<0.0002	0.0023	7.2	0.38	<0.001	193	<0.002	726
MW-7	05/14/2019	<0.001	<0.001	0.065	<0.001	0.263	<0.001	--	<4	<0.0015	<0.001	0.22	<0.001	--	<0.0002	--	7.0	0.4	<0.001	160	<0.002	662
MW-7	08/21/2019	--	0.0017	0.0634	--	0.395	--	133	<5	<0.0015	0.0011	0.25	<0.001	0.0048	--	0.0033	6.7	0.41	<0.001	150	--	654
MW-7	11/13/2019	<0.001	0.0024	0.0569	<0.001	0.194	<0.001	--	<4	<0.0015	0.0013	0.29	<0.001	--	<0.0002	--	7.1	0.77	<0.001	220	<0.002	564
MW-7	02/11/2020	<0.001	<0.001	0.0473	<0.001	0.12	<0.001	110	<5	<0.0015	<0.001	0.21	<0.001	<0.003	<0.0002	0.0022	7.2	0.25	<0.001	168	<0.002	556
MW-7	05/12/2020	<0.001	<0.001	0.0469	<0.001	0.212	<0.001	--	<4	<0.0015	<0.001	0.22	<0.001	--	<0.0002	--	7.2	0.21	<0.001	149	<0.002	512
MW-7	08/26/2020	<0.001	<0.001	0.0437	<0.001	0.33	--	104	<5	<0.0015	<0.001	0.36	<0.001	<0.003	--	0.0029	7.1	1.66	<0.001	160	--	494
MW-7	12/02/2020	<0.001	<0.001	0.0535	<0.001	0.46	<0.001	--	4	<0.0015	<0.001	0.29	<0.001	--	<0.0002	--	7.0	0.25	<0.001	237	<0.002	610
MW-7	03/30/2021	<0.001	<0.001	0.0522	<0.001	0.126	<0.001	104	<5	<0.0015	<0.001	0.23	<0.001	<0.003	<0.0002	0.0026	7.1	0.109	<0.001	132	<0.002	476

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-7	06/10/2021	<0.001	<0.001	0.0399	<0.001	0.281	<0.001	--	2	<0.0015	<0.001	0.27	<0.001	--	<0.0002	--	6.8	0.658	<0.001	135	<0.002	542
MW-7	09/01/2021	<0.001	0.0014	0.0909	<0.001	0.604	<0.001	198	3	<0.0015	0.0017	0.26	<0.001	0.0043	<0.0002	0.0031	6.6	1.83	<0.001	317	<0.002	970
MW-7S	02/24/2021	<0.001	0.0106	0.0461	<0.001	3.83	<0.001	183	12	<0.0015	0.0014	0.34	<0.001	<0.005	<0.0002	<0.0015	6.8	0.134	<0.001	432	<0.002	1130
MW-7S	03/16/2021	<0.001	0.0072	0.047	<0.001	3.8	<0.001	175	11	0.0032	0.0012	0.33	<0.001	<0.003	<0.0002	<0.0015	6.8	0.227	<0.001	429	<0.002	1080
MW-7S	04/06/2021	<0.001	0.003	0.0421	<0.001	3.57	<0.001	172	10	<0.0015	0.0012	0.34	<0.001	<0.003	<0.0002	<0.0015	6.2	0.149	<0.001	400	<0.002	1030
MW-7S	05/21/2021	<0.005	0.0059	0.0543	<0.005	3.56	<0.005	170	10	<0.0075	<0.005	0.34	<0.005	<0.015	<0.0002	<0.0075	6.5	0.161	<0.005	343	<0.01	1010
MW-7S	06/10/2021	<0.001	0.0141	0.0665	<0.001	4.23	<0.001	189	12	0.0045	0.002	0.35	0.003	<0.003	<0.0002	0.0017	6.8	1.12	<0.001	468	<0.002	--
MW-7S	07/02/2021	<0.001	0.0086	0.0402	<0.001	4.72	<0.001	204	11	<0.0015	0.0013	0.31	<0.001	<0.003	<0.0002	<0.0015	6.6	0.594	<0.001	563	<0.002	1160
MW-7S	07/23/2021	0.0016	0.175	0.203	<0.001	5.51	<0.001	210	11	0.0221	0.0064	0.31	0.0113	0.0076	<0.0002	0.0043	6.7	0.0936	<0.001	573	<0.002	1240
MW-7S	08/11/2021	<0.001	0.0261	0.071	<0.001	5.42	<0.001	224	11	0.0107	0.0027	0.29	0.0019	<0.003	<0.0002	0.0032	6.8	1.75	<0.001	577	<0.002	1270
MW-8	06/04/2015	--	--	--	--	--	--	--	--	--	--	0.2	--	--	<0	--	--	--	--	--	--	--
MW-8	06/17/2015	<0.001	<0.025	0.0366	<0.0005	0.935	<0.002	--	24	<0.005	<0.005	0.2	<0.0075	--	<0.0002	--	7.0	--	<0.04	319	<0.001	1000
MW-8	12/15/2015	<0.001	<0.001	0.0364	<0.001	0.965	<0.001	167	27	<0.001	0.002	0.22	<0.001	0.0019	<0.0002	<0.001	6.6	2.08	<0.001	316	<0.001	866
MW-8	02/29/2016	<0.001	<0.001	0.0329	<0.001	1.02	<0.001	180	25	<0.001	0.0013	0.19	<0.001	0.0019	<0.0002	<0.001	6.6	0.15	<0.001	336	<0.001	862
MW-8	05/16/2016	<0.001	<0.001	0.0328	<0.001	0.997	<0.001	162	24	<0.001	0.0014	0.2	<0.001	0.002	<0.0002	<0.001	6.8	0.7	<0.001	325	<0.001	932
MW-8	08/22/2016	<0.001	<0.001	0.0335	<0.001	0.954	<0.001	159	25	<0.001	0.0016	0.2	<0.001	0.0016	<0.0002	<0.001	6.5	2.11	<0.001	348	<0.001	952
MW-8	11/15/2016	<0.001	<0.001	0.0359	<0.001	1.51	<0.001	162	25	<0.001	0.0019	0.2	<0.001	0.0022	<0.0002	<0.001	7.0	0	<0.001	327	<0.001	986
MW-8	02/13/2017	<0.001	<0.001	0.0296	<0.001	0.9	<0.001	157	25	<0.001	0.0013	0.21	<0.001	0.002	<0.0002	<0.001	6.6	0.31	<0.001	324	<0.001	936
MW-8	05/19/2017	<0.001	<0.001	0.0322	<0.001	1.09	<0.001	159	26	<0.001	0.0013	0.2	<0.001	0.002	<0.0002	<0.001	6.6	0.66	<0.001	311	<0.001	940
MW-8	07/18/2017	<0.001	<0.001	0.0326	<0.001	1.17	<0.001	169	25	<0.001	0.0016	0.2	<0.001	0.0021	<0.0002	<0.001	6.8	2.32	<0.001	273	<0.001	898
MW-8	11/07/2017	<0.001	<0.001	0.0323	<0.001	1.09	<0.001	164	24	<0.001	0.0015	0.2	<0.001	--	<0.0002	--	6.9	0.71	<0.001	285	<0.001	872
MW-8	06/01/2018	<0.001	<0.001	0.0338	<0.001	1.14	<0.001	163	25	<0.0015	0.0014	0.22	<0.001	0.0022	<0.0002	<0.0015	6.6	0.14	<0.001	264	<0.002	898

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-8	08/28/2018	--	<0.001	0.0303	--	1.05	--	157	25	<0.0015	0.0014	0.21	<0.001	0.002	--	<0.0015	6.6	0.39	<0.001	255	--	884
MW-8	11/08/2018	<0.001	<0.001	0.0338	<0.001	1.1	<0.001	--	24	<0.0015	0.0015	0.2	<0.001	--	<0.0002	--	6.9	0.3	<0.001	262	<0.002	922
MW-8	02/14/2019	<0.001	<0.001	0.0267	<0.001	1.02	<0.001	175	21	<0.0015	<0.001	0.23	<0.001	0.0032	<0.0002	<0.0015	6.9	0.2	<0.001	332	<0.002	946
MW-8	05/14/2019	<0.001	<0.001	0.0284	<0.001	0.971	<0.001	--	22	<0.0015	0.0013	0.25	<0.001	--	<0.0002	--	6.5	0.04	<0.001	281	<0.002	882
MW-8	08/21/2019	--	<0.001	0.033	--	1.1	--	166	19	<0.0015	0.0014	0.21	<0.001	<0.003	--	<0.0015	6.5	0.34	<0.001	258	--	864
MW-8	11/14/2019	<0.001	<0.001	0.0302	<0.001	1.04	<0.001	--	20	<0.0015	0.0014	0.23	<0.001	--	<0.0002	--	6.7	0.21	<0.001	332	<0.002	894
MW-8	02/11/2020	<0.001	<0.001	0.0222	<0.001	0.858	<0.001	168	17	<0.0015	<0.001	0.26	<0.001	<0.003	<0.0002	<0.0015	6.7	0.23	<0.001	337	<0.002	966
MW-8	05/12/2020	<0.001	<0.001	0.0246	<0.001	0.938	<0.001	--	16	<0.0015	0.001	0.26	<0.001	--	<0.0002	--	6.7	0.41	<0.001	305	<0.002	870
MW-8	08/26/2020	<0.001	<0.001	0.0306	<0.001	0.918	--	154	17	<0.0015	0.0013	0.21	<0.001	<0.003	--	<0.0015	6.7	0.6	<0.001	289	--	836
MW-8	12/02/2020	<0.001	<0.001	0.0315	<0.001	1.05	<0.001	--	18	<0.0015	0.0013	0.21	<0.001	--	<0.0002	--	6.6	0	<0.001	272	<0.002	798
MW-8	03/30/2021	<0.001	<0.001	0.0237	<0.001	0.865	<0.001	159	15	<0.0015	0.0013	0.26	<0.001	<0.003	<0.0002	<0.0015	6.6	0.217	<0.001	260	<0.002	800
MW-8	06/10/2021	<0.001	<0.001	0.0249	<0.001	0.958	<0.001	--	20	<0.0015	<0.001	0.25	<0.001	--	<0.0002	--	6.3	0	<0.001	261	<0.002	806
MW-8	09/01/2021	<0.001	<0.001	0.027	<0.001	0.986	<0.001	149	21	<0.0015	0.0013	0.21	<0.001	<0.003	<0.0002	<0.0015	6.5	0.604	<0.001	267	<0.002	794
MW-8S	02/24/2021	<0.001	0.002	0.103	<0.001	0.742	<0.001	194	16	<0.0015	0.0044	0.2	0.001	<0.005	<0.0002	0.0037	6.8	2.01	<0.001	427	<0.002	1190
MW-8S	03/17/2021	<0.001	0.0023	0.0848	<0.001	0.982	<0.001	184	12	0.0018	0.0028	0.33	0.0011	<0.003	<0.0002	0.0027	6.8	0.31	<0.001	586	<0.002	1150
MW-8S	04/06/2021	<0.001	0.0044	0.0657	<0.001	1.1	<0.001	182	11	<0.0015	0.003	0.19	<0.001	<0.003	<0.0002	0.0023	6.7	0.476	<0.001	609	<0.002	1210
MW-8S	05/21/2021	<0.001	0.0011	0.0688	<0.001	1.09	<0.001	241	11	<0.0015	0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.4	0.269	<0.001	566	<0.002	1320
MW-9	06/04/2015	--	--	--	--	--	--	--	--	--	--	0.18	--	--	<0	--	--	--	--	--	--	--
MW-9	06/17/2015	<0.001	<0.025	0.0781	<0.0005	0.101	<0.002	--	<5	<0.005	<0.005	0.18	<0.0075	--	<0.0002	--	7.4	--	<0.04	48	<0.001	385
MW-9	12/14/2015	<0.001	<0.001	0.0598	<0.001	0.0605	<0.001	--	5	<0.001	<0.001	0.21	<0.001	--	<0.0002	--	7.0	--	0.0026	87	<0.001	334
MW-9	05/16/2016	<0.001	<0.001	0.0502	<0.001	0.0898	<0.001	--	<5	<0.001	<0.001	0.18	<0.001	--	<0.0002	--	7.2	--	<0.001	50	<0.001	258
MW-9	11/15/2016	<0.001	<0.001	0.0577	<0.001	0.102	<0.001	--	5	<0.001	<0.001	0.2	<0.001	--	<0.0002	--	7.5	--	0.0053	96	<0.001	416

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-9	05/19/2017	<0.001	<0.001	0.0597	<0.001	0.078	<0.001	--	<5	<0.001	<0.001	0.19	<0.001	--	<0.0002	--	6.9	--	0.0017	62	<0.001	340
MW-9	11/07/2017	<0.001	<0.001	0.0601	<0.001	0.101	<0.001	--	10	0.0016	<0.001	0.18	<0.001	--	<0.0002	--	7.2	0.78	0.0071	139	<0.001	456
MW-9	06/01/2018	<0.001	<0.001	0.0548	<0.001	0.14	<0.001	--	11	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.9	1.58	0.0063	152	<0.002	466
MW-9	11/08/2018	<0.001	<0.001	0.0659	<0.001	0.182	<0.001	--	9	<0.0015	<0.001	0.17	<0.001	--	<0.0002	--	7.2	0.03	0.0036	137	<0.002	494
MW-9	05/14/2019	<0.001	<0.001	0.0583	<0.001	0.0766	<0.001	--	<4	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	7.0	0.05	<0.001	52	<0.002	324
MW-9	11/14/2019	<0.001	<0.001	0.0654	<0.001	0.113	<0.001	--	<4	<0.0015	<0.001	0.17	<0.001	--	<0.0002	--	7.0	0.22	0.0011	63	<0.002	292
MW-9	05/12/2020	<0.001	<0.001	0.055	<0.001	0.0676	<0.001	--	<4	<0.0015	<0.001	0.17	<0.001	--	<0.0002	--	7.1	0.04	<0.001	33	<0.002	266
MW-9	12/02/2020	<0.001	<0.001	0.0618	<0.001	0.101	<0.001	--	9	<0.0015	<0.001	0.16	<0.001	--	<0.0002	--	6.9	0.25	0.0036	121	<0.002	390
MW-9	06/10/2021	<0.001	<0.001	0.0529	<0.001	0.0918	<0.001	--	1	<0.0015	<0.001	0.2	<0.001	--	<0.0002	--	6.8	0.894	<0.001	33	<0.002	244
MW-10	06/04/2015	--	--	--	--	--	--	--	--	--	--	0.17	--	--	<0	--	--	--	--	--	--	--
MW-10	06/17/2015	<0.001	<0.025	0.0233	<0.0005	1.46	<0.002	--	14	<0.005	<0.005	0.16	<0.0075	--	<0.0002	--	6.7	--	<0.04	472	<0.001	1100
MW-10	12/14/2015	<0.001	<0.001	0.0328	<0.001	1.25	<0.001	--	74	<0.001	<0.001	0.17	<0.001	--	<0.0002	--	6.3	--	0.0207	527	<0.001	1140
MW-10	05/16/2016	<0.001	<0.001	0.0228	<0.001	1.57	<0.001	--	10	<0.001	<0.001	0.16	<0.001	--	<0.0002	--	6.8	--	0.0067	401	<0.001	902
MW-10	11/15/2016	<0.001	<0.001	0.0231	<0.001	1.27	<0.001	--	81	<0.001	<0.001	0.17	<0.001	--	<0.0002	--	7.6	--	0.0027	459	<0.001	1200
MW-10	05/19/2017	<0.001	<0.001	0.0204	<0.001	1.46	<0.001	--	<5	<0.001	<0.001	0.21	<0.001	--	<0.0002	--	6.5	--	0.012	313	<0.001	754
MW-10	11/07/2017	<0.001	<0.001	0.0343	<0.001	0.685	<0.001	--	245	<0.001	<0.001	0.13	<0.001	--	<0.0002	--	6.8	1.24	0.0048	492	<0.001	1430
MW-10	06/01/2018	<0.001	<0.001	0.0223	<0.001	1.18	<0.001	--	101	<0.0015	<0.001	0.16	<0.001	--	<0.0002	--	6.6	0.93	0.008	480	<0.002	1310
MW-10	11/08/2018	<0.001	<0.001	0.0328	<0.001	1.08	<0.001	--	181	<0.0015	<0.001	0.12	<0.001	--	<0.0002	--	6.8	0.07	0.0085	535	<0.002	1490
MW-10	05/14/2019	<0.001	<0.001	0.0201	<0.001	1.69	<0.001	--	5	<0.0015	<0.001	0.21	<0.001	--	<0.0002	--	6.4	0.11	0.0153	323	<0.002	834
MW-10	11/14/2019	<0.001	<0.001	0.0359	<0.001	1.45	<0.001	--	45	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.5	0.58	0.0089	411	<0.002	978
MW-10	05/12/2020	<0.001	<0.001	0.0238	<0.001	1.56	<0.001	--	<4	<0.0015	<0.001	0.2	<0.001	--	<0.0002	--	6.6	0.25	0.0189	310	<0.002	728
MW-10	12/02/2020	<0.001	<0.001	0.031	<0.001	1.04	<0.001	--	108	<0.0015	<0.001	0.16	<0.001	--	<0.0002	--	6.5	0.73	0.008	428	<0.002	1100

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-10	06/10/2021	<0.001	<0.001	0.0257	<0.001	1.45	<0.001	--	11	<0.0015	<0.001	0.21	<0.001	--	<0.0002	--	6.1	1.14	0.0036	311	<0.002	758
MW-11	12/15/2015	<0.001	0.0028	0.157	<0.001	1.79	<0.001	130	45	<0.001	<0.001	0.53	<0.001	0.003	<0.0002	0.0026	6.9	0.18	<0.001	135	<0.001	660
MW-11	02/29/2016	<0.001	0.0028	0.147	<0.001	1.65	<0.001	135	45	<0.001	<0.001	0.42	<0.001	0.002	<0.0002	0.0026	6.9	0.64	0.0012	130	<0.001	624
MW-11	05/16/2016	<0.001	0.0013	0.139	<0.001	1.46	<0.001	125	41	<0.001	<0.001	0.46	<0.001	0.0021	<0.0002	0.0025	7.1	0.86	<0.001	130	<0.001	670
MW-11	08/22/2016	<0.001	0.0015	0.14	<0.001	1.75	<0.001	121	43	<0.001	<0.001	0.51	<0.001	0.0022	<0.0002	0.002	7.3	0.56	<0.001	130	<0.001	664
MW-11	11/15/2016	<0.001	0.0019	0.15	<0.001	1.67	<0.001	123	42	<0.001	<0.001	0.52	<0.001	0.0026	<0.0002	0.0025	7.4	1.54	<0.001	115	<0.001	678
MW-11	02/13/2017	<0.001	0.0012	0.136	<0.001	1.38	<0.001	117	42	<0.001	<0.001	0.44	<0.001	0.0019	<0.0002	0.0023	6.9	0.39	<0.001	123	<0.001	660
MW-11	05/18/2017	<0.001	<0.001	0.134	<0.001	1.61	<0.001	121	42	<0.001	<0.001	0.48	<0.001	0.0029	<0.0002	0.0023	7.0	1.02	0.0015	121	<0.001	670
MW-11	07/18/2017	<0.001	0.0016	0.136	<0.001	1.79	<0.001	133	42	<0.001	<0.001	0.5	<0.001	0.0025	<0.0002	0.0022	7.0	1.22	0.0021	106	<0.001	664
MW-11	11/06/2017	<0.001	0.0029	0.155	<0.001	1.95	<0.001	125	39	<0.001	<0.001	0.49	<0.001	--	<0.0002	--	7.0	1.2	<0.001	114	<0.001	646
MW-11	05/31/2018	<0.001	0.002	0.126	<0.001	1.52	<0.001	127	40	<0.0015	<0.001	0.52	<0.001	0.0021	<0.0002	0.0036	6.8	1.16	0.0011	102	<0.002	662
MW-11	08/28/2018	--	0.0017	0.126	--	1.73	--	114	41	0.0018	<0.001	0.54	<0.001	0.0032	--	0.0032	6.8	0.29	<0.001	103	--	658
MW-11	11/08/2018	<0.001	0.0023	0.142	<0.001	2.28	<0.001	--	41	<0.0015	<0.001	0.53	<0.001	--	<0.0002	--	6.9	0.61	<0.001	97	<0.002	676
MW-11	02/14/2019	<0.001	0.0081	0.138	<0.001	1.69	<0.001	131	38	<0.0015	0.0011	0.52	<0.001	0.0025	<0.0002	0.0025	7.1	0.81	<0.001	103	<0.002	616
MW-11	05/14/2019	<0.001	<0.001	0.118	<0.001	1.42	<0.001	--	38	<0.0015	<0.001	0.55	<0.001	--	<0.0002	--	6.8	0.06	0.0037	104	<0.002	646
MW-11	08/21/2019	--	0.0012	0.129	--	1.85	--	125	30	<0.0015	<0.001	0.49	<0.001	<0.003	--	0.0024	6.7	0.7	0.0027	88	--	628
MW-11	11/13/2019	<0.001	0.0015	0.16	<0.001	1.83	<0.001	--	33	<0.0015	<0.001	0.54	<0.001	--	<0.0002	--	6.8	0	<0.001	103	<0.002	620
MW-11	02/11/2020	<0.001	0.0011	0.113	<0.001	1.49	<0.001	121	34	<0.0015	<0.001	0.53	<0.001	<0.003	<0.0002	0.002	6.9	1.28	0.0016	95	<0.002	658
MW-11	05/12/2020	<0.001	<0.001	0.125	<0.001	1.49	<0.001	--	36	<0.0015	<0.001	0.55	<0.001	--	<0.0002	--	7.0	0	0.0025	112	<0.002	658
MW-11	08/26/2020	<0.001	0.0013	0.129	<0.001	1.55	--	120	35	<0.0015	<0.001	0.59	<0.001	<0.003	--	0.0021	6.9	1.08	0.0016	107	--	554
MW-11	12/02/2020	<0.001	<0.001	0.139	<0.001	1.73	<0.001	--	40	<0.0015	<0.001	0.54	<0.001	--	<0.0002	--	6.8	0.95	<0.001	106	<0.002	612
MW-11	03/30/2021	<0.001	0.0021	0.129	<0.001	1.34	<0.001	118	36	<0.0015	<0.001	0.51	<0.001	<0.003	<0.0002	0.0021	6.9	0.97	<0.001	96	<0.002	578

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-11	06/09/2021	<0.001	0.0011	0.127	<0.001	1.53	<0.001	--	36	<0.0015	<0.001	0.53	<0.001	--	<0.0002	--	6.6	0.24	0.0013	108	<0.002	604
MW-11	09/01/2021	<0.001	0.0013	0.127	<0.001	1.56	<0.001	115	38	<0.0015	<0.001	0.48	<0.001	<0.003	<0.0002	0.0022	6.7	1.31	<0.001	110	<0.002	584
MW-12	12/15/2015	<0.001	<0.001	0.137	<0.001	2.1	<0.001	197	49	<0.001	<0.001	0.22	<0.001	0.0093	<0.0002	0.0013	6.9	0.13	<0.001	326	<0.001	1070
MW-12	02/29/2016	<0.001	<0.001	0.113	<0.001	2.64	<0.001	220	39	<0.001	<0.001	0.18	<0.001	0.0082	<0.0002	<0.001	6.8	0.19	<0.001	390	<0.001	1140
MW-12	05/16/2016	<0.001	<0.001	0.119	<0.001	2.48	<0.001	205	44	<0.001	<0.001	0.18	<0.001	0.0088	<0.0002	<0.001	7.0	1.12	<0.001	379	<0.001	1140
MW-12	08/22/2016	<0.001	<0.001	0.115	<0.001	2.53	<0.001	198	44	<0.001	<0.001	0.19	<0.001	0.0102	<0.0002	<0.001	7.2	1.51	<0.001	398	<0.001	1160
MW-12	11/15/2016	<0.001	<0.001	0.112	<0.001	2.43	<0.001	200	42	<0.001	<0.001	0.21	<0.001	0.0106	<0.0002	0.0011	7.2	0.56	<0.001	330	<0.001	1140
MW-12	02/13/2017	<0.001	<0.001	0.0941	<0.001	3.03	<0.001	199	41	<0.001	<0.001	0.17	<0.001	0.0088	<0.0002	<0.001	6.7	0	<0.001	390	<0.001	1180
MW-12	05/18/2017	<0.001	<0.001	0.106	<0.001	2.51	<0.001	199	33	<0.001	<0.001	0.18	<0.001	0.009	<0.0002	<0.001	6.7	0.64	<0.001	406	<0.001	1170
MW-12	07/18/2017	<0.001	<0.001	0.0953	<0.001	3.55	<0.001	235	39	<0.001	<0.001	0.18	<0.001	0.0097	<0.0002	<0.001	6.9	2.65	<0.001	383	<0.001	1170
MW-12	11/06/2017	<0.001	<0.001	0.101	<0.001	2.99	<0.001	212	38	<0.001	<0.001	0.18	<0.001	--	<0.0002	--	7.1	0.49	<0.001	388	<0.001	1110
MW-12	05/31/2018	<0.001	<0.001	0.0701	<0.001	3.87	<0.001	214	35	<0.0015	<0.001	0.16	<0.001	0.0085	<0.0002	<0.0015	6.6	1.44	<0.001	413	<0.002	1230
MW-12	08/28/2018	--	<0.001	0.0815	--	3	--	209	33	<0.0015	<0.001	0.18	<0.001	0.0097	--	<0.0015	6.7	1.05	<0.001	388	--	1160
MW-12	11/08/2018	<0.001	<0.001	0.0889	<0.001	3.3	<0.001	--	35	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	7.0	0.57	<0.001	381	<0.002	1210
MW-12	02/14/2019	<0.001	<0.001	0.0892	<0.001	3.06	<0.001	224	32	<0.0015	<0.001	0.19	<0.001	0.0095	<0.0002	<0.0015	6.9	0.4	<0.001	393	<0.002	1130
MW-12	05/14/2019	<0.001	<0.001	0.0772	<0.001	1.95	<0.001	--	20	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.5	0.28	<0.001	399	<0.002	1100
MW-12	08/20/2019	--	<0.001	0.0655	--	4.42	--	219	29	<0.0015	<0.001	0.18	<0.001	0.0087	--	<0.0015	6.4	1.02	<0.001	371	--	1160
MW-12	11/13/2019	<0.001	<0.001	0.0921	<0.001	3	<0.001	--	27	<0.0015	<0.001	0.18	<0.001	--	<0.0002	--	6.7	0.24	<0.001	345	<0.002	1100
MW-12	02/11/2020	<0.001	<0.001	0.056	<0.001	2.26	<0.001	197	22	<0.0015	<0.001	0.17	<0.001	0.0068	<0.0002	<0.0015	6.7	0.99	<0.001	370	<0.002	1070
MW-12	05/12/2020	<0.001	<0.001	0.0762	<0.001	2.05	<0.001	--	22	<0.0015	<0.001	0.21	<0.001	--	<0.0002	--	6.8	0	<0.001	368	<0.002	1040
MW-12	08/26/2020	<0.001	<0.001	0.0734	<0.001	3.76	--	211	31	<0.0015	<0.001	0.22	<0.001	0.0079	--	<0.0015	6.6	4.2	<0.001	424	--	1100
MW-12	12/02/2020	<0.001	<0.001	0.0708	<0.001	3.76	<0.001	--	32	<0.0015	<0.001	0.16	<0.001	--	<0.0002	--	6.7	0.28	<0.001	411	<0.002	1150

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-12	03/30/2021	<0.001	0.0013	0.0848	<0.001	1.97	<0.001	181	17	<0.0015	<0.001	0.18	<0.001	0.0069	<0.0002	<0.0015	6.5	0.429	0.0019	295	<0.002	908
MW-12	06/10/2021	<0.001	<0.001	0.0884	<0.001	2.48	<0.001	--	34	<0.0015	<0.001	0.26	<0.001	--	<0.0002	--	6.6	0.447	<0.001	329	<0.002	985
MW-12	09/01/2021	<0.001	<0.001	0.0802	<0.001	2.78	<0.001	197	40	<0.0015	<0.001	0.22	<0.001	0.0096	<0.0002	<0.0015	6.7	1.97	<0.001	332	<0.002	1050
MW-12S	02/25/2021	<0.001	0.0029	0.0826	<0.001	0.856	<0.001	124	25	<0.0015	0.0016	0.15	<0.001	<0.005	<0.0002	0.004	6.8	1.65	<0.001	140	<0.002	598
MW-12S	03/16/2021	<0.001	0.0032	0.0942	<0.001	1.18	<0.001	145	15	<0.0015	0.0017	0.19	<0.001	<0.003	<0.0002	0.0035	6.8	0.339	<0.001	128	<0.002	648
MW-12S	04/06/2021	<0.001	0.0082	0.0729	<0.001	1.73	<0.001	169	7	<0.0015	0.0025	0.21	<0.001	<0.003	<0.0002	0.0037	6.2	0.518	<0.001	212	<0.002	814
MW-12S	05/20/2021	<0.001	0.0033	0.114	<0.001	1.43	<0.001	154	2	<0.0015	0.0012	0.19	<0.001	<0.003	<0.0002	0.0044	6.5	0.587	<0.001	118	<0.002	654
MW-12S	06/10/2021	<0.001	0.0113	0.0567	<0.001	2.07	<0.001	169	5	<0.0015	0.0021	0.26	<0.001	<0.003	<0.0002	0.0035	6.5	0.695	<0.001	243	<0.002	--
MW-12S	07/02/2021	<0.001	0.005	0.174	<0.001	1.33	<0.001	181	5	<0.0015	0.0012	0.21	<0.001	<0.003	<0.0002	0.007	6.4	0.565	<0.001	176	<0.002	730
MW-12S	07/23/2021	<0.001	0.0178	0.106	<0.001	2.63	<0.001	175	6	<0.0015	0.0023	0.27	<0.001	<0.003	<0.0002	0.0047	6.5	0.0467	<0.001	239	<0.002	884
MW-12S	08/11/2021	<0.001	0.0083	0.107	<0.001	1.58	<0.001	159	6	<0.0015	0.0012	0.24	<0.001	<0.003	<0.0002	0.0055	6.6	0.729	<0.001	223	<0.002	818
MW-12D	02/25/2021	<0.001	0.0012	1.26	<0.001	0.709	<0.001	55.6	210	<0.0015	<0.001	0.78	<0.001	0.0086	<0.0002	<0.0015	7.2	0.773	<0.001	<10	<0.002	606
MW-12D	03/16/2021	<0.001	0.002	1.61	<0.001	0.829	<0.001	66.4	209	0.0102	0.0021	0.33	0.0023	0.0123	<0.0002	<0.0015	7.3	3.12	<0.001	<10	<0.002	634
MW-12D	04/06/2021	<0.001	0.0013	1.52	<0.001	0.827	<0.001	62.1	195	0.0053	<0.001	0.73	0.0012	0.0112	<0.0002	<0.0015	6.7	1.3	<0.001	<10	<0.002	616
MW-12D	05/20/2021	<0.001	<0.001	1.52	<0.001	0.876	<0.001	61.2	210	0.0017	<0.001	0.72	<0.001	0.0105	<0.0002	<0.0015	7.2	1.84	<0.001	<10	<0.002	632
MW-12D	06/10/2021	<0.001	<0.001	1.47	<0.001	0.833	<0.001	62.5	199	<0.0015	<0.001	0.78	<0.001	0.0103	<0.0002	<0.0015	7.1	1.47	<0.001	<10	<0.002	--
MW-12D	07/02/2021	<0.001	<0.001	1.55	<0.001	0.839	<0.001	60.6	209	<0.0015	<0.001	0.75	<0.001	0.0101	<0.0002	<0.0015	9.9	2.23	<0.001	<10	<0.002	602
MW-12D	07/23/2021	<0.001	<0.001	1.9	<0.001	1.08	<0.001	61	216	<0.0015	<0.001	0.74	<0.001	0.0118	<0.0002	<0.0015	7.1	2.48	<0.001	<10	<0.002	614
MW-12D	08/11/2021	<0.001	<0.001	1.64	<0.001	0.863	<0.001	66	210	<0.0015	<0.001	0.71	<0.001	0.0095	<0.0002	<0.0015	7.2	2.12	<0.001	<10	<0.002	612
MW-20	02/26/2021	<0.001	<0.001	0.164	<0.001	0.34	<0.001	106	25	<0.0015	<0.001	0.42	<0.001	0.0233	<0.0002	0.0124	7.2	0.312	<0.001	134	<0.002	572
MW-20	03/16/2021	<0.001	<0.001	0.142	<0.001	0.4	<0.001	115	24	<0.0015	<0.001	0.4	<0.001	0.0201	<0.0002	0.0094	7.1	0.0709	<0.001	127	<0.002	594
MW-20	04/06/2021	<0.001	0.0011	0.122	<0.001	0.442	<0.001	112	26	<0.0015	<0.001	0.41	<0.001	0.0169	<0.0002	0.0064	6.5	0.0814	<0.001	130	<0.002	608

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-20	05/18/2021	<0.001	0.0012	0.115	<0.001	0.463	<0.001	123	23	<0.0015	<0.001	0.38	<0.001	0.0142	<0.0002	0.0055	6.9	0.524	<0.001	134	<0.002	624
MW-20	06/09/2021	<0.001	0.0011	0.117	<0.001	0.44	<0.001	132	24	<0.0015	<0.001	0.41	<0.001	0.0118	<0.0002	0.0051	6.8	0.132	<0.001	141	<0.002	--
MW-20	07/01/2021	<0.001	0.0014	0.117	<0.001	0.503	<0.001	119	24	<0.0015	<0.001	0.39	<0.001	0.0122	<0.0002	0.0055	6.9	0.698	<0.001	137	<0.002	628
MW-20	07/22/2021	<0.001	0.0024	0.138	<0.001	0.564	<0.001	125	24	<0.0015	<0.001	0.39	<0.001	0.0134	<0.0002	0.006	6.9	0.459	<0.001	143	<0.002	610
MW-20	08/10/2021	<0.001	0.0023	0.119	<0.001	0.499	<0.001	127	26	<0.0015	<0.001	0.37	<0.001	0.01	<0.0002	0.0056	6.9	0.44	<0.001	147	<0.002	636
MW-20S	02/26/2021	<0.001	<0.001	0.038	<0.001	1.18	<0.001	158	24	<0.0015	<0.001	0.18	<0.001	<0.005	<0.0002	<0.0015	6.8	0.139	<0.001	243	<0.002	842
MW-20S	03/16/2021	<0.001	<0.001	0.0423	<0.001	1.2	<0.001	163	20	<0.0015	<0.001	0.17	<0.001	<0.003	<0.0002	<0.0015	6.9	0	<0.001	254	<0.002	846
MW-20S	04/06/2021	<0.001	<0.001	0.0373	<0.001	1.2	<0.001	162	21	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.3	0.00643	<0.001	260	<0.002	878
MW-20S	05/19/2021	<0.001	<0.001	0.0407	<0.001	1.38	<0.001	174	21	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.5	0.807	<0.001	297	<0.002	922
MW-20S	06/09/2021	<0.001	<0.001	0.0378	<0.001	1.37	<0.001	187	20	<0.0015	<0.001	0.2	<0.001	<0.003	<0.0002	<0.0015	6.4	0.308	<0.001	346	<0.002	--
MW-20S	07/01/2021	<0.001	<0.001	<0.001	<0.001	0.0611	<0.001	175	20	<0.0015	<0.001	0.2	<0.001	<0.003	<0.0002	<0.0015	6.5	0.582	<0.001	312	<0.002	936
MW-20S	07/22/2021	<0.001	<0.001	0.0442	<0.001	1.89	<0.001	187	20	<0.0015	<0.001	0.2	<0.001	<0.003	<0.0002	<0.0015	6.5	0.262	<0.001	392	<0.002	1020
MW-20S	08/10/2021	<0.001	<0.001	0.0492	<0.001	1.65	<0.001	201	22	<0.0015	<0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.6	0.269	<0.001	383	<0.002	1020
MW-22	02/26/2021	<0.001	<0.001	0.0822	<0.001	1.55	<0.001	91.7	26	<0.0015	<0.001	0.36	<0.001	<0.005	<0.0002	0.0051	7.0	0.291	<0.001	104	<0.002	510
MW-22	03/17/2021	0.001	<0.001	0.0762	<0.001	1.45	<0.001	91.1	28	<0.0015	<0.001	0.36	<0.001	0.0036	<0.0002	0.0038	7.0	0.483	<0.001	123	<0.002	500
MW-22	04/07/2021	<0.001	<0.001	0.0726	<0.001	1.44	<0.001	91	28	<0.0015	<0.001	0.36	<0.001	<0.003	<0.0002	0.0034	6.5	0.151	<0.001	119	<0.002	494
MW-22	05/18/2021	<0.001	<0.001	0.0719	<0.001	1.47	<0.001	92.8	25	<0.0015	<0.001	0.34	<0.001	<0.003	<0.0002	0.0029	6.9	0.0665	<0.001	118	<0.002	506
MW-23	02/26/2021	<0.001	<0.001	0.159	<0.001	2.01	<0.001	109	33	<0.0015	0.001	0.34	<0.001	<0.005	<0.0002	0.0024	6.9	0.151	<0.001	55	<0.002	586
MW-23	03/18/2021	<0.001	<0.001	0.052	<0.001	0.932	<0.001	50.5	30	<0.0015	<0.001	0.36	<0.001	<0.003	<0.0002	<0.0015	6.7	0.194	<0.001	43	<0.002	582
MW-23	04/06/2021	<0.001	0.0013	0.107	<0.001	1.95	<0.001	107	31	<0.0015	0.0012	0.37	<0.001	<0.003	<0.0002	<0.0015	6.6	0.311	<0.001	42	<0.002	580
MW-23	05/19/2021	<0.001	<0.001	0.0987	<0.001	2.17	<0.001	116	30	<0.0015	0.001	0.33	<0.001	<0.003	<0.0002	<0.0015	6.6	1.15	<0.001	43	<0.002	566
MW-23	06/09/2021	<0.001	<0.001	0.101	<0.001	2.09	<0.001	120	31	<0.0015	<0.001	0.38	<0.001	<0.003	<0.0002	<0.0015	6.4	0.744	<0.001	43	<0.002	--

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-23	07/01/2021	<0.001	0.001	0.0938	<0.001	1.98	<0.001	114	29	<0.0015	0.0011	0.36	<0.001	<0.003	<0.0002	<0.0015	6.5	0.502	<0.001	45	<0.002	608
MW-23	07/22/2021	<0.001	0.0016	0.122	<0.001	2.67	<0.001	114	30	<0.0015	0.0016	0.37	<0.001	<0.003	<0.0002	<0.0015	6.5	0.502	<0.001	46	<0.002	594
MW-23	08/10/2021	<0.001	0.0011	0.0913	<0.001	1.91	<0.001	102	30	<0.0015	0.0012	0.36	<0.001	<0.003	<0.0002	<0.0015	6.6	0.0477	<0.001	45	<0.002	592
MW-24	03/01/2021	<0.001	0.001	0.169	<0.001	0.124	<0.001	109	18	<0.0015	0.0018	0.23	<0.001	0.0066	<0.0002	0.0033	6.6	0.156	<0.001	63	<0.002	608
MW-24	03/18/2021	<0.001	<0.001	0.212	<0.001	0.214	<0.001	138	17	<0.0015	0.0012	0.22	<0.001	0.0045	<0.0002	0.0027	6.4	0.545	<0.001	59	<0.002	664
MW-24	04/07/2021	<0.001	<0.001	0.195	<0.001	0.242	<0.001	135	16	<0.0015	<0.001	0.26	<0.001	0.0051	<0.0002	0.0026	6.0	0.959	<0.001	76	<0.002	664
MW-24	05/19/2021	<0.001	<0.001	0.18	<0.001	0.203	<0.001	141	15	<0.0015	<0.001	0.26	<0.001	<0.003	<0.0002	0.0027	6.4	1.29	<0.001	75	<0.002	670
MW-25	02/25/2021	<0.001	0.0025	0.0668	<0.001	1.04	<0.001	72.9	8	0.003	0.0039	0.17	0.0012	0.0077	<0.0002	0.0022	6.7	0.113	<0.001	177	<0.002	448
MW-25	03/17/2021	<0.001	0.0049	0.0833	<0.001	1.08	<0.001	77.9	8	0.0059	0.0056	0.17	0.0028	0.0064	<0.0002	<0.0015	6.6	0.269	<0.001	177	<0.002	454
MW-25	04/07/2021	<0.001	0.0039	0.0548	<0.001	1.06	<0.001	75.2	8	0.0027	0.0045	0.17	0.0011	0.0037	<0.0002	<0.0015	6.2	0.186	<0.001	174	<0.002	436
MW-25	05/21/2021	<0.001	0.0062	0.0694	<0.001	1.11	<0.001	80.6	7	0.0052	0.0055	0.17	0.0021	0.0048	<0.0002	<0.0015	6.3	0.0383	<0.001	177	<0.002	450
MW-25	08/11/2021	<0.001	0.0068	0.0569	<0.001	1.14	<0.001	78.7	8	0.0027	0.0051	0.17	0.0016	<0.003	<0.0002	0.0018	6.5	0.157	<0.001	205	<0.002	440
MW-26	02/25/2021	<0.001	0.0014	0.103	<0.001	1.09	<0.001	125	19	0.0055	0.0026	0.21	0.0017	<0.005	<0.0002	0.0023	6.7	2.45	<0.001	179	<0.002	660
MW-26	03/17/2021	<0.001	0.0044	0.158	<0.001	1.1	<0.001	137	19	0.0138	0.0065	0.22	0.0061	0.0071	<0.0002	0.0022	6.7	0.522	<0.001	181	<0.002	708
MW-26	04/06/2021	<0.001	0.0027	0.0961	<0.001	1.07	<0.001	134	20	0.0045	0.0048	0.22	0.002	0.0031	<0.0002	<0.0015	6.4	0.251	<0.001	175	<0.002	712
MW-26	05/21/2021	<0.001	0.0022	0.0687	<0.001	1.32	<0.001	144	19	<0.0015	0.0038	0.21	<0.001	<0.003	<0.0002	<0.0015	6.4	0.914	<0.001	196	<0.002	724
MW-27	02/24/2021	<0.001	0.0649	0.926	0.0048	0.774	<0.001	162	18	0.155	0.0552	0.17	0.0777	0.088	0.00023	0.0086	7.0	0.318	<0.001	247	<0.002	344
MW-27	03/16/2021	<0.001	0.0067	0.19	<0.001	1.13	<0.001	156	15	0.0158	0.0074	0.72	0.0074	0.0092	<0.0002	0.0042	6.9	0.454	<0.001	313	<0.002	938
MW-27	04/06/2021	<0.001	0.0026	0.106	<0.001	1.18	<0.001	165	16	0.0034	0.0022	0.22	0.0018	<0.003	<0.0002	0.0023	6.4	0.355	<0.001	283	<0.002	962
MW-27	05/21/2021	<0.001	0.0054	0.0916	<0.001	1.34	<0.001	174	14	0.0024	0.0012	0.22	0.0012	<0.003	<0.0002	<0.0015	6.8	0.32	<0.001	232	<0.002	958
MW-27	06/10/2021	<0.001	0.14	2.66	0.0104	0.866	0.0017	377	17	0.351	0.139	0.25	0.254	0.178	0.00048	0.0278	6.7	9.25	<0.001	266	0.0022	--
MW-27	07/02/2021	0.001	0.0111	0.172	<0.001	1.45	<0.001	187	14	0.0096	0.0077	0.24	0.0044	0.0049	<0.0002	0.0048	6.7	1.34	<0.001	326	<0.002	1100

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-27	07/23/2021	<0.001	0.0269	0.436	0.0021	1.5	<0.001	205	15	0.0721	0.0284	0.21	0.031	0.0377	<0.0002	0.0081	6.6	5.81	<0.001	346	<0.002	1080
MW-27	08/11/2021	<0.001	0.0054	0.143	<0.001	1.27	<0.001	168	16	0.0079	0.0044	0.2	0.0035	0.0046	<0.0002	0.0033	6.7	1.53	<0.001	336	<0.002	1050
MW-28	02/24/2021	<0.001	<0.001	0.0243	<0.001	9.09	<0.001	265	14	<0.0015	0.0011	0.13	<0.001	0.0066	<0.0002	<0.0015	6.9	0	<0.001	884	<0.002	1790
MW-28	03/16/2021	<0.001	<0.001	0.0234	<0.001	9.29	<0.001	264	13	<0.0015	<0.001	0.54	<0.001	0.0066	<0.0002	<0.0015	7.0	0.303	<0.001	929	<0.002	1830
MW-28	04/07/2021	<0.001	<0.001	0.0292	<0.001	10.8	<0.001	247	13	<0.0015	0.0015	0.13	<0.001	0.0076	<0.0002	<0.0015	6.3	0	<0.001	889	<0.002	1640
MW-28	05/18/2021	<0.001	<0.001	0.0209	<0.001	9.7	<0.001	256	12	<0.0015	<0.001	0.12	<0.001	0.0069	<0.0002	<0.0015	6.5	0.0913	<0.001	795	<0.002	1700
MW-28	06/10/2021	<0.001	<0.001	0.0196	<0.001	9.42	<0.001	261	14	<0.0015	<0.001	0.14	<0.001	0.0072	<0.0002	<0.0015	6.6	0.0444	<0.001	903	<0.002	--
MW-28	07/02/2021	<0.001	<0.001	0.0263	<0.001	9.56	<0.001	237	13	<0.0015	<0.001	0.13	<0.001	0.0061	<0.0002	<0.0015	6.7	0.327	<0.001	815	<0.002	1610
MW-28	07/23/2021	<0.001	<0.001	0.0241	<0.001	10.9	<0.001	244	12	<0.0015	<0.001	0.14	<0.001	0.0078	<0.0002	<0.0015	6.7	0.18	<0.001	774	<0.002	1720
MW-28	08/11/2021	<0.001	<0.001	0.0215	<0.001	8.35	<0.001	219	13	<0.0015	<0.001	0.12	<0.001	0.0057	<0.0002	<0.0015	6.8	0.172	<0.001	883	<0.002	1570
MW-29	02/25/2021	<0.001	<0.001	0.0913	<0.001	1.59	<0.001	144	50	<0.0015	<0.001	0.13	<0.001	0.0084	<0.0002	<0.0015	6.7	0.311	<0.001	148	<0.002	778
MW-29	03/16/2021	<0.001	<0.001	0.0885	<0.001	1.65	<0.001	149	47	<0.0015	<0.001	0.6	<0.001	0.009	<0.0002	<0.0015	6.9	1.32	<0.001	149	<0.002	774
MW-29	04/06/2021	<0.001	<0.001	0.0907	<0.001	1.78	<0.001	148	48	<0.0015	<0.001	0.13	<0.001	0.0091	<0.0002	<0.0015	6.2	0.182	<0.001	148	<0.002	768
MW-29	05/21/2021	<0.001	<0.001	0.0789	<0.001	1.66	<0.001	154	44	<0.0015	<0.001	0.12	<0.001	0.0083	<0.0002	<0.0015	6.6	0.194	<0.001	148	<0.002	764
MW-29	06/10/2021	<0.001	<0.001	0.0814	<0.001	1.66	<0.001	153	46	<0.0015	<0.001	0.13	<0.001	0.0087	<0.0002	<0.0015	6.6	0.499	<0.001	154	<0.002	--
MW-29	07/02/2021	<0.001	<0.001	0.0983	<0.001	1.85	<0.001	149	48	<0.0015	<0.001	0.12	<0.001	0.0088	<0.0002	<0.0015	6.6	0	<0.001	154	<0.002	788
MW-29	07/23/2021	<0.001	<0.001	0.0952	<0.001	2.01	<0.001	150	51	<0.0015	<0.001	0.12	<0.001	0.0106	<0.0002	<0.0015	6.7	0.835	<0.001	163	<0.002	790
MW-29	08/11/2021	<0.001	<0.001	0.0796	<0.001	1.57	<0.001	136	49	<0.0015	<0.001	0.11	<0.001	0.0078	<0.0002	<0.0015	6.7	0.749	<0.001	161	<0.002	756
MW-30	02/25/2021	<0.001	0.0014	0.17	<0.001	1.14	<0.001	129	52	0.0047	0.0026	0.2	<0.001	<0.005	<0.0002	0.0043	6.6	4.64	<0.001	85	<0.002	678
MW-30	03/17/2021	<0.001	0.002	0.162	<0.001	1.19	<0.001	137	53	0.0021	0.0025	0.25	<0.001	0.0042	<0.0002	0.0036	6.6	0.783	<0.001	54	<0.002	682
MW-30	04/07/2021	<0.001	0.0021	0.16	<0.001	1.6	<0.001	132	49	0.0024	0.0027	0.23	<0.001	0.0033	<0.0002	0.0026	6.2	1.14	<0.001	40	<0.002	682
MW-30	05/20/2021	<0.001	0.0023	0.135	<0.001	1.18	<0.001	136	54	<0.0015	0.0021	0.25	<0.001	<0.003	<0.0002	<0.0015	6.4	0.733	<0.001	22	<0.002	684

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-30	06/09/2021	<0.001	0.0037	0.155	<0.001	1.09	<0.001	141	52	<0.0015	0.002	0.29	<0.001	<0.003	<0.0002	0.0019	6.4	0.692	<0.001	22	<0.002	--
MW-30	07/01/2021	<0.001	0.0044	0.173	<0.001	1.24	<0.001	133	51	<0.0015	0.003	0.29	<0.001	<0.003	<0.0002	0.0019	6.5	0.532	<0.001	18	<0.002	690
MW-30	07/22/2021	<0.001	0.0073	0.174	<0.001	1.29	<0.001	129	52	<0.0015	0.0023	0.28	<0.001	<0.003	<0.0002	<0.0015	6.4	0.757	<0.001	14	<0.002	680
MW-30	08/10/2021	<0.001	0.0048	0.155	<0.001	1.06	<0.001	122	52	<0.0015	0.0018	0.27	<0.001	<0.003	<0.0002	<0.0015	6.6	1.48	<0.001	12	<0.002	676
MW-31	02/24/2021	<0.001	0.0032	0.279	<0.001	0.217	<0.001	125	51	<0.0015	0.0013	0.2	<0.001	0.0057	<0.0002	0.0029	6.8	0.454	<0.001	<10	<0.002	530
MW-31	03/17/2021	<0.001	0.0032	0.263	<0.001	0.259	<0.001	138	51	<0.0015	<0.001	0.19	<0.001	0.0054	<0.0002	0.0023	6.7	1.87	<0.001	<10	<0.002	620
MW-31	04/07/2021	<0.001	0.0036	0.22	<0.001	0.369	<0.001	137	48	<0.0015	<0.001	0.18	<0.001	0.0063	<0.0002	0.0019	6.2	0.926	<0.001	<10	<0.002	618
MW-31	05/20/2021	<0.001	0.0026	0.218	<0.001	0.285	<0.001	143	47	<0.0015	<0.001	0.17	<0.001	0.0047	<0.0002	0.0022	6.5	1.3	<0.001	<10	<0.002	646
MW-31	06/09/2021	<0.001	0.0028	0.244	<0.001	0.296	<0.001	140	51	<0.0015	<0.001	0.19	<0.001	0.0052	<0.0002	0.0017	6.4	0.688	<0.001	<10	<0.002	--
MW-31	07/01/2021	<0.001	0.0028	0.263	<0.001	0.325	<0.001	142	50	<0.0015	<0.001	0.17	<0.001	0.0055	<0.0002	<0.0015	6.6	0.381	<0.001	<10	<0.002	658
MW-31	07/22/2021	<0.001	0.0031	0.269	<0.001	0.327	<0.001	136	50	<0.0015	<0.001	0.18	<0.001	0.0059	<0.0002	0.0019	6.5	2.27	<0.001	<10	<0.002	626
MW-31	08/10/2021	<0.001	0.0023	0.22	<0.001	0.259	<0.001	139	48	<0.0015	<0.001	0.16	<0.001	0.0049	<0.0002	<0.0015	6.6	0.902	<0.001	<10	<0.002	614
MW-31S	02/24/2021	<0.001	0.0021	0.233	<0.001	0.0539	<0.001	170	17	<0.0015	0.0034	0.21	<0.001	<0.005	<0.0002	0.004	6.6	0.34	<0.001	216	<0.002	872
MW-31S	03/17/2021	0.0012	0.0064	0.255	<0.001	0.0606	<0.001	184	15	0.007	0.0056	0.22	0.0037	0.0052	<0.0002	0.0036	6.7	1.25	<0.001	177	<0.002	896
MW-31S	04/06/2021	<0.001	0.0063	0.224	<0.001	0.0542	<0.001	181	16	0.0032	0.0038	0.23	0.0016	<0.003	<0.0002	0.0031	6.3	1.55	<0.001	160	<0.002	900
MW-31S	05/20/2021	<0.001	0.0083	0.213	<0.001	0.0493	<0.001	182	14	<0.0015	0.0037	0.24	<0.001	<0.003	<0.0002	0.0024	6.4	3.82	<0.001	119	<0.002	840
MW-31S	06/10/2021	0.0014	0.02	0.633	0.0012	0.0575	<0.001	235	21	0.0477	0.018	0.25	0.0294	0.0255	<0.0002	0.0061	6.4	5.29	<0.001	102	<0.002	--
MW-31S	07/01/2021	<0.001	0.0195	0.503	<0.001	0.059	<0.001	191	17	0.0381	0.0168	0.23	0.0169	0.0167	<0.0002	0.005	6.5	2.8	<0.001	78	<0.002	820
MW-31S	07/23/2021	<0.001	0.0096	0.304	<0.001	0.0527	<0.001	167	17	0.0145	0.0051	0.23	0.0046	0.0052	<0.0002	0.0053	6.8	4.19	<0.001	69	<0.002	770
MW-31S	08/10/2021	<0.001	0.0075	0.247	<0.001	0.0444	<0.001	149	16	0.0094	0.004	0.22	0.0029	0.0033	<0.0002	0.0049	6.6	--	<0.001	63	<0.002	762
MW-31S	08/11/2021	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	2.84	--	--	--	--
MW-32	02/25/2021	<0.001	<0.001	0.104	<0.001	1.56	<0.001	172	14	<0.0015	0.0013	0.18	<0.001	<0.005	<0.0002	<0.0015	6.6	0.471	<0.001	443	<0.002	1180

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

Location	Sample Date	Antimony, total (mg/L)	Arsenic, total (mg/L)	Barium, total (mg/L)	Beryllium, total (mg/L)	Boron, total (mg/L)	Cadmium, total (mg/L)	Calcium, total (mg/L)	Chloride, total (mg/L)	Chromium, total (mg/L)	Cobalt, total (mg/L)	Fluoride, total (mg/L)	Lead, total (mg/L)	Lithium, total (mg/L)	Mercury, total (mg/L)	Molybdenum, total (mg/L)	pH (field) (SU)	Radium 226 and 228 combined (pCi/L)	Selenium, total (mg/L)	Sulfate, total (mg/L)	Thallium, total (mg/L)	Total Dissolved Solids (mg/L)
35 I.A.C. 845.600	Lower	0	0	0	0	0	0	--	0	0	0	0	0	0	0	0	6.5	0	0	0	0	0
	Upper	0.006	0.010	2.0	0.004	2	0.005	--	200	0.1	0.006	4.0	0.0075	0.04	0.002	0.1	9.0	5	0.05	400	0.002	1200
MW-32	03/17/2021	<0.001	<0.001	0.0977	<0.001	1.58	<0.001	190	13	<0.0015	0.0011	0.16	<0.001	<0.003	<0.0002	<0.0015	6.4	0.239	<0.001	425	<0.002	1190
MW-32	04/07/2021	<0.001	<0.001	0.0905	<0.001	1.88	<0.001	193	14	<0.0015	0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.0	0.338	<0.001	477	<0.002	1190
MW-32	05/19/2021	<0.001	<0.001	0.0795	<0.001	1.67	<0.001	193	13	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.3	0.591	<0.001	462	<0.002	1190
MW-32	06/09/2021	<0.001	<0.001	0.0851	<0.001	1.62	<0.001	198	14	<0.0015	<0.001	0.19	<0.001	<0.003	<0.0002	<0.0015	6.2	0.285	<0.001	474	<0.002	--
MW-32	07/01/2021	<0.001	<0.001	0.0973	<0.001	1.75	<0.001	186	13	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.4	0.149	<0.001	464	<0.002	1180
MW-32	07/22/2021	<0.001	<0.001	0.0882	<0.001	1.87	<0.001	192	13	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.5	1.55	<0.001	454	<0.002	1150
MW-32	08/10/2021	<0.001	0.0013	0.0732	<0.001	1.44	<0.001	176	13	<0.0015	<0.001	0.18	<0.001	<0.003	<0.0002	<0.0015	6.5	0	<0.001	465	<0.002	1190
PZ-4C	02/25/2021	<0.001	<0.001	0.233	<0.001	1.34	<0.001	117	43	0.0016	<0.001	0.41	<0.001	0.0076	<0.0002	<0.0015	7.4	0.485	<0.001	71	<0.002	570
PZ-4C	03/16/2021	<0.001	<0.001	0.252	<0.001	1.49	<0.001	124	40	<0.0015	<0.001	0.41	<0.001	0.0076	<0.0002	<0.0015	7.0	2.02	<0.001	71	<0.002	564
PZ-4C	04/05/2021	<0.001	<0.001	0.25	<0.001	1.57	<0.001	118	39	<0.0015	<0.001	0.4	<0.001	0.007	<0.0002	<0.0015	6.4	0.328	<0.001	77	<0.002	560
PZ-4C	05/20/2021	<0.001	<0.001	0.258	<0.001	1.54	<0.001	123	36	<0.0015	<0.001	0.38	<0.001	0.0067	<0.0002	<0.0015	6.5	0.522	<0.001	82	<0.002	582
PZ-4C	06/10/2021	<0.001	0.0014	0.295	<0.001	1.57	<0.001	123	40	0.0023	<0.001	0.42	0.0013	0.0089	<0.0002	<0.0015	6.7	0.482	<0.001	82	<0.002	--
PZ-4C	07/02/2021	<0.001	0.0045	0.335	<0.001	1.69	<0.001	134	39	0.0104	0.0042	0.4	0.0059	0.0134	<0.0002	0.0018	6.7	2.04	<0.001	82	<0.002	568
PZ-4C	07/23/2021	<0.001	0.0026	0.341	<0.001	1.93	<0.001	119	39	0.0023	<0.001	0.41	0.0011	0.0095	<0.0002	<0.0015	6.7	1.46	<0.001	82	<0.002	578
PZ-4C	08/11/2021	<0.001	0.0039	0.302	<0.001	1.41	<0.001	121	39	0.0099	0.0036	0.39	0.0062	0.0137	<0.0002	<0.0015	6.8	1.93	<0.001	55	<0.002	568

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

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-1	06/16/2015	--	--	6.8	447	--	--
MW-1	12/15/2015	<1	94	6.6	407	16.1	<1
MW-1	02/29/2016	<1	122	6.6	397	13.8	<1
MW-1	05/16/2016	<1	103	6.9	356	12.9	<1
MW-1	08/22/2016	<1	136	6.8	429	18.4	1
MW-1	11/15/2016	<1	51	7.0	397	15.6	<1
MW-1	02/13/2017	<1	115	6.8	409	14.8	<1
MW-1	05/18/2017	1.81	69	6.7	429	14.7	<1
MW-1	07/18/2017	<1	137	6.7	411	19.5	<1
MW-1	11/06/2017	0	263	6.8	478	16.2	4.5
MW-1	05/31/2018	<1	163	6.5	578	15.0	<1
MW-1	08/28/2018	<1	86	6.2	461	17.7	2.5
MW-1	11/08/2018	--	--	6.4	499	16.0	--
MW-1	02/14/2019	<1	100	6.7	526	11.8	<1
MW-1	05/14/2019	--	--	6.4	593	11.5	--
MW-1	08/21/2019	1.00	233	6.3	603	15.1	2.8
MW-1	11/13/2019	--	--	6.5	616	9.2	--
MW-1	02/11/2020	<1	128	6.6	566	12.8	1.8
MW-1	05/12/2020	--	--	6.6	501	11.9	--
MW-1	08/26/2020	1.00	109	6.6	482	16.3	1.7
MW-1	12/02/2020	--	--	6.6	487	15.6	--
MW-1	02/24/2021	0.46	219	6.5	562.5	9.8	0
MW-1	03/15/2021	0.18	182	6.5	511.4	11.5	0
MW-1	03/30/2021	<1	126	6.5	534	11.6	<1
MW-1	04/05/2021	0.30	204	6.0	475.4	12.8	0
MW-1	05/19/2021	0.41	214	6.1	538	12.4	<1
MW-1	06/10/2021	0.37	68	6.2	528	12.9	<1
MW-1	07/01/2021	0.44	81	6.2	572	13.9	<1
MW-1	07/22/2021	1.26	94	6.3	548	18.0	<1
MW-1	08/10/2021	0.92	106	6.3	513	19.1	<1
MW-1	09/01/2021	0.58	117	6.5	555	20.0	4.4
MW-10	06/17/2015	--	--	6.7	1038	--	--
MW-10	12/14/2015	--	--	6.3	1544	14.3	--
MW-10	05/16/2016	--	--	6.8	800	12.3	--
MW-10	11/15/2016	--	--	7.6	1260	--	--
MW-10	05/19/2017	--	--	6.5	776	12.8	--
MW-10	11/07/2017	--	--	6.8	1980	15.6	--
MW-10	06/01/2018	--	--	6.6	1530	15.7	--
MW-10	11/08/2018	--	--	6.8	2060	15.0	--
MW-10	05/14/2019	--	--	6.4	1150	11.9	--
MW-10	11/14/2019	--	--	6.5	1370	15.1	--
MW-10	05/12/2020	--	--	6.5	973	13.2	--
MW-10	12/02/2020	--	--	6.5	1370	14.5	--
MW-10	06/10/2021	--	--	6.1	1090	13.1	--

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-11	12/15/2015	<1	55	6.9	812	17.1	8.3
MW-11	02/29/2016	6.74	121	6.9	779	16.0	5.9
MW-11	05/16/2016	<1	83	7.1	720	14.4	4.8
MW-11	08/22/2016	<1	0	7.3	821	21.2	3.4
MW-11	11/15/2016	6.65	-21	7.4	784	17.3	2.5
MW-11	02/13/2017	<1	101	6.9	813	16.4	2.9
MW-11	05/18/2017	<1	94	7.0	771	19.6	<1
MW-11	07/18/2017	<1	35	7.0	809	19.4	2.1
MW-11	11/06/2017	0	248	7.0	952	15.5	0
MW-11	05/31/2018	<1	77	6.8	1088	17.4	9.8
MW-11	08/28/2018	1.25	31	6.8	884	17.8	2.6
MW-11	11/08/2018	--	--	6.9	948	16.3	--
MW-11	02/14/2019	1.16	106	7.1	994	13.6	<1
MW-11	05/14/2019	--	--	6.8	1120	13.5	--
MW-11	08/21/2019	<1	147	6.7	1150	17.2	1.6
MW-11	11/13/2019	--	--	6.8	1180	16.1	--
MW-11	02/11/2020	<1	61	6.9	1080	13.0	2
MW-11	05/12/2020	--	--	7.0	979	13.1	--
MW-11	08/26/2020	1.00	63	6.9	967	16.8	2.1
MW-11	12/02/2020	--	--	6.8	977	14.9	--
MW-11	03/30/2021	1.61	109	6.9	1010	14.1	2.4
MW-11	06/09/2021	--	--	6.6	1070	14.7	--
MW-11	09/01/2021	0.44	72	6.7	1030	17.2	3.6
MW-12	12/15/2015	<1	40	6.9	1080	15.1	3.7
MW-12	02/29/2016	<1	18	6.8	1130	13.8	27
MW-12	05/16/2016	<1	-19	7.0	1030	13.1	17.6
MW-12	08/22/2016	<1	-77	7.2	1370	17.0	13.1
MW-12	11/15/2016	<1	-97	7.2	1080	14.9	3.5
MW-12	02/13/2017	<1	5	6.7	1300	14.5	18.5
MW-12	05/18/2017	<1	19	6.7	1120	15.7	9.3
MW-12	07/18/2017	<1	-81	6.9	1280	18.4	15.2
MW-12	11/06/2017	0	160	7.1	1450	15.7	6.9
MW-12	05/31/2018	<1	40	6.6	1648	14.3	9.7
MW-12	08/28/2018	<1	-53	6.7	1480	17.3	9.9
MW-12	11/08/2018	--	--	7.0	1610	15.4	--
MW-12	02/14/2019	<1	-34	6.9	1630	12.6	42.3
MW-12	05/14/2019	--	--	6.5	1580	11.8	--
MW-12	08/20/2019	<1	42	6.4	1750	16.2	1.4
MW-12	11/13/2019	--	--	6.7	1740	14.5	--
MW-12	02/11/2020	<1	-10	6.6	1520	12.4	24
MW-12	05/12/2020	--	--	6.8	1350	12.5	--
MW-12	08/26/2020	1.00	-28	6.6	1480	15.7	7.8
MW-12	12/02/2020	--	--	6.7	1500	14.8	--
MW-12	03/30/2021	<1	28	6.5	1410	11.8	5.3

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-12	06/10/2021	--	--	6.6	1550	13.2	--
MW-12	09/01/2021	0.29	-64	6.7	1460	15.8	9.6
MW-12D	02/25/2021	0.16	12.4	7.2	1207	9.0	27.1
MW-12D	03/16/2021	0.13	-20.2	7.3	1134	13.4	0
MW-12D	04/06/2021	0.17	6	6.7	1160	14.0	114
MW-12D	05/20/2021	0.21	-99	7.2	1270	14.3	18
MW-12D	06/10/2021	0.44	-72	7.1	1210	14.7	9.3
MW-12D	07/02/2021	0.45	61	9.9	1330	14.8	8
MW-12D	07/23/2021	1.23	-74	7.1	1290	18.1	19
MW-12D	08/11/2021	1.06	-73	7.2	1090	17.8	7.9
MW-12S	02/25/2021	4.95	10.6	6.8	805.1	3.6	0
MW-12S	03/16/2021	3.00	27.3	6.8	926	8.0	0
MW-12S	04/06/2021	0.23	-24	6.2	1188	10.9	0
MW-12S	05/20/2021	0.46	-21	6.5	908	14.0	4.6
MW-12S	06/10/2021	0.78	145	6.5	1260	15.6	<1
MW-12S	07/02/2021	0.53	-20	6.4	1190	18.4	<1
MW-12S	07/23/2021	0.48	-107	6.5	1370	19.1	1
MW-12S	08/11/2021	0.62	-89	6.6	1040	20.0	7.9
MW-2	06/16/2015	--	--	7.5	684	--	--
MW-2	12/15/2015	<1	-5	7.1	635	14.7	65.4
MW-2	02/29/2016	2.23	78	7.2	571	12.7	10.8
MW-2	05/16/2016	<1	4	7.4	546	13.0	30.5
MW-2	08/22/2016	<1	34	7.4	680	18.8	4.5
MW-2	11/15/2016	<1	-49	7.5	614	14.6	9.8
MW-2	02/13/2017	2.09	143	7.2	658	13.8	1.9
MW-2	05/18/2017	2.86	62	7.2	690	14.7	<1
MW-2	07/18/2017	<1	-23	7.3	646	17.0	6
MW-2	11/06/2017	0	207	7.1	700	15.3	7.2
MW-2	05/31/2018	<1	44	7.0	843	15.0	23.2
MW-2	08/28/2018	2.41	-38	6.8	647	18.9	13.2
MW-2	11/08/2018	--	--	6.9	725	14.9	--
MW-2	02/14/2019	4.64	76	7.4	714	10.6	27.6
MW-2	05/14/2019	--	--	7.2	820	12.8	--
MW-2	08/20/2019	<1	2	7.1	820	15.0	5
MW-2	11/13/2019	--	--	7.3	846	11.6	--
MW-2	02/11/2020	4.82	103	7.3	785	11.4	9.1
MW-2	05/12/2020	--	--	7.4	714	12.0	--
MW-2	08/26/2020	1.00	77	7.3	717	16.0	6.9
MW-2	12/02/2020	--	--	7.3	717	14.2	--
MW-2	02/24/2021	1.80	38.9	7.2	837.4	10.5	61.5
MW-2	03/15/2021	0.76	15.6	7.3	762.2	11.0	211
MW-2	03/30/2021	<1	86	7.1	784	11.5	9.9
MW-2	04/05/2021	1.01	68.7	6.7	722.3	15.8	75.1
MW-2	05/19/2021	0.22	-73	7.0	778	12.6	10

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-2	06/10/2021	0.40	-63	7.0	780	13.5	9.8
MW-2	07/01/2021	0.60	62	6.5	843	13.4	9.8
MW-2	07/22/2021	1.30	124	6.6	809	14.2	7.2
MW-2	08/10/2021	1.18	102	6.9	751	19.5	21
MW-2	09/01/2021	0.37	-41	7.0	726	15.8	25
MW-20	02/26/2021	2.97	173	7.2	1012	8.6	3.11
MW-20	03/16/2021	0.89	70.8	7.1	920.7	11.2	0
MW-20	04/06/2021	0.57	71.3	6.5	922.3	12.7	0
MW-20	05/18/2021	0.52	107	6.9	1430	14.6	9.4
MW-20	06/09/2021	0.72	-118	6.8	1060	18.1	8.6
MW-20	07/01/2021	0.57	-93	6.9	1040	17.1	7.5
MW-20	07/22/2021	1.26	-93	6.9	1100	22.4	8.7
MW-20	08/10/2021	1.05	-63	6.9	1010	21.0	9.9
MW-20S	02/26/2021	1.84	151	6.8	1336	8.4	0.79
MW-20S	03/16/2021	1.16	114	6.9	1292	9.1	0
MW-20S	04/06/2021	0.54	162	6.3	1300	11.2	0
MW-20S	05/19/2021	0.50	77	6.5	1400	14.8	9.8
MW-20S	06/09/2021	0.70	58	6.4	1480	14.7	7.3
MW-20S	07/01/2021	0.48	83	6.5	1530	16.8	3.8
MW-20S	07/22/2021	0.84	81	6.5	1570	18.8	1.3
MW-20S	08/10/2021	0.10	73	6.6	1360	19.9	5.1
MW-22	02/26/2021	2.62	177	7.0	881.7	9.7	41
MW-22	03/17/2021	1.41	80.3	7.0	851.5	10.2	261
MW-22	04/07/2021	0.59	133	6.5	423.9	14.1	0
MW-22	05/18/2021	0.35	-36	6.9	1170	12.7	8.8
MW-23	02/26/2021	1.38	182	6.9	1074	12.2	1.86
MW-23	03/18/2021	0.92	220	6.7	1058	11.9	14.7
MW-23	04/06/2021	1.02	104	6.6	1007	16.7	0
MW-23	05/19/2021	1.68	429	6.6	1030	15.3	9.7
MW-23	06/09/2021	1.12	141	6.4	1060	15.1	<1
MW-23	07/01/2021	0.73	112	6.5	1130	15.6	1.2
MW-23	07/22/2021	0.91	120	6.5	1080	16.3	1
MW-23	08/10/2021	0.89	106	6.6	998	19.1	<1
MW-24	03/01/2021	4.11	471	6.6	937	13.7	25.9
MW-24	03/18/2021	3.76	555	6.4	1088	12.8	246
MW-24	04/07/2021	3.98	487	6.0	1112	17.4	0
MW-24	05/19/2021	4.20	373	6.4	1110	18.0	7.6
MW-25	02/25/2021	3.33	118	6.7	732.5	10.5	973
MW-25	03/17/2021	1.21	29	6.6	645.3	11.4	0
MW-25	04/07/2021	1.10	69.3	6.2	662.2	14.7	146
MW-25	05/21/2021	0.40	-65	6.3	777	15.8	34
MW-25	08/11/2021	0.76	-98	6.5	679	19.7	36
MW-26	02/25/2021	2.36	11.8	6.7	1133	10.0	91.7
MW-26	03/17/2021	1.99	20	6.7	1095	8.8	47.2

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-26	04/06/2021	0.25	-68.9	6.4	979	14.5	0
MW-26	05/21/2021	0.92	-110	6.4	1290	16.8	8.4
MW-27	02/24/2021	4.66	120	7.0	1035	11.6	66.7
MW-27	03/16/2021	3.71	115	6.9	1331	10.3	2370
MW-27	04/06/2021	0.86	18.6	6.4	1386	15.2	0
MW-27	05/21/2021	0.51	-180	6.8	1680	16.0	68
MW-27	06/10/2021	0.48	-145	6.6	1560	14.1	28
MW-27	07/02/2021	0.66	-83	6.7	1760	14.4	180
MW-27	07/23/2021	4.54	44	6.6	1710	14.9	620
MW-27	08/11/2021	2.96	-42	6.6	1420	15.8	150
MW-28	02/24/2021	0.45	89	6.9	2305	11.8	0
MW-28	03/16/2021	0.22	15.6	7.0	1484	11.8	0
MW-28	04/07/2021	0.41	65.2	6.3	2138	15.2	0
MW-28	05/18/2021	0.28	-59	6.5	2840	12.9	<1
MW-28	06/10/2021	0.76	-6	6.6	2200	15.3	<1
MW-28	07/02/2021	0.43	47	6.7	2360	14.3	<1
MW-28	07/23/2021	0.42	4	6.6	2230	14.9	1
MW-28	08/11/2021	1.39	-50	6.8	1910	20.5	2.7
MW-29	02/25/2021	0.15	106	6.7	1338	10.7	0
MW-29	03/16/2021	0.19	76.3	6.9	1224	12.2	0
MW-29	04/06/2021	0.22	103	6.2	1065	13.1	0
MW-29	05/21/2021	1.21	48	6.6	1400	15.9	1.5
MW-29	06/10/2021	0.51	29	6.6	1280	13.6	<1
MW-29	07/02/2021	0.48	28	6.6	1410	13.8	<1
MW-29	07/23/2021	0.47	47	6.7	1360	14.7	<1
MW-29	08/11/2021	0.60	-4	6.7	1160	16.2	<1
MW-3	06/16/2015	--	--	7.1	902	--	--
MW-3	12/15/2015	--	--	7.0	785	15.5	--
MW-3	05/16/2016	--	--	7.1	712	12.6	--
MW-3	11/15/2016	--	--	7.3	771	--	--
MW-3	05/18/2017	--	--	6.7	793	13.7	--
MW-3	11/06/2017	--	--	7.1	871	15.2	--
MW-3	05/31/2018	--	--	6.8	1035	15.4	--
MW-3	11/08/2018	--	--	7.0	860	14.3	--
MW-3	05/14/2019	--	--	6.7	1020	12.4	--
MW-3	11/13/2019	--	--	6.8	1110	13.8	--
MW-3	05/12/2020	--	--	6.9	936	12.3	--
MW-3	12/02/2020	--	--	6.8	924	14.5	--
MW-3	02/25/2021	0.34	78.3	6.8	1087	12.2	16.8
MW-3	03/16/2021	0.32	208	6.7	1010	11.4	0
MW-3	04/05/2021	0.29	146	6.4	954.4	12.7	0
MW-3	05/18/2021	0.86	46	6.7	1400	13.8	<1
MW-3	06/09/2021	0.32	54	6.5	1030	13.2	<1
MW-3	07/01/2021	0.53	99	6.6	1090	14.3	<1

TABLE 4-2. GROUNDWATER FIELD PARAMETERS
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KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-3	07/22/2021	0.77	89	6.7	1030	19.2	<1
MW-3	08/10/2021	0.77	91	6.7	947	20.3	<1
MW-30	02/25/2021	0.94	-31.6	6.6	1212	14.6	11.6
MW-30	03/17/2021	0.34	-33.5	6.6	889.5	12.8	47.8
MW-30	04/07/2021	1.59	28.9	6.2	1113	15.9	0
MW-30	05/20/2021	0.44	-68	6.4	1310	15.7	10
MW-30	06/09/2021	0.48	-90	6.4	1260	15.4	10
MW-30	07/01/2021	0.90	-77	6.5	1360	17.2	9.8
MW-30	07/22/2021	0.62	-79	6.4	1270	15.5	4.6
MW-30	08/10/2021	0.88	-79	6.6	1150	18.1	2.6
MW-31	02/24/2021	0.55	-42.1	6.8	1015	13.3	0
MW-31	03/17/2021	0.38	-30.5	6.7	1136	11.9	0
MW-31	04/07/2021	0.39	-9.9	6.2	968.6	14.9	0
MW-31	05/20/2021	0.80	-76	6.5	1200	15.1	8.5
MW-31	06/09/2021	0.83	-92	6.4	1160	15.9	10
MW-31	07/01/2021	0.69	-89	6.6	1240	15.9	9.8
MW-31	07/22/2021	0.87	-77	6.5	1170	15.7	10
MW-31	08/10/2021	0.80	-70	6.6	1090	18.1	1
MW-31S	02/24/2021	0.48	-60.5	6.6	1320	14.2	21.5
MW-31S	03/17/2021	0.89	-8.3	6.7	1384	10.4	67.7
MW-31S	04/06/2021	1.30	17.4	6.3	1147	18.7	0
MW-31S	05/20/2021	0.73	-102	6.4	1330	16.3	36
MW-31S	06/10/2021	3.25	-102	6.4	1360	17.0	37
MW-31S	07/01/2021	4.15	-48	6.5	1460	16.8	21
MW-31S	07/23/2021	5.66	-9	6.8	1420	15.9	320
MW-31S	08/10/2021	6.88	-122	6.6	1180	15.5	160
MW-32	02/25/2021	0.35	-50.4	6.6	1678	15.4	0
MW-32	03/17/2021	0.36	34.7	6.4	1641	13.4	0
MW-32	04/07/2021	0.53	63.8	6.0	1581	17.8	0
MW-32	05/19/2021	0.86	-40	6.3	1550	15.8	1
MW-32	06/09/2021	1.22	-7	6.2	1660	16.2	<1
MW-32	07/01/2021	1.30	51	6.4	1760	16.4	3.4
MW-32	07/22/2021	2.13	35	6.5	1690	19.9	1
MW-32	08/10/2021	0.93	20	6.5	1550	18.1	<1
MW-4	06/16/2015	--	--	7.3	727	--	--
MW-4	12/15/2015	--	--	6.9	654	15.7	--
MW-4	05/16/2016	--	--	7.1	593	12.6	--
MW-4	11/15/2016	--	--	7.3	646	--	--
MW-4	05/18/2017	--	--	6.8	693	13.7	--
MW-4	11/06/2017	--	--	7.1	775	15.9	--
MW-4	05/31/2018	--	--	6.8	904	15.2	--
MW-4	11/08/2018	--	--	7.0	769	15.3	--
MW-4	05/14/2019	--	--	6.7	921	12.9	--
MW-4	11/13/2019	--	--	6.9	969	14.2	--

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-4	05/12/2020	--	--	7.0	793	12.4	--
MW-4	12/02/2020	--	--	7.2	787	14.6	--
MW-4	02/25/2021	0.11	-80.2	6.9	912.9	12.1	0
MW-4	03/16/2021	0.14	-36.1	6.9	864.4	11.7	0
MW-4	04/06/2021	0.19	-9.5	6.4	845.3	13.0	0
MW-4	05/19/2021	0.30	-139	6.6	876	13.4	<1
MW-4	06/09/2021	--	--	6.6	889	14.5	--
MW-5	06/16/2015	--	--	7.0	997	--	--
MW-5	12/15/2015	<1	76	6.6	858	14.6	9.4
MW-5	02/29/2016	<1	83	6.6	839	15.3	1.9
MW-5	05/16/2016	<1	71	7.0	770	14.3	<1
MW-5	08/22/2016	<1	30	7.2	920	16.4	1
MW-5	11/15/2016	1.16	-13	7.2	828	13.9	<1
MW-5	02/13/2017	<1	96	6.7	878	14.9	7.5
MW-5	05/18/2017	1.11	69	6.7	867	16.9	<1
MW-5	07/18/2017	<1	31	6.8	897	17.4	1
MW-5	11/06/2017	0	208	7.1	992	14.1	0
MW-5	05/31/2018	<1	74	6.7	1194	17.4	<1
MW-5	08/28/2018	<1	28	6.8	980	15.8	3.7
MW-5	11/08/2018	--	--	6.9	1070	13.6	--
MW-5	02/14/2019	1.90	40	7.0	1090	12.4	<1
MW-5	05/14/2019	--	--	6.6	1270	14.6	--
MW-5	08/21/2019	<1	132	6.6	1320	16.4	1.4
MW-5	11/14/2019	--	--	6.6	1340	12.5	--
MW-5	02/11/2020	<1	39	6.7	1250	13.3	1.3
MW-5	05/12/2020	--	--	6.8	1130	14.0	--
MW-5	08/26/2020	1.00	69	6.7	1100	16.3	2.1
MW-5	12/02/2020	--	--	6.7	1100	13.6	--
MW-5	03/30/2021	<1	130	6.5	1290	14.6	5.2
MW-5	06/09/2021	--	--	6.4	1270	15.4	--
MW-5	09/01/2021	2.43	42	6.6	1280	18.6	9.3
MW-6	06/16/2015	--	--	7.0	718	--	--
MW-6	12/15/2015	<1	169	6.5	722	14.8	3.3
MW-6	02/29/2016	4.91	136	6.7	573	13.6	3.6
MW-6	05/16/2016	3.05	165	7.0	540	12.3	2
MW-6	08/22/2016	<1	154	6.5	719	17.2	3.7
MW-6	11/15/2016	<1	62	6.8	732	15.2	5.8
MW-6	02/13/2017	4.65	170	6.6	675	14.0	2
MW-6	05/18/2017	3.63	53	6.6	590	13.9	<1
MW-6	07/18/2017	<1	103	6.5	703	17.4	2.5
MW-6	11/06/2017	0	218	6.7	914	16.0	0
MW-6	05/31/2018	6.74	168	6.5	842	14.1	<1
MW-6	08/28/2018	2.74	71	6.6	697	17.4	6.1
MW-6	11/08/2018	--	--	6.8	773	15.1	--

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-6	02/15/2019	7.31	161	6.7	838	10.1	8.6
MW-6	05/14/2019	--	--	6.5	863	11.7	--
MW-6	08/21/2019	1.95	224	6.4	984	16.3	2.2
MW-6	11/13/2019	--	--	6.6	909	14.0	--
MW-6	02/11/2020	6.29	126	6.7	753	11.8	3
MW-6	05/12/2020	--	--	6.7	717	11.7	--
MW-6	08/26/2020	2.38	128	6.5	744	16.2	6.5
MW-6	12/02/2020	--	--	6.5	863	14.5	--
MW-6	03/30/2021	9.26	116	6.6	630	11.5	<1
MW-6	06/10/2021	--	--	6.4	727	13.1	--
MW-6	09/01/2021	0.28	78	6.4	841	19.1	7.3
MW-7	06/17/2015	--	--	7.5	692	--	--
MW-7	12/15/2015	3.87	142	7.1	772	14.1	<1
MW-7	02/29/2016	7.43	139	7.3	556	11.3	1.8
MW-7	05/16/2016	2.47	149	7.3	519	12.9	2
MW-7	08/22/2016	<1	1	6.9	707	17.6	<1
MW-7	11/15/2016	<1	-44	7.3	719	15.3	<1
MW-7	02/13/2017	<1	140	7.1	799	13.5	1.7
MW-7	05/19/2017	3.53	153	7.0	621	14.0	<1
MW-7	07/18/2017	<1	-91	7.1	720	16.4	<1
MW-7	11/07/2017	0	150	7.0	843	16.1	8
MW-7	06/01/2018	<1	103	7.0	803	15.7	<1
MW-7	08/28/2018	<1	-32	7.0	674	17.7	1.3
MW-7	11/08/2018	--	--	7.3	805	14.6	--
MW-7	02/15/2019	1.22	152	7.2	1160	6.6	<1
MW-7	05/14/2019	--	--	7.0	1030	11.5	--
MW-7	08/21/2019	<1	-112	6.7	1140	17.6	3.6
MW-7	11/13/2019	--	--	7.1	952	14.7	--
MW-7	02/11/2020	3.08	113	7.2	843	9.3	2.6
MW-7	05/12/2020	--	--	7.2	719	11.5	--
MW-7	08/26/2020	1.00	23	7.1	748	17.4	3.9
MW-7	12/02/2020	--	--	7.0	914	14.4	--
MW-7	03/30/2021	1.46	113	7.1	773	11.7	1.8
MW-7	06/10/2021	--	--	6.8	820	13.1	--
MW-7	09/01/2021	0.59	107	6.6	1550	20.5	15
MW-7S	02/24/2021	0.28	-28.8	6.8	1686	11.8	3.06
MW-7S	03/16/2021	0.27	-21.6	6.8	1536	11.0	0
MW-7S	04/06/2021	1.64	63	6.2	1418	14.9	0
MW-7S	05/21/2021	0.44	-111	6.5	1590	13.5	2.6
MW-7S	06/10/2021	4.30	-130	6.8	1620	14.4	790
MW-7S	07/02/2021	0.50	-84	6.6	1860	15.5	7.8
MW-7S	07/23/2021	4.64	-19	6.7	1820	17.4	190
MW-7S	08/11/2021	5.63	-62	6.8	1540	18.0	91
MW-8	06/17/2015	--	--	7.0	1085	--	--

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

Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
MW-8	12/15/2015	<1	124	6.6	959	15.3	2
MW-8	02/29/2016	<1	220	6.6	932	14.4	1.3
MW-8	05/16/2016	<1	150	6.8	858	13.5	<1
MW-8	08/22/2016	<1	78	6.5	1040	15.4	<1
MW-8	11/15/2016	<1	42	7.0	951	14.4	<1
MW-8	02/13/2017	<1	154	6.6	1000	15.5	<1
MW-8	05/19/2017	1.95	138	6.6	935	14.9	<1
MW-8	07/18/2017	<1	50	6.8	978	16.8	<1
MW-8	11/07/2017	0	206	6.9	1120	15.3	2.5
MW-8	06/01/2018	<1	153	6.6	1280	16.2	<1
MW-8	08/28/2018	1.25	63	6.6	1030	16.5	1
MW-8	11/08/2018	--	--	6.9	1130	15.0	--
MW-8	02/14/2019	<1	100	6.9	1260	12.8	<1
MW-8	05/14/2019	--	--	6.5	1370	12.8	--
MW-8	08/21/2019	<1	74	6.5	1410	15.1	1.6
MW-8	11/14/2019	--	--	6.6	1420	14.6	--
MW-8	02/11/2020	<1	129	6.7	1380	13.3	1.6
MW-8	05/12/2020	--	--	6.7	1180	12.8	--
MW-8	08/26/2020	1.00	100	6.7	1160	15.1	1.7
MW-8	12/02/2020	--	--	6.6	1170	14.9	--
MW-8	03/30/2021	<1	103	6.6	1250	12.9	<1
MW-8	06/10/2021	--	--	6.3	1280	14.8	--
MW-8	09/01/2021	0.29	98	6.5	1160	15.0	4.8
MW-8S	02/24/2021	5.53	36.1	6.8	1696	9.3	25.2
MW-8S	03/17/2021	4.15	31.3	6.8	1393	8.1	260
MW-8S	04/06/2021	6.46	121	6.7	1661	26.3	0
MW-8S	05/21/2021	2.99	78	6.4	1950	18.9	19
MW-9	06/17/2015	--	--	7.4	463	--	--
MW-9	12/14/2015	--	--	7.0	617	13.9	--
MW-9	05/16/2016	--	--	7.2	304	12.0	--
MW-9	11/15/2016	--	--	7.5	452	--	--
MW-9	05/19/2017	--	--	6.9	435	12.3	--
MW-9	11/07/2017	--	--	7.2	607	14.8	--
MW-9	06/01/2018	--	--	6.9	489	14.0	--
MW-9	11/08/2018	--	--	7.2	618	15.0	--
MW-9	05/14/2019	--	--	7.0	526	11.6	--
MW-9	11/14/2019	--	--	7.0	549	15.1	--
MW-9	05/12/2020	--	--	7.1	419	11.5	--
MW-9	12/02/2020	--	--	6.9	582	14.3	--
MW-9	06/10/2021	--	--	6.8	434	12.5	--
PZ-4C	02/25/2021	5.66	113	7.4	1007	9.9	26.8
PZ-4C	03/16/2021	1.86	10	7.0	930.8	9.5	61.4
PZ-4C	04/05/2021	1.03	44.1	6.4	858.1	17.2	0
PZ-4C	05/20/2021	0.28	-57	6.5	1050	19.3	9

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

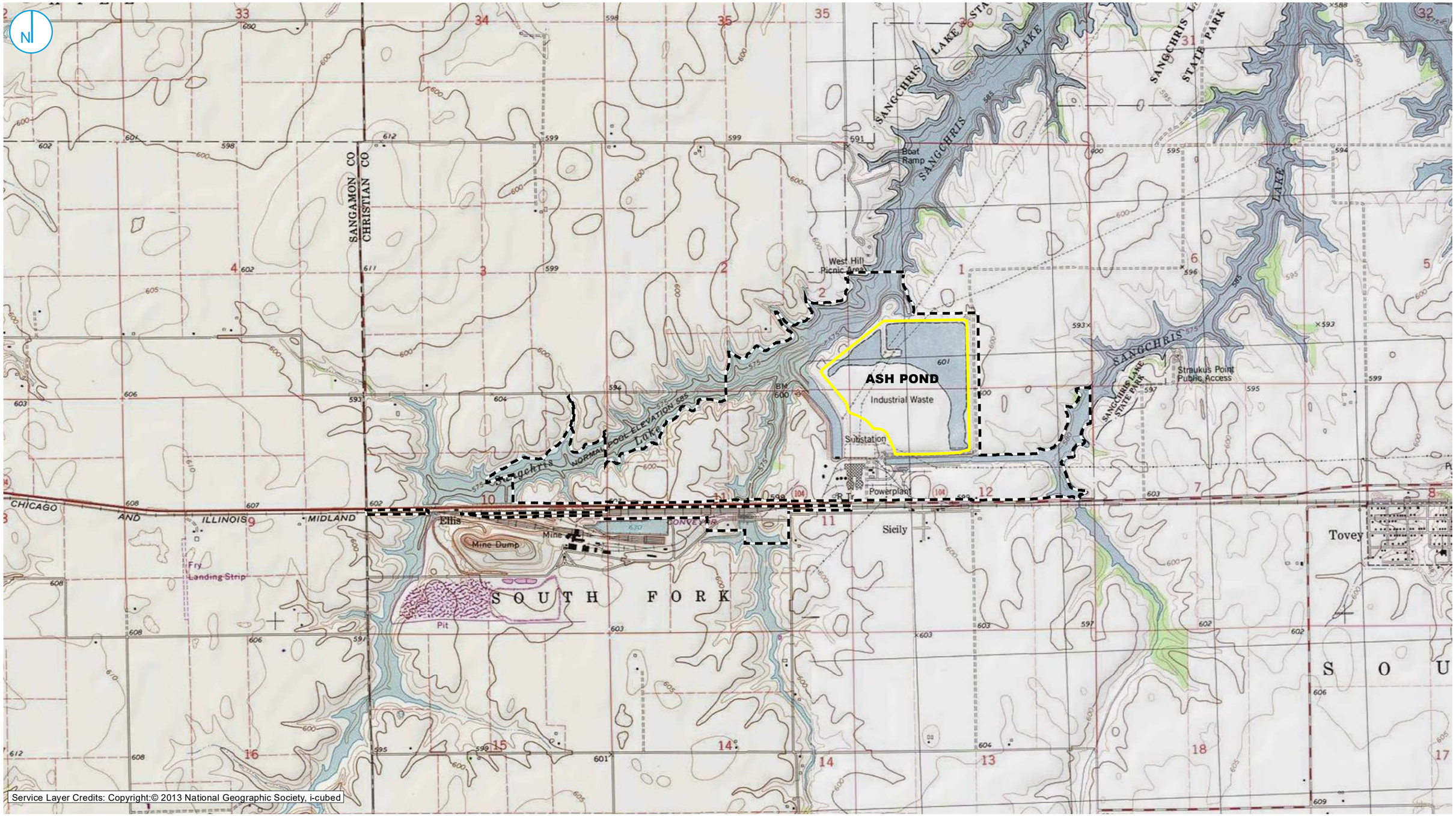
Sample Location	Sample Date	Dissolved Oxygen (mg/L)	Oxidation Reduction Potential (mV)	pH (field) (SU)	Specific Conductance (micromhos/cm)	Temperature (deg. C)	Turbidity (NTU)
PZ-4C	06/10/2021	0.34	-118	6.7	994	20.9	43
PZ-4C	07/02/2021	8.96	-3	6.7	964	15.4	650
PZ-4C	07/23/2021	0.41	-93	6.7	1060	16.7	25
PZ-4C	08/11/2021	0.45	-231	6.8	886	18.1	210

Notes:
Field readings are reported with as many significant figures as provided by analytical laboratory.
-- = data not available
cm = centimeter
deg. C = degrees Celsius
mg/L = milligrams per liter
mV = millivolts
NTU = nephelometric turbidity units
SU = standard units

generated 10/05/2021, 3:58:28 PM CDT

FIGURES

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



PROJECT: 169000XXXX | DATED: 8/5/2021 | DESIGNER: galarnmc

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 1,000 2,000 Feet

SITE LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 1-2_Site_Map.mxd

PROJECT: 169000XXXX | DATED: 8/5/2021 | DESIGNER: galarnme

PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

SITE MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 2-1_Site Topographic Map.mxd

PROJECT: 169000XXXX | DATED: 8/16/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY
10 FOOT ELEVATION CONTOUR (NAVD88)
2 FOOT ELEVATION CONTOUR (NAVD88)

0 250 500 Feet

SOURCE:
INGENAE SURVEY, 2021

SITE TOPOGRAPHIC MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\12285\MXD\845_Operating_Permit\KincaidFigure 2-2_Soil Survey.mxd

PROJECT: 169000XXXX | DATED: 8/5/2021 | DESIGNER: galarnmc

MAP UNIT SYMBOL	MAP UNIT NAME
536	Dumps, mine
259C2	Assumption silt loam, 5 to 10 percent slopes, eroded
43A	Ipava silt loam, 0 to 2 percent slopes
45A	Denny silt loam, 0 to 2 percent slopes
50A	Virden silty clay loam, 0 to 2 percent slopes
802B	Orthents, loamy, undulating
86B	Osco silt loam, 2 to 5 percent slopes
W	Water

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

NRCS SOIL SURVEY MAP UNIT BOUNDARY

0 250 500 Feet

SOURCE:
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

SOIL SURVEY MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 2-3_Surficial Geologic Deposits.mxd
PROJECT: 169000XXXX | DATED: 9/30/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

CAHOKIA ALLUVIUM (INCLUDES ALLUVIAL FAN FACIES)
MACKINAW MEMBER
VANDALIA TILL MEMBER
WATER

0 1,500 3,000 Feet

SOURCE:
ILLINOIS STATE GEOLOGICAL SURVEY (ISGS)

SURFICIAL GEOLOGIC DEPOSITS

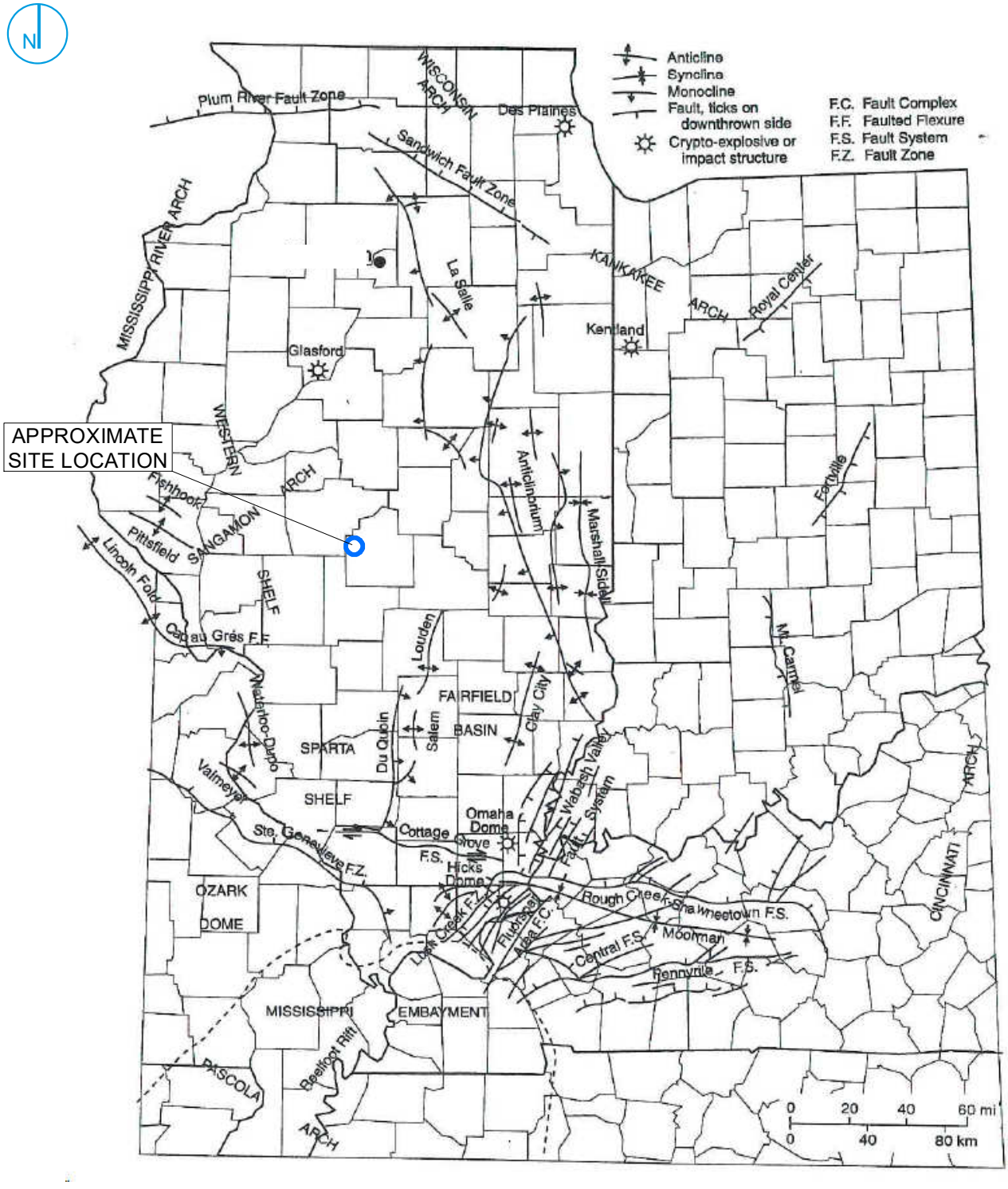
HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\KincaidIFigure 2-4_Major Structural Features of Illinois.mxd
PROJECT: 169000XXXX | DATED: 8/5/2021 | DESIGNER: galarnmc



SOURCE NOTE: MODIFIED FROM "NELSON, W.J. 1995, STRUCTURAL FEATURES IN ILLINOIS, ILLINOIS STATE GEOLOGICAL SURVEY, BULLETIN 100, CHAMPAIGN, ILLINOIS."

Service Layer Credits:

MAJOR STRUCTURAL FEATURES OF ILLINOIS

FIGURE 2-4

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\222285MXD\845_Operating_Permit\Kincad\Figure 2-5_Field Investigation Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/5/2021 | DESIGNER: STOLZSD

MONITORING WELL
SOURCE SAMPLE LOCATION
SOIL BORING
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

FIELD INVESTIGATION LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

5 FOOT HISTORIC ELEVATION CONTOUR
4 FOOT HISTORIC ELEVATION CONTOUR
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

BOTTOM OF ASH

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-6

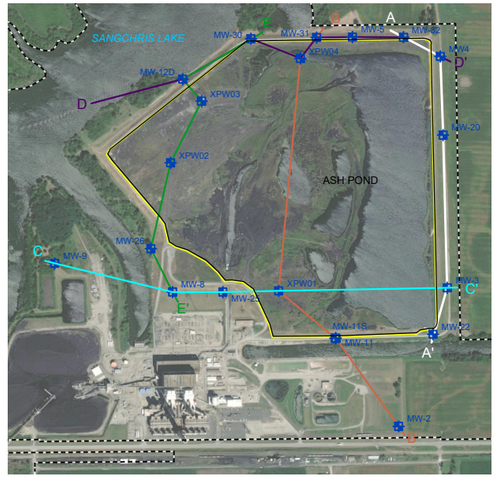
RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

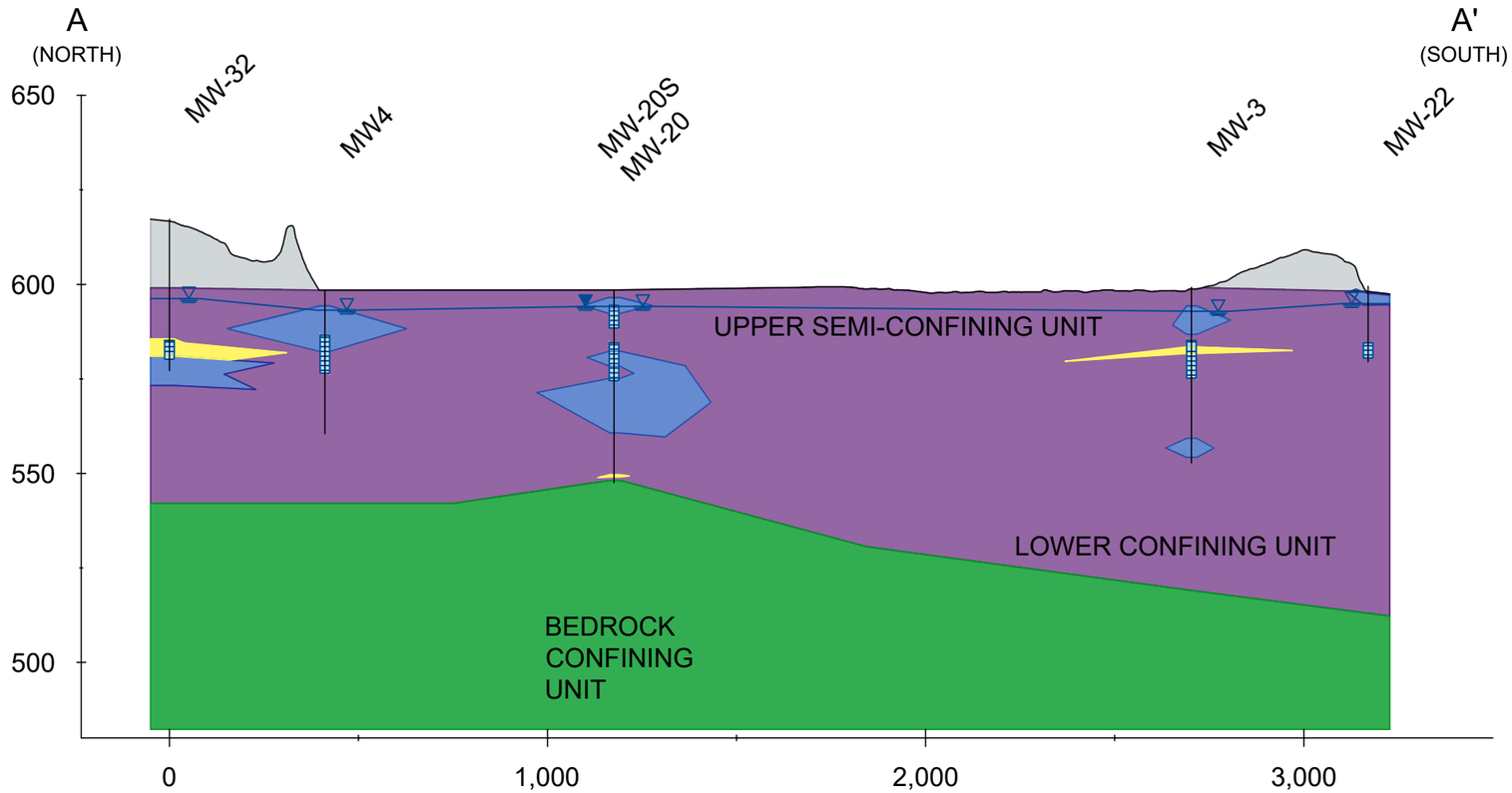
RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Kincaid\Figure 2-6_Bottom of Ash.mxd
PROJECT: 169000XXXX | DATED: 9/30/2021 | DESIGNER: STOLZSD

NOTES

1. This profile was developed by interpolation between widely spaced boreholes. Only at the borehole location should it be considered as an approximately accurate representation and then only to the degree implied by the notes on the borehole logs.
2. Scale is approximate.
3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
5. Groundwater elevations measured on July 22-23, 2021.





LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

40' 0 400'

GEOLOGIC CROSS SECTION A-A'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT ASH POND

KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-7

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 1690006869 DRAWN BY: MW DESIGNED BY: MW CHECKED BY: TK SCALE: AS NOTED DATE: 10/28/2021 FILE: P:\Documents\CCR GW\Deliverables\Part 845 Operating Permits\Sites\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg

NOTES

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3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
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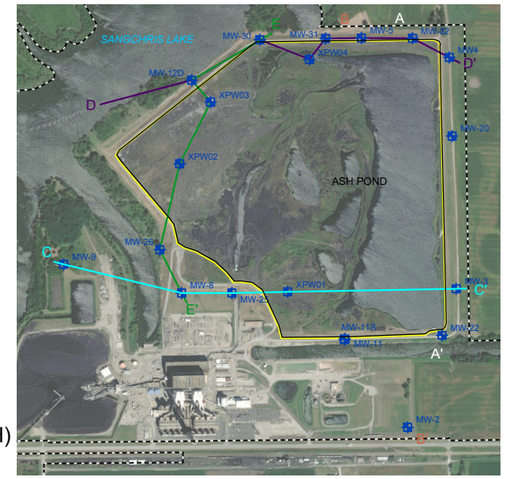
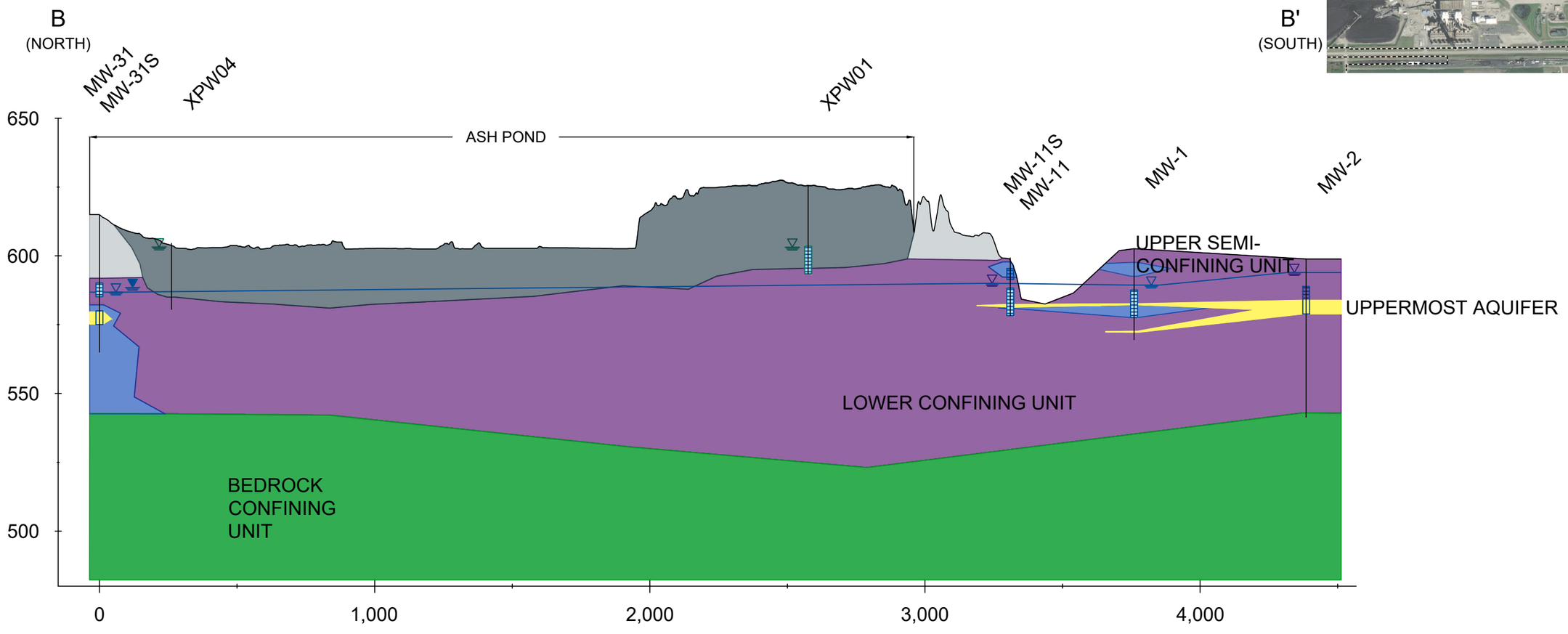


B
(NORTH)

B'
(SOUTH)



LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

40' 0 400'

GEOLOGIC CROSS SECTION B-B'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-8

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: \\ramboldata.com\data\Projects\Projects_US\Documents\Documents-CCR GW\Deliverables\Part 845 Operating Permits\Sites\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg

NOTES

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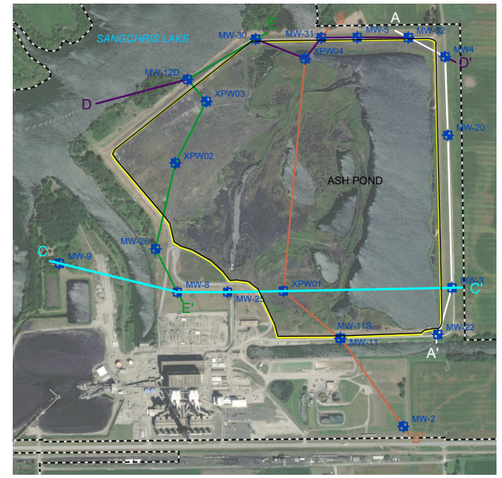
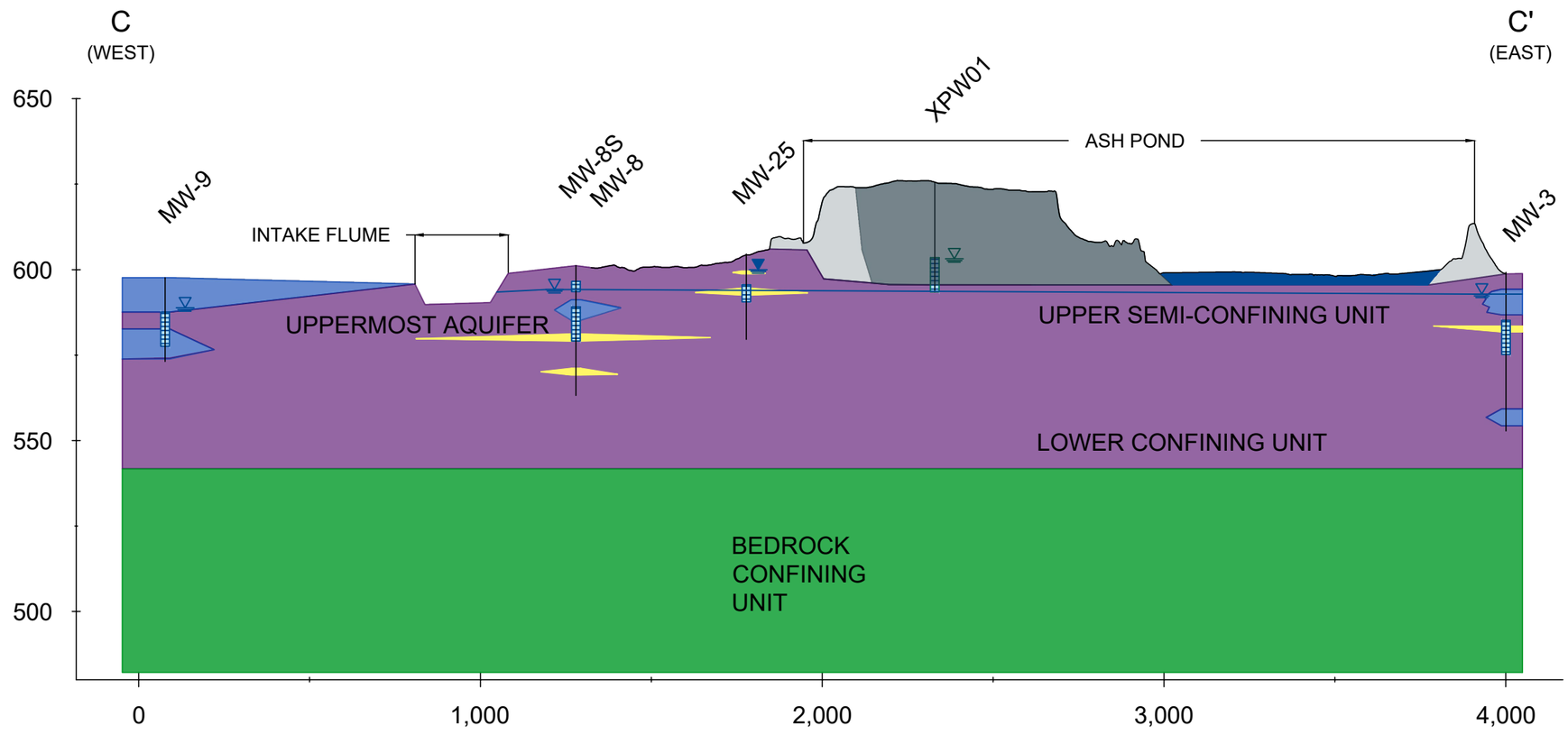
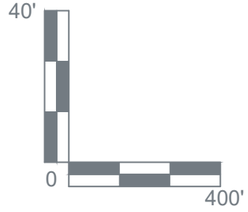
3. Vertical scale is exaggerated 10X.
4. Vertical Datum: NAVD88
5. Groundwater elevations measured on July 22-23, 2021.





LEGEND

- SURFACE WATER
- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)



GEOLOGIC CROSS SECTION C-C'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-9

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: \\amrdata\data\projects\2021\1690021892 - Kincaid AWMP\Deliverables\Part 845 Operating Permits\Sites\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg
Documents\-CCR GW\Deliverables\Part 845 Operating Permits\Sites\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg

NOTES

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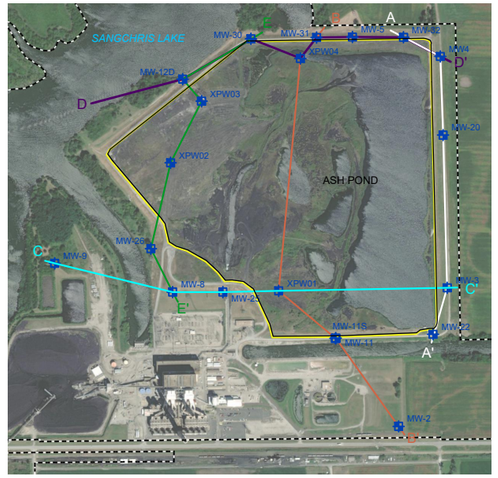
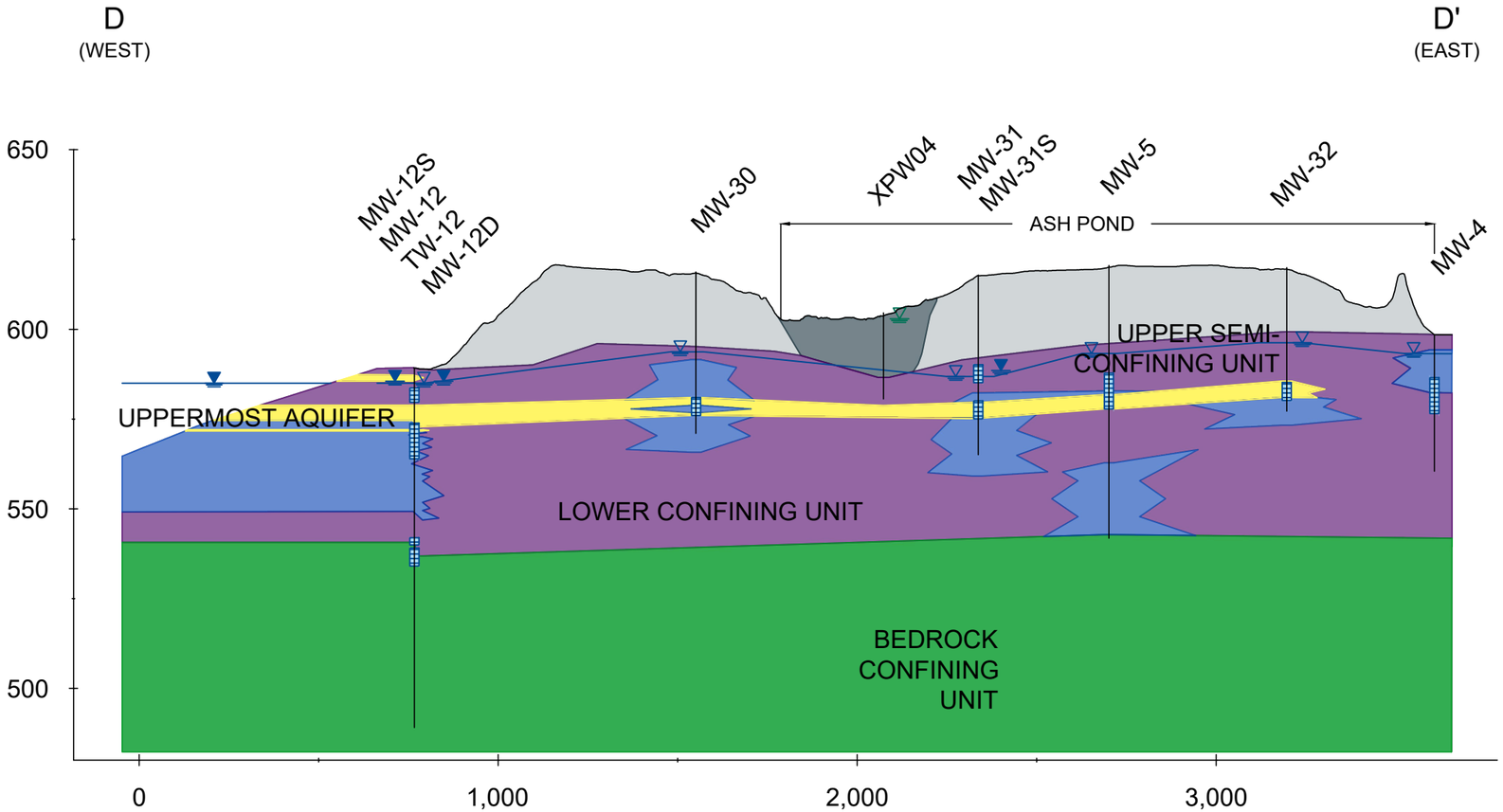
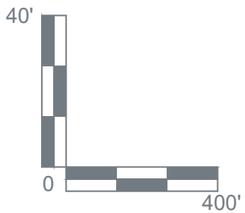
5. Groundwater elevations measured on July 22-23, 2021.





LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)
- SURFACE WATER



GEOLOGIC CROSS SECTION D-D'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT ASH POND

KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-10

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: \\amnbldata.amer.ramboll.com\projects\US-Projects\US-Projects\Projects\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg
DATE: 10/28/2021 10:44:49 AM
USER: ENKEMEN, STEVEN
XREF: Documents\-CCR GWDeliverables\Part 845 Operating Permits\Sites\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg

NOTES

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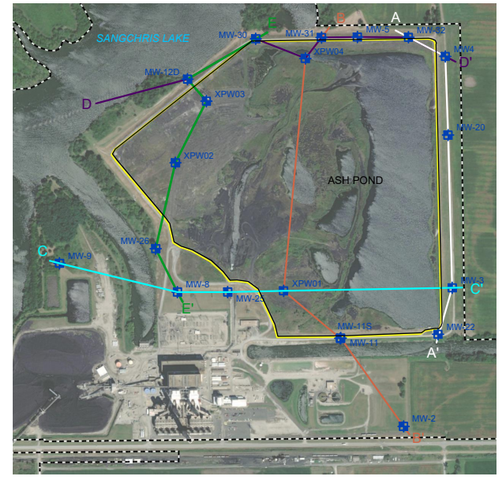
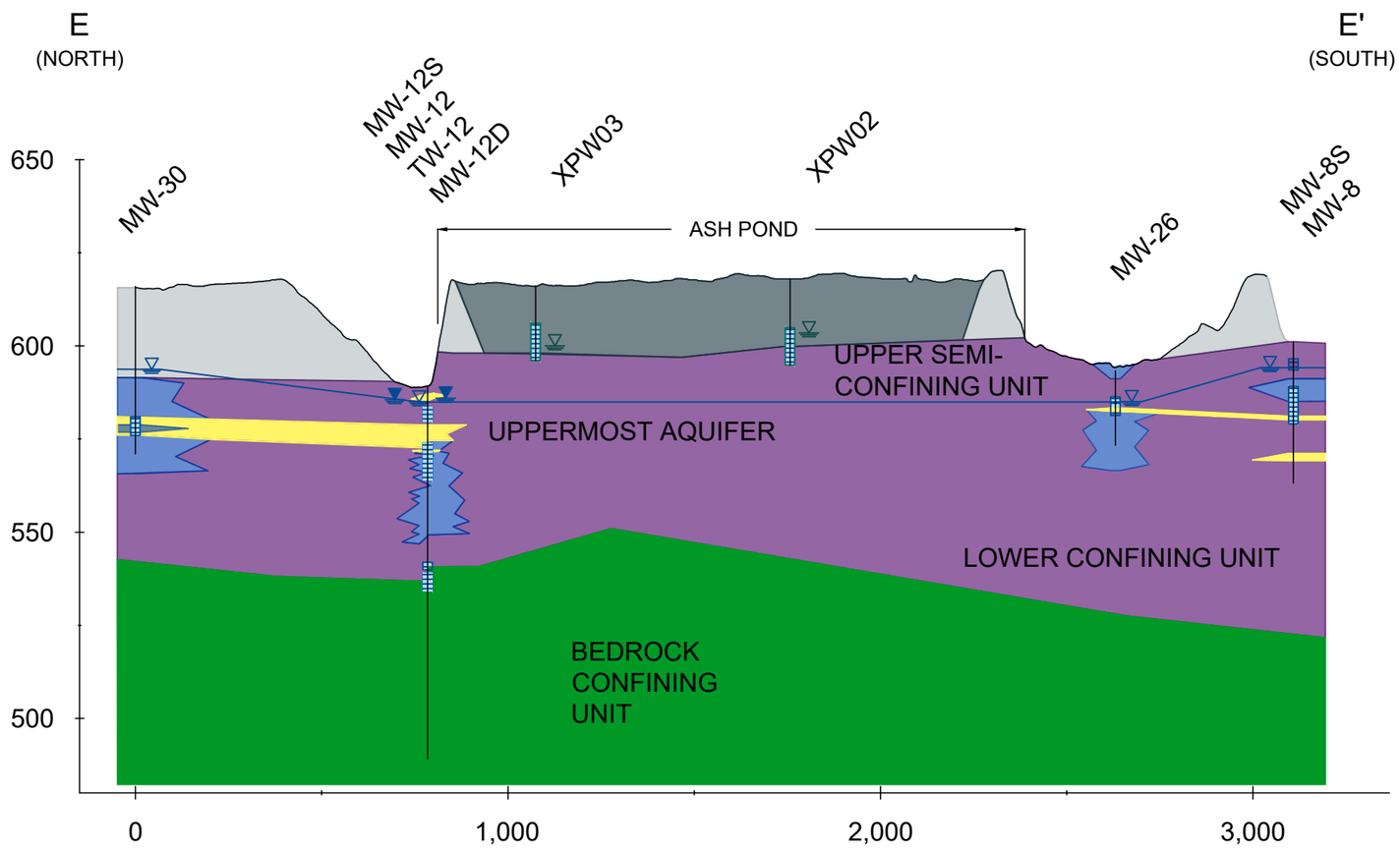
4. Vertical Datum: NAVD88
5. Groundwater elevations measured on July 22-23, 2021.





LEGEND

- COAL COMBUSTION RESIDUALS, CCRs
- FILL
- CLAY (CL/CH)
- SILT (ML)
- SAND (SP/SM/SW)
- BEDROCK / WEATHERED BEDROCK (INTERBEDDED SHALE, LIMESTONE, SANDSTONE, V. LITTLE SS)
- WELL SCREEN INTERVAL
- UPPERMOST AQUIFER POTENTIOMETRIC SURFACE
- UPPER AQUIFER GROUNDWATER ELEVATION
- POREWATER ELEVATION
- BEDROCK GROUNDWATER / OTHER GROUNDWATER / SURFACE WATER ELEVATION(S)

40' 0 400'

GEOLOGIC CROSS SECTION E-E'

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT ASH POND

KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-11

RAMBOLL AMERICAS ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 1620010869 DATE: 10/28/2021 10:34 AM USER: bcollins DRAWING: I:\gm\projects\1620010869\Deliverables\Part 845 Operating Permits\Sites\Kincaid\Hydrogeo\Figures\EVS\working files\CAD\Cross Sections\Kincaid Cross Sections.dwg

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 3-1_Monitoring Well Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/1/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE

PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

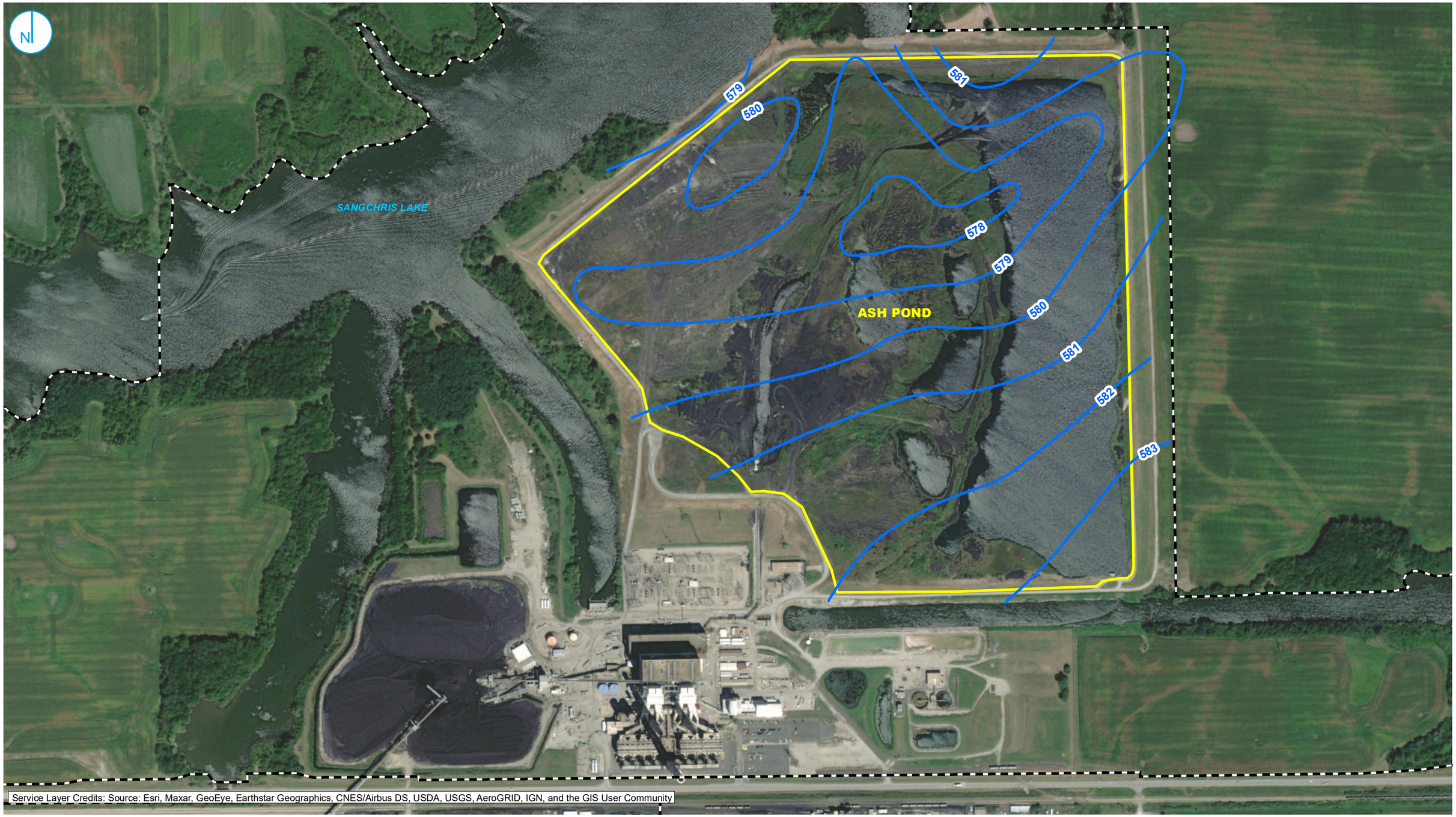
MONITORING WELL LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 3-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL



INTERPRETED TOP OF UPPERMOST AQUIFER (95TH PERCENTILE GROUNDWATER ELEVATION CONTOURS)

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 250 500 Feet

NOTE

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

TOP OF UPPERMOST AQUIFER

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 3-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/18/2021 | DESIGNER: STOLZSD

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

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

GROUNDWATER ELEVATION CONTOUR FEBRUARY 23, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 3-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 10/1/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 3-3_GWE_Contours_20210223.mxd

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 3-4_GWE_Contours_20210315.mxd

ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

- BACKGROUND WELL
- MONITORING WELL
- SOURCE SAMPLE LOCATION
- STAFF GAGE

- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 250 500 Feet

GROUNDWATER ELEVATION CONTOUR MARCH 15, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 3-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

GROUNDWATER ELEVATION CONTOUR APRIL 5, 2021

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 3-5

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 9/28/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\Figure 3-5_GWE_Contours_20210405.mxd

APPENDICES

APPENDIX A
HISTORIC PLAT OF SURVEY MAP (1966)

SECTION THRU DISCHARGE FLUME
SCALE: 1" = 50'-0"

SECTION THRU INTAKE FLUME
SCALE: 1" = 50'-0"

SOUTH LINE SECTION 2 T-13N R4W
NORTH LINE SECTION 11 T-13N R4W
EAST LINE SECTION 2 T-13N R4W
WEST LINE SECTION 1, T-13N R4W
SOUTH LINE SECTION 1 T-13N R4W
NORTH LINE SECTION 12 T-13N R4W
INTAKE FLUME EL 555.0
MINE #8
MINE #10
FUTURE
COAL STORAGE
1¾ MILLION TONS
50'-0" HIGH
SWITCHYARD
CIRCULATING WATER SUPPLY
TURBINE ROOM
BOILER ROOM
PRECIPITATOR
CRUSHER HOUSE
CONSTRUCTION TRACKS
EL. 565'-0" DISCHARGE FLUME
WEIR & SPILLWAY
FUTURE TRACK TO TRACK HOPPER
MINE CONVEYOR
BM 599.0
HIGHWAY ROUTE Nº 104
C & I M RAILROAD
SEC. 11
SEC. 12
EAST LINE SECTION 11 T13N R4W
WEST LINE SECTION 12 T13N R4W
NORTH

PROPERTY PLAT
UNITS NO. 1 & NO. 2
KINCAID STATION
COMMONWEALTH EDISON CO.
CHICAGO, ILLINOIS

SCALE 1" = 200'-0"
DRAWN F. TROYKE 12-9-66
CHECKED
ENGINEER
APPROVED
JOB NO. 3087

SARGENT & LUNDY
ENGINEERS
CHICAGO 3, ILLINOIS
DRAWING NO.
SCHEME 1

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

SUMMARY OF POTENTIAL RECEPTORS WITHIN 1,000 METERS

DESKTOP STUDY

KINCAID POWER PLANT

ASH POND

KINCAID, IL

Category	Number of Receptors Identified Within 1,000 Meters	Number of Receptors Identified Downgradient of Unit	Notes
Wells	9	2	
Surface Water Features	21	9	
Historic Sites	1	1	
Natural Sites	-	---	
Threatened or Endangered Species	5	5	Data provided only at county level
Mines	2	---	Mines identified are located beneath unit
Oil Sites	2	2	Dry/ Plugged Units

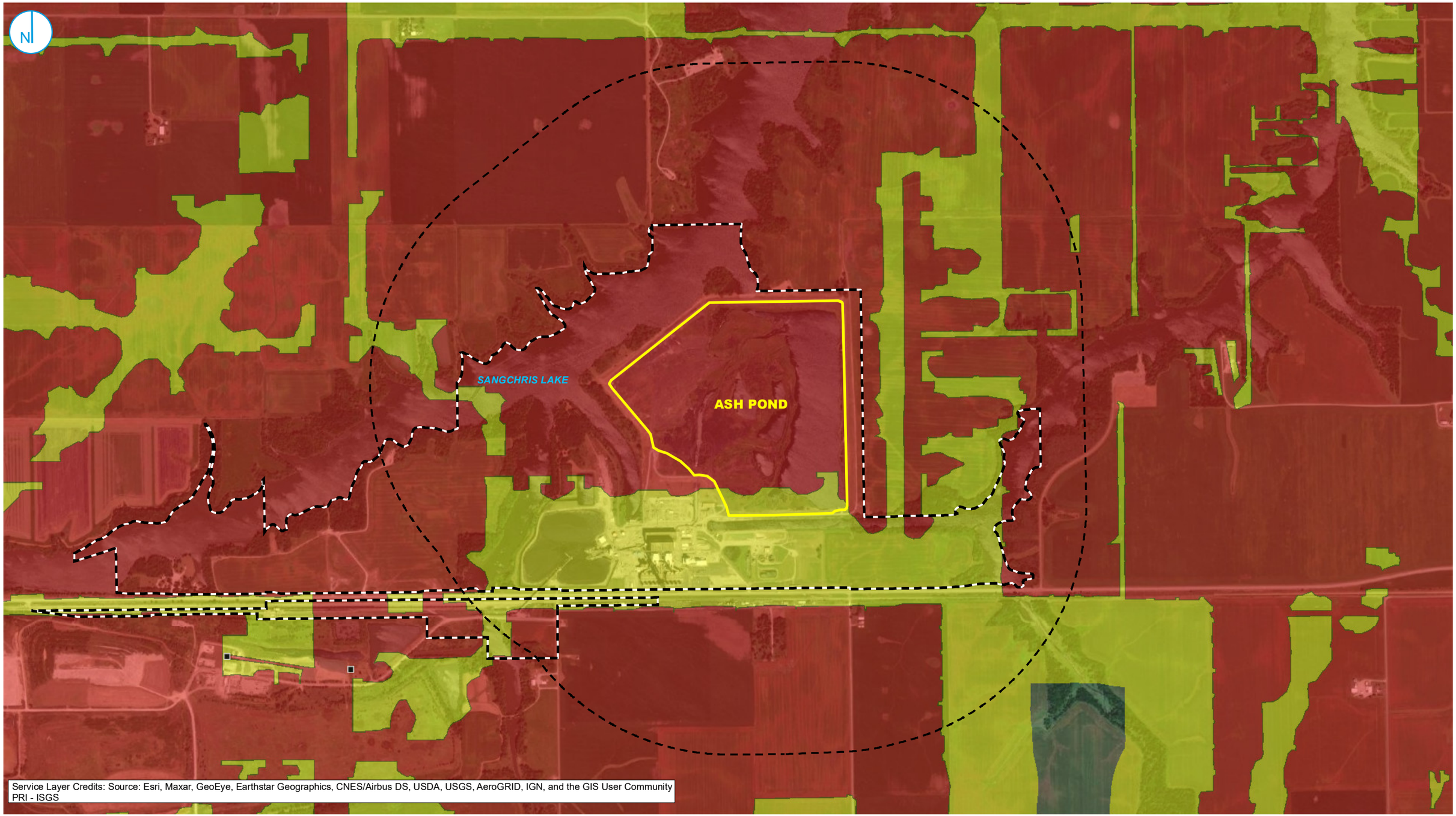
[O: LTA 04/08/21; C: LDC 09/15/21]

Notes:

--- = none

RAMBOLL

MINING ACTIVITIES



Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Kincaid\Figure B-1_Active and Abandoned Coal Mines.mxd

PROJECT: 169000XXXX | DATED: 8/18/2021 | DESIGNER: STOLZSD

- COAL MINE SHAFT
- UNDERGROUND COAL MINE
- UNDERGROUND MINE BUFFER REGION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- 1000 METER UNIT BUFFER
- PROPERTY BOUNDARY

0 625 1,250 Feet

SOURCES:
ISGS - ILMINES

ACTIVE AND ABANDONED COAL MINES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE B-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

MINES WITHIN 1,000 METERS

DESKTOP STUDY

KINCAID POWER PLANT

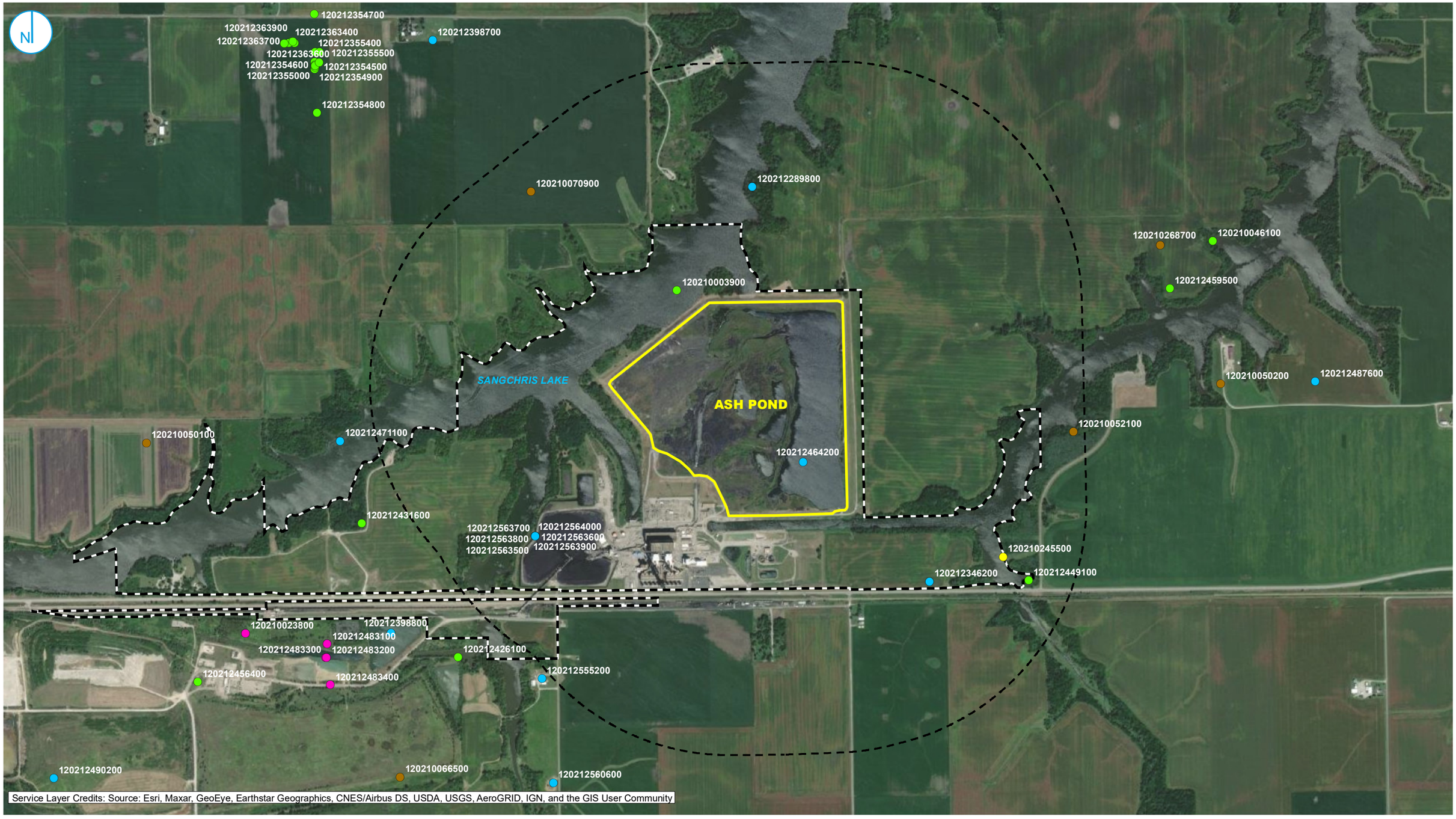
ASH POND

KINCAID, IL

Mine ID	Mine Name	Distance from Unit (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Range of Active Dates	Mine Type	Coal Unit Mined	Mine Depth Top (ft BGS)	Mine Depth Bottom (ft BGS)	Final Extent Map Available
0220	Peabody No. 8 Mine	244	Below and surrounding	Downgradient	1914-1954	Main Shaft/Air Shaft	Herrin	--	370	Yes
0693	Peabody No. 10 Mine	0	Below and surrounding	Upgradient	1951-1994	Main Slopt/Air Shaft	Herrin	300	380	Yes

[O: LTA 04/08/21; C: LDC 09/15/21]

WATER WELL SURVEY



Y:\Mapping\Projects\22\22885\MXD\845_Operating_Permit\Kincaid\Figure B-2_Drinking Water Intakes Pumps Other Water Uses.mxd

PROJECT: 169000XXXX | DATED: 8/18/2021 | DESIGNER: STOLZSD

- DRY
- ENGINEERING
- MINE-RELATED
- WATER
- N/A

- PART 845 REGULATED UNIT (SUBJECT UNIT)
- 1000 METER UNIT BUFFER
- PROPERTY BOUNDARY

0 625 1,250 Feet

SOURCE:
IL WELLS

DRINKING WATER INTAKES, PUMPS, AND OTHER WATER USES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE B-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

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

Well Number	Date Constructed	Ground Elevation (ft NAVD88)	Screen Top Depth (FT BGS)	Screen Bottom Depth (ft BGS)	Screen Length (ft)	Screen Diameter (inches)	Well Depth (ft BGS)	Total Boring Depth (ft BGS)	Latitude (DD)	Longitude (DD)	Hydraulic Position Designation (B/Sd/U/D)	Notes
120210003900	12/31/1911	---	---	---	---	---	---	310	39.601681	-89.495745	D	coal test, Herrin Coal #6
120210052100	4/1/1956	590	---	---	---	---	---	1933	---	---	---	dry and abandoned
120210070900	12/1/1954	606	---	---	---	---	---	1914	---	---	---	dry and abandoned
120210245500	7/1/1964	---	---	---	---	---	25	28	39.59156	-89.479955	---	engineering test
120212289800	4/1/1975	---	11	47	36	36	47	47	39.605548	-89.492034	D	municipal water well
120212346200	3/4/1980	---	10	30	20	30	30	30	39.590652	-89.483559	---	water well, commercial
120212449100	11/1/1996	---	---	---	---	---	---	21	39.590657	-89.478728	---	test hole
120212464000	02/08/1996	---	12	35	23	36	50	50	39.547152	-89.447541	---	private water well
120212464200	2/14/1996	---	11	62	51	36	68	68	39.595172	-89.489659	---	private water well

[O: LTA 04/08/21; C: LDC 09/15/21]

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

ILLINOIS STATE GEOLOGICAL SURVEY

Coal Test	Top	Bottom
surface	0	2
sand	2	15
sandstone	15	19
limestone	19	30
slate, blue	30	34
slate, black	34	40
limestone	40	55
slate, blue	55	107
slate, black	107	108
coal	108	110
slate, light	110	129
coal	129	130
limestone	130	135
sandstone	135	156
slate, sandy	156	232
slate, light	232	237
slate, blue	237	244
limestone	244	249
slate, blue	249	260
sandstone	260	267
limestone	267	269
slate, light	269	272
limestone	272	274
shale	274	278

Permit Date: **Permit #:**

COMPANY owner

FARM Whitecraft, Mrs.

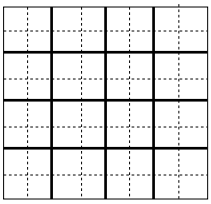
DATE DRILLED January 1, 1912 **NO.** 8

ELEVATION 569GL **COUNTY NO.** 00039

LOCATION SW NW SW

LATITUDE 39.601681 **LONGITUDE** -89.495745

COUNTY **Christian** **API 120210003900** **1 - 13N - 4W**



ILLINOIS STATE GEOLOGICAL SURVEY

sandstone	278	287
slate, black	287	289
limestone	289	298
slate, black	298	299
coal (6)	299	306
fireclay, very soft	306	310
Herrin Coal #6	299	306
Total Depth		**310**

Driller's Log filed

Owner Address: ,
Location source: Location from the driller

owner Whitecraft, Mrs 8

COUNTY Christian **API 120210003900** **1 - 13N - 4W**

ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Ste Genevieve	834	
Rosiclare	856	900
Fredonia	900	1203
Osage	1203	1422
Keokuk	1422	1638
Chouteau	1638	1660
Kinderhook	1660	1735
Rockford	1735	1738
New Albany	1738	1848
Devonian	1848	1850
Silurian	1850	1933
Aux Vases	8908	817
Total Depth		1933

Dry and abandoned.

Plugged March 2, 1956.

Electric Log filed.
Drilling Time Log filed.
Survey Core Study filed.

Core # 3332 1844'- 1874'Silurian
1844'- 1874'Devonian
Sample set # 26587110'- 1930'

Imaged Log viewing help: New users please read this.

GET FILE Induction Electric Log

Get Scout Check Ticket for this well.

Get Handwritten Scout Ticket for this well.

Get Scanned Documents for this well.

Get Scanned Drilling Time Log.

Permit Date March 23, 1956 **Permit #** 958 **Reference #** 803578

COMPANY Wirth, Edward Lee

FARM Bryant **NO.** 1

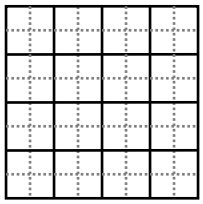
DATE DRILLED April 1, 1956 **COUNTY NO** 00521

AUTHORITY

ELEVATION 590' KB

LOCATION 275'N line, 321'W line of section

COUNTY **CHRISTIAN** **API#120210052100** **7-13N-3W**



ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom

Wirth, Edward Lee Bryant #1

COUNTY **CHRISTIAN** **API#** **120210052100** **7-13N-3**

ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Pennsylvanian	71	743
Paint Creek	743	795
Renault	795	804
Aux Vases	804	824
Ste Genevieve	835	850
Rosiclare	850	882
Fredonia	882	1148
Osage	1148	1354
Keokuk	1354	1616
Chouteau	1616	1632
Kinderhook	1632	1760
New Albany	1760	1826
Silurian	1826	1914
Total Depth		1914

Dry and abandoned.

Plugged December 23, 1954.

Electric Log filed.
Drilling Time Log filed.
Survey Core Study filed.

Core # 3192 1828'- 1853'Silurian
Sample set # 25281100'- 1915'

Imaged Log viewing help: New users please read this.

GET FILE Induction Electric Log

Get Scout Check Ticket for this well.

Get Handwritten Scout Ticket for this well.

Get Scanned Documents for this well.

Permit Date December 16, 1954 **Permit #** 288 **Reference #** 803638

COMPANY Heath, B. M. etal

FARM Kavanaugh Trust **NO.** 1

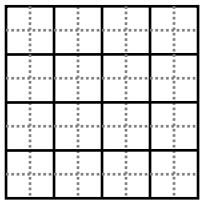
DATE DRILLED December 1, 1954 **COUNTY NO** 00709

AUTHORITY

ELEVATION 606' DF

LOCATION 330'S line, 990'W line of NE

COUNTY **CHRISTIAN** **API#120210070900** **2-13N-4W**



ILLINOIS STATE GEOLOGICAL SURVEY

	Top	Bottom
Get Scanned Drilling Time Log.		

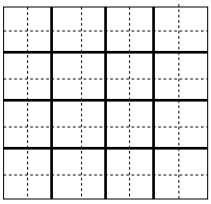
ILLINOIS STATE GEOLOGICAL SURVEY

Engineering Test	Top	Bottom
red-brown silty clay (medium)	0	7
gray-brown silty clay (stiff)	7	9
black silty clay loam (medium)	9	18
gray-brown silty clay till (hard)	18	22
brown silt (very dense)(medium)	22	24
gry-brn sty cl till (vy dns)anglr lyrs	24	28
Total Depth		**28**

Owner Address: ,
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM SBI 104
DATE DRILLED July 1, 1964 **NO.** 1
ELEVATION 587GL **COUNTY NO.** 02455
LOCATION SE NE
LATITUDE 39.59156 **LONGITUDE** -89.479955
COUNTY **Christian** **API 120210245500** **12 - 13N - 4W**



ILLINOIS STATE GEOLOGICAL SURVEY

Municipal Water Supply	Top	Bottom
SS#60180	0	0
top soil, black	0	2
yellow clay	2	15
yellow sand & gravel, little water	15	17
gray sandy clay	17	36
brown shale soft	36	42
brown clay	42	47
rock at	47	47
Total Depth		**47**

Casing: 6" 40# STEEL PIPE from -1' to 11'
36" CONCRETE PIPE from 11' to 46'
38" CONCRETE PIPE from 44' to 47'

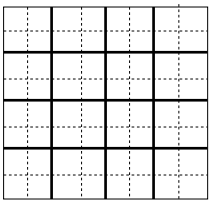
Water from drift at 11' to 47'.
Static level 4' below casing top which is 1' above GL
Pumping level 23' when pumping at 5 gpm for 3 hours

Driller's Log filed
Sample set # 60180 (0' - 50') Received: February 10, 1976

Owner Address: ,
Add'l loc. info: FALSE
ST.of Ill. Dept.of Conser
Location source: Location from permit

Permit Date: October 29, 1974 **Permit #:** 34214

COMPANY owner
FARM SangChris State Park
DATE DRILLED April 1, 1975 **NO.** 1-1975
ELEVATION 0 **COUNTY NO.** 22898
LOCATION 2315'N line, 1390'W line of NW
LATITUDE 39.605548 **LONGITUDE** -89.492034
COUNTY **Christian** **API 120212289800** **1 - 13N - 4W**



ILLINOIS STATE GEOLOGICAL SURVEY

Water Well for Commercial Operation	Top	Bottom
top soil	0	1
light gray clay	1	8
medium gray w/yellow	8	18
dark gray w/yellow	18	30
Total Depth		**30**

Casing: 6" PVC SCH 40 from -2' to 10'
30" CONCRETE from 10' to 30'

Water from clay at 16' to 18'.
Static level 3' below casing top which is 2' above GL

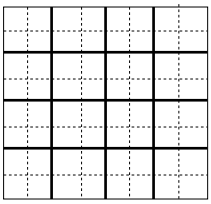
Remarks: sub pump set at 27'

Driller's Log filed
Sample set # 62948 (0' - 30') Received: April 14, 1980

Owner Address: Kincade, IL
Location source: Platbook verified

Permit Date: February 27, 1980 **Permit #:** 92795

COMPANY Erwin, James Ray
FARM Commonwealth Edison
DATE DRILLED March 4, 1980 **NO.** 1
ELEVATION 0 **COUNTY NO.** 23462
LOCATION SE SW NE
LATITUDE 39.590652 **LONGITUDE** -89.483559
COUNTY **Christian** **API 120212346200** **12 - 13N - 4W**



ILLINOIS STATE GEOLOGICAL SURVEY

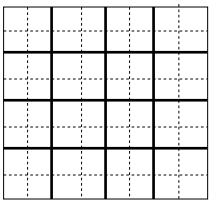
Test Hole	Top	Bottom
C#C4911 (0-20.5')	0	0
Total Depth		**21**

Core #C 4911 (0' - 21') Received: November 1, 1996

Owner Address: ,
Add'l loc. info: FALSE
Paris District
Location source: Location from the driller

Permit Date: **Permit #:**

COMPANY owner
FARM SBI 104 test
DATE DRILLED **NO.** 2
ELEVATION 0 **COUNTY NO.** 24491
LOCATION SE SE NE
LATITUDE 39.590657 **LONGITUDE** -89.478728
COUNTY **Christian** **API 120212449100** **12 - 13N - 4W**



ILLINOIS STATE GEOLOGICAL SURVEY

Private Water Well	Top	Bottom
clay	0	8
sandy clay	8	12
gravelly clay	12	17
gray gravelly clay	17	34
gray sandy gravel	34	35
gray gravelly clay	35	50
Total Depth		**50**

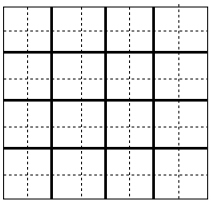
Casing: 6" PLASTIC from 0' to 10'
36" CONCRETE from 0' to 50'

Water from gravelly clay-sand at 12' to 35'.

Owner Address: R.R. #2 Box #148 Pawnee, IL
Location source: Location from permit

Permit Date: January 31, 1996 **Permit #:**

COMPANY Walters, Steven
FARM Braeuniger, Walter
DATE DRILLED February 8, 1996 **NO.**
ELEVATION 0 **COUNTY NO.** 24640
LOCATION SE SW NE
LATITUDE 39.547152 **LONGITUDE** -89.447541
COUNTY **Christian** **API 120212464000** **29 - 13N - 3W**



ILLINOIS STATE GEOLOGICAL SURVEY

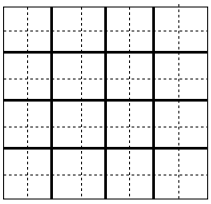
Private Water Well	Top	Bottom
black dirt	0	2
brown clay	2	11
sandy brown clay	11	16
gray clay	16	22
sand	22	23
gray clay	23	30
sand	30	31
gray clay	31	62
soft sandstone	62	68
Total Depth		**68**

Casing: 6" PVC from -1' to 11'
36" CONCRETE from 11' to 68'
Water from clay-sandstone at 11' to 62'.

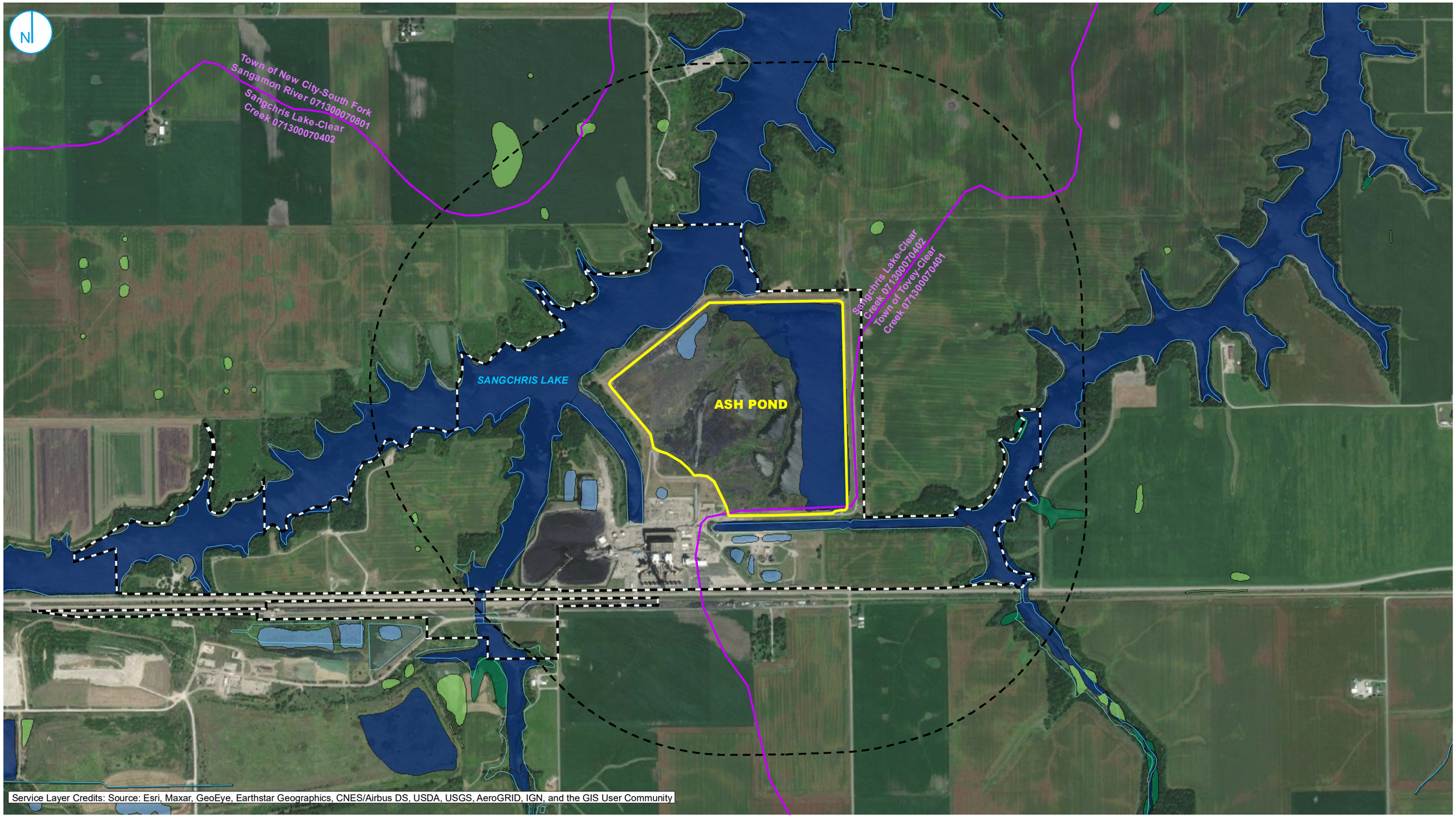
Owner Address: R.R. #2 Box #137 E Pawnee, IL
Location source: Location from permit

Permit Date: February 14, 1996 **Permit #:**

COMPANY Reynolds Well Drilling
FARM Terra International Inc.
DATE DRILLED February 14, 1996 **NO.**
ELEVATION 0 **COUNTY NO.** 24642
LOCATION NE NW
LATITUDE 39.595172 **LONGITUDE** -89.489659
COUNTY **Christian** **API 120212464200** **12 - 13N - 4W**



SURFACE WATERS



SURFACE WATERBODY
WATERSHED BOUNDARY (HUC 12)
PART 845 REGULATED UNIT (SUBJECT UNIT)
1000 METER UNIT BUFFER
PROPERTY BOUNDARY

0 625 1,250 Feet

NATIONAL WETLANDS INVENTORY
FRESHWATER EMERGENT WETLAND
FRESHWATER FORESTED/SHRUB WETLAND
FRESHWATER POND
LAKE
OTHER
RIVERINE

SOURCES:
USGS, USFWS

SURFACE WATERBODIES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE B-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/18/2021 | DESIGNER: STOLZSD

Y:\Mapping\Projects\2202285\MXD\845_Operating_Permit\Kincaid\Figure B-3_Surface Waterbodies.mxd

SURFACE WATER FEATURES WITHIN 1,000 METERS

DESKTOP STUDY

KINCAID POWER PLANT

ASH POND

KINCAID, IL

HUC	Surface Water ID	Distance from Unit (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Classification Code	Size (acres)
07130007	Lake (Sangchris Lake)	27	NW, SE	Downgradient	L1UBHh	300.4
--	Freshwater Pond 1	30	NW	Downgradient	PUBGh	2.60
--	Freshwater Pond 2	335	SW	Upgradient	PUBGx	1.40
--	Freshwater Pond 3	305	SW	Upgradient	PUBGx	2.10
--	Freshwater Pond 4	146	SW	Upgradient	PUBGx	0.45
--	Freshwater Pond 5	91	SW	Upgradient	PUBGx	0.65
--	Freshwater Pond 6	91	SW	Upgradient	PUBGx	0.83
--	Freshwater Pond 7	152	SW	Upgradient	PUBGx	0.63
--	Freshwater Pond 8	183	SW	Upgradient	PUBGx	0.42
--	Freshwater Pond 9	213	SW	Upgradient	PUBGx	0.86
--	Creek (Clear Creek)	229	NW, SE	Downgradient	--	--
--	Freshwater Emergent Wetland 1	914	NW	Downgradient	PEM1Af	6.59
--	Freshwater Emergent Wetland 2	701	NW	Downgradient	PEM1Af	0.36
--	Freshwater Emergent Wetland 3	853	NW	Downgradient	PEM1Af	0.98
--	Freshwater Emergent Wetland 4	731	N	Downgradient	PEM1C	0.57
--	Freshwater Emergent Wetland 5	320	N	Upgradient	PEM1Af	0.64
--	Freshwater Emergent Wetland 6	1067	SW	Upgradient	PEM1Af	0.26
--	Freshwater Forested/Shrub Wetland 1	716	E	Downgradient	PFO1A	1.00
--	Freshwater Forested/Shrub Wetland 2	762	SE	Downgradient	PFO1Ah	2.99
--	Freshwater Forested/Shrub Wetland 3	823	SE	Upgradient	PFO1Ah	0.82
--	Riverine	792	SE	Upgradient	R5UBH	0.07

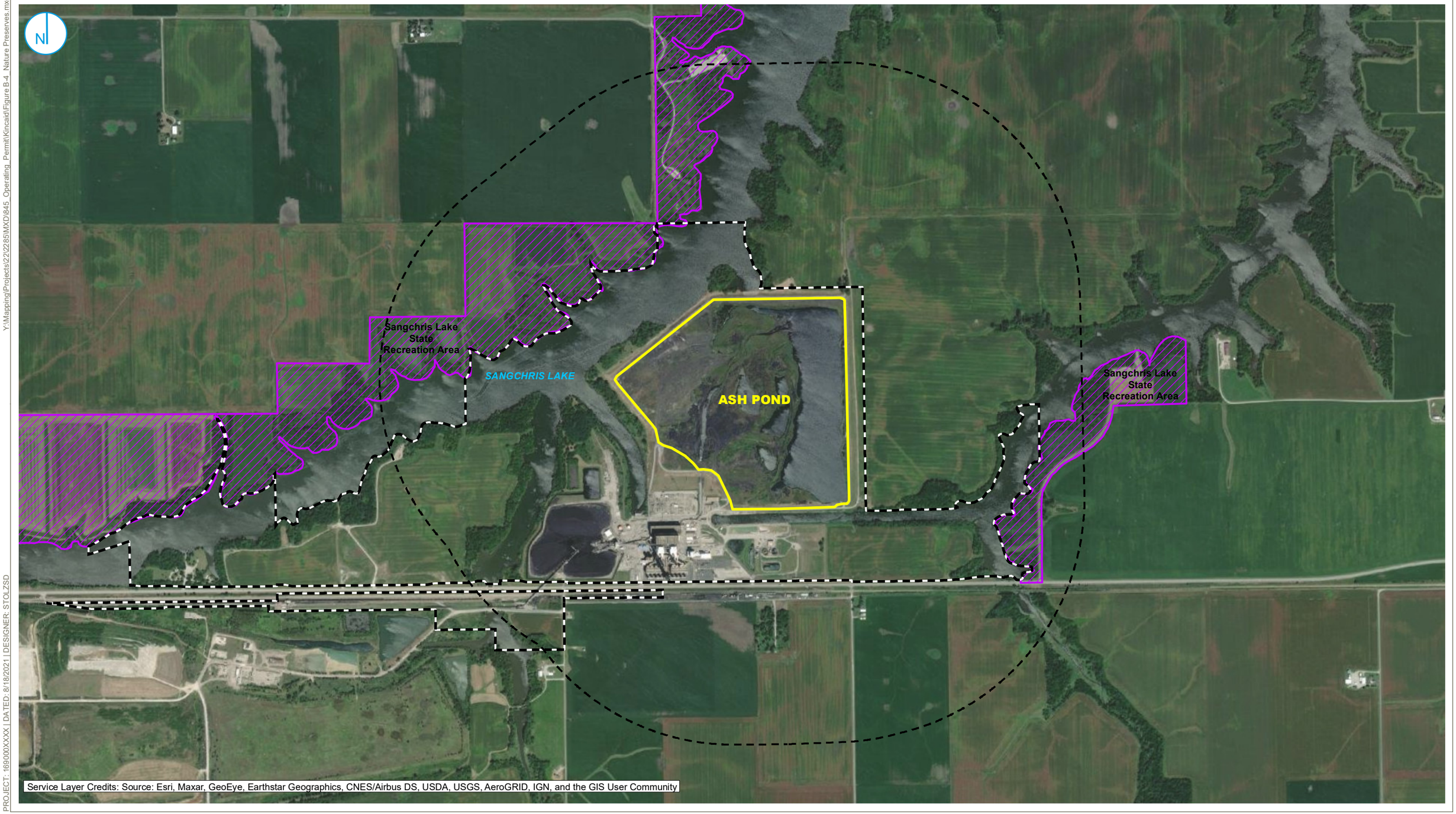
[O: LTA 04/08/21; C: LDC 09/15/21]

Notes:

-- = not applicable
E = east
HUC = Hydrologic Unit Code
N = north
NW = northwest
SE = southeast
SW = southwest
W = west

RAMBOLL

NATURE PRESERVES, HISTORIC SITES, ENDANGERED/THREATENED SPECIES



PROJECT: 169000XXXX | DATED: 8/18/2021 | DESIGNER: STOLZSD

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

PROTECTED AREA
PART 845 REGULATED UNIT (SUBJECT UNIT)
1000 METER UNIT BUFFER
PROPERTY BOUNDARY

0 625 1,250 Feet

SOURCES:
USGS - PAD-US, USFWS

NATURE PRESERVES

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE B-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

NATURAL AND HISTORIC SITES WITHIN 1,000 METERS

DESKTOP STUDY

KINCAID POWER PLANT

ASH POND

KINCAID, IL

INAI/INPC Number	INAI/INPC Name	Category/Categories	Size (acres)	Distance from Unit (meters)	Orientation to Unit
--	Abraham Lincoln National Heritage Area	I, III	17,053,708	0	Within

[O: LTA 04/08/21; C: LDC 09/15/21]

Notes:

-- = not applicable
INAI = Illinois Natural Areas Inventory
INPC = Illinois Nature Preserves Commission
I = High quality natural community and natural community restorations
II = Specific suitable habitat for state-listed species or state-listed species relocations
III = State dedicated Nature Preserves, Land and Water Reserves, & Natural Heritage Landmarks
IV = Outstanding geological features
V = Not used at this time
VI = Unusual concentrations of flora or fauna and high quality streams

CHRISTIAN COUNTY THREATENED AND ENDANGERED SPECIES DESKTOP
STUDY
KINCAID POWER PLANT
ASH POND
KINCAID, IL

Scientific Name	Common Name	Status	Number of Occurances	Last Observed
Bartramia longicauda	Upland Sandpiper	LE	1	1979-07-28
Clonophis kirtlandii	Kirtland's Snake	LT	4	2019-09-01
Hylotelephium telephioides	American Orpine	LT	1	1948-06-02
Lanius ludovicianus	Loggerhead Shrike	LE	1	2000-06-12
Poliocitellus franklinii	Franklin's Ground Squirrel	LT	1	2019-06-01

[O: LTA 04/08/21; C: LDC 09/15/21]

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

OIL FIELDS

OIL FIELDS WITHIN 1,000 METERS

DESKTOP STUDY

KINCAID POWER PLANT

ASH POND

KINCAID, IL

ID Number	Oil Field Name	Distance from Unit (meters)	Physical Orientation to Unit	Hydraulic Orientation to Unit	Range of Active Dates	Field Type	Producing Unit	Top Depth of Producing Zone (ft BGS)	Bottom Depth of Producing Zone (ft BGS)	Notes
120210052100	Bryant	686	east	Downgradient	None Given	-	-	-	-	Dry and Abandoned, No Shows, Plugged
120210070900	Kavanaugh Trust	808	northwest	Downgradient	None GIven	-	-	-	-	Dry and Abandoned, No Shows, Plugged

[O: LTA 04/08/21; C: LDC 09/15/21]

Notes:

-- = not applicable

BGS = below ground surface

APPENDIX C
BORING AND WELL CONSTRUCTION LOGS

2021 Ramboll Soil Boring Logs

Y:\Mapping\Projects\222285MXD\845_Operating_Permit\Kincad\Figure 2-5_Field Investigation Location Map.mxd

PROJECT: 169000XXXX | DATED: 10/5/2021 | DESIGNER: STOLZSD

MONITORING WELL
SOURCE SAMPLE LOCATION
SOIL BORING
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

FIELD INVESTIGATION LOCATION MAP

HYDROGEOLOGIC SITE CHARACTERIZATION REPORT
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE C-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-11S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-11S	Feet (NAVD88)	599.43 Feet (NAVD88)	6.0 inches

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

State Plane 1,066,374.94 N, 2,486,959.86 E E/Ⓦ

1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 35.214"

Long -89° 29' 27.9672"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 8' **SILTY CLAY:** CL/ML, dark brown (10YR3/3), yellowish brown (10YR 5/6) mottling (5-10%), sand (0-10%), gravel (0-5%), hard to stiff, no dilatancy to slow dilatancy, medium to low toughness, dry to moist.	CL/ML				4.5					CS = Core Sample
			1											
			2	2.4' - 2.7' layer of silt brown (10YR 5/3), gravel (0-5%), dry.										
			3						3					
			4											
2 CS	36 26		5	5' brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (15-25%), firm to stiff, slow dilatancy, moist.					1.5					
			6											
			7						1					
			8	8' End of Boring.										

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

Signature

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

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

Template: RAMBOLL_IL_BORING LOG - Project: 845_KINCAID_2021.GPJ

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-12D

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-12D	Feet (NAVD88)	589.08 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,939.69 N, 2,485,442.58 E E/Ⓦ

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 36' 0.6732"

Long -89° 29' 47.1048"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0.5 1.0 1.5	0 - 1.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), roots (5-15%), silt (5-15%), sand (0-5%), no dilatancy, medium toughness, medium plasticity, wet.	CL									CS = Core Sample
			2.0 2.5 3.0	1.8 - 3.1' **POORLY-GRADED SAND:** SP, dark yellowish brown (10YR 4/6), silt (15-30%), clay (5-15%), gravel (0-5%), loose, moist.	SP									
			3.5 4.0 4.5	3.1 - 5' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), silt (15-30%), sand (0-5%), roots (0-5%), no dilatancy, low toughness, low plasticity.	CL									
2 SH	24 24		5.0 5.5 6.0 6.5	5 - 7' **CLAYEY SAND:** SC.	SC					18.6	22	9	45.3	SH = Shelby Tube
3 CS	36 36		7.0 7.5 8.0 8.5 9.0 9.5 10.0	7 - 7.5' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), silt (15-30%), sand (0-5%), roots (0-5%), no dilatancy, low toughness, low plasticity. 7.5 - 10' **LEAN CLAY:** CL, brownish yellow (10YR 6/6), dark yellowish brown (10YR 4/6) mottling (5-15%), no dilatancy, low toughness, low to medium plasticity, moist.	CL CL									

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

Signature

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

Boring Number MW-12D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 MC	24 24		10.5 11.0 11.5	10 - 12' **LEAN CLAY:** CL.	CL					18.2	22	10	64.2	MC = Modified California
5 CS	36 36		12.0 12.5 13.0	12 - 12.8' **WELL-GRADED SAND WITH SILT:** SW, brownish yellow (10YR 6/6), subrounded to subangular sand, gravel (15-30%), clay (5-15%), wet.	SW									
			13.5 14.0 14.5	12.8 - 14.5' **SILTY SAND:** to **SANDY SILT:** SM, brownish yellow (10YR 6/6), fine subrounded sand, clay (15-30%), dense, wet.	SM									
6 CS	60 60		15.0 15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5	14.5 - 20' **SILT:** ML, grayish brown (10YR 5/2), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, low plasticity, dry.	ML									
7 SH	24 7		20.0 20.5 21.0 21.5	20 - 22' **CLAYEY SAND:** SC.	SC					14	22	9	47.6	
8 CS	156 156		22.0 22.5 23.0 23.5 24.0 24.5 25.0 25.5 26.0 26.5	22 - 39.8' **SILT:** ML, grayish brown (10YR 5/2), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, low plasticity, dry. 23.5' - 24' layer of silty clay, olive brown (2.5Y 4/3) mottling (5-15%), gray (10YR 5/1) mottling (0-5%), sand (5-15%), gravel (0-5%). 25' - 26.5' layer of silty clay, olive brown (2.5Y 4/3) mottling (0-5%), gray (10YR 5/1) mottling (5-15%).	ML									

Boring Number MW-12D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			27.0	22 - 39.8' **SILT:** ML, grayish brown (10YR 5/2), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, low plasticity, dry. *(continued)*										
			27.5											
			28.0											
			28.5	28.5' gray (10YR 5/1) mottling (15-30%), olive brown (2.5Y 4/3) mottling (5-15%), sand (15-30%).										
			29.0											
			29.5											
			30.0											
			30.5											
			31.0	31' - 33.5' layer of silty clay, gray (10YR 5/1), grayish brown (10YR 5/2) mottling (15-30%), olive brown (2.5Y 4/3) mottling (0-5%), dark yellowish brown (10YR 3/4) mottling (0-5%).										
			31.5											
			32.0											
			32.5											
			33.0											
			33.5	33.5' brown (10YR 4/3).	ML									
			34.0	34' - 34.5' layer of silty clay, gray (10YR 5/1), grayish brown (10YR 5/2) mottling (15-30%), olive brown (2.5Y 4/3) mottling (0-5%), dark yellowish brown (10YR 3/4) mottling (0-5%).										
			34.5											
9 CS	36 36		35.0	34.5' dark gray (10YR 4/1).										
			35.5											
			36.0											
			36.5											
			37.0											
			37.5											
10 CS	120 98		38.0											
			38.5											
			39.0											
			39.5											
			40.0	39.9 - 47.3' **LEAN CLAY:** CL, very dark gray (10YR 3/1), gray (10YR 5/1) mottling (0-5%), sand (0-5%), gravel (0-5%), slow dilatancy, high toughness, high plasticity, moist, laminated black (10YR 2/1) (0-5%).										
			40.5											
			41.0											
			41.5		CL									
			42.0											
			42.5											
			43.0											

Boring Number MW-12D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			43.5	39.9 - 47.3' **LEAN CLAY:** CL, very dark gray (10YR 3/1), gray (10YR 5/1) mottling (0-5%), sand (0-5%), gravel (0-5%), slow dilatancy, high toughness, high plasticity, moist, laminated black (10YR 2/1) (0-5%). *(continued)*	CL									
			44.0											
			44.5											
			45.0											
			45.5											
			46.0											
			46.5											
			47.0											
			47.5	47.3 - 48.4' **WELL-GRADED GRAVEL:** GW, gray (10YR 5/1), sand (5-15%), dry.	GW									
11 CS	72 72		48.0											
			48.5	48.4 - 56.6' **LIMESTONE:** BDX (LS), bluish black (GLEY2 5PB 2.5/1), fossiliferous, light gray (GLEY1 N 7/1) in recrystallized fossils, calcite replacement in some fossils.	BDX (LS)									
			49.0											
			49.5											
			50.0											
			50.5											
			51.0											
			51.5											
			52.0											
			52.5											
			53.0											
			53.5											
			54.0											
12 CS	72 72		54.5											
			55.0											
			55.5											
			56.0											
			56.5											
			57.0	56.6 - 60.8' **SHALE:** BDX (SH), black (GLEY 1 2.5/N).	BDX (SH)									
			57.5											
			58.0											
			58.5											
			59.0											
			59.5											
			60.0											

Boring Number MW-12D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
13 CS	240 120		60.5	56.6 - 60.8' **SHALE:** BDX (SH), black (GLEY 1 2.5/N). *(continued)*	BDX (SH)									
			61.0	60.8 - 68.8' **LIMESTONE:** BDX (LS), bluish black (GLEY2 5PB 2.5/1), fossiliferous, light gray (GLEY1 N 7/1) in recrystallized fossils, calcite replacement in some fossils.	BDX (LS)									
			68.5											
			69.0	68.8 - 81' **SHALE:** BDX (SH), black (GLEY 1 2.5/N).	BDX (SH)									
			76.5											

Boring Number MW-12D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			77.0	68.8 - 81' **SHALE:** BDX (SH), black (GLEY 1 2.5/N). *(continued)*										
			77.5											
			78.0											
			78.5											
			79.0		BDX (SH)									
			79.5											
14 CS	120 71		80.0											
			80.5											
			81.0	81 - 83' **LIMESTONE:** BDX (LS), bluish black (GLEY2 5PB 2.5/1), fossiliferous, light gray (GLEY1 N 7/1) in recrystallized fossils, calcite replacement in some fossils.										
			81.5											
			82.0		BDX (LS)									
			82.5											
			83.0	83 - 100' **SHALE:** BDX (SH), greenish gray (GLEY 1 10Gy 5/1) to gray (GLEY1 N 5/N), dark gray (10YR 4/1) laminae (5-15%), white (10YR 8/1) laminae (0-5%).										
			83.5											
			84.0											
			84.5											
			85.0											
			85.5											
			86.0											
			86.5											
			87.0											
			87.5											
			88.0		BDX (SH)									
			88.5											
			89.0											
			89.5											
15 CS	120 120		90.0											
			90.5											
			91.0											
			91.5											
			92.0											
			92.5											
			93.0											

Boring Number MW-12D

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			93.5	83 - 100' **SHALE:** BDX (SH), greenish gray (GLEY 1 10Gy 5/1) to gray (GLEY1 N 5/N), dark gray (10YR 4/1) laminae (5-15%), white (10YR 8/1) laminae (0-5%). *(continued)*	BDX (SH)									
			94.0											
			94.5											
			95.0											
			95.5											
			96.0											
			96.5											
			97.0	97' dark gray (10YR 4/1).										
			97.5											
			98.0											
			98.5											
			99.0											
			99.5											
			100.0	100' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-12S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	1/27/2021	1/27/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-12S	Feet (NAVD88)	588.62 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,944.79 N, 2,485,444.27 E E/W

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 36' 0.7236"

Long -89° 29' 47.0832"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 1.8' **LEAN CLAY:** CL, Blind drill to 9.5 feet below ground surface. See MW-12D boring log for detailed lithologies.	CL								
			2	1.8 - 3.1' **POORLY-GRADED SAND:** SP.	SP								
			3	3.1 - 5' **LEAN CLAY:** CL.	CL								
			4										
			5	5 - 7' **CLAYEY SAND:** SC.	SC								
			6										
			7	7 - 7.5' **LEAN CLAY:** CL.	CL								
				7.5 - 9.5' **LEAN CLAY:** CL.									
			8		CL								
			9										
				9.5' End of Boring.									

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

Signature

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

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-20

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-20	Feet (NAVD88)	598.52 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,397.57 N, 2,488,021.74 E E/W

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 35' 55.122"

Long -89° 29' 14.208"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 49		0	0 - 2' **FILL, LEAN CLAY:** CL, brown (10YR 5/3) to pale brown (10YR 6/3), silt (15-25%), roots (0-5%), sand (0-5%), gravel (0-5%), stiff, slow dilatancy, low toughness, medium plasticity, moist.	(FILL) CL				1.5					CS = Core Sample
			2	2 - 6.2' **CLAYEY SILT** ML/CL, very dark grayish brown (10YR 3/2), sand (0-5%), very stiff, slow dilatancy, medium toughness, low plasticity, moist.	ML/CL				2					
2 CS	60 / 44		5						3.5					
			6	6.2 - 15' **LEAN CLAY:** CL, pale brown (10YR 6/3) to brownish yellow (10YR 6/6), silt (15-25%), sand (0-5%), stiff to firm, slow dilatancy, low toughness, medium to high plasticity, moist.	CL				3.5					
			9						1.5					
3 CS	60 / 53		10						0.75					
			12											

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

Signature

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

Tel: (414) 837-3607
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Boring Number MW-20 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	6.2 - 15' **LEAN CLAY:** CL, pale brown (10YR 6/3) to brownish yellow (10YR 6/6), silt (15-25%), sand (0-5%), stiff to firm, slow dilatancy, low toughness, medium to high plasticity, moist. *(continued)*	CL				0.75					
			14											
4 SH	24 24		15	15 - 17' **LEAN CLAY:** CL.					0.75	18.9	32	18	69.5	SH = Shelby Tube
			16		CL									
5 CS	96 89		17	17 - 20.2' **SILT:** ML, light yellowish brown (2.5Y 6/4), clay (15-25%), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, low plasticity, dry.					0.75					
			18		ML									
			19						4.5					
			20											
			21	20.2 - 23.4' **SILTY CLAY:** CL/ML, gray (10YR 5/1), sand (0-5%), gravel (0-5%), very stiff to hard, no dilatancy, medium toughness, non-plastic, dry.					4.5					
			22		CL/ML									
			23						4.5					
			24	23.4 - 26.8' **CLAYEY SILT** ML/CL, gray (10YR 5/1), sand (0-5%), gravel (0-5%), very stiff to hard, no dilatancy, medium toughness, low plasticity, dry.										
6 CS	60 50		25		ML/CL				2.5					
			26											
			27	26.8 - 37.8' **SILT:** ML, gray (10YR 5/1), sand (0-10%), gravel (0-5%), stiff, no dilatancy, medium toughness, non-plastic, dry.										
			28											
			29		ML									
7 CS	60 49		30											
			31											
			32											

Boring Number MW-20 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	26.8 - 37.8' **SILT:** ML, gray (10YR 5/1), sand (0-10%), gravel (0-5%), stiff, no dilatancy, medium toughness, non-plastic, dry. *(continued)*										
			34											
8 CS	60 42		35		ML									
			36											
			37											
			38	37.8 - 48.9' **LEAN CLAY:** CL, gray (10YR 5/1), silt (15-25%), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, medium plasticity, dry to moist.					4.5					
			39											
9 CS	60 55		40											
			41						4.5					
			42											
			43						4.5					
			44		CL									
11 CS	60 54		45						4.5					Shelby Tube and Modified California samples attempted with refusal at 45 feet below ground surface.
			46											
			47						4.5					
			48											
			49	48.9 - 49.5' **WELL-GRADED SAND:** SW, grayish brown (10YR 5/2), subrounded to round, fine sand, loose, moist.	SW				4.5					
12 CS	12 12		50	49.5 - 50.5' **LEAN CLAY:** CL, gray (10YR 5/1), silt (15-25%), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium toughness, medium plasticity, dry to moist.	CL									
			51	50.5 - 51' **LIMESTONE:** BDX (LS). 51' End of Boring.	BDX (LS)				4.5					

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-20S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-20S	Feet (NAVD88)	598.43 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,402.07 N, 2,488,021.76 E E/Ⓦ

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 35' 55.1688"

Long -89° 29' 14.2044"

Local Grid Location

Feet ☐ N ☐ S Feet ☐ E ☐ W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 2' **FILL, LEAN CLAY:** CL, Blind drill to 10 feet below ground surface. See MW-20 boring log for detailed lithologies.	(FILL) CL								
			2	2 - 6.2' **CLAYEY SILT** ML/CL.	ML/CL								
			6	6.2 - 10' **LEAN CLAY:** CL.	CL								
			10	10' End of Boring.									

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

Signature

Firm Ramboll
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RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-22

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade Drilling	2/3/2021	2/3/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-22	Feet (NAVD88)	599.51 Feet (NAVD88)	6.0 inches

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

State Plane 1,066,423.38 N, 2,487,935.62 E E/Ⓦ

1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 35.6208"

Long -89° 29' 15.4968"

Local Grid Location

Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 43		0	0 - 0.7' **FILL, LEAN CLAY:** CL, light yellowish brown (10YR 6/4), silt (15-25%), gravel (0-5%), sand (0-5%), stiff , slow dilatancy, low toughness, medium plasticity, moist.	(FILL) CL									CS = Core Sample
			1	0.7 - 5' **CLAYEY SILT** ML/CL, dark brown (10YR 3/3), organic material (5-10%), sand (0-5%), very stiff, slow dilatancy, low toughness, low plasticity, moist.					2.5					
			2											
			3		ML/CL				3.5					
			4											
2 CS	60 59		5	5 - 16.7' **LEAN CLAY:** CL, yellowish brown (10YR 5/6) to gray (10YR 5/1), sand (0-5%), soft, slow dilatancy, low toughness, medium to high plasticity, moist.					4					
			6											
			7						0.5					
			8											
			9		CL				0.5					
			10											
3 CS	60 56		11						0.75					
			12											

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

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

Boring Number MW-22 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	5 - 16.7' **LEAN CLAY:** CL, yellowish brown (10YR 5/6) to gray (10YR 5/1), sand (0-5%), soft, slow dilatancy, low toughness, medium to high plasticity, moist. *(continued)*					1.75					
			14		CL									
4 CS	60 60		15						1.75					
			16											
			17	16.7 - 20' **SANDY LEAN CLAY:** to **CLAYEY SAND:** s(CL), yellowish brown (10YR 5/4), hard, no dilatancy, medium toughness, low to medium plasticity, moist to dry. 17.2' - 17.4' layer of silty sand.					4.5					
			18		s(CL)									
			19						4.5					
			20	20' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-23

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-23	Feet (NAVD88)	608.05 Feet (NAVD88)	6.0 inches

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

State Plane 1,066,440.78 N, 2,487,452.37 E E/W

1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 35.826"

Long -89° 29' 21.6672"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 29		0	**0 - 8.3' FILL, LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt (15-25%), sand (0-5%), gravel (0-5%), roots (0-5%), stiff, no dilatancy to slow dilatancy, low toughness, medium plasticity.	(FILL) CL				1.5					CS = Core Sample
			1											
			2											
			3						2.5					
			4											
2 CS	60 / 43		5						2.25					
			6											
			7						2.5					
			8											
			9	8.3 - 15' **SILTY CLAY:** CL/ML, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (10-15%), silt seams (0-5%) 1-3 mm thick, gravel (0-5%), sand (0-5%), stiff, no dilatancy, low to medium toughness, medium to low plasticity, moist to dry.	CL/ML				2.25					
3 CS	60 / 60		10											
			11						2.5					
			12											

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

Signature

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Boring Number MW-23 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	8.3 - 15' **SILTY CLAY:** CL/ML, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (10-15%), silt seams (0-5%) 1-3 mm thick, gravel (0-5%), sand (0-5%), stiff, no dilatancy, low to medium toughness, medium to low plasticity, moist to dry. *(continued)* 13.3' very dark grayish brown (10YR 3/2), organic material (5-10%), stiff, no dilatancy, medium toughness, medium plasticity, moist to dry.	CL/ML				2.5					
			14											
4 SH	24 24		15	15 - 17' **LEAN CLAY:** CL.					2.5	28.4	43	26	97.5	SH = Shelby Tube
			16		CL									
5 CS	96 83		17	17 - 25' **LEAN CLAY:** CL, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-10%), gray (10YR 5/1) mottling (5-10%), sand (0-5%), silt seams (0-5%) 1 mm thick, firm, slow dilatancy, low toughness, high plasticity, moist.					1.25					
			18											
			19						1.25					
			20											
			21		CL				1					
			22											
			23						0.75					
			24											
6 CS	60 60		25	25 - 27' **LEAN CLAY:** CL. 25.3' - 25.8' sand (10-15%).					1.25	15.6	32	18	58.4	
			26		CL									
			27	27 - 27.3' **LEAN CLAY:** CL, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-10%), gray (10YR 5/1) mottling (5-10%), sand (0-5%), silt seams (0-5%) 1 mm thick, firm, slow dilatancy, low toughness, high plasticity, moist.	CL				4.5					
			28											
			29	27.3 - 40' **CLAYEY SILT** ML/CL, gray (10YR 5/1), sand (0-5%), gravel (0-5%), hard, no dilatancy, medium toughness, non-plastic to low plasticity, dry.					4.5					
			30		ML/CL									
7 CS	60 54		31						4.5					
			32											

Boring Number MW-23 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	27.3 - 40' **CLAYEY SILT** ML/CL, gray (10YR 5/1), sand (0-5%), gravel (0-5%), hard, no dilatancy, medium toughness, non-plastic to low plasticity, dry. *(continued)*					4.5					
			34											
8 CS	60 60		35	35' sand seams 1mm thick, loose, dry.					4.5					
			36		ML/CL									
			37						4.5					
			38											
			39						4.5					
9 CS	60 60		40	40 - 50' **SILTY CLAY:** CL/ML, gray (10YR 5/1), sand (5-10%), gravel (0-5%), hard, no dilatancy, medium to high toughness, medium plasticity, dry to moist.										
			41						4.5					
			42											
			43						4.5					
			44	44' yellowish brown (10YR 5/4) mottling (10-15%).										
12 CS	60 60		45		CL/ML				4.5					Shelby Tube and Modified California samples attempted with refusal at 45 feet below ground surface.
			46											
			47						4.5					
			48											
			49						4.5					
			50	50' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-24

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-24	Feet (NAVD88)	613.01 Feet (NAVD88)	6.0 inches

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

State Plane 1,066,424.59 N, 2,486,349.15 E E/Ⓦ

1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 35.7504"

Long -89° 29' 35.7612"

Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 60		0–5	0 - 10.6' ASH, very dark gray (10YR 3/1) to black (10YR 2/1), silt to clay sized grains, coal (5-10%), gravel (0-5%), wood (0-5%), brick (0-5%), firm, slow to rapid dilatancy, low toughness, low plasticity, moist to dry.	(FILL) ASH									CS = Core Sample Advanced 8-inch override casing to 15 feet below ground surface.
2 CS	60 / 60		5–10											
3 CS	60 / 60		10–13	10.6 - 32' **LEAN CLAY:** CL, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-10%), silt (5-10%), sand (0-5%), gravel (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist.	CL				0.75					

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

Signature

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Boring Number MW-24 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			14	10.6 - 32' **LEAN CLAY:** CL, brown (10YR 5/3), yellowish brown (10YR 5/6) mottling (5-10%), silt (5-10%), sand (0-5%), gravel (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist. *(continued)*					1					
4 CS	120 73		15						1					
			16											
			17						2					
			18											
			19						4					
			20											
			21						4					
			22											
			23		CL				2.25					
			24											
5 CS	84 71		25						2.5					
			26											
			27						1.5					
			28											
			29						2.25					
			30	29.6' - 30' layer of sandy clay.										
			31						4.5					
			32	31.5' hard.										
				32' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-25

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-25	Feet (NAVD88)	604.60 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,830.95 N, 2,485,840.34 E E/(W)
1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 39.804"
Long -89° 29' 42.2232"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 NR	60 0		0	0 - 5' No Recovery.										NR = No Recovery
2 CS	60 60		5	5 - 5.8' **WELL-GRADED SAND WITH GRAVEL:** (SW)g, grayish brown (10YR 5/2), wet.	(SW)g									CS = Core Sample
			6	5.8 - 6.6' **LEAN CLAY:** CL, brown (10YR 5/3), sand (0-5%), gravel (0-5%), stiff, medium plasticity, moist.	CL									
			7	6.6 - 10' **SILTY CLAY:** CL/ML, gray (10YR 5/1), gravel (0-5%), hard, low plasticity.	CL/ML				1.5					
			8						4					
			9						4					
3 CS	60 60		10	10 - 12' **WELL-GRADED SAND WITH SILT:** SW-SM, gray (10YR 5/1), clay (15-25%), wet.	SW-SM				4					
			11											
			12											

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

Signature [signature]

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Boring Number MW-25 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	12 - 14.2' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), orange mottling (15-25%), silt (15-25%), medium to high plasticity, soft, moist.	CL				0.25					
			14											
4 CS	60 60		15	14.2 - 19.6' **SILTY CLAY:** CL/ML, reddish yellow (7.5YR 6/8), sand (0-5%), gravel (0-5%), stiff, medium plasticity, moist.	CL/ML				1					
			16											
			17											
			18											
			19											
5 CS	60 60		20	19.6 - 25' **SILTY CLAY WITH GRAVEL** (CL/ML)g, gray (10YR 6/1), gravel (15-25%), sand (0-5%), hard, low plasticity, dry.	(CL/ML)g									
			21											
			22											
			23											
			24											
			25	25' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-26

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-26	Feet (NAVD88)	593.33 Feet (NAVD88)	6.0 inches

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

State Plane 1,067,258.09 N, 2,485,127.12 E E/Ⓦ

1/4 of 1/4 of Section 11, T 13 N, R 4 W

Lat 39° 35' 44.0772"

Long -89° 29' 51.2952"

Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 79		0	0 - 2.1' **SILT:** ML, dark grayish brown (10YR 4/2), dark yellowish brown (10YR 4/4) mottling (5-15%), very dark gray (10YR 3/1) mottling (0-5%), organic material (5-15%), roots (5-15%), sand (0-5%), slow dilatancy, medium toughness, low plasticity, moist.	ML										CS = Core Sample
			2	2.1 - 10' **LEAN CLAY:** CL, grayish brown (10YR 5/2) to yellowish brown (10YR 5/6), silt (15-30%), sand (0-5%), organic material (0-5%), very soft, no dilatancy, low toughness, medium plasticity, moist.	CL				0.25					
			5						0.25					
			7						0.25					
2 CS	120 120		10	10 - 10.9' **CLAYEY SAND:** (SM)g, yellowish brown (10YR 5/4), gravel (5-15%), dense, wet.	(SM)g									
			11	10.9 - 11.7' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, gray (10YR 5/1), grayish brown (10YR 5/2), to yellowish brown (10YR 5/4), sand (5-15%), gravel (0-5%), no dilatancy, low to high toughness, low to medium plasticity, dry to wet.	ML/CL									
			13	11.7 - 20' **SILT:** ML, gray (10YR 5/1) to grayish brown (10YR 5/2), clay (15-30%), sand (5-15%), gravel (0-5%), hard, no dilatancy, high toughness, low plasticity, dry.	ML									

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

Signature

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Boring Number MW-26 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	11.7 - 20' **SILT:** ML, gray (10YR 5/1) to grayish brown (10YR 5/2), clay (15-30%), sand (5-15%), gravel (0-5%), hard, no dilatancy, high toughness, low plasticity, dry. *(continued)*	ML				4.5					
			17											
			18						4.5					
			19											
			20	20' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-27

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-27	Feet (NAVD88)	597.35 Feet (NAVD88)	6.0 inches

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

State Plane 1,067,661.72 N, 2,485,026.71 E E/Ⓦ

1/4 of 1/4 of Section 11, T 13 N, R 4 W

Lat 39° 35' 48.0732"

Long -89° 29' 52.5372"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 95		0	0 - 1.2' **SILT:** ML, very dark grayish brown (10YR 3/2) to dark yellowish brown (10YR 4/6), clay (15-30%), gravel (0-5%), roots (0-5%), very soft, no dilatancy, low to medium toughness, low plasticity, wet.	ML				0.25					CS = Core Sample
			1	1.2 - 9.6' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), yellowish brown (10YR 5/6) mottling 5-15%), silt (15-30%), sand (0-5%), firm to very soft, no dilatancy, low toughness, medium plasticity, moist.					0.75					
			2											
			3											
			4	4.5' grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%).										
			5	5.3' - 5.8' very dark grayish brown (10YR 3/2) mottling (15-30%), roots (5-15%).	CL				1.25					
			6											
			7						0.25					
			8											
			9						0.25					
2 CS	120 86		10	9.6 - 10.8' **CLAYEY SAND:** SC, yellowish brown (10YR 5/4), subrounded, fine sand, gravel (5-15%), wet.	SC									
			11	10.8 - 13.5' **SANDY LEAN CLAY:** s(CL), grayish brown (10YR 5/2), yellowish brown (10YR 5/4) mottling (30-45%), silt (15-30%), very soft, low toughness, low plasticity, wet.					0.25					
			12		s(CL)									
			13											
			14	13.5 - 17.5' **SILT:** ML, gray (10YR 5/1), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, non-plastic to low plasticity, dry.	ML									
			15											

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

Signature

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Boring Number MW-27 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			16	13.5 - 17.5' **SILT:** ML, gray (10YR 5/1), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, non-plastic to low plasticity, dry. *(continued)*	ML									
			17											
			18	17.5 - 20' **SILTY SAND:** SM, gray (10YR 5/1), rounded to subangular, fine sand, gravel (0-5%), loose, dry.	SM									
			19											
			20	20' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-28

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-28	Feet (NAVD88)	598.33 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,595.29 N, 2,485,010.02 E E/Ⓦ

1/4 of 1/4 of Section 2, T 13 N, R 4 W

Lat 39° 35' 57.3"

Long -89° 29' 52.6632"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 91		0 - 14	0 - 5.2' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4), dark grayish brown (10YR 4/2) mottling (0-5%), silt (15-30%), sand (0-5%), organic material (0-5%), no dilatancy, low toughness, medium plasticity, moist to wet.	CL									CS = Core Sample
				5.2 - 6.8' **SILTY CLAY:** CL/ML, dark yellowish brown (10YR 4/4), sand (5-15%), no dilatancy, low toughness, low plasticity, moist.	CL/ML									
				6.8 - 8.4' **SILT:** ML, yellowish brown (10YR 5/6), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, low plasticity, moist.	ML									
				8.4 - 11.2' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, yellowish brown (10YR 5/6), sand (15-30%), gravel (0-5%), no dilatancy, low toughness, non-plastic to low plasticity, wet.	ML/CL									
2 CS	120 103			11.2 - 17.6' **SILT:** ML, yellowish brown (10YR 5/4), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, non-plastic, moist.	ML									

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

Signature

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Boring Number MW-28 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			15	11.2 - 17.6' **SILT:** ML, yellowish brown (10YR 5/4), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, non-plastic, moist. *(continued)*	ML									
			16											
			17											
			18	17.6 - 19.5' **SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (5-15%), gravel (0-5%), no dilatancy, medium toughness, non-plastic, moist.	(ML)s									
			19											
3 CS	60 60		20	19.5 - 22' **SANDY SILT:** s(ML), gray (10YR 5/1), wet to moist.	s(ML)									
			21	21' - 21.5' layer of sand, gray (10YR 5/1) subrounded fine sand, loose, wet.										
			22	22 - 24.3' **SILTY SAND:** SM, grayish brown (10YR 5/2) to gray (10YR 5/1), subrounded, fine sand, gravel (0-5%), dense, wet.	SM									
			23											
			24											
			25	24.3 - 25' **CLAYEY SAND:** SC, grayish brown (10YR 5/2), gravel (5-15%), loose, wet.	SC									
				25' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-29

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-29	Feet (NAVD88)	596.86 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,754.64 N, 2,485,209.80 E E/Ⓦ

1/4 of 1/4 of Section 2, T 13 N, R 4 W

Lat 39° 35' 58.8624"

Long -89° 29' 50.0964"

Local Grid Location

Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 120		0.5 1.0 1.5 2.0 2.5 3.0 3.5	0 - 3.7' **LEAN CLAY:** CL, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/6) mottling (15-30%), very dark grayish brown (10YR 3/2) mottling (0-5%), silt (15-30%), roots (0-5%), organic material (0-5%), slow dilatancy, low toughness, medium to high plasticity, moist.	CL				0.25					CS = Core Sample
			4.0 4.5 5.0 5.5 6.0 6.5	3.7 - 6.8' **SILTY CLAY:** ML/CL, dark yellowish brown (10YR 4/6), sand (0-5%), low to medium plasticity, moist.	ML/CL				0.25					
			7.0 7.5 8.0	6.8 - 8.4' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), silt (15-30%), sand and sand seams (15-30%), no dilatancy, low toughness, low to medium plasticity, moist.	CL									
			8.5 9.0 9.5 10.0	8.4 - 10' **SANDY LEAN CLAY:** s(CL), dark yellowish brown (10YR 4/6), silt (15-30%), gravel (0-5%), no dilatancy, medium toughness, low plasticity.	s(CL)									

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

Signature

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SOIL BORING LOG INFORMATION SUPPLEMENT

Boring Number MW-29 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
2 CS	120 95		10.5	10 - 11.6' **CLAYEY SAND:** SC, dark yellowish brown (10YR 4/4), subrounded medium sand, gravel (5-15%), wet.	SC									
			11.0											
			11.5											
			12.0	11.6 - 16' **SANDY SILT:** s(ML), dark yellowish brown (10YR 4/6), grayish brown (10YR 5/2) mottling (5-15%), clay (5-15%), gravel (0-5%), slow dilatancy, medium toughness, non-plastic to low plasticity, dry.	s(ML)									
			12.5											
			13.0											
			13.5											
			14.0											
			14.5											
			15.0											
			15.5											
			16.0											
			16.5	16 - 17.5' **WELL-GRADED SAND:** GW, dark yellowish brown (10YR 4/6), gravel (5-15%), clay (5-15%), wet.	GW									
			17.0											
			17.5											
			18.0	17.5 - 20' **SILT:** ML, dark yellowish brown (10YR 4/6), grayish brown (10YR 5/2) mottling (5-15%), sand (5-15%), clay (5-15%), gravel (0-5%), no dilatancy, medium toughness, low plasticity, dry.	ML									
			18.5											
			19.0											
			19.5											
			20.0	20' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-30

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	2/3/2021	2/3/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-30	Feet (NAVD88)	616.00 Feet (NAVD88)	6.0 inches

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

State Plane 1,069,336.19 N, 2,486,121.89 E E/W

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 36' 4.6044" Long -89° 29' 19.1148"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 120		0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0	0 - 1.5' **FILL, SILT:** ML, dark gray (10YR 4/1) to very dark gray (10YR 3/1), medium sand sized ash (5-15%), roots (5-15%), gravel (0-5%), soft, slow dilatancy, low toughness, low plasticity, wet. 1.1' - 1.2' layer of ash. 1.5 - 7.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) mottling (0-5%), dark gray (10YR 4/1) laminations (5-15%), yellowish brown (10YR 5/6) laminations (0-5%), sand (0-5%), gravel (0-5%), firm to stiff, no dilatancy, high toughness, low plasticity, dry yellowish brown (10YR 5/6 sand seams (0-5%), 1/8" thick.	(FILL) ML CL/ML									CS = Core Sample

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

Signature

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Boring Number MW-30 Page 2 of 6

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			5.5	1.5 - 7.4' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) mottling (0-5%), dark gray (10YR 4/1) laminations (5-15%), yellowish brown (10YR 5/6) laminations (0-5%), sand (0-5%), gravel (0-5%), firm to stiff, no dilatancy, high toughness, low plasticity, dry yellowish brown (10YR 5/6 sand seams (0-5%), 1/8" thick. *(continued)*	CL/ML									
			6.0											
			6.5											
			7.0											
			7.5	7.4 - 7.9' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), yellowish brown (10YR 5/6) mottling (5-15%), silt (5-15%), organic material (5-15%), slow dilatancy, low toughness, high plasticity, moist.	CL									
			8.0	7.9 - 8.7' **SILT WITH SAND:** (ML)s, light brownish gray (10YR 6/2), gray (10YR 6/1) mottling (0-5%), clay (5-15%), gravel (0-5%), high toughness, low plasticity, dry.	(ML)s									
			8.5											
			9.0	8.7 - 9.5' **SILT:** ML, dark grayish brown (10YR 4/2), yellowish brown (10YR 5/6) mottling (0-5%), clay (5-15%), sand (5-15%), gravel (0-5%), stiff, no dilatancy, high toughness, low plasticity, dry.	ML									
			9.5	9.5 - 24.5' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt (15-30%), sand (0-5%), gravel (0-5%), slow dilatancy, low toughness, medium plasticity.										
2 CS	120 96		10.0											
			10.5											
			11.0											
			11.5	11.3' greenish gray (GLEY2 6/10BG) mottling (5-15%), olive brown (2.5Y 4/4) mottling (5-15%), yellowish brown (10YR 5/6) mottling (0-5%).	CL									
			12.0											
			12.5	12.5' greenish gray (GLEY2 6/10BG), very dark grayish brown (10YR 3/2) mottling (15-30%), olive brown (2.5Y 4/4) mottling (5-15%), dark yellowish brown (10YR 4/6) mottling (0-5%).										
			13.0											

Boring Number MW-30 Page 3 of 6

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13.5	9.5 - 24.5' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt (15-30%), sand (0-5%), gravel (0-5%), slow dilatancy, low toughness, medium plasticity. *(continued)*										
			14.0	14' very dark grayish brown (10YR 3/2), greenish gray (GLEY2 6/10BG) mottling (5-15%), olive brown (2.5Y 4/4) mottling (5-15%), yellowish brown (10YR 5/6) mottling (0-5%).										
			14.5											
			15.0	15' very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1), dark grayish brown (10YR 4/2) mottling, organic material (0-5%), high plasticity.										
			15.5											
			16.0											
			16.5											
			17.0											
			17.5		CL									
			18.0											
			18.5											
			19.0											
			19.5											
3 CS	120 116		20.0											
			20.5											
			21.0											
			21.5											

Boring Number MW-30 Page 4 of 6

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			22.0	9.5 - 24.5' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), silt (15-30%), sand (0-5%), gravel (0-5%), slow dilatancy, low toughness, medium plasticity. *(continued)*	CL									
			22.5											
			23.0											
			23.5											
			24.0											
			24.5	24.5 - 25' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), gray (10YR 5/1) mottling (15-30%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low to medium plasticity, moist.	ML/CL									
			25.0	25 - 26.6' **SILT:** ML, gray (10YR 5/1), dark grayish brown (10YR 4/2) mottling (5-15%), yellowish brown (10YR 5/4) laminations (5-15%), clay (15-30%), sand (5-15%), gravel (0-5%), moist.	ML									
			25.5											
			26.0											
			26.5	26.6 - 35' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), gray (10YR 5/1) mottling (15-30%), greenish gray (GLEY2 6/10BG) mottling (0-5%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low to medium plasticity, moist. 27.1' - 28.5' very dark gray (10YR 3/1) to dark gray (10YR 4/1).	ML/CL									
			27.0											
			27.5											
			28.0											
			28.5											
			29.0											
			29.5											
			30.0											

Boring Number MW-30 Page 5 of 6

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	120 113		30.5	26.6 - 35' **CLAYEY SILT** to **SILTY CLAY:** ML/CL, dark grayish brown (10YR 4/2) to grayish brown (10YR 5/2), gray (10YR 5/1) mottling (15-30%), greenish gray (GLEY2 6/10BG) mottling (0-5%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low to medium plasticity, moist. *(continued)*	ML/CL									
			31.0											
			31.5											
			32.0											
			32.5											
			33.0											
			33.5											
			34.0											
			34.5											
			35.0	35 - 37.2' **SANDY LEAN CLAY:** to **CLAYEY SAND:** (CL)g, yellowish brown (10YR 5/6), grayish brown (10YR 5/2) mottling (0-10%), gravel (0-5%), low toughness, low plasticity to non-plastic, loose, wet.	(CL)g									
			35.5											
			36.0											
			36.5											
			37.0											
			37.5	37.2 - 39.2' **SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (5-15%), dark grayish brown (10YR 4/2) mottling (0-5%), gravel (0-5%), moist.	(ML)s									
			38.0											

Boring Number MW-30 Page 6 of 6

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			38.5	37.2 - 39.2' **SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (5-15%), dark grayish brown (10YR 4/2) mottling (0-5%), gravel (0-5%), moist. *(continued)*	(ML)s									
			39.0											
			39.5	39.2 - 40' **SILTY SAND:** SM, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (0-5%), gravel (0-5%), moist.	SM									
5 CS	60 45.6		40.0	40 - 45' **CLAYEY SILT** ML/CL, dark grayish brown (10YR 4/2) to dark gray (10YR 4/1), sand (5-15%), gravel (0-5%).										
			40.5											
			41.0											
			41.5											
			42.0											
			42.5		ML/CL									
			43.0											
			43.5											
			44.0											
			44.5											
			45.0	45' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-31

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	2/3/2021	2/3/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-31	Feet (NAVD88)	615.02 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,069,352.71 N, 2,486,768.38 E E/Ⓦ
1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 36' 4.6584"
Long -89° 29' 30.1272"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 95		1.5	0 - 2' ASH, dark gray (10YR 4/1), silt sized grains, clay (5-15%), moist.	(FILL) ASH				0.5					CS = Core Sample
			3.0	2 - 8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), sand (5-15%), gravel (0-5%), hard to firm, no dilatancy, medium toughness, low plasticity, moist.	CL/ML				3					
			4.5											
			6.0											
			7.5						1					
			9.0	8 - 9' **SILTY SAND:** SM, brown (10YR 5/3), clay (15-30%), gravel (0-5%), loose, moist.	SM									
2 CS	240 240		10.5	9 - 18' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/4), grayish brown (10YR 5/2) mottling (5-15%), sand (0-5%), organic material (0-5%), soft to firm, low toughness, medium to low plasticity, moist.					0.5					
			12.0	11.4' dark brown (10YR 3/3) mottling (5-15%). 11.9' dark brown (10YR 3/3) mottling (0-5%), silt (15-30%), medium plasticity.										
			13.5		CL/ML				0.5					
			15.0	14.6' dark brown (10YR 3/3) mottling (5-15%), yellowish brown (10YR 5/6) silt seams (0-5%).					0.5					
			16.5											
			18.0						0.5					

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

Signature

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Boring Number MW-31 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			19.5	18 - 20.2' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2) mottling (5-15%), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-30%), organic material (15-30%), medium to high plasticity.	CL				1					
			21.0	20.2 - 23.8' **SILTY CLAY:** CL/ML, yellowish brown (10YR 5/4), dark brown (10YR 3/3) mottling 5-15%), yellowish brown (10YR 5/6) silt seams (0-5%).	CL/ML									
			22.5	22.8' wet in clay fracture.										
			24.0	23.8 - 26.1' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2) mottling (5-15%), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-30%), organic material (15-30%), medium to high plasticity.	CL									
			25.5	26.1 - 26.7' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), dark grayish brown (10YR 4/2) mottling (5-15%), very dark gray (10YR 3/1) mottling (0-5%), no dilatancy, medium toughness, medium to high plasticity, moist.	CL									
			27.0		CL									
			28.5	26.7 - 28' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), grayish brown (10YR 5/2) mottling (5-15%), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-30%), organic material (15-30%), sand (0-5%), medium to high plasticity.	CL									
3 CS	120 120		30.0	28 - 32.8' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), dark grayish brown (10YR 4/2) mottling (5-15%), very dark gray (10YR 3/1) mottling (0-5%), no dilatancy, medium toughness, medium to high plasticity, moist.										
			31.5											
			33.0	31.4' dark grayish brown (10YR 4/2) to dark gray (10YR 4/1).										
			34.5	32.8 - 35.4' **CLAYEY SILT** ML/CL, grayish brown (10YR 5/2), yellowish brown (10YR 5/4) mottling (5-15%), light gray (10YR 7/2) mottling (0-5%), very dark gray (10YR 3/1) mottling (0-5%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low plasticity.	ML/CL									
			36.0	34.6' olive brown (2.5Y 4/3) mottling (15-30%) in sand seams, sand (15-30%).	s(CL)									
			37.5	35.4 - 38.3' **SANDY LEAN CLAY:** s(CL), olive brown (2.5Y 4/3), dark gray (10YR 4/1) mottling (5-15%), gravel (0-5%), no dilatancy, low toughness, low plasticity, wet.										
			39.0	38.3 - 39.8' **POORLY-GRADED SAND:** SP, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (5-15%), subrounded, fine sand, silt (5-15%), clay (5-15%), gravel (0-5%), dense, moist to wet.	SP									
4 CS	120 120		40.5											
			42.0	39.8 - 50' **SILT:** ML, dark gray (10YR 4/1) to gray (10YR 5/1), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, low plasticity to non-plastic, dry.										
			43.5	42' low plasticity.										
				43.6' - 43.7' layer of medium to coarse sand, wet.	ML									
			45.0											
			46.5	46' fine sand seams 1/8" to 1/2" thick, moist to dry.										
			48.0											

Boring Number MW-31 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			49.5	39.8 - 50' **SILT:** ML, dark gray (10YR 4/1) to gray (10YR 5/1), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, low plasticity to non-plastic, dry. *(continued)*	ML									
				50' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-31S

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Dave Gordon Cascade Drilling	2/3/2021	2/3/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-31S	Feet (NAVD88)	615.13 Feet (NAVD88)	6.0 inches

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

State Plane 1,069,353.41 N, 2,486,774.19 E E/W

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 36' 4.662"

Long -89° 29' 30.0516"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 88		0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0	0 - 2' ASH, Blind drill to 10 feet below ground surface. See MW-31 boring log for detailed lithologies. 2 - 8' **SILTY CLAY:** CL/ML. 8 - 9' **SILTY SAND:** SM. 9 - 10' **SILTY CLAY:** CL/ML.	(FILL) ASH CL/ML SM CL/ML									CS = Core Sample

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

Signature

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

Boring Number MW-31S

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
2 CS	120 120		10.5	10 - 12.4' **SILT:** ML, grayish brown (10YR 5/2), yellowish brown (10YR 5/6) mottling (5-15%), very dark grayish brown (10YR 3/2) mottling (0-5%), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, medium toughness, moist. 10.8' - 11.2' yellowish brown (10YR 5/6), grayish brown (10YR 5/2) mottling (5-15%), sand (15-30%), hard.	ML									
			11.0											
			11.5											
			12.0											
			12.5	12.4 - 15.4' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2) mottling (5-15%), olive brown (2.5Y 4/4) mottling (0-5%), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-30%), organic material (0-5%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, medium plasticity, moist. 14' olive brown (2.5Y 4/4), dark grayish brown (10YR 4/2) mottling (5-15%), dry.	CL									
			13.0											
			13.5											
			14.0											
			14.5											
			15.0											
			15.5	15.4 - 16.6' **SILT:** ML, yellowish brown (10YR 5/4), yellowish brown (10YR 5/6) mottling (5-15%), clay (15-30%), sand (5-15%), gravel (0-5%), no dilatancy, high toughness, low plasticity, dry.	ML									
			16.0											
			16.5											
			17.0	16.6 - 26.8' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/4) laminations (15-30%), olive brown (2.5Y 4/4) laminations (0-5%), silt (5-15%), organic material (5-15%), gravel (0-5%), sand (0-5%), slow dilatancy, low to medium toughness, high plasticity, moist.	CL									
			17.5											
			18.0											
			18.5											
			19.0											
			19.5											
3 CS	120 120		20.0											
			20.5											
			21.0											
			21.5											
			22.0											
			22.5											
			23.0											
			23.5											
			24.0											
			24.5											
			25.0											
			25.5											
			26.0											
			26.5											

Boring Number MW-31S

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)								Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			27.0 27.5 28.0 28.5 29.0 29.5 30.0	26.8 - 30' **LEAN CLAY:** CL, yellowish brown (10YR 5/6), very dark grayish brown (10YR 3/2) mottling (0-5%), yellowish brown (10YR 5/6) mottling (0-5%), silt (15-30%), organic material (0-5%), sand (0-5%), gravel (0-5%), no dilatancy, medium toughness, low plasticity, moist.	CL										
				30' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name: Kincaid Power Station	License/Permit/Monitoring Number:	Boring Number: MW-32
Boring Drilled By: Name of crew chief (first, last) and Firm: Adam Jochimsen, Cascade Drilling	Date Drilling Started: 2/3/2021	Date Drilling Completed: 2/3/2021 / Drilling Method: Mini Sonic
Common Well Name: MW-32	Final Static Water Level: Feet (NAVD88)	Surface Elevation: 617.20 Feet (NAVD88) / Borehole Diameter: 6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,069,353.90 N, 2,487,630.18 E E/W
1/4 of 1/4 of Section 1, T 13 N, R 4 W
Lat 39° 36' 4.6044" Long -89° 29' 19.1148"
Local Grid Location: Feet ☐N ☐S ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 / 36		0	0 - 1.2' ASH, very dark gray (10YR 3/1), gravel to sand sized grians, loose, dry.	(FILL) ASH									CS = Core Sample
			1	1.2 - 4.6' **FILL, SILT WITH SAND:** (ML)s, yellowish brown (10YR 5/4), gravel (0-5%), soft, slow dilatancy, low toughness, non-plastic, moist.	(FILL) (ML)s				0.25					Advanced 8-inch override casing to 10 feet below ground surface.
			2											
			3											
			4											
2 CS	60 / 45		5	4.6 - 6.3' ASH, black (10YR 2/1) to very dark gray (10YR 3/1), sand to silt sized grains, loose.	(FILL) ASH				0.25					
			6											
			7	6.3 - 10.3' **SILTY CLAY:** ML/CL, pale brown (10YR 6/3), sand (5-10%), gravel (0-5%), very stiff, slow dilatancy, low toughness, low plasticity, moist.	ML/CL									
			8											
			9						3.25					
3 CS	60 / 43		10											
			11	10.3 - 11.7' **LEAN CLAY:** CL, pale brown (10YR 6/3), silt (15-25%), sand (0-5%), gravel (0-5%), stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL				2.75					
			12	11.7 - 20.1' **LEAN CLAY:** CL, grayish brown (2.5Y 5/2), gray (10YR 5/1) mottling (5-15%), silt (15-25%), organic material (5-10%), sand (0-5%), stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL									
			13						2.75					
			14											

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

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

Boring Number MW-32 Page 2 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
4 CS	60 35		15	11.7 - 20.1' **LEAN CLAY:** CL, grayish brown (2.5Y 5/2), gray (10YR 5/1) mottling (5-15%), silt (15-25%), organic material (5-10%), sand (0-5%), stiff, no dilatancy, medium toughness, medium plasticity, moist. *(continued)* 14.9' layer of wood.	CL				2.75					Wood in shoe of core barrel.
			16											
			17						3					
			18											
			19						4					
5 CS	60 56		20	20.1 - 22.9' **LEAN CLAY:** CL, light yellowish brown (10YR 6/4) to light brownish gray (10YR 6/2), yellowish brown (10YR 5/6) mottling (5-10%), silt (15-25%), gravel (0-5%), sand (0-5%), stiff, slow dilatancy, low toughness, medium plasticity, moist.	CL				0.75					
			21											
			22											
			23	22.9 - 25' **LEAN CLAY:** CL, grayish brown (2.5Y 5/2), gray (10YR 5/1) mottling (5-15%), silt (15-25%), organic material (5-10%), sand (0-5%), stiff, no dilatancy, medium toughness, medium plasticity, moist.	CL				1.75					
			24											
6 CS	120 120		25	25 - 31.6' **LEAN CLAY:** CL, yellowish brown (10YR 5/4), yellowish brown (10YR 5/8) mottling, silt (10-15%), sand (0-5%), firm, slow dilatancy, low toughness, medium plasticity, moist.	CL				3					
			26											
			27						0.75					
			28											
			29						1.25					
			30											
			31						0.5					
			32	31.6 - 36.2' **SANDY LEAN CLAY WITH GRAVEL:** to **LEAN CLAY WITH SAND:** s(CL), yellowish brown (10YR 5/8), gravel (0-5%), soft, slow dilatancy, low toughness, low to medium plasticity, moist.	s(CL)				0.5					
			33											
			34											
7 CS	60 60		35						4.5					
			36											
			37	36.2 - 40' **SILTY CLAY:** ML/CL, gray (10YR 5/1), sand (0-10%), gravel (0-5%), hard, no dilatancy, high toughness, low plasticity, wet.	ML/CL				4.5					

Boring Number MW-32 Page 3 of 3

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			38 39 40	36.2 - 40' **SILTY CLAY:** ML/CL, gray (10YR 5/1), sand (0-10%), gravel (0-5%), hard, no dilatancy, high toughness, low plasticity, wet. *(continued)*	ML/CL				4.5					
				40' End of Boring.										

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-7S

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-7S	Feet (NAVD88)	595.59 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,011.16 N, 2,484,728.09 E E/Ⓦ

1/4 of 1/4 of Section 2, T 13 N, R 4 W

Lat 39° 35' 51.5472"

Long -89° 29' 56.3208"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 104		0.5 1.0 1.5 2.0 2.5 3.0 3.5	0 - 3.5' **CLAYEY SILT** ML/CL, very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2) mottling (5-15%), dark yellowish brown (10YR 4/6) mottling (5-15%), sand (5-15%), gravel (0-5%), roots (0-5%), firm, slow dilatancy, low to medium toughness, low plasticity, moist.	ML/CL				1					CS = Core Sample
			4.0 4.5 5.0 5.5 6.0 6.5 7.0	3.5 - 7.5' **LEAN CLAY:** CL, grayish brown (10YR 5/2), very dark grayish brown (10YR 3/2) mottling (5-15%), dark yellowish brown (10YR 4/6) mottling (5-15%), silt (15-30%), sand (0-5%), gravel (0-5%), stiff to soft, no dilatancy, medium toughness, low to medium plasticity, moist.	CL				1.25 2.75					
			7.5	7.2' red brick (15-30%).					0.5					
			8.0 8.5 9.0 9.5 10.0	7.5 - 13' **LEAN CLAY:** CL, grayish brown (10YR 5/2), silt (15-30%), dark yellowish brown (10YR 4/4) mottling (5-15%), sand (0-5%), gravel (0-5%), no dilatancy, low to medium toughness, medium plasticity, moist.	CL				0.25					
2 CS	60 60		10.5 11.0											

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

Signature

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

Boring Number MW-7S

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			11.5 12.0 12.5 13.0 13.5 14.0 14.5 15.0	7.5 - 13' **LEAN CLAY:** CL, grayish brown (10YR 5/2), silt (15-30%), dark yellowish brown (10YR 4/4) mottling (5-15%), sand (0-5%), gravel (0-5%), no dilatancy, low to medium toughness, medium plasticity, moist. *(continued)* 13 - 15' **SANDY LEAN CLAY:** to **CLAYEY SAND:** s(CL), dark yellowish brown (10YR 4/4), gravel (0-5%), non-cohesive to cohesive, low plasticity, wet. 15' End of Boring.	CL s(CL)									

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SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-8S

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-8S	Feet (NAVD88)	600.57 Feet (NAVD88)	6.0 inches

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

State Plane 1,066,821.52 N, 2,485,344.57 E E/Ⓦ

1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 39.7464"

Long -89° 29' 48.5592"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	120 120		0–1	0 - 1.9' **LEAN CLAY:** CL, grayish brown (10YR 5/2), dark yellowish brown (10YR 4/4) mottling (5-15%), very dark gray (10YR 3/1) mottling (0-5%), silt (15-30%), gravel (0-5%), no dilatancy, low toughness, medium plasticity, wet to moist.	CL									CS = Core Sample
			1–5	1.9 - 5.6' **SILT:** ML, dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2) mottling (5-15%), dark yellowish brown (10YR 4/6) mottling (0-5%), clay (15-30%), sand (0-5%), gravel (0-5%), roots (0-5%), no dilatancy, high toughness, low plasticity, moist.	ML									
			5–7	5.6 - 7.1' **LEAN CLAY:** CL, very dark gray (10YR 3/1) to very dark grayish brown (10YR 3/2), silt (15-30%), organic material (0-5%), slow dilatancy, low toughness, medium to high plasticity, moist.	CL									
			7–8	7.1 - 8.8' **SILTY CLAY:** CL/ML, grayish brown (10YR 5/2), yellowish brown (10YR 5/4) mottling (15-30%), no dilatancy, low toughness, medium plasticity, moist.	CL/ML									
			8–12	8.8 - 15' **SILT WITH SAND:** (ML)s, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling (5-15%), clay (15-30%), no dilatancy, low toughness, non-plastic to low plasticity, moist to wet.	(ML)s									
2 CS	120 120													

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

Signature

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

Boring Number MW-8S

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	8.8 - 15' **SILT WITH SAND:** (ML)s, gray (10YR 5/1), dark yellowish brown (10YR 4/6) mottling (5-15%), clay (15-30%), no dilatancy, low toughness, non-plastic to low plasticity, moist to wet. *(continued)*	(ML)s									
			14											
			15	15 - 18.5' **SANDY LEAN CLAY:** to **CLAYEY SAND:** s(CL), yellowish brown (10YR 5/4), gravel (0-5%), dense, non-plastic to low plasticity, wet.	s(CL)									
			16											
			17											
			18											
			19	18.5 - 20' **SILT:** ML, gray (10YR 5/1) to grayish brown (10YR 5/2), clay (15-30%), sand (0-5%), gravel (0-5%), dry.	ML									
			20	20' End of Boring.										

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SOIL BORING LOG INFORMATION

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

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

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW01	Feet (NAVD88)	625.48 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,842.23 N, 2,486,392.09 E E/W
1/4 of 1/4 of Section 12, T 13 N, R 4 W

Lat 39° 35' 39.8724"
Long -89° 29' 35.1744"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 8' ASH, black (10YR 2/1), silt to sand sized grains, fine to medium sand, gravel (0-5%), slag-like material (0-5%), dry.	(FILL) ASH									CS = Core Sample
2 CS	36 36		5											
3 MC	24 24		8	8 - 10' ASH, sand sized grains.	(FILL) ASH					19.4	12		2.6	MC = Modified California
4 CS	60 60		10	10 - 15.6' ASH, black (10YR 2/1), silt to sand sized grains, gravel (0-5%), slag-like material (0-5%), dry.	(FILL) ASH									

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

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

Boring Number XPW01 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			14	10 - 15.6' ASH, black (10YR 2/1), silt to sand sized grains, gravel (0-5%), slag-like material (0-5%), dry. *(continued)*	(FILL) ASH									
5 CS	36 36		15											
			16	15.6 - 18' ASH, black (10YR 2/1), sand to silt sized grains, slag-like material (0-5%), gravel (0-5%), dry.										
			17		(FILL) ASH									
6 MC	24 12		18	18 - 20' ASH, Not Analyzed.										
			19		(FILL) ASH									
7 MC	24 24		20	20 - 22' ASH, sand sized grains.						26.8	17	2	3.7	
			21		(FILL) ASH									
8 CS	36 36		22	22 - 30' ASH, black (10YR 2/1), sand to silt sized grains, slag-like material (0-5%), gravel (0-5%), dry.										
			23	23' wet.										
			24											
9 CS	60 60		25											
			26		(FILL) ASH									
			27											
			28	28' - 28.2' layer of clay, brown.										
			29											
10 MC	24 24		30	30 - 32' **LEAN CLAY:** CL, Not Analyzed.										
			31		CL									
			32	32' End of Boring.										

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SOIL BORING LOG INFORMATION

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

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW02	Feet (NAVD88)	617.91 Feet (NAVD88)	6.0 inches

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

State Plane 1,068,109.66 N, 2,485,321.31 E E/W

1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 35' 52.4796"

Long -89° 29' 48.732"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 60		0	0 - 8' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), slag-like material (0-5%), silt (0-5%), dry.	(FILL) ASH									CS = Core Sample
2 CS	36 36		5											
3 MC	24 18		8	8 - 10' ASH, sand sized grains.	(FILL) ASH					11.8	4		5.9	MC = Modified California
4 CS	60 60		10	10 - 15' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), slag-like material (0-5%), silt (0-5%), dry.	(FILL) ASH									
			12											

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

Signature

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

Boring Number XPW02 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	10 - 15' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), slag-like material (0-5%), silt (0-5%), dry. *(continued)*	(FILL) ASH									
			14											
5 CS	36 25		15	15 - 18' ASH, black (10YR 2/1), sand to gravel sized grains, slag-like material (0-5%), silt (0-5%), wet.	(FILL) ASH									
			16											
			17											
6 MC	24 0		18	18 - 20' ASH, Not Analyzed.	(FILL) ASH									
			19											
7 MC	24 24		20	20 - 22' ASH, sand sized grains.	(FILL) ASH					13.9	8		5.5	
			21											
			22	22 - 23' Blind drilled to 23 feet below ground surface.										
				23' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

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

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW03	Feet (NAVD88)	616.08 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,068,720.21 N, 2,485,628.19 E E/W
1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 35' 58.4916"
Long -89° 29' 44.754"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 49		0	0 - 3.2' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), slag-like material (0-5%), dry.	(FILL) ASH									CS = Core Sample
			3	3.2 - 5.8' **FILL, SILTY CLAY WITH SAND** (CL/ML)S, yellowish brown (10YR 5/8), sand (15-25%), gravel (0-5%), brick (0-5%), stiff, low plasticity, moist.	(FILL) (CL/ML)S				1.5					
2 CS	36 36		5											
			6	5.8 - 8' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), brick (0-5%), slag-like material (0-5%), dry.	(FILL) ASH									
3 MC	24 18		8	8 - 10' ASH.	(FILL) ASH					27.4	14	1	8.4	MC = Modified California
4 CS	60 40		10	10 - 10.2' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), brick (0-5%), slag-like material (0-5%), dry.	(FILL) ASH									
			11	10.2 - 10.8' **FILL, SANDY LEAN CLAY:** s(CL), grayish brown (10YR 5/2), gravel (0-5%), brick (0-5%), very stiff, low plasticity, wet.	(FILL) s(CL) (FILL) ASH									
			12											

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

Signature [signature]

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

Boring Number XPW03 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	10.8 - 18' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), slag-like material (0-5%), brick (0-5%), wet. *(continued)*										
			14											
5 CS	36 36		15	15 - 16' ASH, black (10YR 2/1), sand to clay sized grains, gravel (0-5%), slag-like material (0-5%), brick (0-5%), wet.	(FILL) ASH (FILL) ASH									
			16	16 - 18' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), slag-like material (0-5%), brick (0-5%), wet.										
			17		(FILL) ASH									
6 MC	24 24		18	18 - 20' ASH.						36.4	5		1.3	
			19		(FILL) ASH									
			20	20' End of Boring.										

RAMBOLL

SOIL BORING LOG INFORMATION

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

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Russ Gordon Cascade Drilling	1/26/2021	1/26/2021	Mini Sonic

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
XPW04	Feet (NAVD88)	604.57 Feet (NAVD88)	6.0 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,069,145.99 N, 2,486,608.19 E E/W
1/4 of 1/4 of Section 1, T 13 N, R 4 W

Lat 39° 36' 2.6244"
Long -89° 29' 32.1936"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	IL	Kincaid

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 34		0	0 - 3.6' ASH, dark gray (10YR 4/1), sand to silt sized grains, fine sand, moist.	(FILL) ASH									CS = Core Sample
			3.6	3.6 - 8' ASH, black (10YR 2/1), sand sized grains , gravel (0-5%), wet.	(FILL) ASH									
2 CS	36 24		5											
3 MC	24 0		8	8 - 10' ASH, No Recovery.	(FILL) ASH									MC = Modified California
4 MC	24 12		10	10 - 12' ASH, sand sized grains.	(FILL) ASH					18.3	3	1.4		

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

Signature [signature]

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

Boring Number XPW04 Page 2 of 2

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
5 CS	36 0		12	12 - 18' ASH, black (10YR 2/1), sand sized grains, gravel (0-5%), wet.	(FILL) ASH									
6 CS	36 0		15											
7 MC	24 0		18	18 - 20' ASH, No Recovery.	(FILL) ASH									
8 MC	24 24		20	20 - 22' ASH, sand sized grains.	(FILL) ASH					32.3	15	2.7		
9 CS	24 24		22	22 - 24' **LEAN CLAY:** CL, grayish brown (10YR 5/2), stiff, medium plasticity, moist.	CL				1					
			24	24' End of Boring.										

2021 Ramboll Well Construction Logs

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-11S
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 35.2" Long. -89° 29' 28.0" or	
Facility ID	St. Plane 1,066,375 ft. N, 2,486,960 ft. E. E/Ⓦ	Date Well Installed: 01/26/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 602.72 ft. (NAVD88)

B. Well casing, top elevation 601.76 ft. (NAVD88)

C. Land surface elevation 599.4 ft. (NAVD88)

D. Surface seal, bottom 598.4 ft. (NAVD88) or 1.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 598.4 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 596.4 ft. (NAVD88) or 3.0 ft.

H. Screen joint, top 595.4 ft. (NAVD88) or 4.0 ft.

I. Well bottom 591.4 ft. (NAVD88) or 8.0 ft.

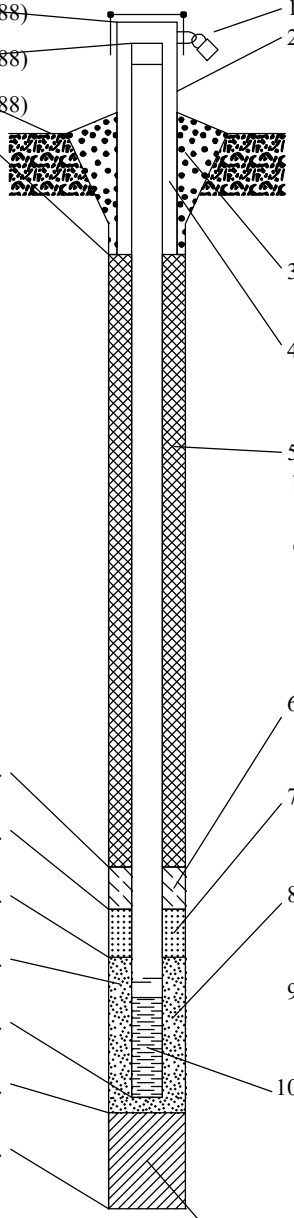
J. Filter pack, bottom 591.4 ft. (NAVD88) or 8.0 ft.

K. Borehole, bottom 591.4 ft. (NAVD88) or 8.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.349 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 0.873 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 4.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-12D
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 0.7" Long. -89° 29' 47.1" or	
Facility ID	St. Plane 1,068,940 ft. N, 2,485,443 ft. E. E/Ⓦ	Date Well Installed: 01/27/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 591.33 ft. (NAVD88)

B. Well casing, top elevation 590.96 ft. (NAVD88)

C. Land surface elevation 589.1 ft. (NAVD88)

D. Surface seal, bottom 587.1 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 543.1 ft. (NAVD88) or 46.0 ft.

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

G. Filter pack, top 541.1 ft. (NAVD88) or 48.0 ft.

H. Screen joint, top 539.1 ft. (NAVD88) or 50.0 ft.

I. Well bottom 534.1 ft. (NAVD88) or 55.0 ft.

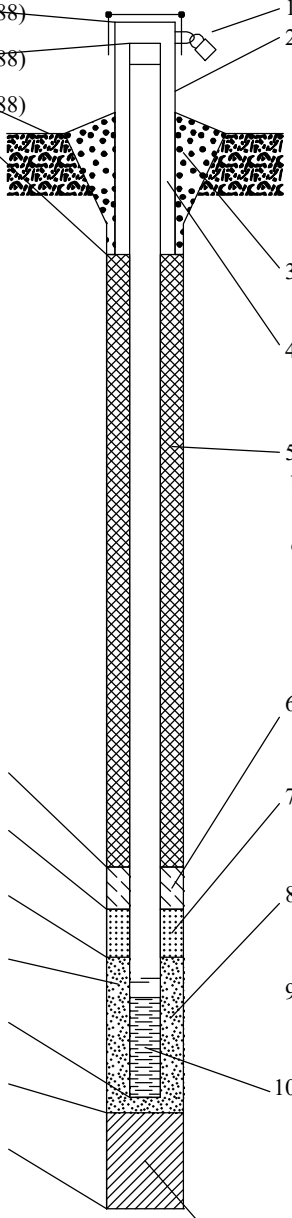
J. Filter pack, bottom 532.1 ft. (NAVD88) or 57.0 ft.

K. Borehole, bottom 489.1 ft. (NAVD88) or 100.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. 9.5 Lbs/gal mud weight . . . Bentonite slurry ☒
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 7.679 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐

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

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.614 ft^3

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

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

11. Backfill material (below filter pack): None ☐ Bentonite Slurry Grout Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-12S
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 0.7" Long. -89° 29' 47.1" or	
Facility ID	St. Plane 1,068,945 ft. N, 2,485,444 ft. E. E/Ⓦ	Date Well Installed: 01/27/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 591.35 ft. (NAVD88)

B. Well casing, top elevation 591.10 ft. (NAVD88)

C. Land surface elevation 588.6 ft. (NAVD88)

D. Surface seal, bottom 587.6 ft. (NAVD88) or 1.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 587.6 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 586.1 ft. (NAVD88) or 2.5 ft.

H. Screen joint, top 584.6 ft. (NAVD88) or 4.0 ft.

I. Well bottom 579.6 ft. (NAVD88) or 9.0 ft.

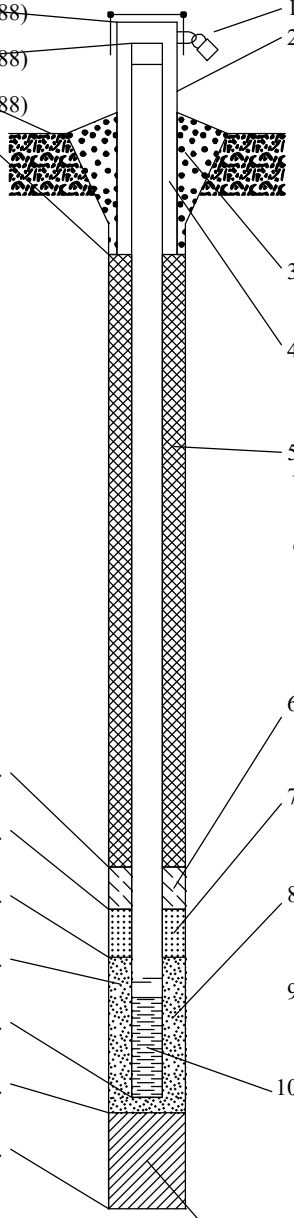
J. Filter pack, bottom 579.6 ft. (NAVD88) or 9.0 ft.

K. Borehole, bottom 579.1 ft. (NAVD88) or 9.5 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.262 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.134 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-20
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 55.1" Long. -89° 29' 14.2" or	
Facility ID	St. Plane 1,068,398 ft. N, 2,488,022 ft. E. E/Ⓦ	Date Well Installed: 01/26/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen / Cascade Drilling
Distance from Waste/Source: ____ ft. State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____

A. Protective pipe, top elevation 601.44 ft. (NAVD88)

B. Well casing, top elevation 600.77 ft. (NAVD88)

C. Land surface elevation 598.5 ft. (NAVD88)

D. Surface seal, bottom 596.5 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 588.5 ft. (NAVD88) or 10.0 ft.

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

G. Filter pack, top 586.5 ft. (NAVD88) or 12.0 ft.

H. Screen joint, top 584.5 ft. (NAVD88) or 14.0 ft.

I. Well bottom 574.5 ft. (NAVD88) or 24.0 ft.

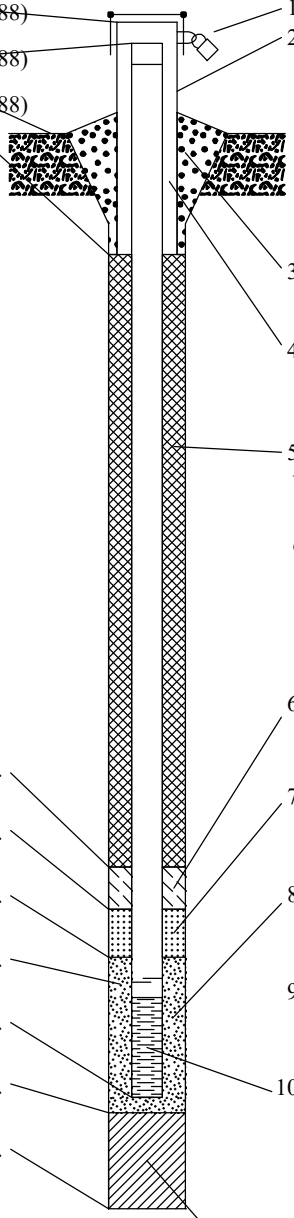
J. Filter pack, bottom 572.5 ft. (NAVD88) or 26.0 ft.

K. Borehole, bottom 547.5 ft. (NAVD88) or 51.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 1.396 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.487 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☐ Bentonite Slurry Grout Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-20S
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 55.2" Long. -89° 29' 14.2" or	
Facility ID	St. Plane 1,068,402 ft. N, 2,488,022 ft. E. E/Ⓦ	Date Well Installed: 01/26/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 601.23 ft. (NAVD88)

B. Well casing, top elevation 600.64 ft. (NAVD88)

C. Land surface elevation 598.4 ft. (NAVD88)

D. Surface seal, bottom 597.4 ft. (NAVD88) or 1.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 597.4 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 595.4 ft. (NAVD88) or 3.0 ft.

H. Screen joint, top 594.4 ft. (NAVD88) or 4.0 ft.

I. Well bottom 588.4 ft. (NAVD88) or 10.0 ft.

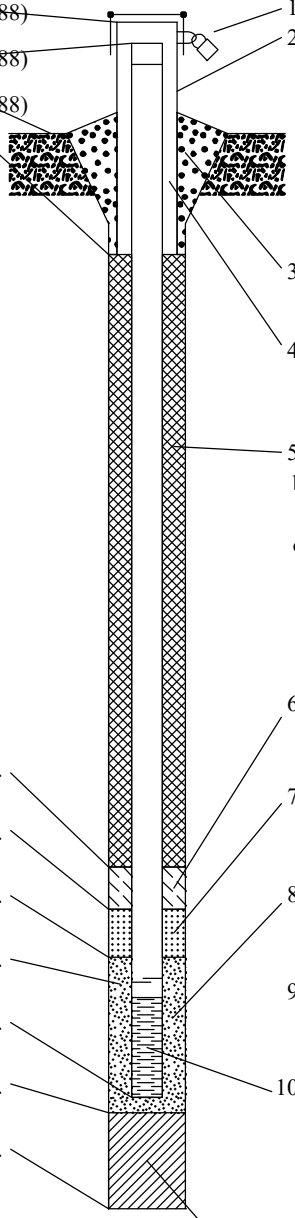
J. Filter pack, bottom 588.4 ft. (NAVD88) or 10.0 ft.

K. Borehole, bottom 588.4 ft. (NAVD88) or 10.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.349 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.222 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 6.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-22
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 35.6" Long. -89° 29' 15.5" or	
Facility ID	St. Plane 1,066,423 ft. N, 2,487,936 ft. E. E/Ⓦ	Date Well Installed: 02/03/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 602.16 ft. (NAVD88)

B. Well casing, top elevation 601.77 ft. (NAVD88)

C. Land surface elevation 599.5 ft. (NAVD88)

D. Surface seal, bottom 597.5 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 589.5 ft. (NAVD88) or 10.0 ft.

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

G. Filter pack, top 586.5 ft. (NAVD88) or 13.0 ft.

H. Screen joint, top 584.5 ft. (NAVD88) or 15.0 ft.

I. Well bottom 580.5 ft. (NAVD88) or 19.0 ft.

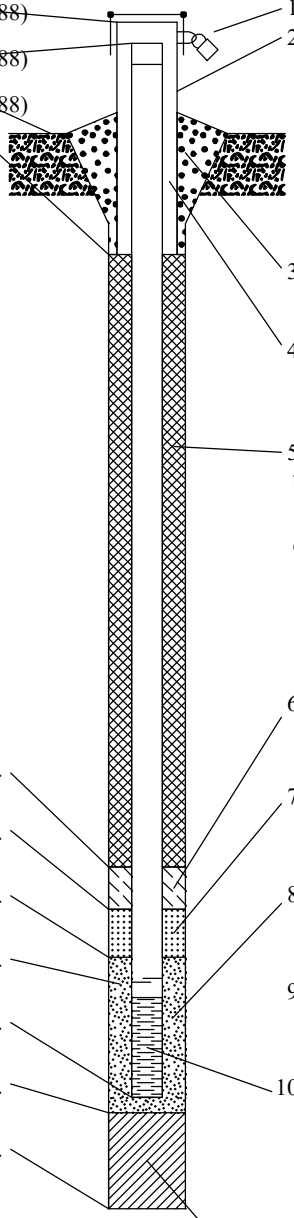
J. Filter pack, bottom 579.5 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom 579.5 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 1.396 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.244 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 4.0 ft.
11. Backfill material (below filter pack): None ☒ Bentonite Slurry Grout Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station

Facility License, Permit or Monitoring No.:

Facility ID:

Type of Well: Well Code 72/dp

Distance from Waste/Source: ft. State: IL

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

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

Lat. 39° 35' 35.8" Long. -89° 29' 21.7" or

St. Plane 1,066,441 ft. N, 2,487,452 ft. E. E/Ⓦ

Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W

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

Gov. Lot Number:

Well Name: MW-23

Date Well Installed: 02/02/2021

Well Installed By: (Person's Name and Firm): Adam Jochimsen, Cascade Drilling

A. Protective pipe, top elevation 610.57 ft. (NAVD88)

B. Well casing, top elevation 610.32 ft. (NAVD88)

C. Land surface elevation 608.1 ft. (NAVD88)

D. Surface seal, bottom 606.1 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 589.1 ft. (NAVD88) or 19.0 ft.

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

G. Filter pack, top 587.1 ft. (NAVD88) or 21.0 ft.

H. Screen joint, top 585.1 ft. (NAVD88) or 23.0 ft.

I. Well bottom 580.1 ft. (NAVD88) or 28.0 ft.

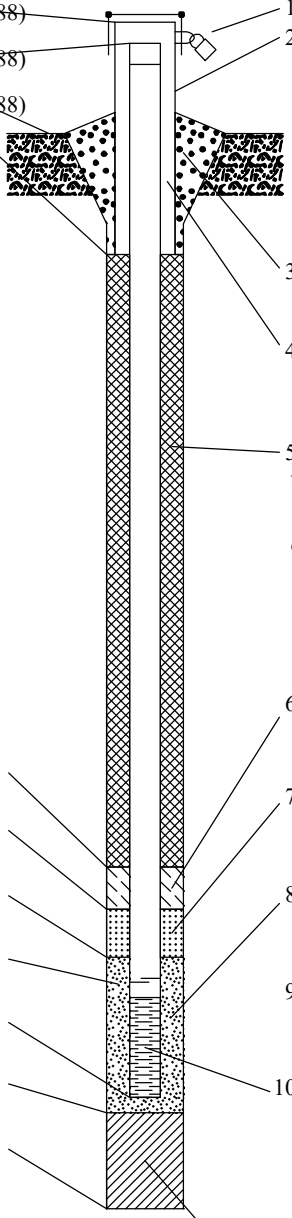
J. Filter pack, bottom 578.1 ft. (NAVD88) or 30.0 ft.

K. Borehole, bottom 558.1 ft. (NAVD88) or 50.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 2.967 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

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

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.614 ft^3

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

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

11. Backfill material (below filter pack): None ☐ Bentonite Slurry Grout Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

Signature

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-24
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 35.8" Long. -89° 29' 35.8" or	
Facility ID	St. Plane 1,066,425 ft. N, 2,486,349 ft. E. E /Ⓦ	Date Well Installed: 02/02/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 615.85 ft. (NAVD88)

B. Well casing, top elevation 615.48 ft. (NAVD88)

C. Land surface elevation 613.0 ft. (NAVD88)

D. Surface seal, bottom 611.0 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 591.0 ft. (NAVD88) or 22.0 ft.

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

G. Filter pack, top 588.0 ft. (NAVD88) or 25.0 ft.

H. Screen joint, top 586.0 ft. (NAVD88) or 27.0 ft.

I. Well bottom 581.0 ft. (NAVD88) or 32.0 ft.

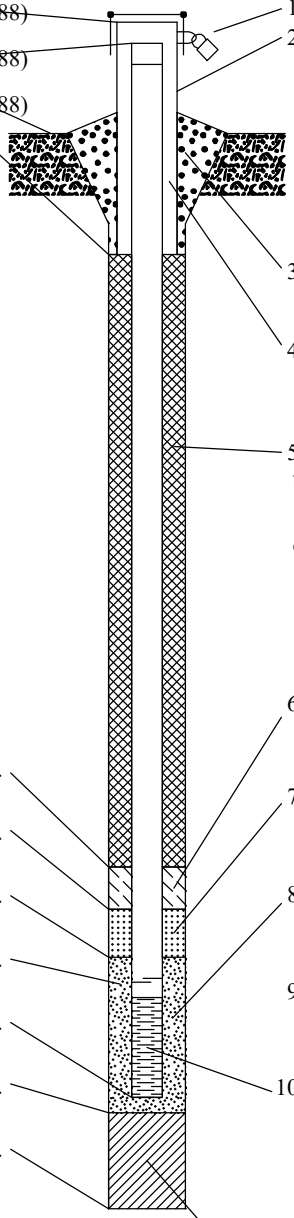
J. Filter pack, bottom 581.0 ft. (NAVD88) or 32.0 ft.

K. Borehole, bottom 581.0 ft. (NAVD88) or 32.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 3.491 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.222 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-25
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 39.8" Long. -89° 29' 42.2" or	
Facility ID	St. Plane 1,066,831 ft. N, 2,485,840 ft. E. E/(W)	Date Well Installed: 02/02/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm) Dave Gordon, Cascade Drilling
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number

A. Protective pipe, top elevation 607.53 ft. (NAVD88)

B. Well casing, top elevation 607.20 ft. (NAVD88)

C. Land surface elevation 604.6 ft. (NAVD88)

D. Surface seal, bottom 602.6 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 599.6 ft. (NAVD88) or 5.0 ft.

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

G. Filter pack, top 597.6 ft. (NAVD88) or 7.0 ft.

H. Screen joint, top 595.6 ft. (NAVD88) or 9.0 ft.

I. Well bottom 590.6 ft. (NAVD88) or 14.0 ft.

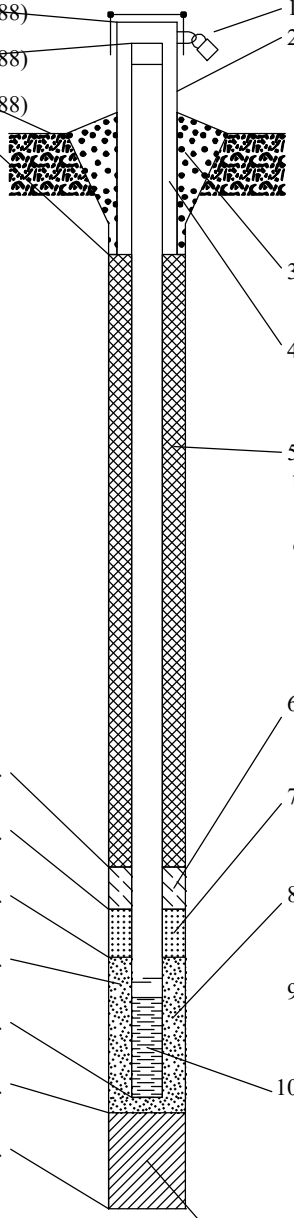
J. Filter pack, bottom 590.6 ft. (NAVD88) or 14.0 ft.

K. Borehole, bottom 579.6 ft. (NAVD88) or 25.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.524 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.222 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Bentonite Chips Other ☒

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

Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-26
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 44.1" Long. -89° 29' 51.3" or	
Facility ID	St. Plane 1,067,258 ft. N, 2,485,127 ft. E. E/Ⓦ	Date Well Installed: 02/02/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 11, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm) Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 596.56 ft. (NAVD88)

B. Well casing, top elevation 596.16 ft. (NAVD88)

C. Land surface elevation 593.3 ft. (NAVD88)

D. Surface seal, bottom 591.3 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Distilled Water

E. Bentonite seal, top 591.3 ft. (NAVD88) or 2.0 ft.

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

G. Filter pack, top 588.3 ft. (NAVD88) or 5.0 ft.

H. Screen joint, top 586.3 ft. (NAVD88) or 7.0 ft.

I. Well bottom 581.3 ft. (NAVD88) or 12.0 ft.

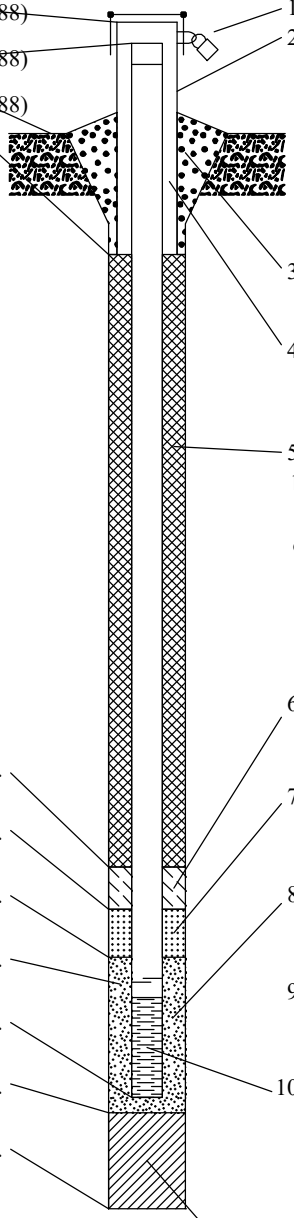
J. Filter pack, bottom 580.3 ft. (NAVD88) or 13.0 ft.

K. Borehole, bottom 573.3 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 0.524 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

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

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.418 ft^3

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

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

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

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-27
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 48.1" Long. -89° 29' 52.5" or	
Facility ID	St. Plane 1,067,662 ft. N, 2,485,027 ft. E. E/Ⓦ	Date Well Installed: 02/02/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 11, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm) Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 600.37 ft. (NAVD88)

B. Well casing, top elevation 600.05 ft. (NAVD88)

C. Land surface elevation 597.3 ft. (NAVD88)

D. Surface seal, bottom 595.3 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 591.3 ft. (NAVD88) or 6.0 ft.

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

G. Filter pack, top 589.3 ft. (NAVD88) or 8.0 ft.

H. Screen joint, top 587.3 ft. (NAVD88) or 10.0 ft.

I. Well bottom 582.3 ft. (NAVD88) or 15.0 ft.

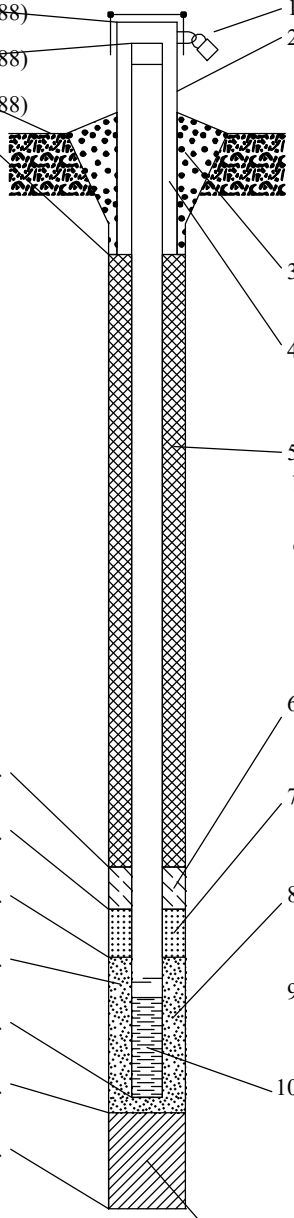
J. Filter pack, bottom 581.3 ft. (NAVD88) or 16.0 ft.

K. Borehole, bottom 577.3 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.698 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.418 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Bentonite Chips Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-28
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 57.3" Long. -89° 29' 52.7" or	
Facility ID	St. Plane 1,068,595 ft. N, 2,485,010 ft. E. E/Ⓦ	Date Well Installed: 02/02/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 2, T. 13 ☐ E ☒ W N, R. 4	Well Installed By: (Person's Name and Firm) Dave Gordon
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 601.66 ft. (NAVD88)

B. Well casing, top elevation 601.40 ft. (NAVD88)

C. Land surface elevation 598.3 ft. (NAVD88)

D. Surface seal, bottom 596.3 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Distilled Water

E. Bentonite seal, top 590.3 ft. (NAVD88) or 8.0 ft.

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

G. Filter pack, top 588.3 ft. (NAVD88) or 10.0 ft.

H. Screen joint, top 586.3 ft. (NAVD88) or 12.0 ft.

I. Well bottom 576.3 ft. (NAVD88) or 22.0 ft.

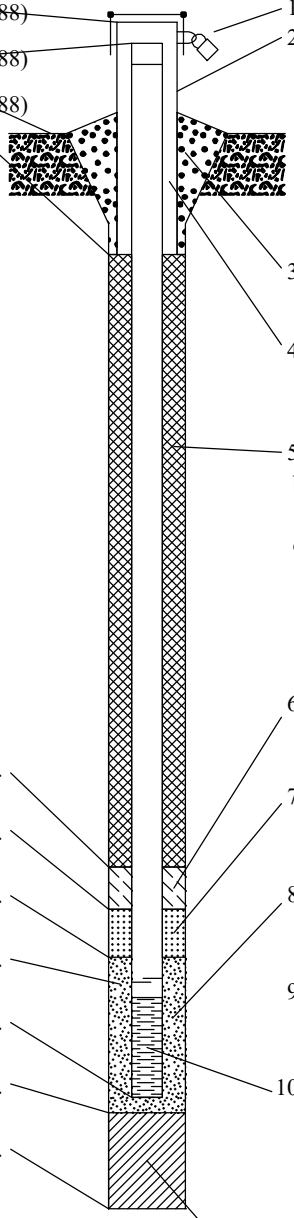
J. Filter pack, bottom 573.3 ft. (NAVD88) or 25.0 ft.

K. Borehole, bottom 573.3 ft. (NAVD88) or 25.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 1.047 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.683 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-29
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 58.9" Long. -89° 29' 50.1" or St. Plane 1,068,755 ft. N, 2,485,210 ft. E. E/Ⓦ	Date Well Installed: 02/01/2021
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 2, T. 13 ☐ E ☒ W N, R. 4	Well Installed By: (Person's Name and Firm): Dave Gordon
Type of Well: Well Code 72/dp	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____
Distance from Waste/Source: ____ ft. State: IL		Cascade Drilling

A. Protective pipe, top elevation: 600.19 ft. (NAVD88)

B. Well casing, top elevation: 599.94 ft. (NAVD88)

C. Land surface elevation: 596.9 ft. (NAVD88)

D. Surface seal, bottom: 594.9 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top: 586.9 ft. (NAVD88) or 10.0 ft.

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

G. Filter pack, top: 584.9 ft. (NAVD88) or 12.0 ft.

H. Screen joint, top: 582.9 ft. (NAVD88) or 14.0 ft.

I. Well bottom: 577.9 ft. (NAVD88) or 19.0 ft.

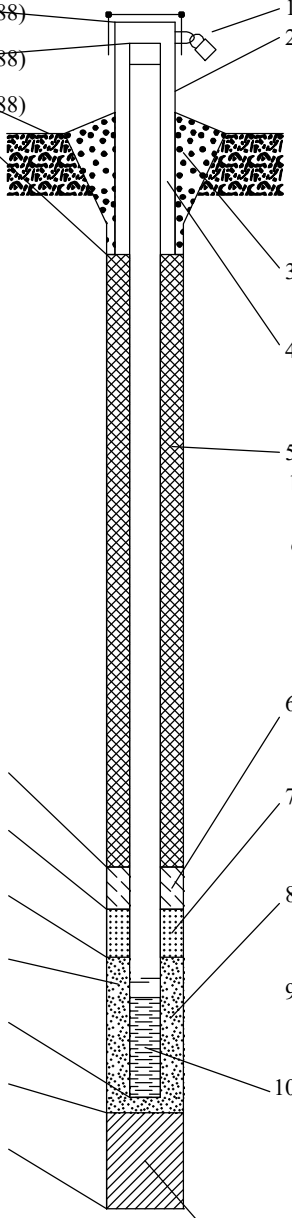
J. Filter pack, bottom: 576.9 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom: 576.9 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter: 6.0 in.

M. O.D. well casing: 2.38 in.

N. I.D. well casing: 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 1.396 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.418 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-30
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 4.6" Long. -89° 29' 19.1" or	
Facility ID	St. Plane 1,069,336 ft. N, 2,486,122 ft. E. E/Ⓦ	Date Well Installed: 02/03/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 619.15 ft. (NAVD88)

B. Well casing, top elevation 618.47 ft. (NAVD88)

C. Land surface elevation 616.0 ft. (NAVD88)

D. Surface seal, bottom 614.0 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 585.0 ft. (NAVD88) or 31.0 ft.

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

G. Filter pack, top 583.0 ft. (NAVD88) or 33.0 ft.

H. Screen joint, top 581.0 ft. (NAVD88) or 35.0 ft.

I. Well bottom 576.0 ft. (NAVD88) or 40.0 ft.

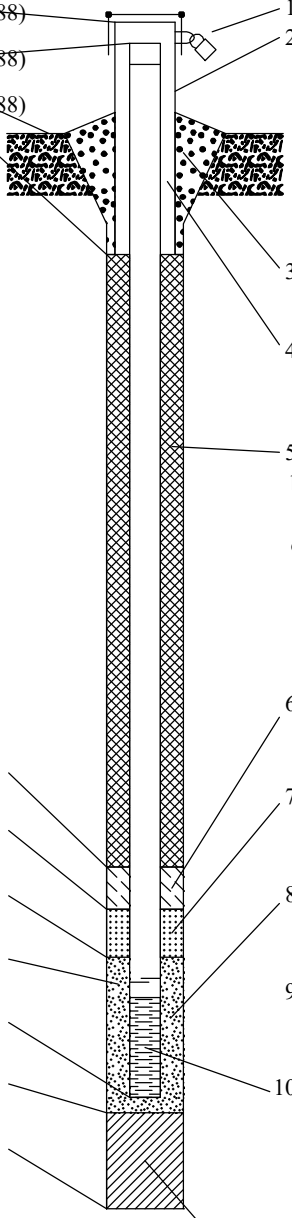
J. Filter pack, bottom 574.0 ft. (NAVD88) or 42.0 ft.

K. Borehole, bottom 571.0 ft. (NAVD88) or 45.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 5.061 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.614 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Bentonite Chips Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-31
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 4.7" Long. -89° 29' 30.1" or	
Facility ID	St. Plane 1,069,353 ft. N, 2,486,768 ft. E. E/Ⓦ	Date Well Installed: 02/03/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ____ ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Cascade Drilling

A. Protective pipe, top elevation 617.66 ft. (NAVD88)

B. Well casing, top elevation 617.34 ft. (NAVD88)

C. Land surface elevation 615.0 ft. (NAVD88)

D. Surface seal, bottom 613.0 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 584.0 ft. (NAVD88) or 31.0 ft.

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

G. Filter pack, top 582.0 ft. (NAVD88) or 33.0 ft.

H. Screen joint, top 580.0 ft. (NAVD88) or 35.0 ft.

I. Well bottom 575.0 ft. (NAVD88) or 40.0 ft.

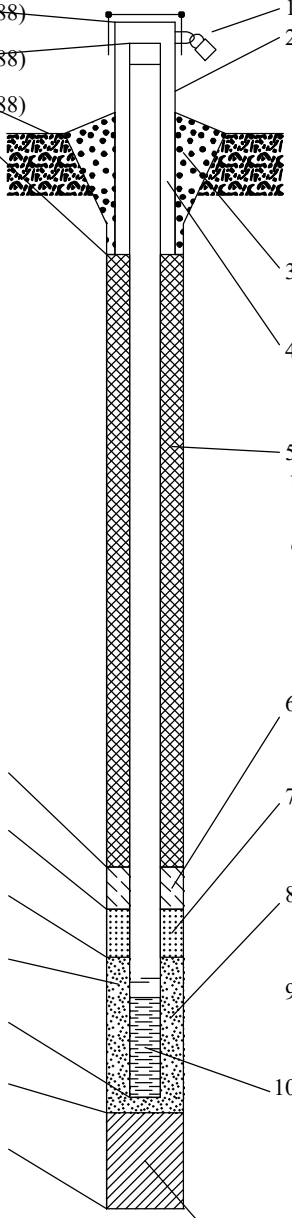
J. Filter pack, bottom 574.0 ft. (NAVD88) or 41.0 ft.

K. Borehole, bottom 565.0 ft. (NAVD88) or 50.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
a. Inside diameter: 4.0 in.
b. Length: 5.0 ft.
c. Material: Steel ☒ Other ☐
d. Additional protection? ☒ Yes ☐ No
If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 5.061 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.418 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
b. Manufacturer Johnson Screens
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Bentonite Chips Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-31S
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 4.7" Long. -89° 29' 30.1" or	
Facility ID	St. Plane 1,069,353 ft. N, 2,486,774 ft. E. E/Ⓦ	Date Well Installed: 02/03/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 617.85 ft. (NAVD88)

B. Well casing, top elevation 617.54 ft. (NAVD88)

C. Land surface elevation 615.1 ft. (NAVD88)

D. Surface seal, bottom 613.1 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 594.1 ft. (NAVD88) or 21.0 ft.

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

G. Filter pack, top 592.1 ft. (NAVD88) or 23.0 ft.

H. Screen joint, top 590.1 ft. (NAVD88) or 25.0 ft.

I. Well bottom 585.1 ft. (NAVD88) or 30.0 ft.

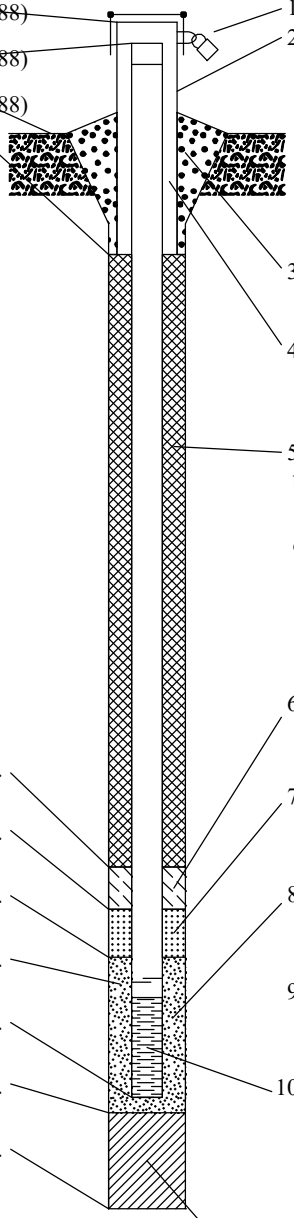
J. Filter pack, bottom 585.1 ft. (NAVD88) or 30.0 ft.

K. Borehole, bottom 585.1 ft. (NAVD88) or 30.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 3.316 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

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

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.222 ft^3

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

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

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

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-32
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 4.6" Long. -89° 29' 19.1" or	
Facility ID	St. Plane 1,069,354 ft. N, 2,487,630 ft. E. E/Ⓦ	Date Well Installed: 02/03/2021
Type of Well: Well Code 72/dp	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Adam Jochimsen
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 619.76 ft. (NAVD88)

B. Well casing, top elevation 619.49 ft. (NAVD88)

C. Land surface elevation 617.2 ft. (NAVD88)

D. Surface seal, bottom 615.2 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 590.2 ft. (NAVD88) or 27.0 ft.

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

G. Filter pack, top 587.2 ft. (NAVD88) or 30.0 ft.

H. Screen joint, top 585.2 ft. (NAVD88) or 32.0 ft.

I. Well bottom 580.2 ft. (NAVD88) or 37.0 ft.

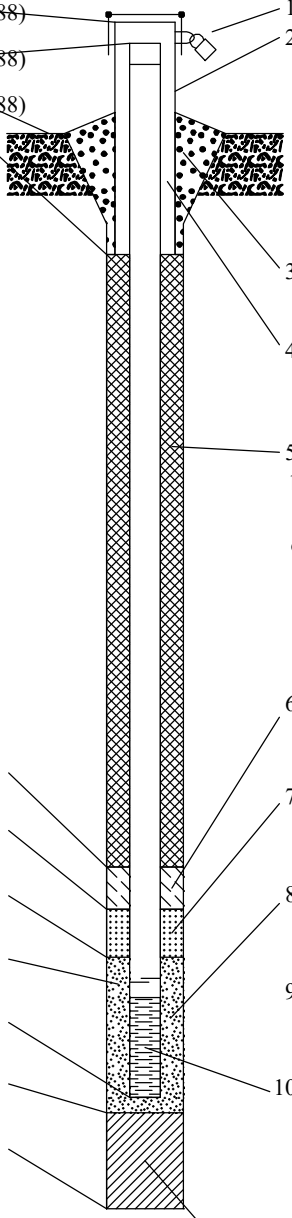
J. Filter pack, bottom 579.2 ft. (NAVD88) or 38.0 ft.

K. Borehole, bottom 577.2 ft. (NAVD88) or 40.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 4.363 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 1.418 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☐ Formation Materials Other ☒

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-7S
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 51.5" Long. -89° 29' 56.3" or	
Facility ID	St. Plane 1,068,011 ft. N, 2,484,728 ft. E. E/Ⓦ	Date Well Installed: 02/02/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 2, T. 13 ☐ E ☒ W N, R. 4	Well Installed By: (Person's Name and Firm): Dave Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 598.14 ft. (NAVD88)

B. Well casing, top elevation 597.64 ft. (NAVD88)

C. Land surface elevation 595.6 ft. (NAVD88)

D. Surface seal, bottom 593.6 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 593.6 ft. (NAVD88) or 2.0 ft.

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

G. Filter pack, top 591.6 ft. (NAVD88) or 4.0 ft.

H. Screen joint, top 589.6 ft. (NAVD88) or 6.0 ft.

I. Well bottom 584.6 ft. (NAVD88) or 11.0 ft.

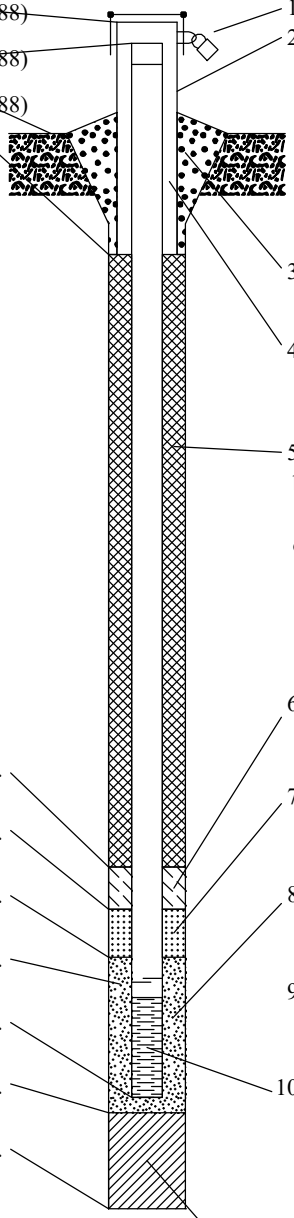
J. Filter pack, bottom 583.6 ft. (NAVD88) or 12.0 ft.

K. Borehole, bottom 580.6 ft. (NAVD88) or 15.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No

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

3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐

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

5. Annular space seal: a. Granular/Chipped Bentonite ☒
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. ____ % Bentonite . . . Bentonite-cement grout ☐
e. 0.349 Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒

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

7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3

8. Filter pack material: Manufacturer, product name & mesh size
a. Filter Sil, Industrial Quartz
b. Volume added 1.418 ft^3

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

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

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

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: MW-8S
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 39.7" Long. -89° 29' 48.6" or	
Facility ID	St. Plane 1,066,822 ft. N, 2,485,345 ft. E. E/Ⓦ	Date Well Installed: 02/02/2021
Type of Well: Well Code 71/dw	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm) Dave Gordon
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 603.68 ft. (NAVD88)

B. Well casing, top elevation 603.30 ft. (NAVD88)

C. Land surface elevation 600.6 ft. (NAVD88)

D. Surface seal, bottom 599.6 ft. (NAVD88) or 1.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Distilled Water

E. Bentonite seal, top 599.6 ft. (NAVD88) or 1.0 ft.

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

G. Filter pack, top 598.1 ft. (NAVD88) or 2.5 ft.

H. Screen joint, top 596.6 ft. (NAVD88) or 4.0 ft.

I. Well bottom 593.6 ft. (NAVD88) or 7.0 ft.

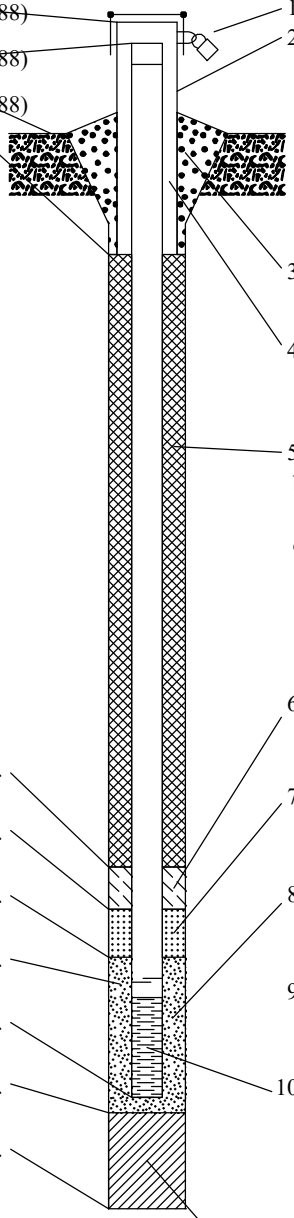
J. Filter pack, bottom 592.6 ft. (NAVD88) or 8.0 ft.

K. Borehole, bottom 580.6 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 0.262 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 0.982 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 3.0 ft.
11. Backfill material (below filter pack): None ☒ Formation Materials and Bentonite Chips Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: XPW01
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 39.9" Long. -89° 29' 35.2" or	
Facility ID	St. Plane 1,066,842 ft. N, 2,486,392 ft. E. E / (W)	Date Well Installed: 02/02/2021
Type of Well: Well Code 99/ot	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 12, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm) Russ Gordon
Distance from Waste/Source ft. / State IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number ____	Cascade Drilling

A. Protective pipe, top elevation 628.23 ft. (NAVD88)

B. Well casing, top elevation 627.84 ft. (NAVD88)

C. Land surface elevation 625.5 ft. (NAVD88)

D. Surface seal, bottom 623.5 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 607.5 ft. (NAVD88) or 18.0 ft.

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

G. Filter pack, top 605.5 ft. (NAVD88) or 20.0 ft.

H. Screen joint, top 603.5 ft. (NAVD88) or 22.0 ft.

I. Well bottom 593.5 ft. (NAVD88) or 32.0 ft.

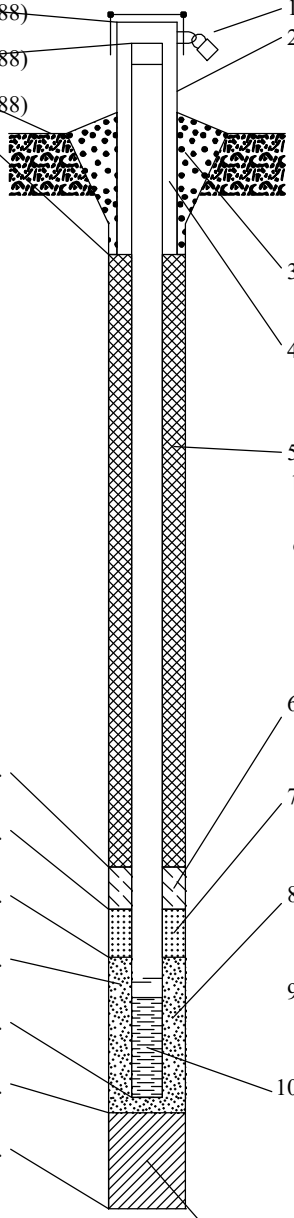
J. Filter pack, bottom 593.5 ft. (NAVD88) or 32.0 ft.

K. Borehole, bottom 593.5 ft. (NAVD88) or 32.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 2.793 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.094 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

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

Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: XPW02
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 52.5" Long. -89° 29' 48.7" or	
Facility ID	St. Plane 1,068,110 ft. N, 2,485,321 ft. E. E/Ⓦ	Date Well Installed: 01/26/2021
Type of Well: Well Code 99/ot	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 ☐ E ☒ W N, R. 4	Well Installed By: (Person's Name and Firm): Russ Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 620.71 ft. (NAVD88)

B. Well casing, top elevation 620.19 ft. (NAVD88)

C. Land surface elevation 617.9 ft. (NAVD88)

D. Surface seal, bottom 615.9 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 608.9 ft. (NAVD88) or 9.0 ft.

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

G. Filter pack, top 606.9 ft. (NAVD88) or 11.0 ft.

H. Screen joint, top 604.9 ft. (NAVD88) or 13.0 ft.

I. Well bottom 594.9 ft. (NAVD88) or 23.0 ft.

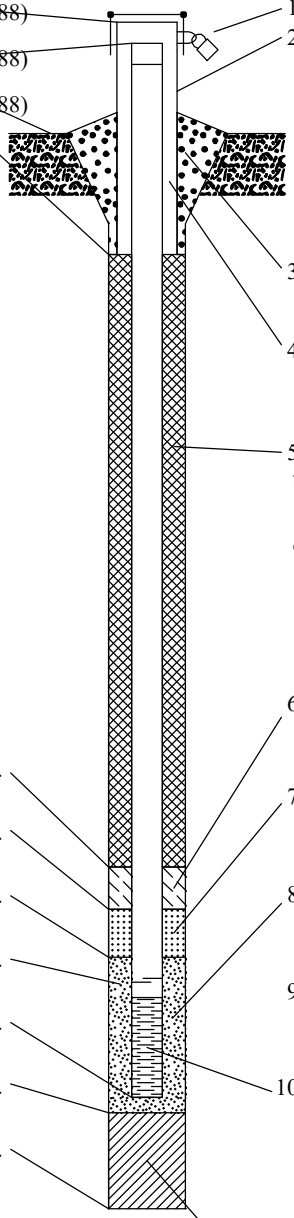
J. Filter pack, bottom 594.9 ft. (NAVD88) or 23.0 ft.

K. Borehole, bottom 595.9 ft. (NAVD88) or 22.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 1.222 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.094 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name Kincaid Power Station	Local Grid Location of Well _____ft. ☐ N. ☐ S. _____ft. ☐ E. ☐ W.	Well Name XPW03
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 35' 58.5" Long. -89° 29' 44.8" or	
Facility ID	St. Plane 1,068,720 ft. N, 2,485,628 ft. E. E / (W)	Date Well Installed 01/26/2021
Type of Well Well Code 99/ot	Section Location of Waste/Source ____1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm) Russ Gordon Cascade Drilling
Distance from Waste/ Source ft. / State IL	Location of Well Relative to Waste/Source u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known Gov. Lot Number _____	

A. Protective pipe, top elevation 619.03 ft. (NAVD88)

B. Well casing, top elevation 618.86 ft. (NAVD88)

C. Land surface elevation 616.1 ft. (NAVD88)

D. Surface seal, bottom 614.1 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe _____

17. Source of water (attach analysis, if required):
Distilled Water

E. Bentonite seal, top 610.1 ft. (NAVD88) or 6.0 ft.

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

G. Filter pack, top 608.1 ft. (NAVD88) or 8.0 ft.

H. Screen joint, top 606.1 ft. (NAVD88) or 10.0 ft.

I. Well bottom 596.1 ft. (NAVD88) or 20.0 ft.

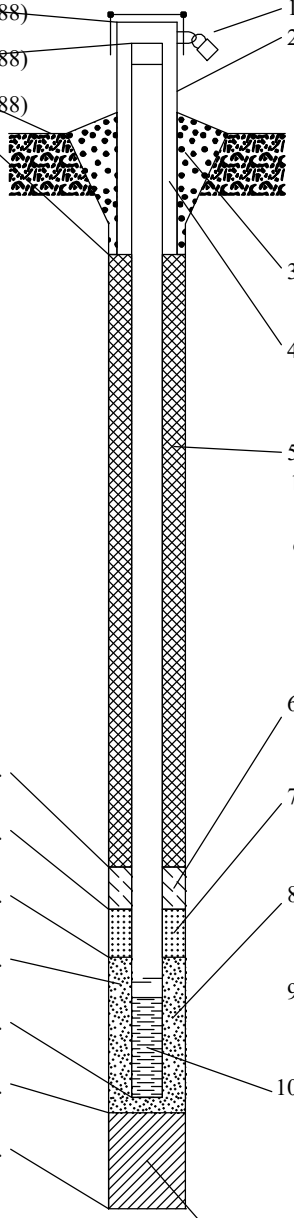
J. Filter pack, bottom 596.1 ft. (NAVD88) or 20.0 ft.

K. Borehole, bottom 596.1 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____% Bentonite . . . Bentonite-cement grout ☐
   e. 0.698 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. _____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. _____
   b. Volume added _____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.094 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

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

Date Modified: 5/3/2021

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

RAMBOLL

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: XPW04
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. 39° 36' 2.6" Long. -89° 29' 32.2" or	
Facility ID	St. Plane 1,069,146 ft. N, 2,486,608 ft. E. E/W	Date Well Installed: 01/26/2021
Type of Well: Well Code 99/ot	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. 1, T. 13 N, R. 4 ☐ E ☒ W	Well Installed By: (Person's Name and Firm): Russ Gordon
Distance from Waste/Source ft. / State: IL	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ Cascade Drilling

A. Protective pipe, top elevation 606.78 ft. (NAVD88)

B. Well casing, top elevation 606.53 ft. (NAVD88)

C. Land surface elevation 604.6 ft. (NAVD88)

D. Surface seal, bottom 602.6 ft. (NAVD88) or 2.0 ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Distilled Water

E. Bentonite seal, top 595.6 ft. (NAVD88) or 9.0 ft.

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

G. Filter pack, top 593.6 ft. (NAVD88) or 11.0 ft.

H. Screen joint, top 591.6 ft. (NAVD88) or 13.0 ft.

I. Well bottom 581.6 ft. (NAVD88) or 23.0 ft.

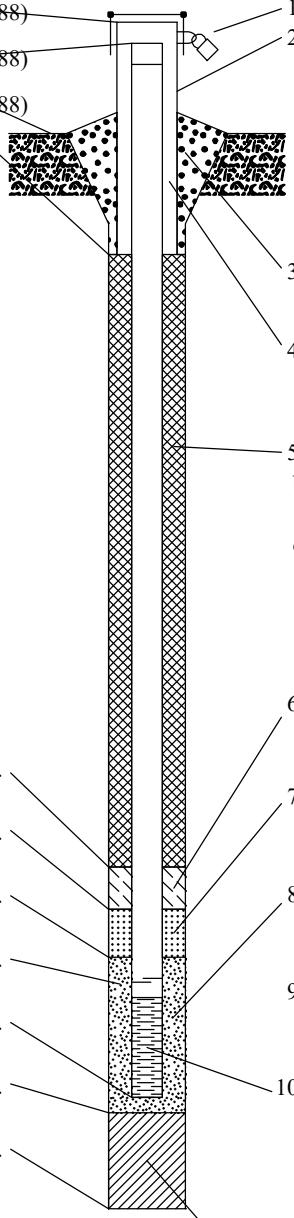
J. Filter pack, bottom 580.6 ft. (NAVD88) or 24.0 ft.

K. Borehole, bottom 580.6 ft. (NAVD88) or 24.0 ft.

L. Borehole, diameter 6.0 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



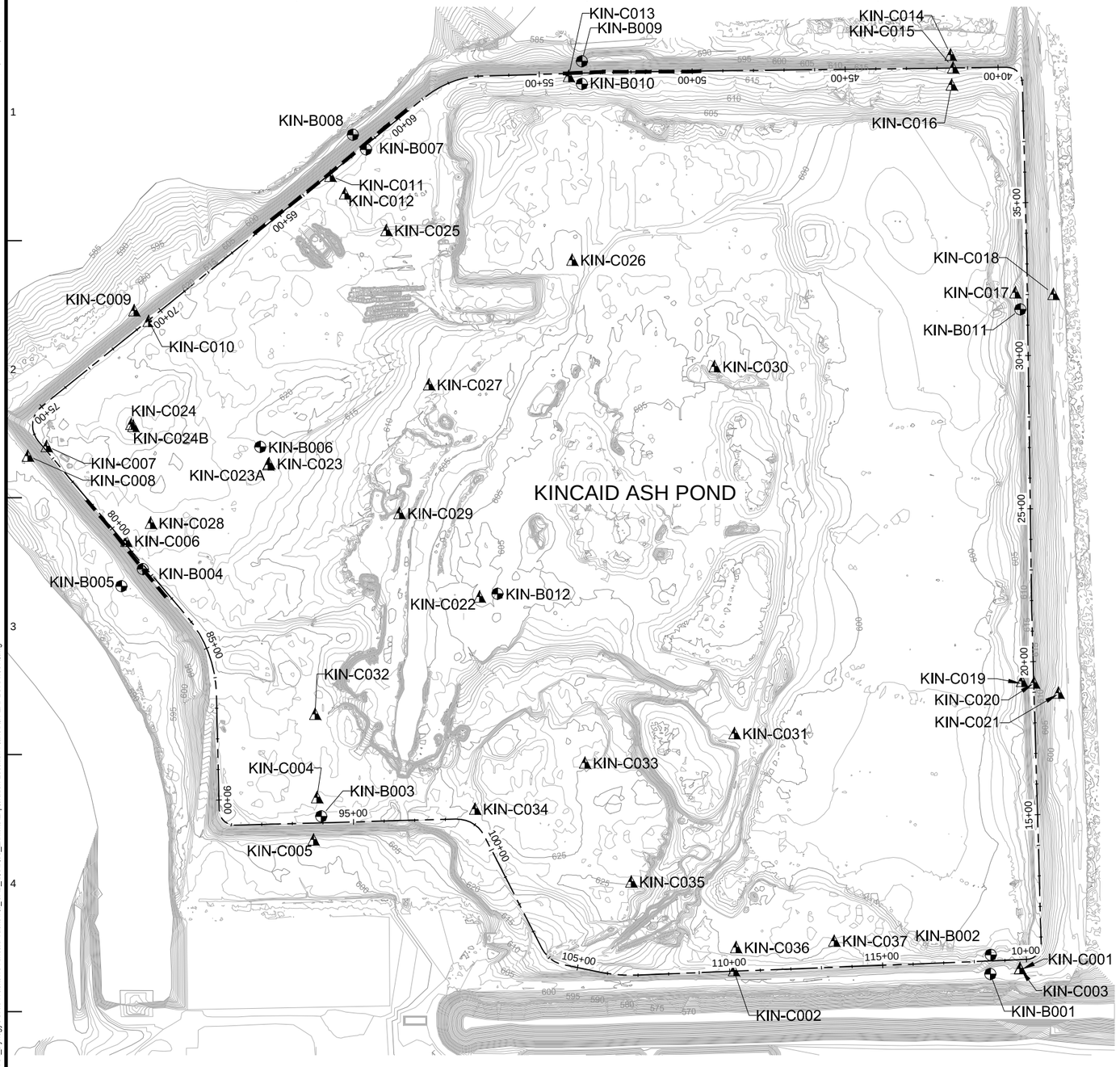
1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bollards
3. Surface seal: Bentonite ☐ Concrete ☒ Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ Sand Other ☒
5. Annular space seal: a. Granular/Chipped Bentonite ☒
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. ____ % Bentonite . . . Bentonite-cement grout ☐
   e. 1.222 Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☐ Gravity ☒
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Filter Sil, Industrial Quartz
   b. Volume added 2.291 ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐
    b. Manufacturer Johnson Screens
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 5/3/2021

Signature: SA WL

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

Pre-2021 Soil Boring and Well Construction Logs



LEGEND

KIN-B000	AECOM BORING LOCATION
KIN-C000	AECOM CONE PENETROMETER TESTING LOCATION
	LOCATION OF ELECTRICAL RESISTIVITY IMAGING LINE (ERI)

NOTES:

1. CONTOURS ARE 2 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. GROUND CONTOURS ARE INTERPRETED FROM HISTORIC TOPOGRAPHIC MAPS PROVIDED BY DYNEGY, RECENT GROUND SHOTS BY AECOM, AND FINAL RESULTS OF LIDAR SURVEYING PERFORMED BY SURDEX CORPORATION IN AUGUST 2015.
4. BATHYMETRY CONTOURS ARE BASED ON A BATHYMETRIC SURVEY PERFORMED BY WEAVER CONSULTANTS IN OCTOBER 2015.

N

0 200 400 600
SCALE IN FEET

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

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

30% DESIGN DRAWINGS FOR REMEDIATION OF ASH POND

ISSUED FOR BIDDING — DATE BY

ISSUED FOR CONSTRUCTION — DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	
DRAWN BY:	GJH
DESIGNED BY:	EJV
CHECKED BY:	MCR
DATE CREATED:	12/23/2015
PLOT DATE:	1/5/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

EXPLORATION LOCATIONS

D-01

SHEET 1 OF 3

SMITH, CURT - 1/5/2016 3:39 PM

DRAWING PATHP:\Projects\Geotech\60428794_DynegyCCR\04Tasks\13 Kincaid Tasks\7.0_CAD_GIS\7.09_Exhibits\Exploration Location Plans\KIN-EXPLORATION.dwg

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Sheet 1 of 1

Date(s) Drilled	08/14/2015 8:20 AM to 08/14/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	598.0 ft NAVD 88
Borehole Backfill	Piezometer KIN-P001	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066408.5 E 2487814 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 598.0 / Depth (feet) 0.0								
	0						Medium dense, brown and gray, CLAY with fine to medium sand, trace fine gravel, with topsoil and roots, (CL) (FILL)								
		S1	6 6 7		100			11.8				3.0			
595															
		S2	6 6 6		0										*Rock blocked S2.*
	5						592.0 / 6.0								
		S3	4 5 7		83		Stiff, moist, brown, high plasticity, SILT with sand, with topsoil, (ML) (FILL)	20.8		39	23	4.0			
590															
		S4	2 2 3		0										
	10						586.0 / 12.0								
585		S5					Stiff, gray, silty CLAY (CL) with reddish brown silt seams, trace fine sand								
	15	S6			0										
		S7					580.0 / 18.0								
580		S8	12 24 32		100		Hard, very moist, brown and gray, low plasticity, sandy silty CLAY with orange brown silt seams, trace fine gravel, (CL) (TILL)	8.9		23	8	> 4.5			*Shelby tube refusal at 18 ft.*
	20														
575															
	25	S9	26 50 / 5"		67		Hard, wet, gray, sandy CLAY, trace fine gravel, (CL) (TILL)	8.9				> 4.5			
570															
	30	S10	27 41 50 / 4 "		59		Hard, wet, gray, sandy CLAY (CL) (TILL) 568.0 / 30.0	10.8				4.5			*Installed Piezometer KIN - P001 in boring.*

End of Boring at 30 ft

AECOM

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 12/29/2015 4:59:11 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Date(s) Drilled	08/12/2015 9:00 AM to 08/13/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	604.1 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P002 5 ft East of KIN-B002)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066471 E 2487815.2 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 604.1 / Depth (feet) 0.0								
	0						Moist, light gray, sandy GRAVEL, trace silt, (GM) (FILL) — 603.1 / 1.0								
		S1	3 5 5		78		Stiff, moist, brown and gray, high plasticity, CLAY, trace sand and gravel with topsoil and roots, (CL) (EMBANKEMENT FILL)	18.1				3.5			
600		S2			71			19.0	130.7	38	21				
	5	S3	2 5 6		100		Stiff, moist, brown and gray, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	13.9				3.5			
							596.1 / 8.0								
595		S4	2 3 4		94		Medium stiff, moist, dark gray, high plasticity, CLAY with topsoil, (CL)	28.4		48	26	0.5			*Organic content 5.9%.*
	10														
590		S5	2 2 2		100		Soft, wet, brown and gray, CLAY (CL)	26.2				1.5			
	15	S6			100		Gray and yellowish brown, trace dark gray, high plasticity, CLAY, trace sand and gravel, (CL)	27.5	121.4	41	24				
585		S7	WOH 2 2		100		Soft, very wet, brown and gray, CLAY, trace fine sand, (CL)	27.1				0.5			
	20														
							581.1 / 23.0								
580		S8	12 23 41		78		Hard, very moist to wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	12.6	153.0	22	8	> 4.5			*Shelby tube refusal at 23' bgs. No recovery.*
	25														
575		S9	30 41 50 / 5"		94		Hard, wet, gray, sandy CLAY, (CL) (TILL)	8.4				> 4.5			
	30														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 12/29/2015 4:59:15 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													
570														*8/12/15*
	35	S10	16 41 50 / 3"	78		Hard, wet, gray, sandy CLAY, trace fine gravel, (CL) (TILL)	8.9				> 4.5			*Rig needs to be repaired at site, work stopped 12 N.*
														8/13/15
565		S11	10 32 50	89			8.8				> 4.5			*Work continued on hole at 9:45 a.m.*
	40													
														Switch to Rotary drilling.
560		S12	27 27 34	100		Hard, very wet, brown and gray, sandy CLAY, (CL) (TILL)	11.9				> 4.5			
	45													
						Hard, wet, brown and gray, sandy CLAY, trace fine gravel, (CL) (TILL)								
555		S13	17 23 29											
	50					554.1 / 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P002 with 5 ft offset to the East. Coordinates shown are for Boring KIN-B002.*
550														
	55													
545														
	60													
540														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Sheet 1 of 2

Date(s) Drilled	08/14/2015 1:20 PM to 08/15/2015 3:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.8 ft NAVD 88
Borehole Backfill	Piezometer KIN-P003	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066923.6 E 2485626.8 (ft NAD83)	Groundwater Level(s)	29 ft on 8/14/2015 1:20:00 PM		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 621.8 / Depth (feet) 0.0								
	0						Stiff, brown and gray, CLAY with fine to coarse sand, trace fine gravel with roots and topsoil, (CL) (EMBANKMENT FILL)								
620		S1	4 4 5		94			11.6				> 4.5			
	5	S2	3 4 10		94		Stiff, brown and gray, CLAY with fine to medium sand, trace fine gravel, (CL) (EMBANKMENT FILL)	15.5				> 4.5			
615		S3	3 4 7		100			16.4				> 4.5			
	10	S4	3 5 7		72		Stiff, brown and gray, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.5				3.0			
610															
	15	S5	3 4 5		100		Stiff, moist, brown and gray, CLAY, trace fine to medium sand, (CL) (EMBANKMENT FILL)	18.0				1.5			
605							Elevation (feet) 603.3 / Depth (feet) 18.5								
	20	S6	3 5 7		100		Stiff, moist, brown and gray, very plastic, CLAY, trace fine to medium sand, (CH) (EMBANKMENT FILL)	23.9	144.2	54	34	2.0			
600							Elevation (feet) 599.8 / Depth (feet) 22.0								
		S7			100		Moist, dark grayish brown with gray and olive, trace yellowish brown, high plasticity, CLAY with sand, with organics (CL)	21.4	125.6	47	27				
	25	S8			92		Stiff to very stiff, moist, grayish green, medium plastic, sandy CLAY, trace fine gravel with reddish brown silt seams (CL)	18.4	129.9	31	15				
595															
							Elevation (feet) 592.8 / Depth (feet) 29.0								
	30	S9	3 4 4				Medium stiff, wet, brown and gray, CLAY (CL-CH)	29.7							

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					588.8 / 33.0								
590		S10	WOH WOH 1	100		Very soft, very wet, brown and gray, medium plastic, CLAY, trace fine sand, with reddish brown silt seams, (CL)	25.2		36	17	0.5			
	35	S11		96										
585		S12	WOH 1 3	100		Soft, very wet, brown and gray, high plasticity, sandy CLAY (CL)	26.0		41	23	0.5			
	40					580.8 / 41.0								
580						Hard, gray, sandy CLAY, trace fine gravel, (CL) (TILL)								
	45	S13	7 16 46	100			9.2				> 4.5			
575														
		S14	19 19 50 / 5"			572.8 / 49.0	17.3				2.0			
	50					571.8 Very dense, very wet, brown and gray, silty fine to medium SAND, trace clay and fine gravel (SM) (TILL) / 50.0								*Installed Piezometer KIN-P003 in boring.*
570						End of Boring at 50 ft								
	55													
565														
	60													
560														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Sheet 1 of 2

Date(s) Drilled	08/18/2015 3:50 PM to 08/19/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	617.8 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout Piezometer KIN-P005	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067731.3 E 2485043.6 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
						Elevation (feet) 617.8 / Depth (feet) 0.0								
	0	S1	9 9 9	72		Very stiff, moist, brown, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.1				> 4.5			
615														
	5	S2	4 6 10	100		Very stiff, brown, medium plastic, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	12.1		31	16	> 4.5			
		S3	4 3 4	61		Medium stiff, brown, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.8							
610														
	10	S4	2 2 3	67		Medium stiff, moist, brown, sandy CLAY, trace fine gravel with reddish brown silt seams (CL) (EMBANKMENT FILL)	19.3				1.25			
605														*No S5 Sample.*
	15	S6	6 7 7	0										
600		S7		79		Stiff, moist, dark grayish brown with dark yellowish brown, medium plastic, CLAY with sand, with reddish brown silt seams (CL) (EMBANKMENT FILL)	14.6	135.1	29	14				
	20	S8		92		Dark brown and green, medium plastic, CLAY with sand (CL) (EMBANKMENT FILL)	21.6	125.1	32	14				
						595.8 / 22.0								
595						Very stiff, moist, brown and gray, CLAY, with fine to medium sand, trace fine gravel, with organics (CL)								
		S9	4 9 10	100			19.0				2.5			
	25					592.8 / 25.0								
						Very stiff, moist, greenish gray, silty CLAY, (CH).								
590														
		S10	2 4 5	100		Stiff, moist, brown and dark brown, high plasticity, CLAY (CH)	29.0		55	33	2.0			
	30					587.8 / 30.0								

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	S11		100		Brown and gray, CLAY (CL)	25.9	126.0						
585														
	35	S12	WOH 2 3	100		Medium stiff, wet, brown and gray, high plasticity, CLAY with reddish orange silt seams (CL)	21.2	135.6	42	25	1.0			
580		S13				Brown and gray, high plasticity, CLAY, trace fine gravel (CL)	21.2	132.8	43	28				*ST refusal at 39 ft.*
	40													
575														
		S14	20 50 / 3"	67		573.8 / 44.0 Hard, wet, brown and gray, sandy CLAY, trace fine gravel (CL) (TILL)	9.0				> 4.5			
	45													
570														
		S15	25 30 33			Hard, very moist, brownish gray, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					567.8 / 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P005 in boring.*
565														
	55													
560														
	60													
555														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Date(s) Drilled	08/21/2015 8:00 AM to 08/23/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Mud Rotary / Rock Core	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	85.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	594.5 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P006 5 ft Southeast of KIN-B005)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067675.7 E 2484973.6 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 594.5 / Depth (feet) 0.0								
	0						Stiff, moist, brown and gray with dark brown, CLAY, with fine to coarse sand (FILL)								
		S1	2 4 6		83			9.8				4.5			
							591.5 / 3.0								
		S2	2 3 4		100		Medium stiff, moist, brown and gray, CLAY with silt seams (CH)	29.2				2.5			
590	5						588.5 / 6.0								
		S3			92		Grayish brown, medium plastic, CLAY, trace sand (CL)	23.9	127.0	35	12	1.5			
		S4			83		Stiff, moist, grayish brown, medium plastic, CLAY with sand, with reddish brown silt seams (CL).	24.2	126.6	38	16	1.25			
585	10														
		S5	2 2 2		100		Soft, very moist to wet, brown and gray, CLAY, with fine to medium sand, trace fine gravel, (CL)	21.9				1.0			
580	15														
		S6			100		577.5 / 17.0	13.8	139.3	22	8	> 4.5			
							Brown and gray, low plasticity, clayey SAND, trace fine gravel, with reddish brown silt seams, (SC) (TILL) 576.0 / 18.5								
		S7	5 6 8		78		Stiff, brown and gray, medium plastic, sandy CLAY, trace fine gravel (CL) (TILL)	10.2				> 4.5			
575	20														
		S8	22 29 35		100		Hard, moist, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	6.7		20	7	2.0			
570	25														
							566.0 / 28.5								
		S9	6 10 14		100		Very stiff, dry, brownish gray, shaley CLAY, trace silt seams (CL-CH)	27.7				3.5			
565	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													
		S10	13 18 23	100		560.5 / 34.0 Hard, moist, brown, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
560	35													
		S11	16 24 30	100		Hard, brown and gray, sandy CLAY, trace fine gravel (CL) (TILL)	7.8				> 4.5			
555	40													
		S12A	12 23 36	100			8.2				> 4.5			*Auger head broke at 10 a.m. Restart 8/23/15. Grout hole; offset 8 ft. SE, set 14 ft. HSA as casing, drill mud rotary and start sampling at 42 ft (S 12A).*
		S12	20 23 30	100			9.5				> 4.5			
550	45													
545	50													
		S13	8 14 21	100		Hard, brown, medium plastic, CLAY, trace fine sand (CL) (TILL)	17.5	129.6	36	18	> 4.5			
540	55													
535	60													
		S14	10 16 26	94		Hard, very wet, brown and gray, sandy CLAY (CL) (TILL)	16.6				> 4.5			
530	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
525	70							523.0	71.5								
							Hard, gray, shaley CLAY, trace fine gravel (CL)	522.0	72.5								
		S15A	23 50 / 5"	72			Very soft, gray, sandy shaley CLAY, trace fine gravel, (CL) (BEDROCK)			15.2 8.4				> 4.5			
520	75							519.5	75.0								*Switch to roller bit. Hard drilling 74 - 75'. Rollerbit refusal at 75 ft. Start wireline coring on 8/24/15.*
							Limestone, hard, medium strong, light to medium gray. qu = 6,500 psi (75.9 - 76.5 ft)			1.0	163.6						
		C1	79	100													
515	80							514.9	79.6								
							SHALE, very soft, laminated, waxy, dark gray SHALE, moderately hard, laminated, black										
		C2	53	91						8.4	116.3						
510	85							509.5	85.0								*Installed Piezometer KIN-P006 with 5 ft offset to the Southeast. Coordinates shown are for Boring KIN-B005.*
							End of Boring at 85 ft										
505	90																
500	95																
495	100																

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Sheet 1 of 2

Date(s) Drilled	08/14/2015 9:30 AM to 08/18/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Cased, Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	41.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	617.2 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1068130.5 E 2485427.3 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					617.2 / 0.0 Dry, black, CINDERS with fine to coarse grained sand (ASH)								
615		S1	3 3 3	100		Loose, wet, brown and gray, CINDERS with clayey silt (ASH)	34.2							
						613.7 / 3.5								
		S2	WOH 1 WOH	100		Very soft, wet, brown with black, CLAY, with cinders (CL)	71.4				0.5			
	5	S3		0										
610														
		S4		100		Dark brown, very wet, fine to medium grained sandy CLAY with ash (CL)								*Piston sample.*
	10													
605		S5	WOH	100		Very soft, very wet, dark brown and gray, sandy CLAY, with organics, with ash (CL)	48.0				0.25			
		S6		47		602.2 / 15.0								*Piston sample. 8/14/15 12:05 work stopped.*
	15					Very loose, wet, coarse grained CINDERS (ASH)								
600		S7	1 1 1	100		Very loose, very wet, dark brown, CINDERS, with organics and clay (ASH)	38.5							
	20	S8		0		Very loose, very wet, black, fine to coarse grained CINDERS (ASH)								*8/18/15 9:15 work resumed. Piston sample.*
595		S9		100		Very loose, wet, coarse grained CINDERS (ASH)								
	25													
590														
		S10	2 2 3	56		588.2 / 29.0 Medium stiff, very wet, brown and gray, medium plastic CLAY, trace fine sand, with	30.4		36	15	1.0			
	30													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30						reddish brown silt seams (CL)										
585								583.7	33.5								
	35	S	S11	WOH 2 3	100		Medium stiff, very wet, CLAY, with reddish brown silt seams (CH)			28.2				1.0			
580		S	S12		100												
	40	S	S13		46			576.2	41.0								
575							End of Boring at 41 ft										
	45																
570																	
	50																
565																	
	55																
560																	
	60																
555																	
	65																

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Sheet 1 of 2

Date(s) Drilled	08/20/2015 11:35 AM to 08/20/2015 2:15 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	616.8 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P007 adj. to KIN-B007).	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069102.7 E 2485773.3 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						616.8 / 0.0 Hard, dry, brown, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)								
615		S1		21 26 31	78			5.5				> 4.5			
		S2		9 12 15	100		612.8 / 4.0 Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL)	8.0				> 4.5			
	5														
610		S3		20 15 8	100			20.8				> 4.5			
		S4		4 6 9	100		608.3 / 8.5 Stiff, moist, brown to dark brown, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	6.2				3.0			*Organic content 3.9%.*
	10														
605															
		S5		4 5 7	100			15.0				4.25			
	15														
600		S6			83		Green, brown and gray, medium plastic CLAY, with sand (CL) (EMBANKMENT FILL)			35	15				
		S7		3 6 8	100		Stiff, very moist, brown and gray, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	10.3				3.0			
	20														
595															
		S8		3 5 6	100		592.8 / 24.0 Stiff, very moist, brown and gray with dark gray, CLAY, with fine to medium sand, trace fine gravel (CL - CH) (EMBANKMENT FILL)	24.9				1.5			
	25						591.8 / 25.0								
		S9			100		Soft, grayish brown, silty CLAY (CL)					0.5			
590															
		S10			100		Medium stiff, very moist, brown to light brown, sandy CLAY, trace silt, trace fine gravel, with roots (CL)	10.8				1.0			
	30														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 12/29/2015 4:59:56 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30															
585						Medium stiff, wet, light brown, sandy CLAY (CL)										
	35	S11		100												
		S12		100												
580							578.8	38.0								
		S13	WOH WOH 6	67		Very loose, very wet, brown, clayey SAND, trace fine gravel (SC)	577.3	39.5	13.8				0.75			
	40					Medium stiff, wet, light brown, Sandy CLAY, trace silt (CL) (TILL)										
575																
		S14	24 38 42	100		Hard, very wet, gray, medium plastic, sandy CLAY, trace fine gravel (CL) (TILL)			11.2		27	13	> 4.5			
	45															
570																
		S15	25 34 50			Hard, brownish gray, sandy CLAY, trace fine gravel (CL) (TILL)	566.8	50.0	7.7				> 4.5			
	50					End of Boring at 50 ft										*Installed Piezometer KIN-P007 with offset. Coordinates shown are for Boring KIN-B007.*
565																
	55															
560																
	60															
555																
	65															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B008

Sheet 1 of 1

Date(s) Drilled	08/20/2015 7:45 AM to 08/20/2015 11:10 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	590.5 ft NAVD 88
Borehole Backfill	Piezometer KIN-P008	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069150.5 E 2485729.9 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 590.5 / Depth (feet) 0.0								
590	0						Rockfill (3 - 7 inch), little topsoil.								
							589.5 / 1.0								
		S1	7 5 5		0		Medium stiff, very moist, brown and gray, sandy CLAY, (CL) (FILL)								*Rock lodged in S1.*
		S2	2 2 4		100			25.4				2.25			
585	5						Soft to medium stiff, wet, brown, sandy CLAY (CL) (FILL)								
		S3	2 2 3		100			22.8				0.25 1.0			
		S4			100		581.5 / 9.0	11.4	140.0	19	7				
580	10						Low plasticity, sandy CLAY (CL) (TILL)								*Till material at the bottom of S4.*
		S5	15 30 39		100		Hard, wet, brown and gray, medium plastic, sandy CLAY, trace fine to coarse gravel (CL) (TILL)	13.3		25	11	> 4.5			
575	15														
		S6	13 31 41		100		Hard, brownish gray, sandy CLAY, trace fine gravel (CL) (TILL)	10.7	144.8			> 4.5			
570	20														
		S7	20 35 43		100		Hard, slightly moist, brownish gray, sandy CLAY, trace fine gravel (CL) (TILL)	7.6				> 4.5			
565	25														
		S8	18 32 50 / 4"				560.5 / 30.0	7.1				> 4.5			*Installed Piezometer KIN-P008 in boring.*
	30						End of Boring at 30 ft								

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B009

Sheet 1 of 1

Date(s) Drilled	08/14/2015 1:15 PM to 08/14/2015 2:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	593.6 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P009 adj. to KIN-B009)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069390.8 E 2486478.7 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 593.6 / Depth (feet) 0.0								
	0	SS	S1	3 3 4	100		Medium stiff, moist, dark brown, CLAY, with fine sand, with roots (CL) (FILL)	20.3				1.75			
590							589.6 / 4.0								
		SS	S2	2 2 3	100		Medium stiff, moist, dark brown, high plasticity, CLAY, with sand, with roots (CL)	23.8		42	23	1.5			
	5						588.6 / 5.0								
		SS	S3	2 3 5	100		Medium stiff, moist, brown and gray, CLAY, with fine to medium sand, with silt seams (CH)	21.3				1.0			
							586.1 / 7.5								
585		SS	S4		100		Grayish brown, medium plastic, sandy CLAY, with pebbles	19.9	123.7	28	13				
	10	SS	S9		63										*S9 and S10 collocated hole.*
		SS	S10		0										
580		SS	S5	6 15 19	100		Hard, wet, brown, sandy CLAY, trace fine gravel, (CL) (TILL)	10.3	113.6			> 4.5			*Shelby tube refusal.*
	15														
575		SS	S6	16 29 40	100		Gray	7.5				> 4.5			
	20														
570		SS	S7	18 32 50 / 5"	94		Hard, gray, sandy silty CLAY, trace fine gravel (CL) (TILL)	11.5				> 4.5			
	25														*Installed Piezometer KIN-P009 in boring.*
565		SS	S8	16 33 50 / 5"	94		Hard, brownish gray, sandy CLAY, trace fine gravel (CL) (TILL)	9.2	105.4			> 4.5			
	30						563.6 / 30.0								

End of Boring at 30 ft

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Sheet 1 of 3

Date(s) Drilled	08/26/2015 8:00 AM to 08/26/2015 5:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary	Drill Bit Size/Type	7.75 in. O.D. HSA / 4 in. Roller Bit	Borehole Depth	75.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	611.4 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-010 12 ft West of KIN-B010)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069316.4 E 2486478.7 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 611.4 / Depth (feet) 0.0 Topsoil and gravel basecourse (fill).								
							610.4 / 1.0								
610		S1	4 4 6		78		Stiff, moist, brown, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	4.9				> 4.5			
		S2	4 5 7		89			8.9				4.0			
	5														
605		S3	3 3 4		100		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (EMBANKMENT FILL)	9.5		23	9	1.75 3.0			
		S4	4 6 7		89		Stiff, moist, brown and dark brown, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	11.8	135.8			> 4.5			
	10														
600															
		S5	2 5 5		100		Brown and gray	19.5				0.75			
	15														
595															
		S6			20		Stiff, moist, grayish brown, medium plastic, CLAY, with sand (CL) (EMBANKMENT FILL)	21.1	128.1	33	19	1.5			
	20						590.4 / 21.0								
590		S7			18		Very stiff, CLAY, with sand (CL)	11.8	137.7	31	16	3.5			*ST refusal*
								23.3							
		S8	3 5 7		94		587.0 / 24.4	17.6	136.5			1.25			
	25						Stiff, very wet, brown and gray with dark brown, CLAY, with fine to medium sand (CH)								
585															
		S9	2 2 3		100		582.4 / 29.0 Medium stiff, dark brown, medium plastic, CLAY (CL)	28.9		40	20	0.5			*Organic content 5.3%.*
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													*30 - 32': Duttings appear as topsoil.*
580						579.4 / 32.0								
		S10		22		Medium stiff, very wet, brown and gray, sandy CLAY, trace fine gravel, (CL - CH) (TILL)					1.75			
	35	S11	3 4 4	100			20.9				1.75			
575						573.4 / 38.0								
		S12	13 32 50 / 3"	89		Very dense, very wet, brown and gray, clayey SAND, trace fine gravel (SC) (TILL)	9.8							*38': Hard augering.*
	40													*40': Mud rotary*
570						568.4 / 43.0								
		S13	23 42 50	89		Hard, wet, gray, sandy CLAY, trace fine gravel (CL) (TILL)	10.7				> 4.5			
	45													
565														
		S14	27 50 / 5"	89		Low plasticity	9.9	149.4	23	9	> 4.5			
	50													
560														
	55													
555														
		S15	23 35 50 / 5"	100			9.5				> 4.5			
	60													
550														*61 - 63': Easier drilling.*
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
545																
		S16	13 50 50 / 1"	89		Greenish gray and brown Shale (BEDROCK)	541.9	69.5	17.0				> 4.5			*Roller bit refusal. S17-SPT bouncing. Switch to rock coring.*
70	70					Shale, dark gray, very soft, waxy	541.1	70.3								
540		C1	53	95		Run #1 70.3 - 75': Limestone, gray, thinly bedded, strong, moderately hard, qu = 11,380 psi (70.6 - 71.2 ft)			0.3	165.8						
	75					End of Boring at 75 ft	536.4	75.0								*Installed Piezometer KIN-P010 with 12 ft offset West.*
535																
	80															
530																
	85															
525																
	90															
520																
	95															
515																
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Date(s) Drilled	08/11/2015 11:30 AM to 08/11/2015 4:30 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6.50 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	611.8 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1068580.1 E 2487911.8 (ft NAD83)	Groundwater Level(s)	26 ft on 8/11/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 611.8 / Depth (feet) 0.0								
							Sandy gravel fill.								
							Elevation (feet) 610.8 / Depth (feet) 1.0								
610		S1	3 4 4		33		Medium stiff, moist, brown, CLAY, with fine sand, (CL) (EMBANKMENT FILL)	16.6							
		S2	3 6 7		83		Stiff, moist, brown and dark brown, medium plastic, CLAY, with fine sand, trace fine gravel (CL) (EMBANKMENT FILL)	18.6		38	18				*Organic Content of 2.9%.*
	5														
605		S3	3 5 8		100		Stiff, brown and dark brown, high plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	17.2		44	26				
							Elevation (feet) 603.3 / Depth (feet) 8.5								
		S4	3 5 8		100		Stiff, brown to gray, CLAY, trace fine sand (CL - CH) (EMBANKMENT FILL)	20.4							
	10														
600															
		S5			96		Elevation (feet) 597.3 / Depth (feet) 14.5	22.9	118.0	58	37				*Organic content 2.5%.*
	15						Dark brown, high plasticity, CLAY (CH) (EMBANKMENT FILL) 16 - 18': Possible topsoil								
595							Elevation (feet) 593.8 / Depth (feet) 18.0								
		S6	3 5 6		100		Stiff, brown and gray, high plasticity, CLAY, trace fine sand (CL - CH)	27.7	140.7	49	29				
	20														
590															
		S7	2 2 3		100		Elevation (feet) 587.8 / Depth (feet) 24.0	26.8				0.75			
	25						Medium stiff, moist, brown and gray, CLAY, trace fine sand, with reddish brown silt seams (CL) ▽								
585		S8			96							0.5			
		S9	WOH		100		Very soft, moist, brown and gray, high plasticity, CLAY, trace fine sand, with reddish	26.5		40	21	0.3			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					brown silt seams (CL)								
580		S10	WOH 1 1	100		Very soft, wet, brown and gray, medium plastic, sandy CLAY (CL)	25.0		33	17				
	35													
575						Elevation (feet) 574.8 / Depth (feet) 37.0								
		S11	12 21 50 / 2"	100		Very dense, wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)	8.2		23	9				
	40													
570						Elevation (feet) 569.8 / Depth (feet) 42.0								
		S12	37 50 / 3"	61		Hard, wet, brownish gray, sandy CLAY, trace fine gravel, (CL) (TILL)	9.0				> 4.5			
	45													
565														
		S13	50 / 5"	33		Elevation (feet) 561.8 / Depth (feet) 50.0	9.6				> 4.5			
	50					End of Boring at 50 ft								
560														
	55													
555														
	60													
550														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B012

Sheet 1 of 2

Date(s) Drilled	08/25/2015 8:00 AM to 08/25/2015 12:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	40.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	604.2 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1067650.8 E 2486203 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 604.2 / Depth (feet) 0.0								
	0														
		SS	S1	7 8 12	83		Medium dense, moist, black, fine to coarse grained CINDERS (ASH)	11.2							
600		SS	S2	12 18 18	100			12.0							
	5						Very dense, very wet, black, CINDERS (ASH)								
		ST	S3		0										*Piston sample 6' to 8': NR. Auger to 8.5'.*
595		SS	S4	3 3 4	44		Loose, very wet, black, CINDERS (ASH)	19.4							*Ash flowing into auger at 8.5'. Use SPT.*
	10														
							Elevation (feet) 590.4 / Depth (feet) 13.8								*Piston sampler.*
590		SS	S5		60		Very soft, wet, light brown, silty CLAY (CL)					0.25			
	15														
		ST	S6		100		Very soft to soft					0.5			
585															
		ST	S7		92		Soft					0.75			
	20														
							Soft, grayish brown, sandy silty CLAY, trace fine gravel (CL)								
580		ST	S8		100							0.6			
	25														
							Hard, brown and gray, low plasticity, sandy silty CLAY, trace fine gravel (CL)								*28' Harder drilling*
575		SS	S9	11 28 43	100			8.4		19	6	> 4.5			
	30														

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

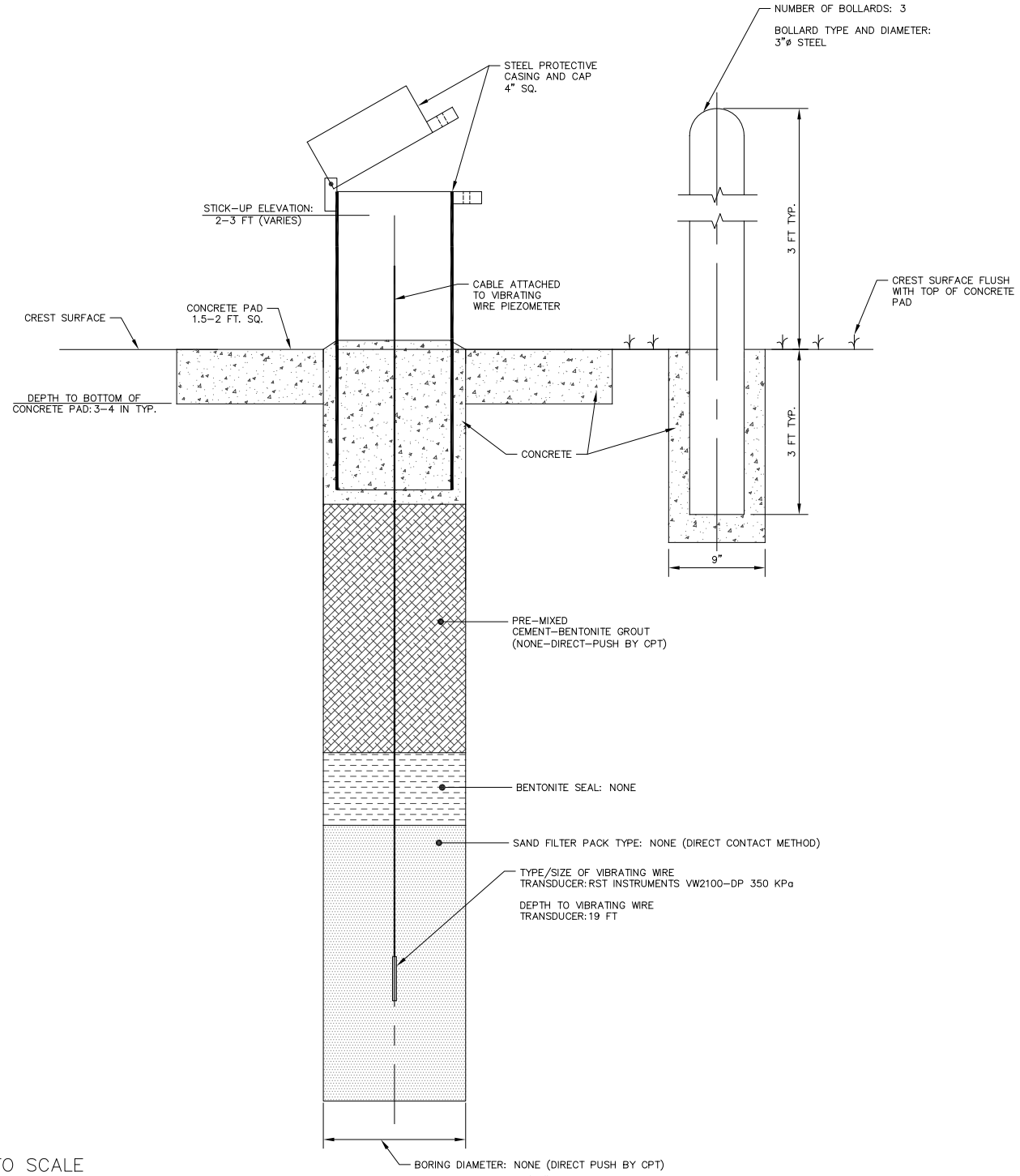
Log of Boring KIN-B012

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													
570	35	S10	22 47 50 / 3"	89		Hard, brown and gray, sandy CLAY, trace fine gravel (CL)	7.1							*35' Very hard drilling*
						566.2 / 38.0								
565	40	S11	27 38 50 / 4"	89		Very dense, very wet, brown and gray, clayey SAND, trace fine gravel (SC)	14.9							
						564.2 / 40.0								
						End of Boring at 40 ft								
560	45													
555	50													
550	55													
545	60													
540	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 12/29/2015 5:00:30 PM

Project: Dynegy	Log of Piezometer
Project Location: KINCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

Piezometer Location	KIN-P004	Date Installed	8 / 2015	Time	
Installed By		Observed By	AECOM	Total Depth	19 FT
Method of Installation	CPT - DIRECT PUSH	Drilling Contractor	CONETEC, INC.	Surface Elevation	601.7 FT
Screened Interval	N/A	Completion Zone	FOUNDATION		
Remarks		Groundwater Level(s)	14.3 FT BGS (10/7/2015)		



NOT TO SCALE

AECOM

Project: Dynegy

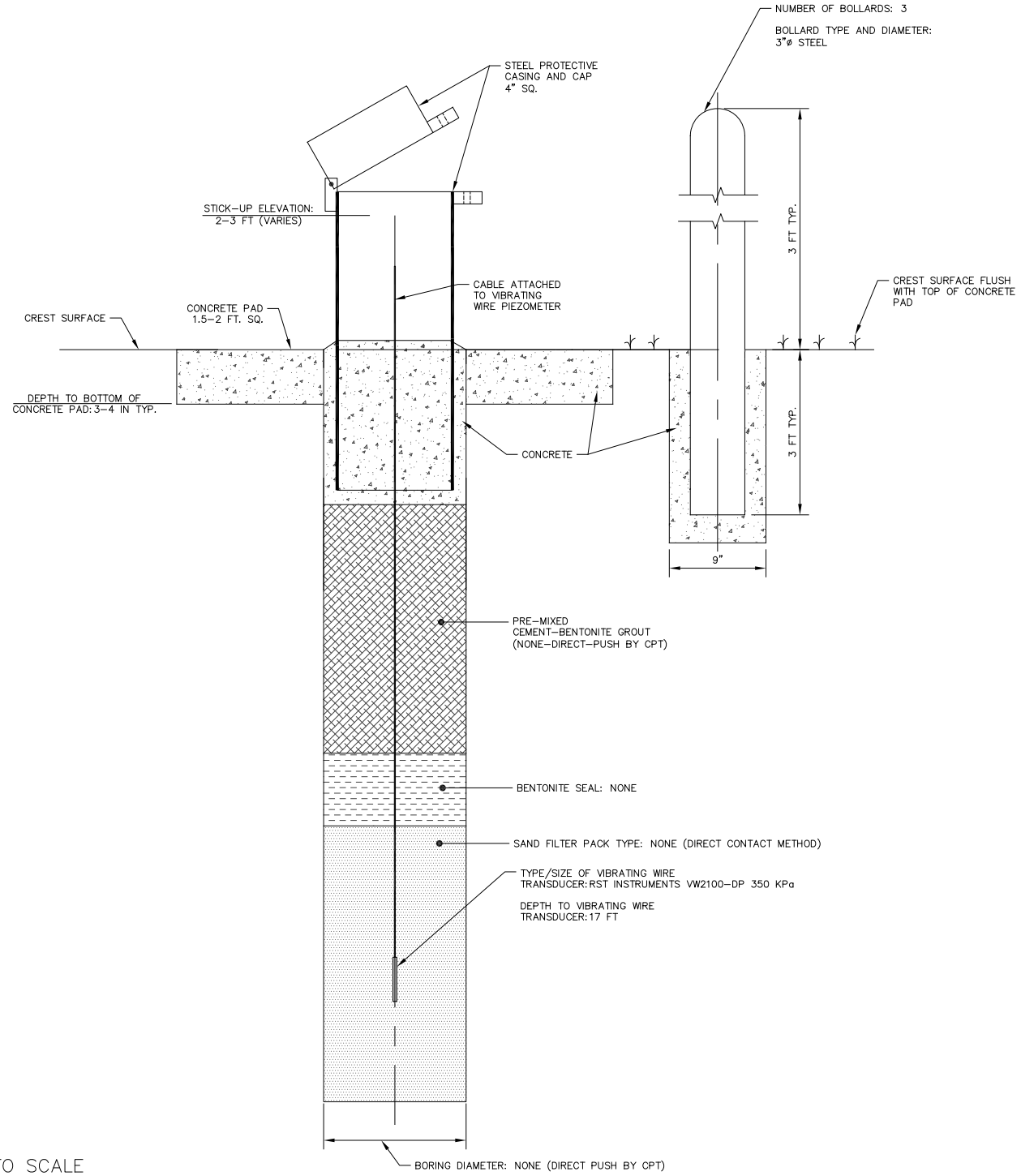
Project Location: KINCAID POWER STATION, ILLINOIS

Project Number: 60440697

Log of Piezometer

Sheet 1 of 1

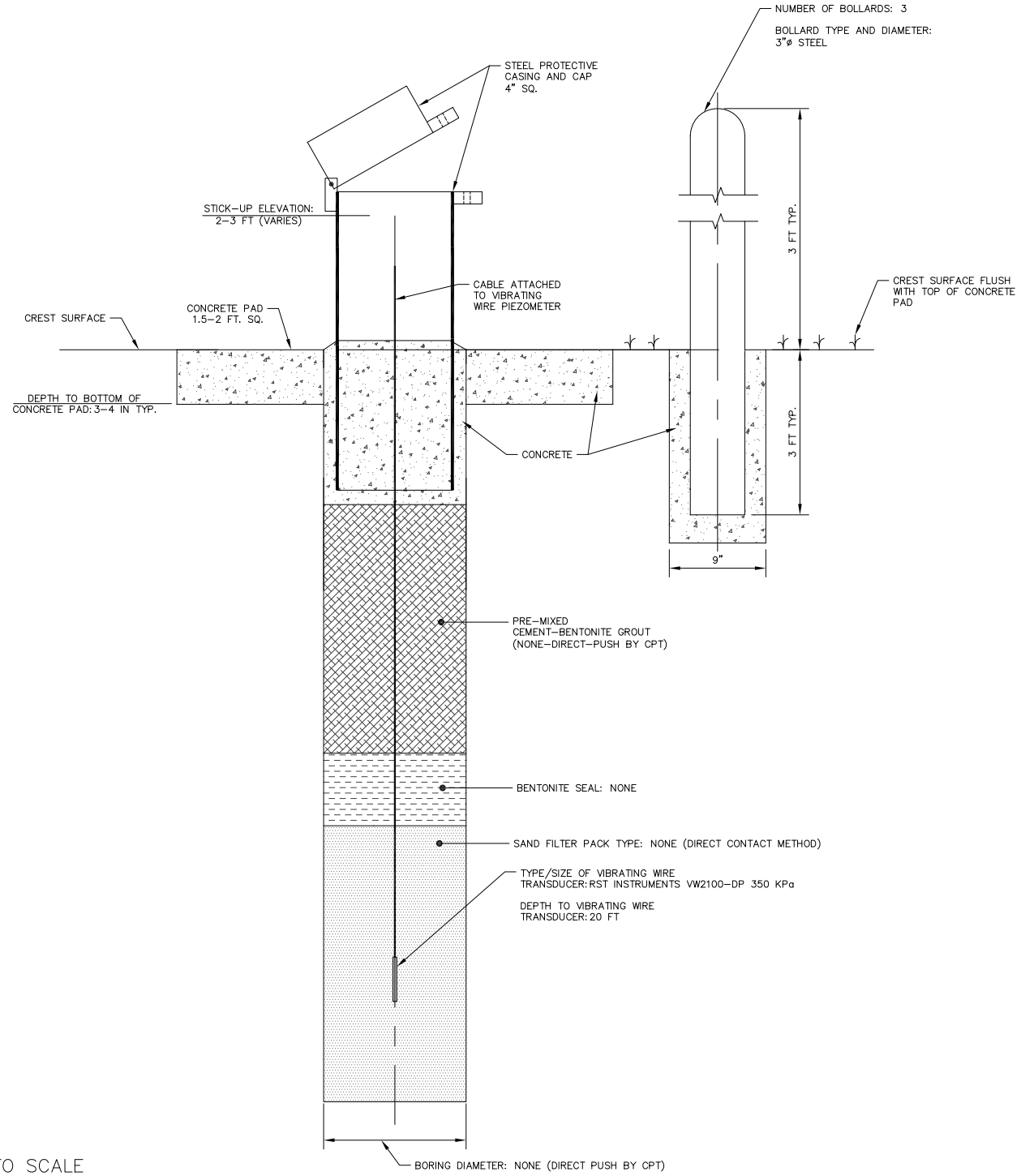
Piezometer Location	KIN-P011	Date Installed	8 / 2015	Time	
Installed By		Observed By	AECOM	Total Depth	17 FT
Method of Installation	CPT - DIRECT PUSH	Drilling Contractor	CONETEC, INC.	Surface Elevation	605.5 FT
Screened Interval	N/A	Completion Zone	FOUNDATION		
Remarks		Groundwater Level(s)	13.9 FT BGS (10/7/2015)		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KINCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

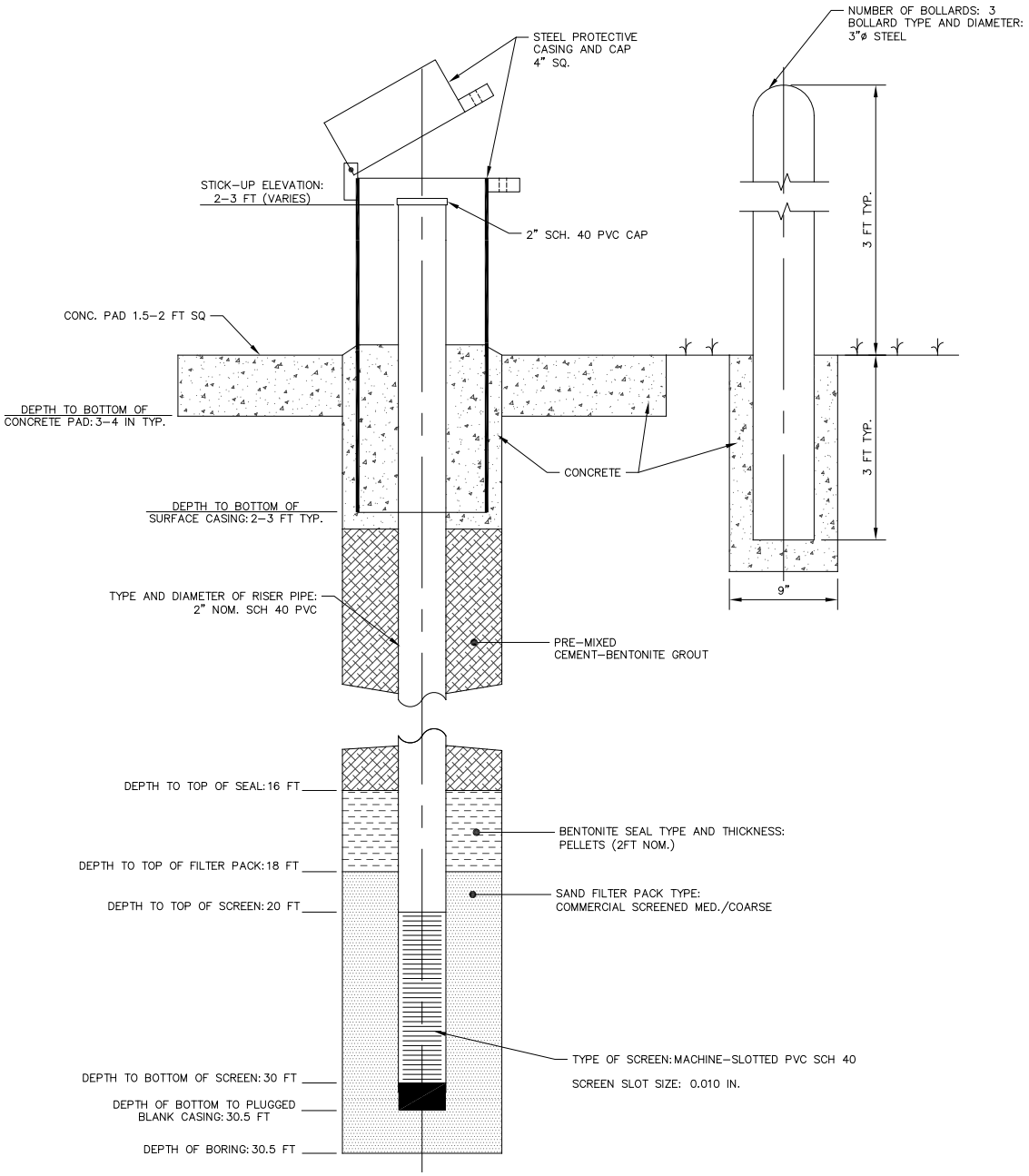
Piezometer Location	KIN-P012	Date Installed	8 / 2015	Time	
Installed By		Observed By	AECOM	Total Depth	20 FT
Method of Installation	CPT - DIRECT PUSH	Drilling Contractor	CONETEC, INC.	Surface Elevation	617.0 FT
Screened Interval	N/A	Completion Zone	FOUNDATION		
Remarks		Groundwater Level(s)	16.1 FT BGS (10/7/2015)		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

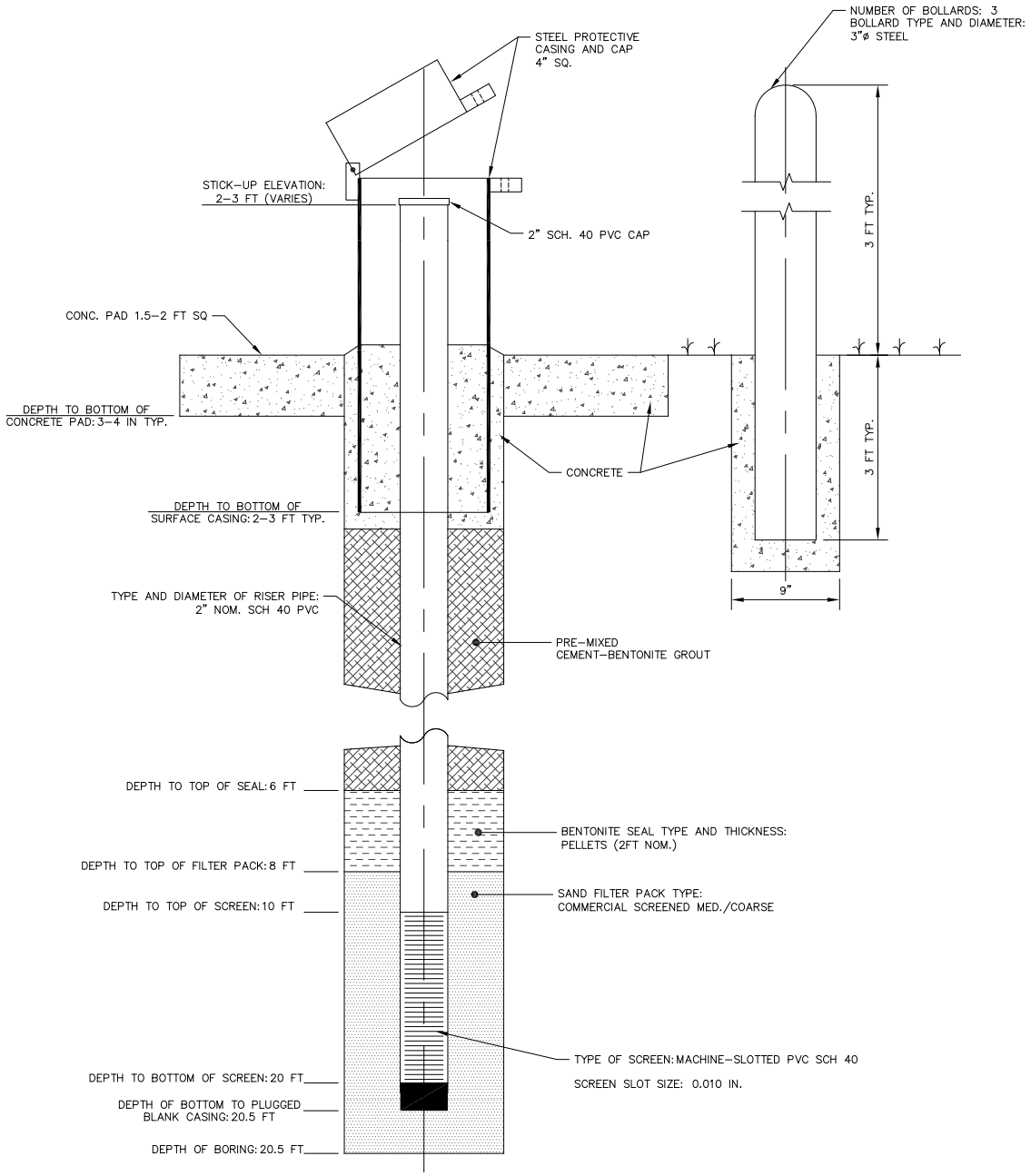
Piezometer Location	KIN-P001	Date Installed	8/14/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	598.0 FT
Screened Interval	20-30 FT	Completion Zone	FOUNDATION		
Remarks	INSTALLED IN KIN-B001	Groundwater Level(s)	12.5 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

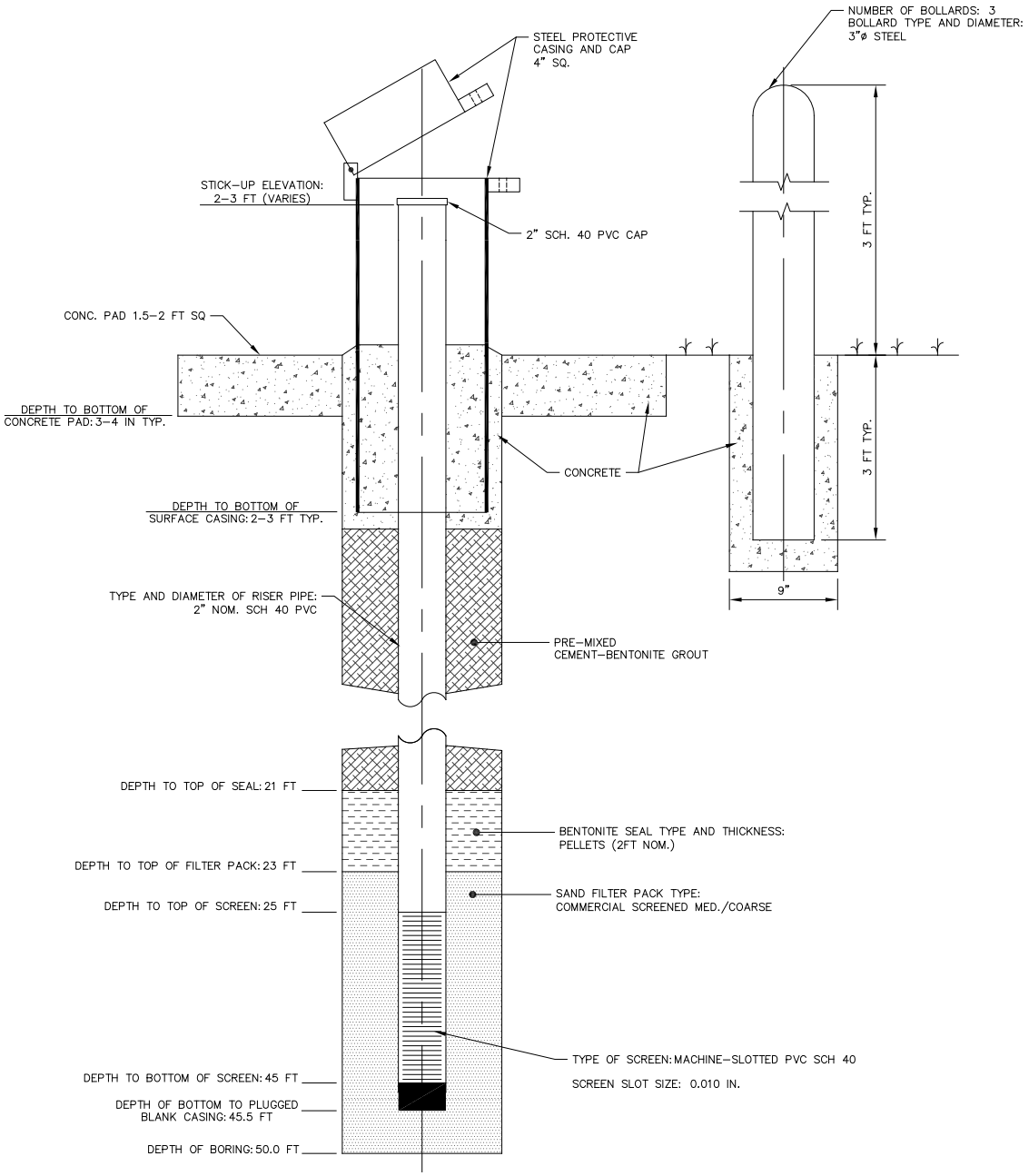
Piezometer Location	KIN-P002	Date Installed	8/13/2015	Time	
Installed By		Observed By	AECOM	Total Depth	20 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	604.1 FT
Screened Interval	10-20 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET 5 FT EAST OF KIN-B002	Groundwater Level(s)	5.9 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

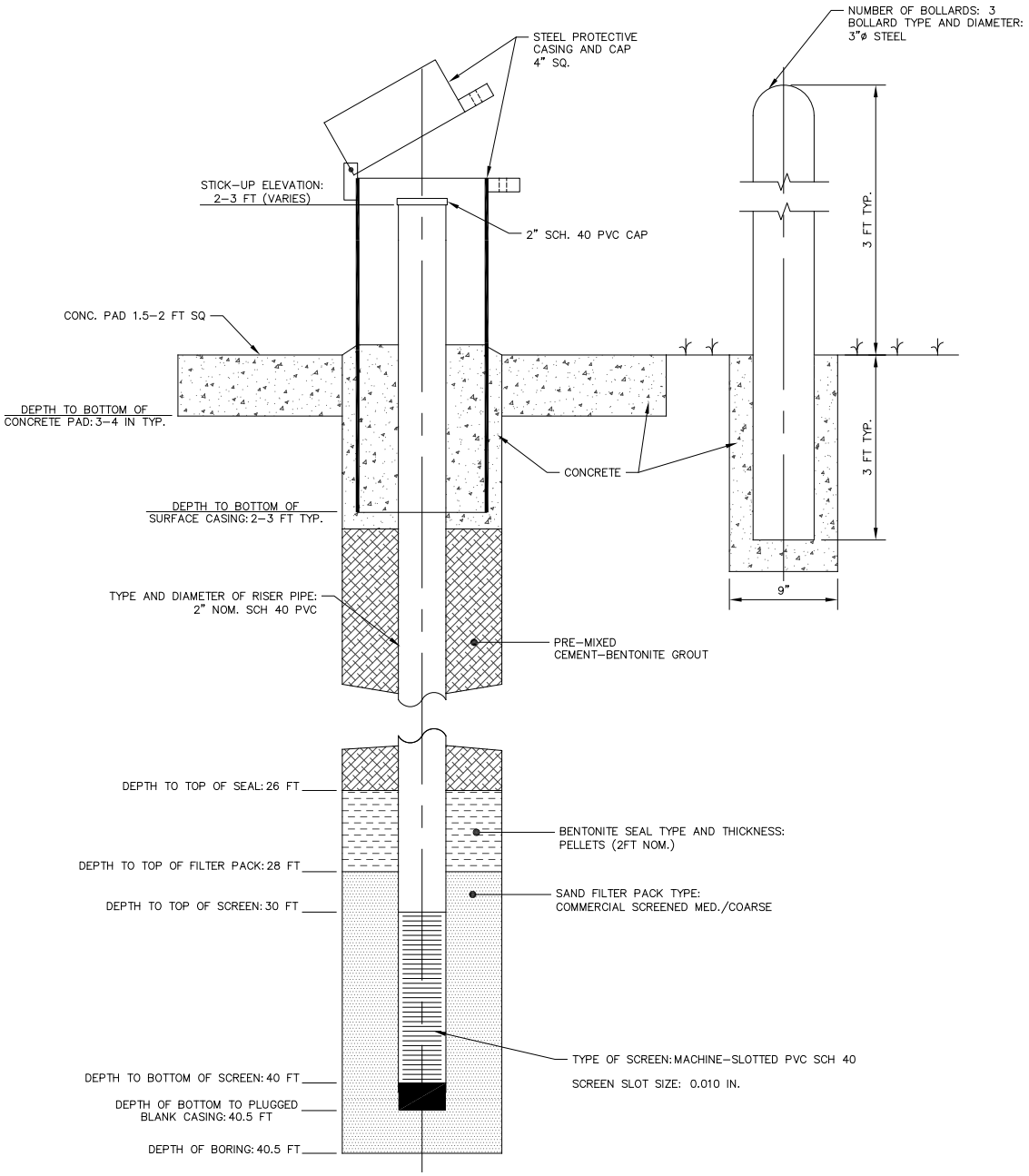
Piezometer Location	KIN-P003	Date Installed	8/15/2015	Time	
Installed By		Observed By	AECOM	Total Depth	50 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	621.8 FT
Screened Interval	25-45 FT	Completion Zone	FOUNDATION		
Remarks	INSTALL IN KIN-B003	Groundwater Level(s)	21.8 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

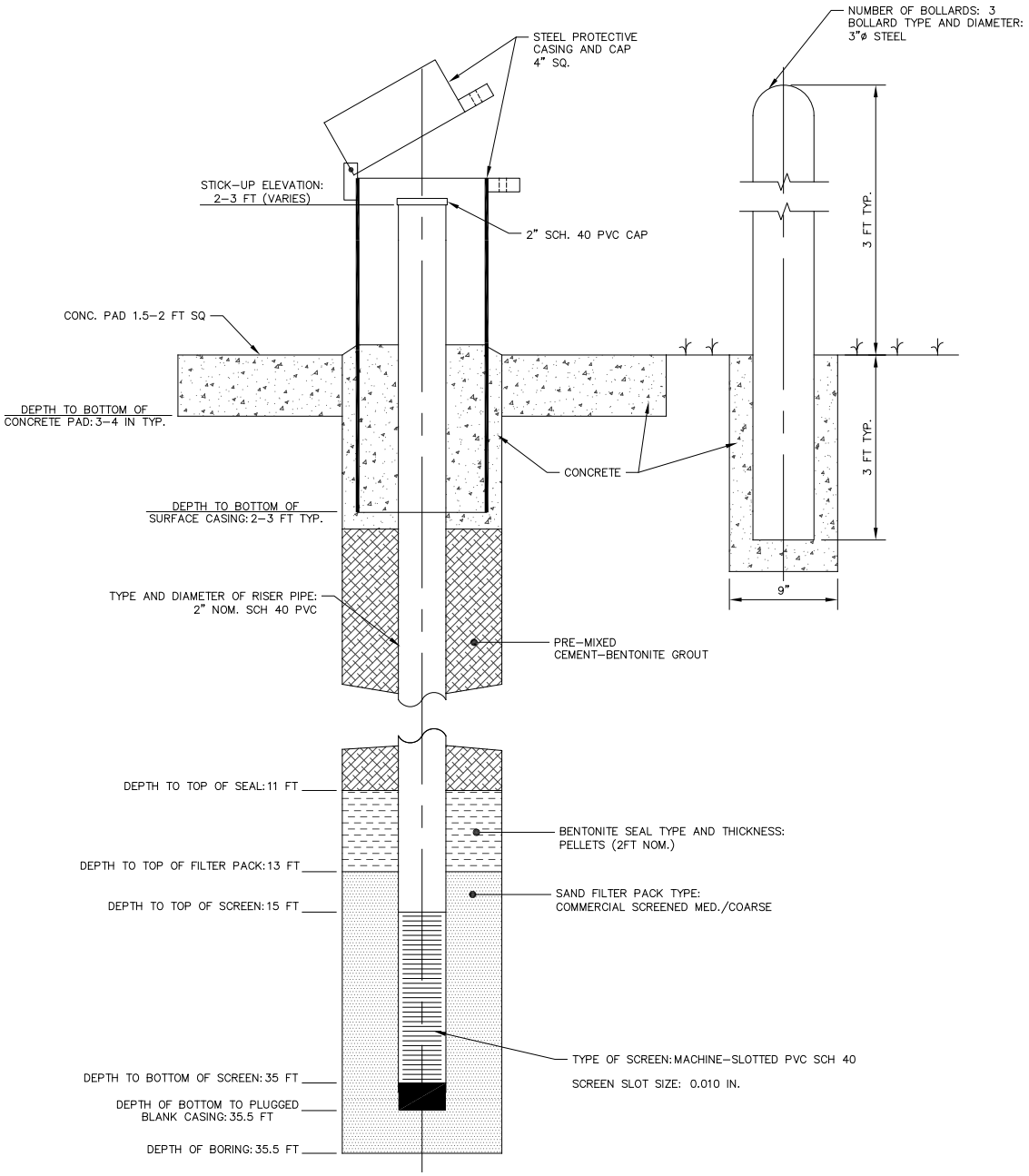
Piezometer Location	KIN-P005	Date Installed	8/19/2015	Time	
Installed By		Observed By	AECOM	Total Depth	40 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	617.8 FT
Screened Interval	30-40 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET FROM KIN-B004	Groundwater Level(s)	25.9 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

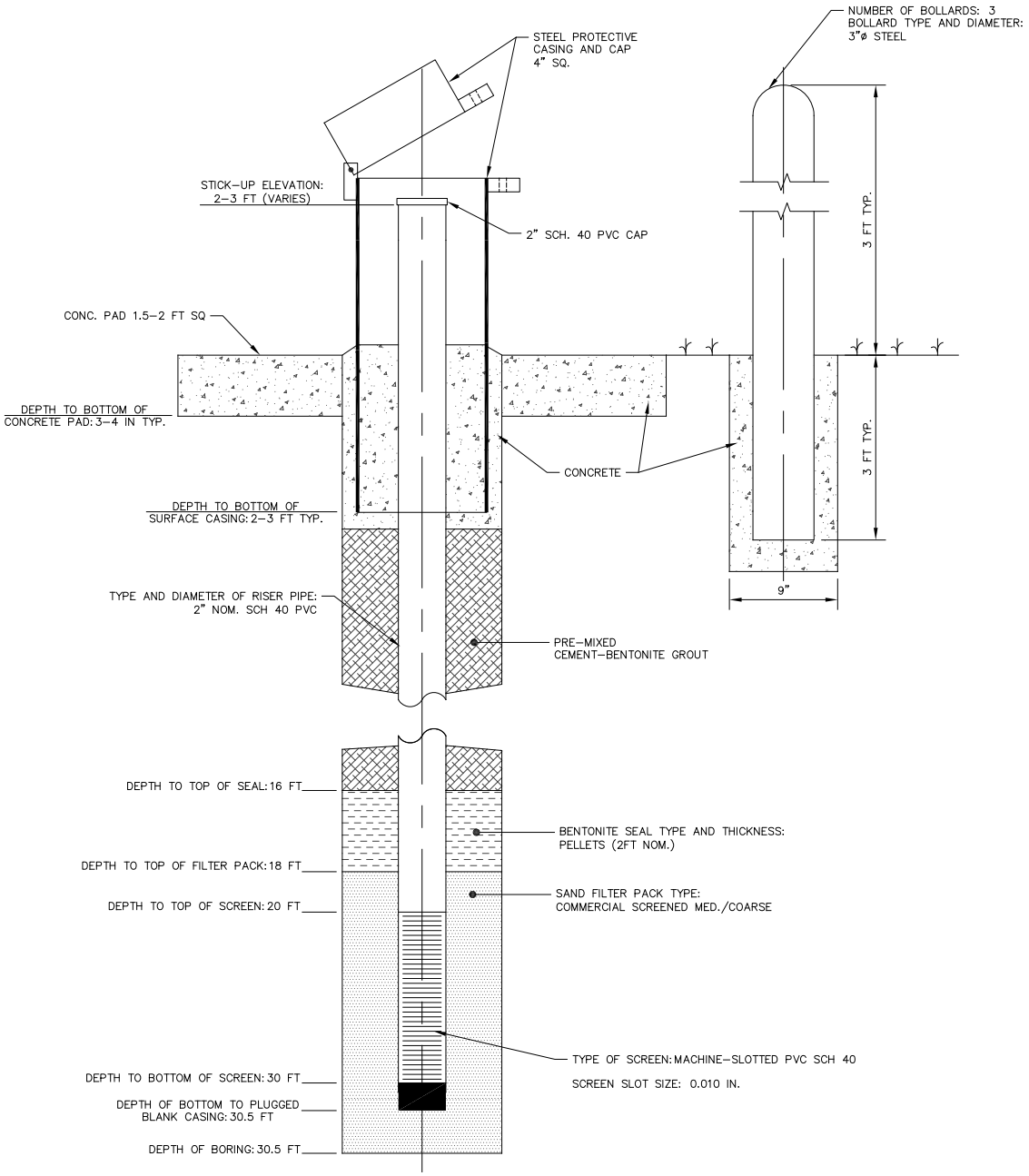
Piezometer Location	KIN-P006	Date Installed	8/23/2015	Time	
Installed By		Observed By	AECOM	Total Depth	35 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	594.5 FT
Screened Interval	15-35 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET 5 FT SE OF KIN-B005	Groundwater Level(s)	10.3 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

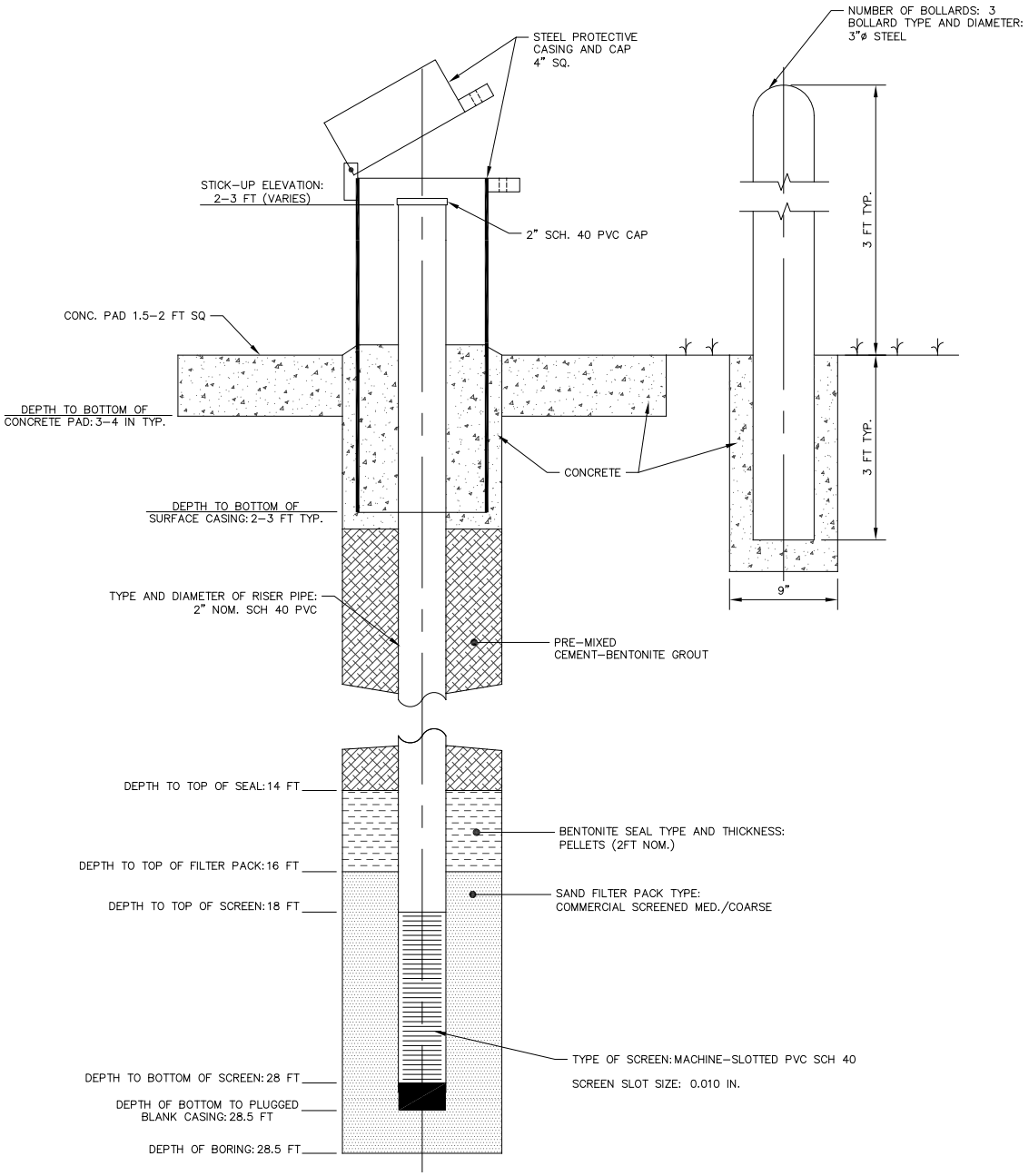
Piezometer Location	KIN-P007	Date Installed	8/20/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	616.8 FT
Screened Interval	20-30 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET FROM KIN-B007	Groundwater Level(s)	24.0 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

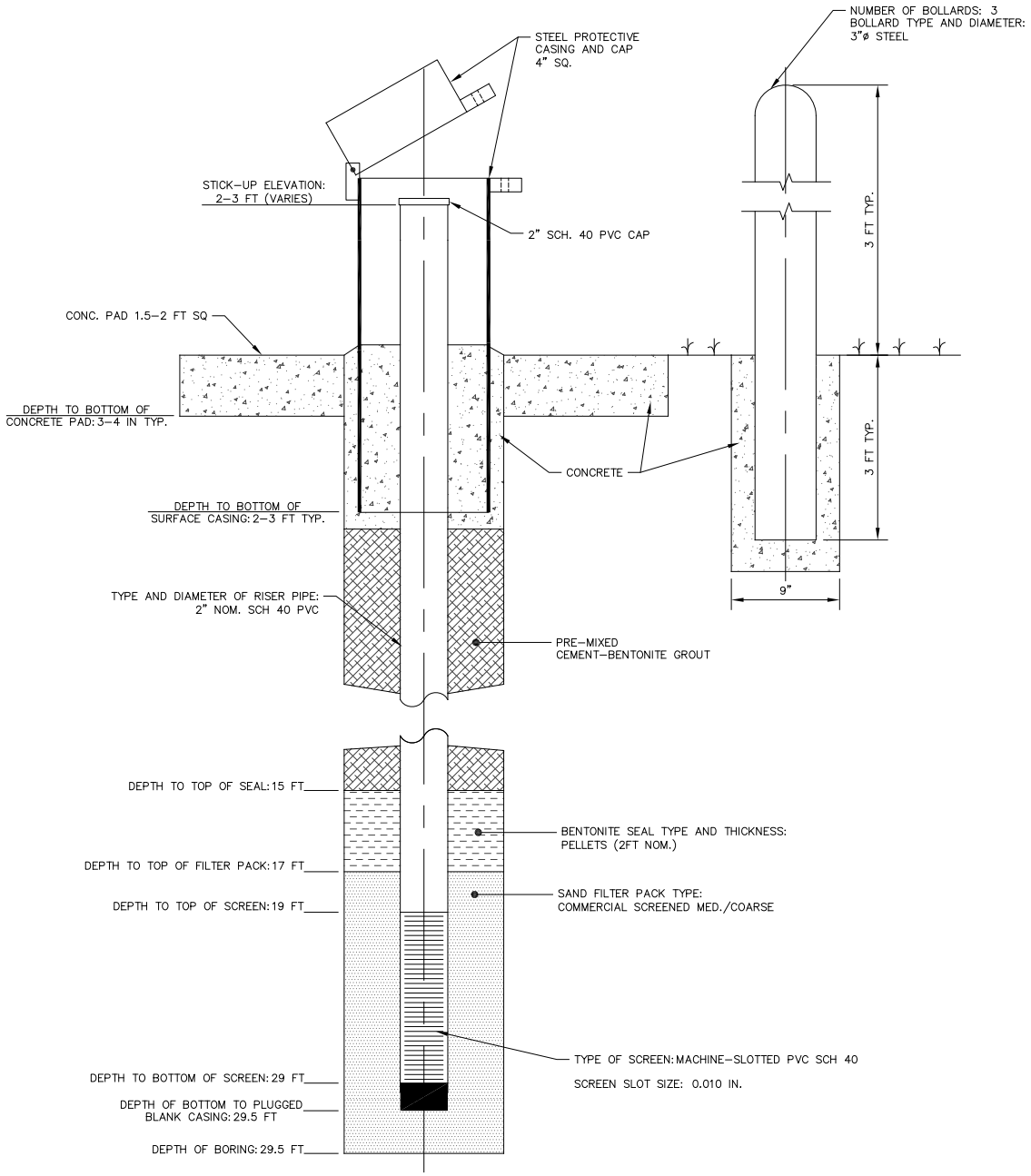
Piezometer Location	KIN-P008	Date Installed	8/20/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	590.5 FT
Screened Interval	18-28 FT	Completion Zone	FOUNDATION		
Remarks	INSTALL IN KIN-B008	Groundwater Level(s)	5.2 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

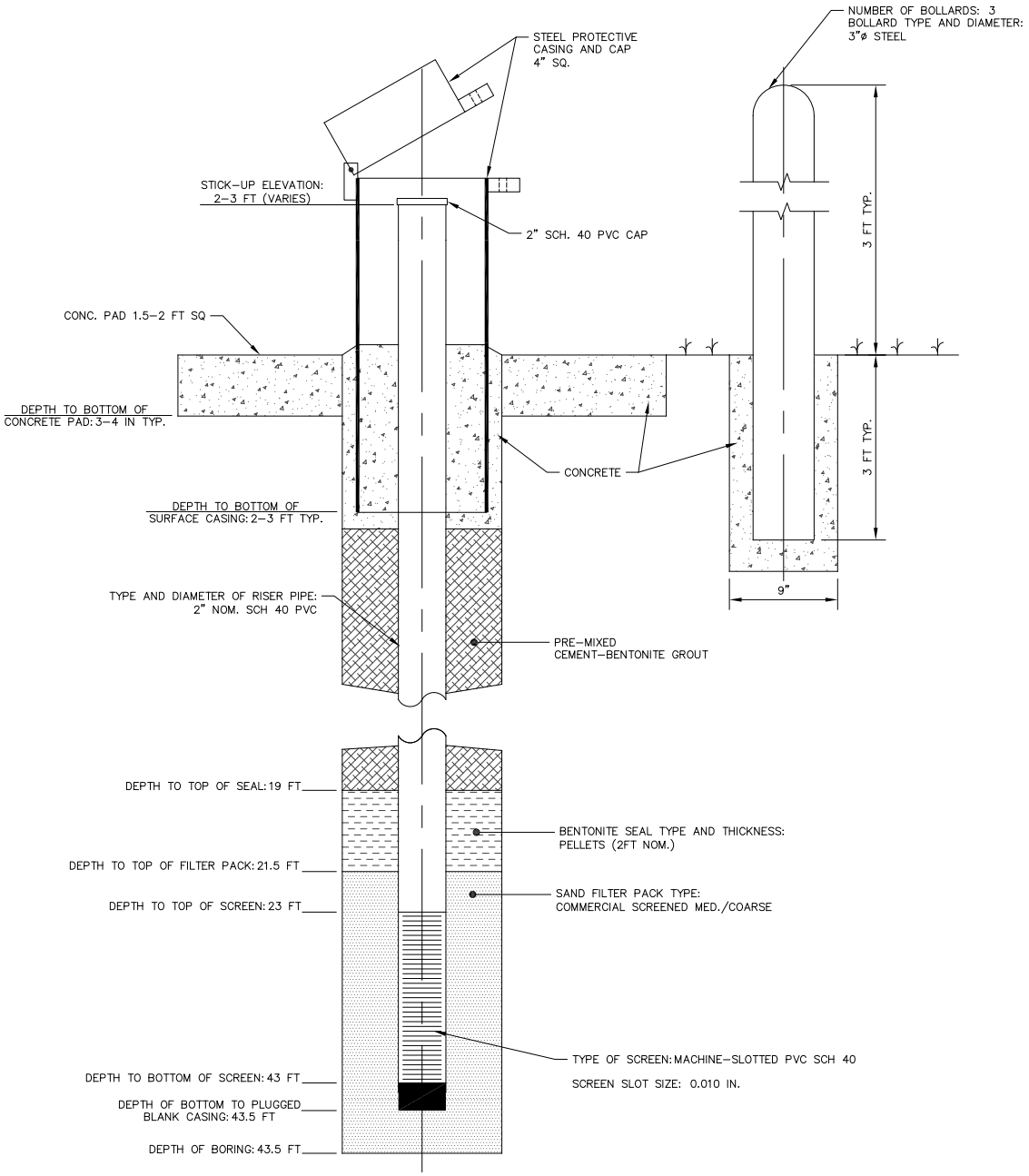
Piezometer Location	KIN-P009	Date Installed	8/20/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	593.6 FT
Screened Interval	19-29 FT	Completion Zone	FOUNDATION		
Remarks	INSTALL IN KIN-B009	Groundwater Level(s)	6.2 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

Piezometer Location	KIN-P010	Date Installed	8/26/2015	Time	
Installed By		Observed By	AECOM	Total Depth	43 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	611.4 FT
Screened Interval	23-43 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET 12 FT W OF KIN-B010	Groundwater Level(s)	13.9 FT BGS ON 10/7/2015		



NOT TO SCALE

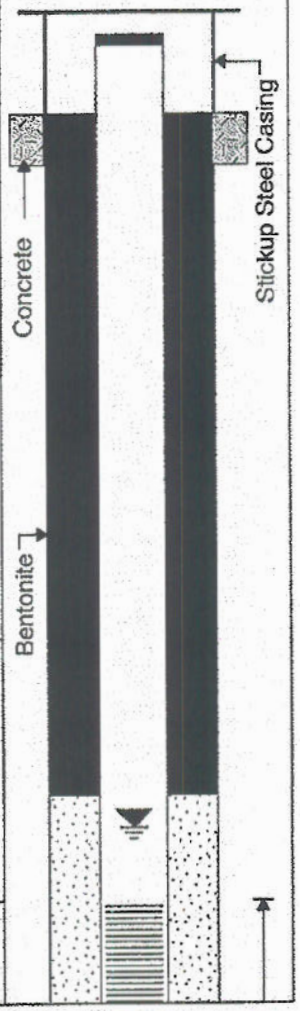
Civil & Environmental Consultants, Inc.

Chicago Cincinnati Columbus Export Detroit Indianapolis Nashville Pittsburgh St. Louis

Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-1
	Casing Elevation: 605.12
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 591.52
Date Started: 4/19/2010 Completed: 4/20/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 15-25' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2			
						Ground Surface		0.0
					0	Topsoil		-0.5
1	1.2	4-6-6	0.0	SS		FILL Brown SILTY CLAY, trace gravel, stiff, dry		
					2			
					4			-5.0
2	0.8	4-4-5	0.0	SS		Brownish grey CLAYEY SILT, moist, medium stiff, slightly plastic		
					6			
					8			-10.0
3	0.0	2-1-3	NA	SS	10	No Recovery		
					12			
					14			-15.0
4	0.8	2-2-2	0.0	SS	16	Orangish tan SILTY CLAY, soft, plastic, moist		

Well Diagram



Civil & Environmental Consultants, Inc.					Project Name:			Borehole/Well ID: MW-1	
					Project No.: 100-399				
Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)	Well Diagram
					18				
					20			-20.0	
5	1.5	12-30-50/5	0.0	SS		Brown SILTY SAND, some chert fragments, wet		-20.4	
					22	GLACIAL TILL Brown SANDY SILT, very stiff, moist			
					24			-25.0	
6	1.4	24-34-50/5	0.0	SS	26	Grey SILTY CLAY, some gravel, very stiff, moist(-)			
					28				
					30			-30.0	
7	1.4	22-25-50/5	0.0	SS		Grey SILTY SAND, coarse grained, wet		-30.4	
					32	Grey SILTY CLAY, some sand and gravel, very stiff, moist(-)			
								-33.0	
8	1.3	24-45-50/3	0.0	SS	34	Grey SILTY CLAY, some gravel, hard, dry to moist(-) Auger refusal @ 33'		-34.5	

Clean Silica Sand

0.01 Slot PVC Screen

Bentonite

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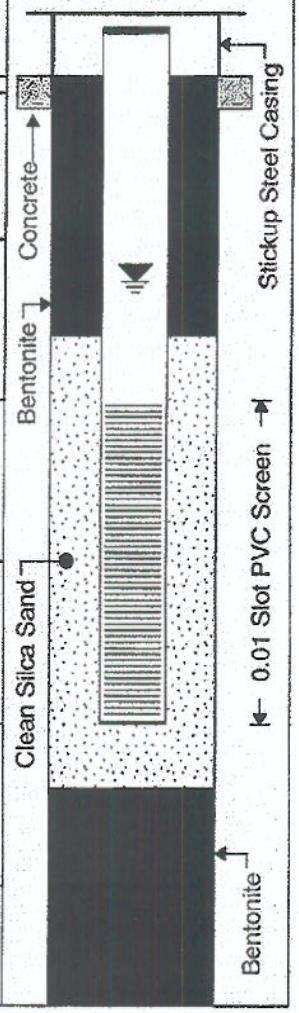
Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-2
	Casing Elevation: 601.44
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 595.14
Date Started: 4/20/2010 Completed: 4/21/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 10-20' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					0	Ground Surface		0.0
1	0.9	4-4-4	0.0	SS	0	Topsoil		
					2	Brown SILTY CLAY, medium stiff, moist(-)		
					4			-5.0
2	0.8	2-2-2	0.0	SS	6	Brownish grey SILTY CLAY, soft, slightly plastic, moist		
					8			-10.0
3	1.3	2-2-2	0.0	SS	10	Dark grey SILTY CLAY, trace sand and gravel, medium stiff, plastic, moist		
					12			-15.0
4	1.5	1-2-6	0.0	SS	14	Greyish brown SANDY SILT, trace gravel, soft, slightly plastic, wet		
					16			-20.0
5	1.3	22-50/5	0.0	SS	18	GLACIAL TILL Grey SILTY CLAY, trace sand and gravel, hard, dry		
					20			-25.0
6	1.0	14-50/5	0.0	SS	22	Grey SILTY CLAY, some sand and gravel, very hard, dry to moist		
					24			
					26			
					28			

Well Diagram



Civil & Environmental Consultants, Inc.					Project Name:			Borehole/Well ID: MW-2	
					Project No.: 100-399				
Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)	Well Diagram
					30	Sand(-)			
7	1.4	26-43-50/5.5	0.0	SS	32				
					34				
8	1.3	26-41-50/4	0.0	SS	36				
					38				
9	0.8	30-50/4	0.0	SS	40	Started air-rotary drilling			
					42				
					44				
					46				
					48				
					50			-50.0	
10	1.5	21-26-31	NA	SS		Grey SILTY CLAY, some pebbles, very stiff, moist			
					52				
					54				
					56			-56.0	
11	1.5	11-23-25	NA	SS		BEDROCK Grey SHALE, weathered		-57.5	
					58				

Bentonite

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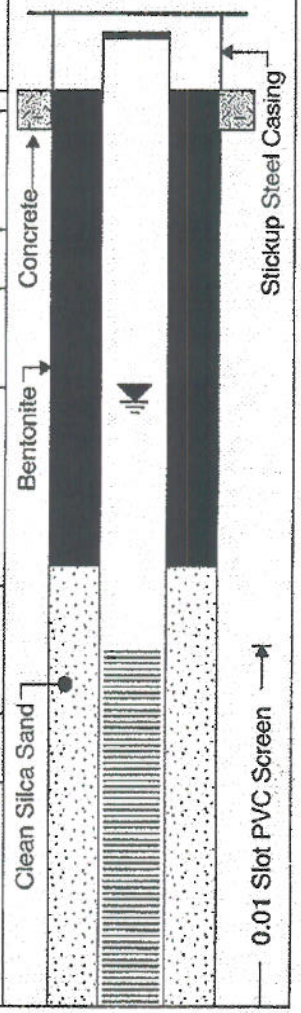
Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-3
	Casing Elevation: 601.79
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 593.94
Date Started: 4/15/2010 Completed: 4/15/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 14-24' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2			
					0	Ground Surface		0.0
						Topsoil		
					2	Dark brown SILTY CLAY, moist		
1	1.4	4-5-7	0.0	SS				-3.5
					4	Brown SILTY CLAY, moist		-5.0
2	0.6	2-2-3	0.0	SS		Orange brown CLAYEY SILT, soft, mottled, moist		
					6			-7.5
3	1.3	2-2-3	0.0	SS		Orangish tan CLAYEY SILT, soft, slightly plastic, mottled, moist		
					8	Trace gravel		
4	1.5	2-1-2	0.0	SS				
					10			
								-12.5
5	1.3	2-1-3	0.0	SS	12	Orangish tan SILTY CLAY, trace gravel, plastic, moist		
6	0.8	2-1-4	0.0	SS	14			-15.8
						SAND, coarse grained, wet		-17.5
7	1.5	1-6-7	0.0	SS	16	GLACIAL TILL Grey SILTY CLAY, trace sand and gravel, soft, moist		
8	1.5	7-6-7	0.0	SS	18			
						Thin sand lense		
					20			
					22			



Civil & Environmental Consultants, Inc.					Project Name:			Borehole/Well ID: MW-3	
					Project No.: 100-399				
Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)	Well Diagram
					24			-25.0	
9	1.5	10-15-23	0.0	SS	26	Grey SILTY CLAY, trace sand and gravel, stiff, dry			
					28				
10	1.5	10-15-22	0.0	SS	30				
					32				
					34			-35.0	
11	1.5	6-10-13	0.0	SS	36	Dark grey SILTY CLAY, trace organics, medium stiff, dry			
					38				
					40			-40.0	
12	1.5	3-5-10	0.0	SS		Dark grey to black CLAYEY SILT, trace organics, medium stiff, moist			
					42				
					44			-45.0	
13	1.5	8-13-18	0.0	SS	46	Dark grey green SILTY CLAY, trace sand and gravel, very stiff, moist		-46.5	

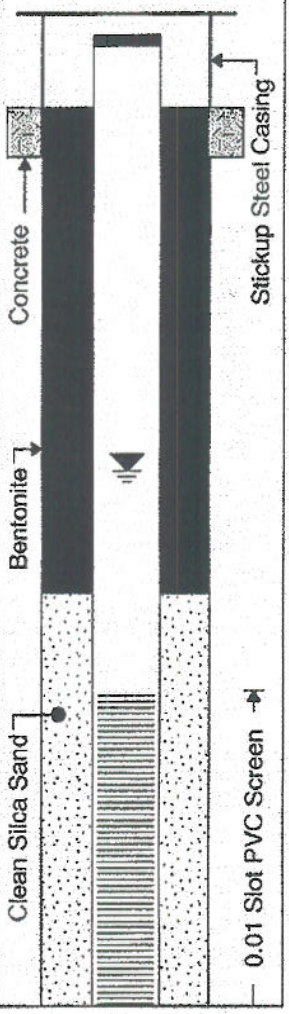
Bentonite

Civil & Environmental Consultants, Inc.

Chicago Cincinnati Columbus Export Detroit Indianapolis Nashville Pittsburgh St. Louis

Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-4
	Casing Elevation: 601.18
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 593.73
Date Started: 4/14/2010 Completed: 4/14/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 12-22' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					0	Ground Surface		0.0
						Topsoil		
1	1.3	3-4-5	0.0	SS	2	Dark brown SILTY CLAY, very stiff, mottled, moist(-)		
					4			-4.0
2	1.4	4-5-6	0.0	SS		Orange brown SILTY CLAY, moist		
					6	Orangish tan CLAYEY SILT, medium stiff, mottled, moist		
3	1.2	2-2-3	0.0	SS				-8.0
					8	Light tan CLAYEY SILT, soft, slightly plastic, moist		
4	1.0	1-1-2	0.0	SS				-10.0
					10	Greyish tan CLAYEY SILT, soft, slightly plastic, mottled, moist		
5	0.9	1-2-2	0.0	SS				-12.0
					12	Orangish tan CLAYEY SILT, medium stiff, mottled, moist, grades to a silty clay		
6	1.5	2-2-4	0.0	SS	14	Trace sand and gravel, very moist		
								-16.2
7	1.5	1-3-3	0.0	SS	16	GLACIAL TILL Grey SILTY CLAY, trace gravel, medium stiff		
8	1.2	2-4-5	0.0	SS	18			



Civil & Environmental Consultants, Inc.	Project Name:	Borehole/Well ID: MW-4
	Project No.: 100-399	

Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)	Well Diagram
9	1.2	3-7-30	0.0	SS		Thin sand lense, wet			
					20			-20.0	
10	1.0	44-41-50/2	0.0	SS		Grey SILTY CLAY, trace gravel, moist to moist(-)			
					22				
11	0.8	42-50/2.5	0.0	SS					
					24				
12	1.0	28-30-40	0.0	SS					
					26			-26.0	
13	1.5	17-20-35	0.0	SS		Grey SILTY CLAY, trace gravel, very stiff, dry to moist			
					28				
14	1.5	7-20-40	0.0	SS					
					30				
15	0.0	50/0	0.0	SS					
					32	Trace sand and gravel			
16	1.0	31-50/0	0.0	SS					
					34				
17	0.7	40-50/2.5	0.0	SS					
					36				
						Auger refusal @ 38'		-38.0	
					38				

Bentonite

Civil & Environmental Consultants, Inc.

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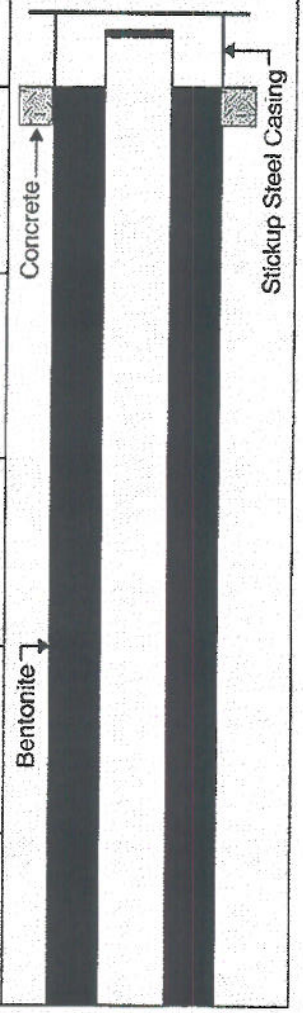
Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-5
	Casing Elevation: 619.91
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 594.83
Date Started: 4/21/2010 Completed: 4/22/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 30-40' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					0	Ground Surface		0.0
					2	FILL Brown SILTY CLAY, some gravel		
					4			-5.0
1	1.3	4-6-10	0.0	SS	6	Grey brown SILTY CLAY, some sand and gravel, very stiff, moist		
					8			-10.0
2	1.5	3-5-7	0.0	SS	10	Greenish grey SILTY CLAY, trace gravel, very stiff, moist		
					12			
					14			-15.0
3	1.3	2-3-5	0.0	SS	16	Dark grey to black CLAYEY SILT, soft, moist		
					18			
					20			-20.0
4	1.4	4-5-7	0.0	SS	22	Grey brown SILTY CLAY, medium stiff, moist		
					24			

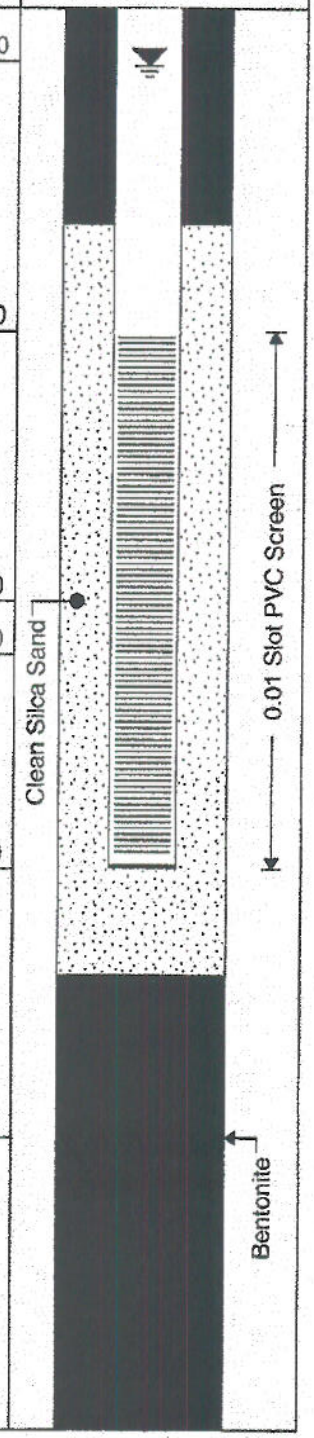
Well Diagram



Civil & Environmental Consultants, Inc.	Project Name:	Borehole/Well ID: MW-5
	Project No.: 100-399	

Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
								-25.0
5	1.5	3-3-4	0.0	SS	26	Light to dark grey CLAYEY SILT, soft, moist		
					28			
					30			-30.0
6	1.0	3-2-2	0.0	SS		Brownish grey SILTY CLAY, plastic, medium stiff, moist		
					32			
					34			-35.0
7	1.5	2-4-5	0.0	SS	36	Orangish tan CLAYEY SILT, medium stiff, moist, native		-36.0
						Orangish brown SILTY SAND, wet		
					38			
					40			-40.0
8	1.3	23-41-50/5	0.0	SS		GLACIAL TILL Light grey SILTY CLAY, some gravel, hard, moist(-)		
					42			
					44			-45.0
9	0.7	45-50/2	0.0	SS	46	Grey SILTY CLAY, some sand and gravel, hard, moist(-)		
					48			
					50			

Well Diagram



Civil & Environmental Consultants, Inc.	Project Name:	Borehole/Well ID: MW-5
	Project No.: 100-399	

Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)	Well Diagram
					52				
					54			-55.0	
10		50/2.5	0.0	SS	56	Dark grey SANDY SILT, trace gravel, stiff, moist			
					58				
					60				
					62				Bentonite
					64			-65.0	
11	1.3	16-30-36	0.0	SS	66	Dark greyish green SANDY SILT, trace gravel, stiff, moist			
					68				
					70				
					72				
					74			-75.0	
12	0.4	30-42-3	0.0	SS	76	BEDROCK SHALE, weathered		-76.0	

Civil & Environmental Consultants, Inc.

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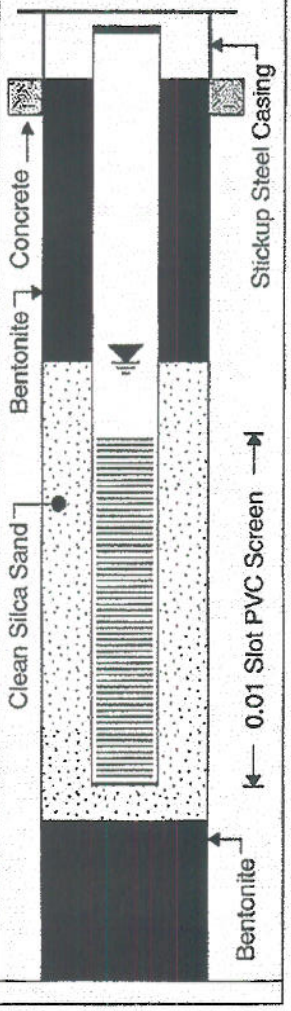
Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-6
	Casing Elevation: 600.83
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 592.85
Date Started: 4/16/2010 Completed: 4/16/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 10-20' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2	Ground Surface		0.0
1	1.3	2-4-4	0.0	SS	0	Dark brown CLAYEY SILT, some organics, slightly plastic, medium stiff, moist		
					2			
					4			-5.0
2	1.3	2-1-2	0.0	SS	6	Tan brown CLAYEY SILT, trace organics, slightly plastic, soft, moist		
					8			
					10			-10.0
3	1.5	2-3-4	0.0	SS		Brown SANDY SILT, some clay, trace gravel, medium stiff, moist to wet		
					12			
					14			-15.0
4	1.3	3-1-1	0.0	SS	16	Orangish brown SILTY SAND, coarse grained, trace gravel, soft, wet		
					18			
					20			-20.0
5	0.8	30-50/5.5	0.0	SS		GLACIAL TILL Grey SILTY CLAY, trace gravel, medium stiff, moist		
					22			
					24			-24.0
6	1.3	20-36-50/5.5	0.0	SS		Grey SILTY CLAY, trace gravel, very stiff, dry		-25.5

Well Diagram

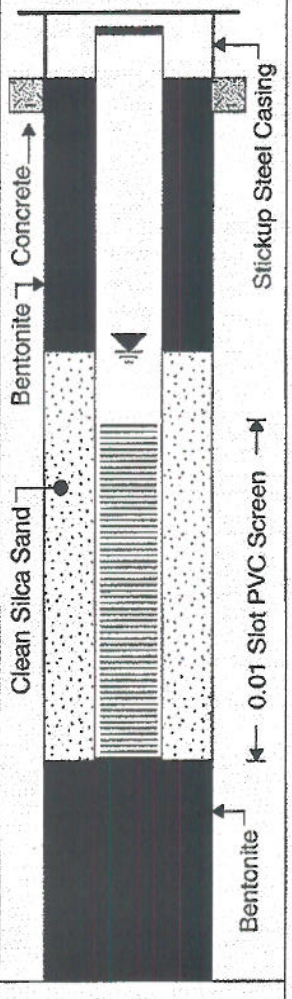


Civil & Environmental Consultants, Inc.

Chicago Cincinnati Columbus Export Detroit Indianapolis Nashville Pittsburgh St. Louis

Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-7
	Casing Elevation: 598.02
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 589.32
Date Started: 4/16/2010 Completed: 4/16/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 10-20' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2			
					0	Ground Surface		0.0
1	1.5	3-4-3	0.0	SS	2	Brown CLAYEY SILT, trace sand and gravel, medium stiff, moist		
					4			
2	1.5	3-2-4	0.0	SS	6			-5.7
					8	Dark grey CLAYEY SILT, trace gravel, some organics, slightly plastic, moist		
					10			-10.0
3	1.4	2-3-4	0.0	SS	12	Brown grey SILTY CLAY, trace gravel, plastic, medium stiff, mottled, moist		
					14			-15.0
4	1.5	1-1-2	0.0	SS	16	Orangish brown SANDY SILT, trace gravel, soft, wet		
					18			-20.0
5	1.5	10-25-35	0.0	SS	20	GLACIAL TILL Grey SILTY CLAY, trace gravel, non-plastic, moist(-)		
					22			-25.0
6	1.5	20-35-45	0.0	SS	24			
					26	Grey SILTY CLAY, trace sand and gravel, stiff, non-plastic, dry		-26.5

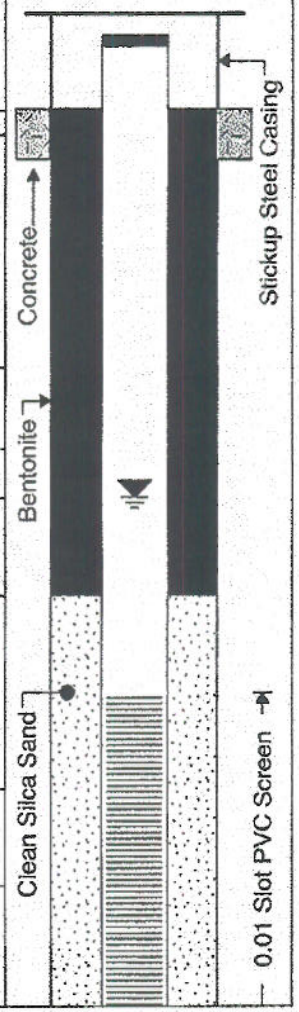


Civil & Environmental Consultants, Inc.

Chicago Cincinnati Columbus Export Detroit Indianapolis Nashville Pittsburgh St. Louis

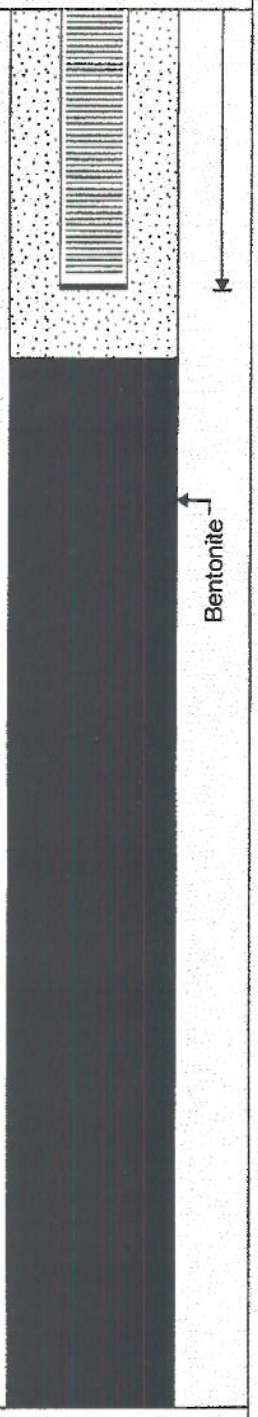
Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-8
	Casing Elevation: 603.54
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 595.55
Date Started: 4/13/2010 Completed: 4/13/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 12-22' bgs.	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2			
					0	Ground Surface		0.0
						Topsoil		
					2	Brown SILTY CLAY, trace sand, medium stiff, moist, no odor		
1	1.0	2-4-8	0.4	SS				
					4			
2	1.0	2-3-4	0.0	SS				-5.3
					6	Grey brown SILTY CLAY, trace gravel, moist		-7.0
3	1.5	3-3-5	0.0	SS		Grey SILTY CLAY, medium stiff, moist		-8.0
					8	Orangish brown SILTY CLAY, trace sand, moist to wet		-10.0
4	1.4	3-3-2	0.0	SS	10	Orangish tan CLAYEY SILT, trace sand, slightly plastic, medium stiff, wet		
5	1.5	2-2-3	0.0	SS				
					12			
6	1.8	4-1-1	0.0	SS				-14.0
					14	Tan CLAYEY SILT, trace sand, slightly plastic, soft, moist to wet		-16.0
7	1.7	1-2-2	0.0	SS	16	Orangish tan SILTY CLAY, trace sand, slightly plastic, medium stiff, wet		
8	1.5	1-1-3	0.0	SS	18			



Civil & Environmental Consultants, Inc.	Project Name:	Borehole/Well ID: MW-8
	Project No.: 100-399	

Sample No./ Core Run	Recovery	Blow Counts/ RQD	Organic Vapor	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)	Well Diagram
9	1.9	1-1-2	0.0	SS	20	Thin sand lens		-20.0	
10	1.4	1-2-6	0.0	SS		Orangish brown SILTY SAND, soft, wet		-21.0	
					22	Brown grey SILTY CLAY, medium stiff, moist		-22.0	
11	1.3	10-50	0.0	SS		GLACIAL TILL Grey SILTY CLAY, trace sand and gravel, moist		-24.0	
12	1.9	21-25-48	0.0	SS	24	Grey SILTY CLAY, trace gravel, dry			
13	1.0	30-50/5	0.0	SS	26				
14	0.9	25-50/5	0.0	SS	28	Thin sand lens, wet		-30.0	
15	0.9	27-50/3	0.0	SS	30	Grey SILTY SAND, dense, moist to wet		-32.0	
16	0.9	41-50/5	0.0	SS	32	Grey SILTY CLAY, trace sand and gravel, stiff, dry to moist			
17	0.9	40-50/5	0.0	SS	34				
18	0.8	40-50	0.0	SS	36			-38.0	
					38				



Civil & Environmental Consultants, Inc.

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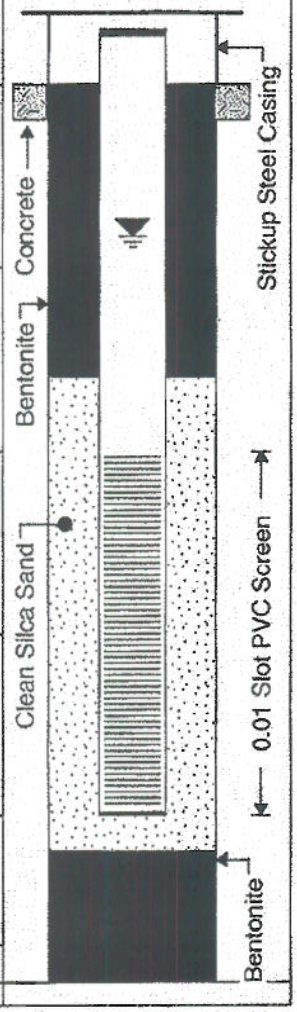
Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-9
	Casing Elevation: 599.73
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 595.59
Date Started: 4/19/2010 Completed: 4/19/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 10-20' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2			
					0	Ground Surface		0.0
1	1.3	2-5-4	0.4	SS		Topsoil		
					2	Dark brown CLAYEY SILT, medium stiff, moist		
					4			-5.0
2	1.1	2-2-4	0.0	SS	6	Brownish tan CLAYEY SILT, soft, slightly plastic, mottled, moist		
					8			-10.0
3	1.3	2-3-4	0.0	SS	10	Brownish tan SILTY CLAY, trace sand, medium stiff, slightly plastic, moist		
					12			
					14			-15.0
4	0.8	2-2-4	0.0	SS	16	Brown CLAYEY SILT, trace sand and gravel, medium stiff, moist to wet		
					18	Thin sand lens		-20.0
5	0.9	22-50/5	0.0	SS	20	GLACIAL TILL Grey CLAYEY SILT, some sand, trace gravel, medium stiff, moist (-) to dry		
					22			-23.5
6	0.8	24-50/5	0.0	SS	24	Grey SILTY CLAY, trace sand		-24.5

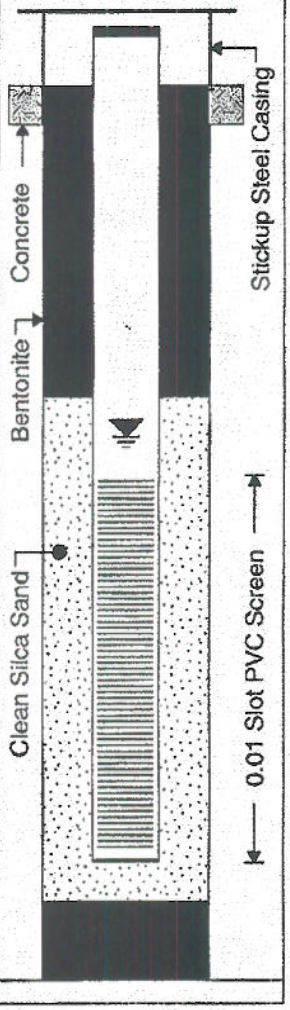


Civil & Environmental Consultants, Inc.

Chicago Cincinnati Columbus Export Detroit Indianapolis Nashville Pittsburgh St. Louis

Project Name: Dominion Energy Kincaid Power Station Kincaid, Illinois	Borehole/Well ID: MW-10
	Casing Elevation: 600.40
	Ground Elevation: NA
Project No.: 100-399	Groundwater Ele.: 591.40
Date Started: 4/19/2010 Completed: 4/19/2010	Sample Information: No analytical analysis was performed.
Drilling Company: Roberts Environmental Drilling, Inc.	
Driller:	
CEC Representative: Corey Strain	
Drilling Method: HSA	Comments/Problems:
Bore Hole: 4.25" Core Size: 2"	
Well Installed: ☑	
Screened Interval: 10-20' bgs	

Sample No./ Core Run	Recovery (feet)	Blow Counts/ RQD	Organic Vapor Reading (ppm)	Sample Type	Depth (feet)	Material Description and Comments	Graphic Log	Elevation (feet, msl)
					-2	Ground Surface		0.0
1	1.4	4-5-5	0.4	SS	0	FILL Dark brown SILTY CLAY, trace sand, medium stiff, some coal fragments, moist		
					2			
					4			-5.0
2	0.9	2-2-4	0.0	SS	6	Greenish grey CLAYEY SILT, trace coal fragments, medium stiff, slightly plastic, moist		
					8			-10.0
3	1.5	2-2-5	0.0	SS	10	Orangish tan CLAYEY SILT, some sand, medium stiff, slightly plastic, moist		
					12			
					14			-15.0
4	1.5	1-4-10	0.0	SS	16	Brown SILTY SAND, trace gravel, wet		
					18	GLACIAL TILL Brown SILTY CLAY, some gravel, very stiff, moist Thin sand lens		-20.0
5	1.5	15-32-46	0.0	SS	20	Grey SILTY CLAY, some gravel, very stiff, moist(-) to dry		-22.0
6	0.9	35-50/5	0.0	SS	22	Grey SILTY CLAY, trace gravel, very stiff, dry		-23.0



KIN-B009
PZ-2C
KIN-P011
MW-5
KIN-C014
KIN-C015
KIN-B008
KIN-B007
KIN-C011
PZ-2A
PZ-2B
KIN-B010
KIN-P012
MW-4
MW-12
KIN-C012
KIN-C025
KIN-C026
KIN-C009
PZ-1C
PZ-1B
KIN-B011
MW-6
KIN-C030
KIN-C008
KIN-B006
KIN-C023
MW-7
KIN-C031
KIN-B004
KIN-C022
KIN-B012
KIN-B005
PZ-4A
PZ-4B
PZ-4C
KIN-C021
MW-9
KIN-C004
KIN-B003
KIN-P004
MW-8
KIN-C005
PZ-3B
PZ-3C
MW-3
KIN-C037
KIN-B002
KIN-C036
KIN-B001
MW-11
GP-5
MW-1
MW-2
MW-10

N

0 250 500
SCALE IN FEET

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

- PIEZOMETER OR GEOPROBE LOCATION
- 30% DESIGN LOCATIONS
- AECOM CONE PENETROMETER LOCATION
- MONITORING WELL LOCATION
- CCR MONITORED UNIT

NOTE:
ELEVATIONS CONTAINING A LESS THAN SYMBOL (I.E. <583.5) INDICATE ONE OF THE FOLLOWING: THE BORING DID NOT EXTEND TO THE CLAY TILL CONTACT, THE SANDY UNIT WAS NOT ENCOUNTERED, OR THE PRECISE ELEVATION COULD NOT BE DETERMINED BECAUSE SOIL SAMPLING WAS NOT CONTINUOUS.

DRAWN BY/DATE:
TDC 5/19/16
REVIEWED BY/DATE:
NRK 5/19/16
APPROVED BY/DATE:
SJC 5/19/16

INVESTIGATION LOCATIONS

CCR RULE GROUNDWATER MONITORING
KINCAID ASH POND
KINCAID POWER STATION
KINCAID, ILLINOIS

DRAFT

PROJECT NO: 2365/5

FIGURE NO: 2

NATURAL RESOURCE TECHNOLOGY

Y:\Mapping\Projects\22\2285_Kincaid\MXD\Figure 2_Top of Aquifer_rev2.mxd Author: tcushman Date/Time: 5/19/2016, 3:55:29 PM

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-4C

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/30/2016	3/30/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-4C	Feet (NAVD88)	597.83 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,067,582.54 N, 2,488,047.98 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
CS	42 39		0 1 2 3	0 - 0.5' **FILL, SILT:** ML, very dark grayish brown (10YR 3/2), trace roots, sand, and sand sized ash, cohesive, low plasticity, stiff (2.0 tsf), dry. 0.5 - 15.5' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), trace sand and fine gravel, cohesive, medium to high plasticity, very stiff to hard (3.0 - 4.5 tsf), dry to moist. 1.7' black (10YR 2/1).	(FILL) ML								Sampling completed using 2" macro core
CS	60 54		4 5 6	3.5' soft to stiff (0.5 - 2.0 tsf), moist. 3.8' pale brown (10YR 6/3) with dark yellowish brown (10YR 4/4) and dark gray (10YR 4/1) mottling.	CL								
CS	60 57		7 8 9 10 11 12	8.5' dark gray (10YR 4/1), soft (0.5 tsf).									

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 PZ-4C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	0.5 - 15.5' **LEAN CLAY:** CL, very dark grayish brown (10YR 3/2), trace sand and fine gravel, cohesive, medium to high plasticity, very stiff to hard (3.0 - 4.5 tsf), dry to moist. *(continued)*									
CS	60 56		14	13.8' yellowish brown (10YR 5/4), 0-25% gravel, cohesive, medium plasticity, soft (0.0 - 0.5 tsf), moist.	CL								
			15										
			16	15.5 - 18.5' **SANDY LEAN CLAY:** s(CL), 15-25% gravel, cohesive, nonplastic, soft (0.5 tsf), wet.									
			17		s(CL)								
			18	17.5' very stiff (3.0 tsf), dry.									
SS	20 24		19	18.5 - 20' **LEAN CLAY:** CL, brown (10YR 4/3), trace sand and gravel, very stiff (3.5 tsf), dry.	CL								Split spoon sample used for final 2'
			20	20 - 20.5' **SILT:** ML, dark gray (10YR 4/1), very stiff (3.5 tsf), dry.	ML								
				20.5' End of Boring.									

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-4B

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/30/2016	3/30/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-4B	Feet (NAVD88)	597.81 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,067,579.46 N, 2,488,049.31 E E/W
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
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			1 2 3 4 5 6 7 8 9 10 11 12 13	0 - 0.5' **FILL, SILT:** ML. 0.5 - 13' **LEAN CLAY:** CL. 13' End of Boring.	(FILL) ML CL									Blind Drilled, see PZ-3C 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

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-4A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/30/2016	3/30/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-4A	Feet (NAVD88)	597.81 Feet (NAVD88)	8.3 inches

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

State Plane 1,067,576.32 N, 2,488,049.24 E E/W

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
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 0.5' **FILL, SILT:** ML.	(FILL) ML									Blind Drilled, see PZ-4C for details
				0.5 - 10' **LEAN CLAY:** CL.										
			1											
			2											
			3											
			4											
			5		CL									
			6											
			7											
			8											
			9											
			10	10' End of Boring.										

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

Signature

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NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-3C

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/29/2016	3/30/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-3C	Feet (NAVD88)	603.49 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,849.23 N, 2,485,786.53 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 57		1	0 - 1.2' **FILL, SANDY SILT:** (ML)s, black (10YR 2/1) to very dark grayish brown (10YR 3/2), 15-25% sand sized ash, noncohesive, nonplastic, very soft (0.0 tsf), dry.	(FILL) (ML)s								Sampling completed using 2" macro core
			2	1.2 - 3.2' **FILL, LEAN CLAY WITH SAND:** (CL)s, dark yellowish brown (10YR 4/4), and very dark grayish brown (10YR 3/2), trace gravel, cohesive, nonplastic, very stiff to hard (3.5 - 4.5 tsf), dry.	(FILL) (CL)s								
			3	3.2 - 3.4' **FILL, POORLY-GRADED SAND:** SP, mostly fine sand, trace coarse sand, moist.	(FILL) SP								
			4	3.4 - 3.9' **FILL, LEAN CLAY:** CL, dark gray (10YR 4/1), cohesive, high plasticity, very stiff (2.5 - 3.0 tsf), moist.	(FILL) CL								
					ML								
2 CS	60 26		5	3.9 - 5' **SILT:** ML, black (10YR 2/1), cohesive, nonplastic, very stiff (2.0 - 2.5), dry to moist.									
			6	5 - 14.3' **LEAN CLAY:** CL, black (10YR 2/1) grading to dark yellowish brown (10YR 4/4), cohesive, medium to high plasticity, soft to very stiff (0.5 - 3.0 tsf), moist.									
			7										
			8										
			9		CL								
3 CS	60 56		10	10' dark yellowish brown (10YR 4/4).									
			11										
			12										

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

Signature

Firm Natural Resource Technology
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NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-3C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	5 - 14.3' **LEAN CLAY:** CL, black (10YR 2/1) grading to dark yellowish brown (10YR 4/4), cohesive, medium to high plasticity, soft to very stiff (0.5 - 3.0 tsf), moist. *(continued)*	CL								
			14										
				14.3 - 15' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/4), cohesive, medium to low plasticity, soft (0.5 tsf), wet.	CL/ML								
4 CS	60 57		15	15 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4) with dark gray (10YR 4/1) mottling, trace fine gravel, cohesive, nonplastic, soft to stiff (0.5 - 1.5 tsf), moist.									
			16										
			17		CL								
			18										
			19										
5 CS	60 57		20	20 - 21.5' **SILTY CLAY** CL/ML, dark yellowish brown (10YR 4/4), cohesive, nonplastic, very soft (0.0 tsf), wet.	CL/ML								
			21										
			22	21.5 - 22' **LEAN CLAY:** CL, dark grayish brown (10YR 4/2), trace sand and gravel, cohesive, low plasticity, very stiff to hard (3.5 - 4.5 tsf), moist to wet [TILL].	CL								
				22 - 22.3' **POORLY-GRADED SAND:** SP, dark gray (10YR 4/1), little gravel and clay, wet.	SP								
			23	22.3 - 24.8' **LEAN CLAY:** CL, dark gray (10YR 4/1), 15-25% gravel, trace sand, hard (4.5 tsf), dry.	CL								
			24										
				24.8' End of Boring.									

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-3B

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/29/2016	3/30/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-3B	Feet (NAVD88)	603.47 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,848.81 N, 2,485,789.93 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 1.2' **FILL, SANDY SILT:** (ML)s.	(FILL) (ML)s									Blind Drilled, see PZ-3C for details
			2	1.2 - 3.2' **FILL, LEAN CLAY WITH SAND:** (CL)s.	(FILL) (CL)s									
			3	3.2 - 3.4' **FILL, POORLY-GRADED SAND:** SP.	(FILL) SP									
			4	3.4 - 3.9' **FILL, LEAN CLAY:** CL.	(FILL) CL									
				3.9 - 5' **SILT:** ML.	ML									
			5	5 - 14.3' **LEAN CLAY:** CL.	CL									
			6											
			7											
			8											
			9											
			10											
			11											
			12											

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

Signature

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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-3B

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			13	5 - 14.3' **LEAN CLAY:** CL. *(continued)*	CL									
			14											
				14.3 - 15' **SILTY CLAY** CL/ML.	CL/ML									
			15	15 - 17' **LEAN CLAY:** CL.	CL									
			16											
			17	17' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-3A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/29/2016	3/30/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-3A	Feet (NAVD88)	603.33 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,848.40 N, 2,485,792.80 E E/W
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
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 1.2' **FILL, SANDY SILT:** (ML)s.	(FILL) (ML)s								Blind Drilled, see PZ-3C for details
			1	1.2 - 3.2' **FILL, LEAN CLAY WITH SAND:** (CL)s.	(FILL) (CL)s								
			2										
			3	3.2 - 3.4' **FILL, POORLY-GRADED SAND:** SP.	(FILL) SP								
				3.4 - 3.9' **FILL, LEAN CLAY:** CL.	(FILL) CL								
			4	3.9 - 5' **SILT:** ML.	ML								
			5	5 - 12' **LEAN CLAY:** CL.	CL								
			6										
			7										
			8										
			9										
			10										
			11										
			12	12' End of Boring.									

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

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SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-2C

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/31/2016	4/1/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-2C	Feet (NAVD88)	614.10 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,069,329.19 N, 2,486,393.15 E E/W
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
	Christian	Illinois	Kincaid

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	42 24		0–3	0 - 3.6' ASH (Coal), very dark brown (10YR 2/2), mostly fine sand sized ash, trace fine gravel sized, dry.	(FILL) ASH (Coal)								Sampling completed using 2" macro core
2 CS	60 57		3–15	3.6 - 24' **FILL, LEAN CLAY:** CL, brown (10YR 4/3) to gray (10YR 5/1), 15-25% silt, trace sand and fine gravel, cohesive, low to high plasticity, very stiff to hard (2.0 - 4.0 tsf), moist to dry.	(FILL) CL								
3 CS	60 55			10.5' color change to gray (10YR 4/1). 10.7' color change to brown (10YR 4/3).									
4 CS	60 56			13.5' brown (10YR 4/3) with brownish yellow (10YR 6/8) and dark gray (10YR 4/1) mottling, trace dark gray (10YR 4/1) silt seams.									

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

Signature [signature]

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NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-2C

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			16	3.6 - 24' **FILL, LEAN CLAY:** CL, brown (10YR 4/3) to gray (10YR 5/1), 15-25% silt, trace sand and fine gravel, cohesive, low to high plasticity, very stiff to hard (2.0 - 4.0 tsf), moist to dry. *(continued)*									
			17										
			18										
5 CS	60 57		19	18.5' no silt seams, no dark gray (10YR 4/1) mottling.	(FILL) CL								
			20										
			21										
			22										
			23										
6 CS	60 56		24	24 - 29.2' **LEAN CLAY:** CL, black (10YR 2/1) grading to dark gray (10YR 4/1), cohesive, medium to high plasticity, medium stiff to stiff (0.5 - 1.5 tsf), moist to wet.	CL								
			25										
			26										
			27										
			28										
7 CS	60 57		29	28.5' moist to wet.									
			30	29.2 - 31.6' **SILTY CLAY** CL/ML, brown (10YR 4/3), trace fine sand, cohesive, medium to low plasticity, stiff (1.0 tsf), wet.	CL/ML								
			31										
			32	31.6 - 35.1' **LEAN CLAY:** CL, brown (10YR 4/3), trace fine sand and fine gravel, cohesive, medium to high plasticity, stiff to very stiff (1.5 - 2.5 tsf), moist.	CL								
			33										
8 CS	56 60		34	33.5' dark yellowish brown (10YR 4/6).									
			35										
			36	35.1 - 37.5' **SANDY ORGANIC CLAY WITH GRAVEL:** s(CL), dark yellowish brown (10YR 4/6), trace gravel, cohesive, nonplastic, very soft (0.0 tsf), wet.	s(CL)								
			37										
			38	37.5 - 38.1' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/6), trace sand and gravel, very hard (4.5 tsf), dry.	CL								
				38.1' End of Boring.									

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-2B

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/31/2016	4/1/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-2B	Feet (NAVD88)	613.96 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,069,329.32 N, 2,486,397.79 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 3.6' ASH (Coal).	(FILL) ASH (Coal)									Blind Drilled, see PZ-2C for details
			2											
			3											
			4	3.6 - 24' FILL, LEAN CLAY: CL.	(FILL) CL									
			5											
			6											
			7											
			8											
			9											
			10											
			11											
			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
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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-2B

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	PID 10.6 eV Lamp	Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			14	3.6 - 24' **FILL, LEAN CLAY:** CL. *(continued)*										
			15											
			16											
			17											
			18		(FILL) CL									
			19											
			20											
			21											
			22											
			23											
			24	24 - 29.2' **LEAN CLAY:** CL.										
			25											
			26											
			27		CL									
			28											
			29	29.2 - 31.6' **SILTY CLAY** CL/ML.										
			30		CL/ML									
			31											
			32	31.6 - 32' **LEAN CLAY:** CL.	CL									
				32' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-2A

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/31/2016	4/1/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-2A	Feet (NAVD88)	614.17 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,069,329.92 N, 2,486,401.04 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 3.6' ASH (Coal).	(FILL) ASH (Coal)									Blind Drilled, see PZ-2C for details
			2											
			3											
			4	3.6 - 24' FILL, LEAN CLAY: CL.										
			5											
			6											
			7											
			8		(FILL) CL									
			9											
			10											
			11											
			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
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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number PZ-2A

Sample: Number and Type	Sample: Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			14	3.6 - 24' **FILL, LEAN CLAY:** CL. *(continued)*	(FILL) CL									
			15											
			16											
			17											
			18											
			19											
			20											
			21											
			22											
			23											
			24	24 - 28' **LEAN CLAY:** CL.	CL									
			25											
			26											
			27											
			28	28' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-1C

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/28/2016	3/29/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-1C	Feet (NAVD88)	598.86 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,068,557.43 N, 2,484,987.72 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 1.8' **SILT:** ML.	ML								Blind Drilled, see GP-1 for details
			2	1.8 - 8' **LEAN CLAY:** CL.	CL								
			8	8 - 11.2' **SANDY LEAN CLAY:** s(CL).	s(CL)								
			11	11.2 - 15' **SANDY SILT:** s(ML).	s(ML)								

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 PZ-1C

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	11.2 - 15' **SANDY SILT:** s(ML). *(continued)*	s(ML)									
			14											
			15	15' End of Boring.										

NATURAL RESOURCE TECHNOLOGY

SOIL BORING LOG INFORMATION

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		PZ-1B

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/28/2016	3/29/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
PZ-1B	Feet (NAVD88)	599.05 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,068,559.28 N, 2,484,990.01 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	PID 10.6 eV Lamp	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 1.8' **SILT:** ML.	ML									Blind Drilled, see GP-1 for details
			2	1.8 - 7.5' **LEAN CLAY:** CL.	CL									
			3											
			4											
			5											
			6											
			7											
				7.5' End of Boring.										

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

Signature

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SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		GP-5

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/30/2016	3/31/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	598.90 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,386.90 N, 2,487,586.87 E E/W
1/4 of 1/4 of Section , T N, R
Lat ° ' "
Long ° ' "
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	36 37		0	0 - 0.5' **SILT:** ML, very dark grayish brown (10YR 3/2), trace roots, sand, and gravel, cohesive, nonplastic, dry.	ML								
			1	0.5 - 18.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4) grading to black (10YR 2/1), trace roots in top 1' of unit, trace fine gravel, cohesive, high plasticity, very stiff (3.5 - 4.0 tsf), dry to moist, increase in moisture content with depth.									
			2										
2 CS	60 60		3	3' (soft to very stiff 0.5 to 4.0 tsf).									
			4	4.2' grayish brown (10YR 5/2).									
			5										
			6	6' brown (10YR 4/3) with gray (10YR 5/1) and yellowish brown (10YR 5/8) mottling.	CL								
			7										
3 CS	60 53		8	8' (soft to stiff 0.5 - 2.0 tsf).									
			9	8.8' dark gray (10YR 4/1) with dark yellowish brown (10YR 4/4) mottling and trace black (10YR 2/1) oxidation staining.									
			10										
			11										
			12										

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

Signature

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NATURAL RESOURCE TECHNOLOGY

Boring Number GP-5

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
4 CS	60 60		13	0.5 - 18.8' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4) grading to black (10YR 2/1), trace roots in top 1' of unit, trace fine gravel, cohesive, high plasticity, very stiff (3.5 - 4.0 tsf), dry to moist, increase in moisture content with depth. *(continued)*										
			14	13' soft (0.5 tsf), wet. 13.3' light yellowish brown (10YR 6/4). 13.8' dark gray (10YR 4/1).										
			15											
			16	15.5' -16.0' trace sand, saturated in fractures for 6".	CL									
			17											
5 CS	24 24		18	17.4' dark yellowish brown (10YR 4/4), with dark gray (10YR 4/1) mottling, trace gravel.										
			19	18.8 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4) to dark gray (10YR 4/1), trace sand and gravel, noncohesive, nonplastic, hard (4.5 tsf), dry.	CL									
			20	20' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		GP-1

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
John Gates Bulldog Drilling	3/28/2016	3/29/2016	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	598.86 Feet (NAVD88)	8.3 inches

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

State Plane 1,068,557.43 N, 2,484,987.72 E E/W

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

Lat ° ' "

Long ° ' "

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 CS	60 33		1	0 - 1.8' **SILT:** ML, very dark grayish brown (10YR 3/2), 15-25% clay, trace roots and ash in top 6", cohesive, nonplastic, stiff (1.75 tsf), dry to moist.	ML								
			2	1.8 - 8' **LEAN CLAY:** CL, brown (10YR 4/3) with yellowish red (5YR 5/6) mottling, trace black (10YR 2/1) oxidation stains, cohesive, medium to high plasticity, medium to stiff (0.5 - 1.75 tsf), moist.									
			3										
			4										
2 CS	60 53		5		CL								
			6										
			7										
			8	8 - 11.2' **SANDY LEAN CLAY:** s(CL), dark yellowish brown (10YR 4/4), 10-25% fine gravel, cohesive, nonplastic, stiff to very stiff (1.5 - 2.5 tsf), moist to wet.									
			9		s(CL)								
3 CS	60 58		10										
			11										
			12		s(ML)								

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

Signature

Firm Natural Resource Technology
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SOIL BORING LOG INFORMATION SUPPLEMENT

NATURAL RESOURCE TECHNOLOGY

Boring Number GP-1

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			13	11.2 - 15' **SANDY SILT:** s(ML), dark yellowish brown (10YR 4/4), trace fine gravel, cohesive, nonplastic, very soft to soft (0.0 - 0.5 tsf), wet. *(continued)*	s(ML)								
			14										
4 CS	60 60		15	15 - 20' **LEAN CLAY:** CL, dark yellowish brown (10YR 4/4) with darker yellowish brown mottling (10YR 3/4), 15-25% sand, trace gravel, very stiff to hard (2.0 - 4.5 tsf), increasing hardness with depth, moist to dry.									
			16										
			17		CL								
			18										
			19										
			20	20' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		B-12

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/20/2015	7/21/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
	Feet (NAVD88)	588.86 Feet (NAVD88)	8.3 inches

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

State Plane 1,068,944.76 N, 2,485,453.08 E E/W

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

Lat 39° 36' 0.722"

Long -89° 29' 46.969"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
1 SS	24 15	1 3 7 6	1	0 - 2' **FILL, SILT:** ML, very dark gray (2.5YR 3/1), mostly silt, trace clay, roots, and subangular gravel, noncohesive, dry. 0.9' dark grayish brown (2.5YR 4/2), no roots, noncohesive to cohesive.	(FILL) ML								
2 SS	24 20	4 6 7 7	2 3	2 - 4' **FILL, CLAYEY SILT** ML/CL, dark grayish brown (2.5YR 4/2), trace gravel, trace fine sand seams, nonplastic, cohesive, dry to moist. 3.3' very dark grayish brown (2.5YR 3/2), trace ash, trace slag, trace clear glass fragments.	(FILL) ML/CL								
3 ST	24 17		4 5	4 - 6' Shelby Tube Sample.									ST3: 24" push at 150 lbs of pressure.
4 SS	24 17	2 1 2 1	6 7	6 - 6.2' **FILL, CLAYEY SILT** ML/CL, dark grayish brown (2.5YR 4/2), trace gravel, trace fine sand seams, trace fine to coarse ash, nonplastic, cohesive, moist. 6.2 - 8' **SILTY CLAY** CL/ML, yellowish brown (10YR 5/4), trace sand seams, trace gravel. 6.9' noncohesive to cohesive, wet.	(FILL) ML/CL CL/ML								
5 SS	24 20	1 1 1 4	8 9	8 - 10' **CLAYEY SILT** ML/CL, yellowish brown (10YR 5/4), trace gravel, trace to few fine sand, wet. 9.4' nonplastic, noncohesive to cohesive.	ML/CL								
6 SS	24 16.5	5 9 13 19	10 11 12	10 - 12' **CLAYEY SAND:** SC, yellowish brown (10YR 5/4), trace yellowish brown (10YR 5/8) mottling, clay content decreasing with depth, trace fine gravel, noncohesive, moist.	SC								

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

Signature

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NATURAL RESOURCE TECHNOLOGY

Boring Number B-12

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
7 SS	24 18	2 4 5 7	13	12 - 14.4' **WELL-GRADED SAND:** SW, yellowish brown (10YR 5/4), trace clay, trace subrounded gravel, noncohesive, wet.	SW								
8 SS	24 22	13 23 45 50	14 15	14.4 - 16' **SILTY SAND:** SW-SM, yellowish brown (10YR 5/4), mostly very fine sand, trace yellowish brown (10YR 5/8) mottling, trace fine sand seams, trace gravel, trace black silt, trace clay, nonplastic, cohesive, moist to dry.	SW-SM								
9 ST	9 5		16 17	16 - 18' Shelby Tube Sample.									ST9: 9" push at 950lbs of pressure.
10 SS	23 20	20 28 34 50 for 5"	18 19	18 - 30' **SILTY CLAY** to **POORLY-GRADED SAND:** CL/ML, gray (2.5YR 5/1), some very fine sand, little clay, nonplastic, cohesive, dry. 19.2' dark gray (2.5YR 4/1), trace coarse sand.									
11 SS	12 13	28 50 for 6"	20 21	20' - 21.2' trace clay, trace coarse sand to fine gravel.									
12 SS	17 14	16 39 50 for 5"	22 23	22' - 23.2' trace to little clay, trace coarse sand. 22.8' trace gravel.									
13 SS	12 13	31 50 for 6"	24 25	24' -25.1' clay (0-15%), trace coarse sand.	CL/ML								
14 SS	11 4.5	43 50 for 5"	26 27	26' clay (15-30%).									
15 SS	12 11	37 50 for 6"	28 29										
16 ST	8 0		30 31 32	30 - 32' Shelby Tube Sample, No Recovery.									ST16: 8" push at 650lbs of pressure.

NATURAL RESOURCE TECHNOLOGY

Boring Number B-12

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
17 ST	6 4		32	32 - 34' Shelby Tube Sample.										ST17: 6" push at 650lbs of pressure.
			33											
18 SS	23 21.5	12 23 42 50 for 5"	34	34 - 42' **CLAYEY SILT** ML/CL, gray (2.5YR 5/1), trace to few fine to coarse sand, nonplastic to low plasticity, cohesive, hard (>4.5 tsf), moist.										
			35	35.2' trace gravel.										
19 SS	23 24	10 18 34 50 for 5"	36	36' olive brown (2.5YR 4/4) mottling, trace fine sand, trace coarse sand, hard (>4.5 tsf), moist to dry.										
			37											
20 SS	18 18	16 24 50 for 6"	38	37.9' trace fine sand seams, hard (4.0 - 4.5+ tsf).	ML/CL									
			39											
21 SS	17 22	25 33 50 for 5"	40	40' low plasticity, stiff to very stiff (1.5 - 3.0 tsf), dry.										
			41											
22 ST	4.5 5		42	42 - 44' Shelby Tube Sample.										ST22: 4.5" push at 700lbs of pressure.
			43											
23 SS	6 6	50 for 6"	44	44 - 48' **LEAN CLAY:** CL, very dark gray (10YR 3/1), trace silt, medium plasticity, cohesive, soft (0.5 tsf), dry.										
			45											
24 SS	6 6	50 for 6"	46	46 - 48' trace gravel-sized shale pieces, very stiff to hard (3.0 - 4.5+ tsf).	CL									
			47											
25 ST	5 5		48	48 - 50' Shelby Tube Sample.										ST25: 5" push at 700lbs of pressure.
			49											
26 SS	6 5	50 for 6"	50	50 - 52' **LEAN CLAY:** CL, as above, hard (>4.5 tsf).										
			51		CL									
			52											

NATURAL RESOURCE TECHNOLOGY

Boring Number B-12

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram		Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
27 SS	1 0	50 for 1"		52 - 52.1' No Recovery.										Split Spoon Refusal at 52.1' bgs.
28 CORE	119 116			52.1 - 62' **LIMESTONE:** BDX (LS), white (GLEY 1 8/N), trace shaley limestone, fossiliferous, vuggy texture, microcrystalline, massive, intensely fractured, very narrow to moderately narrow apertures.	BDX (LS)									RQD = 61.3% (fair).
				53.5' no vuggy texture.										
				54.8' mud-filled fracture.										
				57.6' color change to light gray (GLEY 17/N).										
				60.2' shale layer (0.1" thick).										
				62' End of Boring.										

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-11

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Adam Jochimsen Cascade	6/17/2015	6/17/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-11	Feet (NAVD88)	599.27 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,066,371.19 N, 2,486,955.55 E E /Ⓦ
1/4 of 1/4 of Section , T N, R

Lat 39° 35' 35.176"
Long -89° 29' 28.013"

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

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

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 21.5	5 6 6 6		0 - 0.2' **SILTY CLAY** CL/ML, very dark gray (10YR 3/1), 5-50% roots, trace gravel, wet.	CL/ML								
			1	0.2 - 3' **CLAYEY SILT** ML/CL, dark brown (10YR 3/3), yellowish brown (10YR 5/6) mottling, trace gravel, dry. 1.5' dark yellowish brown (10YR 4/6).	ML/CL								
2 SS	24 24	8 8 11 17	2	2' trace coarse sand to fine gravel, color grades to yellowish brown (10YR 4/6).									
			3	3 - 4' **SILT:** ML, black (10YR 2/1), 5-15% clay, cohesive, nonplastic, moist.	ML								
3 SS	24 21	3 5 8 7	4	4 - 6' **CLAYEY SILT** ML/CL, very dark brown (10YR 2/2), cohesive, low plasticity. 4.5' grading to silty clay, color grades to light olive brown (2.5Y 5/3) with olive yellow (2.5Y 6/6) mottling, cohesive, medium to high plasticity. 5.5' color grades to very dark brown (10YR 2/2), cohesive, low plasticity.	ML/CL								
4 ST	24 12		6	6 - 8' Shelby Tube Sample.									ST4: 24" push.
			7										
5 SS	24 24	2 2 5 7	8	8 - 15.3' **SILTY CLAY** CL/ML, light olive brown (2.5Y 5/3), olive yellow (2.5Y 6/6) and very dark brown (10YR 2/2) mottling, cohesive, medium plasticity, moist. 9.3' very dark grayish brown (2.5Y 3/2).									
6 SS	24 23.5	2 3 5 7	10	10' low to medium plasticity, moist.	CL/ML								
			11										
			12										

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

Signature Patrick M. Hufl

Firm Natural Resource Technology
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Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-11

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
7 SS	24 21	1 2 3 5	13	8 - 15.3' **SILTY CLAY** CL/ML, light olive brown (2.5Y 5/3), olive yellow (2.5Y 6/6) and very dark brown (10YR 2/2) mottling, cohesive, medium plasticity, moist. *(continued)* 12.2' dark grayish brown (2.5Y 4/2) with olive yellow (2.5Y 6/6) mottling. 12.5' wet.	CL/ML								
8 SS	24 24	1 2 4 5	14 15										
9 SS	24 21	2 2 2 3	16	15.3 - 16.9' **SILTY CLAY** CL/ML, light olive brown (2.5Y 5/4), trace sand, trace fine gravel, cohesive, nonplastic, wet.	CL/ML								
			17	16.9 - 18' **SILTY SAND:** SM, light olive brown (2.5Y 5/4), mostly fine grained sand, silt is cohesive and nonplastic.	SM								
10 SS	24 23	1 2 25 50 for 6"	18	18 - 18.4' **SILT:** ML, light olive brown (2.5Y 5/4), trace sand, cohesive, nonplastic, wet.	ML								
			19	18.4 - 20.8' **SILTY CLAY** CL/ML, light olive brown (2.5Y 5/3), 5-15% sand and gravel, hard, dry.	CL/ML								
11 SS	9 9	44 53 for 3"	20	20' trace sand and gravel.									
			21	20.8 - 21' Overdrilled to Install Monitoring Well. 21' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		MW-12

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/22/2015	7/23/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
MW-12	Feet (NAVD88)	588.86 Feet (NAVD88)	8.3 inches

Local Grid Origin ☐ (estimated: ☐) or Boring Location ☒
State Plane 1,068,944.76 N, 2,485,453.08 E E/W
1/4 of 1/4 of Section , T N, R
Lat 39° 36' 0.722"
Long -89° 29' 46.969"
Local Grid Location ☐N ☐S Feet ☐E ☐W Feet

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			0	0 - 2' **FILL, SILT:** ML.	(FILL) ML								0-15' Blind Drilled. See log B-12 for soil description details.
			2	2 - 4' **FILL, CLAYEY SILT** ML/CL.	(FILL) ML/CL								
			4	4 - 6' Shelby Tube Sample Collected at Location B-12.									
			6	6 - 6.2' **FILL, CLAYEY SILT** ML/CL.	(FILL) ML/CL								
				6.2 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8	8 - 10' **CLAYEY SILT** ML/CL.	ML/CL								
			10	10 - 12' **CLAYEY SAND:** SC.	SC								
			12										

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

Signature

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

NATURAL RESOURCE TECHNOLOGY

Boring Number MW-12

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			12	12 - 14.4' **WELL-GRADED SAND:** SW.	SW								
			13										
			14										
				14.4 - 15' **SILTY SAND:** SW-SM.	SW-SM								
1 SS	24 20	9 19 26 26	15	15 - 15.2' **SILT:** ML, very dark gray (2.5YR 3/1), trace roots, clay, gravel, and sand, noncohesive, moist.	ML								
			16	15.2 - 17' **CLAYEY SILT** to **SANDY SILT:** ML/CL, yellowish brown (10YR 5/4), very fine sand, sand content increasing with depth, nonplastic, cohesive, moist.	ML/CL								
2 SS	24 15	9 19 32 48	17	15.9' gray (2.5YR 5/1).	SM								
			18	17 - 17.4' **SILTY SAND:** SM, gray (2.5YR 5/1), trace clay, moist.	CL/ML								
				17.4 - 19' **SILTY CLAY** to **CLAYEY SILT** CL/ML, gray (2.5YR 5/1), trace coarse sand, clay content decreasing with depth, low to medium plasticity, cohesive.									
3 SS	23 22	19 36 40 50 for 5"	19	19 - 23' **CLAYEY SILT** ML/CL, gray (2.5YR 5/1), trace coarse sand, low plasticity, cohesive, moist.									
			20										
4 SS	17 15	25 43 50 for 5"	21		ML/CL								
			22										
			23	23 - 25' **SILTY CLAY** to **POORLY-GRADED SAND:** CL/ML.									23-25' Overdrilled. See log B-12 for soil description details.
			24		CL/ML								
			25	25' End of Boring.									

SOIL BORING LOG INFORMATION

NATURAL RESOURCE TECHNOLOGY

Facility/Project Name	License/Permit/Monitoring Number	Boring Number
Kincaid Power Station		TW-12

Boring Drilled By: Name of crew chief (first, last) and Firm	Date Drilling Started	Date Drilling Completed	Drilling Method
Chad Dutton Bulldog Drilling	7/22/2015	7/22/2015	hollow stem auger

Common Well Name	Final Static Water Level	Surface Elevation	Borehole Diameter
TW-12	Feet (NAVD88)	588.86 Feet (NAVD88)	8.3 inches

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

State Plane 1,068,944.76 N, 2,485,453.08 E E/W

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

Lat 39° 36' 0.722"

Long -89° 29' 46.969"

Local Grid Location

Feet ☐N ☐S Feet ☐E ☐W

Facility ID	County	State	Civil Town/City/ or Village
	Christian	Illinois	Kincaid

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	USCS	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	RQD/ Comments
			1	0 - 2' **FILL, SILT:** ML.	(FILL) ML								0-39' Blind Drilled. See log B-12 for soil description details.
			2	2 - 4' **FILL, CLAYEY SILT** ML/CL.	(FILL) ML/CL								
			4	4 - 6' Shelby Tube Sample Collected at Location B-12.									
			6	6 - 6.2' **FILL, CLAYEY SILT** ML/CL.	(FILL) ML/CL								
				6.2 - 8' **SILTY CLAY** CL/ML.	CL/ML								
			8	8 - 10' **CLAYEY SILT** ML/CL.	ML/CL								
			10	10 - 12' **CLAYEY SAND:** SC.	SC								
			12										

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 TW-12

Sample		Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties					RQD/ Comments
Number and Type	Length Att. & Recovered (in)							Compressive Strength (tsf)	Moisture Content	Liquid Limit	Plasticity Index	P 200	
			12	12 - 14.4' **WELL-GRADED SAND:** SW.	SW								
			13										
			14										
			14	14.4 - 16' **SILTY SAND:** SW-SM.	SW-SM								
			15										
			16	16 - 18' Shelby Tube Sample Collected at Location B-12.									
			17										
			18	18 - 30' **SILTY CLAY** to **POORLY-GRADED SAND:** CL/ML.	CL/ML								
			19										
			20										
			21										
			22										
			23										
			24										
			25										
			26										
			27										
			28										
			29										
			30	30 - 32' Shelby Tube Sample Collected at Location B-12.									
			31										
			32										

NATURAL RESOURCE TECHNOLOGY

Boring Number TW-12

Sample Number and Type	Sample Length Att. & Recovered (in)	Blow Counts	Depth In Feet	Soil/Rock Description And Geologic Origin For Each Major Unit	U S C S	Graphic Log	Well Diagram	Soil Properties: Compressive Strength (tsf)	Soil Properties: Moisture Content	Soil Properties: Liquid Limit	Soil Properties: Plasticity Index	Soil Properties: P 200	RQD/ Comments
			33	32 - 34' Shelby Tube Sample Collected at Location B-12.									
			34	34 - 39' **CLAYEY SILT** ML/CL.									
			35										
			36										
			37		ML/CL								
			38										
1 SS	17 16	26 36 50 for 5"	39	39 - 43' **CLAYEY SILT** ML/CL, gray (2.5YR 5/1) with olive brown (2.5YR 4/4) mottling, trace fine to coarse sand and gravel, low plasticity, cohesive, dry.									
			40										
2 SS	16 14.5	19 30 50 for 4"	41		ML/CL								
			42	41.8' - 42' increased clay content.									
3 SS	12 10	22 50 for 6"	43	43 - 45' **LEAN CLAY:** CL, very dark gray (10YR 3/1), trace silt, trace gravel-sized pieces of weathered shale (very hard, dry), very stiff (2.5-3.0 tsf), dry, low plasticity, cohesive.	CL								
			44										
4 ST	5 0		45	45 - 47' Shelby Tube Sample. No Recovery.									ST4: 5" at 700lbs of pressure.
			46										
5 SS	22 12	15 31 36 50 for 4"	47	47 - 49' **LEAN CLAY:** CL, very dark gray (10YR 3/1), trace silt, no gravel, cohesive, medium plasticity, stiff to very stiff (2.0 tsf), dry.	CL								
			48										
			49	49' End of Boring.									

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-1B
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,068,559.28 ft. N, 2,484,990.01 ft. E /Ⓦ	Date Well Installed: 03/29/2016
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates; Bulldog Drilling
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:
Distance from Waste/Source: ____ ft. State: Illinois		

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

B. Well casing, top elevation 602.43 ft. (NAVD88)

C. Land surface elevation 599.05 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 599.1 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 596.6 ft. (NAVD88) or 2.5 ft.

H. Screen joint, top 595.6 ft. (NAVD88) or 3.5 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

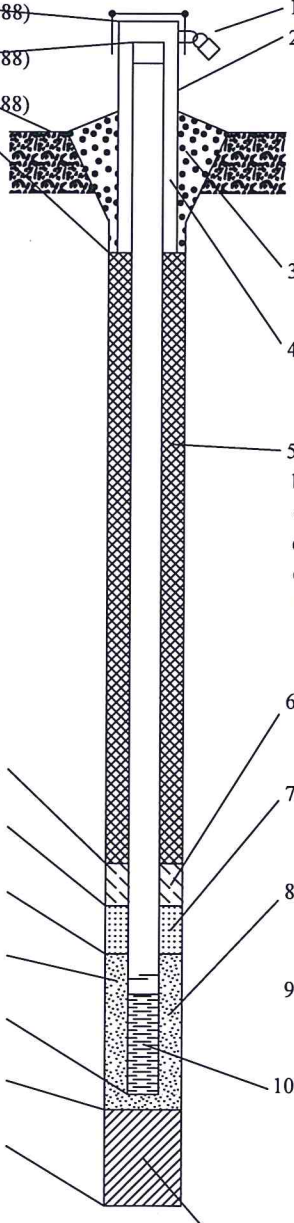
J. Filter pack, bottom 591.6 ft. (NAVD88) or 7.5 ft.

K. Borehole, bottom 591.6 ft. (NAVD88) or 7.5 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☒ Other ☐ ____
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☒ Other ☐ ____
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐ ____
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐ ____
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 4.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐ ____

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: John M. Hale

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-1C
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,068,557.43 ft. N, 2,484,987.72 ft. E/(W)	Date Well Installed: 03/29/2016
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Bulldog Drilling
Distance from Waste/Source: ft. / State: Illinois	Gov. Lot Number:	

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

B. Well casing, top elevation 602.38 ft. (NAVD88)

C. Land surface elevation 598.86 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 598.9 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 589.9 ft. (NAVD88) or 9.0 ft.

H. Screen joint, top 588.9 ft. (NAVD88) or 10.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

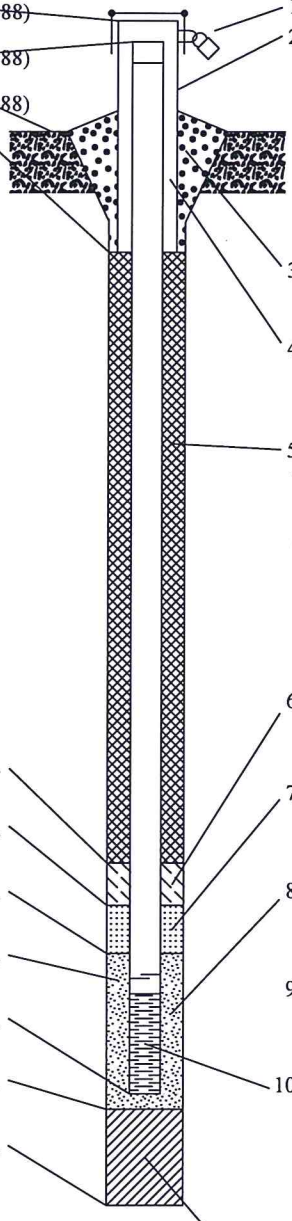
J. Filter pack, bottom 583.9 ft. (NAVD88) or 15.0 ft.

K. Borehole, bottom 578.9 ft. (NAVD88) or 20.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
   a. Inside diameter: ____ in.
   b. Length: ____ ft.
   c. Material: Steel ☒ ____ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: Pam M. Holt

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-2A
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,069,329.92 ft. N, 2,486,401.04 ft. E/(W)	Date Well Installed: 04/01/2016
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates; Bulldog Drilling
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:
Distance from Waste/Source: ft.	State: Illinois	

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

B. Well casing, top elevation 616.93 ft. (NAVD88)

C. Land surface elevation 614.17 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 614.2 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 591.2 ft. (NAVD88) or 23.0 ft.

H. Screen joint, top 590.2 ft. (NAVD88) or 24.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

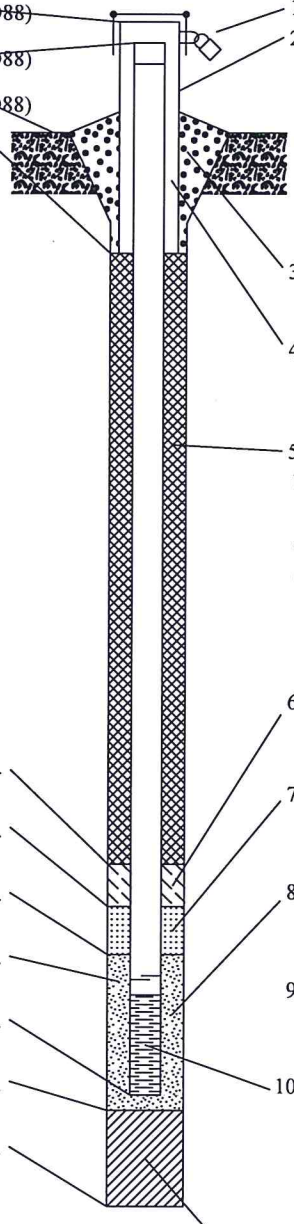
J. Filter pack, bottom 586.2 ft. (NAVD88) or 28.0 ft.

K. Borehole, bottom 586.2 ft. (NAVD88) or 28.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☒ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 4.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: John M. Hart

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-2B
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,069,329.32 ft. N, 2,486,397.79 ft. E / W	Date Well Installed: 04/01/2016
Facility ID	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates; Bulldog Drilling
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:
Distance from Waste/Source: ft.	State: Illinois	

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

B. Well casing, top elevation 616.60 ft. (NAVD88)

C. Land surface elevation 613.96 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 614.0 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 585.0 ft. (NAVD88) or 29.0 ft.

H. Screen joint, top 584.0 ft. (NAVD88) or 30.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

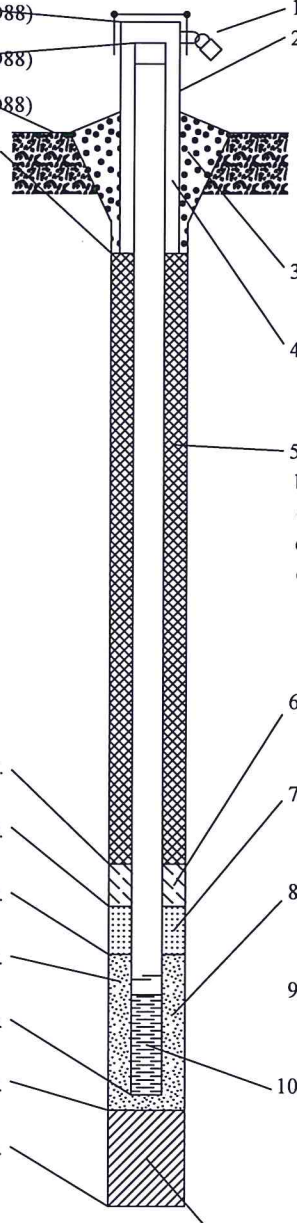
J. Filter pack, bottom 582.0 ft. (NAVD88) or 32.0 ft.

K. Borehole, bottom 582.0 ft. (NAVD88) or 32.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
   a. Inside diameter: ____ in.
   b. Length: ____ ft.
   c. Material: Steel ☒ ____ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 2.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: Pam M. Hale

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-2C
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,069,329.19 ft. N, 2,486,393.15 ft. E/(W)	Date Well Installed: 04/01/2016
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____
Distance from Waste/Source: ____ ft. / State: Illinois		Bulldog Drilling

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

B. Well casing, top elevation 616.60 ft. (NAVD88)

C. Land surface elevation 614.10 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 614.1 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 579.6 ft. (NAVD88) or 34.5 ft.

H. Screen joint, top 578.6 ft. (NAVD88) or 35.5 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

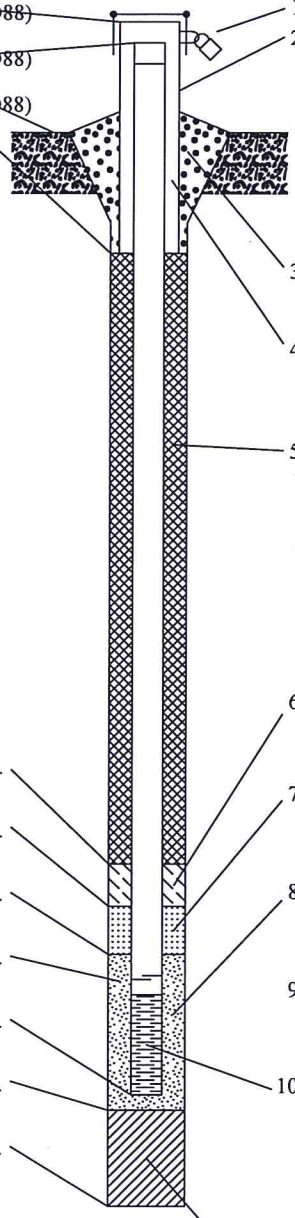
J. Filter pack, bottom 576.0 ft. (NAVD88) or 38.1 ft.

K. Borehole, bottom 576.0 ft. (NAVD88) or 38.1 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
   a. Inside diameter: ____ in.
   b. Length: ____ ft.
   c. Material: Steel ☒ ____ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 2.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: Paul M. Hunt

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-3A
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,066,848.40 ft. N, 2,485,792.80 ft. E / W	Date Well Installed: 03/30/2016
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates; Bulldog Drilling
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:
Distance from Waste/Source: ft. / State: Illinois		

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

B. Well casing, top elevation 606.26 ft. (NAVD88)

C. Land surface elevation 603.33 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 603.3 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 596.3 ft. (NAVD88) or 7.0 ft.

H. Screen joint, top 595.3 ft. (NAVD88) or 8.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

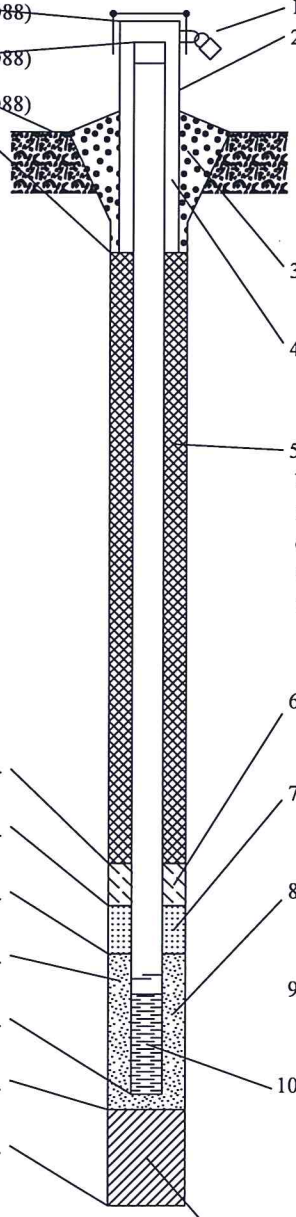
J. Filter pack, bottom 591.3 ft. (NAVD88) or 12.0 ft.

K. Borehole, bottom 591.3 ft. (NAVD88) or 12.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☒ Other ☐ ____
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☒ Other ☐ ____
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐ ____
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐ ____
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 4.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐ ____

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: John M. Hale

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-3B
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,066,848.81 ft. N, 2,485,789.93 ft. E. E/Ⓦ	Date Well Installed: 03/30/2016
Facility ID	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates; Bulldog Drilling
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:
Distance from Waste/Source: ft. / State: Illinois		

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

B. Well casing, top elevation 606.17 ft. (NAVD88)

C. Land surface elevation 603.47 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 603.5 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 589.5 ft. (NAVD88) or 14.0 ft.

H. Screen joint, top 588.5 ft. (NAVD88) or 15.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

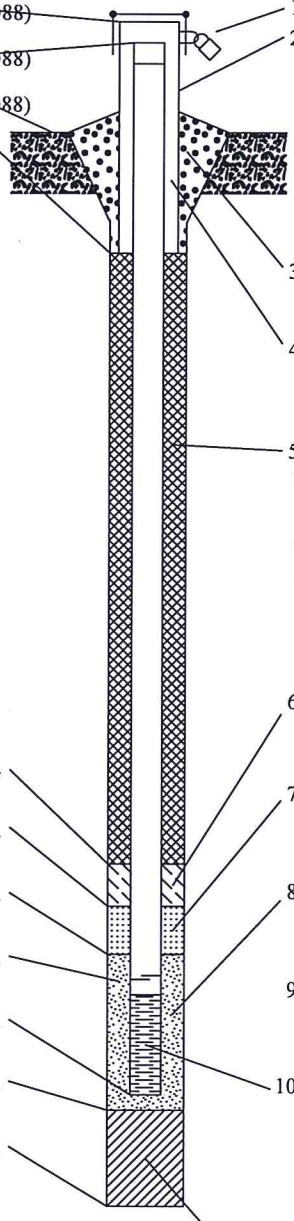
J. Filter pack, bottom 586.5 ft. (NAVD88) or 17.0 ft.

K. Borehole, bottom 586.5 ft. (NAVD88) or 17.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☒ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 2.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: John M. Hesla

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-3C
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,066,849.23 ft. N, 2,485,786.53 ft. E/Ⓦ	Date Well Installed: 03/30/2016
Facility ID	Section Location of Waste/Source: ____1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates; Bulldog Drilling
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number:
Distance from Waste/Source: ft. State: Illinois		

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

B. Well casing, top elevation 606.25 ft. (NAVD88)

C. Land surface elevation 603.49 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 603.5 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 584.5 ft. (NAVD88) or 19.0 ft.

H. Screen joint, top 583.5 ft. (NAVD88) or 20.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

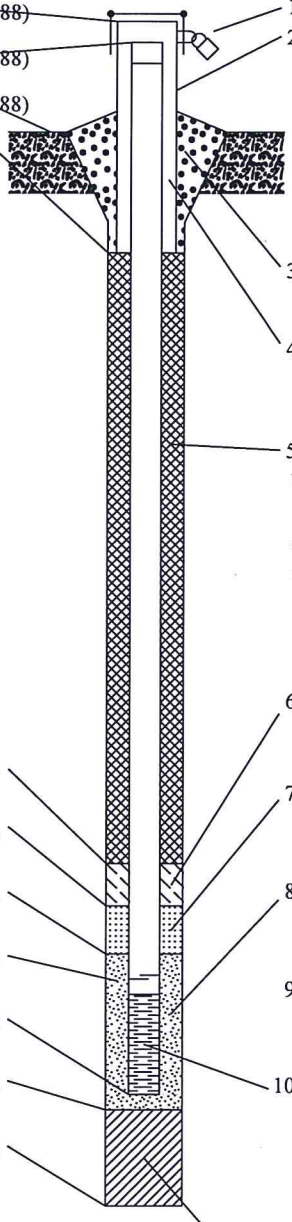
J. Filter pack, bottom 578.7 ft. (NAVD88) or 24.8 ft.

K. Borehole, bottom 578.7 ft. (NAVD88) or 24.8 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
   a. Inside diameter: ____ in.
   b. Length: ____ ft.
   c. Material: Steel ☒ ____ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 3.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: Paul M. Hahn

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-4A
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or St. Plane 1,067,576.32 ft. N, 2,488,049.24 ft. E /Ⓦ	Date Well Installed: 03/30/2016
Facility ID	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates
Type of Well: pz	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____
Distance from Waste/Source: ____ ft. State: Illinois		Bulldog Drilling

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

B. Well casing, top elevation 600.49 ft. (NAVD88)

C. Land surface elevation 597.81 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 597.8 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 593.8 ft. (NAVD88) or 4.0 ft.

H. Screen joint, top 592.8 ft. (NAVD88) or 5.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

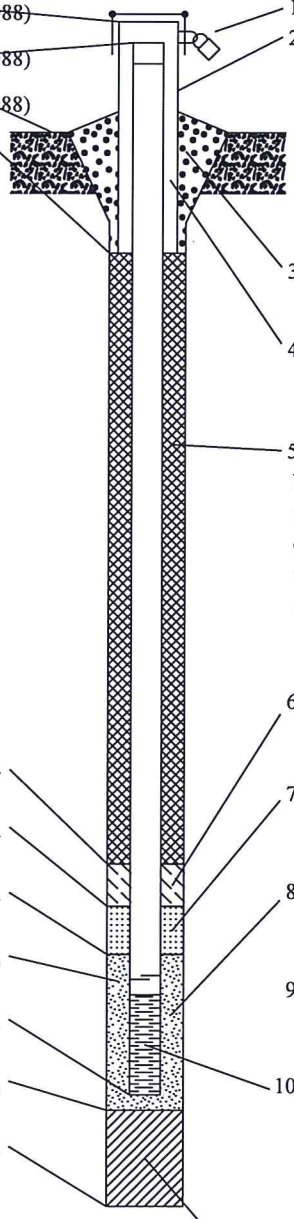
J. Filter pack, bottom 587.8 ft. (NAVD88) or 10.0 ft.

K. Borehole, bottom 587.8 ft. (NAVD88) or 10.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☒ ____ Other ☐
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 5.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: John M. Hess

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-4B
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or	
Facility ID	St. Plane 1,067,579.46 ft. N, 2,488,049.31 ft. E/(W)	Date Well Installed: 03/30/2016
Type of Well: pz	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm): John Gates
Distance from Waste/Source: ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known	Gov. Lot Number: ____ / Bulldog Drilling

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

B. Well casing, top elevation 600.58 ft. (NAVD88)

C. Land surface elevation 597.81 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

15. Drilling fluid used: Water ☒ 02 Air ☐ Drilling Mud ☐ 03 None ☐

16. Drilling additives used? ☐ Yes ☒ No
Describe ____

17. Source of water (attach analysis, if required):
Village of Pawnee, IL

E. Bentonite seal, top 597.8 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 587.8 ft. (NAVD88) or 10.0 ft.

H. Screen joint, top 586.8 ft. (NAVD88) or 11.0 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

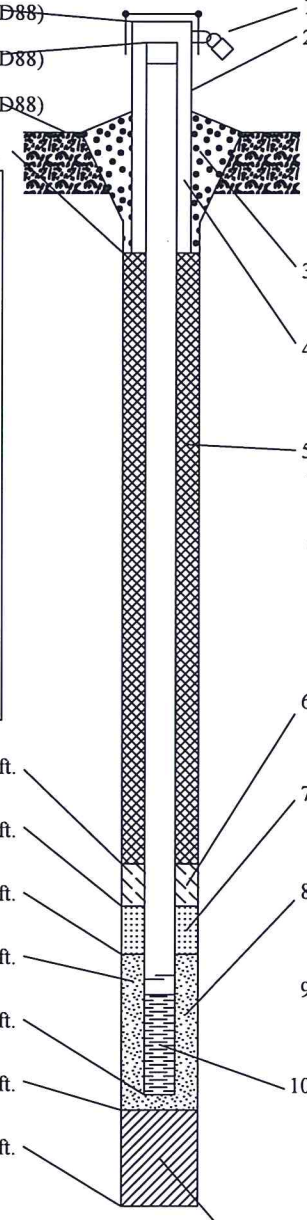
J. Filter pack, bottom 584.8 ft. (NAVD88) or 13.0 ft.

K. Borehole, bottom 584.8 ft. (NAVD88) or 13.0 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
a. Inside diameter: ____ in.
b. Length: ____ ft.
c. Material: Steel ☒ Other ☐ ____
d. Additional protection? ☐ Yes ☒ No
If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ Other ☐ ____
4. Material between well casing and protective pipe: Bentonite ☒ Other ☐ ____
5. Annular space seal: a. Granular/Chipped Bentonite ☐
b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
d. 30 % Bentonite . . . Bentonite-cement grout ☒
e. ____ Ft^3 volume added for any of the above
f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
a. ____
b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
a. Unimin Corporation, FILTERSIL
b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ Other ☐ ____
10. Screen material: Schedule 40 PVC
a. Screen Type: Factory cut ☒ Continuous slot ☐ Other ☐ ____
b. Manufacturer ____
c. Slot size: 0.010 in.
d. Slotted length: 2.0 ft.
11. Backfill material (below filter pack): None ☒ Other ☐ ____

I hereby certify that the information on this form is true and correct to the best of my knowledge. Date Modified: 4/14/2016

Signature: John M. Hall

Firm: Natural Resource Technology
234 W. Florida Street, Floor 5, Milwaukee, WI 53204
Tel: (414) 837-3607
Fax: (414) 837-3608

NATURAL RESOURCE TECHNOLOGY

MONITORING WELL CONSTRUCTION

Facility/Project Name: Kincaid Power Station	Local Grid Location of Well: ____ ft. ☐ N. ☐ S. ____ ft. ☐ E. ☐ W.	Well Name: PZ-4C
Facility License, Permit or Monitoring No.	Local Grid Origin ☐ (estimated: ☐) or Well Location ☒ Lat. ° ' " Long. ° ' " or	
Facility ID	St. Plane 1,067,582.54 ft. N, 2,488,047.98 ft. E. E/(W)	Date Well Installed: 03/30/2016
Type of Well: pz	Section Location of Waste/Source: ____ 1/4 of ____ 1/4 of Sec. ____, T. ____ N, R. ____ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) John Gates, Bulldog Drilling
Distance from Waste/Source ft. / State: Illinois	Location of Well Relative to Waste/Source: u ☐ Upgradient s ☐ Sidegradient d ☐ Downgradient n ☐ Not Known / Gov. Lot Number	

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

B. Well casing, top elevation 600.70 ft. (NAVD88)

C. Land surface elevation 597.83 ft. (NAVD88)

D. Surface seal, bottom ____ ft. (NAVD88) or ____ ft.

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

13. Sieve analysis attached? ☐ Yes ☐ No

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

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

16. Drilling additives used? ☐ Yes ☒ No

Describe ____

17. Source of water (attach analysis, if required): Village of Pawnee, IL

E. Bentonite seal, top 597.8 ft. (NAVD88) or 0.0 ft.

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

G. Filter pack, top 583.3 ft. (NAVD88) or 14.5 ft.

H. Screen joint, top 582.3 ft. (NAVD88) or 15.5 ft.

I. Well bottom ____ ft. (NAVD88) or ____ ft.

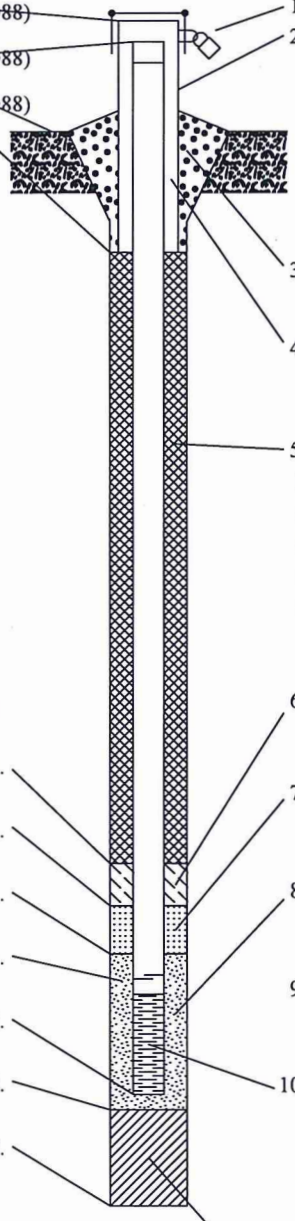
J. Filter pack, bottom 577.3 ft. (NAVD88) or 20.5 ft.

K. Borehole, bottom 577.3 ft. (NAVD88) or 20.5 ft.

L. Borehole, diameter 8.3 in.

M. O.D. well casing 2.38 in.

N. I.D. well casing 2.07 in.



1. Cap and lock? ☐ Yes ☒ No
2. Protective cover pipe:
   a. Inside diameter: ____ in.
   b. Length: ____ ft.
   c. Material: Steel ☒ ____ Other ☐
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ____
3. Surface seal: Bentonite ☐ Concrete ☐ ____ Other ☐
4. Material between well casing and protective pipe: Bentonite ☒ ____ Other ☐
5. Annular space seal: a. Granular/Chipped Bentonite ☐
   b. ____ Lbs/gal mud weight . . . Bentonite-sand slurry ☐
   c. ____ Lbs/gal mud weight . . . Bentonite slurry ☐
   d. 30 % Bentonite . . . Bentonite-cement grout ☒
   e. ____ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ Tremie pumped ☒ Gravity ☐
6. Bentonite seal: a. Bentonite granules ☐
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite chips ☒
   c. ____ Other ☐
7. Fine sand material: Manufacturer, product name & mesh size
   a. ____
   b. Volume added ____ ft^3
8. Filter pack material: Manufacturer, product name & mesh size
   a. Unimin Corporation, FILTERSIL
   b. Volume added ____ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ Flush threaded PVC schedule 80 ☐ ____ Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ Continuous slot ☐ ____ Other ☐
    b. Manufacturer ____
    c. Slot size: 0.010 in.
    d. Slotted length: 2.0 ft.
11. Backfill material (below filter pack): None ☒ ____ Other ☐

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

Date Modified: 4/14/2016

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

APPENDIX D
GEOTECHNICAL LABORATORY REPORTS

March 23, 2021
Revised: May 10, 2021

Mr. Scott Woods
Ramboll Environ U.S. Corporation
333 West Wacker Drive, Ste 2700
Chicago, IL 60606-2872

RE: Laboratory Testing Program for the Kinkaid Power Station Project – Terracon Project No. 11215018

Dear Mr. Woods,

We are pleased to submit our report pertaining to geotechnical laboratory testing of soil samples in reference to the Edwards Power Station Project. As instructed, Terracon performed the following tests on samples selected by Ramboll:

- Specific Gravity of Soils – ASTM D854
- Water Content of Soil and Rock – ASTM D2216
- Liquid Limit, Plastic Limit and Plasticity Index of Soils – ASTM D4318
- Permeability of Granular Soils (Constant Head) – ASTM D 2434
- Hydraulic Conductivity of Saturated Porous Materials Using a Flexible-Wall Permeameter – ASTM D5084
- Laboratory Determination of Density (Unit Weight) of Soil Specimens – ASTM D7263
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis – ASTM D6913
- Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis – ASTM D7928

The permeability test method was changed to ASTM D2434 for several samples. Because of the granular matrix of the samples, use a flexible-wall permeameter was not a suitable test method.

The test data included in this report, only represent the samples tested and may not reflect actual site materials and/or conditions. The scope of services provided by Terracon did not include interpretation of the laboratory test data, and therefore, we are not liable for any interpretation performed by others. If you wish us to provide you with this service, we would be happy to discuss this matter with you at your convenience. Any reproduction of this report must be done in its entirety.

We are pleased to have the opportunity to provide you with our testing services. Should you have any questions, or require additional assistance, please feel free to contact us at any time.

Sincerely,
Terracon Consultants, Inc.

William P. Quinn
Department Manager – Laboratory Services

Attachments:

LABORATORY TESTING SUMMARY

PROJECT NAME: Kincaid Power Station

PROJECT NUMBER: 11215018

CLIENT: Confidential

Boring Number	Sample Number	Depth	Description	USCS	WC %	Dry Density (pcf)	% Gravel	% Sand	% Silt	% Clay	LL	PL	PI	Permeability k (cm/sec)	Specific Gravity
MW-12D	0915	5.0'-7.0'	BROWN CLAYEY SAND	SC	18.6	97.8	4.9	49.8	27.2	18.1	22	13	9	3.16E-07	2.682
MW-12D	0940	11.5'-12.0'	BROWN TO GRAY SANDY LEAN CLAY	CL	18.2	94.5	1.1	34.7	41.2	23.0	22	12	10	7.21E-08	2.704
MW-12D	1025	20.5'-22.5'	GRAY CLAYEY SAND	SC	14.0	106.9	6.0	46.4	26.7	20.9	22	13	9	1.97E-07	2.672
MW-20	0815	15.0'-17.0'	BROWN AND GRAY SANDY LEAN CLAY	CL	18.9	107.7	0.6	29.9	46.2	23.3	32	14	18	1.19E-07	2.701
MW-23	1135	15.0'-17.0'	BROWN AND GRAYISH BROWN LEAN CLAY	CL	28.4	92.7	0.0	2.5	63.7	33.8	43	17	26	7.40E-08	2.705
MW-23	1245	25.0'-27.0'	YELLOWISH BROWN SANDY LEAN CLAY	CL	15.6	112.3	0.0	41.6	32.4	26.0	32	14	18	5.85E-08	2.731
XPW-01	1535	8.5'-9.0'	BLACK POORLY GRADED SAND - CINDERS AND BRICK NOTED	SP	19.4	74.8	0.0	97.4	1.1	1.5	12	14	NP	7.16E-04	2.790
XPW-01	1600	20.5'-21.0'	BLACK POORLY GRADED SAND - CINDERS AND ROOTS NOTED	SP	26.8	79.2	0.0	96.3	2.1	1.6	17	15	2	3.51E-04	2.838
XPW-02	0810	8.5'-9.0'	BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED	SP-SM	11.8	62.7	0.0	94.1	4.2	1.7	4	9	NP	4.04E-03	2.787
XPW-02	0845	21.0'-21.5'	DARK BROWN TO BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED	SP-SM	13.9	93.9	0.0	94.5	3.7	1.8	8	11	NP	1.94E-03	2.799
XPW-03	1015	8.0'-8.5'	BLACK WELL GRADED SAND WITH SILT - CINDERS NOTED	SW-SM	27.4	86.9	0.2	91.4	6.0	2.4	14	13	1	4.31E-03	2.805
XPW-03	1055	18.0'-18.5'	BLACK POORLY GRADED SAND - CINDERS NOTED	SP	36.4	89.3	1.6	97.1	0.2	1.1	5	10	NP	3.52E-03	2.770
XPW-04	1320	10.5'-11.0'	BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS AND ROOTS NOTED	SP	18.3	77.4	0.2	98.4	0.4	1.0	3	6	NP	9.22E-04	2.786
XPW-04	1405	21.0'-21.5	BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS NOTED	SP	32.3	81.3	0.0	97.3	1.7	1.0	15	16	NP	5.54E-04	2.795

Specific Gravity of Soils
ASTM D854

Terracon
Consulting Engineers & Scientists

SPECIFIC GRAVITY OF SOIL SOLIDS

ASTM D-854

AASHTO T 100

Laboratory Services Group **192 Exchange Blvd.** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

Project Number: 11215018
Project Name: Kincaid Power Station
Test Date: 3/1/2021

Results Summary

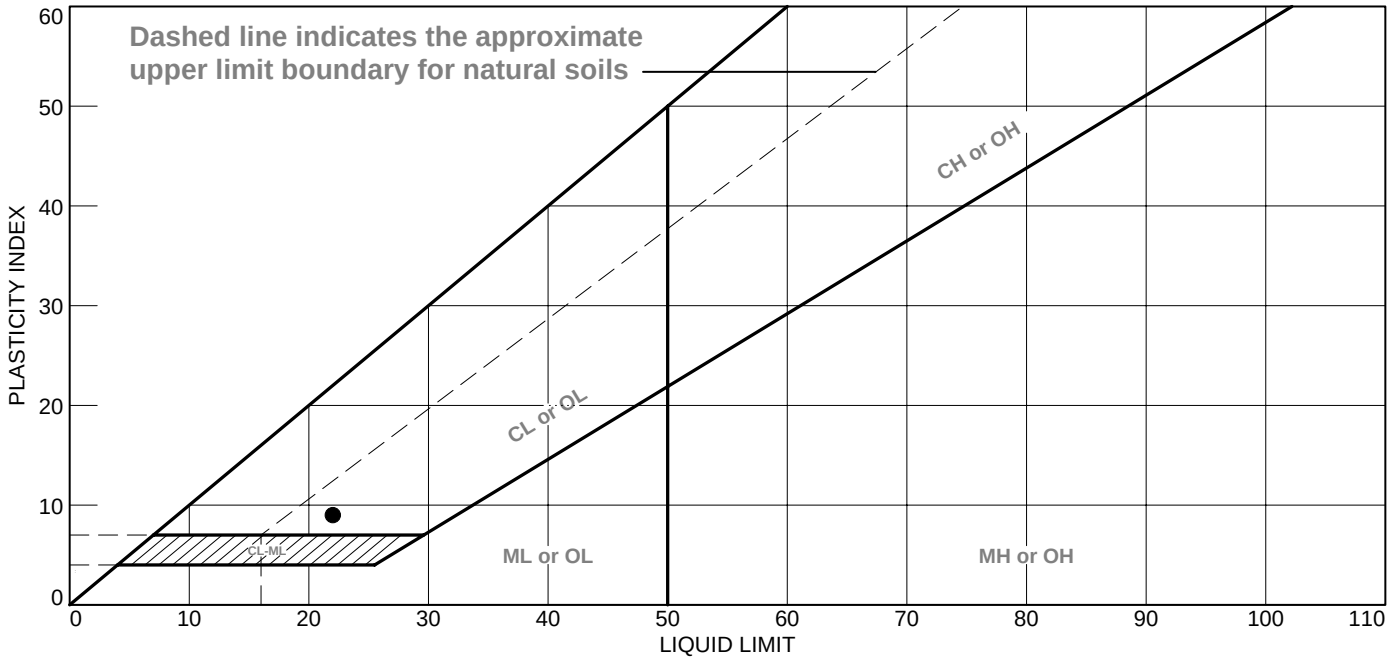
Boring / Sample	Sample Number	Depth (ft)		Specific Gravity (Gs)
MW-12D	0915	5.0'-7.0'		2.682
MW-12D	0940	11.5'-12.0'		2.704
MW-12D	1025	20.5'-22.5'		2.672
MW-20	0815	15.0'-17.0'		2.701
MW-23	1135	15.0'-17.0'		2.705
MW-23	1245	25.0'-27.0'		2.731
XPW-01	1535	8.5'-9.0'		2.790
XPW-01	1600	20.5'-21.0'		2.838
XPW-02	0810	8.5'-9.0'		2.787
XPW-02	0845	21.0'-21.5'		2.799
XPW-03	1015	8.0'-8.5'		2.805
XPW-03	1055	18.0'-18.5'		2.770
XPW-04	1320	10.5'-11.0'		2.786
XPW-04	1405	21.0'-21.5'		2.795

Tested By: SJH

Checked By: WPQ

Liquid Limit, Plastic Limit and Plasticity Index of Soils
ASTM D4318

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN CLAYEY SAND	22	13	9	76.8	45.3	SC

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: MW-12D **Depth:** 5.0'-7.0'
Sample Number: 0915

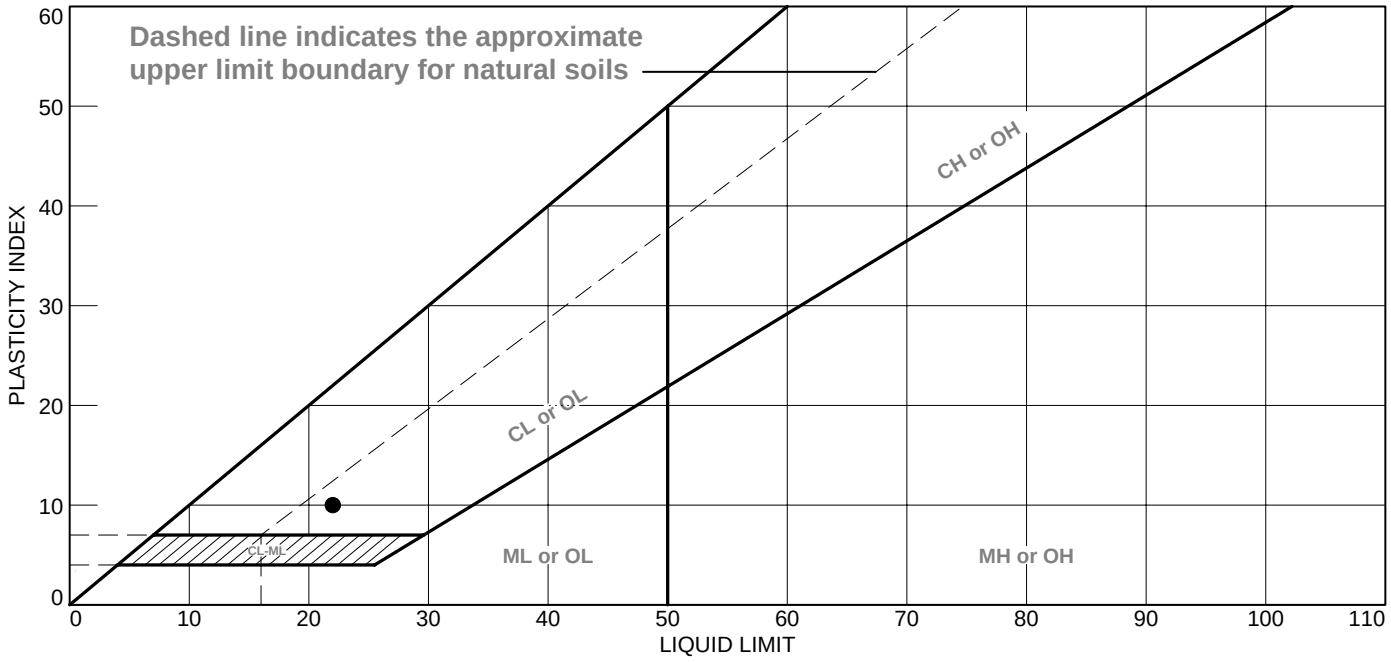
Remarks:

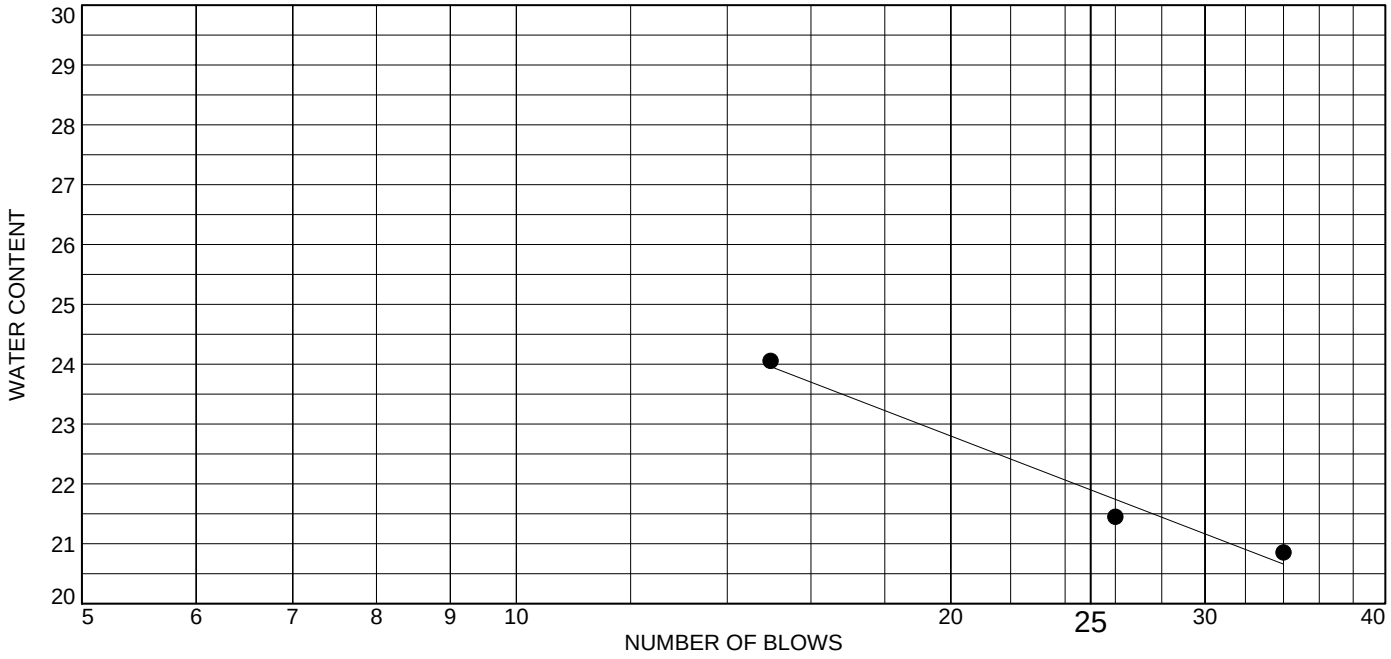
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN TO GRAY SANDY LEAN CLAY	22	12	10	87.3	64.2	CL

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: MW-12D **Depth:** 11.5'-12.0'
Sample Number: 0940

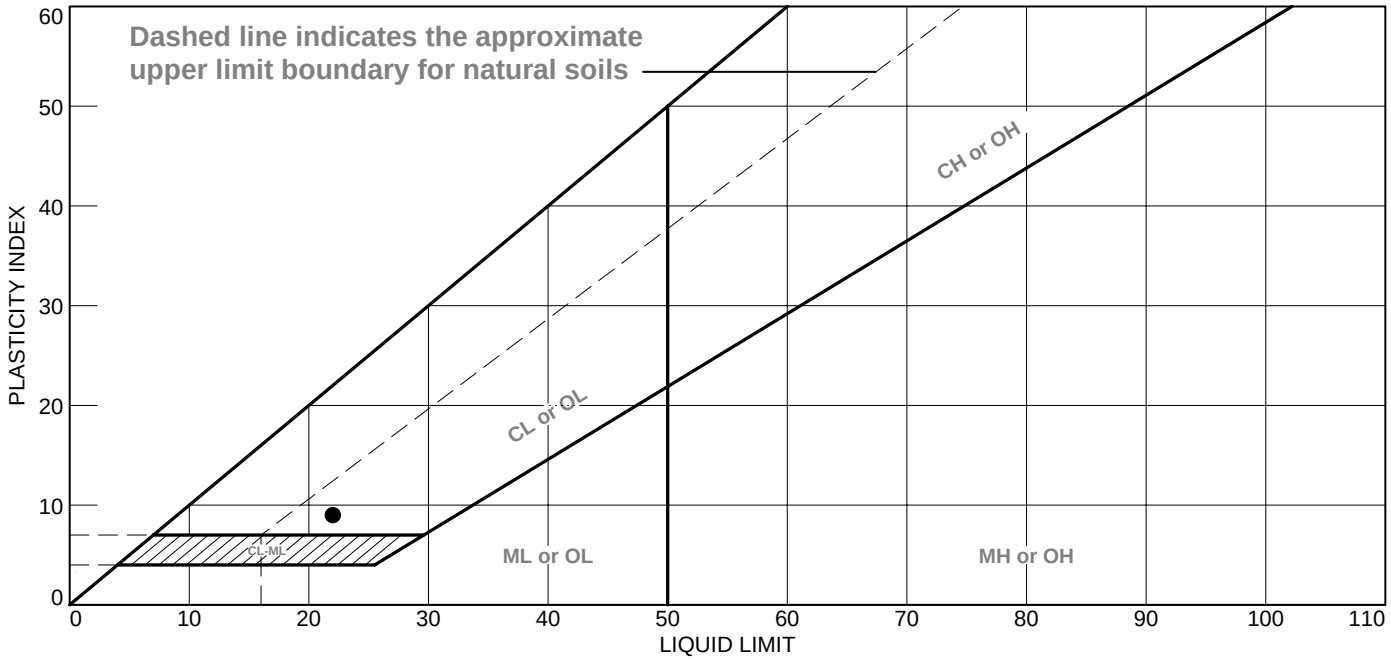
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	GRAY CLAYEY SAND	22	13	9	73.5	47.6	SC

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: MW-12D **Depth:** 20.5'-22.5'
Sample Number: 1025

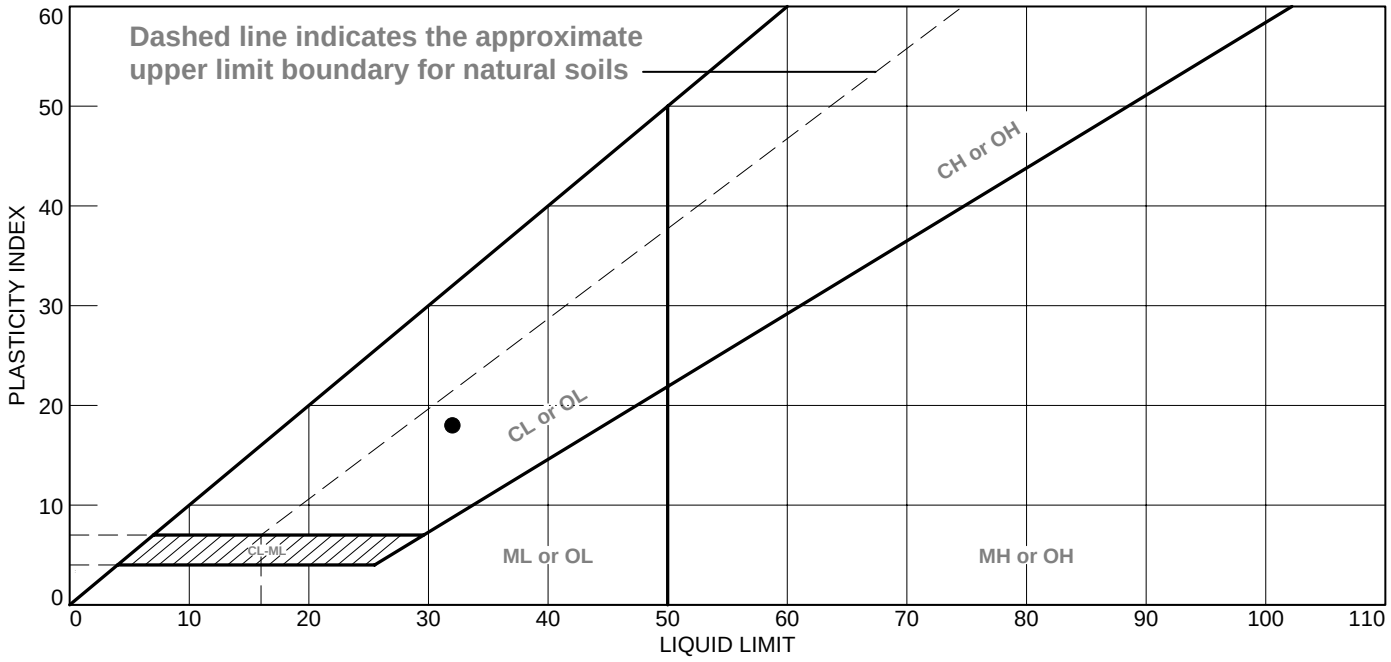
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAY SANDY LEAN CLAY	32	14	18	93.6	69.5	CL

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: MW-20 **Depth:** 15.0'-17.0'
Sample Number: 0815

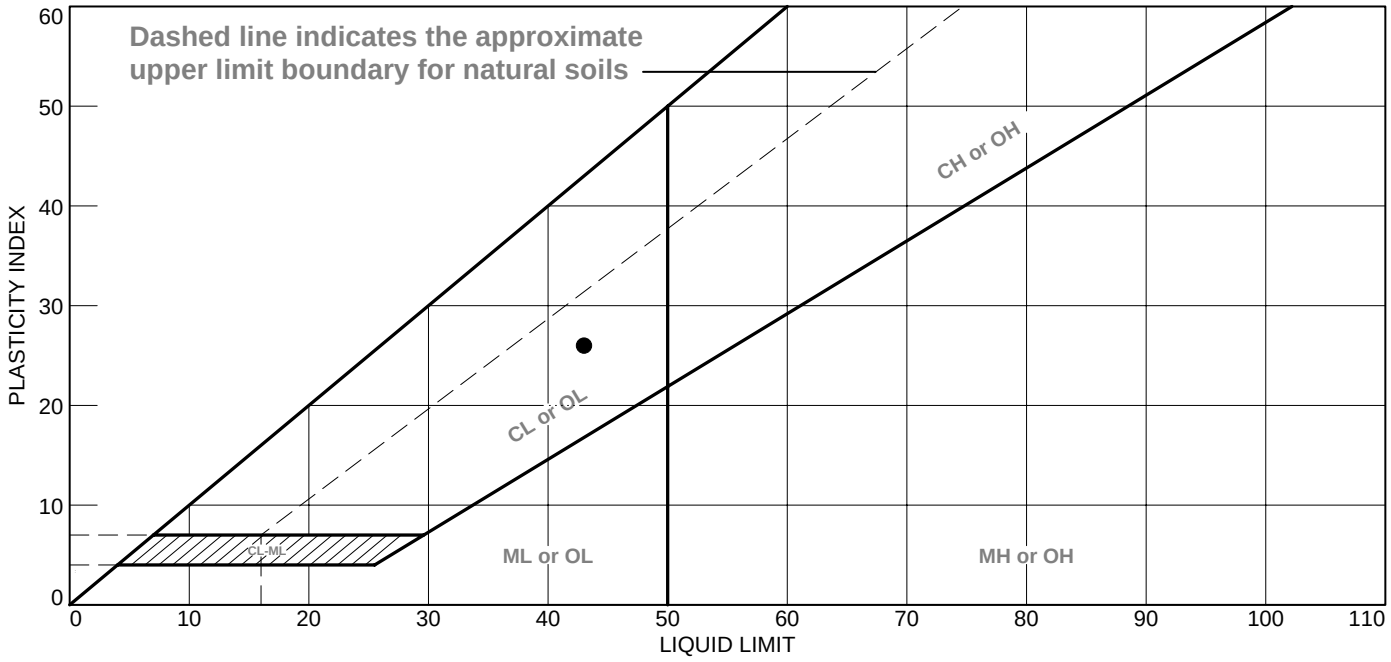
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BROWN AND GRAYISH BROWN LEAN CLAY	43	17	26	99.0	97.5	CL

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: MW-23 **Depth:** 15.0'-17.0'
Sample Number: 1135

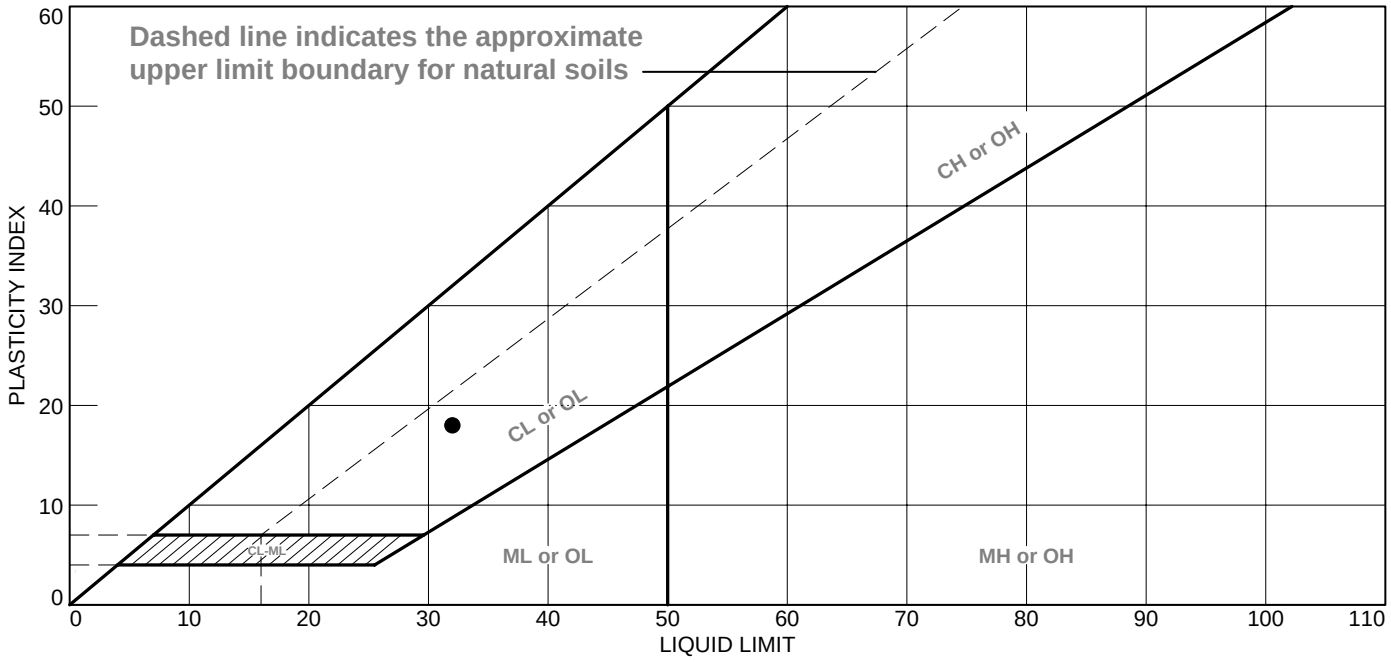
Remarks:

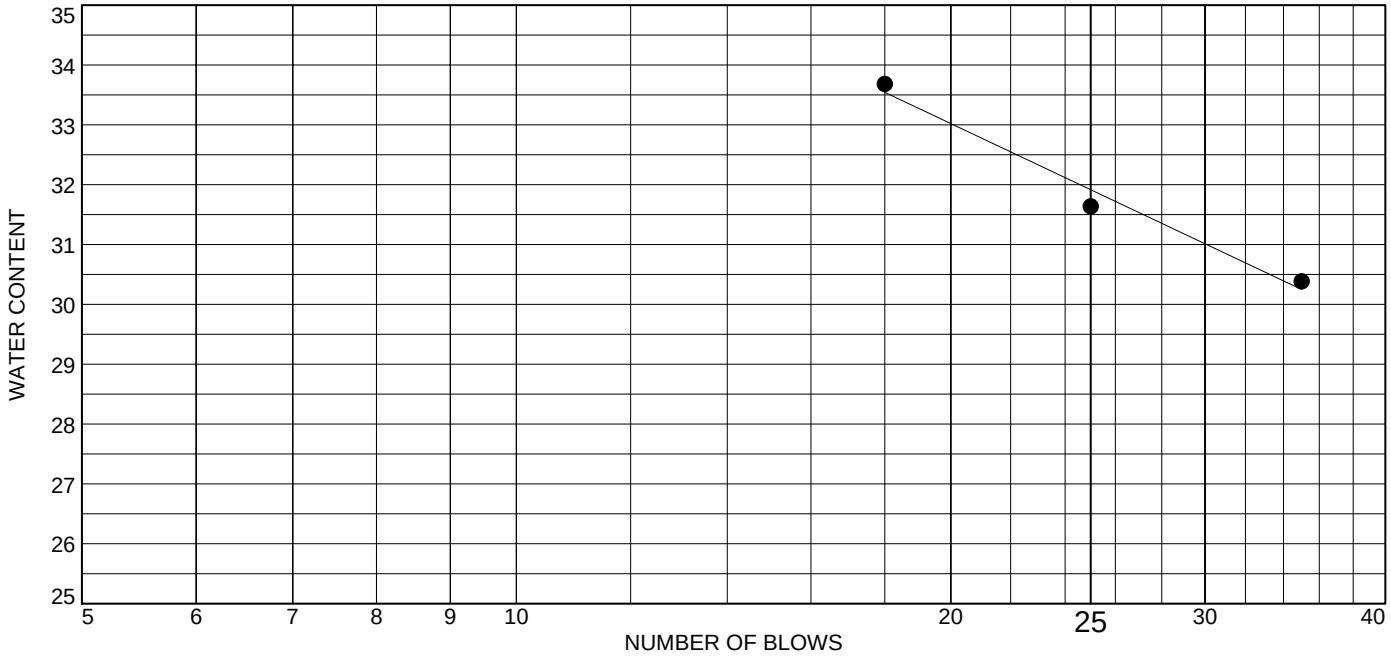
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	YELLOWISH BROWN SANDY LEAN CLAY	32	14	18	87.1	58.4	CL

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: MW-23 **Depth:** 25.0'-27.0'
Sample Number: 1245

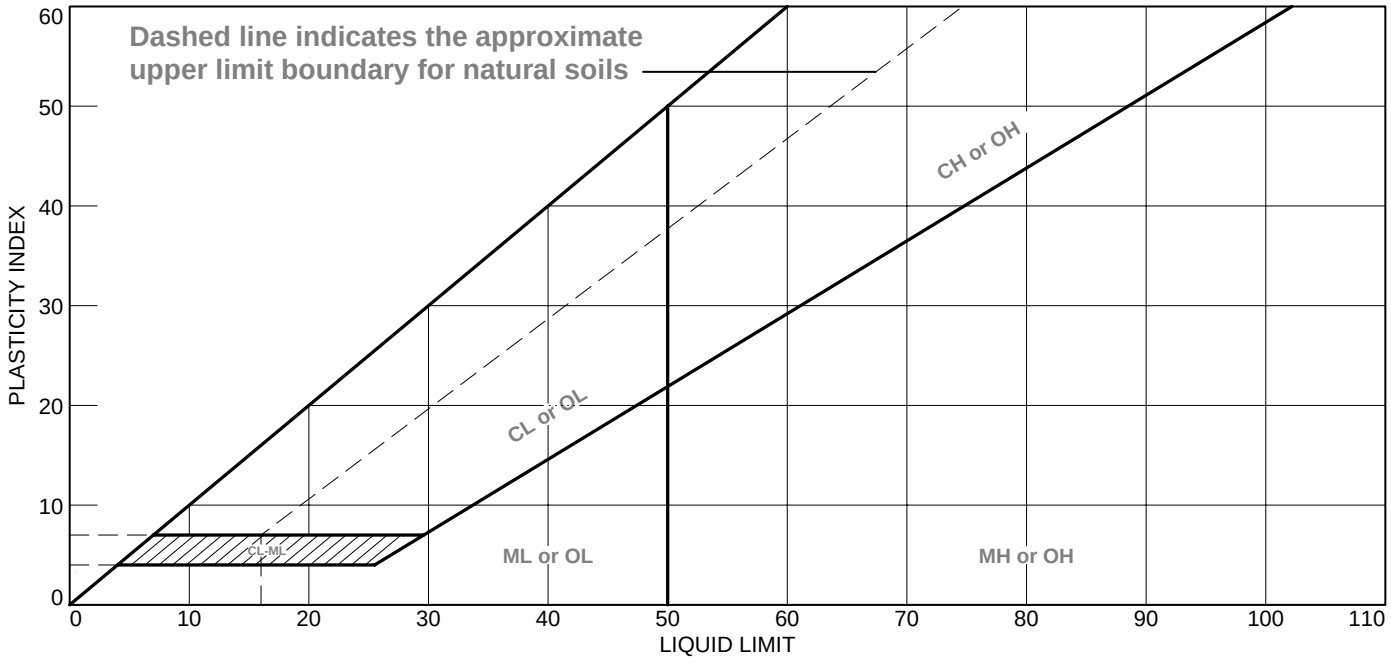
Remarks:

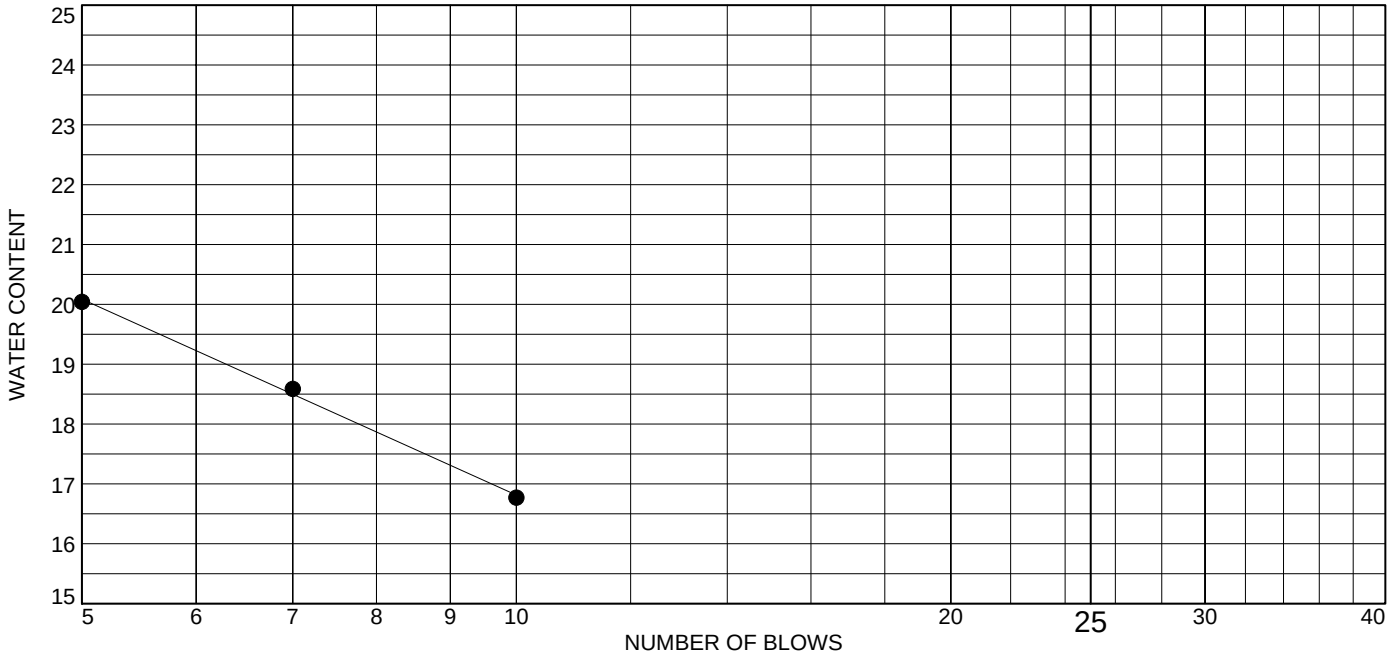
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK POORLY GRADED SAND - CINDERS AND BRICK NOTED	12	14	NP	16.2	2.6	SP

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-01 **Depth:** 8.5'-9.0'
Sample Number: 1535

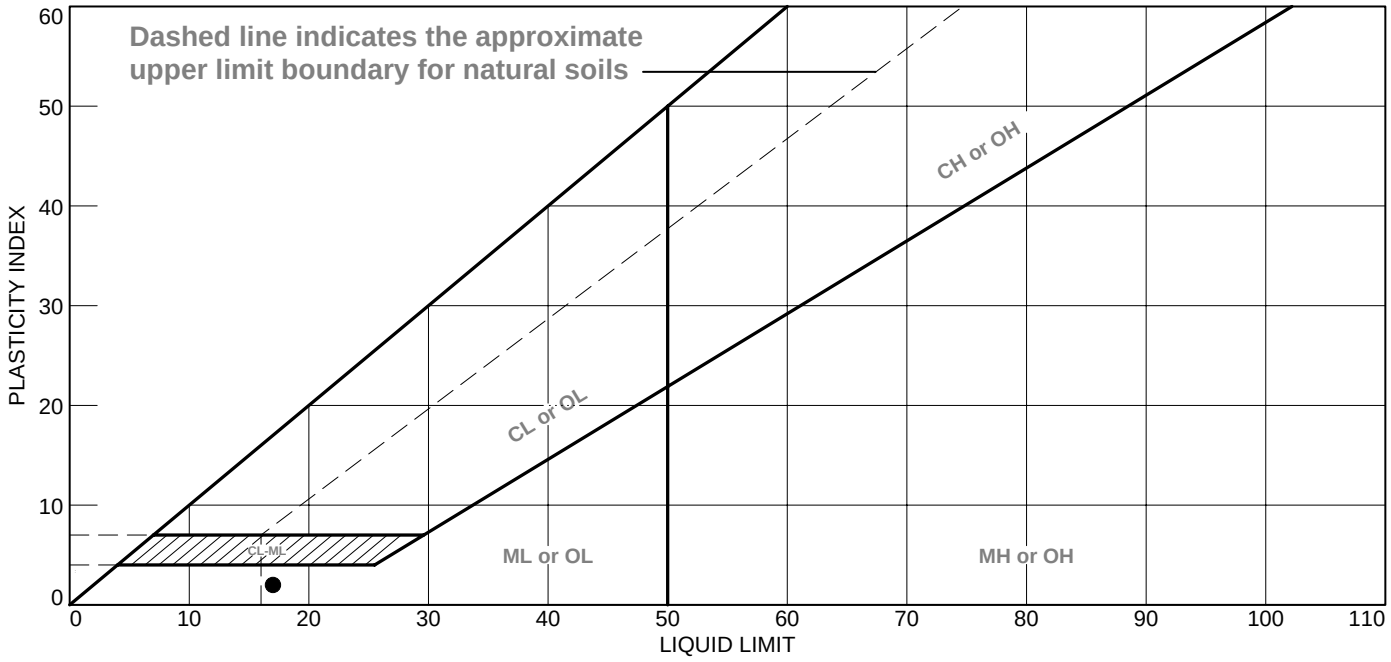
Remarks:

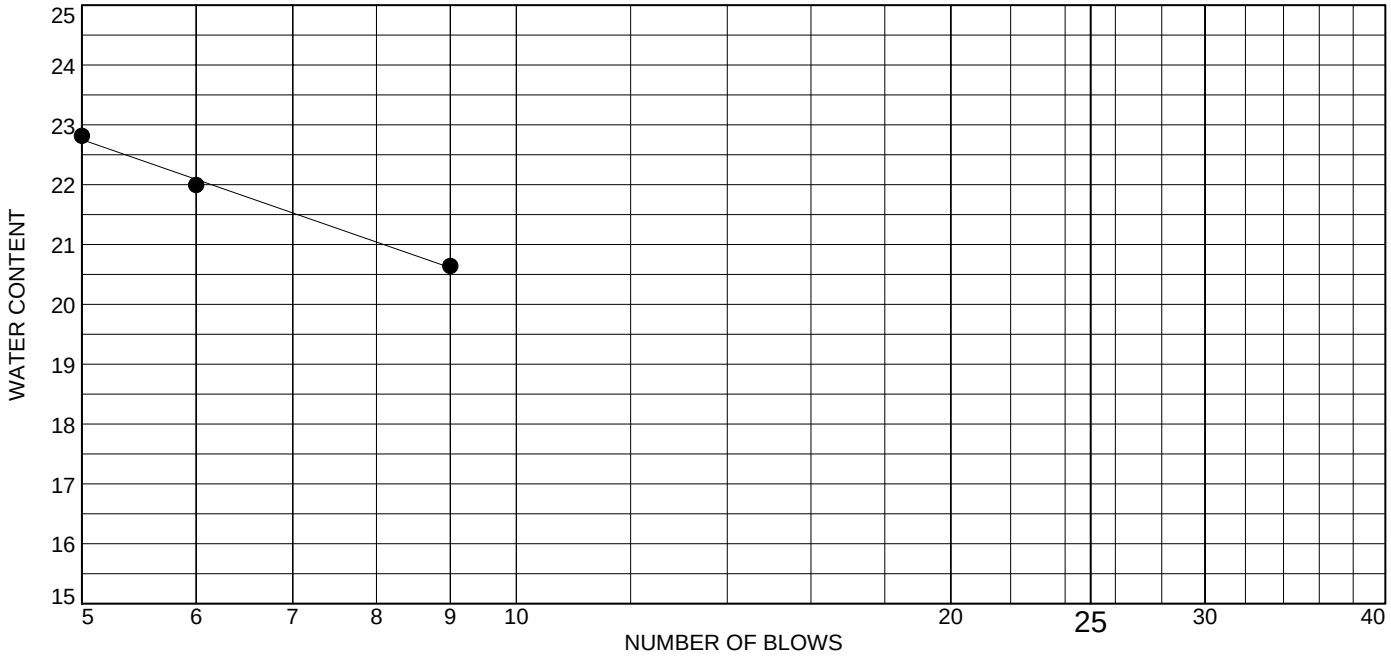
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK POORLY GRADED SAND - CINDERS AND ROOTS NOTED	17	15	2	17.1	3.7	SP

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-01 **Depth:** 20.5'-21.0'
Sample Number: 1600

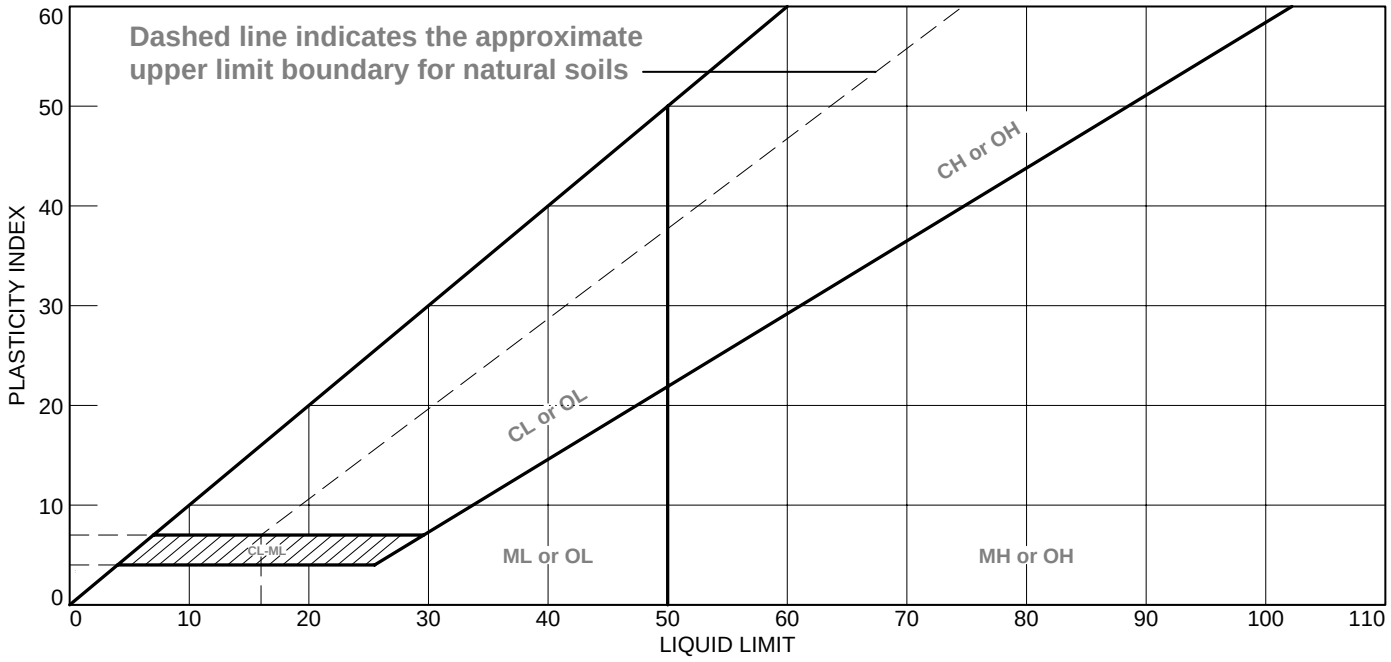
Remarks:

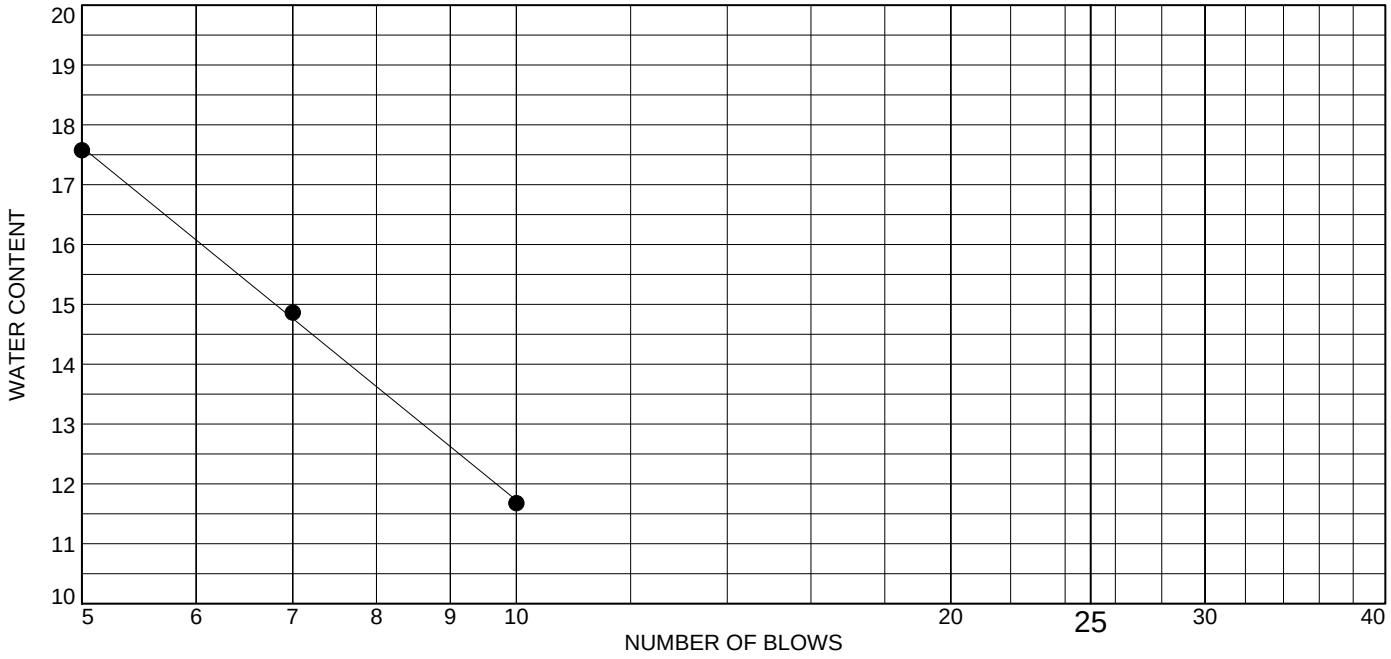
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED	4	9	NP	44.5	5.9	SP-SM

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-02 **Depth:** 8.5'-9.0'
Sample Number: 0810

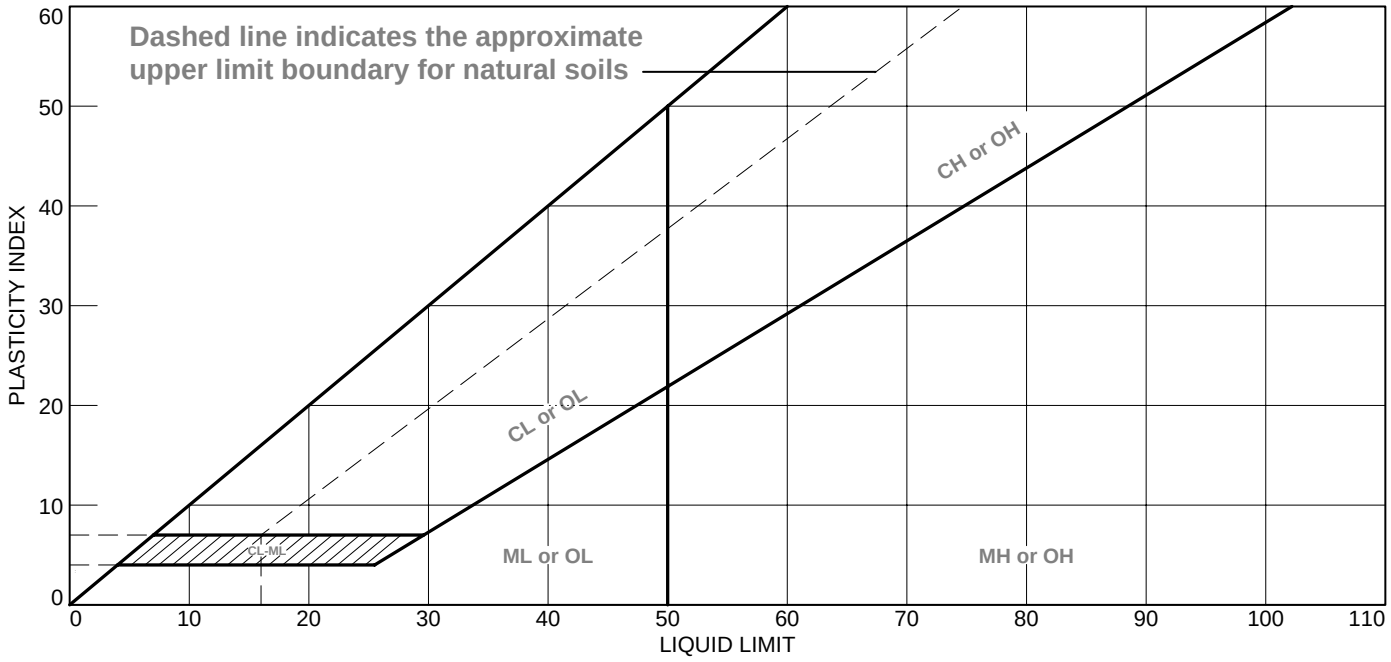
Remarks:

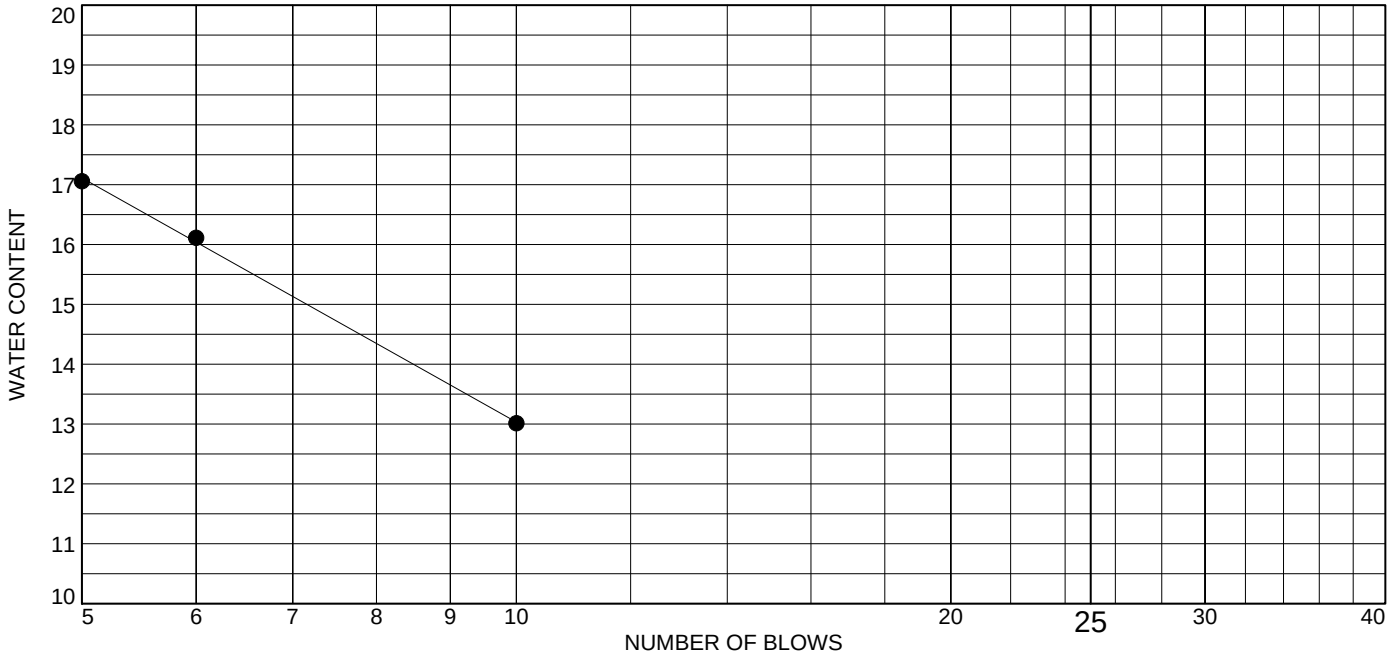
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	DARK BROWN TO BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED	8	11	NP	38.4	5.5	SP-SM

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-02 **Depth:** 21.0'-21.5'
Sample Number: 0845

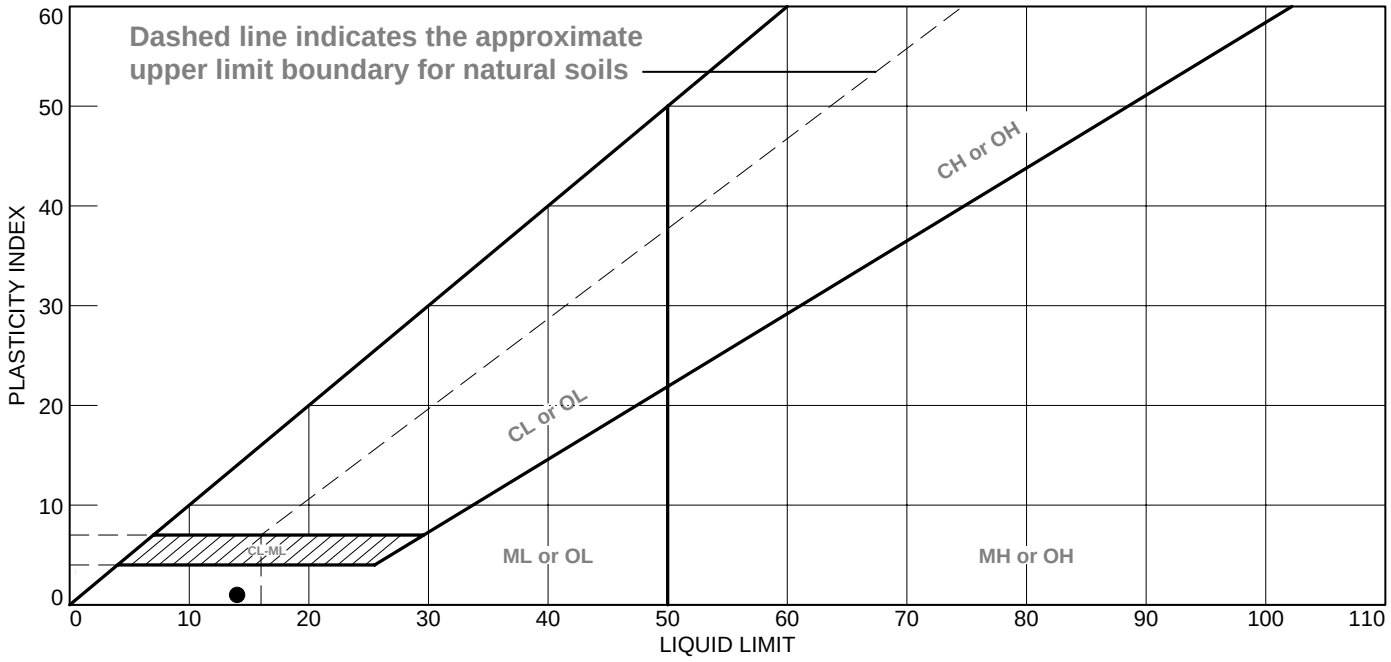
Remarks:

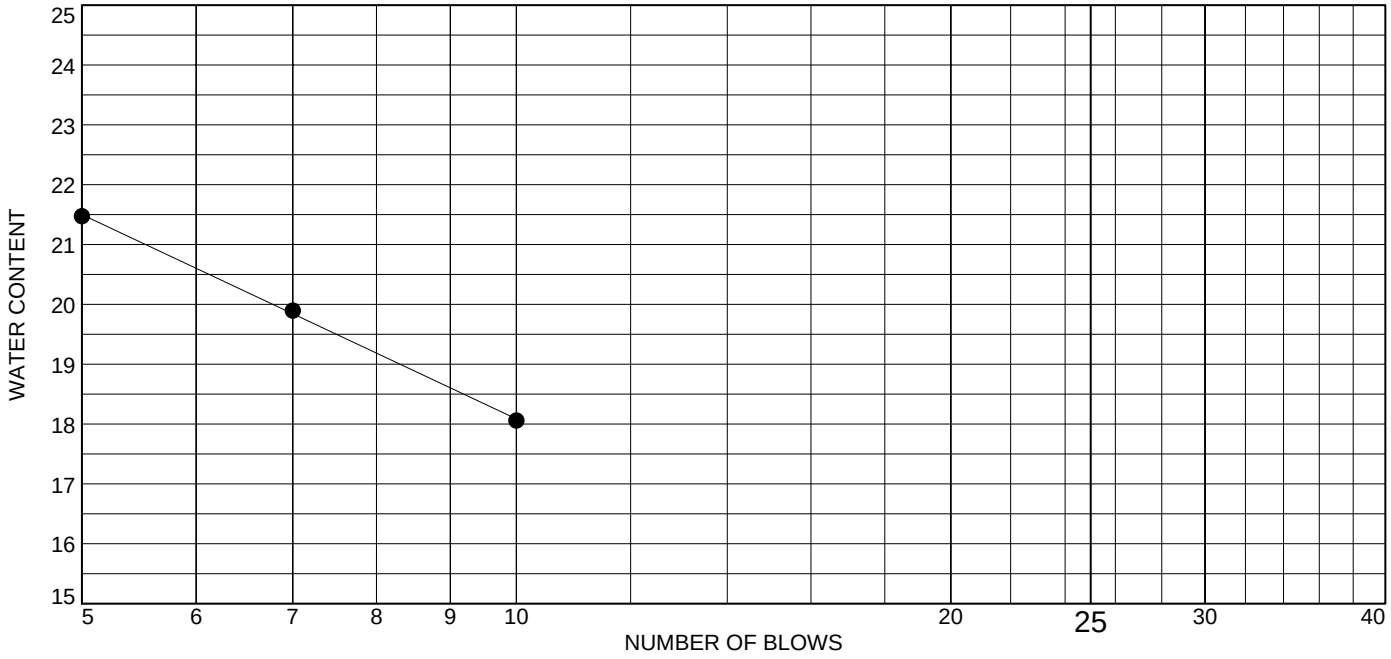
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK WELL GRADED SAND WITH SILT - CINDERS NOTED	14	13	1	44.1	8.4	SW-SM

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-03 **Depth:** 8.0'-8.5'
Sample Number: 1015

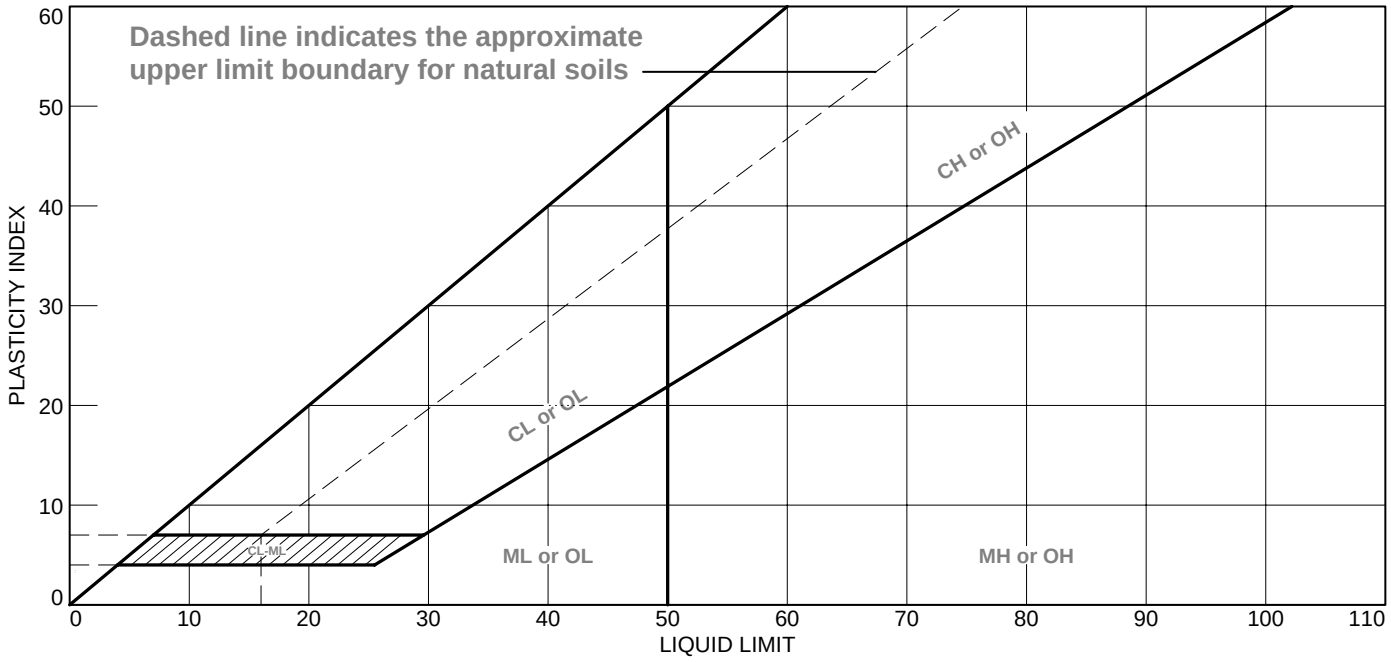
Remarks:

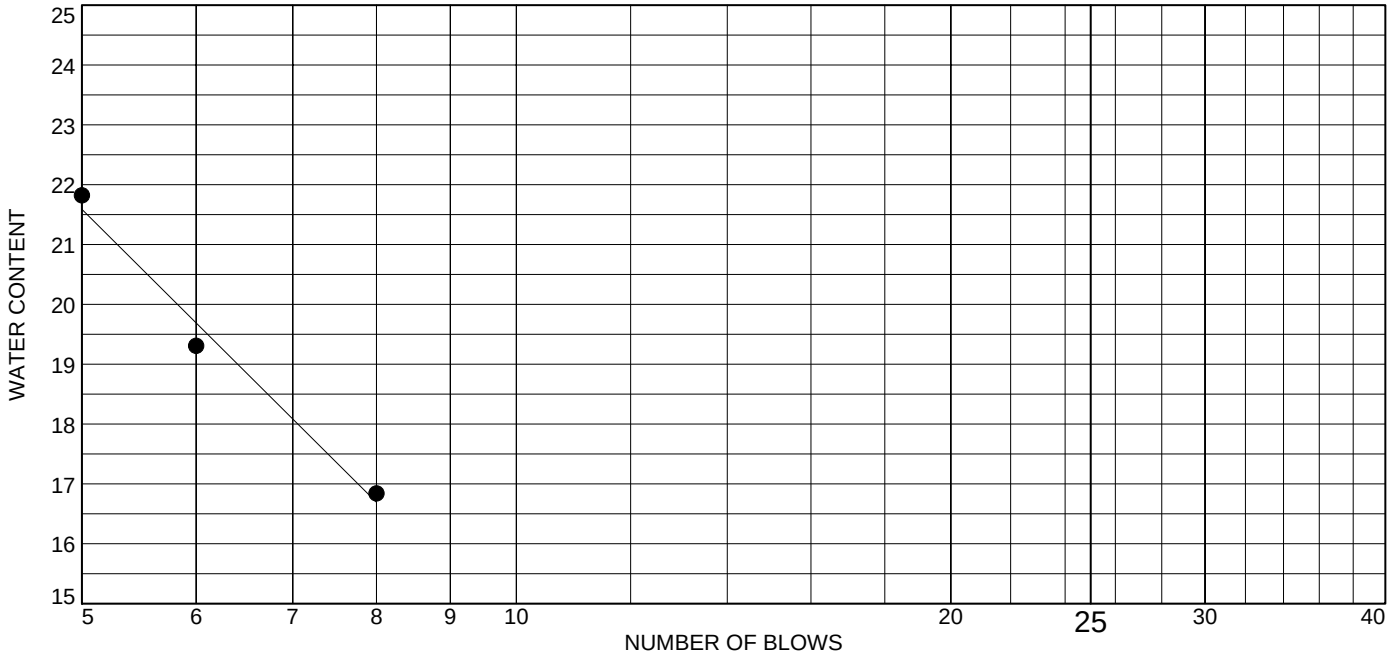
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK POORLY GRADED SAND - CINDERS NOTED	5	10	NP	10.9	1.3	SP

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-03 **Depth:** 18.0'-18.5'
Sample Number: 1055

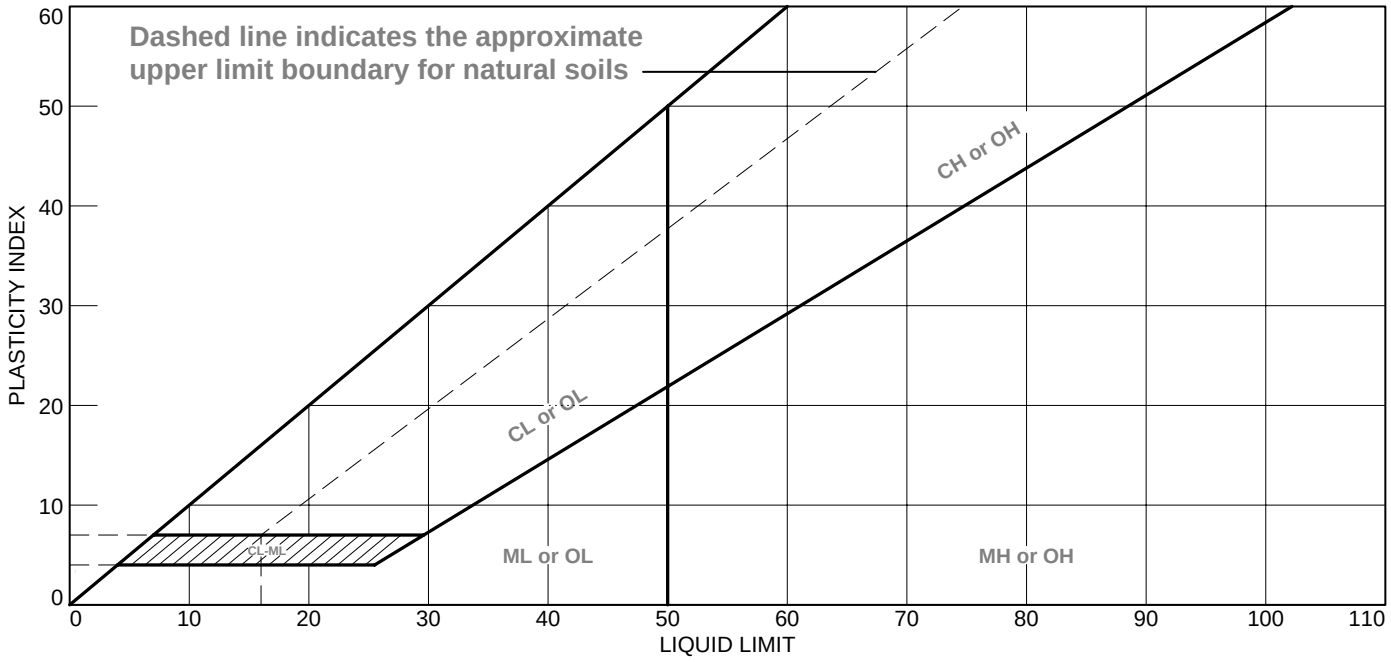
Remarks:

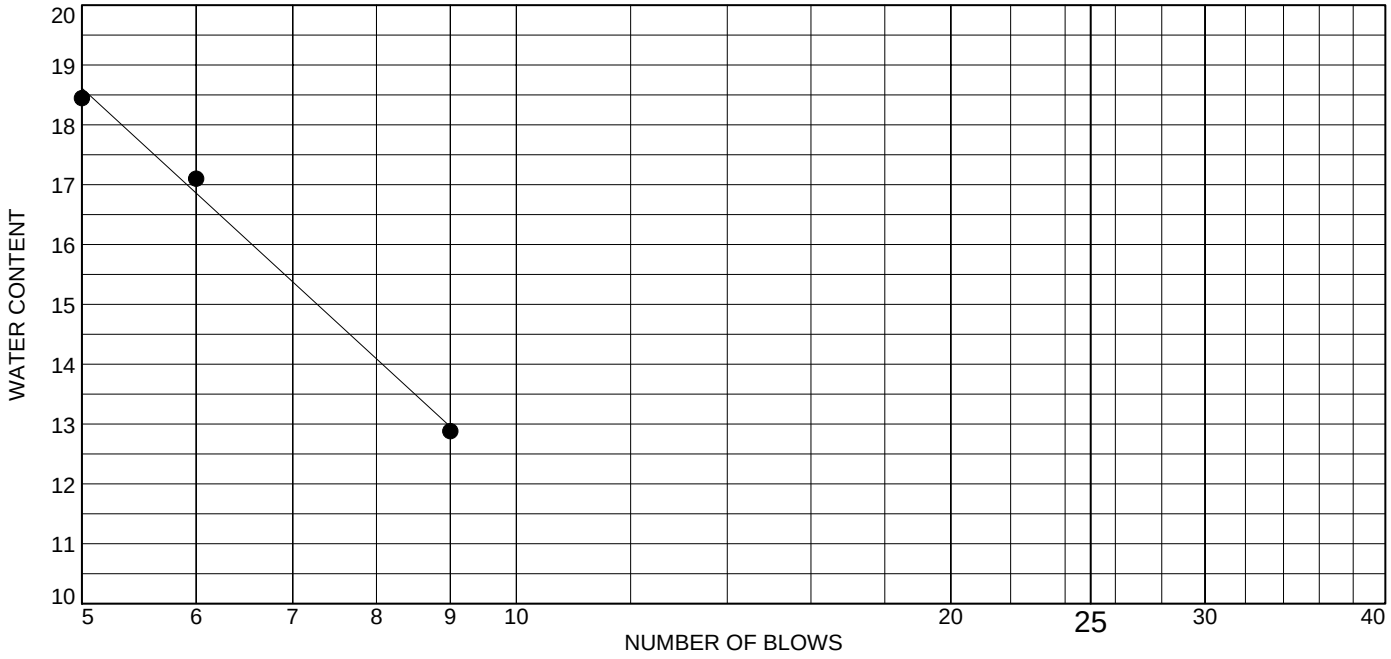
Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS AND ROOTS NOTED	3	6	NP	15.5	1.4	SP

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-04 **Depth:** 10.5'-11.0'
Sample Number: 1320

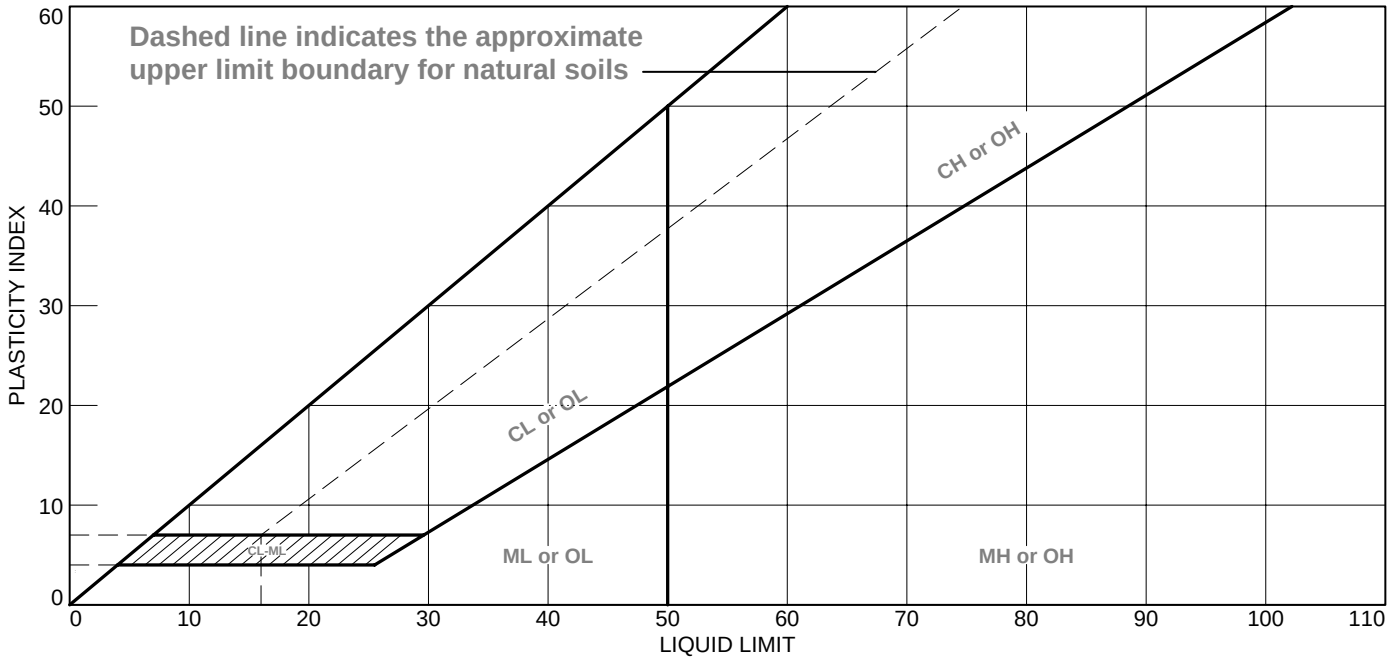
Remarks:

Terracon

Figure

Tested By: DT **Checked By:** WPQ

LIQUID AND PLASTIC LIMITS ASTM D4318



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS NOTED	15	16	NP	11.9	2.7	SP

Project No. 11215018 **Client:** CONFIDENTIAL

Project: KINCAID POWER STATION

Source of Sample: XPW-04 **Depth:** 21.0'-21.5
Sample Number: 1405

Remarks:

Terracon

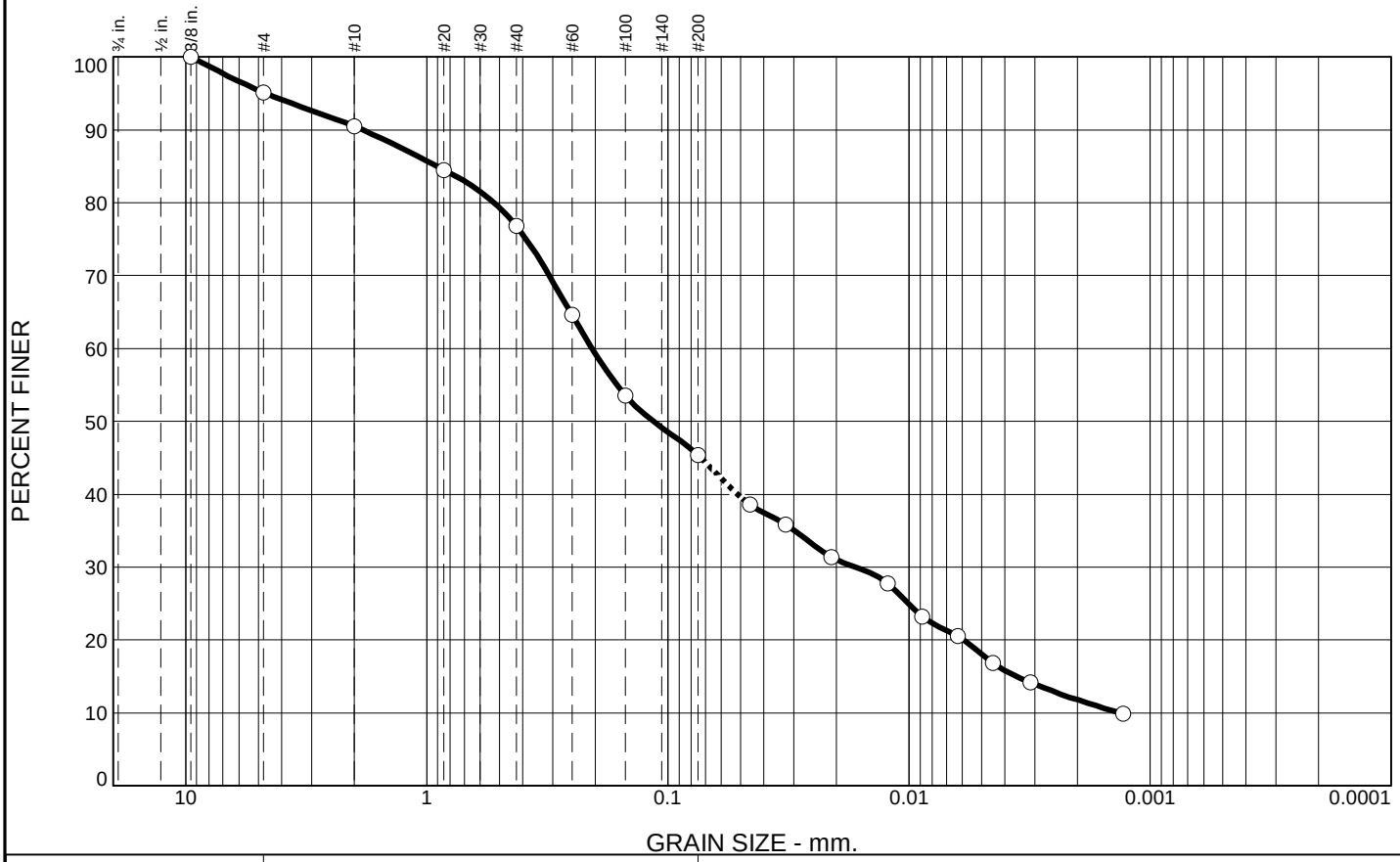
Figure

Tested By: DT **Checked By:** WPQ

Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
ASTM D6913

Particle-Size Distribution (Gradation) of Fine-Grained Soils
Using the Sedimentation (Hydrometer) Analysis
ASTM D7928

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.9	4.6	13.7	31.5	27.2	18.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	95.1		
#10	90.5		
#20	84.5		
#40	76.8		
#60	64.6		
#100	53.6		
#200	45.3		
0.0456 mm.	38.6		
0.0326 mm.	35.9		
0.0209 mm.	31.4		
0.0122 mm.	27.7		
0.0088 mm.	23.2		
0.0063 mm.	20.5		
0.0045 mm.	16.9		
0.0031 mm.	14.2		
0.0013 mm.	9.9		

* (no specification provided)

Soil Description

BROWN CLAYEY SAND

Atterberg Limits

PL= 13 LL= 22 PI= 9

Coefficients

D_{90}= 1.8498 D_{85}= 0.9081 D_{60}= 0.2064
D_{50}= 0.1148 D_{30}= 0.0167 D_{15}= 0.0036
D_{10}= 0.0013 C_u= 154.15 C_c= 1.01

Classification

USCS= SC AASHTO= A-4(1)

Remarks

F.M.=1.22

Source of Sample: MW-12D **Depth:** 5.0'-7.0'
Sample Number: 0915 **Date:** 2-25-21

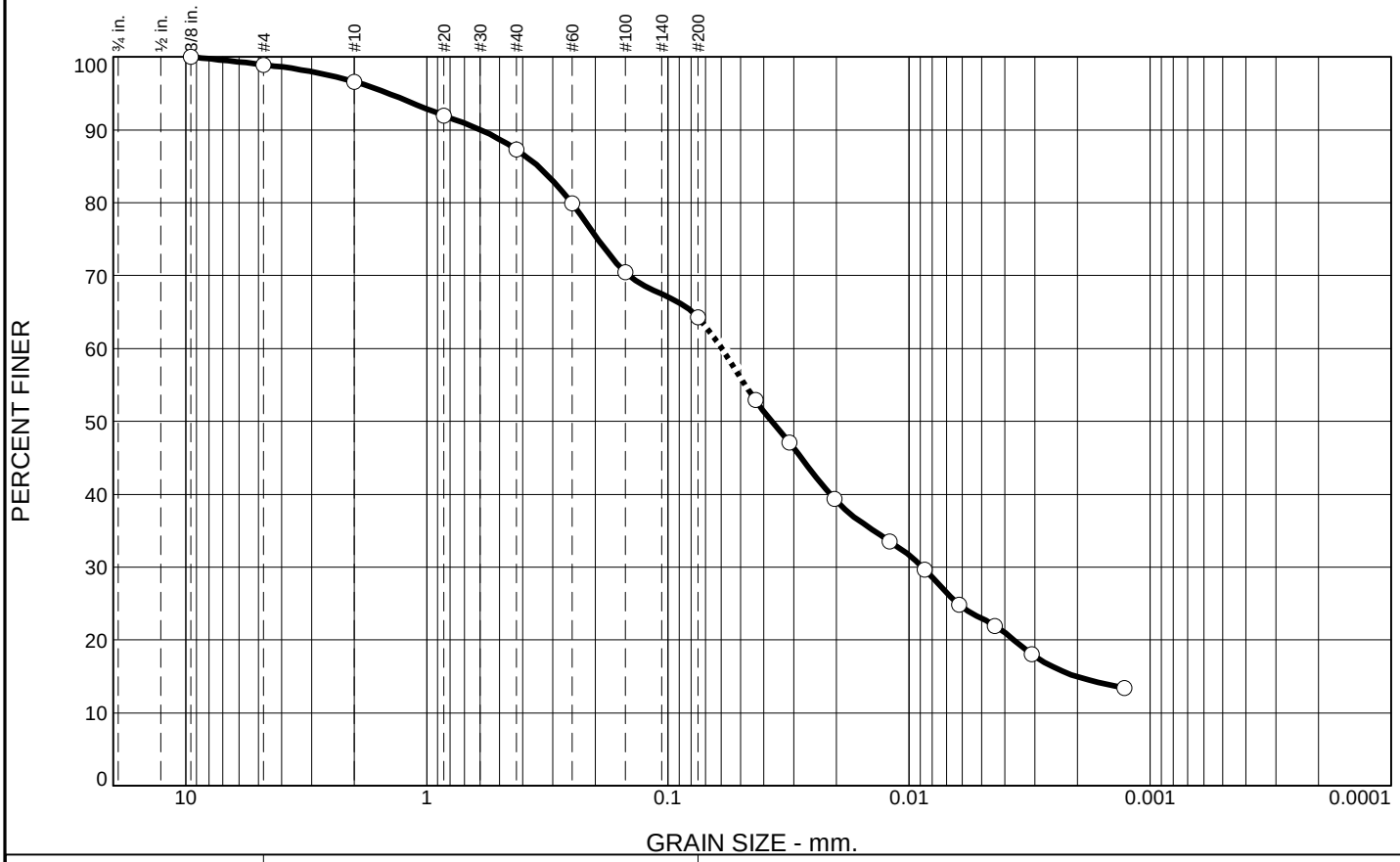
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.1	2.3	9.3	23.1	41.2	23.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.9		
#10	96.6		
#20	92.0		
#40	87.3		
#60	79.9		
#100	70.4		
#200	64.2		
0.0434 mm.	52.9		
0.0314 mm.	47.1		
0.0204 mm.	39.4		
0.0120 mm.	33.6		
0.0086 mm.	29.7		
0.0062 mm.	24.8		
0.0044 mm.	21.9		
0.0031 mm.	18.1		
0.0013 mm.	13.5		

* (no specification provided)

Soil Description

BROWN TO GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 12 LL= 22 PI= 10

Coefficients

D_{90}= 0.6011 D_{85}= 0.3458 D_{60}= 0.0598
D_{50}= 0.0371 D_{30}= 0.0088 D_{15}= 0.0020
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-4(3)

Remarks

F.M.=0.67

Source of Sample: MW-12D **Depth:** 11.5'-12.0'
Sample Number: 0940 **Date:** 2-25-21

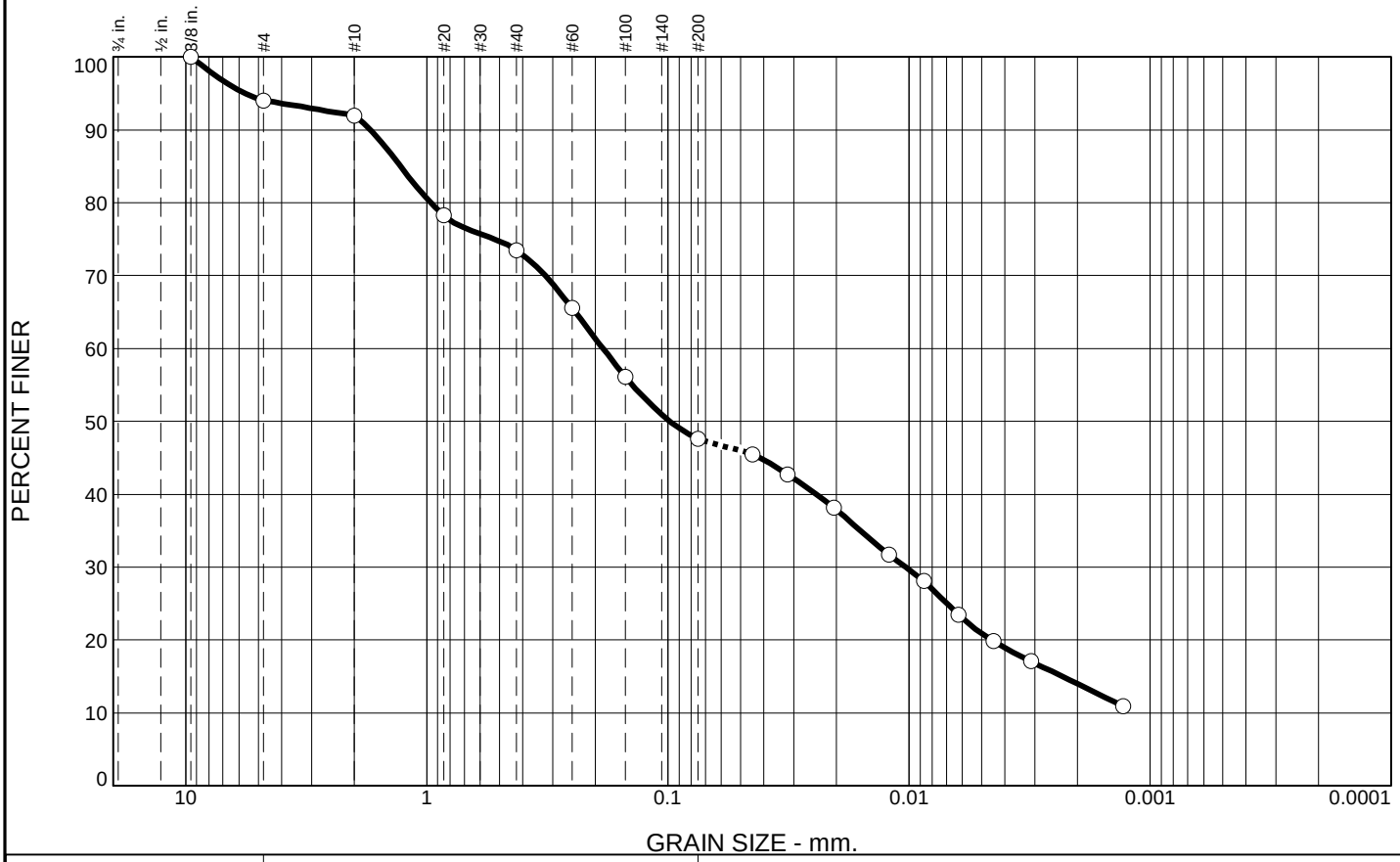
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	6.0	2.0	18.5	25.9	26.7	20.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	94.0		
#10	92.0		
#20	78.3		
#40	73.5		
#60	65.6		
#100	56.1		
#200	47.6		
0.0446 mm.	45.5		
0.0319 mm.	42.7		
0.0205 mm.	38.1		
0.0121 mm.	31.7		
0.0087 mm.	28.1		
0.0062 mm.	23.5		
0.0045 mm.	19.8		
0.0031 mm.	17.1		
0.0013 mm.	10.9		

* (no specification provided)

Soil Description

GRAY CLAYEY SAND

Atterberg Limits

PL= 13 LL= 22 PI= 9

Coefficients

D_{90}= 1.7145 D_{85}= 1.2854 D_{60}= 0.1859
D_{50}= 0.0983 D_{30}= 0.0103 D_{15}= 0.0023
D_{10}= C_u= C_c=

Classification

USCS= SC AASHTO= A-4(1)

Remarks

F.M.=1.30

Source of Sample: MW-12D **Depth:** 20.5'-22.5'
Sample Number: 1025 **Date:** 2-25-21

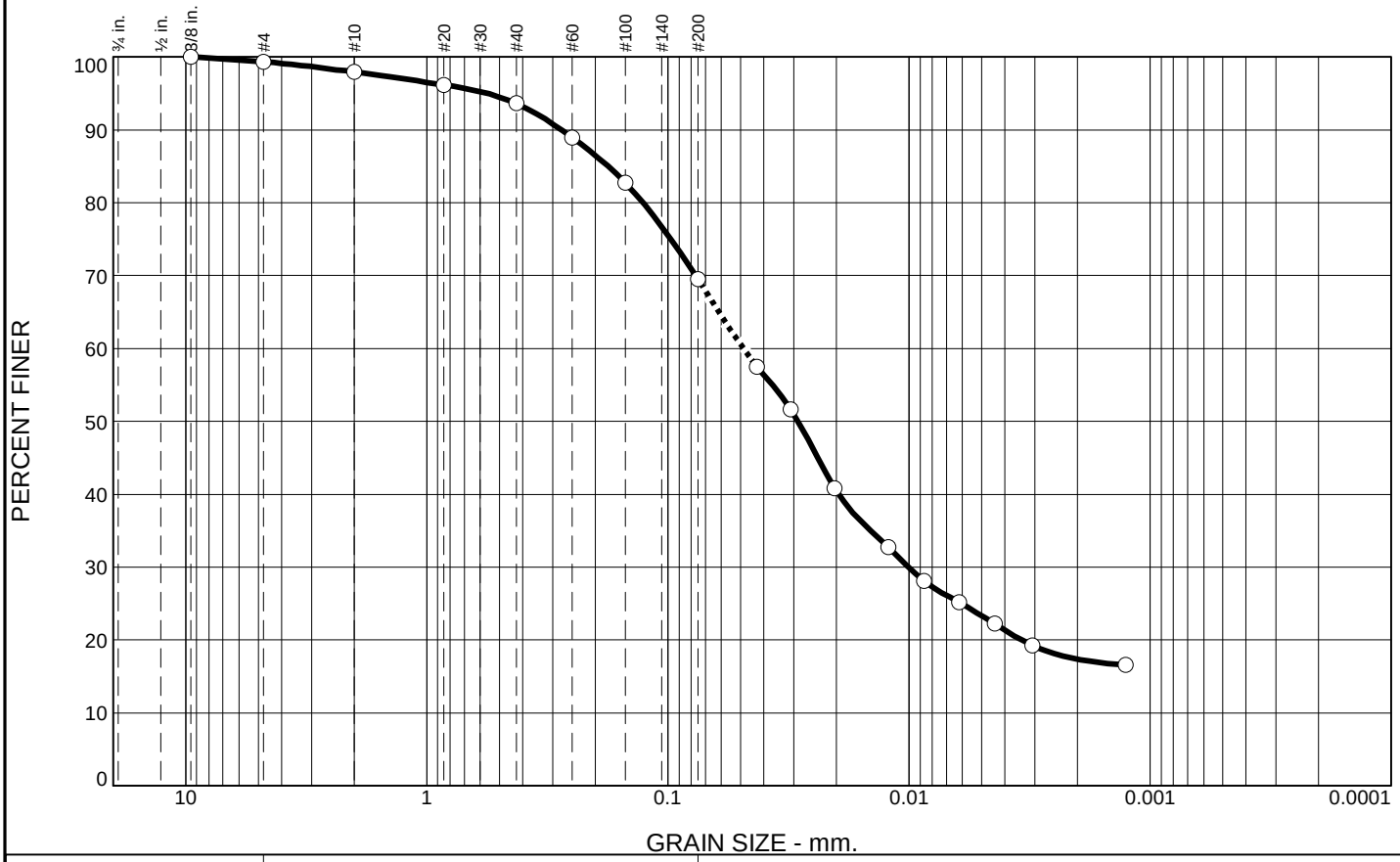
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.6	1.5	4.3	24.1	46.2	23.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.4		
#10	97.9		
#20	96.2		
#40	93.6		
#60	89.0		
#100	82.7		
#200	69.5		
0.0428 mm.	57.5		
0.0309 mm.	51.6		
0.0203 mm.	40.8		
0.0122 mm.	32.7		
0.0087 mm.	28.1		
0.0062 mm.	25.2		
0.0044 mm.	22.2		
0.0031 mm.	19.3		
0.0013 mm.	16.6		

* (no specification provided)

Soil Description

BROWN AND GRAY SANDY LEAN CLAY

Atterberg Limits

PL= 14 LL= 32 PI= 18

Coefficients

D_{90}= 0.2765 D_{85}= 0.1768 D_{60}= 0.0487
D_{50}= 0.0289 D_{30}= 0.0100 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(10)

Remarks

F.M.=0.37

Source of Sample: MW-20 **Depth:** 15.0'-17.0'
Sample Number: 0815

Date: 2-25-21

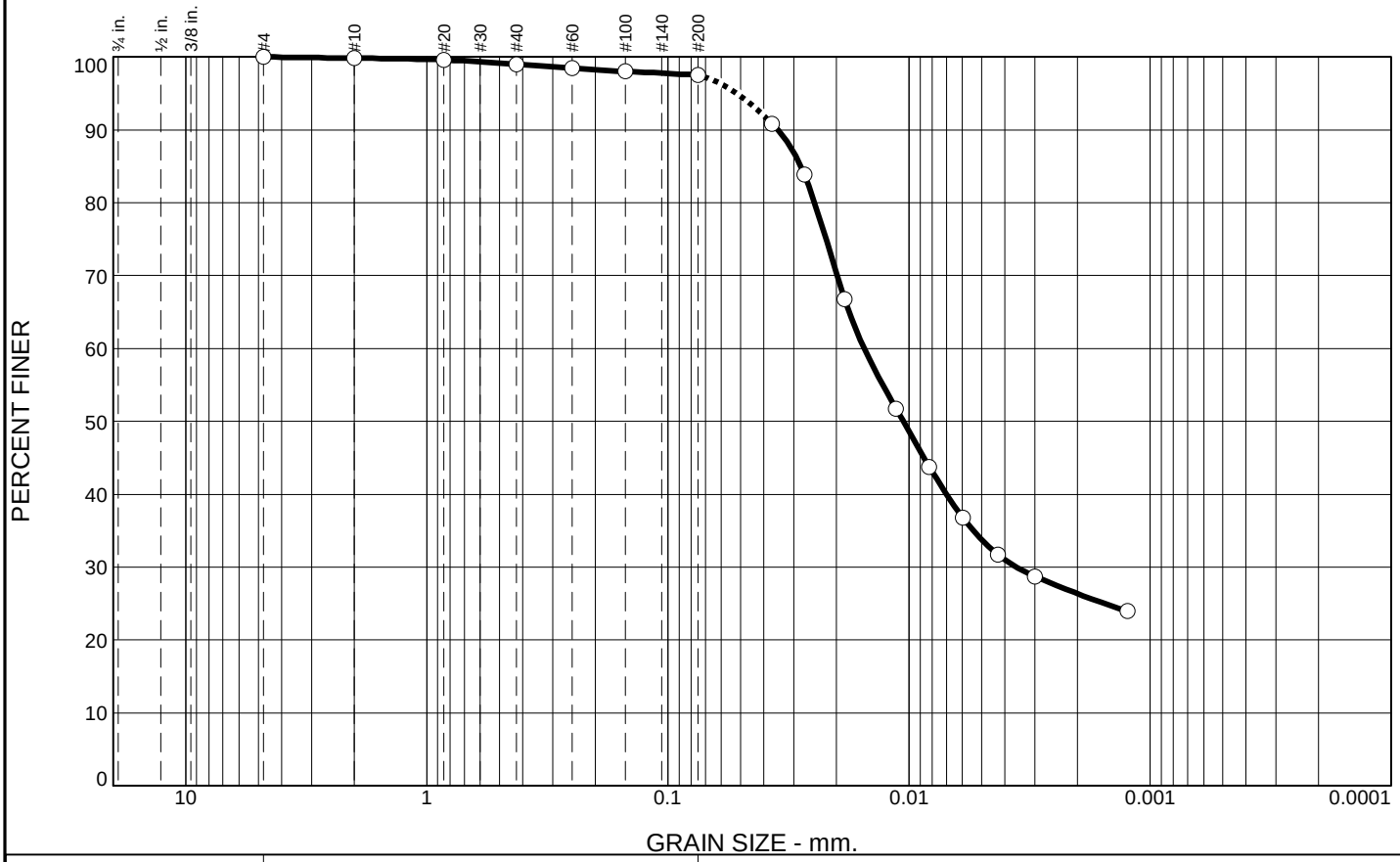
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.2	0.8	1.5	63.7	33.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.8		
#20	99.6		
#40	99.0		
#60	98.5		
#100	98.0		
#200	97.5		
0.0370 mm.	90.8		
0.0271 mm.	83.8		
0.0185 mm.	66.8		
0.0113 mm.	51.8		
0.0082 mm.	43.8		
0.0060 mm.	36.7		
0.0043 mm.	31.7		
0.0030 mm.	28.7		
0.0012 mm.	23.9		

* (no specification provided)

Soil Description

BROWN AND GRAYISH BROWN LEAN CLAY

Atterberg Limits

PL= 17 LL= 43 PI= 26

Coefficients

D_{90}= 0.0351 D_{85}= 0.0281 D_{60}= 0.0153
D_{50}= 0.0106 D_{30}= 0.0036 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(27)

Remarks

F.M.=0.04

Source of Sample: MW-23 **Depth:** 15.0'-17.0'
Sample Number: 1135

Date: 2-25-21

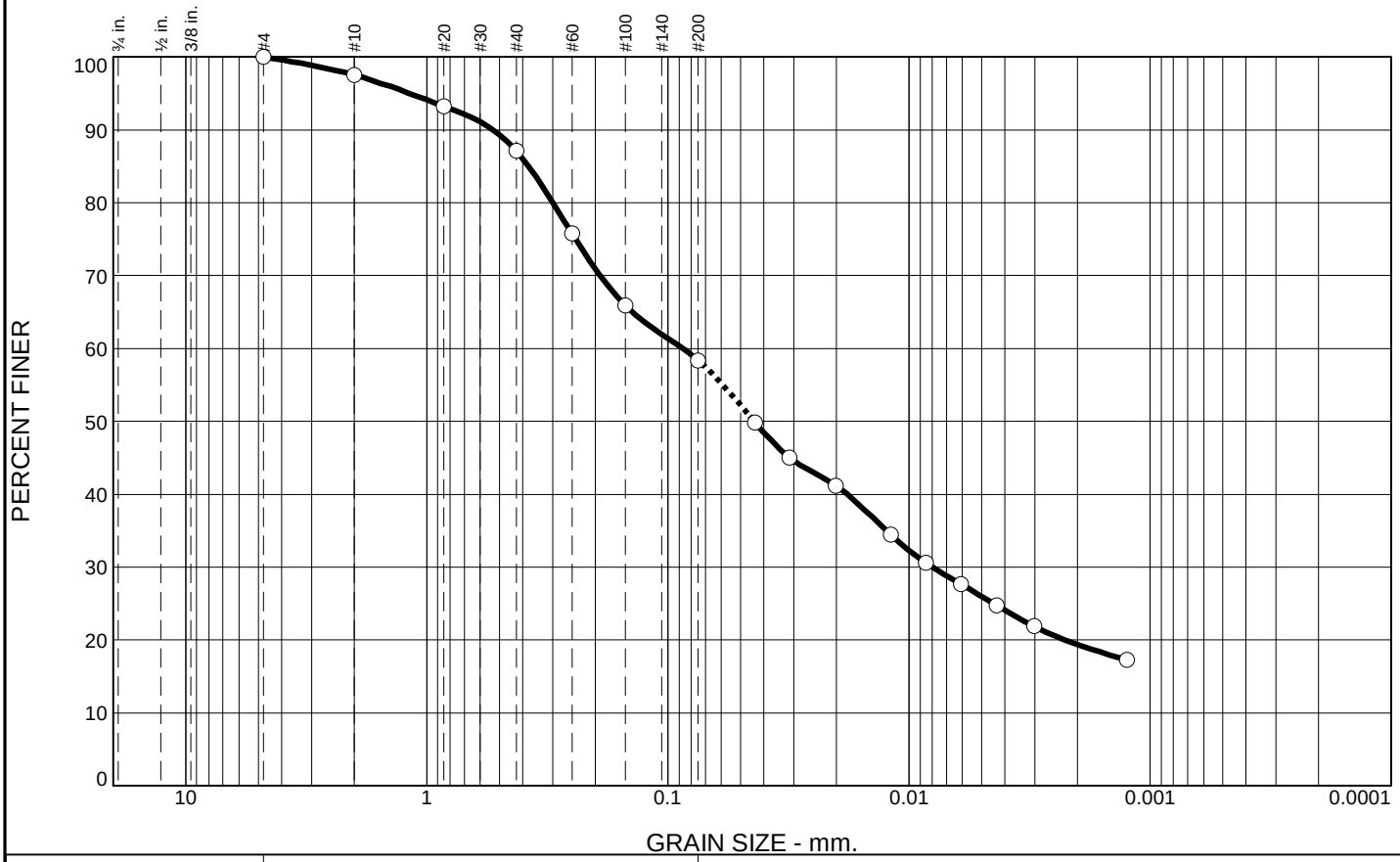
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.5	10.4	28.7	32.4	26.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	97.5		
#20	93.2		
#40	87.1		
#60	75.8		
#100	65.9		
#200	58.4		
0.0435 mm.	49.9		
0.0313 mm.	45.0		
0.0201 mm.	41.2		
0.0119 mm.	34.4		
0.0085 mm.	30.6		
0.0061 mm.	27.7		
0.0043 mm.	24.8		
0.0030 mm.	21.9		
0.0013 mm.	17.3		

* (no specification provided)

Soil Description

YELLOWISH BROWN SANDY LEAN CLAY

Atterberg Limits

PL= 14 LL= 32 PI= 18

Coefficients

D_{90}= 0.5310 D_{85}= 0.3782 D_{60}= 0.0869
D_{50}= 0.0439 D_{30}= 0.0080 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(7)

Remarks

F.M.=0.70

Source of Sample: MW-23 **Depth:** 25.0'-27.0'
Sample Number: 1245

Date: 2-19-21

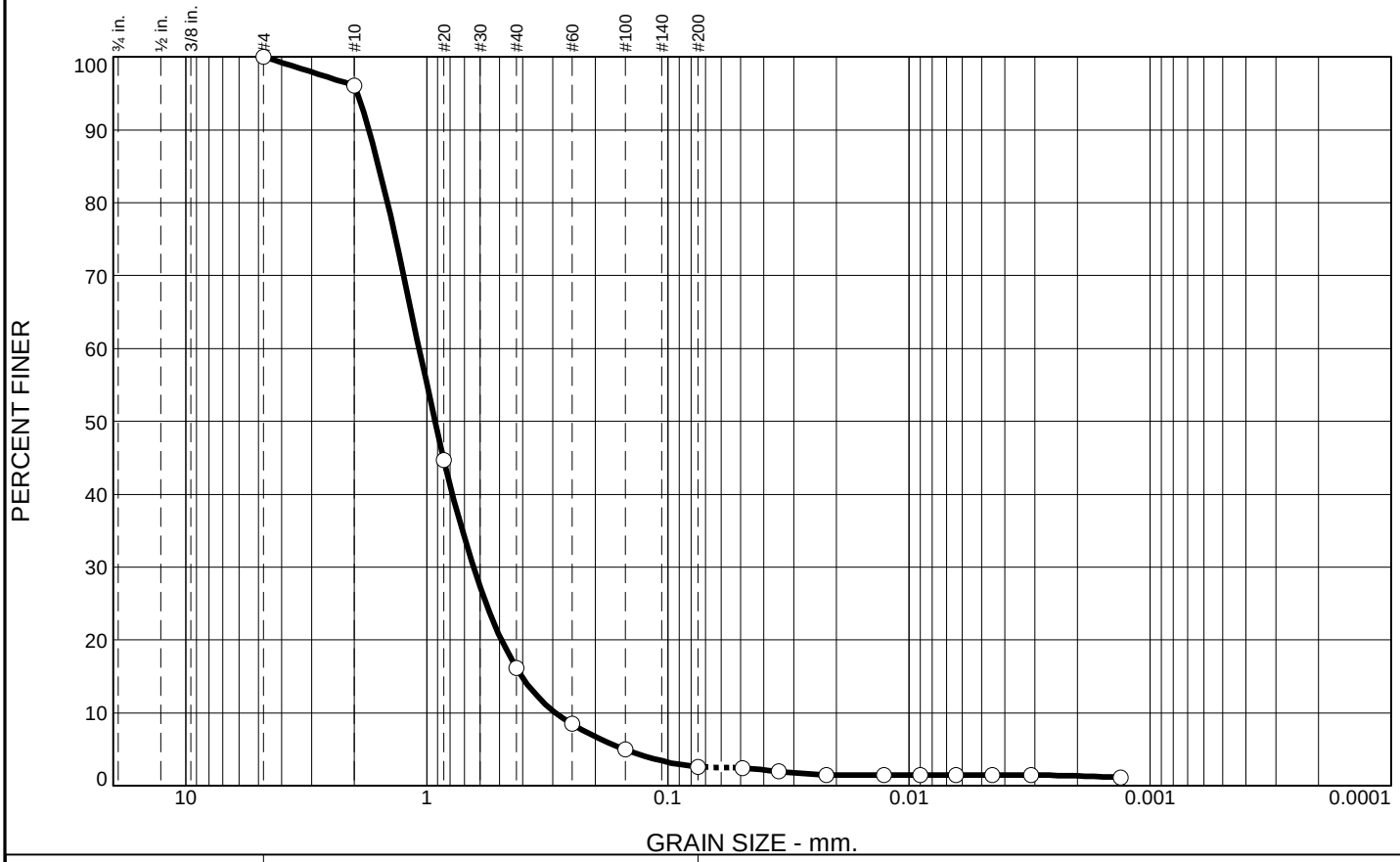
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.9	79.9	13.6	1.1	1.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	96.1		
#20	44.7		
#40	16.2		
#60	8.5		
#100	5.0		
#200	2.6		
0.0491 mm.	2.4		
0.0348 mm.	1.9		
0.0221 mm.	1.5		
0.0127 mm.	1.5		
0.0090 mm.	1.5		
0.0064 mm.	1.5		
0.0045 mm.	1.5		
0.0031 mm.	1.5		
0.0013 mm.	1.1		

* (no specification provided)

Soil Description

BLACK POORLY GRADED SAND - CINDERS AND BRICK NOTED

Atterberg Limits

PL= 14 LL= 12 PI= NP

Coefficients

D_{90}= 1.7391 D_{85}= 1.5843 D_{60}= 1.0768
D_{50}= 0.9256 D_{30}= 0.6402 D_{15}= 0.4036
D_{10}= 0.2921 C_u= 3.69 C_c= 1.30

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=2.94

Source of Sample: XPW-01 **Depth:** 8.5'-9.0'
Sample Number: 1535

Date: 2-19-21

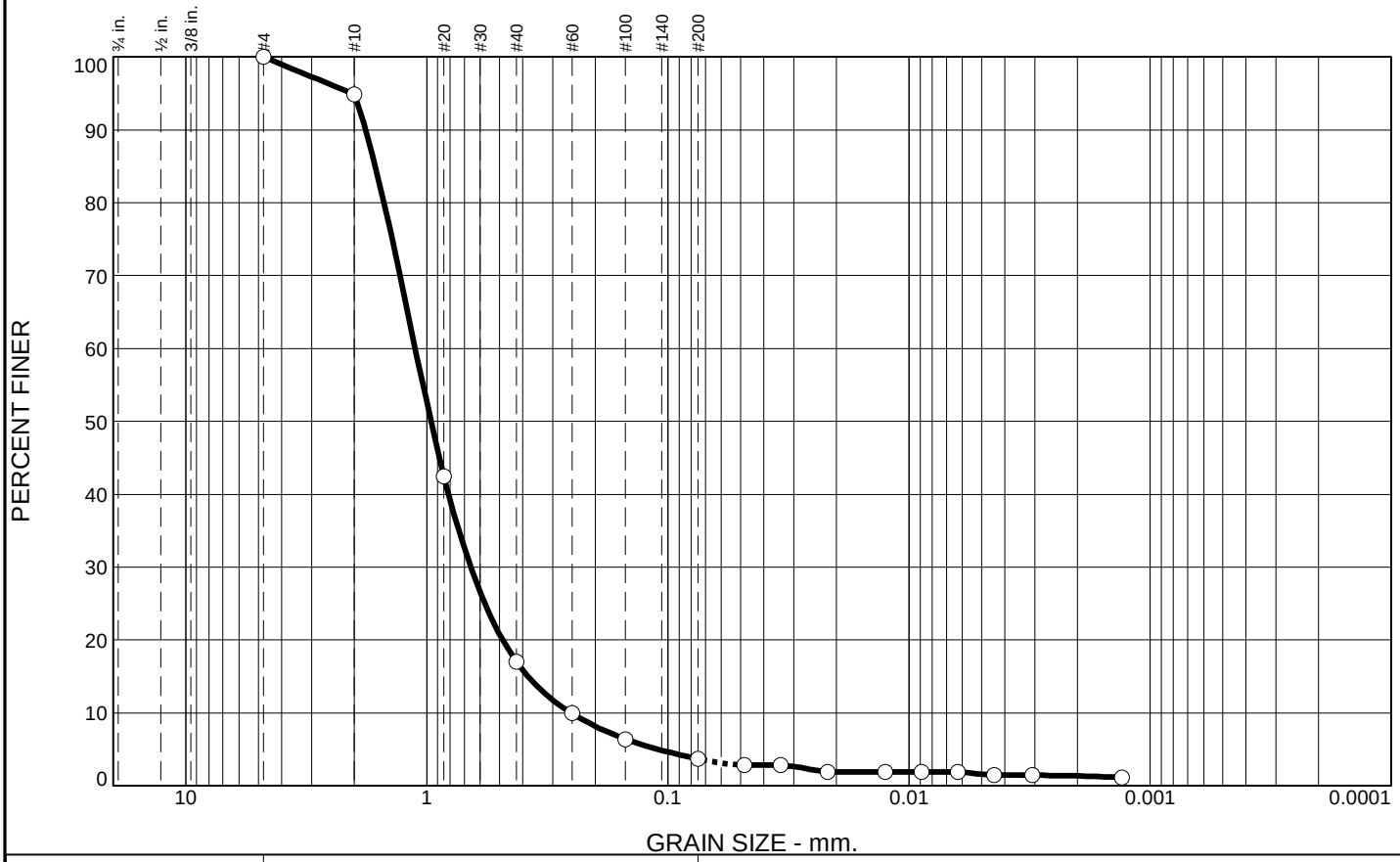
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.1	77.8	13.4	2.1	1.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	94.9		
#20	42.5		
#40	17.1		
#60	9.9		
#100	6.4		
#200	3.7		
0.0483 mm.	2.8		
0.0341 mm.	2.8		
0.0217 mm.	1.9		
0.0125 mm.	1.9		
0.0089 mm.	1.9		
0.0063 mm.	1.9		
0.0044 mm.	1.4		
0.0031 mm.	1.4		
0.0013 mm.	1.1		

* (no specification provided)

Soil Description

BLACK POORLY GRADED SAND - CINDERS AND ROOTS NOTED

Atterberg Limits

PL= 15 LL= 17 PI= 2

Coefficients

D_{90}= 1.7938 D_{85}= 1.6347 D_{60}= 1.1167
D_{50}= 0.9615 D_{30}= 0.6575 D_{15}= 0.3802
D_{10}= 0.2514 C_u= 4.44 C_c= 1.54

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=2.96

Source of Sample: XPW-01 **Depth:** 20.5'-21.0'
Sample Number: 1600 **Date:** 2-19-21

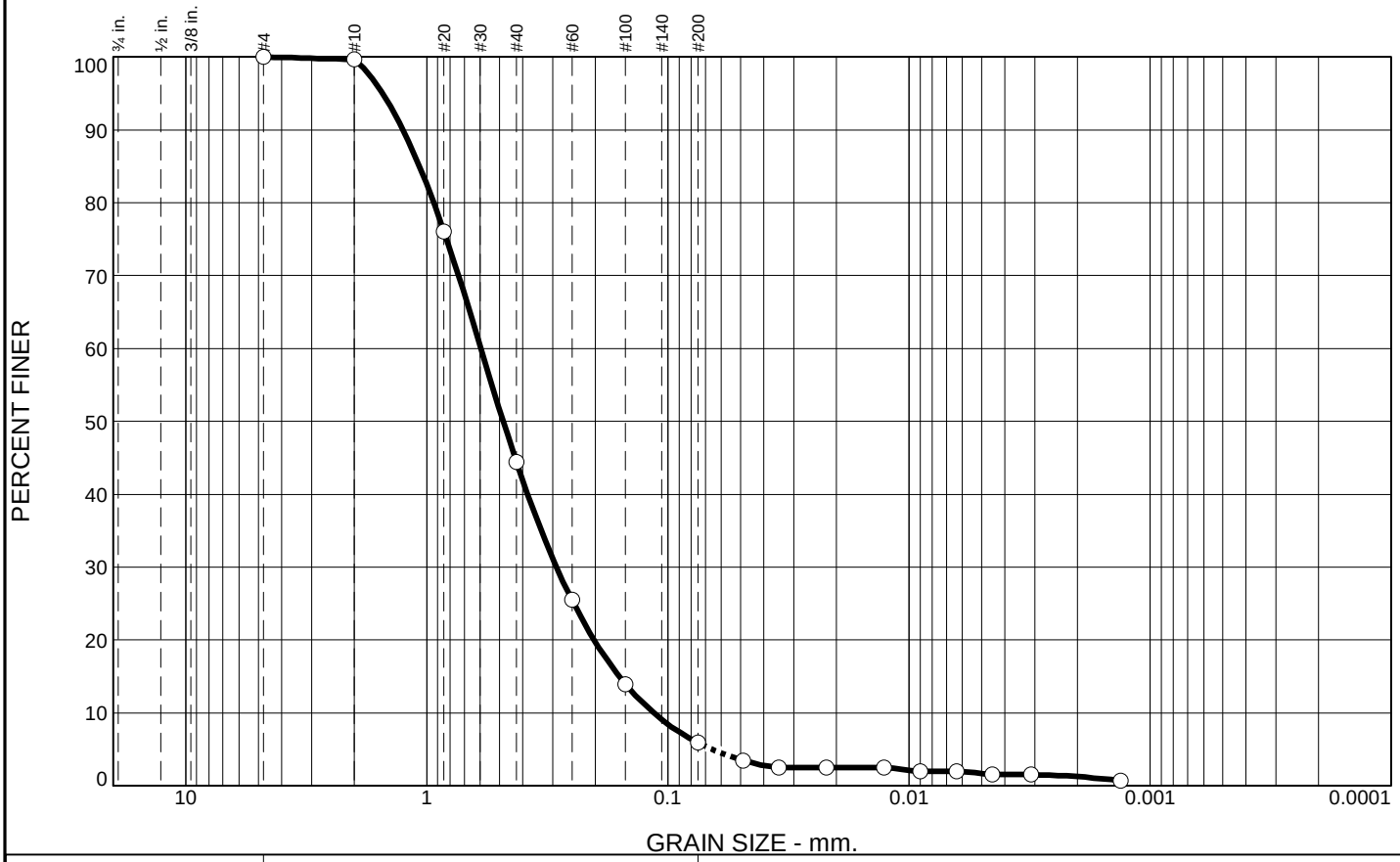
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.3	55.2	38.6	4.2	1.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.7		
#20	76.1		
#40	44.5		
#60	25.5		
#100	14.0		
#200	5.9		
0.0488 mm.	3.5		
0.0347 mm.	2.5		
0.0220 mm.	2.5		
0.0127 mm.	2.5		
0.0090 mm.	2.0		
0.0064 mm.	2.0		
0.0045 mm.	1.5		
0.0031 mm.	1.5		
0.0013 mm.	0.7		

* (no specification provided)

Soil Description

BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED

Atterberg Limits

PL= 9 LL= 4 PI= NP

Coefficients

D_{90}= 1.2561 D_{85}= 1.0736 D_{60}= 0.5965
D_{50}= 0.4816 D_{30}= 0.2895 D_{15}= 0.1590
D_{10}= 0.1144 C_u= 5.21 C_c= 1.23

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

F.M.=2.07

Source of Sample: XPW-02 **Depth:** 8.5'-9.0'
Sample Number: 0810

Date: 2-19-21

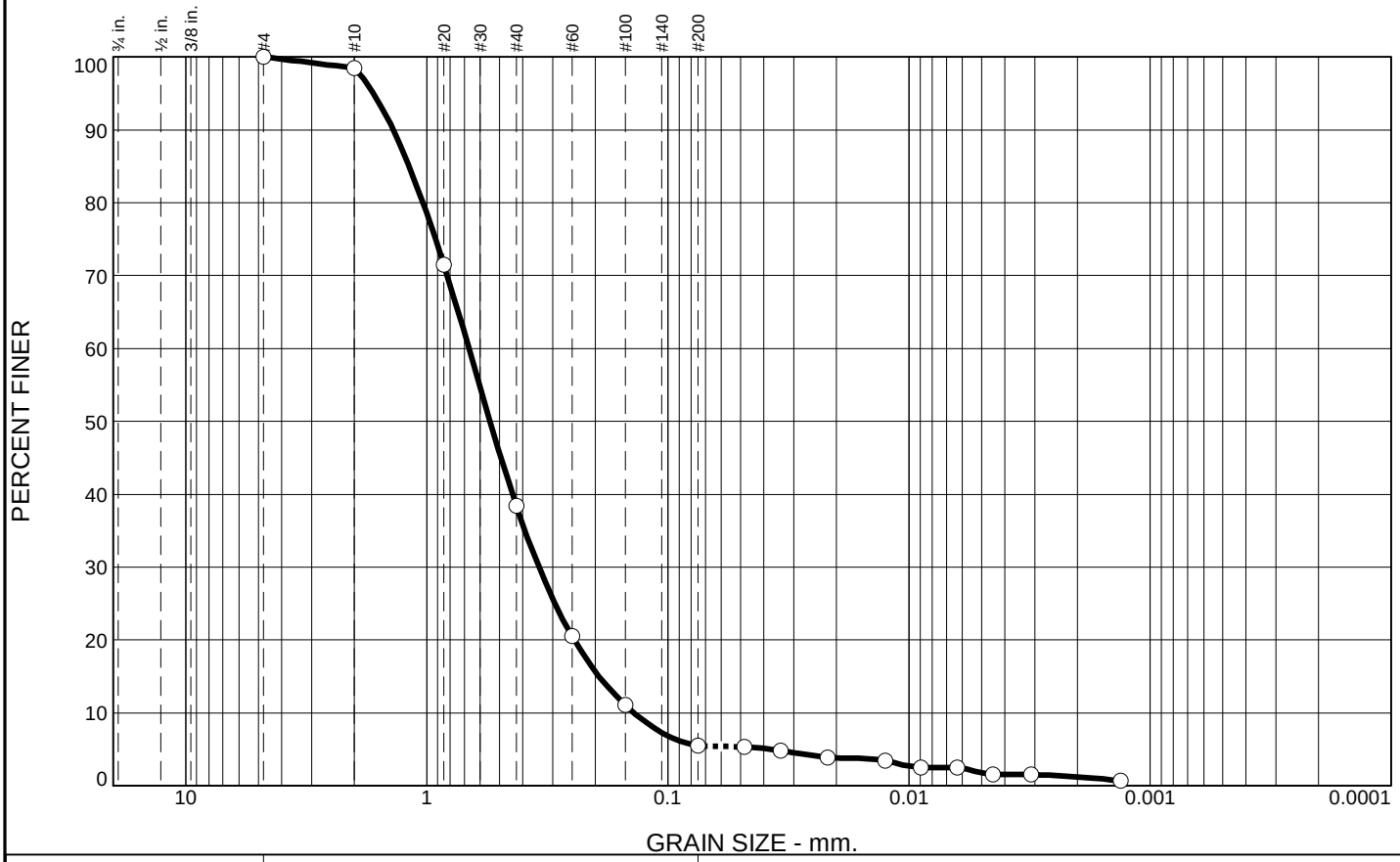
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.5	60.1	32.9	3.7	1.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	98.5		
#20	71.5		
#40	38.4		
#60	20.6		
#100	11.1		
#200	5.5		
0.0481 mm.	5.3		
0.0341 mm.	4.9		
0.0217 mm.	3.9		
0.0126 mm.	3.4		
0.0089 mm.	2.5		
0.0063 mm.	2.5		
0.0045 mm.	1.5		
0.0031 mm.	1.5		
0.0013 mm.	0.7		

* (no specification provided)

Soil Description

DARK BROWN TO BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED

Atterberg Limits

PL= 11 LL= 8 PI= NP

Coefficients

D_{90}= 1.3786 D_{85}= 1.1845 D_{60}= 0.6692
D_{50}= 0.5464 D_{30}= 0.3422 D_{15}= 0.1928
D_{10}= 0.1381 C_u= 4.85 C_c= 1.27

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

F.M.=2.25

Source of Sample: XPW-02 **Depth:** 21.0'-21.5'
Sample Number: 0845

Date: 2-19-21

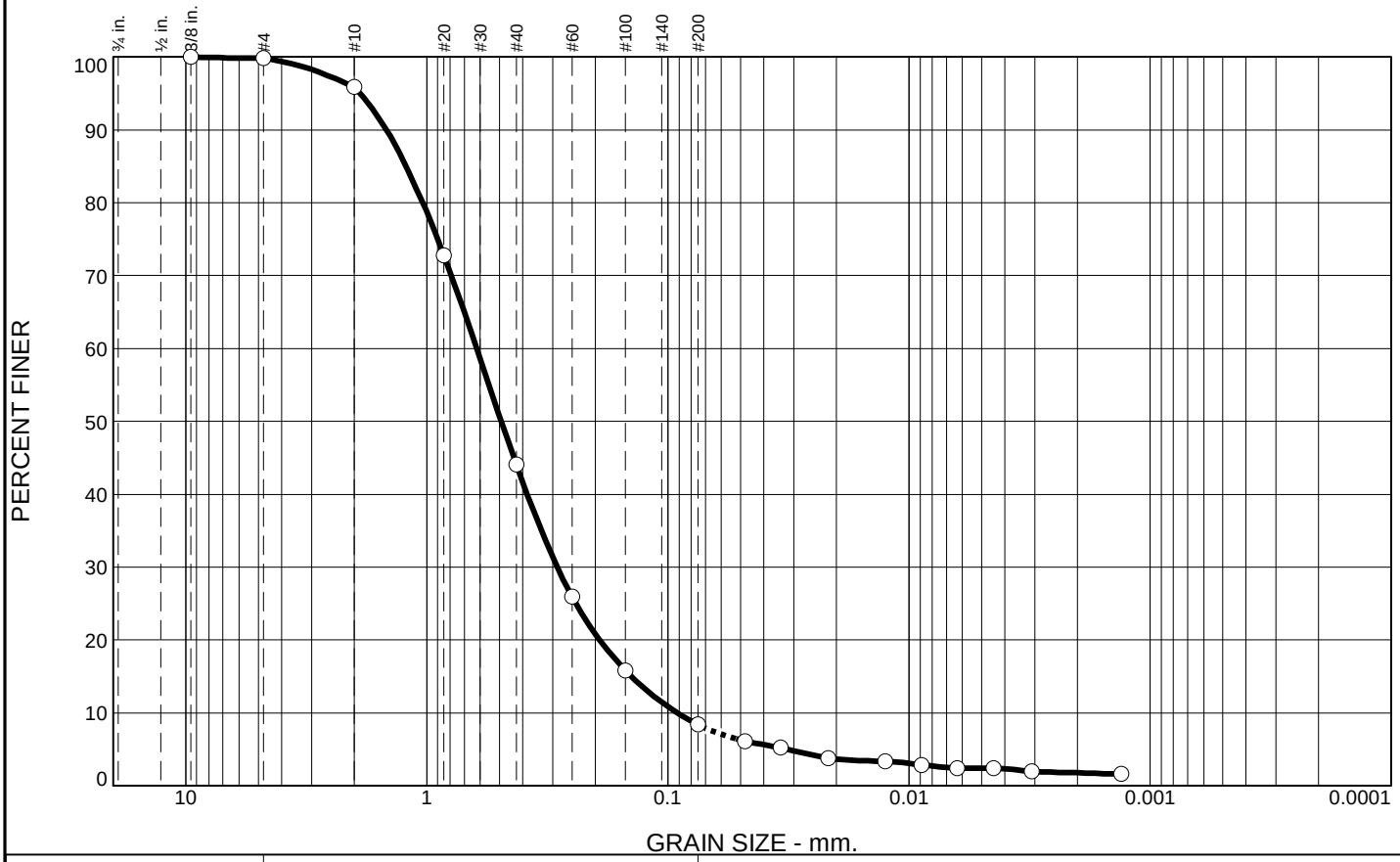
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	3.9	51.8	35.7	6.0	2.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	95.9		
#20	72.8		
#40	44.1		
#60	26.0		
#100	15.8		
#200	8.4		
0.0478 mm.	6.1		
0.0340 mm.	5.2		
0.0217 mm.	3.8		
0.0125 mm.	3.3		
0.0089 mm.	2.9		
0.0063 mm.	2.4		
0.0045 mm.	2.4		
0.0031 mm.	1.9		
0.0013 mm.	1.6		

* (no specification provided)

Soil Description

BLACK WELL GRADED SAND WITH SILT - CINDERS NOTED

Atterberg Limits

PL= 13 LL= 14 PI= 1

Coefficients

D_{90}= 1.4720 D_{85}= 1.2199 D_{60}= 0.6214
D_{50}= 0.4909 D_{30}= 0.2872 D_{15}= 0.1414
D_{10}= 0.0915 C_u= 6.79 C_c= 1.45

Classification

USCS= SW-SM AASHTO= A-1-b

Remarks

F.M.=2.13

Source of Sample: XPW-03 **Depth:** 8.0'-8.5'
Sample Number: 1015

Date: 2-19-21

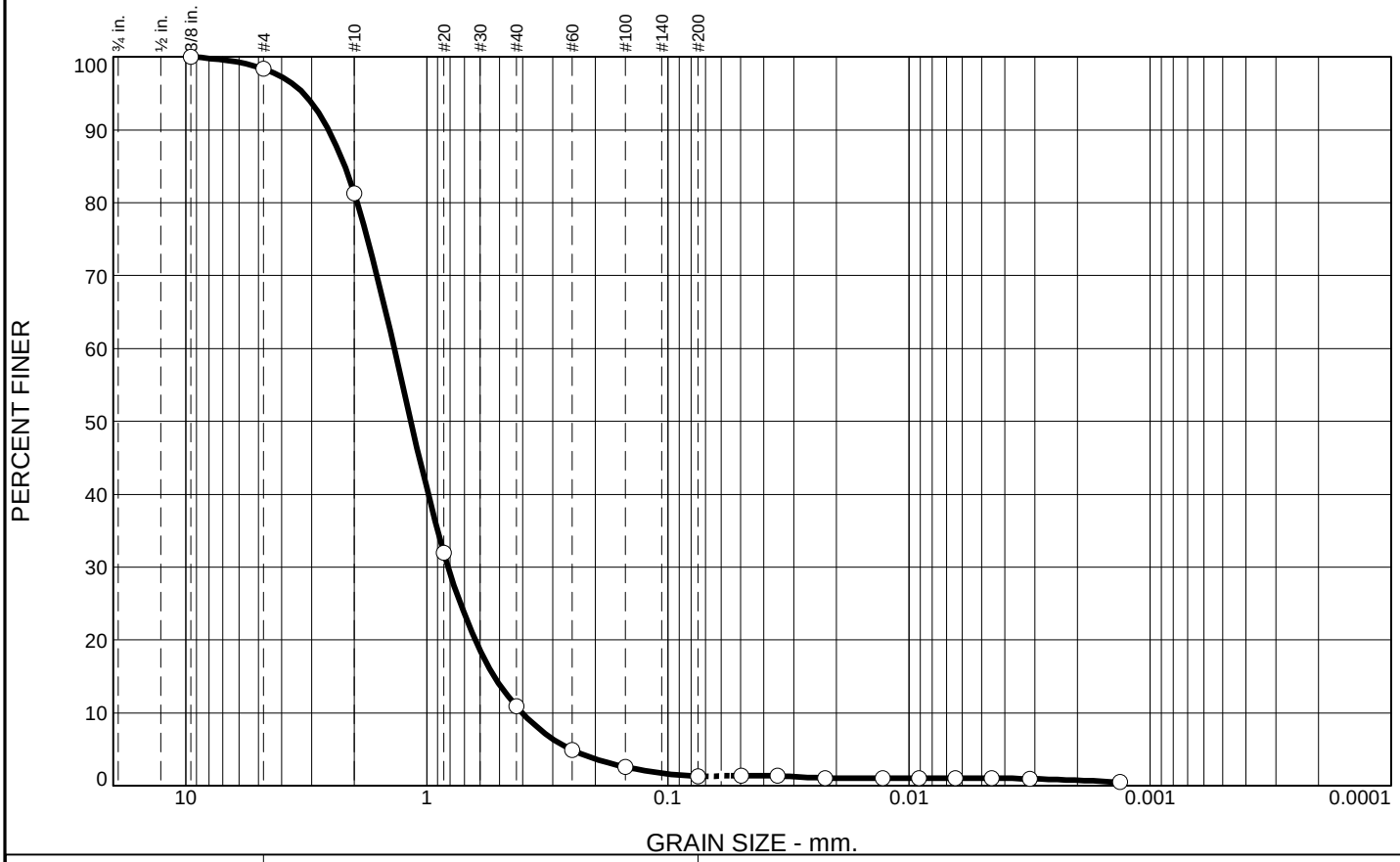
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	1.6	17.1	70.4	9.6	0.2	1.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	98.4		
#10	81.3		
#20	32.0		
#40	10.9		
#60	4.9		
#100	2.6		
#200	1.3		
0.0497 mm.	1.3		
0.0351 mm.	1.3		
0.0222 mm.	1.1		
0.0128 mm.	1.1		
0.0091 mm.	1.1		
0.0064 mm.	1.1		
0.0045 mm.	1.1		
0.0031 mm.	1.0		
0.0013 mm.	0.5		

* (no specification provided)

Soil Description

BLACK POORLY GRADED SAND - CINDERS NOTED

Atterberg Limits

PL= 10 LL= 5 PI= NP

Coefficients

D_{90}= 2.5554 D_{85}= 2.1887 D_{60}= 1.3646
D_{50}= 1.1641 D_{30}= 0.8160 D_{15}= 0.5240
D_{10}= 0.4023 C_u= 3.39 C_c= 1.21

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=3.36

Source of Sample: XPW-03 **Depth:** 18.0'-18.5'
Sample Number: 1055

Date: 2-19-21

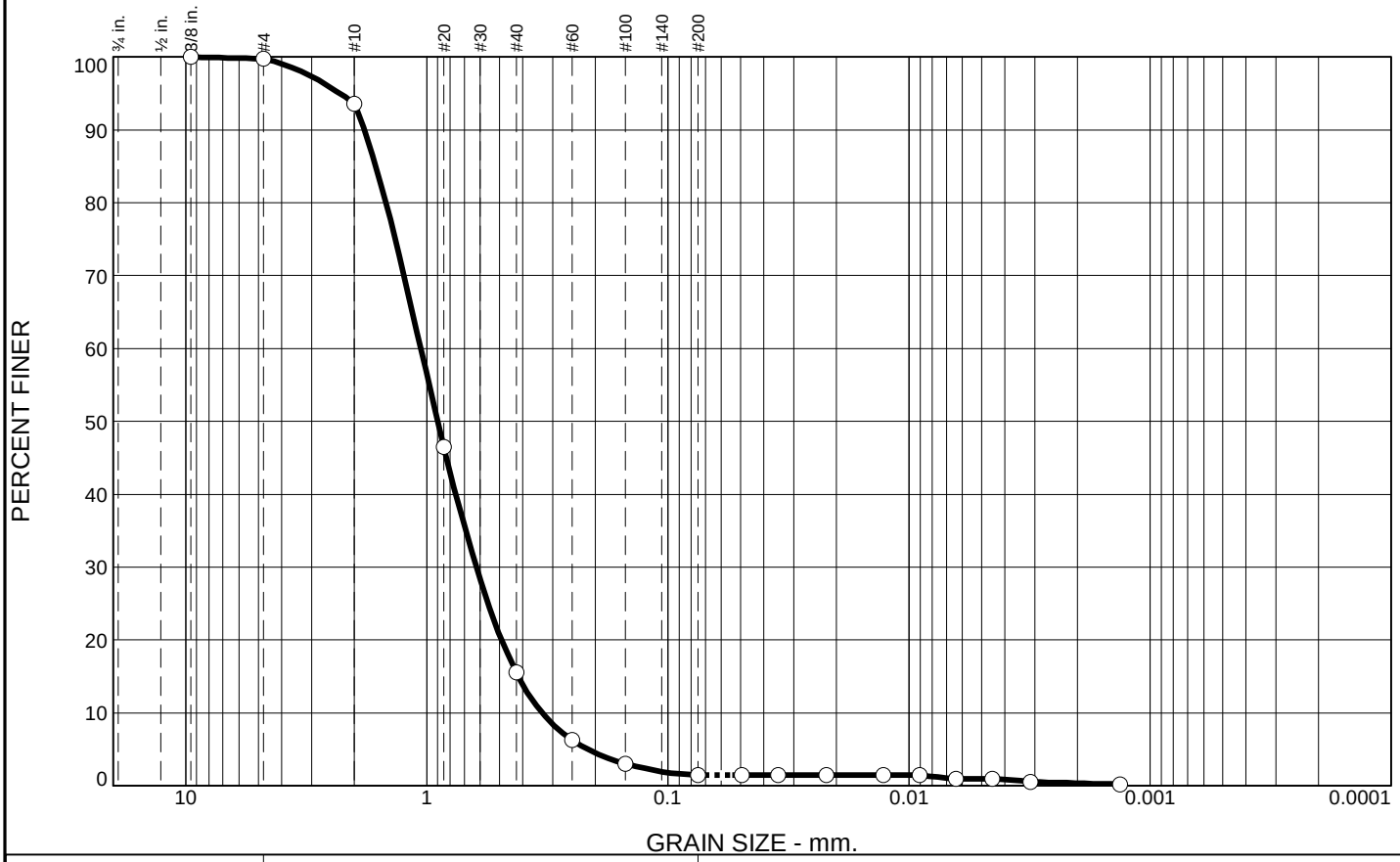
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.2	6.2	78.1	14.1	0.4	1.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.8		
#10	93.6		
#20	46.4		
#40	15.5		
#60	6.3		
#100	3.0		
#200	1.4		
0.0494 mm.	1.4		
0.0349 mm.	1.4		
0.0221 mm.	1.4		
0.0128 mm.	1.4		
0.0090 mm.	1.4		
0.0064 mm.	1.0		
0.0045 mm.	1.0		
0.0031 mm.	0.5		
0.0013 mm.	0.2		

* (no specification provided)

Soil Description

BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS AND ROOTS NOTED

Atterberg Limits

PL= 6 LL= 3 PI= NP

Coefficients

D_{90}= 1.8159 D_{85}= 1.6267 D_{60}= 1.0599
D_{50}= 0.9020 D_{30}= 0.6231 D_{15}= 0.4170
D_{10}= 0.3321 C_u= 3.19 C_c= 1.10

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=2.99

Source of Sample: XPW-04 **Depth:** 10.5'-11.0'
Sample Number: 1320 **Date:** 2-19-21

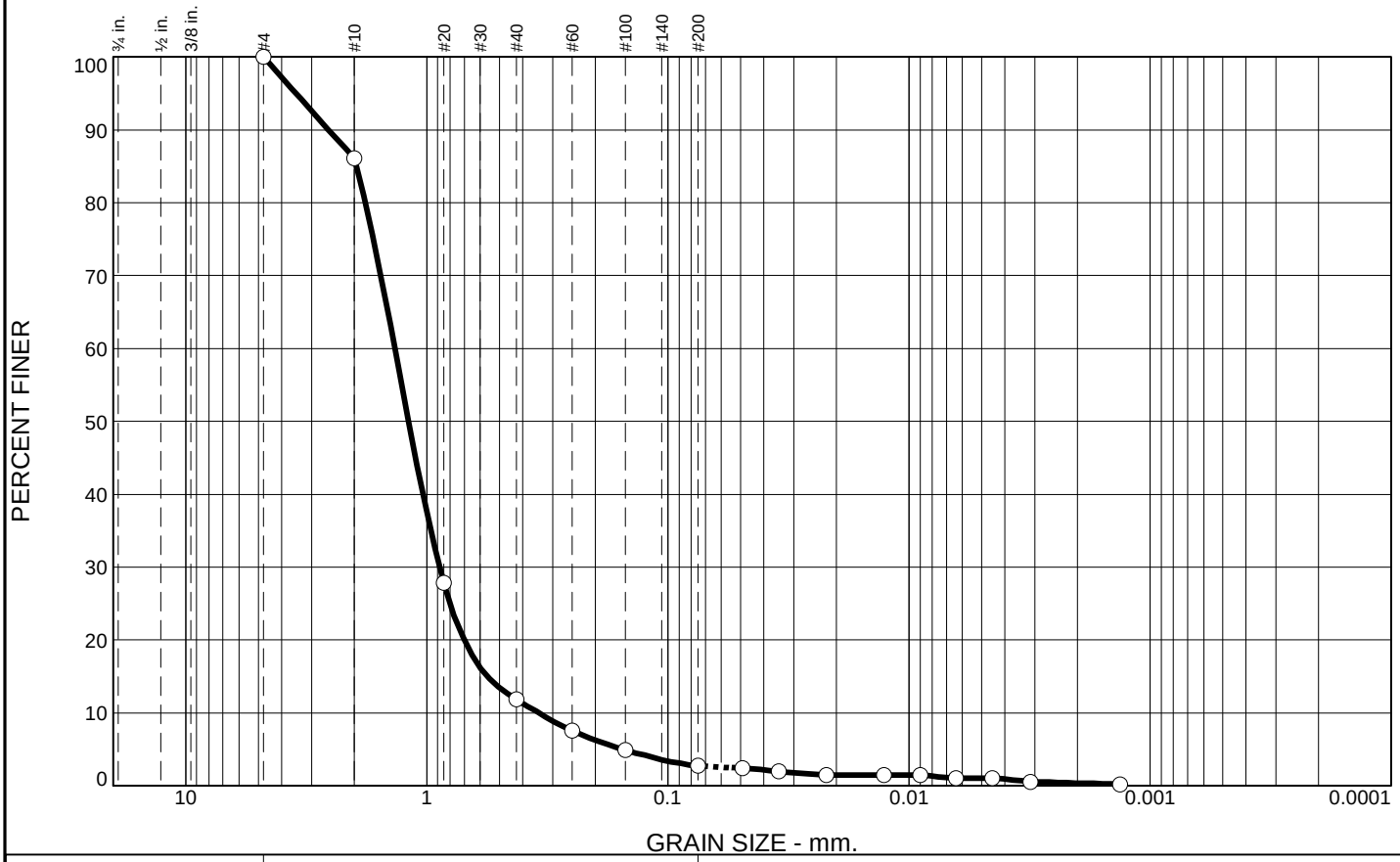
Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Particle Size Analysis of Soils ASTM D6913 and D7928



% Gravel		% Sand			% Fines	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	13.9	74.2	9.2	1.7	1.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	86.1		
#20	27.8		
#40	11.9		
#60	7.6		
#100	4.9		
#200	2.7		
0.0490 mm.	2.4		
0.0347 mm.	2.0		
0.0220 mm.	1.5		
0.0127 mm.	1.5		
0.0090 mm.	1.5		
0.0064 mm.	1.0		
0.0045 mm.	1.0		
0.0031 mm.	0.5		
0.0013 mm.	0.2		

* (no specification provided)

Soil Description

BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS NOTED

Atterberg Limits

PL= 16 LL= 15 PI= NP

Coefficients

D_{90}= 2.5540 D_{85}= 1.9597 D_{60}= 1.3571
D_{50}= 1.1905 D_{30}= 0.8856 D_{15}= 0.5606
D_{10}= 0.3429 C_u= 3.96 C_c= 1.69

Classification

USCS= SP AASHTO= A-1-b

Remarks

F.M.=3.32

Source of Sample: XPW-04 **Depth:** 21.0'-21.5
Sample Number: 1405 **Date:** 2-19-21

Terracon

Client: CONFIDENTIAL
Project: KINCAID POWER STATION

Project No: 11215018 **Figure**

Tested By: SJH **Checked By:** WPQ

Hydraulic Conductivity of Saturated Porous Materials
Using a Flexible-Wall Permeameter
ASTM D5084

Terracon
Consulting Engineers & Scientists

Laboratory Services Group | 192 Exchange Blvd | Glendale Heights, Illinois 60139 | Ph. (630) 717-4263

HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO. **11215018** **3/23/2021**
PROJECT NAME: **KINCAID POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. MW12D

TIME SAMPLED: 9:15

DEPTH: 5.0'-7.0'

CLASSIFICATION BROWN CLAYEY SAND (SC)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	97.8	98.2
WATER CONTENT (%)	18.6	25.4
DIAMETER (cm)	7.147	7.144
LENGTH (cm)	10.536	10.501
B VALUE PARAMETER:	0.96	
HYDRAULIC GRADIENT (MAXIMUM)	18.96	
PERCENT SATURATION	97.1	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec) **3.16E-07**

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO. **11215018** **3/23/2021**
PROJECT NAME: **KINCAID POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. MW12D

TIME SAMPLED: 9:40

DEPTH: 11.0'-11.5'

CLASSIFICATION BROWN TO GRAY SANDY LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	94.5	106.6
WATER CONTENT (%)	18.2	21.0
DIAMETER (cm)	6.155	6.143
LENGTH (cm)	9.627	8.564
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	20.75	
PERCENT SATURATION	99.6	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 7.21E-08

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO. **11215018** **3/23/2021**
PROJECT NAME: **KINCAID POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. MW12D

TIME SAMPLED: 10:25

DEPTH: 20.5'-22.0'

CLASSIFICATION GRAY CLAYEY SAND (SC)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	106.9	107.0
WATER CONTENT (%)	14.0	20.9
DIAMETER (cm)	7.174	7.221
LENGTH (cm)	7.740	7.633
B VALUE PARAMETER:	0.97	
HYDRAULIC GRADIENT (MAXIMUM)	21.27	
PERCENT SATURATION	99.9	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 1.09E-07

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO. **11215018** **3/23/2021**
PROJECT NAME: **KINCAID POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. MW-20

TIME SAMPLED: 8:15

DEPTH: 15.0'-17.0'

CLASSIFICATION BROWN AND GRAY SANDY LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	107.7	110.6
WATER CONTENT (%)	18.9	19.2
DIAMETER (cm)	6.951	6.977
LENGTH (cm)	10.259	9.915
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	29.75	
PERCENT SATURATION	99.7	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec): 1.19E-07

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO. **11215018** **3/23/2021**
PROJECT NAME: **KINCAID POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. MW-23

TIME SAMPLED: 11:35

DEPTH: 15.0'-17.0'

CLASSIFICATION BROWN AND GRAYISH BROWN LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	92.7	94.5
WATER CONTENT (%)	28.4	28.9
DIAMETER (cm)	7.199	7.132
LENGTH (cm)	9.515	9.516
B VALUE PARAMETER:	0.99	
HYDRAULIC GRADIENT (MAXIMUM)	24.69	
PERCENT SATURATION	99.7	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec) **7.40E-08**

Deaired water was used as the liquid permeant.

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HYDRAULIC CONDUCTIVITY DETERMINATION
ASTM D 5084, METHOD C
RISING TAILWATER LEVEL

TERRACON PROJECT NO. **11215018** **3/23/2021**
PROJECT NAME: **KINCAID POWER STATION**
CLIENT: **CONFIDENTIAL**
LOCATION : **CONFIDENTIAL**

SUMMARY OF TEST RESULTS

BORING NO. MW-23

TIME SAMPLED: 12:45

DEPTH: 25.0'-27.0'

CLASSIFICATION YELLOWISH BROWN SANDY LEAN CLAY (CL)

	INITIAL	FINAL
DRY UNIT WEIGHT (pcf)	112.3	112.6
WATER CONTENT (%)	15.6	18.5
DIAMETER (cm)	7.104	7.152
LENGTH (cm)	10.067	9.909
B VALUE PARAMETER:	0.95	
HYDRAULIC GRADIENT (MAXIMUM)	19.84	
PERCENT SATURATION	98.8	

SPECIMEN PHOTO

(Percent saturation calculation is based on final measurements and a measured specific gravity.)

HYDRAULIC CONDUCTIVITY k (cm/sec) **5.85E-08**

Deaired water was used as the liquid permeant.

Permeability of Granular Soils (Constant Head)
ASTM D2434

Terracon
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PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.:	11215018
PROJECT:	KINCAID POWER STATION
DATE:	3/18/2021

SPECIMEN CHARATERISTICS

BORING NO.	XPW-01
TIME SAMPLED:	15:35
DEPTH:	8.5'-9.0'
CLASSIFICATION	BLACK POORLY GRADED SAND - CINDERS AND BRICK NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	74.8
WATER CONTENT (%)	19.4
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.323
HYDRAULIC CONDUCTIVITY k (cm/sec)	**7.16E-04**

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PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-01

TIME SAMPLED: 16:00

DEPTH: 21.0'-21.5'

CLASSIFICATION BLACK POORLY GRADED SAND - CINDERS AND ROOTS NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	79.2
WATER CONTENT (%)	26.8
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.231
HYDRAULIC CONDUCTIVITY k (cm/sec)	**3.51E-04**

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PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-02

TIME SAMPLED: 8:10

DEPTH: 9.0'-9.5'

CLASSIFICATION BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	62.7
WATER CONTENT (%)	11.8
DIAMETER (cm)	2.87
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.769
HYDRAULIC CONDUCTIVITY k (cm/sec)	**4.04E-03**

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PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-02

TIME SAMPLED: 8:45

DEPTH: 20.5'-21.0'

CLASSIFICATION BLACK TO DARK BROWN POORLY GRADED SAND - CINDERS NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	93.9
WATER CONTENT (%)	13.9
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	0.857
HYDRAULIC CONDUCTIVITY k (cm/sec)	**1.94E-03**

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PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-03

TIME SAMPLED: 10:15

DEPTH: 8.5'-9.0'

CLASSIFICATION BLACK WELL GRADED SAND WITH SILT - CINDERS NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	86.9
WATER CONTENT (%)	27.4
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.011
HYDRAULIC CONDUCTIVITY k (cm/sec)	**4.31E-03**

Terracon
Consulting Engineers & Scientists

PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-03

TIME SAMPLED: 10:55

DEPTH: 18.5'-19.0'

CLASSIFICATION BLACK POORLY GRADED SAND - CINDERS NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	89.3
WATER CONTENT (%)	36.4
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	0.932
HYDRAULIC CONDUCTIVITY k (cm/sec)	**3.52E-03**

Terracon
Consulting Engineers & Scientists

PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-04

TIME SAMPLED: 13:20:00 AM

DEPTH: 10.0'-10.5'

CLASSIFICATION: BLACK AND DARK BROWN POORLY GRADED SAND - CINDERS AND ROOTS NOTED

	INITIAL
DRY UNIT WEIGHT (pcf)	77.4
WATER CONTENT (%)	18.3
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.242
HYDRAULIC CONDUCTIVITY k (cm/sec)	**9.22E-04**

Terracon
Consulting Engineers & Scientists

PERMEABILITY OF GRANULAR SOILS
CONSTANT HEAD METHOD IN RIGID WALL PERMEAMETER
ASTM D 2434

Laboratory Services Group **192 Exchange Blvd** **Glendale Heights, Illinois 60139** **Ph. (630) 717-4263**

PROJECT NO.: 11215018

PROJECT: KINCAID POWER STATION

DATE: 3/18/2021

SPECIMEN CHARACTERISTICS

BORING NO. XPW-04

TIME SAMPLED: 13:20:00 AM

DEPTH: 10.0'-10.5'

CLASSIFICATION DARK BROWN TO BLACK POORLY GRADED SAND WITH SILT - CINDERS NOTED

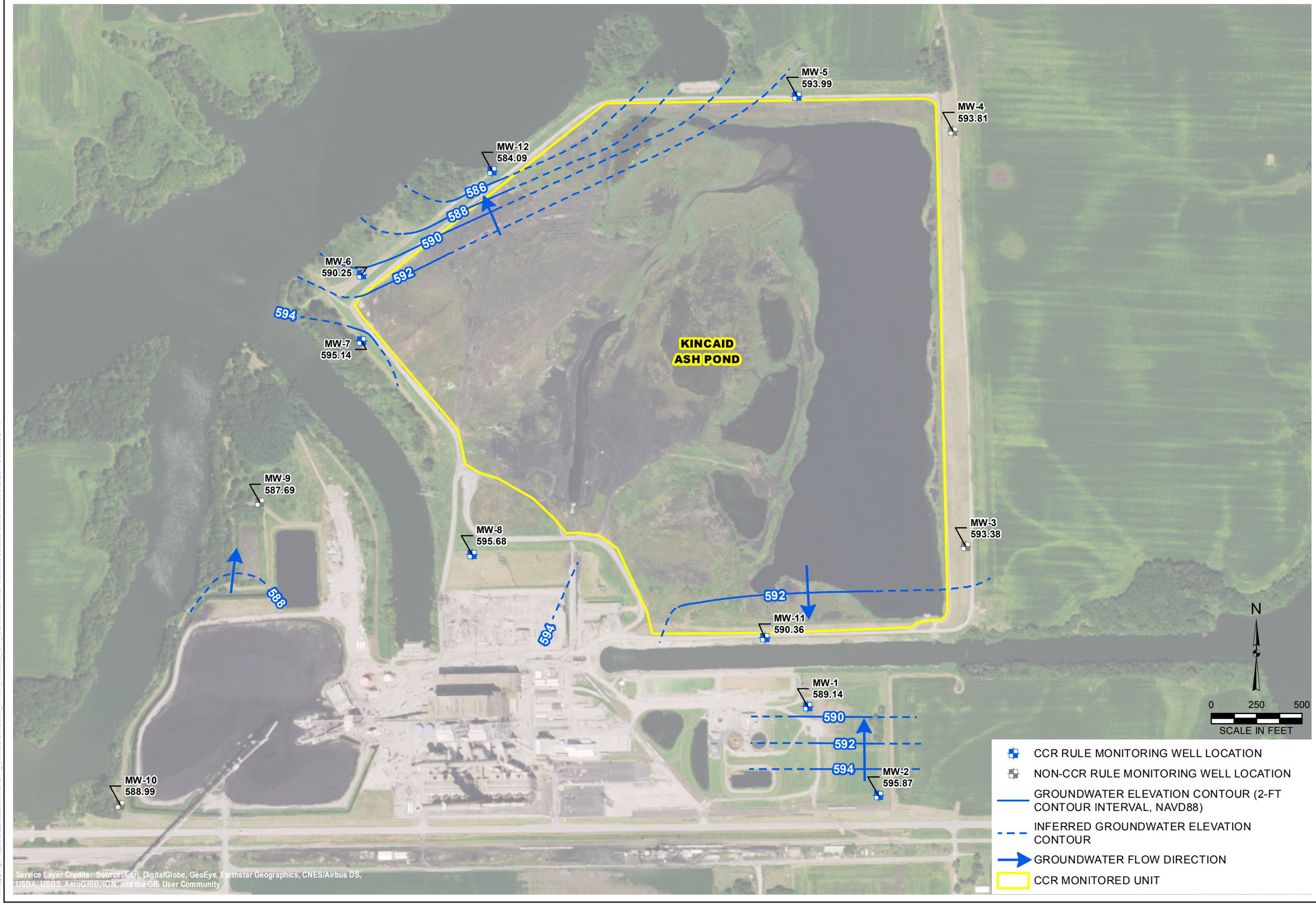
	INITIAL
DRY UNIT WEIGHT (pcf)	81.3
WATER CONTENT (%)	32.3
DIAMETER (cm)	2.57
LENGTH (cm)	11.85

SUMMARY OF TEST RESULTS

HYDRAULIC GRADIENT	1.3
HEAD HEIGHT (cm)	15.00
VOID RATIO	1.140
HYDRAULIC CONDUCTIVITY k (cm/sec)	**5.54E-04**

APPENDIX E
GROUNDWATER CONTOUR MAPS AND ELEVATIONS

GROUNDWATER CONTOUR MAPS



DRAWN BY/DATE:
SDS 1/24/17
REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 1: DECEMBER 14, 2015

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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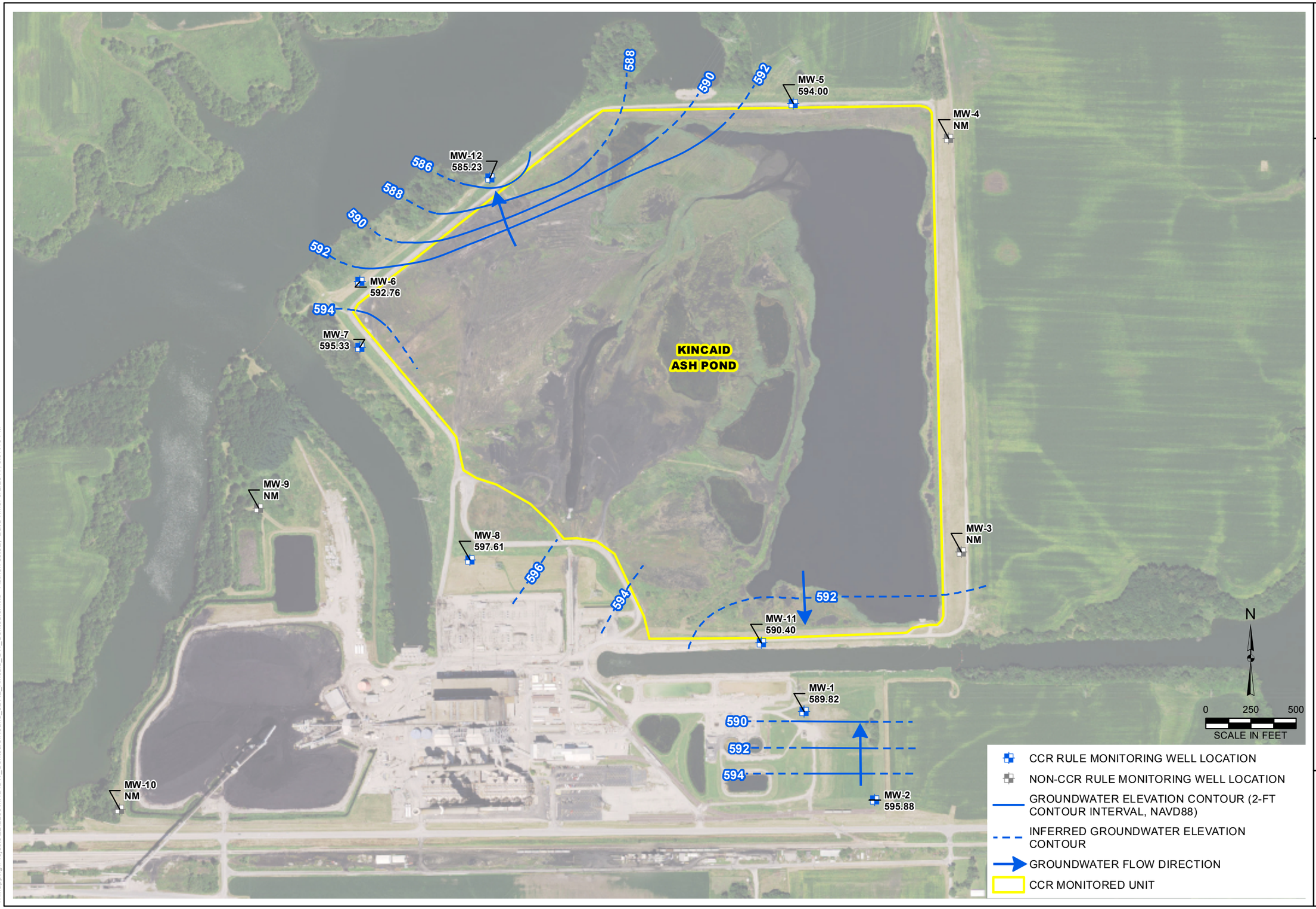

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REVIEWED BY/DATE:
ANS 1/25/17
APPROVED BY/DATE:
JJW 2/8/17

KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 2: FEBRUARY 29, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285/1.5

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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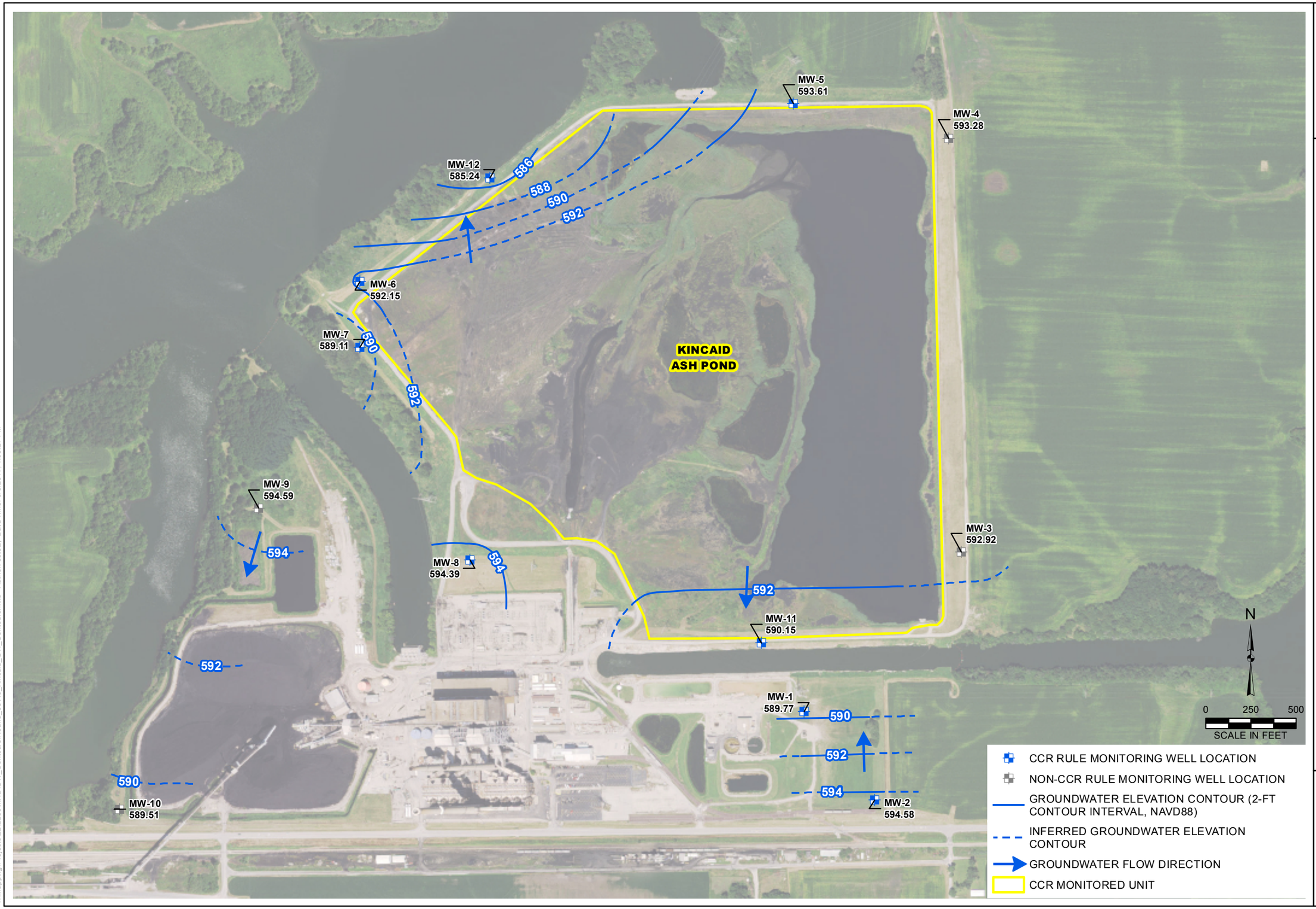

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SDS 1/23/17
REVIEWED BY/DATE:
ANS 1/24/17
APPROVED BY/DATE:
JJW 2/8/17

KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 3: MAY 16, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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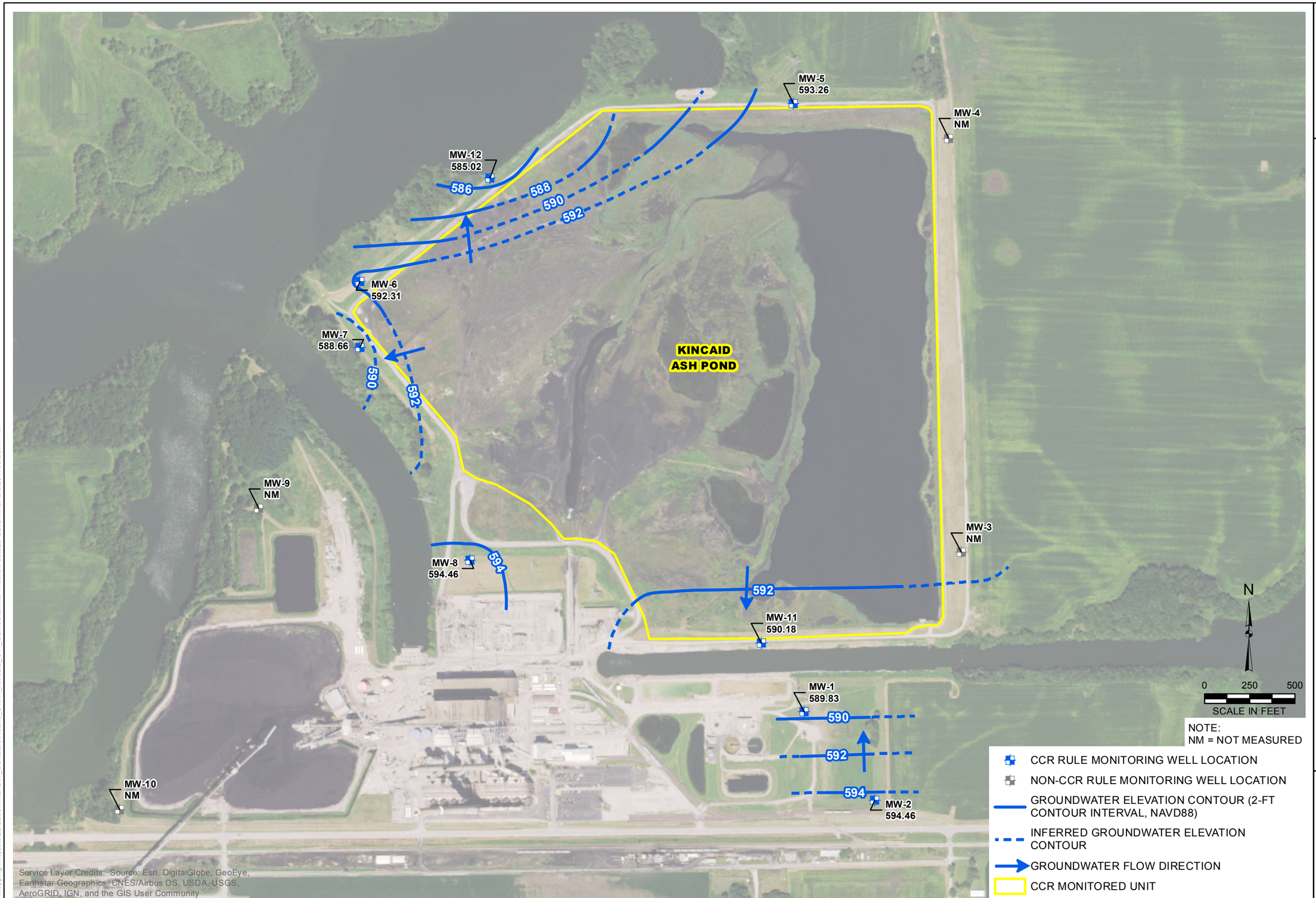

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REVIEWED BY/DATE:
ANS 1/26/17
APPROVED BY/DATE:
JJW 2/8/17

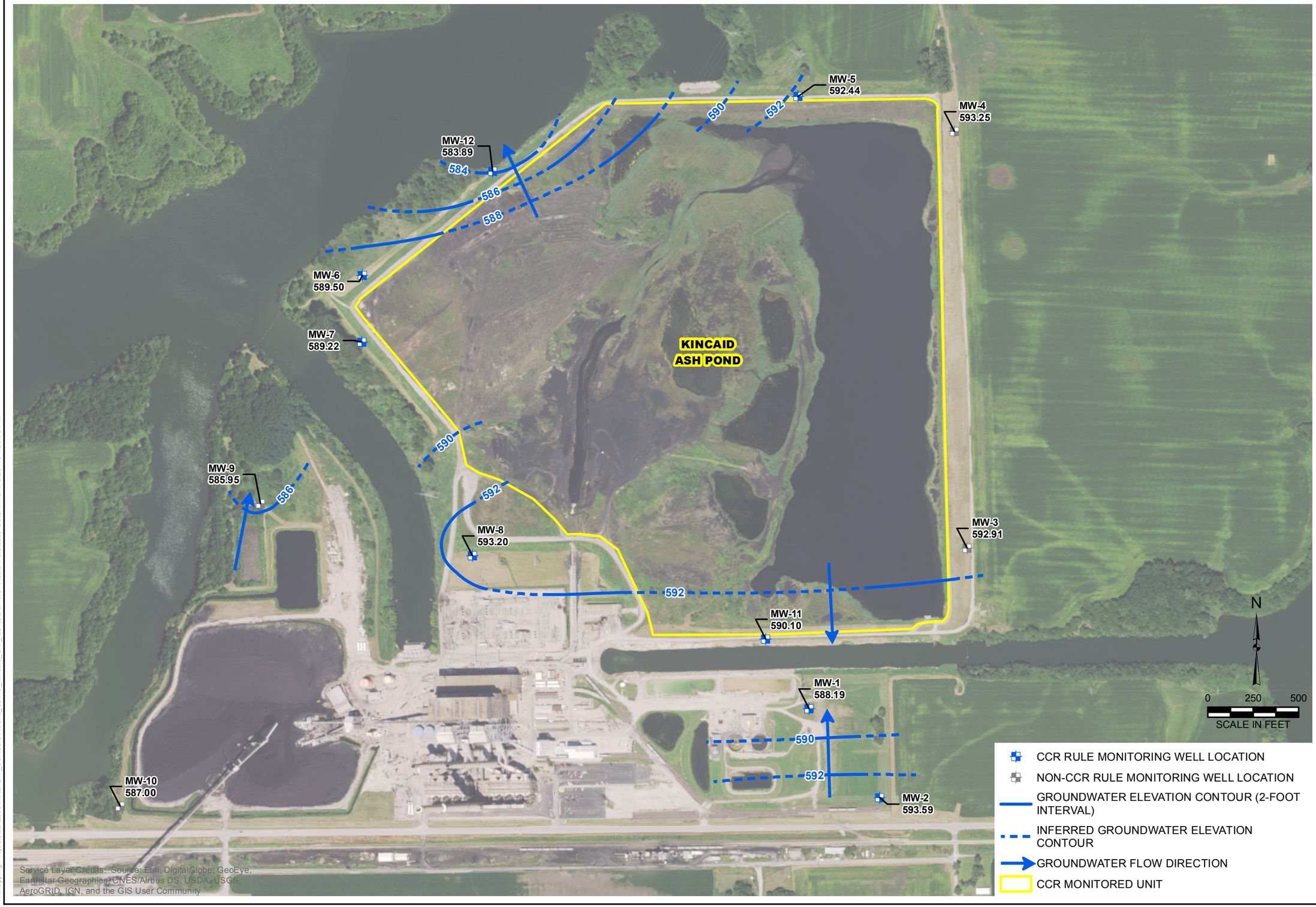
KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 4: AUGUST 22, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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DRAWN BY/DATE:
SDS 3/7/17
REVIEWED BY/DATE:
ANS 3/7/17
APPROVED BY/DATE:
JJW 8/30/17

KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 5: NOVEMBER 15, 2016

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

MW-5
593.54

MW-4
593.30

MW-12
585.05

586

588

590

592

MW-6
591.61

MW-7
588.95

KINCAID
ASH POND

MW-9
590.05

MW-8
594.05

594

MW-3
593.06

MW-11
590.19

MW-1
589.37

MW-2
593.90

MW-10
587.96

N

0 250 500
SCALE IN FEET

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FOOT INTERVAL)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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SDS 3/7/17
REVIEWED BY/DATE:
ANS 3/7/17
APPROVED BY/DATE:
JJW 9/1/17

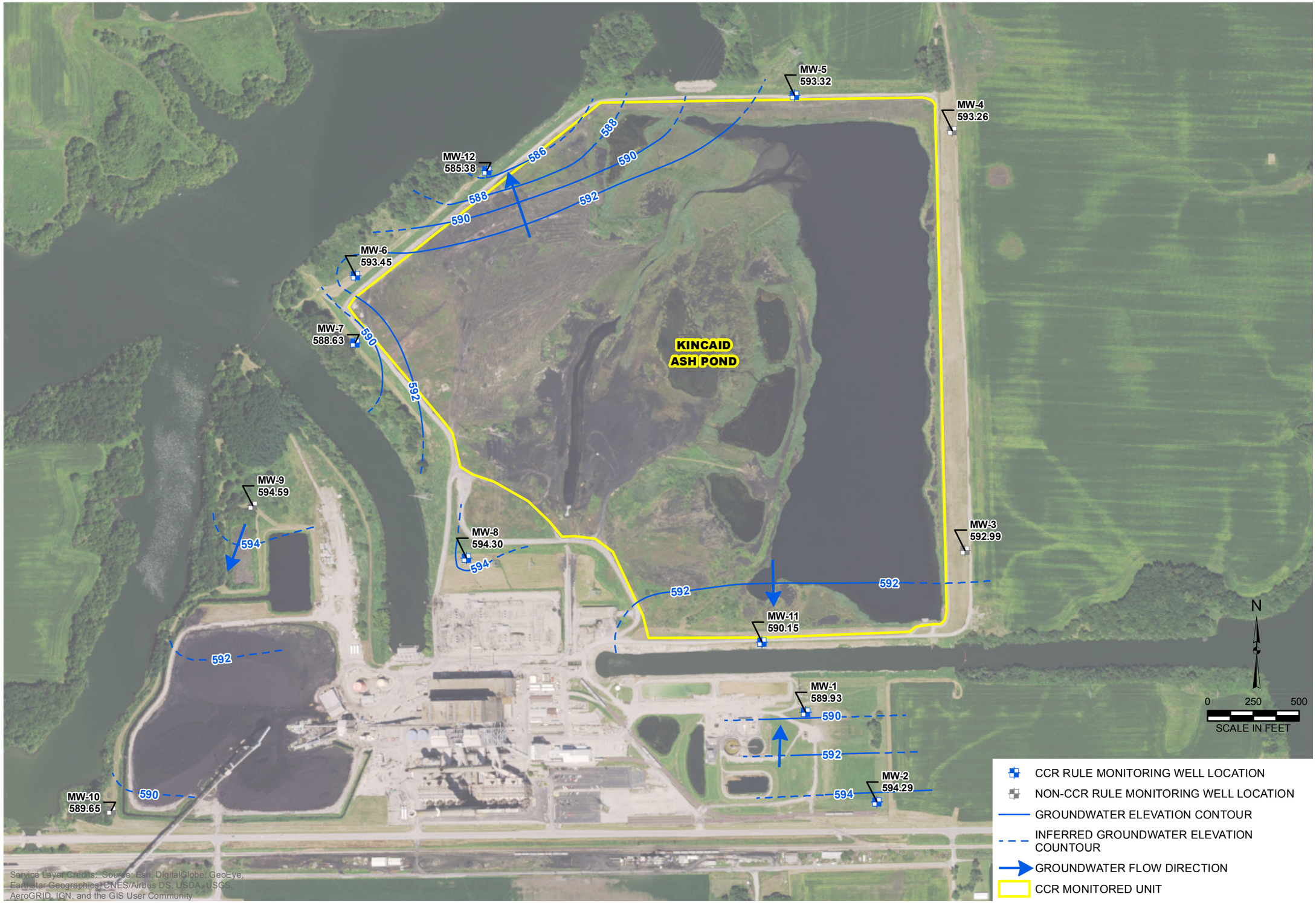
KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 6: FEBRUARY 13, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY



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REVIEWED BY/DATE:
ANS 7/28/17
APPROVED BY/DATE:
JJW 9/1/17

KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 7: MAY 18, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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MW-5
591.61

MW-4
592.14

MW-12
584.57

586
588
590
592

MW-6
589.38

MW-7
587.56

KINCAID
ASH POND

MW-9
587.95

MW-8
593.16

MW-3
592.37

MW-11
589.89

MW-1
588.80

MW-10
586.29

MW-2
592.75

N

0 250 500
SCALE IN FEET

CCR RULE MONITORING WELL LOCATION
NON-CCR RULE MONITORING WELL LOCATION
GROUNDWATER ELEVATION CONTOUR
INFERRED GROUNDWATER ELEVATION COUNTOUR
GROUNDWATER FLOW DIRECTION
CCR MONITORED UNIT

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

KINCAID ASH POND (UNIT ID: 141)
UPPERMOST AQUIFER UNIT
GROUNDWATER ELEVATION CONTOUR MAP
ROUND 8: JULY 18, 2017

DYNEGY CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

DRAWN BY/DATE: SDS 8/16/17
REVIEWED BY/DATE: ANS 8/16/17
APPROVED BY/DATE: JJW 9/1/17

PROJECT NO: 2285

FIGURE NO: 1

Natural Resource Technology
AN OBG COMPANY

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NOTES:
**SANGCHRIS LAKE ELEVATION OBTAINED FROM A TRANSDUCER MONITORING WATER LEVELS LOCATED NEAR PLANT INTAKE. ELEVATION DATUM PRE-DATED NAVD88 AND WAS ASSUMED TO BE IN NGVD29. ELEVATION DATA WAS CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE. THE AVERAGE ELEVATION ON NOVEMBER 6, 2017 WAS ESTIMATED TO THE NEAREST 0.1 FOOT.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

0 125 250 500
Feet

N

KINCAID ASH POND (UNIT ID: 141)
GROUNDWATER ELEVATION CONTOUR MAP
NOVEMBER 6, 2017

O'BRIEN & GERE ENGINEERS, INC.

Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

MW-5
593.77

MW-4
593.48

MW-12
585.11

586

588

590

590

592

592

SANGCHRIS LAKE
ELEVATION = 585.4**

MW-6
593.18

MW-7
589.18

590

592

594

KINCAID
ASH POND

MW-9
589.59

596

MW-8
597.19

596

594

592

MW-3
593.40

MW-11
590.21

MW-1
590.05

592

594

MW-2
595.30

MW-10
588.90

NOTES:
**SANGCHRIS LAKE ELEVATION OBTAINED FROM A TRANSDUCER MONITORING WATER LEVELS LOCATED NEAR PLANT INTAKE. ELEVATION DATUM PRE-DATED NAVD88 AND WAS ASSUMED TO BE IN NGVD29. ELEVATION DATA WAS CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE. THE AVERAGE ELEVATION FROM AUG. 28, 2018 WAS ESTIMATED TO THE NEAREST 0.1 FOOT.

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- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

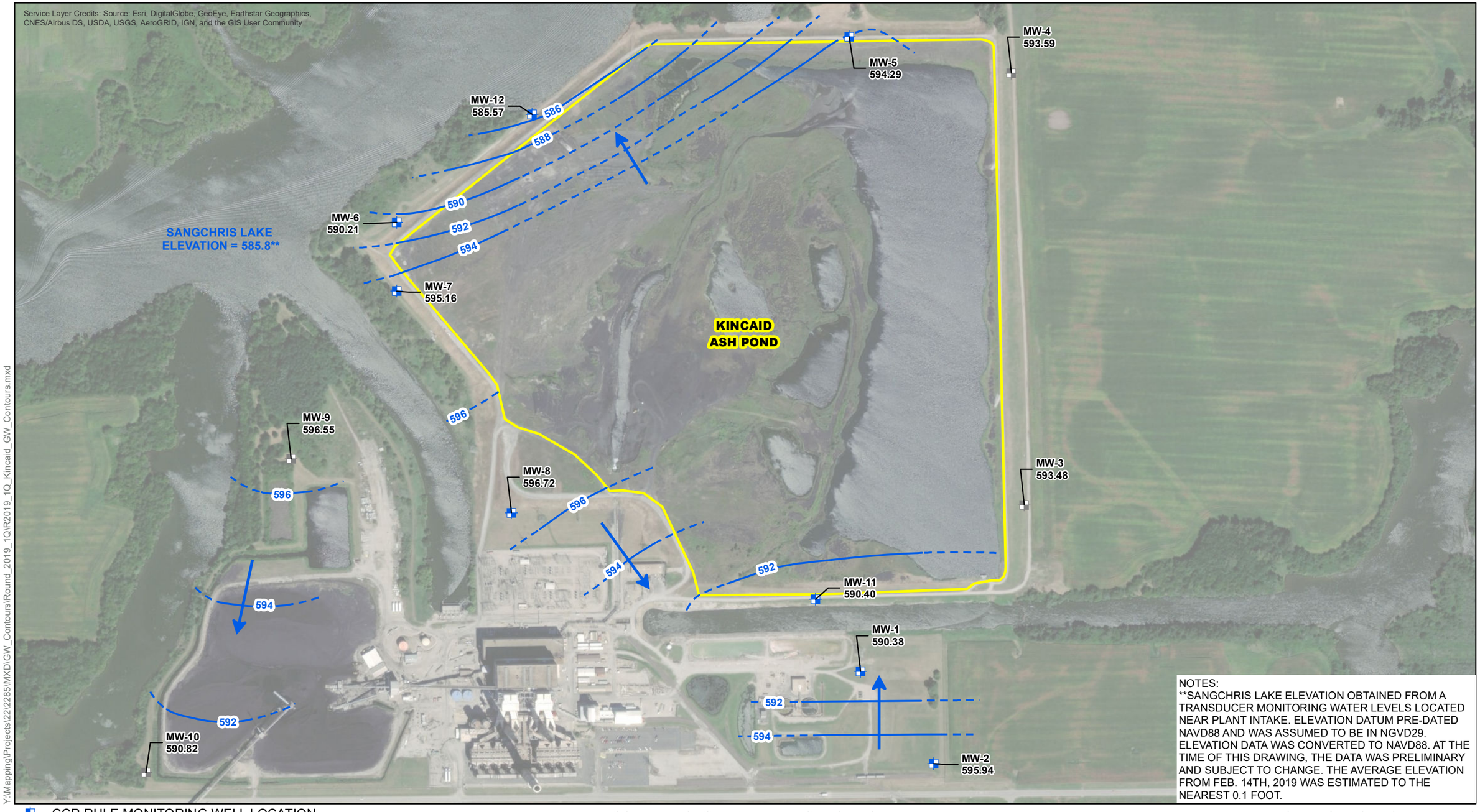
CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

0 125 250 500
Feet

N

KINCAID ASH POND (UNIT ID: 141)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 28, 2018

O'BRIEN & GERE ENGINEERS, INC.



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NOTES:
**SANGCHRIS LAKE ELEVATION OBTAINED FROM A TRANSDUCER MONITORING WATER LEVELS LOCATED NEAR PLANT INTAKE. ELEVATION DATUM PRE-DATED NAVD88 AND WAS ASSUMED TO BE IN NGVD29. ELEVATION DATA WAS CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE. THE AVERAGE ELEVATION FROM FEB. 14TH, 2019 WAS ESTIMATED TO THE NEAREST 0.1 FOOT.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

0 125 250 500
Feet

N

KINCAID ASH POND (UNIT ID: 141)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 14, 2019

O'BRIEN & GERE ENGINEERS, INC.

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NOTES:
**SANGCHRIS LAKE ELEVATION OBTAINED FROM A TRANSDUCER MONITORING WATER LEVELS LOCATED NEAR PLANT INTAKE. ELEVATION DATUM PRE-DATED NAVD88 AND WAS ASSUMED TO BE IN NGVD29. ELEVATION DATA WAS CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE. THE AVERAGE ELEVATION FROM MAY 31 TO JUNE 1, 2018 WAS ESTIMATED TO THE NEAREST 0.1 FOOT.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

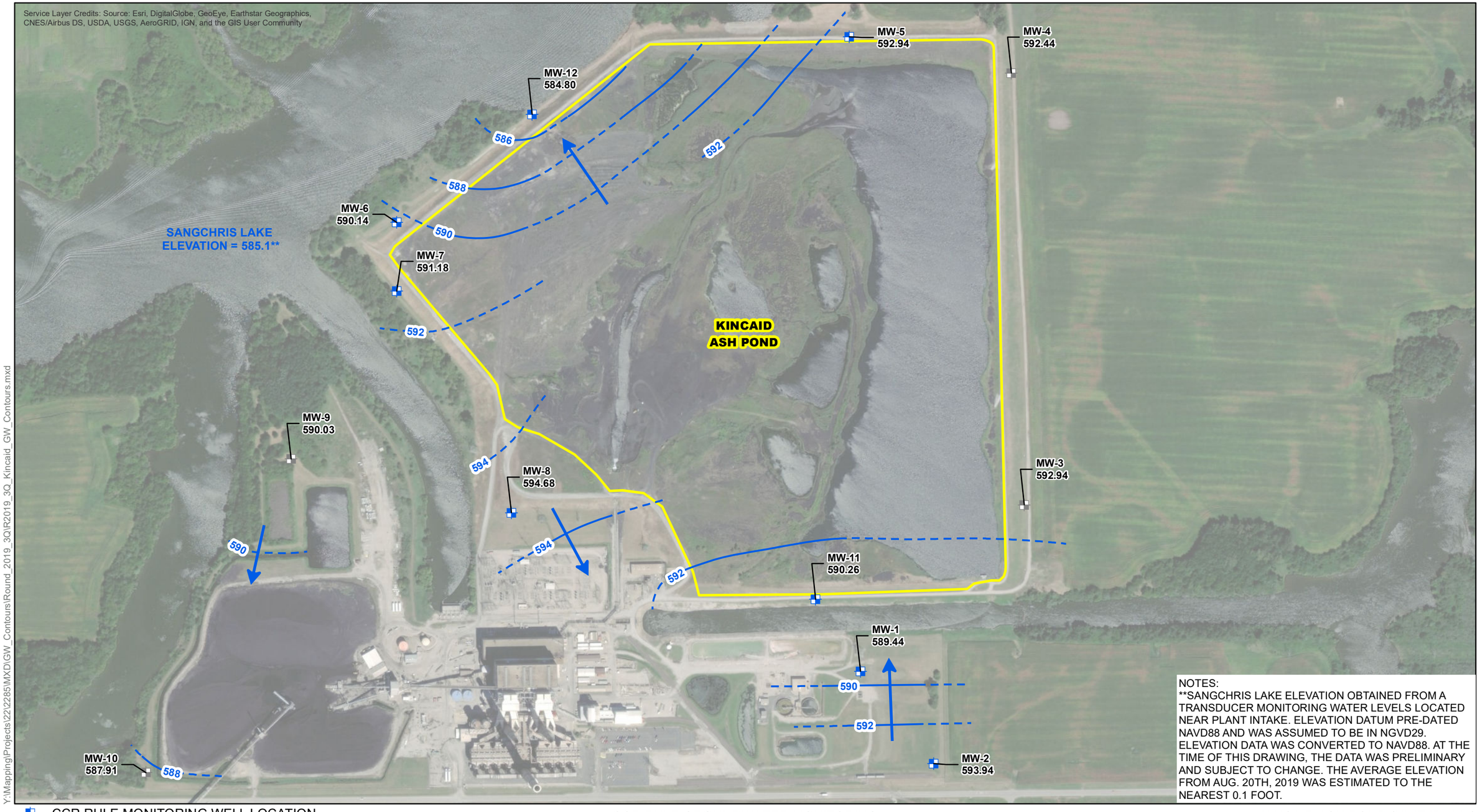
CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

0 125 250 500
Feet

N

KINCAID ASH POND (UNIT ID: 141)
GROUNDWATER ELEVATION CONTOUR MAP
MAY 31 - JUNE 1, 2018

O'BRIEN & GERE ENGINEERS, INC.



NOTES:
**SANGCHRIS LAKE ELEVATION OBTAINED FROM A TRANSDUCER MONITORING WATER LEVELS LOCATED NEAR PLANT INTAKE. ELEVATION DATUM PRE-DATED NAVD88 AND WAS ASSUMED TO BE IN NGVD29. ELEVATION DATA WAS CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE. THE AVERAGE ELEVATION FROM AUG. 20TH, 2019 WAS ESTIMATED TO THE NEAREST 0.1 FOOT.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- CCR MONITORED UNIT

CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

0 125 250 500
Feet

N

KINCAID ASH POND (UNIT ID: 141)
GROUNDWATER ELEVATION CONTOUR MAP
AUGUST 20, 2019

O'BRIEN & GERE ENGINEERS, INC.

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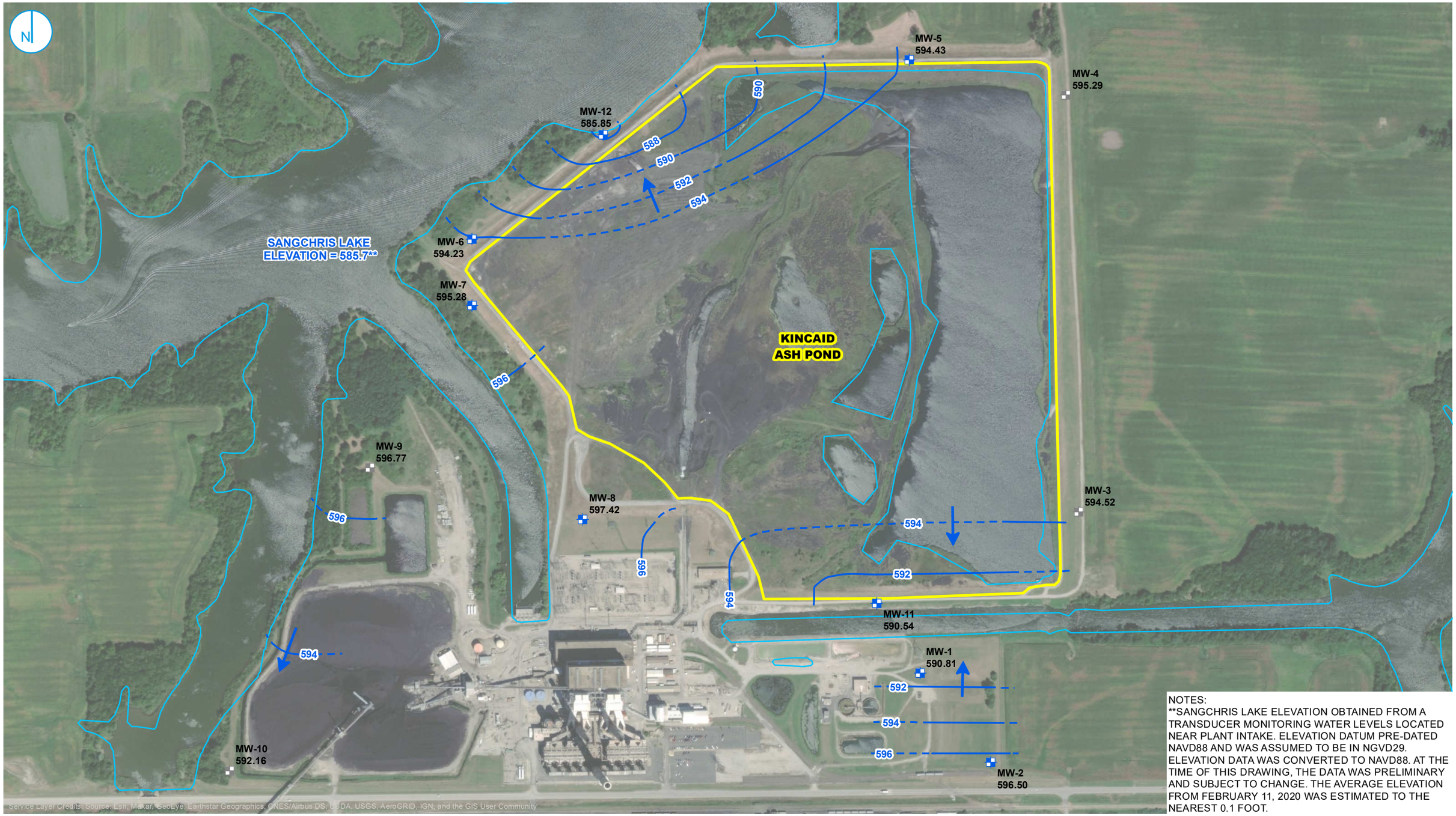
PROJECT: 169000XXXX | DATED: 9/15/2020 | DESIGNER: galammc



NOTES:
**SANGCHRIS LAKE ELEVATION OBTAINED FROM A TRANSDUCER MONITORING WATER LEVELS LOCATED NEAR PLANT INTAKE. ELEVATION DATUM PRE-DATED NAVD88 AND WAS ASSUMED TO BE IN NGVD29. ELEVATION DATA WAS CONVERTED TO NAVD88. AT THE TIME OF THIS DRAWING, THE DATA WAS PRELIMINARY AND SUBJECT TO CHANGE. THE AVERAGE ELEVATION FROM FEBRUARY 11, 2020 WAS ESTIMATED TO THE NEAREST 0.1 FOOT.

- CCR RULE MONITORING WELL LOCATION
- NON-CCR RULE MONITORING WELL LOCATION
- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- SURFACE WATER FEATURE
- CCR MONITORED UNIT

0 250 500 Feet

KINCAID ASH POND (UNIT ID: 141)
GROUNDWATER ELEVATION CONTOUR MAP
FEBRUARY 11, 2020

CCR RULE GROUNDWATER MONITORING
KINCAID POWER STATION
KINCAID, ILLINOIS

FIGURE 1

RAMBOLL US CORPORATION
A RAMBOLL COMPANY

RAMBOLL

TABLE E-1. GROUNDWATER ELEVATION RESULTS

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-1	06/16/2015	604.71
MW-1	12/14/2015	589.14
MW-1	12/15/2015	589.14
MW-1	02/29/2016	589.82
MW-1	05/16/2016	589.77
MW-1	08/22/2016	589.83
MW-1	11/15/2016	588.19
MW-1	02/13/2017	589.37
MW-1	05/18/2017	589.93
MW-1	07/18/2017	588.80
MW-1	11/06/2017	587.63
MW-1	05/31/2018	588.77
MW-1	08/28/2018	590.05
MW-1	11/08/2018	589.66
MW-1	02/14/2019	590.38
MW-1	05/14/2019	590.03
MW-1	08/20/2019	589.44
MW-1	11/13/2019	589.86
MW-1	02/11/2020	590.81
MW-1	05/12/2020	590.05
MW-1	08/26/2020	589.00
MW-1	12/02/2020	588.22
MW-1	02/23/2021	589.03
MW-1	02/24/2021	589.03
MW-1	03/15/2021	589.38
MW-1	03/30/2021	590.48
MW-1	04/05/2021	589.90
MW-1	05/19/2021	592.24
MW-1	06/10/2021	589.60
MW-1	07/01/2021	589.63
MW-1	07/22/2021	589.36
MW-1	08/10/2021	589.63
MW-1	09/01/2021	589.14
MW-2	06/16/2015	601.10
MW-2	12/14/2015	595.87
MW-2	12/15/2015	595.87
MW-2	02/29/2016	595.88
MW-2	05/16/2016	594.58
MW-2	08/22/2016	594.46
MW-2	11/15/2016	593.59
MW-2	02/13/2017	593.90
MW-2	05/18/2017	594.29
MW-2	07/18/2017	592.75
MW-2	11/06/2017	592.42
MW-2	05/31/2018	593.65

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-2	08/28/2018	595.30
MW-2	11/08/2018	595.32
MW-2	02/14/2019	595.94
MW-2	05/14/2019	594.78
MW-2	08/20/2019	593.94
MW-2	11/13/2019	594.15
MW-2	02/11/2020	596.50
MW-2	05/12/2020	594.48
MW-2	08/26/2020	593.43
MW-2	12/02/2020	593.53
MW-2	02/23/2021	594.92
MW-2	02/24/2021	594.92
MW-2	03/15/2021	595.03
MW-2	03/30/2021	596.21
MW-2	04/05/2021	594.46
MW-2	05/19/2021	596.68
MW-2	06/10/2021	594.12
MW-2	07/01/2021	594.79
MW-2	07/22/2021	593.95
MW-2	08/10/2021	595.70
MW-2	09/01/2021	594.10
MW-3	12/14/2015	593.38
MW-3	05/16/2016	592.92
MW-3	11/15/2016	592.91
MW-3	02/13/2017	593.06
MW-3	05/18/2017	592.99
MW-3	07/18/2017	592.37
MW-3	11/06/2017	592.97
MW-3	05/31/2018	591.72
MW-3	08/28/2018	593.40
MW-3	11/08/2018	593.00
MW-3	02/14/2019	593.48
MW-3	05/14/2019	593.18
MW-3	08/20/2019	592.94
MW-3	02/11/2020	594.52
MW-3	05/12/2020	593.17
MW-3	08/26/2020	592.83
MW-3	12/02/2020	592.82
MW-3	02/23/2021	593.71
MW-3	02/25/2021	593.71
MW-3	03/15/2021	593.20
MW-3	03/16/2021	593.20
MW-3	03/30/2021	594.05
MW-3	04/05/2021	593.15
MW-3	05/18/2021	598.11

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-3	06/09/2021	592.88
MW-3	07/01/2021	592.86
MW-3	07/22/2021	592.82
MW-3	08/10/2021	593.34
MW-3	09/01/2021	591.57
MW-4	12/14/2015	593.81
MW-4	05/16/2016	593.28
MW-4	11/15/2016	593.25
MW-4	02/13/2017	593.30
MW-4	05/18/2017	593.26
MW-4	07/18/2017	592.14
MW-4	11/06/2017	590.75
MW-4	05/31/2018	593.29
MW-4	08/28/2018	593.48
MW-4	11/08/2018	593.48
MW-4	02/14/2019	593.59
MW-4	05/14/2019	593.39
MW-4	08/20/2019	592.44
MW-4	02/11/2020	595.29
MW-4	05/12/2020	593.42
MW-4	08/26/2020	592.82
MW-4	12/02/2020	592.56
MW-4	02/23/2021	593.41
MW-4	02/25/2021	593.41
MW-4	03/15/2021	593.45
MW-4	03/16/2021	593.45
MW-4	03/30/2021	594.38
MW-4	04/05/2021	593.33
MW-4	04/06/2021	593.33
MW-4	05/19/2021	597.08
MW-4	06/09/2021	594.37
MW-4	07/01/2021	595.32
MW-4	07/22/2021	593.20
MW-4	08/10/2021	593.49
MW-4	09/01/2021	592.30
MW-5	06/16/2015	619.44
MW-5	12/14/2015	593.99
MW-5	12/15/2015	593.99
MW-5	02/29/2016	594.00
MW-5	05/16/2016	593.61
MW-5	08/22/2016	593.26
MW-5	11/15/2016	592.44
MW-5	02/13/2017	593.54
MW-5	05/18/2017	593.32
MW-5	07/18/2017	591.61

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-5	11/06/2017	590.64
MW-5	05/31/2018	592.94
MW-5	08/28/2018	593.77
MW-5	11/08/2018	593.84
MW-5	02/14/2019	594.29
MW-5	05/14/2019	593.85
MW-5	08/20/2019	592.94
MW-5	11/14/2019	593.77
MW-5	02/11/2020	594.43
MW-5	05/12/2020	593.91
MW-5	08/26/2020	591.82
MW-5	12/02/2020	591.53
MW-5	02/23/2021	594.09
MW-5	03/15/2021	594.36
MW-5	03/30/2021	594.41
MW-5	04/05/2021	593.84
MW-5	05/20/2021	594.57
MW-5	06/09/2021	593.15
MW-5	07/01/2021	593.94
MW-5	07/22/2021	593.09
MW-5	08/10/2021	594.66
MW-5	09/01/2021	593.13
MW-6	06/16/2015	600.46
MW-6	12/14/2015	590.25
MW-6	12/15/2015	590.25
MW-6	02/29/2016	592.76
MW-6	05/16/2016	592.15
MW-6	08/22/2016	592.31
MW-6	11/15/2016	589.50
MW-6	02/13/2017	591.61
MW-6	05/18/2017	593.45
MW-6	07/18/2017	589.38
MW-6	11/06/2017	588.21
MW-6	05/31/2018	590.71
MW-6	08/28/2018	593.18
MW-6	11/08/2018	592.61
MW-6	02/14/2019	590.21
MW-6	02/15/2019	594.21
MW-6	05/14/2019	593.46
MW-6	08/20/2019	590.14
MW-6	11/13/2019	592.19
MW-6	02/11/2020	594.23
MW-6	05/12/2020	593.49
MW-6	08/26/2020	590.40
MW-6	12/02/2020	588.64

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-6	02/23/2021	592.01
MW-6	03/15/2021	592.27
MW-6	03/30/2021	594.96
MW-6	04/05/2021	593.71
MW-6	05/21/2021	595.26
MW-6	06/10/2021	591.58
MW-6	07/01/2021	590.43
MW-6	07/22/2021	591.82
MW-6	08/10/2021	592.67
MW-6	09/01/2021	591.27
MW-7	06/17/2015	597.75
MW-7	12/14/2015	595.14
MW-7	12/15/2015	595.14
MW-7	02/29/2016	595.33
MW-7	05/16/2016	589.11
MW-7	08/22/2016	588.66
MW-7	11/15/2016	589.22
MW-7	02/13/2017	588.95
MW-7	05/18/2017	588.63
MW-7	05/19/2017	588.63
MW-7	07/18/2017	587.56
MW-7	11/06/2017	588.02
MW-7	11/07/2017	588.02
MW-7	06/01/2018	588.10
MW-7	08/28/2018	589.18
MW-7	11/08/2018	589.00
MW-7	02/14/2019	595.16
MW-7	02/15/2019	595.16
MW-7	05/14/2019	590.46
MW-7	08/20/2019	591.18
MW-7	11/13/2019	588.69
MW-7	02/11/2020	595.28
MW-7	05/12/2020	589.51
MW-7	08/26/2020	587.70
MW-7	12/02/2020	586.57
MW-7	02/23/2021	589.45
MW-7	03/15/2021	594.86
MW-7	03/30/2021	590.96
MW-7	04/05/2021	588.64
MW-7	05/21/2021	591.55
MW-7	06/10/2021	586.86
MW-7	07/01/2021	592.54
MW-7	07/22/2021	587.73
MW-7	08/10/2021	595.40
MW-7	09/01/2021	593.93

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-7S	02/23/2021	587.18
MW-7S	02/24/2021	587.18
MW-7S	03/15/2021	587.26
MW-7S	03/16/2021	587.26
MW-7S	04/05/2021	587.12
MW-7S	04/06/2021	587.12
MW-7S	05/21/2021	587.86
MW-7S	06/10/2021	587.44
MW-7S	07/02/2021	587.34
MW-7S	07/23/2021	587.33
MW-7S	08/11/2021	587.73
MW-8	06/17/2015	603.14
MW-8	12/14/2015	595.68
MW-8	12/15/2015	595.68
MW-8	02/29/2016	597.61
MW-8	05/16/2016	594.39
MW-8	08/22/2016	594.46
MW-8	11/15/2016	593.20
MW-8	02/13/2017	594.05
MW-8	05/18/2017	594.30
MW-8	05/19/2017	594.30
MW-8	07/18/2017	593.16
MW-8	11/06/2017	593.59
MW-8	11/07/2017	593.59
MW-8	06/01/2018	593.27
MW-8	08/28/2018	597.19
MW-8	11/08/2018	594.24
MW-8	02/14/2019	596.72
MW-8	05/14/2019	595.03
MW-8	08/20/2019	594.68
MW-8	11/14/2019	594.40
MW-8	02/11/2020	597.42
MW-8	05/12/2020	594.93
MW-8	08/26/2020	593.30
MW-8	12/02/2020	593.90
MW-8	02/23/2021	595.54
MW-8	03/15/2021	595.97
MW-8	03/30/2021	597.13
MW-8	04/05/2021	594.70
MW-8	05/21/2021	597.33
MW-8	06/10/2021	593.85
MW-8	07/01/2021	598.50
MW-8	07/22/2021	594.15
MW-8	08/10/2021	596.10
MW-8	09/01/2021	594.91

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-8S	02/23/2021	594.97
MW-8S	02/24/2021	594.97
MW-8S	03/15/2021	594.85
MW-8S	03/17/2021	594.85
MW-8S	04/05/2021	594.45
MW-8S	04/06/2021	594.45
MW-8S	05/21/2021	597.46
MW-8S	06/10/2021	593.90
MW-9	12/14/2015	587.69
MW-9	05/16/2016	594.59
MW-9	11/15/2016	585.95
MW-9	02/13/2017	590.05
MW-9	05/18/2017	594.59
MW-9	07/18/2017	587.95
MW-9	11/06/2017	583.15
MW-9	06/01/2018	590.00
MW-9	08/28/2018	589.59
MW-9	11/08/2018	587.86
MW-9	02/14/2019	596.55
MW-9	05/14/2019	595.34
MW-9	08/20/2019	590.03
MW-9	02/11/2020	596.77
MW-9	05/12/2020	595.14
MW-9	08/26/2020	590.19
MW-9	12/02/2020	584.93
MW-9	02/23/2021	590.65
MW-9	03/15/2021	593.28
MW-9	03/30/2021	596.07
MW-9	04/05/2021	595.16
MW-9	05/21/2021	595.70
MW-9	06/10/2021	590.55
MW-9	07/01/2021	590.54
MW-9	07/22/2021	588.84
MW-9	08/10/2021	590.23
MW-9	09/01/2021	587.63
MW-10	12/14/2015	588.99
MW-10	05/16/2016	589.51
MW-10	11/15/2016	587.00
MW-10	02/13/2017	587.96
MW-10	05/18/2017	589.65
MW-10	07/18/2017	586.29
MW-10	11/06/2017	586.27
MW-10	06/01/2018	587.14
MW-10	08/28/2018	588.90
MW-10	11/08/2018	585.03

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-10	02/14/2019	590.82
MW-10	05/14/2019	590.44
MW-10	08/20/2019	587.91
MW-10	02/11/2020	592.16
MW-10	05/12/2020	591.21
MW-10	08/26/2020	587.46
MW-10	12/02/2020	587.21
MW-10	02/23/2021	588.69
MW-10	03/15/2021	589.21
MW-10	03/30/2021	591.71
MW-10	04/05/2021	590.58
MW-10	05/21/2021	592.26
MW-10	06/10/2021	588.19
MW-10	07/01/2021	587.97
MW-10	07/22/2021	587.53
MW-10	08/10/2021	587.88
MW-10	09/01/2021	585.27
MW-11	12/14/2015	590.36
MW-11	02/29/2016	590.40
MW-11	05/16/2016	590.15
MW-11	08/22/2016	590.18
MW-11	11/15/2016	590.10
MW-11	02/13/2017	590.19
MW-11	05/18/2017	590.15
MW-11	07/18/2017	589.89
MW-11	11/06/2017	590.06
MW-11	05/31/2018	590.06
MW-11	08/28/2018	590.21
MW-11	11/08/2018	590.17
MW-11	02/14/2019	590.40
MW-11	05/14/2019	590.22
MW-11	08/20/2019	590.26
MW-11	11/13/2019	589.96
MW-11	02/11/2020	590.54
MW-11	05/12/2020	590.25
MW-11	08/26/2020	590.05
MW-11	12/02/2020	590.05
MW-11	02/23/2021	590.21
MW-11	03/15/2021	590.53
MW-11	03/30/2021	590.36
MW-11	04/05/2021	590.22
MW-11	05/18/2021	591.66
MW-11	06/09/2021	590.12
MW-11	07/01/2021	590.21
MW-11	07/22/2021	590.06

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-11	08/10/2021	590.32
MW-11	09/01/2021	590.21
MW-11S	05/19/2021	591.82
MW-12	12/14/2015	584.09
MW-12	02/29/2016	585.23
MW-12	05/16/2016	585.24
MW-12	08/22/2016	585.02
MW-12	11/15/2016	583.89
MW-12	02/13/2017	585.05
MW-12	05/18/2017	585.38
MW-12	07/18/2017	584.57
MW-12	11/06/2017	583.17
MW-12	05/31/2018	585.02
MW-12	08/28/2018	585.11
MW-12	11/08/2018	585.09
MW-12	02/14/2019	585.57
MW-12	05/14/2019	585.45
MW-12	08/20/2019	584.80
MW-12	11/13/2019	585.12
MW-12	02/11/2020	585.85
MW-12	05/12/2020	585.05
MW-12	08/26/2020	584.65
MW-12	12/02/2020	583.81
MW-12	02/23/2021	584.12
MW-12	03/15/2021	584.70
MW-12	03/30/2021	585.65
MW-12	04/05/2021	585.10
MW-12	05/20/2021	586.59
MW-12	06/10/2021	585.02
MW-12	07/01/2021	585.41
MW-12	07/22/2021	584.98
MW-12	08/10/2021	585.05
MW-12	09/01/2021	585.02
MW-12S	02/23/2021	584.81
MW-12S	02/25/2021	584.81
MW-12S	03/15/2021	585.43
MW-12S	03/16/2021	585.43
MW-12S	04/05/2021	585.53
MW-12S	04/06/2021	585.53
MW-12S	05/20/2021	587.19
MW-12S	06/10/2021	585.27
MW-12S	07/02/2021	585.60
MW-12S	07/23/2021	585.12
MW-12S	08/11/2021	585.31
MW-12D	02/23/2021	584.55

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-12D	02/25/2021	584.55
MW-12D	03/15/2021	585.36
MW-12D	03/16/2021	585.36
MW-12D	04/05/2021	586.23
MW-12D	04/06/2021	586.23
MW-12D	05/20/2021	587.18
MW-12D	06/10/2021	586.55
MW-12D	07/02/2021	586.71
MW-12D	07/23/2021	586.58
MW-12D	08/11/2021	586.71
MW-20	02/23/2021	594.82
MW-20	02/26/2021	594.82
MW-20	03/15/2021	595.12
MW-20	03/16/2021	595.12
MW-20	04/05/2021	595.05
MW-20	04/06/2021	595.05
MW-20	05/18/2021	598.93
MW-20	06/09/2021	594.68
MW-20	07/01/2021	595.07
MW-20	07/22/2021	594.18
MW-20	08/10/2021	594.91
MW-20S	02/23/2021	594.83
MW-20S	02/26/2021	594.83
MW-20S	03/15/2021	595.19
MW-20S	03/16/2021	595.19
MW-20S	04/05/2021	595.05
MW-20S	04/06/2021	595.05
MW-20S	05/19/2021	599.06
MW-20S	06/09/2021	594.64
MW-20S	07/01/2021	595.04
MW-20S	07/22/2021	594.17
MW-20S	08/10/2021	594.95
MW-22	02/23/2021	596.14
MW-22	02/26/2021	596.14
MW-22	03/15/2021	596.20
MW-22	03/17/2021	596.20
MW-22	04/05/2021	595.33
MW-22	04/07/2021	595.33
MW-22	05/18/2021	597.51
MW-22	06/09/2021	594.94
MW-22	07/01/2021	595.65
MW-22	07/22/2021	594.93
MW-22	08/10/2021	595.48
MW-23	02/23/2021	594.21
MW-23	02/26/2021	594.21

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-23	03/15/2021	594.14
MW-23	03/18/2021	594.14
MW-23	04/05/2021	594.03
MW-23	04/06/2021	594.03
MW-23	05/19/2021	595.87
MW-23	06/09/2021	593.63
MW-23	07/01/2021	593.82
MW-23	07/22/2021	593.54
MW-23	08/10/2021	593.93
MW-24	02/23/2021	592.21
MW-24	03/01/2021	592.21
MW-24	03/15/2021	593.41
MW-24	03/18/2021	593.41
MW-24	04/05/2021	593.93
MW-24	04/07/2021	593.93
MW-24	05/19/2021	594.36
MW-24	06/09/2021	593.65
MW-24	07/01/2021	590.51
MW-24	07/22/2021	593.47
MW-25	02/23/2021	601.41
MW-25	02/25/2021	601.41
MW-25	03/15/2021	601.60
MW-25	03/17/2021	601.60
MW-25	04/05/2021	601.24
MW-25	04/07/2021	601.24
MW-25	05/21/2021	602.14
MW-25	06/09/2021	583.98
MW-25	07/01/2021	601.23
MW-25	07/22/2021	600.36
MW-25	08/11/2021	601.24
MW-26	02/23/2021	588.87
MW-26	02/25/2021	588.87
MW-26	03/15/2021	589.61
MW-26	03/17/2021	589.61
MW-26	04/05/2021	591.21
MW-26	04/06/2021	591.21
MW-26	05/21/2021	592.50
MW-26	06/09/2021	589.04
MW-26	07/01/2021	586.18
MW-26	07/22/2021	585.02
MW-26	08/10/2021	586.14
MW-27	02/23/2021	586.05
MW-27	02/24/2021	586.05
MW-27	03/15/2021	587.14
MW-27	03/16/2021	587.14

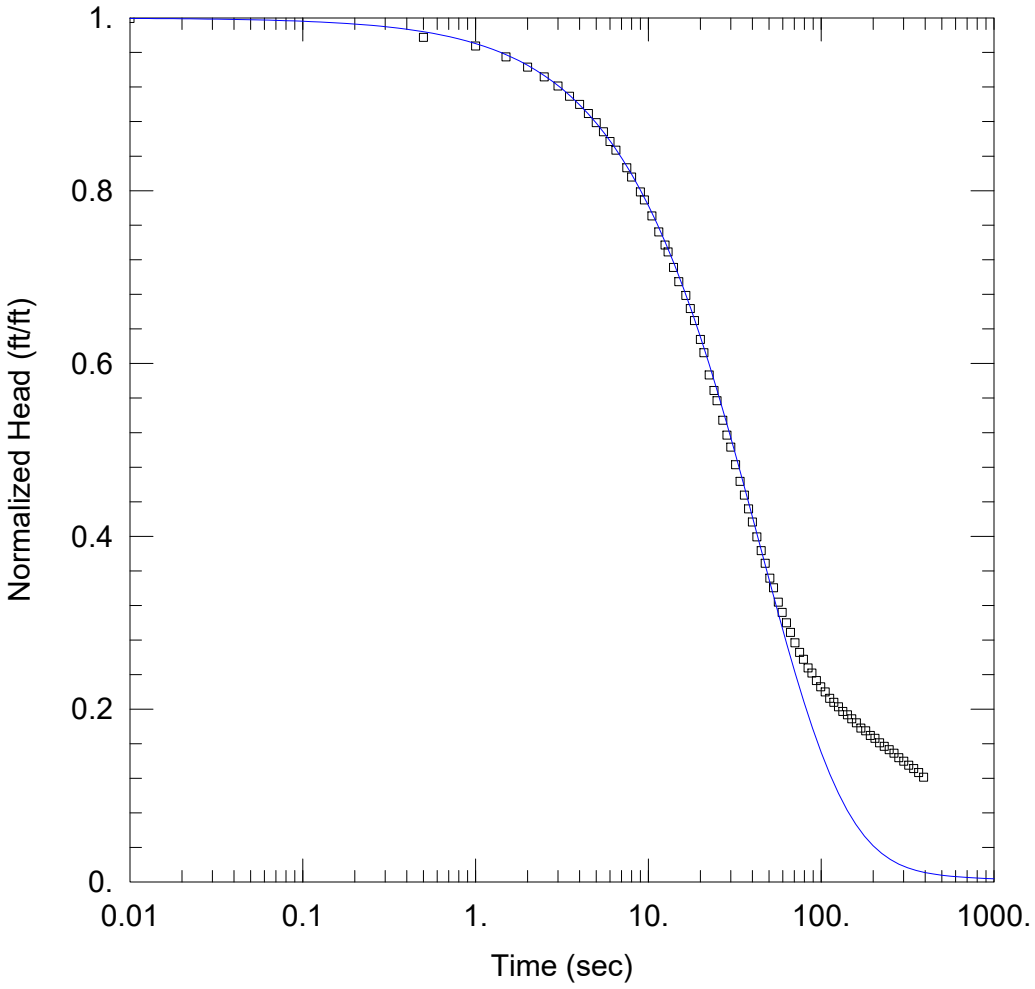
Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-27	04/05/2021	591.44
MW-27	04/06/2021	591.44
MW-27	05/21/2021	594.44
MW-27	06/10/2021	583.38
MW-27	07/02/2021	585.55
MW-27	07/23/2021	584.70
MW-27	08/11/2021	585.72
MW-28	02/23/2021	595.40
MW-28	02/24/2021	595.40
MW-28	03/15/2021	595.92
MW-28	03/16/2021	595.92
MW-28	04/05/2021	595.85
MW-28	04/07/2021	595.85
MW-28	05/18/2021	597.59
MW-28	06/10/2021	594.85
MW-28	07/02/2021	594.20
MW-28	07/23/2021	593.48
MW-28	08/11/2021	595.14
MW-29	02/23/2021	595.74
MW-29	02/25/2021	595.74
MW-29	03/15/2021	596.20
MW-29	03/16/2021	596.20
MW-29	04/05/2021	596.58
MW-29	04/06/2021	596.58
MW-29	05/21/2021	597.06
MW-29	06/10/2021	595.41
MW-29	07/02/2021	595.14
MW-29	07/23/2021	594.94
MW-29	08/11/2021	595.36
MW-30	02/23/2021	593.97
MW-30	02/25/2021	593.97
MW-30	03/15/2021	594.53
MW-30	03/17/2021	594.53
MW-30	04/05/2021	594.90
MW-30	04/07/2021	594.90
MW-30	05/20/2021	595.69
MW-30	06/09/2021	593.99
MW-30	07/01/2021	593.96
MW-30	07/22/2021	593.72
MW-30	08/10/2021	593.37
MW-31	02/23/2021	587.68
MW-31	02/24/2021	587.68
MW-31	03/15/2021	587.96
MW-31	03/17/2021	587.96
MW-31	04/05/2021	587.86

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
MW-31	04/07/2021	587.86
MW-31	05/20/2021	588.63
MW-31	06/09/2021	586.66
MW-31	07/01/2021	594.19
MW-31	07/22/2021	586.69
MW-31	08/10/2021	587.49
MW-31S	02/23/2021	591.18
MW-31S	02/24/2021	591.18
MW-31S	03/15/2021	591.83
MW-31S	03/17/2021	591.83
MW-31S	04/05/2021	590.92
MW-31S	04/06/2021	590.92
MW-31S	05/20/2021	592.83
MW-31S	06/10/2021	588.77
MW-31S	07/01/2021	588.55
MW-31S	07/23/2021	588.55
MW-31S	08/10/2021	588.30
MW-32	02/23/2021	596.90
MW-32	02/25/2021	596.90
MW-32	03/15/2021	596.92
MW-32	03/17/2021	596.92
MW-32	04/05/2021	596.93
MW-32	04/07/2021	596.93
MW-32	05/19/2021	598.69
MW-32	06/09/2021	596.24
MW-32	07/01/2021	596.38
MW-32	07/22/2021	596.09
MW-32	08/10/2021	596.34
PZ-4C	02/23/2021	593.95
PZ-4C	02/25/2021	593.95
PZ-4C	03/15/2021	594.09
PZ-4C	03/16/2021	594.09
PZ-4C	04/05/2021	593.92
PZ-4C	05/20/2021	595.67
PZ-4C	06/10/2021	593.78
PZ-4C	07/02/2021	593.87
PZ-4C	07/23/2021	593.42
PZ-4C	08/11/2021	593.75
XPW01	02/23/2021	603.48
XPW01	03/01/2021	603.48
XPW01	03/15/2021	603.48
XPW01	03/18/2021	603.48
XPW01	04/05/2021	603.40
XPW01	04/07/2021	603.40
XPW01	05/21/2021	603.18

Sample Location	Sample Date	Groundwater Elevation (ft NAVD88)
XPW01	06/10/2021	603.19
XPW01	07/02/2021	603.28
XPW01	07/22/2021	603.14
XPW01	08/11/2021	603.39
XPW02	02/23/2021	603.78
XPW02	03/01/2021	603.78
XPW02	03/15/2021	603.71
XPW02	03/18/2021	603.71
XPW02	04/05/2021	603.91
XPW02	04/07/2021	603.91
XPW02	05/21/2021	603.91
XPW02	06/10/2021	603.79
XPW02	07/02/2021	603.59
XPW02	07/22/2021	603.50
XPW02	08/11/2021	603.61
XPW03	02/23/2021	600.95
XPW03	03/02/2021	600.95
XPW03	03/15/2021	600.93
XPW03	03/18/2021	600.93
XPW03	04/05/2021	601.23
XPW03	04/07/2021	601.23
XPW03	05/20/2021	601.02
XPW03	06/10/2021	601.63
XPW03	07/01/2021	600.76
XPW03	07/22/2021	600.86
XPW03	08/11/2021	600.85
XPW04	02/23/2021	603.42
XPW04	03/02/2021	603.42
XPW04	03/15/2021	603.42
XPW04	03/18/2021	603.42
XPW04	04/05/2021	603.21
XPW04	04/07/2021	603.21
XPW04	05/20/2021	603.24
XPW04	06/09/2021	602.79
XPW04	07/01/2021	602.88
XPW04	07/22/2021	602.92
XPW04	08/10/2021	603.10
XSG-01	05/21/2021	607.26
XSG-01	06/09/2021	606.93
XSG-01	07/01/2021	607.26
XSG-01	07/22/2021	607.38
SG-02	05/21/2021	585.62
SG-02	06/09/2021	585.20

Notes:
ft NAVD88 = feet relative to the North American Vertical Datum 1988, GEOID 12A

APPENDIX F
HYDRAULIC CONDUCTIVITY TEST DATA



12D FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/09/2021

AQUIFER DATA

Saturated Thickness: 9.3 ft

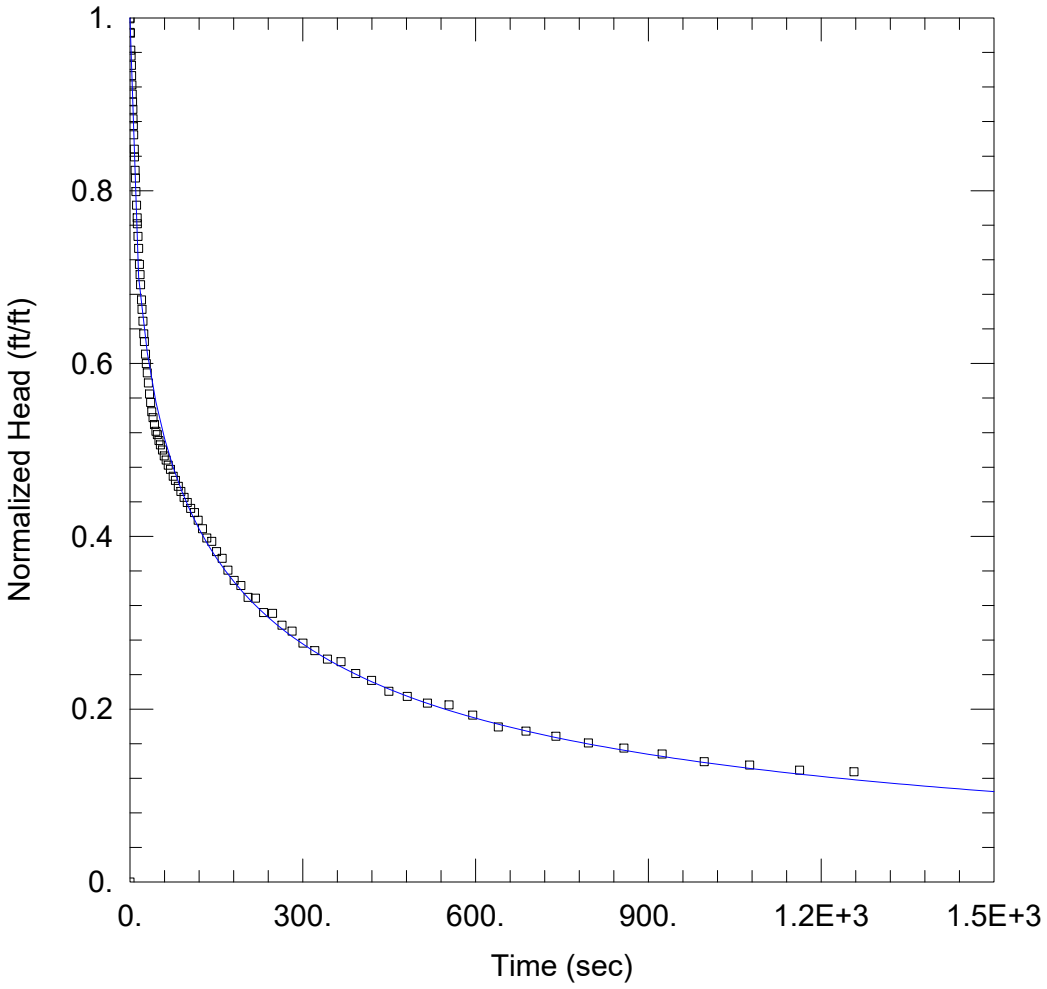
WELL DATA (12D)

Initial Displacement: 1.51 ft
Total Well Penetration Depth: 7.7 ft
Casing Radius: 0.086 ft
Static Water Column Height: 52.3 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.00169 cm/sec
Kz/Kr = 1.
Ss = 4.39E-7 ft^{-1}



12S FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/09/2021

AQUIFER DATA

Saturated Thickness: 36.9 ft

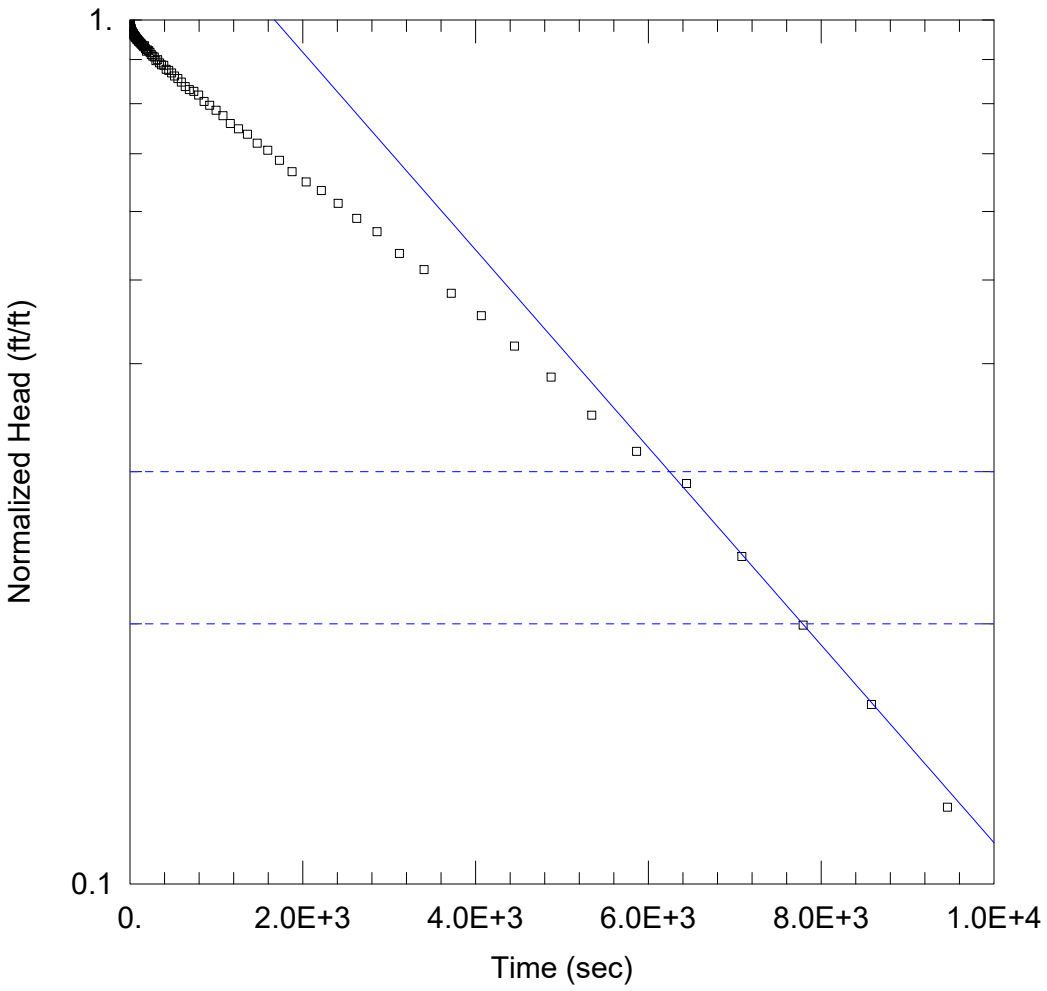
WELL DATA (12S)

Initial Displacement: 1.02 ft
Total Well Penetration Depth: 5.97 ft
Casing Radius: 0.086 ft
Static Water Column Height: 5.969 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: KGS Model

Kr = 3.3E-5 cm/sec
Kz/Kr = 1.
Ss = 0.0472 ft^{-1}



20 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/09/2021

AQUIFER DATA

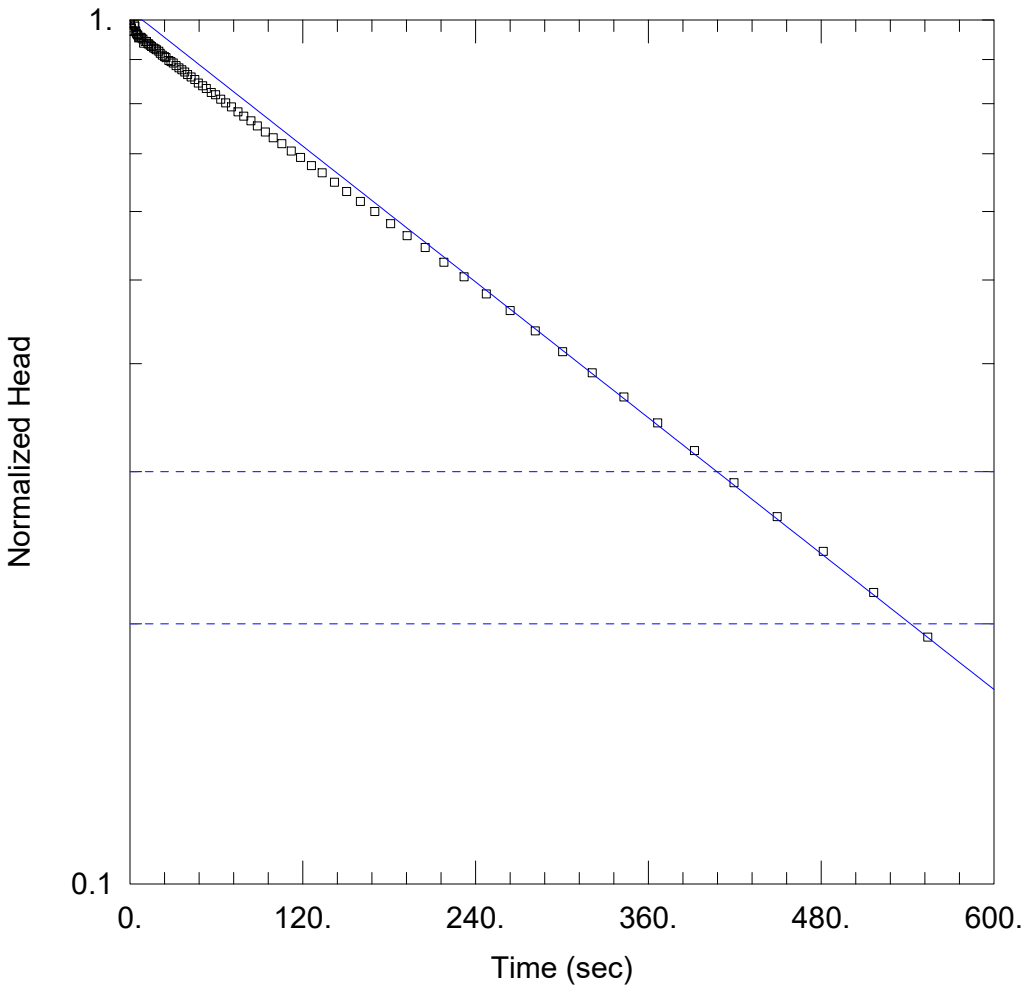
Saturated Thickness: 22.8 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (20)

Initial Displacement: 1.5 ft
Total Well Penetration Depth: 9. ft
Casing Radius: 0.086 ft
Static Water Column Height: 6.44 ft
Screen Length: 9. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 6.77E-6 cm/sec
y0 = 2.33 ft



20S FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/09/2021

AQUIFER DATA

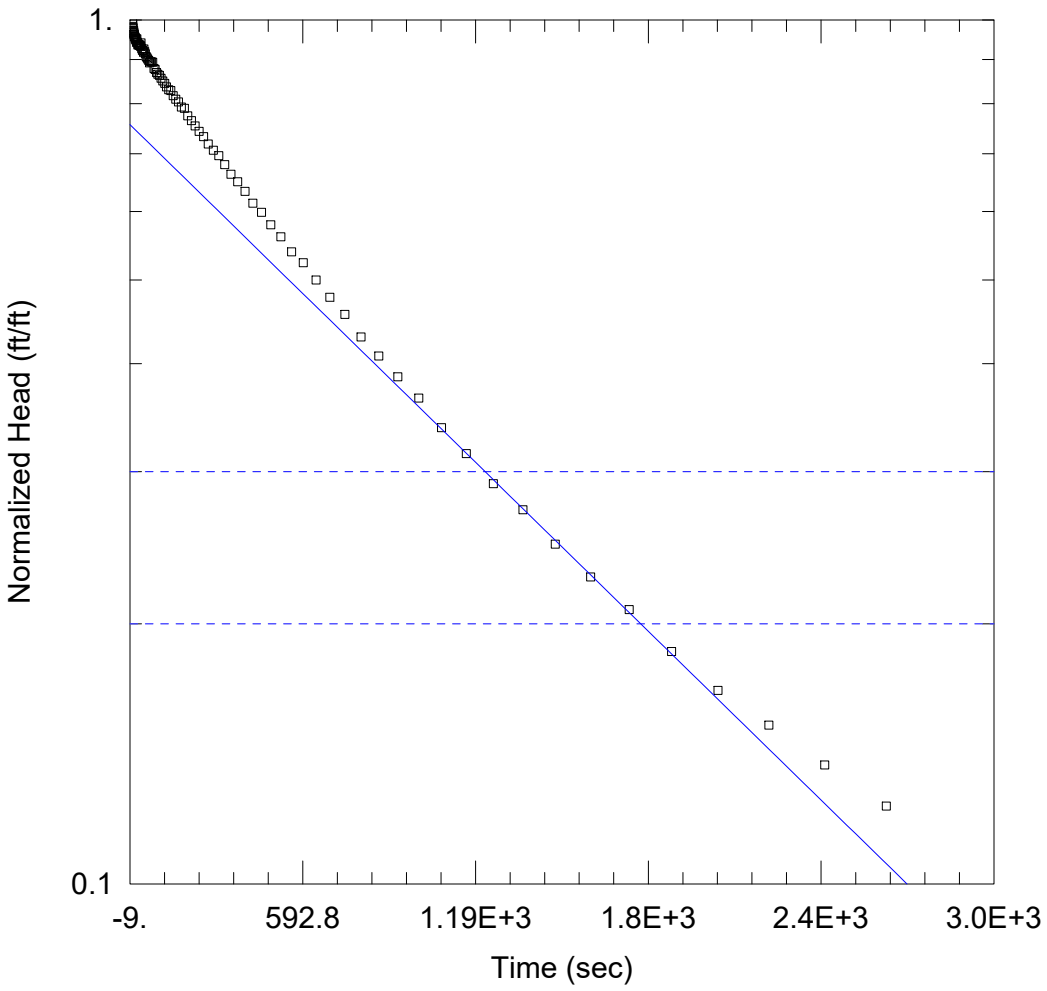
Saturated Thickness: 6.75 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (20S)

Initial Displacement: 1.15 ft
Total Well Penetration Depth: 6.75 ft
Casing Radius: 0.086 ft
Static Water Column Height: 6.75 ft
Screen Length: 6. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.000122 cm/sec
y0 = 1.18 ft



22 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 03/18/2021

AQUIFER DATA

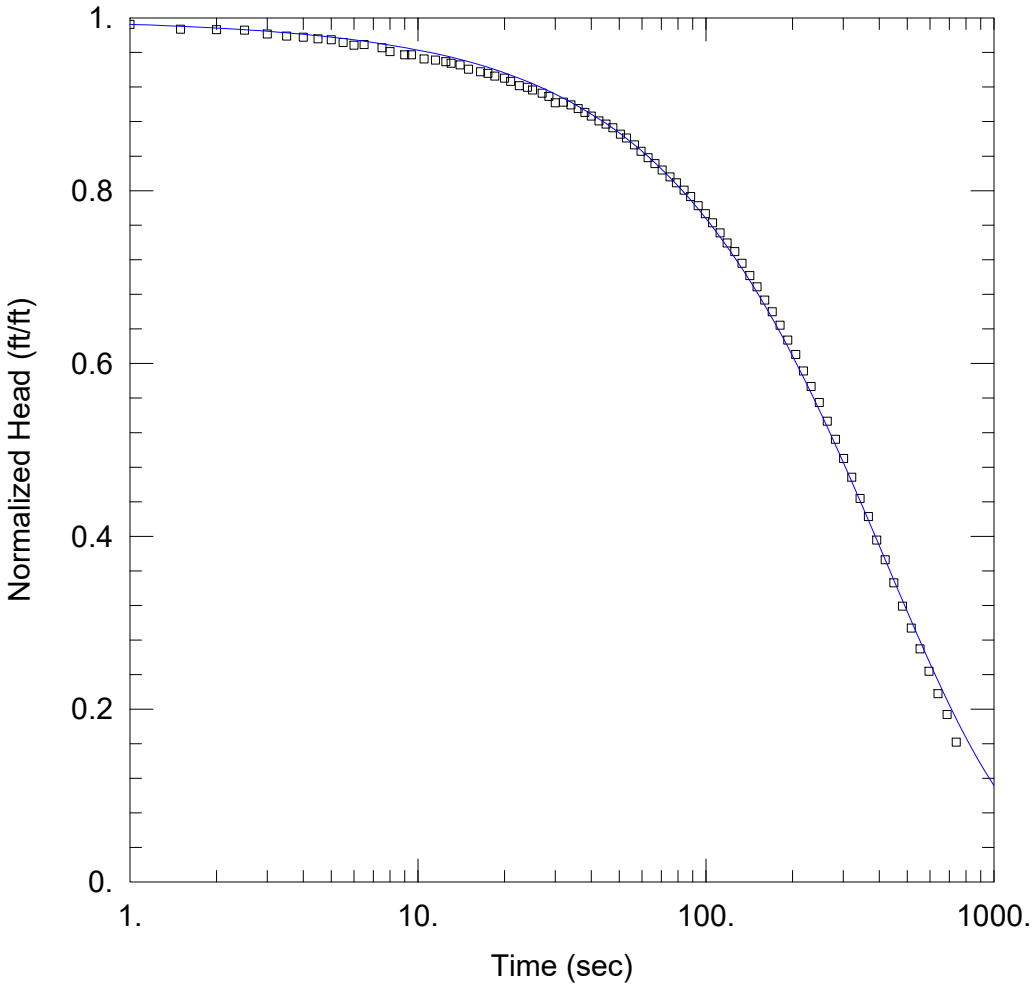
Saturated Thickness: 50.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (22)

Initial Displacement: 1.69 ft
Total Well Penetration Depth: 2.3 ft
Casing Radius: 0.086 ft
Static Water Column Height: 16.8 ft
Screen Length: 2.3 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 3.8E-5 cm/sec
y0 = 1.27 ft



23 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

Saturated Thickness: 48.3 ft

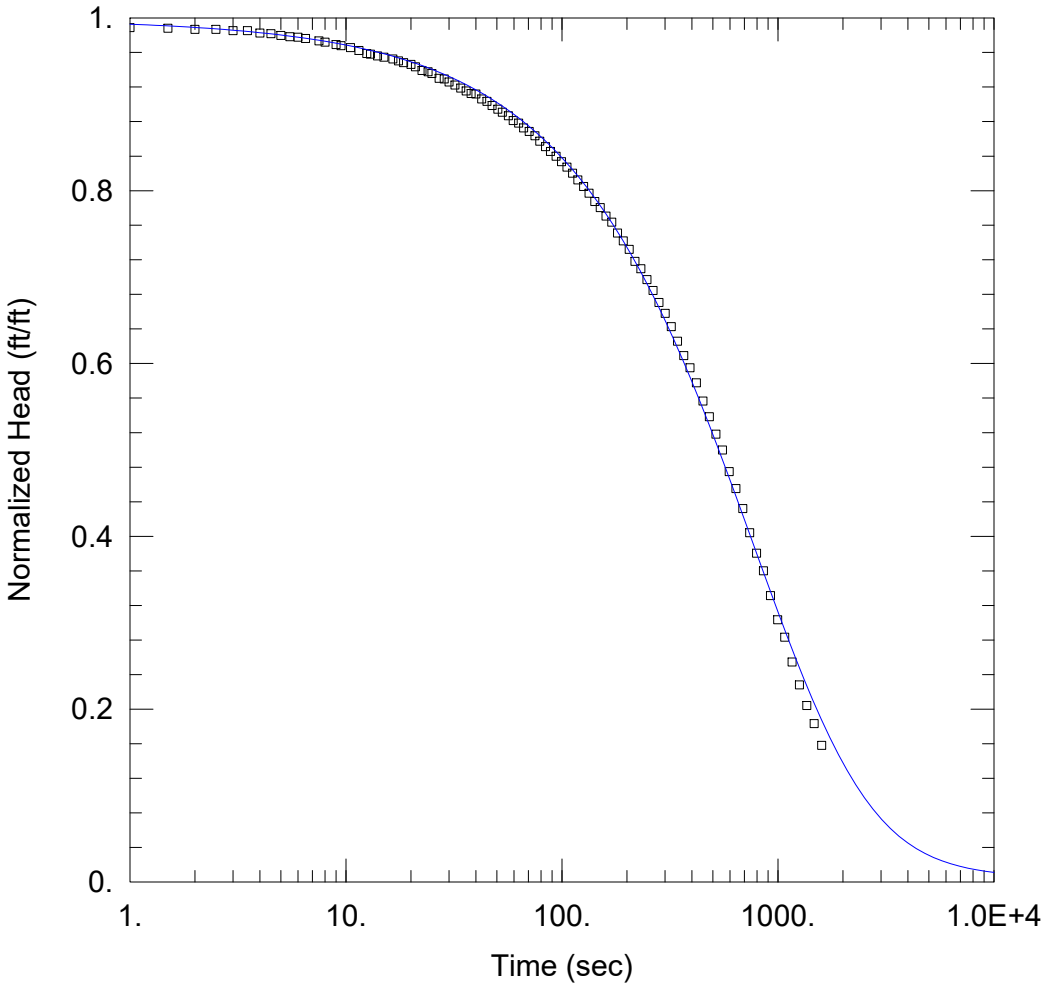
WELL DATA (23)

Initial Displacement: 1.62 ft
Total Well Penetration Depth: 0.7 ft
Casing Radius: 0.08625 ft
Static Water Column Height: 14.2 ft
Screen Length: 0.7 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.000535 cm/sec
Kz/Kr = 1.
Ss = 0.000399 ft^{-1}



25 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

Saturated Thickness: 5.4 ft

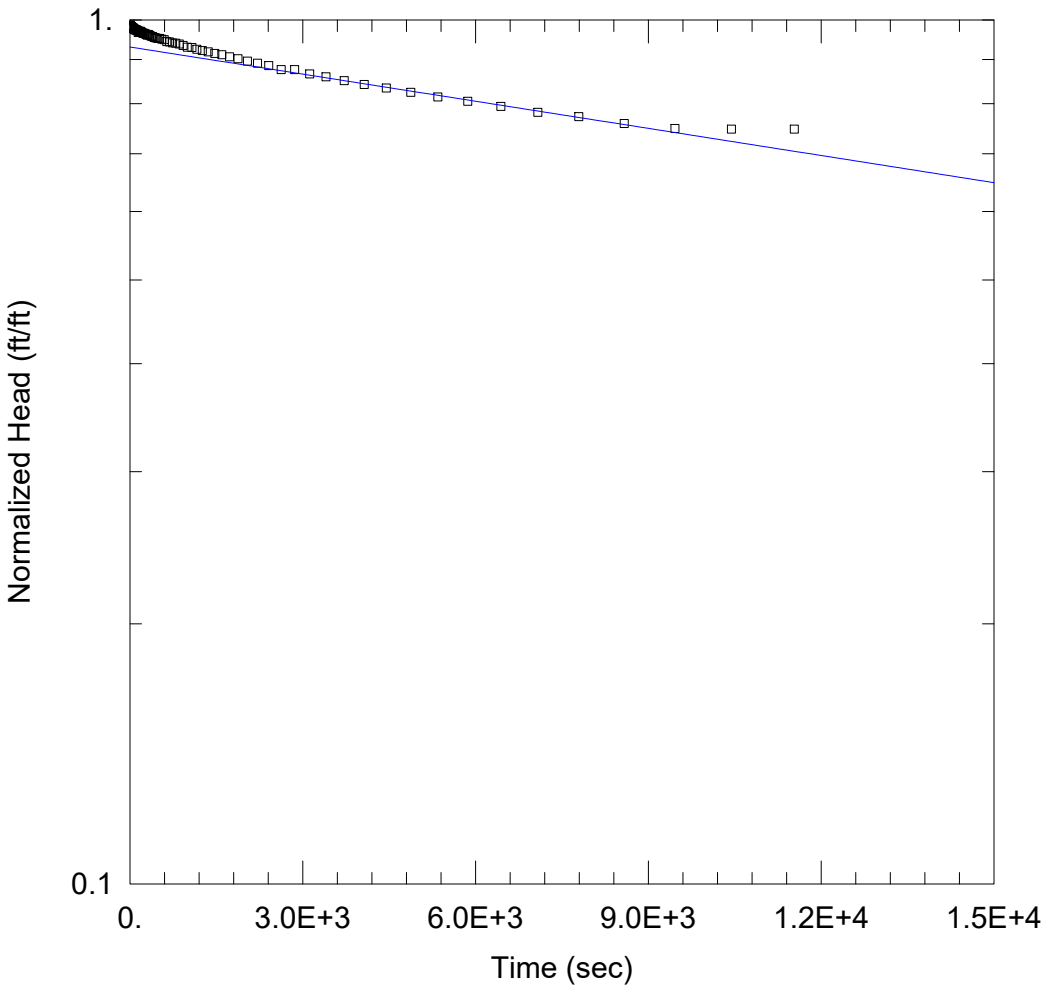
WELL DATA (25)

Initial Displacement: 1.43 ft
Total Well Penetration Depth: 5.4 ft
Casing Radius: 0.086 ft
Static Water Column Height: 11. ft
Screen Length: 3. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.000103 cm/sec
Kz/Kr = 1.
Ss = 0.000145 ft^{-1}



26 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 03/19/2021

AQUIFER DATA

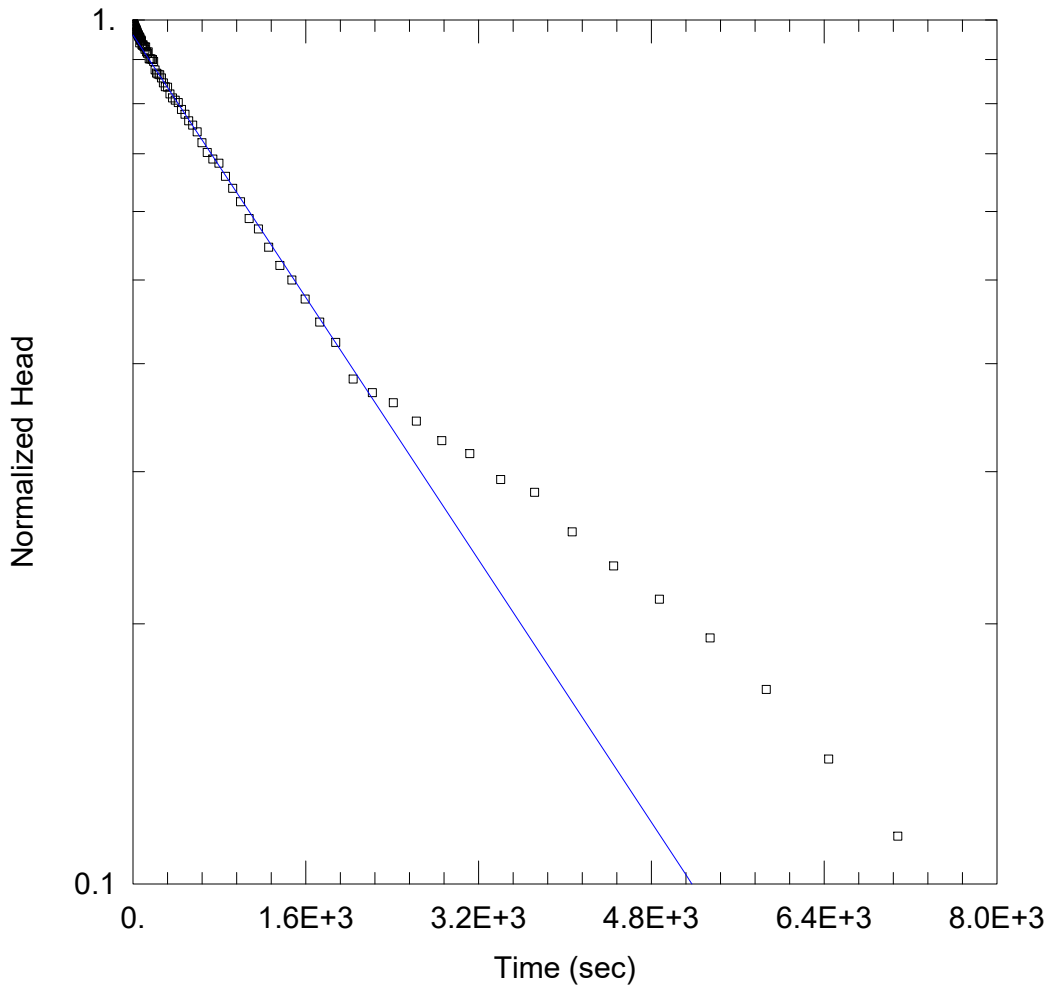
Saturated Thickness: 50.9 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (26)

Initial Displacement: 1.58 ft
Total Well Penetration Depth: 2. ft
Casing Radius: 0.086 ft
Static Water Column Height: 10.5 ft
Screen Length: 2. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 1.29E-6 cm/sec
y0 = 1.47 ft



27 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/28/2021

AQUIFER DATA

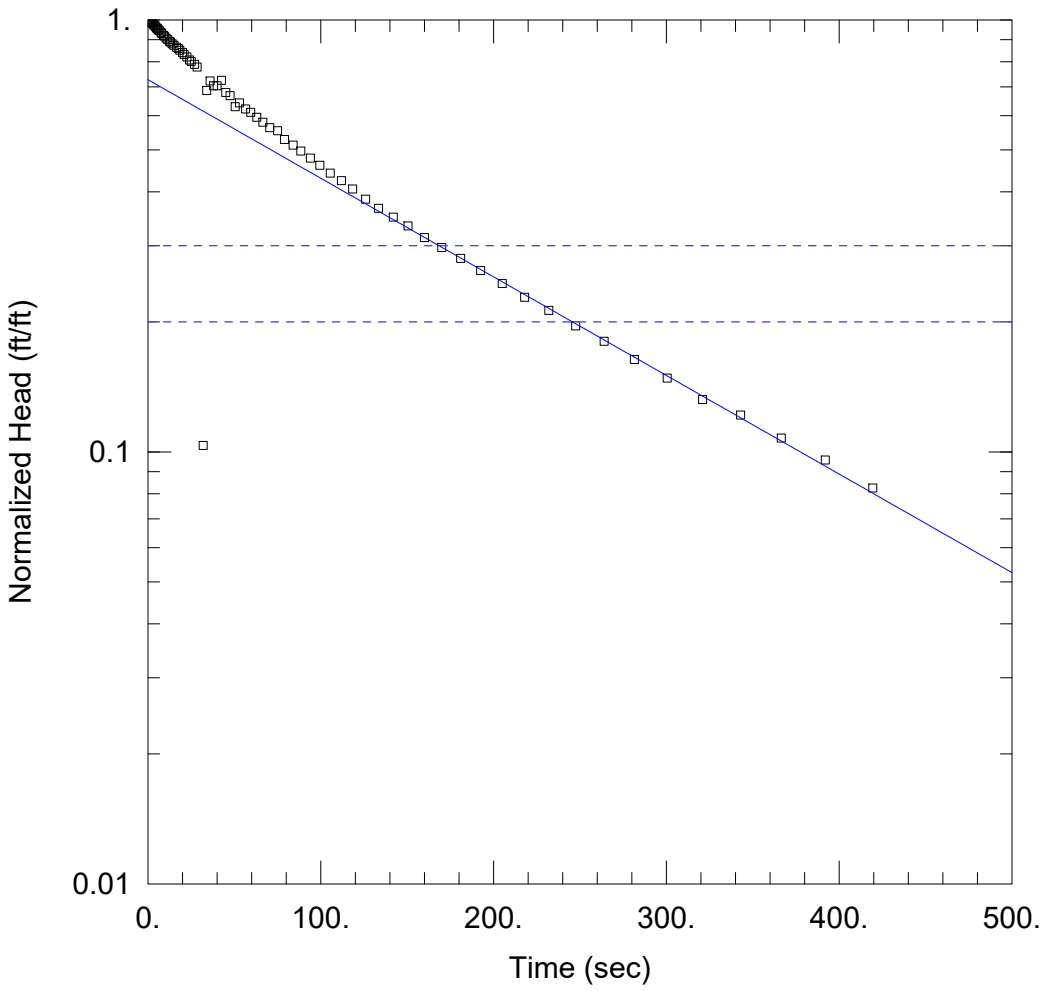
Saturated Thickness: 55.3 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (27)

Initial Displacement: 0.81 ft
Total Well Penetration Depth: 5.4 ft
Casing Radius: 0.086 ft
Static Water Column Height: 7.37 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice
K = 1.56E-5 cm/sec
y0 = 0.778 ft



28 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

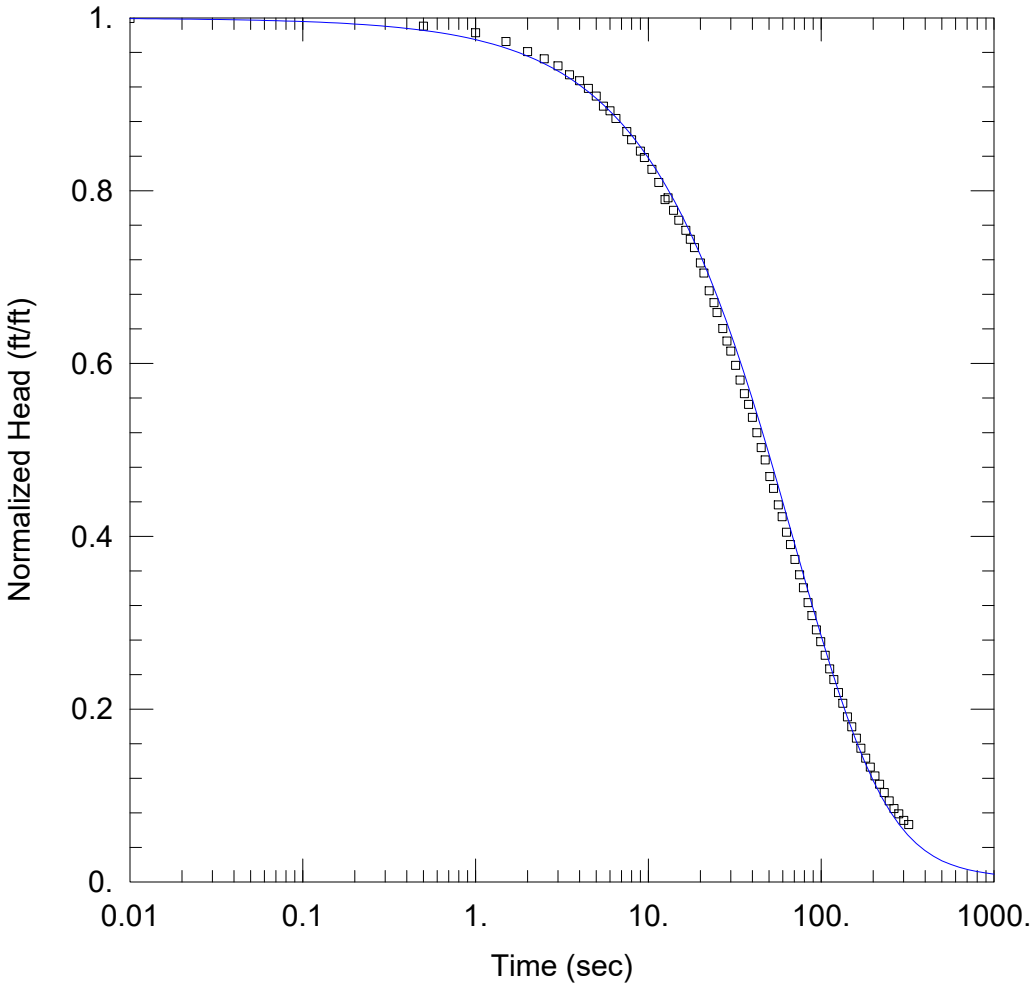
Saturated Thickness: 60.6 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (28)

Initial Displacement: 1.43 ft
Total Well Penetration Depth: 16.8 ft
Casing Radius: 0.086 ft
Static Water Column Height: 19.8 ft
Screen Length: 10. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
K = 0.000134 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.04 ft



29 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

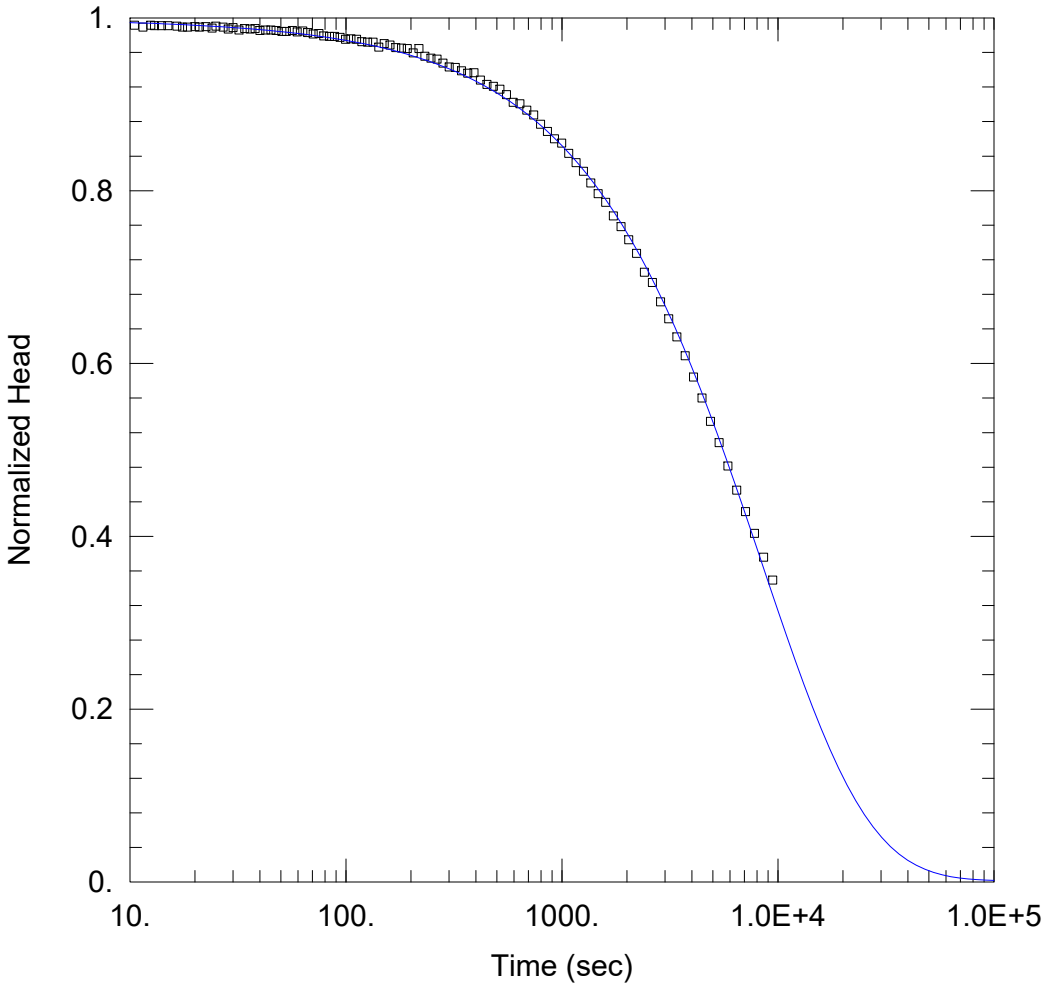
Saturated Thickness: 56. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (29)

Initial Displacement: 1.46 ft
Total Well Penetration Depth: 10.6 ft
Casing Radius: 0.086 ft
Static Water Column Height: 18.97 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.201 cm^2/sec
S = 1.88E-5



30 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/27/2021

AQUIFER DATA

Saturated Thickness: 48.5 ft

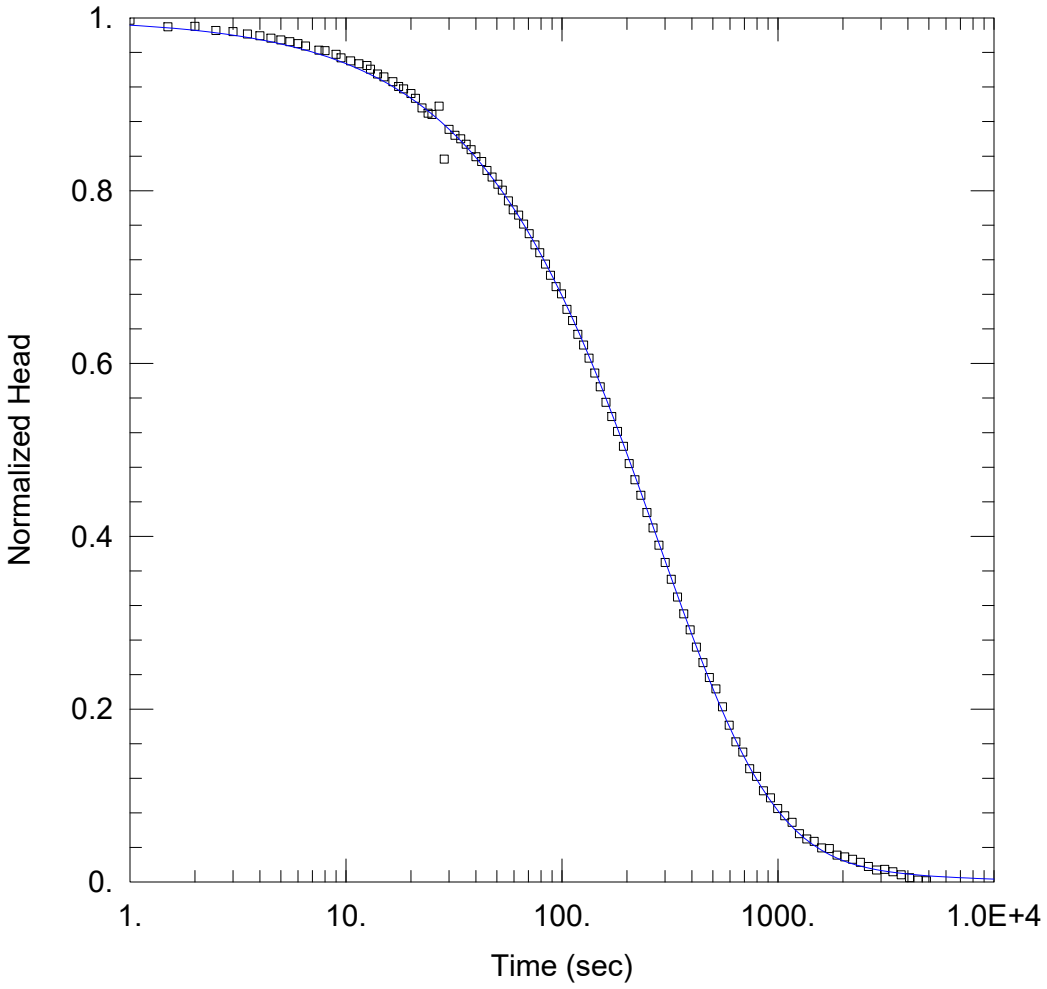
WELL DATA (30)

Initial Displacement: 1.78 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft
Static Water Column Height: 18.3 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 7.07E-6 cm/sec
Kz/Kr = 1.
Ss = 3.3E-5 ft^{-1}



31 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/27/2021

AQUIFER DATA

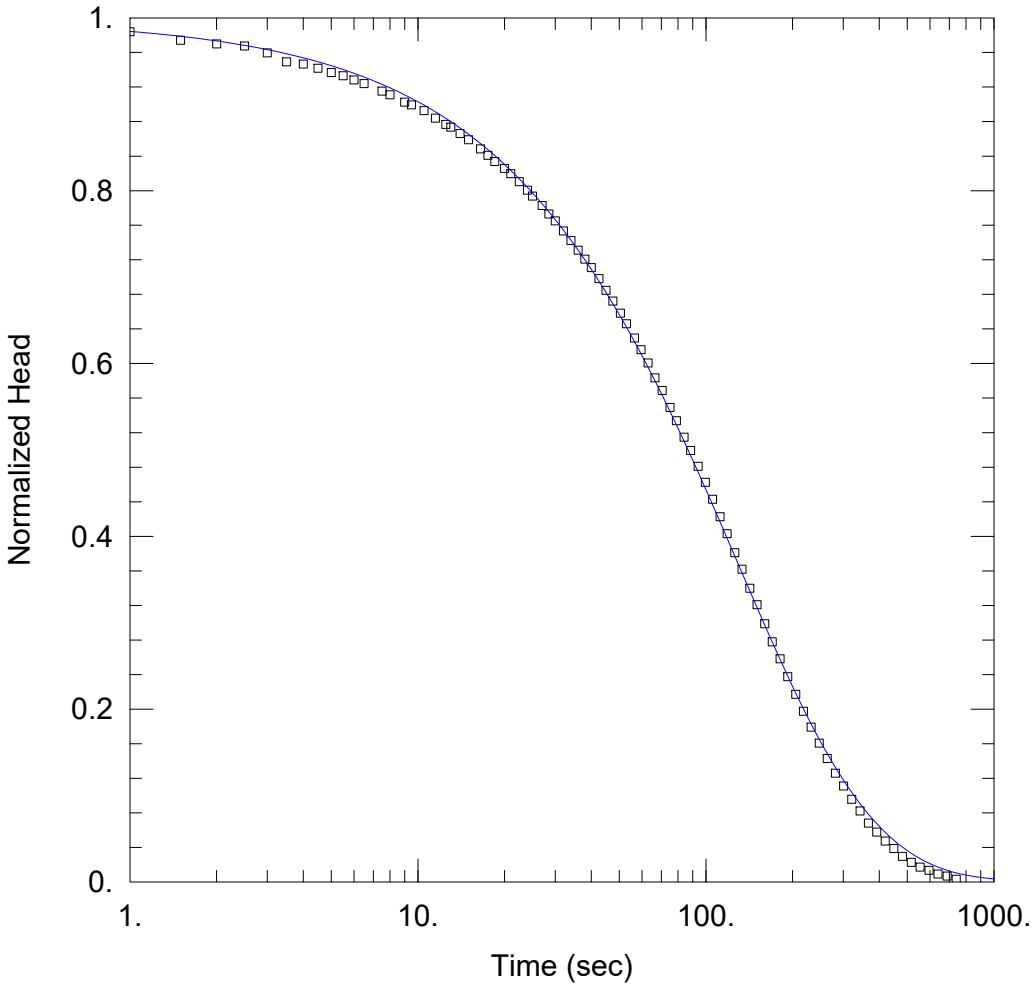
Saturated Thickness: 49.7 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (31)

Initial Displacement: 1.45 ft
Total Well Penetration Depth: 5. ft
Casing Radius: 0.086 ft
Static Water Column Height: 12.6 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Cooper-Bredehoeft-Papadopulos
T = 0.05 cm^2/sec
S = 1.91E-5



32 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/28/2021

AQUIFER DATA

Saturated Thickness: 53.1 ft

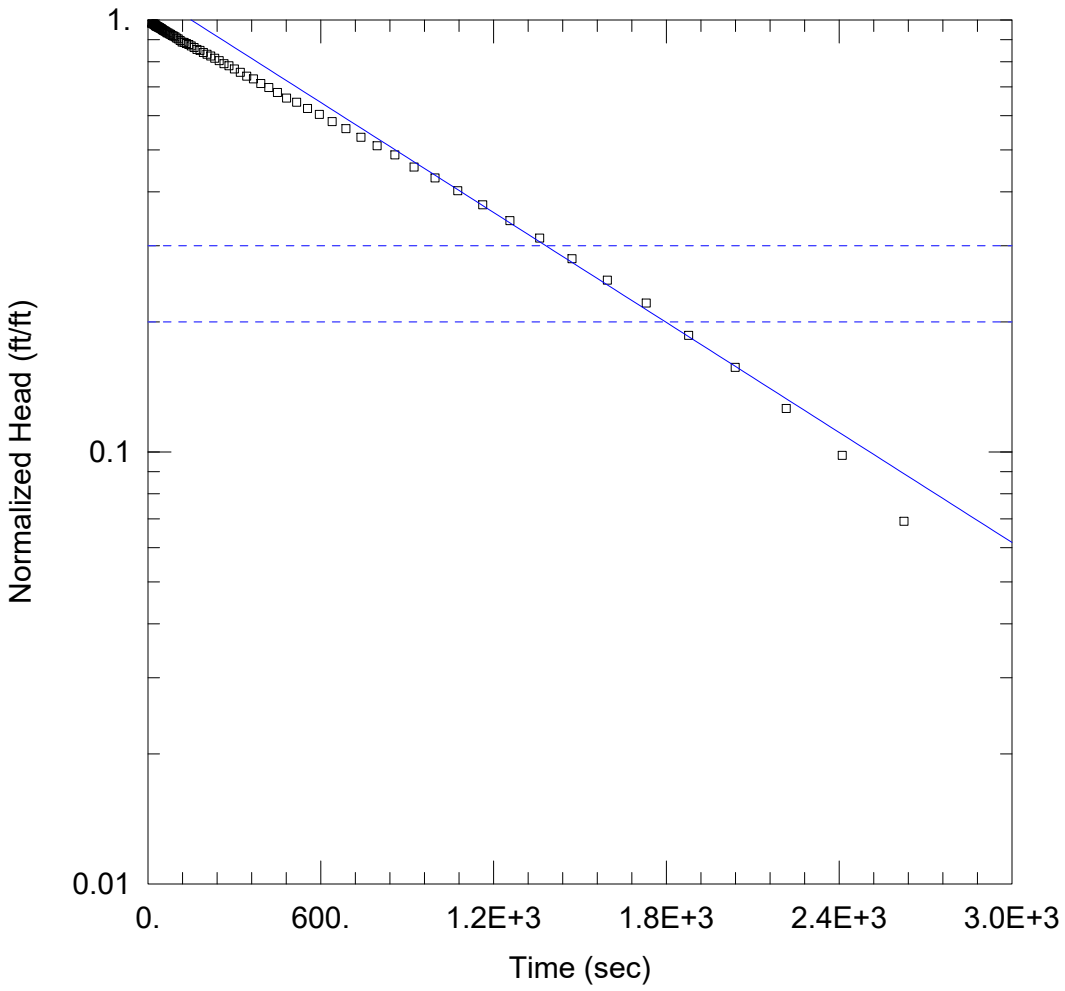
WELL DATA (32)

Initial Displacement: 1.63 ft
Total Well Penetration Depth: 5.4 ft
Casing Radius: 0.086 ft
Static Water Column Height: 16.27 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: KGS Model

Kr = 0.000461 cm/sec
Kz/Kr = 1.
Ss = 1.31E-5 ft^{-1}



PZ-4C FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

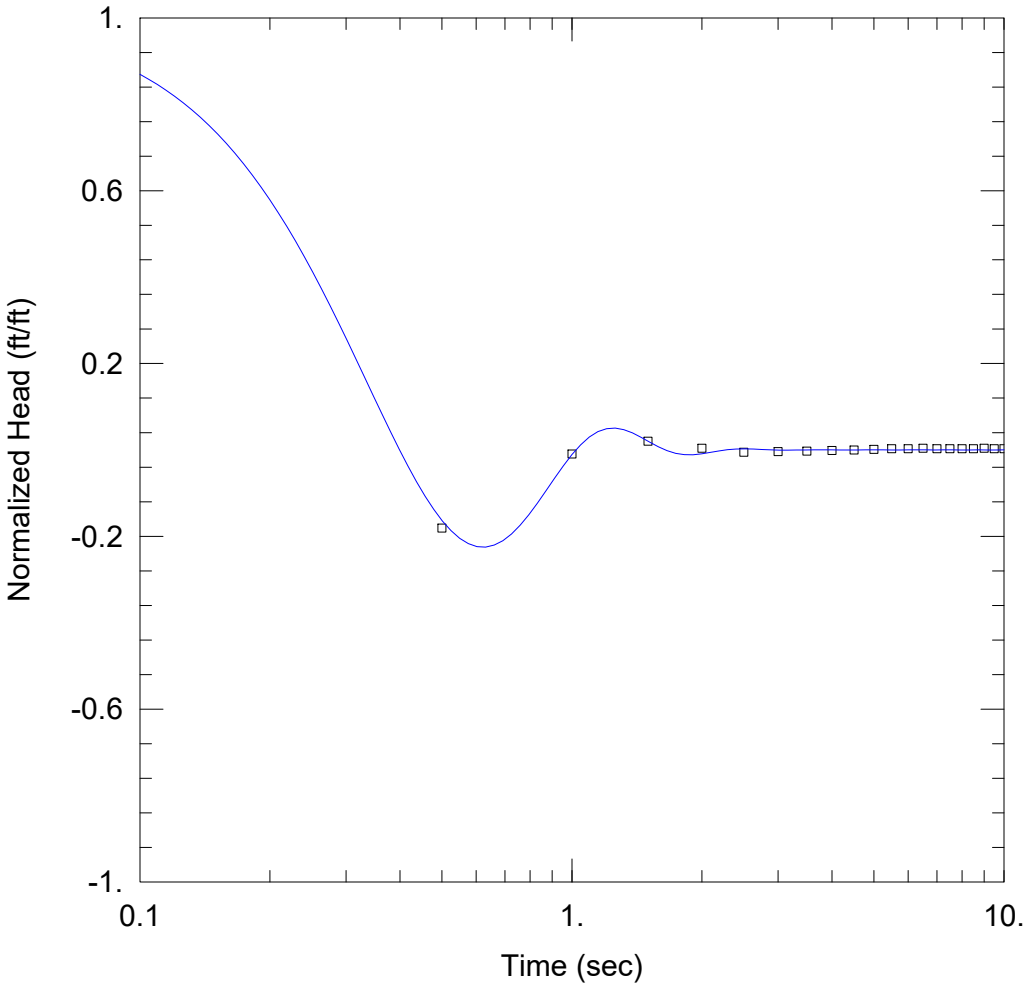
Saturated Thickness: 3. ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (PZ-4C)

Initial Displacement: 1.65 ft
Total Well Penetration Depth: 3. ft
Casing Radius: 0.086 ft
Static Water Column Height: 16.72 ft
Screen Length: 3. ft
Well Radius: 0.35 ft

SOLUTION

Aquifer Model: Confined
K = 4.95E-5 cm/sec
Solution Method: Bouwer-Rice
y0 = 1.91 ft



XPW-01 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

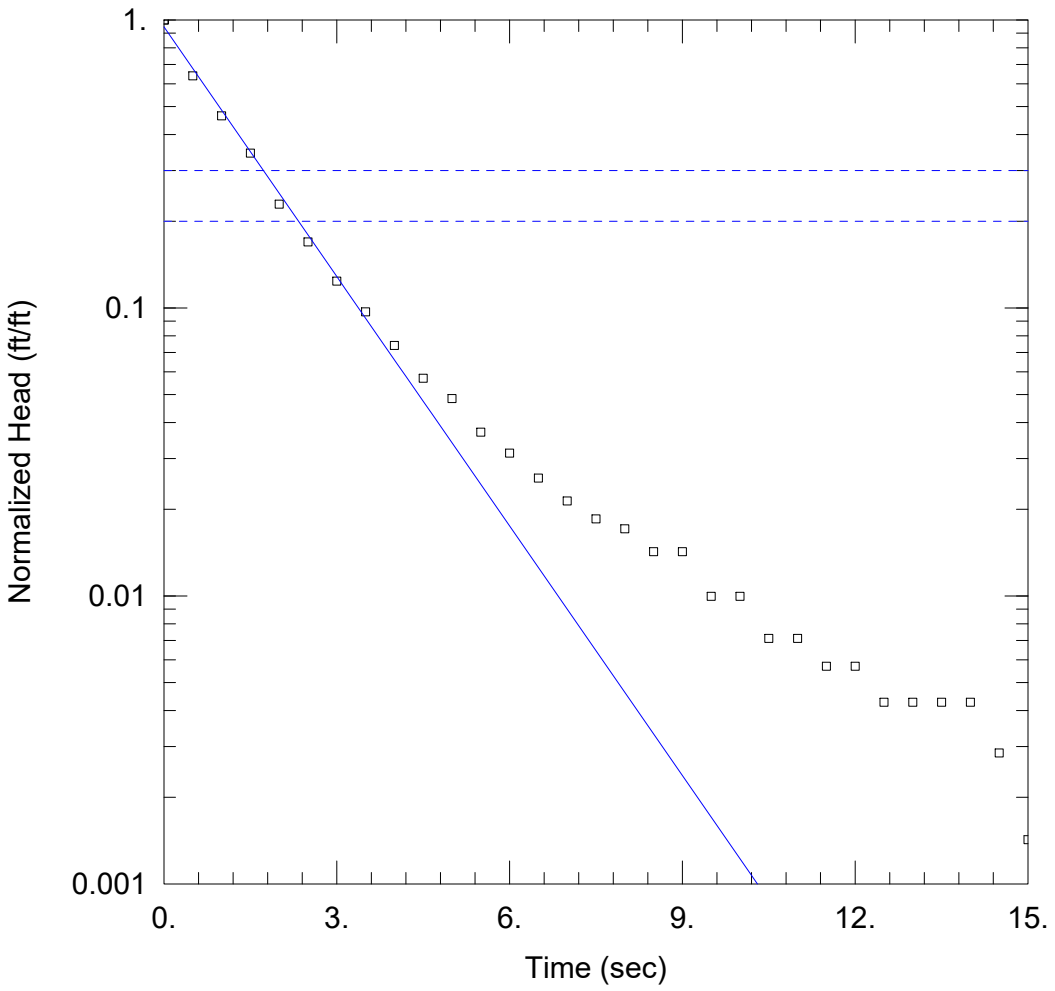
Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.2158

WELL DATA (XPW-01)

Initial Displacement: 0.74 ft
Total Well Penetration Depth: 7.97 ft
Casing Radius: 0.086 ft
Static Water Column Height: 2.71 ft
Screen Length: 7.97 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.264 cm/sec
Solution Method: Springer-Gelhar
Le = 1.03 ft



XPW-02 RH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 03/19/2021

AQUIFER DATA

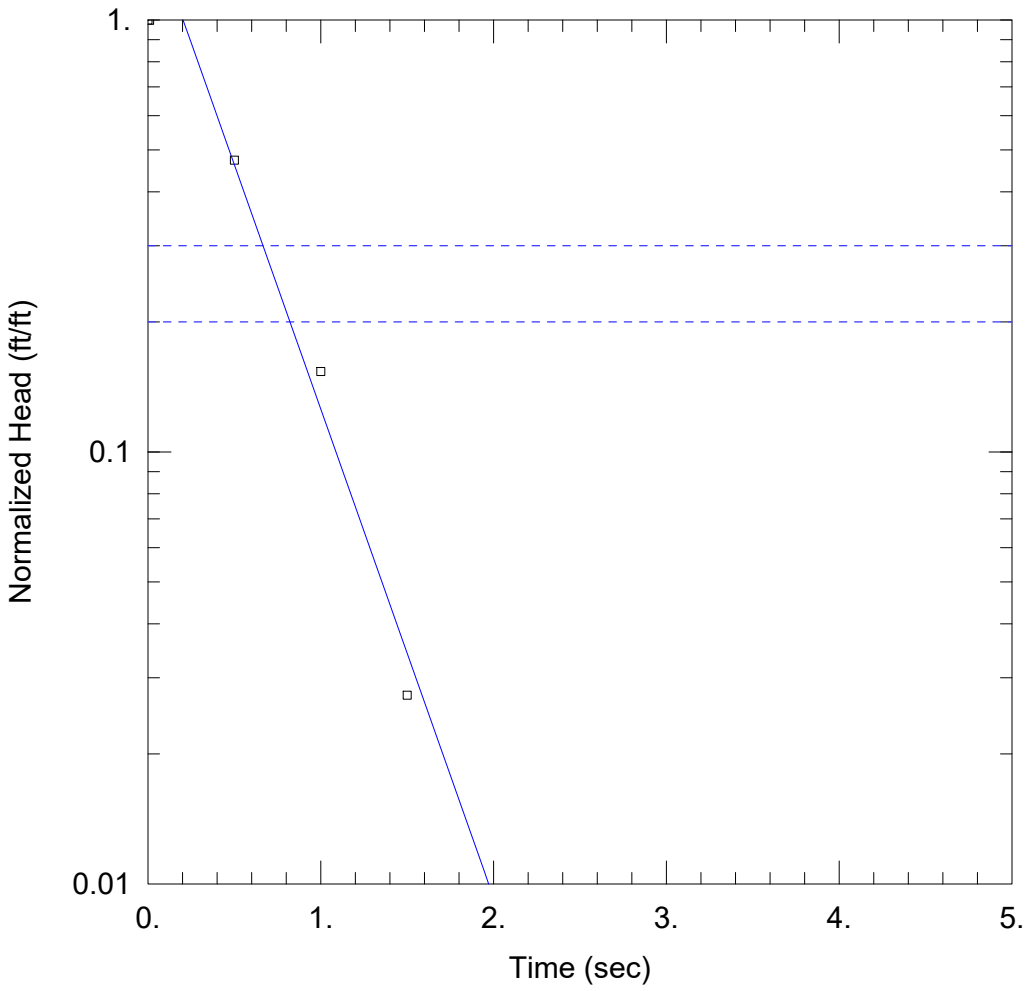
Saturated Thickness: 8.4 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW-02)

Initial Displacement: 0.702 ft
Total Well Penetration Depth: 8.4 ft
Casing Radius: 0.086 ft
Static Water Column Height: 8.91 ft
Screen Length: 8.4 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.0209 cm/sec
Solution Method: Bouwer-Rice
y0 = 0.664 ft



XPW-03 RH-2

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 03/19/2021

AQUIFER DATA

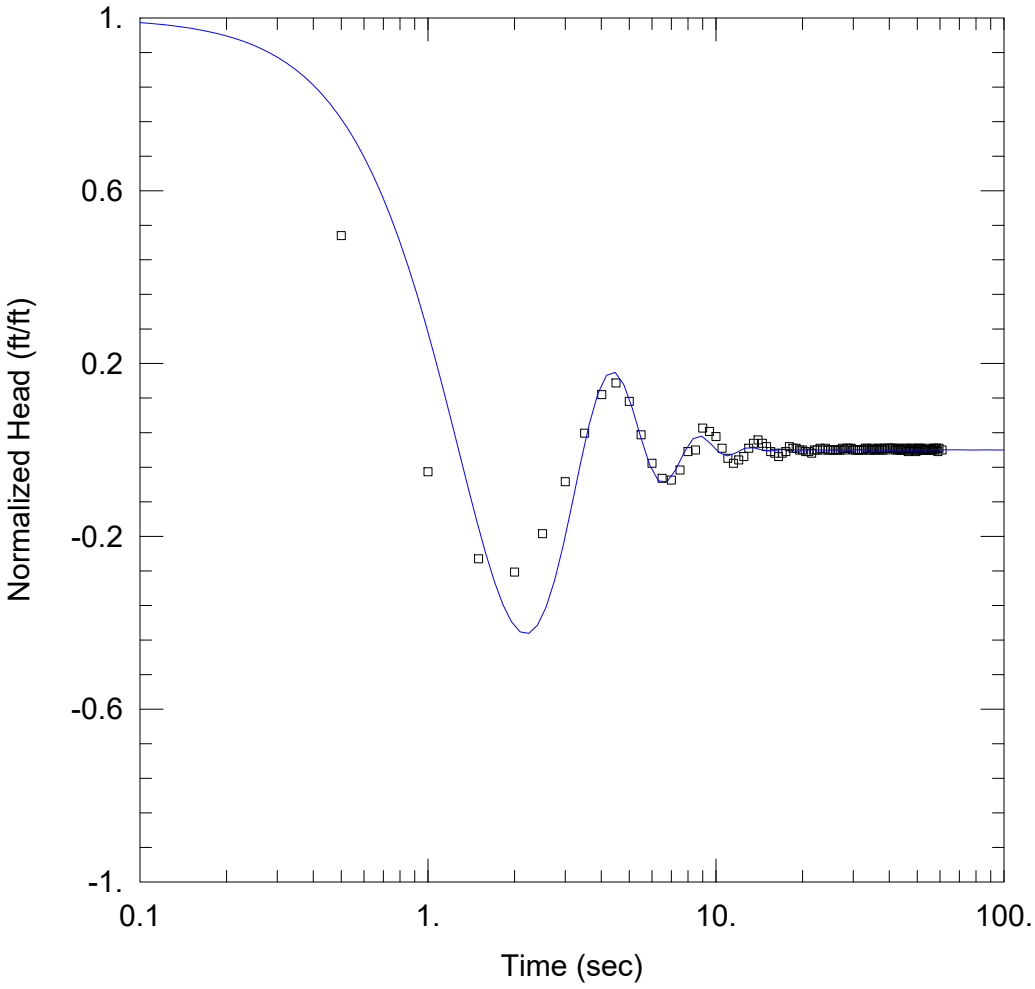
Saturated Thickness: 6.74 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW-03)

Initial Displacement: 2.45 ft
Total Well Penetration Depth: 6.74 ft
Casing Radius: 0.086 ft
Static Water Column Height: 7.74 ft
Screen Length: 6.74 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.0948 cm/sec
Solution Method: Bouwer-Rice
y0 = 4.16 ft



XPW-04 FH-1

PROJECT INFORMATION

Company: Ramboll
Client: Kincaid Generation, LLC
Location: Kincaid Power Plant
Test Date: 04/08/2021

AQUIFER DATA

Saturated Thickness: 20.81 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (XPW-04)

Initial Displacement: 0.258 ft
Total Well Penetration Depth: 20.81 ft
Casing Radius: 0.086 ft
Static Water Column Height: 21.81 ft
Screen Length: 9. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Unconfined
K = 0.103 cm/sec
Solution Method: Springer-Gelhar
Le = 14.5 ft

ATTACHMENT I

October 2021

Intended for
Kincaid Generation, LLC

Date
October 25, 2021

Project No.
1940100806-007

GROUNDWATER MONITORING PLAN

ASH POND

KINCAID POWER PLANT

KINCAID, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

GROUNDWATER MONITORING PLAN
KINCAID POWER PLANT ASH POND

Project Name	**Kincaid Power Plant Ash Pond**
Project No.	**1940100806-007**
Recipient	**Kincaid Generation, LLC**
Document type	**Groundwater Monitoring Plan**
Revision	**FINAL**
Date	**October 25, 2021**
Prepared by	**Chase J. Christenson, PG**

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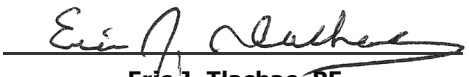

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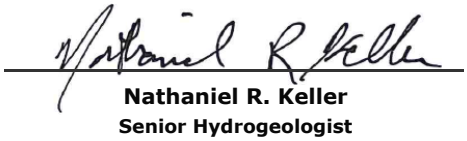

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Hydrogeologist

LICENSED PROFESSIONAL CERTIFICATIONS

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

I, Eric J. Tlachac, a qualified professional engineer in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan, Kincaid Power Plant Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).

Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

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

I, Brian G. Hennings, a qualified professional geologist in good standing in the State of Illinois, certify that the groundwater monitoring system described in this document (Groundwater Monitoring Plan, Kincaid Power Plant Ash Pond), has been designed and constructed to meet the requirements of 35 I.A.C. § 845.630. The monitoring system was developed based on information included in the Hydrogeologic Site Characterization Report (Ramboll 2021; included in the Operating Permit to which this Groundwater Monitoring Plan is attached).

Brian G. Hennings
Professional Geologist
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Date: October 25, 2021

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Appendix A Statistical Analysis Plan

ACRONYMS AND ABBREVIATIONS

35 I.A.C.	Title 35 of the Illinois Administrative Code
40 C.F.R.	Title 40 of the Code of Federal Regulations
AP	Kincaid Ash Pond
ASD	Alternate Source Demonstration
BCU	bedrock confining unit
bgs	below ground surface
CCR	coal combustion residuals
cm/s	centimeters per second
GMP	Groundwater Monitoring Plan
GWPS	Groundwater Protection Standard
HCR	Hydrogeologic Site Characterization Report
ID	identification
IEPA	Illinois Environmental Protection Agency
KPP	Kincaid Power Plant
LCU	lower confining unit
NAVD88	North American Vertical Datum of 1988
NID	National Inventory of Dams
No.	Number
NRT/OBG	Natural Resources Technology, Inc., an OBG Company
Part 845	Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
PMP	Potential Migration Pathway
QA/QC	quality assurance/quality control
Ramboll	Ramboll Americas Engineering Solutions, Inc.
RL	Reporting Limit
SI	Surface Impoundment
TDS	total dissolved solids
USCU	upper semi-confining unit
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.) § 845 (Part 845) (Illinois Environmental Protection Agency [IEPA], April 15, 2021), Ramboll Americas Engineering Solutions, Inc. (Ramboll) has prepared this Groundwater Monitoring Plan (GMP) on behalf of Kincaid Power Plant (KPP) (**Figure 1-1**), operated by Kincaid Generation, LLC. This report will apply specifically to the CCR Unit referred to as the Kincaid Ash Pond (AP), Vistra identification (ID) number (No.) 141, IEPA ID No. W0218140002-01, and National Inventory of Dams (NID) No. IL50706. The AP is a 172-acre unlined CCR SI used to manage CCR and non-CCR waste streams at the KPP. This GMP includes Part 845 content requirements specific to 35 I.A.C. § 845.630 (Groundwater Monitoring System), 35 I.A.C. § 845.640 (Groundwater Sampling and Analysis), and 35 I.A.C. § 845.650 (Groundwater Monitoring Program) for the AP at the KPP.

A checklist which identifies the specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650 is included in **Table 1-1**. The table provides references to sections, tables, and figures included in this document to locate the information that meets specific requirements of 35 I.A.C. § 845.630, 35 I.A.C. § 845.640, and 35 I.A.C. § 845.650.

1.2 Site Location and Background

The KPP is located in the southwest quarter of Section 1, and the northeast quarter of Section 12, Township 13 North, Range 4 West, along West Route 104 Christian County, Illinois and approximately four miles west of the Village of Kincaid (see **Figure 1-1**). The KPP operates as a coal-fired power plant and consists of one CCR unit, the AP, with a total storage capacity of approximately 3,560 acre-feet.

The AP is located between two lobes of Sangchris Lake, which was formed in 1964 by damming Clear Creek, a tributary to the south fork of the Sangamon River (see **Figure 1-2**). Sangchris Lake was created to provide a source of cooling water for the KPP. The western lobe of Sangchris Lake forms part of the western and northern border of the AP and is connected to an intake flume for the KPP on the western edge of the AP. A discharge flume from the KPP forms the southern border of Kincaid Ash Pond and is connected to the eastern lobe of Sangchris Lake.

Construction of the AP began in 1964 and was commissioned for use in 1967. The AP primarily contains bottom ash and boiler slag, and other minor materials including water and wastewater treatment solids, excavation spoils, and dredge spoils. Discharge for the AP is located at the southeast corner of the unit.

1.3 Conceptual Model

Significant site investigation has been completed at the KPP to characterize the geology, hydrogeology, and groundwater quality. Based on extensive investigation and monitoring, the AP has been well characterized and detailed in the Hydrogeologic Site Characterization Report (HCR; included in the Operating Permit to which this Plan is attached). A site conceptual model has been developed and is discussed below.

The five distinct hydrostratigraphic units summarized below have been identified at the AP based on stratigraphic relationships and common hydrogeologic characteristics:

- **CCR**: Saturated CCR, consisting primarily of fly ash and boiler slag.
- **Upper Semi-Confining Unit (USCU)**: Low permeability clay with some silt and minor sand, silt layers, and occasional discontinuous sand lenses. Includes the lithologic layers identified as the Cahokia Formation. Sand lenses within the USCU with higher permeability within the USCU have a higher probability of contaminant transport and these materials are referred to as the potential migration pathways (PMPs).
- **Uppermost Aquifer**: Thin (generally less than 4 feet), moderate permeability sand, silty sand, and clayey sand and gravel units, which includes the unconfined clays and silts of the Upper Cahokia Formation, where saturated, and the thin, moderate permeability sands and gravels of the Lower Cahokia Formation, which, at some locations also includes the interface with the Vandalia Till.
- **Lower Confining Unit (LCU):** Underlying the aquifer unit is dense grey clay till; this till is easily distinguished during investigation by difficult drilling and/or refusal and is apparent on boring logs. The till was encountered at elevations ranging from approximately 570 to 583.5 feet NAVD88. The LCU is comprised of low permeability silt and clay with minor sand, silt layers, and occasional discontinuous sand lenses (more frequently near the top of the unit). Includes the lithologic layers identified as the Vandalia Till.
- **Bedrock (BCU)**: This unit is composed of interbedded shale and limestone of the Bond Formation that underlie the Vandalia Till, and underlies the entire AP.

The elevations of water within the AP are greater than the surrounding areas, and, depending on the hydraulic connection between the AP and the surrounding aquifer, water may flow radially from the AP toward the lobes of Sangchris Lake. The phreatic surface within the AP between February and August 2021 averaged 603.29 feet North American Vertical Datum of 1988 (NAVD88), with a range from 600.76 feet NAVD88 in XPW03 (in the northwest portion of the AP) to 607.38 feet NAVD88 in XSG-01 (in the southeast corner of the AP). Groundwater elevation contour maps for the 2021 sampling events are included in **Figure 1-3** and **Figure 1-4**.

The groundwater elevation in wells within the USCU (MW-7S, MW-8S, MW-12S, MW-20S, MW-25, MW-27, and MW-31S) averaged 591.34 feet NAVD88 between February and August 2021, with a range from 583.38 feet NAVD88 in MW-27 (west of the AP) to 602.14 feet NAVD88 in MW-25 (southwest of the AP). The groundwater elevation in wells within the PMP (MW-7S, MW-12S, MW-25, and MW-27) averaged 589.99 feet NAVD88 between February and August 2021, with a range from 583.38 feet NAVD88 in MW-27 (west of the AP) to 602.14 feet NAVD88 in MW-25 (southwest of the AP). Wells MW-12S and MW-27, located on the north side of the AP near the former drainage feature consistently recorded the lowest groundwater elevation, while MW-8S and MW-20S had relatively equal groundwater elevations, and the highest elevations were measured at MW-25, suggesting that the predominant horizontal groundwater flow in the USCU in the area of the AP is toward the north and northwest toward the western lobe of Sangchris Lake. There also appears to be a component of groundwater flow to the south and east toward the discharge flume that flows to the eastern lobe of Sangchris Lake (see **Figure 1-3** and **Figure 1-4**), as evidenced by groundwater elevations on the southern side of the AP. These two components of groundwater flow suggest a groundwater divide beneath the AP.

The groundwater elevation in wells screened in the uppermost aquifer (MW-1 through MW-12, MW-22 through MW-24, MW-26, MW-28 through MW-32, and PZ4C) averaged 592.68 feet NAVD88 between February and August 2021, with a range from 584.12 feet NAVD88 in MW-12 northwest of the AP to 598.69 feet NAVD88 in MW-32 in the northeast corner of the AP. As noted above, groundwater elevation contour maps suggest that there is a groundwater divide beneath the AP and horizontal groundwater flow in the uppermost aquifer is to the northwest and southeast toward the western and eastern lobes of Sangchris Lake, respectively (**Figure 1-3 and Figure 1-4**).

The groundwater elevation in LCU well MW-20 averaged 595.35 feet NAVD88 between February 2021 and August 2021, with a range from 594.18 to 598.93 feet NAVD88. The groundwater elevation in BCU well MW-12D averaged 586.23 feet NAVD88 between February and August 2021, with a range from 584.55 to 587.18 feet NAVD88 (**Figure 1-3 and Figure 1-4**).

In summary, groundwater elevations are primarily controlled by the surface water levels in Sangchris Lake and the water levels within the AP. There is an apparent groundwater divide beneath the AP with groundwater flow to the northwest towards the western lobe of Sangchris Lake and southeast toward the eastern lobe of Sangchris Lake.

Vertical hydraulic gradients were calculated using available groundwater elevation data from February to August 2021 at nested well locations within the USCU/PMPs, uppermost aquifer, LCU, and BCU. Vertical hydraulic gradients are presented in Table 3-2 of the HCR. The results of the vertical hydraulic gradient calculations for these hydrostratigraphic units are summarized below:

- BCU to uppermost aquifer:
  - Gradients calculated between MW-12D (BCU) and MW-12 (uppermost aquifer) were upward for all events.
- Uppermost aquifer to USCU/PMP:
  - Gradients between MW-12 (uppermost aquifer) and MW-12S (PMP) were downward for all events.
- Uppermost aquifer to USCU:
  - Gradients between MW-31 (uppermost aquifer) and MW-31S (USCU) were downward for seven events, and upward in the July 1, 2021 event.
  - Gradients between MW-8 (uppermost aquifer) and MW-8S (USCU) were variable, with upward gradient in three events (February through April 2021) and a downward gradient in two events (May and June 2021). Gradients were not calculated for the two events in July and one event in August because MW-8S was dry during those sampling events.
  - Gradients between MW-7 (uppermost aquifer) and MW-7S (USCU) were upward for seven events and downward in the June 2021 event.

These results are consistent with previous vertical gradient calculations (Natural Resource Technology, an OBG Company [NRT/OBG], 2017b).

Part 845 parameters were monitored in the uppermost aquifer monitoring wells at the AP as part of the AP Title 40 of the Code of Federal Regulations (40 C.F.R.) § 257 monitoring program beginning in 2015. These data were supplemented with installation and sampling of additional

locations installed in 2021. The results indicate that the following parameters were detected at concentrations greater than the applicable 35 I.A.C. § 845.600 groundwater protection standards (GWPSs) and are considered potential exceedances:

- Arsenic, cobalt, lead, pH, sulfate, total dissolved solids (TDS), and radium 226 and 228 combined were detected in the USCU wells (not including PMP wells) downgradient of the AP.
- Arsenic, barium, beryllium, boron, chromium, cobalt, lead, lithium, pH, sulfate, thallium, TDS, and radium 226 and 228 combined were detected in PMP wells downgradient of the AP.
- Boron, chloride, cobalt, pH, sulfate, thallium, TDS were detected in the uppermost aquifer wells downgradient of the AP.
- Chloride and pH were detected in the BCU wells downgradient of the AP.

Concentration results for the above parameters were compared directly to 35 I.A.C. § 845.600 GWPS, without an evaluation of background concentrations. Evaluation of background groundwater quality has been completed as part of this GMP, and compliance with Part 845 will be determined following the first round of groundwater sampling. The first round of groundwater sampling for compliance will be completed the quarter following issuance of the Operating Permit and in accordance with this GMP.

2. GROUNDWATER MONITORING SYSTEMS

2.1 Existing Monitoring Well Network and Analysis

This GMP is being provided to propose a groundwater monitoring network and monitoring program specific to the AP that will comply with Part 845. The remaining discussion in this document will include only these networks and monitoring programs that are applicable and specific to the AP, specifically the 40 C.F.R. § 257 network and the proposed Part 845 monitoring network.

2.1.1 IEPA Monitoring Program

The current IEPA-required groundwater monitoring program associated with the AP consists of 12 groundwater monitoring wells used to monitor the uppermost aquifer, including four background monitoring wells (MW-1, MW-2, MW 9, and MW-10) and eight compliance monitoring wells (MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-11, and MW-12) in accordance with the GMP (Kincaid Generation, LLC, 2017). The boring logs, well construction forms, and other related monitoring well forms for the well network are included in Appendix C of the HCR (included in the Operating Permit to which this Plan is attached). The well locations are shown on **Figure 2-1**.

Groundwater samples are collected, analyzed and reported semi-annually for the parameters listed in 35 I.A.C. § 620.410 (Groundwater Quality Standards for Class I: Potable Resource Groundwater) with the exception of perchlorate, which is not required under the IEPA monitoring program GMP. The parameters analyzed for the IEPA Monitoring Program are listed in **Table A** below:

Table A. IEPA Groundwater Monitoring Program Parameters

Field Parameters			
Groundwater Elevation	pH	Specific conductivity	Temperature
General Chemistry Parameters			
Chloride (total)	Fluoride (total)	Nitrate (total)	TDS
Cyanide (total)	Nitrite (total)	Sulfate(total)	
Metals (total)			
Antimony	Cadmium	Lead	Silver
Arsenic	Chromium	Manganese	Thallium
Barium	Cobalt	Mercury	Vanadium
Beryllium	Copper	Nickel	Zinc
Boron	Iron	Selenium	Radium 226 and 228 combined

2.1.2 40 C.F.R. § 257 Monitoring

The 40 C.F.R. § 257 well network for the AP consists of eight monitoring wells installed nearby or adjacent to the AP within the unlithified uppermost aquifer. The AP 40 C.F.R. § 257 well network consists of two background monitoring wells (MW-1 and MW-2) and six compliance monitoring wells (MW-5, MW-6, MW-7, MW-8, MW-11, and MW-12). The boring logs, well construction forms, and other related monitoring well forms are available in the Operating Records as required

by 40 C.F.R. § 257.91 for each monitored CCR Unit or CCR Multi-Unit, and are included in Appendix C of the HCR (included in the Operating Permit to which this Plan is attached). The well locations are shown on **Figure 2-1**.

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 the AP (NRT/OBG, 2017a).

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

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

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

2.1.3 Part 845 Well Installation and Monitoring

In 2021, 19 additional monitoring wells (MW-7S, MW-8S, MW-12S, MW-12D, MW-20S, MW-20, MW-22, MW-23, MW-24, MW-25, MW-26, MW-27, MW-28, MW-29, MW-30, MW-31, MW-32, and MW-31S) were installed along the perimeter of the AP to assess the vertical and horizontal lithology, stratigraphy, chemical properties, and physical properties of geologic layers to a minimum of 100 feet below ground surface (bgs) as specified in 35 I.A.C. § 845.620(b).

Prospective Part 845 monitoring wells were sampled for eight rounds between February and August 2021 and the results were used for selection of the AP Part 845 monitoring well network. Groundwater samples were collected and analyzed for 35 I.A.C. § 845.600 parameters as summarized in **Table C** below.

Table C. Part 845 Groundwater Monitoring Program Parameters

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

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

Data and results from the Part 845 background monitoring were included in the water quality discussion included in the HCR (included in the Operating Permit to which this Plan is attached). The data collected from background locations during the Part 845 monitoring were used to evaluate and calculate background concentrations for the AP. The evaluation and discussion are included in **Section 3.2** of this report.

Data collected from the 40 C.F.R. § 257 monitoring network from 2015 to 2020, and from the Part 845 background monitoring were used for selection of the Part 845 monitoring well network proposed in **Section 2.2**.

2.2 Proposed Part 845 Monitoring Well Network

The groundwater monitoring network proposed in this plan will include five monitoring wells screened in the USCU (wells MW-7S[1], MW-8S, MW-20S[1], MW-27[1], and MW-31S), 16 monitoring wells screened in the uppermost aquifer (wells MW-01, MW-02, MW-03, MW-05, MW-06, MW-07, MW-08, MW-11, MW-12, MW-20, MW-23, MW-28, MW-30, MW-31, MW-32, and PZ-4C), and two water level only surface water staff gages (XSG-01 and SG-02). The proposed network is summarized in **Table D** below and displayed on **Figure 2-1**. Twenty-two wells (two background and 20 compliance) will be used to monitor groundwater concentrations within the hydrostratigraphic units.

The groundwater samples collected from the 21 wells will be used to monitor and evaluate groundwater quality and demonstrate compliance with the groundwater quality standards listed in 35 I.A.C. § 845.600(a). The proposed monitoring wells will yield groundwater samples that represent the quality of downgradient groundwater at the CCR boundary (as required in 35 I.A.C. § 845.630(a)(2)). Monitoring well depths and construction details are listed in **Table 2-1** and summarized in **Table D** below.

[1] Wells MW-7S, MW-20S, and MW-27 are screened in the upper semi-confining unit that have been identified to monitor the PMP.

Table D. Proposed Part 845 Monitoring Well Network

Well ID	Monitored Unit	Well Screen Interval (feet bgs)	Well Type [3]
MW-1	uppermost aquifer	15.0 - 25.0	Background
MW-2	uppermost aquifer	10.0 - 20.0	Background
MW-3	uppermost aquifer	14.0 - 24.0	Compliance
MW-5	uppermost aquifer	30.0 - 40.0	Compliance
MW-6	uppermost aquifer	10.0 - 20.0	Compliance
MW-7	uppermost aquifer	10.0 - 20.0	Compliance
MW-7S*	USCU	6.0 - 11.0	Compliance
MW-8	uppermost aquifer	12.0 - 22.0	Compliance
MW-8S	USCU	4.0 - 7.0	Compliance
MW-11	uppermost aquifer	11.0 - 21.0	Compliance
MW-12	uppermost aquifer	15.0 - 25.0	Compliance
MW-20	uppermost aquifer	14.0 - 24.0	Compliance
MW-20S*	USCU	4.0 - 10.0	Compliance
MW-23	uppermost aquifer	23.0 - 28.0	Compliance
MW-27*	USCU	10.0 - 15.0	Compliance
MW-28	uppermost aquifer	12.0 - 22.0	Compliance
MW-30	uppermost aquifer	35.0 - 40.0	Compliance
MW-31	uppermost aquifer	35.0 - 40.0	Compliance
MW-31S	USCU	25.0 - 30.0	Compliance
MW-32	uppermost aquifer	32.0 - 37.0	Compliance
PZ4C	uppermost aquifer	15.5 - 20.5	Compliance
XSG-01[1,2]	Ash/CCR	NA	WLO
SG-02[1,2]	uppermost aquifer	NA	WLO

[1] Surface water level measuring points.

[2] Location is temporary pending implementation of impoundment closure per an approved Construction Permit Application.

[3] Well type refers to the role of the well in the monitoring network.

* Well in the USCU that has been identified to monitor the PMP.

NA = Not Applicable

WLO = water level only

2.3 Well Abandonment

No wells are currently proposed for abandonment.

3. APPLICABLE GROUNDWATER QUALITY STANDARDS

3.1 Groundwater Classification

Groundwater at the AP does not meet the definition of Class I: Potable Resource Groundwater (35 I.A.C. § 620.210), based on the following criteria:

- Site investigations have determined that water bearing lenses contain more than 12 percent fines and are less than five feet in thickness (Cabeno Field Services [Cabeno], 2013),
- Sustained groundwater yield, from a 12-inch borehole, of less than 150-gallons per day from a thickness of 15-feet or less.
- Field (horizontal) hydraulic conductivity tests and laboratory (vertical) hydraulic conductivity tests from wells screened within the uppermost aquifer resulted in an overall (geometric mean) of 5.07 x 10^{-5} centimeters per second (cm/s) and 1.07 x 10^{-7} cm/s, respectively.

As set forth in 35 I.A.C. § 620.220, any geologic material with a hydraulic conductivity of less than 1x10^{-4} cm/s, and which does not meet the provisions of 35 I.A.C. § 620.210 (Class I), 35 I.A.C. § 620.230 (Class III), or 35 I.A.C. § 620.240 (Class IV), meets the definition of Class II: General Resource Groundwater. Based on the detailed geologic information provided for the unlithified materials and bedrock intercepted at the AP along with the hydrogeologic data, the groundwater in the uppermost aquifer can be classified as Class II groundwater: General Resource Groundwater. This is supported by results of the hydrogeologic study completed in 2013 (Cabeno, 2013), which concluded that the AP does not meet most criteria of Class I Groundwater and the data collected supported a Class II Groundwater Classification.

3.2 Statistical Evaluation of Background Groundwater Data

A Statistical Analysis Plan (**Appendix A**) has been developed to describe procedures that will be used to establish background conditions and implement compliance monitoring as necessary and required by 35 I.A.C. § 845.640 and 845.650. The Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance,* March 2009), and is intended to provide a logical process and framework for conducting the statistical analysis of the data obtained during groundwater monitoring.

In accordance with 35 I.A.C. § 845.640(f)(1), the statistical method chosen for analysis of background groundwater quality was either the tolerance interval or the prediction interval procedure for each constituent listed in 35 I.A.C. § 845.600(a)(1) at this CCR unit per 35 I.A.C. § 845.640(f)(1)(C). A comparison of the statistical background concentrations and groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1) and the resulting GWPSs are summarized in **Table 3-1**.

3.3 Applicable Groundwater Protection Standards

The applicable GWPS will be established in accordance with 35 I.A.C. § 845.600(a)(1) (greater of the background concentration or numerical limit specified in 35 I.A.C. § 845.600(a)(1)). The results of the statistical analysis of background groundwater data (**Table 3-1**) indicate that most background concentrations in the uppermost aquifer are below the groundwater quality standards listed in 35 I.A.C. § 845.600(a)(1). Therefore, for these parameters, the groundwater quality

standards listed in 35 I.A.C. § 845.600(a)(1) will be applied to the results from the proposed groundwater monitoring network. The exception is for pH lower limit, where the background lower limit for pH is lower than the 35 I.A.C. § 845.600 standard. Therefore, the GWPS for pH lower limit will be the background measurement.

Under most circumstances, the GWPS will be compared to the lower confidence limit for the observed concentrations for each constituent in each compliance well. Exceptions are when there are high percentages (greater than 50 percent) of non-detects in compliance well data, for which a future mean (for 50 to 70 percent non-detects) or median (for greater than 70 percent non-detects) will be compared to the GWPS. Consistent with the *Unified Guidance*, the same general statistical method of confidence interval testing against a fixed GWPS is recommended in compliance and corrective action programs. Confidence intervals provide a flexible and statistically accurate method to test how a parameter estimated from a single sample compares to a fixed numerical limit. Confidence intervals explicitly account for variation and uncertainty in the sample data used to construct them.

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

4. GROUNDWATER MONITORING PLAN

The groundwater monitoring plan will monitor and evaluate groundwater quality to demonstrate compliance with the groundwater quality standards included in 40 C.F.R. § 257.94(e), 40 C.F.R. § 257.95(h), and 35 I.A.C. § 845.600(a)(1). The groundwater monitoring program will include sampling and analysis procedures that are consistent and that provide an accurate representation of groundwater quality at the background and compliance wells as required by 35 I.A.C. § 845.630. As discussed in **Section 2**, three monitoring networks specific to the AP exist, the IEPA-required monitoring program, the 40 C.F.R. § 257 network, and the proposed Part 845 network. These networks will continue to be monitored until USEPA approves Part 845. It is expected that upon USEPA approval of Part 845, the 40 C.F.R. § 257 network monitoring and reporting will be eliminated, and the proposed Part 845 monitoring and reporting included in this Plan will replace the IEPA monitoring and continue until requirements of Part 845 have been achieved.

4.1 Monitoring Networks and Parameters

4.1.1 IEPA Groundwater Monitoring

The existing IEPA-required monitoring program was discussed in detail in **Section 2.1.1.** Twelve groundwater monitoring wells used to monitor the uppermost aquifer, including four background monitoring wells (MW-1, MW-2, MW 9, and MW-10) and eight compliance monitoring wells (MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-11, and MW-12) are sampled on a semi-annual frequency for the parameters listed in 35 I.A.C. § 620.410 (Groundwater Quality Standards for Class I: Potable Resource Groundwater) with the exception of perchlorate, which is not required under the IEPA monitoring program GMP. Upon approval of this GMP through IEPA granting a Part 845 Operating Permit for the AP, this monitoring program will be superseded by the Part 845 Monitoring Program summarized below.

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

The existing 40 C.F.R. § 257 monitoring program was discussed in detail in **Section 2.1.2**. Eight wells (two background and six compliance) are sampled for Appendix III and Appendix IV parameters on a semi-annual frequency. No changes are proposed to this monitoring network. Well locations and parameters will continue to be monitored and reported as required by 40 C.F.R. § 257 until USEPA approves Part 845.

4.1.3 Part 845 Groundwater Monitoring

The proposed Part 845 Monitoring Network will consist of two background monitoring wells (MW-1 and MW-2), 19 compliance monitoring wells (MW-3, MW-5, MW-6, MW-7, MW-7S, MW-8, MW-8S, MW-11, MW-12, MW-20, MW-20S, MW-23, MW-27, MW-28, MW-30, MW-31, MW-31S, MW-32, and PZ4C), and two temporary water level only surface water staff gages (XSG-01 and SG-02) to monitor potential impacts from the AP (**Figure 2-1**). These monitoring wells are screened within the USCU (MW-7S[2], MW-8S, MW-20S[2], MW-27[2], and MW-31S), and the uppermost aquifer (MW-01, MW-02, MW-03, MW-05, MW-06, MW-07, MW-08, MW-11, MW-12, MW-20, MW-23, MW-28, MW-30, MW-31, MW-32, and PZ-4C) along the perimeter of the AP.

[2] Wells MW-7S, MW-20S, and MW-27 are screened in the upper semi=confining unit that have been identified to monitor the PMP.

Groundwater samples will be collected and analyzed for the laboratory and field parameters in **Table E** below:

Table E. Part 845 Groundwater Monitoring Program Parameters

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

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

All parameters listed above were sampled a minimum of eight times by October 18, 2021 to establish background groundwater quality in accordance with 35 I.A.C. § 845.650 (b)(1)(A). Discussion of background groundwater quality is included in **Section 3.2**.

4.2 Sampling Schedule

Groundwater sampling for the Part 845 monitoring well network will initially be performed quarterly according to the following schedule:

Table F. Part 845 Sampling Schedule

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

4.3 Groundwater Sample Collection

Groundwater sampling procedures have been developed and the collection of groundwater samples is being implemented to meet the requirements of 35 I.A.C. § 845.640. In addition to groundwater well samples, quality assurance samples will be collected as described **in Section 4.5** (**Table 4-1**).

4.4 Laboratory Analysis

Laboratory analysis will be performed consistent with the requirements of 35 I.A.C. § 845.640(j) by a state-certified laboratory using methods approved by IEPA and USEPA. Laboratory methods may be modified based on laboratory equipment availability or procedures, but the Reporting Limit (RL) for all parameters analyzed, regardless of method, will be lower than the applicable groundwater quality standard. RLs for the applicable parameters are summarized in **Table 4-2**. Concentrations lower than the RL will be reported as less than the RL.

4.5 Quality Assurance Program

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

- Field duplicates will be collected at a frequency of one per group of ten or fewer investigative water samples.

- One equipment blank sample will be collected and analyzed for each day of sampling. If dedicated sampling equipment is used, then equipment blank samples will not be collected.
- The duplicate and equipment blank quality assurance samples will be supplemented by the laboratory QA/QC program, which typically includes:
  - Regular generation of instrument calibration curves to assure instrument reliability
  - Laboratory control samples and/or quality control check standards that have been spiked, and analyses to monitor the performance of the analytical method
  - Matrix spike/matrix spike duplicate analyses to determine percent recoveries and relative percent differences for each of the parameters detected
  - Analysis of replicate samples to check the precision of the instrumentation and/or methodology employed for all analytical methods
  - Analysis of method blanks to assure that the system is free of contamination

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

4.6 Groundwater Monitoring System Maintenance Plan

Consistent with the requirements of 35 I.A.C. § 845.630(e)(2), maintenance will be performed as needed to assure that the monitoring wells provide representative groundwater samples. Monitoring wells will be inspected during each groundwater sampling event; inspections will consist of the following:

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

If maintenance of a monitoring well cannot address an identified deficiency, a replacement well will be installed.

4.7 Statistical Analysis

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

4.8 Data Reporting

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

Groundwater monitoring and analysis completed as part of the Part 845 monitoring under an approved monitoring program will be reported to IEPA within 60 days after completion of sampling and the data placed in the facility's operating record as required by 35 I.A.C. § 845.610(b)(3)(D). Within 14 days of posting to the operating record, information will be posted to the publicly accessible internet site "Illinois CCR Rule Compliance Data and Information" as required by 35 I.A.C. § 845.810(d). Information will also be submitted to IEPA annually by January 31 as required by 35 I.A.C. § 845.550, for data collected the preceding year. The report will include the status of the groundwater monitoring and any required corrective action plan for the AP 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 groundwater protection standards in 35 I.A.C. § 845.600; and
- Not increasing for those constituents over background, using the statistical procedures and performance standards in 35 I.A.C. § 845.640(f) and (g), provided that:
  - Concentrations have been reduced to the maximum extent feasible; and
  - Concentrations are protective of human health and the environment.

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

4.10 Alternate Source Demonstrations

As allowed in 35 I.A.C. § 845.650(e), following detection of an exceedance of the GWPS, an ASD will be evaluated and, if completed, submitted to IEPA within 60 days. The ASD will provide lines of evidence that a source other than the CCR SI caused the contamination and the CCR SI did not contribute to the contamination, or that the exceedance of the GWPS resulted from error in sampling, analysis, statistical evaluation, natural variation in groundwater quality, or a change in the potentiometric surface and groundwater flow direction.

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

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

4.11 Assessment of Corrective Measures and Corrective Action

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

- The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;
- The time required to begin and complete the corrective action plan; and
- The institutional requirements, such as State or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the corrective action plan.

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

5. REFERENCES

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United States Environmental Protection Agency (USEPA), 2015. *Title 40 of the Code of Federal Regulations, Part 257*.

TABLES

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST
GROUNDWATER MONITORING PLAN
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in GMP
845.630	**Groundwater Monitoring Systems**	
845.630(a)(2)	Potential contaminant pathways must be monitored.	Sections 1.3, 2.2 & 4.1.3
845.630(a) 845.630(b) 845.630(c)	At least two upgradient wells and four downgradient wells (min. 1 and 3, but requires additional documentation)	Sections 2.2 & 4.1.3 Table 2-1 Figure 2-1
845.630(a) 845.630(b) 845.630(c)	Downgradient Well Density	Figure 2-1
845.630(a)(2)	Downgradient wells at waste boundary	Figure 2-1
845.640	**Groundwater Sampling and Analysis Requirements**	
845.640(a)	Consistent sampling and analysis procedures	Section 4 Tables 4-1 & 4-2
845.640(b)	Methods are appropriate	Section 4 Tables 4-1 & 4-2
845.640(c)	Groundwater elevations must be measured in each well prior to purging, each time groundwater is sampled.	Section 4.3
845.640 (d)(e)(f)(g)(h)	Establishment of background and application of statistical methods	Sections 3 & 4.7 Appendix A
845.640(i)	Analyze total recoverable metals	Section 4.1.3
845.640(j)	Analyze groundwater samples using a certified laboratory	Section 4.4

TABLE 1-1. PART 845 REQUIREMENTS CHECKLIST

GROUNDWATER MONITORING PLAN

KINCAID POWER PLANT

ASH POND

KINCAID, ILLINOIS

Part 845 Reference	Part 845 Components	Location of Information in GMP
845.650	**Groundwater Monitoring Program**	
845.650(a)	Must include monitoring for all constituents with a groundwater protection standard in Section 845.600(a), calcium, and turbidity	Section 4.1.3
845.650(b)(c)	Groundwater Monitoring Frequency	Sections 4.1.3 & 4.2
845.650(d)(e)	Exceedances of the groundwater protection standard	Sections 4.9, 4.10 & 4.11
845.650(b)(2) 845.650(b)(3)	Staff gauge/ piezometer to monitor head in impoundment	Sections 2.2 & 4.1.3 Figure 2-1 (XSG-01)
NA	Staff gauge/ piezometer to monitor head of neighboring surface water body	Sections 2.2 & 4.1.3 Figure 2-1 (SG-02)

[O: CJC 08/11/21; C: LDC 8/17/21]

Notes:

GMP = Groundwater Monitoring Plan

NA = Not Applicable

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

Well Number	Type	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)
MW-1	B	UA	04/20/2010	604.71	604.71	Top of PVC	602.60	15.00	25.00	587.60	577.60	25.00	568.10	10	2	39.592051	-89.490283
MW-2	B	UA	04/21/2010	601.10	601.10	Top of PVC	598.88	10.00	20.00	588.90	578.90	20.00	541.40	10	2	39.590698	-89.488916
MW-3	C	UA	04/15/2010	601.46	601.46	Top of PVC	599.24	14.00	24.00	585.20	575.20	24.00	552.70	10	2	39.594458	-89.487173
MW-5	C	UA	04/22/2010	619.44	619.44	Top of PVC	617.77	30.00	40.00	587.80	577.80	40.00	541.80	10	2	39.601296	-89.490402
MW-6	C	UA	04/16/2010	600.46	600.46	Top of PVC	598.44	10.00	20.00	588.40	578.40	20.00	572.90	10	2	39.598638	-89.498944
MW-7	C	UA	04/16/2010	597.75	597.75	Top of PVC	596.00	10.00	20.00	586.00	576.00	20.00	569.50	10	2	39.597637	-89.498959
MW-7S	C	USCU	02/02/2021	597.64	597.64	Top of PVC	595.59	6.00	11.00	589.59	584.59	11.00	580.59	5	2	39.59766	-89.498978
MW-8	C	UA	04/13/2010	603.14	603.14	Top of PVC	601.14	12.00	22.00	589.10	579.10	22.00	563.10	10	2	39.594399	-89.496829
MW-8S	C	USCU	02/02/2021	603.30	603.30	Top of PVC	600.57	4.00	7.00	596.57	593.57	7.00	580.57	3	2	39.594381	-89.496822
MW-11	C	UA	06/17/2015	601.81	601.81	Top of PVC	599.27	11.00	21.00	588.30	578.30	21.00	578.30	10	2	39.593104	-89.491115
MW-12	C	UA	07/23/2015	591.40	591.40	Top of PVC	589.04	15.00	25.00	573.90	563.90	25.00	563.90	10	2	39.600208	-89.496381
MW-20	C	UA	01/26/2021	600.77	600.77	Top of PVC	598.52	14.00	24.00	584.52	574.52	24.00	547.52	10	2	39.598653	-89.48728
MW-20S	C	USCU	01/26/2021	600.64	600.64	Top of PVC	598.43	4.00	10.00	594.43	588.43	10.00	588.43	6	2	39.598665	-89.487279
MW-23	C	UA	02/02/2021	610.32	610.32	Top of PVC	608.05	23.00	28.00	585.05	580.05	28.00	558.05	5	2	39.593293	-89.489352
MW-27	C	USCU	02/02/2021	600.05	600.05	Top of PVC	597.35	10.00	15.00	587.35	582.35	15.00	577.35	5	2	39.596694	-89.497927
MW-28	C	UA	02/02/2021	601.40	601.40	Top of PVC	598.33	12.00	22.00	586.33	576.33	22.00	573.33	10	2	39.599258	-89.497962
MW-30	C	UA	02/03/2021	618.47	618.47	Top of PVC	616.00	35.00	40.00	581.00	576.00	40.00	571.00	5	2	39.601262	-89.493996
MW-31	C	UA	02/03/2021	617.34	617.34	Top of PVC	615.02	35.00	40.00	580.02	575.02	40.00	565.02	5	2	39.601301	-89.491702
MW-31S	C	USCU	02/03/2021	617.54	617.54	Top of PVC	615.13	25.00	30.00	590.13	585.13	30.00	585.13	5	2	39.601303	-89.491681
MW-32	C	UA	02/03/2021	619.49	619.49	Top of PVC	617.20	32.00	37.00	585.20	580.20	37.00	577.20	5	2	39.601279	-89.488643
PZ-4C	C	UA	03/30/2016	600.57	600.57	Top of PVC	597.89	15.50	20.50	582.39	577.39	20.50	577.39	5	2	39.596398	-89.487207
XSG-01	WLO	CCR	--	--	608.43	Staff gauge	--	--	--	--	--	--	--	--	--	39.593401	-89.48768
SG-02	WLO	SW	--	--	564.80	Staff gauge	--	--	--	--	--	--	--	--	--	39.593106	-89.498155

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

Well Number	Type	HSU	Date Constructed	Top of PVC Elevation (ft)	Measuring Point Elevation (ft)	Measuring Point Description	Ground Elevation (ft)	Screen Top Depth (ft BGS)	Screen Bottom Depth (ft BGS)	Screen Top Elevation (ft)	Screen Bottom Elevation (ft)	Well Depth (ft BGS)	Bottom of Boring Elevation (ft)	Screen Length (ft)	Screen Diameter (inches)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)

Notes:
All elevation data are presented relative to the North American Vertical Datum 1988 (NAVD88), GEOID 12A
Type refers to the role of the well in the monitoring network: background (B), compliance (C), or water level measurements only (WLO)
WLO wells are temporary pending implementation of impoundment closure per an approved Construction Permit application
-- = data not available
BGS = below ground surface
CCR = Coal Combustion Residual
ft = foot or feet
HSU = Hydrostratigraphic Unit
PVC = polyvinyl chloride
SW = surface water
UA = uppermost aquifer
USCU = upper semi-confining unit

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

Parameter	Background Concentration	845 Limit	Groundwater Protection Standard	Unit
Antimony, total	0.001	0.006	0.006	mg/L
Arsenic, total	0.0048	0.010	0.010	mg/L
Barium, total	0.15	2.0	2.0	mg/L
Beryllium, total	0.001	0.004	0.004	mg/L
Boron, total	0.296	2	2	mg/L
Cadmium, total	0.001	0.005	0.005	mg/L
Chloride, total	18	200	200	mg/L
Chromium, total	0.0095	0.1	0.1	mg/L
Cobalt, total	0.0039	0.006	0.006	mg/L
Fluoride, total	0.51	4.0	4.0	mg/L
Lead, total	0.0051	0.0075	0.0075	mg/L
Lithium, total	0.012	0.04	0.04	mg/L
Mercury, total	0.0002	0.002	0.002	mg/L
Molybdenum, total	0.0062	0.1	0.1	mg/L
pH (field)	7.6 / 5.6	9.0 / 6.5	9.0 / 5.6	SU
Radium 226 and 228 combined	1	5	5	pCi/L
Selenium, total	0.0018	0.05	0.05	mg/L
Sulfate, total	151	400	400	mg/L
Thallium, total	0.002	0.002	0.002	mg/L
Total Dissolved Solids	494	1200	1200	mg/L

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

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RAMBOLL

TABLE 4-1. SAMPLING AND ANALYSIS SUMMARY
GROUNDWATER MONITORING PLAN
KINCAID POWER PLANT
ASH POND
KINCAID, 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	22	3	0	0	2	27	plastic	600 mL	HNO_3 to pH<2	6 months
Mercury	7470A or 6020	22	3	0	0	2	27	plastic	400 mL	HNO_3 to pH<2	28 days
Inorganic Parameters											
Fluoride	9214 or EPA 300	22	3	0	0	2	27	plastic	300 mL	Cool to 4 °C	28 days
Chloride	9251 or EPA 300	22	3	0	0	2	27	plastic	100 mL	Cool to 4 °C	28 days
Sulfate	9036 or EPA 300	22	3	0	0	2	27	plastic	50 mL	Cool to 4 °C	28 days
Total Dissolved Solids	SM 2540 C	22	3	0	0	2	27	plastic	200 mL	Cool to 4 °C	7 days
Radium											
Radium 226	9315 or EPA 903	22	0	0	0	0	22	plastic	1000 mL	HNO_3 to pH<2	6 months
Radium 228	9320 or EPA 904	22	0	0	0	0	22	plastic	1000 mL	HNO_3 to pH<2	6 months
Field Parameters											
pH	SM 4500-H+ B	22	NA	NA	NA	NA	22	flow-through cell	NA	none	immediately
Dissolved Oxygen [8]	SM 4500-O/405.1	22	NA	NA	NA	NA	22	flow-through cell	NA	none	immediately
Temperature [8]	SM 2550	22	NA	NA	NA	NA	22	flow-through cell	NA	none	immediately
Oxidation/Reduction Potential [8]	SM 2580 B	22	NA	NA	NA	NA	22	flow-through cell	NA	none	immediately
Specific Conductance [8]	SM 2510 B	22	NA	NA	NA	NA	22	flow-through cell	NA	none	immediately
Turbidity [7]	SM 2130 B	22	NA	NA	NA	NA	22	flow-through cell or hand-held turbidity meter	NA	none	immediately

[O: CJC 08/11/21; C: LDC 8/17/21]

Notes:
[1] Analytical method numbers are from SW-846 unless otherwise indicated. Analytical methods may be updated with more recent versions as appropriate.
[2] Field duplicates will be collected at a frequency of one per group of 10 or fewer investigative water samples. Field duplicates will not be collected for radium analysis.
[3] Field blanks will be collected at the discretion of the project manager; Equipment blanks will be collected at a rate of 1 per sampling event if non-dedicated equipment is used.
[4] Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples will be collected at a frequency of one per group of 20 or fewer investigative water samples per CCR unit/multi-unit. Additional volume to be determined by laboratory.
[5] Sample volume is estimated and will be determined by the laboratory.
[6] Metals = antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chromium, cobalt, lead, lithium, molybdenum, selenium, thallium. Metals may be analyzed via ICP/ ICP-MS USEPA methods 6010 or 6020 depending on laboratory instrument availability
[7] If turbidity exceeds 10 NTUs, a duplicate sample filtered through a .45 micron filter may be collected for metals analysis in addition to the unfiltered sample. Both samples would be submitted for analysis.
[8] Parameter collected for quality assurance and quality control for field sampling purposes only; not required to be collected or reported under Part 845; collection of parameter may be discontinued without notification.
< = less than
°C = degrees Celsius
HNO_3 = nitric acid
mL = milliliter
NA = not applicable
NTU = nephelometric turbidity unit

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS
GROUNDWATER MONITORING PLAN
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	35 I.A.C. § 845.600	RL [4, 5]	MDL [5]
Metals							
Antimony	7440-36-0	mg/L	6020	0.006	0.006	0.003	0.00036
Arsenic	7440-38-2	mg/L	6020	0.01	0.01	0.001	0.00013
Barium	7440-39-3	mg/L	6020	2	2	0.001	0.00028
Beryllium	7440-41-7	mg/L	6020	0.004	0.004	0.001	0.000017
Boron	7440-42-8	mg/L	6020	NS	2	0.01	0.0023
Cadmium	7440-43-9	mg/L	6020	0.005	0.005	0.001	0.000042
Calcium	7440-70-2	mg/L	6020	NS	NS	0.15	0.15
Chromium	7440-47-3	mg/L	6020	0.1	0.1	0.004	0.00027
Cobalt	7440-48-4	mg/L	6020	0.006	0.006	0.002	0.000017
Lead	7439-92-1	mg/L	6020	0.015	0.0075	0.001	0.000025
Lithium	7439-93-2	mg/L	6020 or EPA 200.7	0.04	0.04	0.02	0.0001
Mercury	7439-97-6	mg/L	6020 or 7470A	0.002	0.002	0.0002	0.000078
Molybdenum	7439-98-7	mg/L	6020	0.1	0.1	0.001	0.000063
Selenium	7782-49-2	mg/L	6020	0.05	0.05	0.001	0.00032
Thallium	7440-28-0	mg/L	6020	0.002	0.002	0.001	0.000062
Inorganics							
Fluoride	7681	mg/L	9214 or EPA 300	4	4	0.25	0.065
Chloride	16887-00-6	mg/L	9251 or EPA 300	250 [3]	200	1	0.15
Sulfate	18785-72-3	mg/L	9036 or EPA 300	250 [3]	400	1	0.24
Total Dissolved Solids	10052	mg/L	SM 2540C	500 [3]	1200	17	--
Other							
Radium 226 and 228 Combined	7440-14-4	pCi/L	9315/9320 or EPA 903/904	5	5	-- [6]	-- [7]
Field							
pH	NA	SU	SM 4500-H+ B	NS	6.5-9.0	NA	NA
Oxidation/Reduction Potential	NA	mV	SM 2580 B	NS	NS	NA	NA
Dissolved Oxygen	NA	mg/L	SM 4500-O/405.1	NS	NS	NA	NA
Temperature	NA	°C	SM 2550	NS	NS	NA	NA
Specific Conductivity	NA	µS/cm	SM 2510 B	NS	NS	NA	NA

TABLE 4-2. DETECTION AND REPORTING LIMITS FOR PART 845 PARAMETERS

GROUNDWATER MONITORING PLAN

KINCAID POWER PLANT

ASH POND

KINCAID, ILLINOIS

Constituent	CAS	Unit	Analytical Methods [1]	USEPA MCL [2]	35 I.A.C. § 845.600	RL [4, 5]	MDL [5]
Turbidity	NA	NTU	SM 2130 B	NS	NS	NA	NA

[O: CJC 08/11/21; C: LDC 08/17/21; U: LDC 09/16/21; C: EJT 09/19/21]

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 (MDLs) will vary depending on the laboratory performing the work.

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

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

°C = degrees Celsius

µS/cm = microSiemens per centimeter

CAS = Chemical Abstract Number

MDL = Method detection limit as established by the laboratory

mg/L = milligrams per liter

mV = millivolts

NS = No standard

NTU = nephelometric turbidity unit

pCi/L = picoCuries per liter

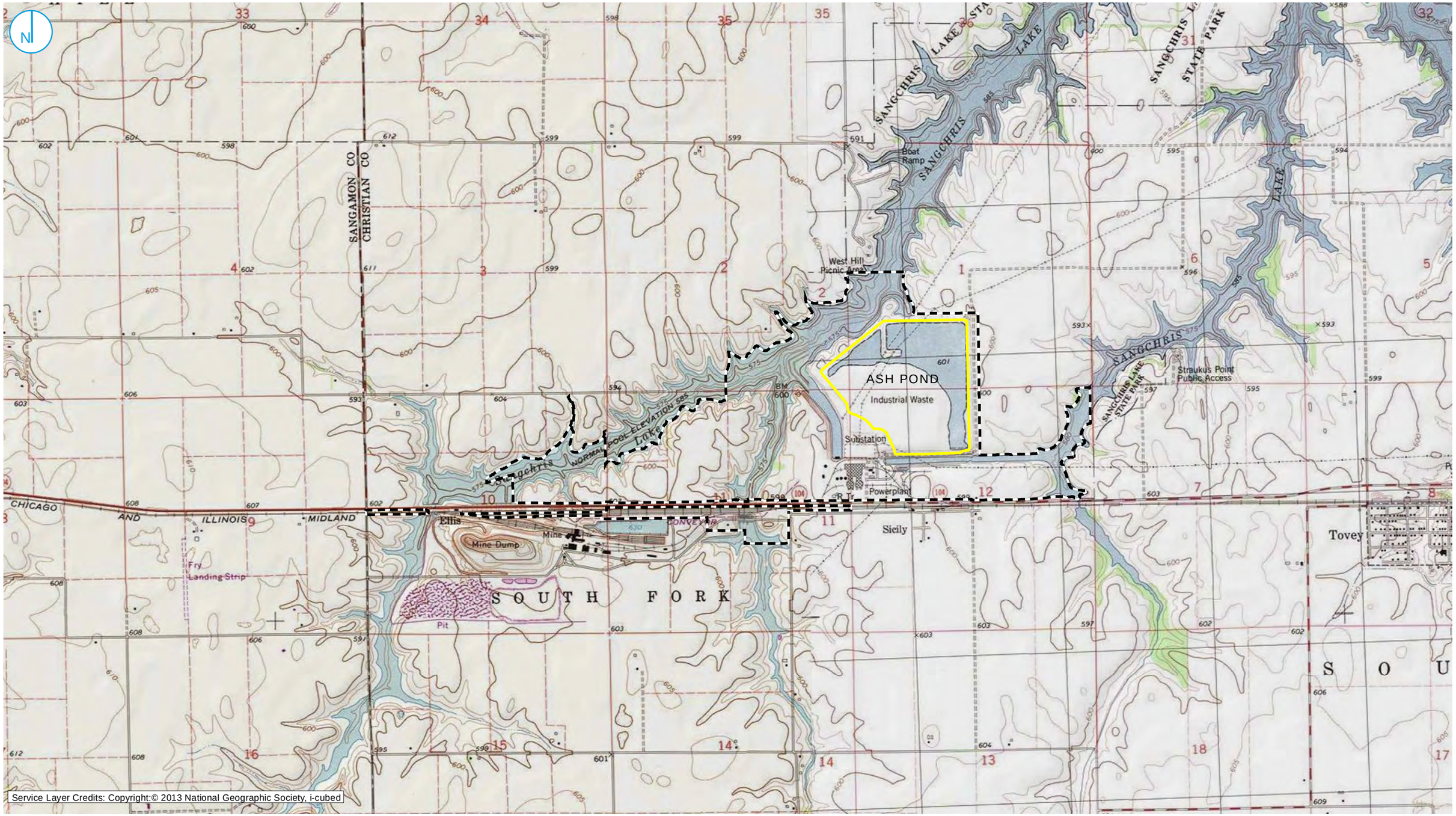
RL = Reporting limit as established by the laboratory

SM = Standard Methods for the Examination of Water and Wastewater

SU = standard units

FIGURES

Y:\Mapping\Projects\221228\MXD\845_Operating_Permit\Kincaid\GMP\Figure 1-1_Site Location Map.mxd



PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 1,000 2,000 Feet

SITE LOCATION MAP

GROUNDWATER MONITORING PLAN
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 1-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

PROJECT: 169000XXXX | DATED: 8/5/2021 | DESIGNER: galarnmc

PROJECT: 169000XXXX | DATED: 8/5/2021 | DESIGNER: galarnmc

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Kincaid\GMP\Figure 1-2_Site_Map.mxd

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 250 500 Feet

SITE MAP

GROUNDWATER MONITORING PLAN
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 1-2

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\GMP\Figure 1-3_GWE_Contours_20210223.mxd

ELEVATIONS IN PARENTHESIS WERE NOT USED FOR CONTOURING.
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

PROJECT: 169000XXXX | DATED: 10/1/2021 | DESIGNER: STOLZSD

- BACKGROUND WELL
- MONITORING WELL
- SOURCE SAMPLE LOCATION
- STAFF GAGE

- GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
- INFERRED GROUNDWATER ELEVATION CONTOUR
- GROUNDWATER FLOW DIRECTION
- PART 845 REGULATED UNIT (SUBJECT UNIT)
- PROPERTY BOUNDARY

0 250 500 Feet

GROUNDWATER ELEVATION CONTOUR FEBRUARY 23, 2021

GROUNDWATER MONITORING PLAN
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 1-3

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\222285\MXD\845_Operating_Permit\Kincaid\GMP\Figure 1-4_GWE_Contours_20210405.mxd

PROJECT: 169000XXXX | DATED: 10/1/2021 | DESIGNER: STOLZSD

BACKGROUND WELL
MONITORING WELL
SOURCE SAMPLE LOCATION
STAFF GAGE

GROUNDWATER ELEVATION CONTOUR (2-FT CONTOUR INTERVAL, NAVD88)
INFERRED GROUNDWATER ELEVATION CONTOUR
GROUNDWATER FLOW DIRECTION
PART 845 REGULATED UNIT (SUBJECT UNIT)
PROPERTY BOUNDARY

0 250 500 Feet

GROUNDWATER ELEVATION CONTOUR APRIL 5, 2021

GROUNDWATER MONITORING PLAN
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 1-4

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Kincaid\GMP\Figure 2-1_Proposed Monitoring Well Network.mxd

PROJECT: 169000XXXX | DATED: 10/7/2021 | DESIGNER: STOLZSD

BACKGROUND WELL

COMPLIANCE WELL

STAFF GAGE

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 250 500 Feet

PROPOSED PART 845 GROUNDWATER MONITORING WELL NETWORK

GROUNDWATER MONITORING PLAN
ASH POND

KINCAID POWER PLANT
KINCAID, ILLINOIS

FIGURE 2-1

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX A
STATISTICAL ANALYSIS PLAN

Prepared for
Kincaid Generation, LLC

Date
October 25, 2021

Project No.
1940100806-007

STATISTICAL ANALYSIS PLAN

ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

RAMBOLL Bright ideas. Sustainable change.

STATISTICAL ANALYSIS PLAN
KINCAID POWER PLANT ASH POND

Project Name	**Kincaid Power Plant Ash Pond**
Project No.	**1940100806-007**
Recipient	**Kincaid Generation, LLC**
Document Type	**Statistical Analysis Plan**
Version	**FINAL**
Date	**October 25, 2021**

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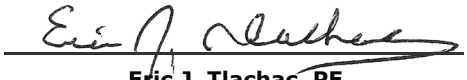
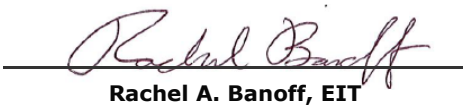
Senior Managing Hydrogeologist



Eric J. Tlachac, PE
Senior Managing Engineer



Rachel A. Banoff, EIT
Project Statistician

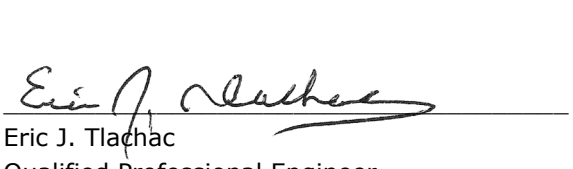
LICENSED PROFESSIONAL CERTIFICATIONS

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

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

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

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



Eric J. Tlachac
Qualified Professional Engineer
062-063091
Illinois
Date: October 25, 2021

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; Kincaid Power Plant Ash Pond) are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Brian G. Hennings
Professional Geologist
196.001482
Illinois
Date: October 25, 2021

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; Kincaid Power Plant Ash Pond), are appropriate for evaluating the groundwater monitoring data collected as described in the attached document and are in substantial compliance with 35 I.A.C. § 845.640.

Rachel A. Banoff, EIT
Project Statistician
Date: October 25, 2021

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Table A Statistical Calculations Used in Compliance Monitoring Procedures

ACRONYMS AND ABBREVIATIONS

§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
ANOVA	analysis of variance
CCR	coal combustion residuals
COC	constituents of concern
GWPS	groundwater protection standard
IEPA	Illinois Environmental Protection Agency
LCL	lower confidence limit
LTL	lower tolerance limit
MSE	mean squared error
P	probability
Part 845	Residuals in Surface Impoundments: Title 35 of the Illinois Administrative Code § 845
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
ROS	regression on order statistics
SI	surface impoundment
SSI	statistically significant increase
SWFPR	site-wide false positive rate
Unified Guidance	*Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (USEPA, 2009)
UPL	upper prediction limit
USEPA	United States Environmental Protection Agency
UTL	upper tolerance limit

1. INTRODUCTION

In April 2021, the Illinois Environmental Protection Agency (IEPA) issued a final rule for the regulation and management of Coal Combustion Residuals (CCR) in surface impoundments (SIs) under the Standards for the Disposal of CCR in Surface Impoundments: Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845 (Part 845). Facilities regulated under Part 845 are required to develop and sample a groundwater monitoring well network to evaluate whether impounded CCR materials are impacting downgradient groundwater quality. The groundwater quality evaluation must include selection and certification by a qualified professional engineer of the statistical procedures to be used. The procedures described in the evaluation will be used to establish background conditions and implement compliance and corrective action monitoring as necessary and required by 35 I.A.C. § 845.640 and 35 I.A.C. § 845.650. This Statistical Analysis Plan was prepared in accordance with the requirements of 35 I.A.C. § 845.640(f), with reference to the acceptable statistical procedures provided in United States Environmental Protection Agency's (USEPA's) *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance* (*Unified Guidance*) (March 2009).

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

1.1 Statistical Analysis Objectives

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

1.2 Statistical Analysis Plan Approach

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

The CCR Rule outlines two phases of groundwater monitoring:

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

Each phase of the groundwater monitoring program requires specific statistical procedures to accomplish the intended purpose. During the background monitoring phase, background groundwater quality will be established utilizing upgradient and background wells and downgradient groundwater quality data will be collected to facilitate statistics in subsequent phases. Compliance Monitoring is then initiated through the evaluation of the downgradient

groundwater monitoring data for exceedances of the groundwater protection standard (GWPS) established by Part 845 (concentration specified in 35 I.A.C. § 845.600 or an IEPA-approved background concentration). The developed statistical analysis plan will be implemented for each monitoring phase and in accordance with the statistical procedures.

2. BACKGROUND MONITORING AND DATA PREPARATION

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

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

As required by 35 I.A.C. § 845.650(a)(1), eight sampling events were completed within 180 days of April 21, 2021. As outlined, groundwater sampling procedures included sampling of the background and compliance wells using low-flow sampling methods, collection of one field quality control sample per event, and groundwater samples were not field filtered before laboratory analysis of total recoverable metals.

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

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

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

2.1 Sample Independence

Independence of sample results is a major assumption for most statistical analyses. To ensure physical independence of groundwater sampling results, the minimum time between sampling events must be longer than the time required for groundwater to move through the monitoring well. The sampling schedules for both the baseline and compliance monitoring periods are specified in 35 I.A.C. § 845.650(b) and may conflict with the statistical assumption of independence of sample results.

2.2 Non-Detect Data Processing

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

For all statistical test procedures:

- If the frequency of non-detect data are less than or equal to 15 percent, half of the RL will be substituted for these data
- If the non-detect frequency is between 15 percent and 50 percent, either the Kaplan-Meier or robust regression on order statistics (ROS) will be used to estimate the mean and standard deviation adjusted for the presence of left-censored values
- If the non-detect frequency is greater than 50 percent, a non-parametric test will be used
- If only one background result is detected that value will be used as the non-parametric upper prediction limit (UPL)

2.3 Testing for Normality

Many statistical analyses assume that sample data are normally distributed (parametric). However, environmental data are frequently not normally distributed (nonparametric). 35 I.A.C. § 845.640(g) requires the knowledge of the background data distribution for comparison to compliance results. The *Unified Guidance* document recommends the Shapiro-Wilk normality test for sample sizes of 50 or less, and the Shapiro-Francia normality test for sample sizes greater than 50.

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

2.4 Testing for Outliers

Part 845 constituents will be screened for the existence of outliers using a method described by the *Unified Guidance*. Outliers are extreme data points that may represent an anomaly or erroneous data point. To test for outliers, one or more of the following outlier tests will be utilized:

- Dixon's test, for well-constituent pairs with less than 25 samples, assumes normally distributed data.
- Rosner's test, for well-constituent pairs with more than 20 samples, assumes normally distributed data.
- Grubb's test for well-constituent pairs with seven or more samples, assumes normally distributed data.
- Time series, box-whisker plots, and probability plots provide visual tools to identify potential outliers, and evaluation of seasonal, spatial, or temporal variability for both normally and non-normally distributed data.

Data quality control, groundwater geochemistry, and sampling procedures will be evaluated as potential sources of error leading to an outlier result. The outlier tests cannot be used alone to determine whether a value is a true outlier that should be excluded from future statistical

analysis. Corroborating evidence needed to exclude values includes a discrete data reporting or analytical error, or potential laboratory bias. Absent corroborating evidence, the flagged values are considered true, but extreme, values in the data set. Professional judgement will be used to exclude extreme outliers from further statistical analyses. Outliers will be retained in the database.

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

2.5 Trend Analysis

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

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

2.6 Spatial Variation

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

2.7 Temporal Variation

Time series plots can be used to identify temporal dependence. Potentially significant temporal components of variability can be identified by graphing single constituent data from multiple wells together on a time series plot. With temporal dependence, the time series plot as a pattern of parallel traces, in which the individual wells will tend to rise and fall together across the sequence of sampling dates. Time series plots can be helpful by plotting multiple constituents over time for the same well, or averaging values for each constituent across wells on each sampling event and then plotting the averages over time. In either case, the plots can signify whether the general concentration pattern over time is simultaneously observed for different

constituents. If so, it may indicate that a group of constituents is highly correlated in groundwater or that the same artifacts of sampling and/or lab analysis impacted the results of several monitoring parameters.

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

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

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

2.8 Updating Background

Updating the background dataset periodically by adding recent results to an existing background dataset can improve the statistical power and accuracy of the statistical analysis, especially for non-parametric prediction intervals. The *Unified Guidance* recommends updating statistical limits (background) when at least four to eight new measurements (every 1 to 2 years under a quarterly monitoring program), are available for comparison to historical data. Professional judgement will be used to evaluate whether any background data appear to be affected by a release and need to be excluded from a background update. A t-test for equal means (if normal data distribution) or appropriate non-parametric test (if non-normal data distribution) such as a Mann-Whitney (or Wilcoxon) rank-sum or box-whisker plots, will be conducted to evaluate whether the two groups of background sample populations are statistically different prior to updating any background datasets. A 0.05 significance level will be utilized when evaluating the two populations, with the null hypothesis that they are equivalent. In addition, time series graphs or other trend evaluation statistics will be conducted on the new background dataset to verify the absence of a release or changing groundwater quality. If the tests indicate that there are no statistical differences between the two background populations, the new data will be combined with the existing dataset. If the two populations are found to be different, the data will be reviewed to evaluate the cause of the difference. If the differences appear to be caused by a

release (if the new data are significantly higher, or lower for pH), then the previous background dataset may continue to be used. Furthermore, verified outliers will not be added to an existing background dataset. In accordance with the *Unified Guidance*, continual background updates will not be conducted due to the lack of sufficient samples for a statistical comparison.

3. COMPLIANCE MONITORING

Compliance monitoring is designed to monitor groundwater for evidence of a release by comparing Part 845 constituents in compliance wells to both background concentrations and the GWPS. Compliance Monitoring will begin the 1st quarter following approval of this Groundwater Monitoring Plan and issuance of the Operating Permit. The selected Compliance Monitoring statistical method used to compare compliance groundwater quality data for each constituent to the GWPS will provide for adequate statistical power, error levels and individual test false positive rates, and be appropriate for the distribution and detection frequency of the background dataset. Statistical power is the ability of a statistical test to detect a true exceedance.

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

3.1 GWPS Establishment and Exceedance Determination

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

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

Table A. Statistical Calculations Used in Compliance Monitoring Procedures

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

3.1.1 The Upper Tolerance Limit

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

- When non-detect frequency is 15 percent or less, half the RL will be substituted for non-detects (simple substitution), and the normal mean and standard deviation will be calculated.

- The Kaplan-Meier or the ROS method will be used when the detection frequency is between 15 percent and 50 percent. The Kaplan-Meier method assesses the linearity of a censored probability plot to determine whether the background sample can be approximately normalized. If so, then the Kaplan-Meier method will be used to compute estimates of the mean and standard deviation adjusted for the presence of left-censored values. The Kaplan-Meier or ROS estimate of the mean and standard deviation will be substituted for the sample mean and standard deviation.
- If background normality cannot be achieved, non-parametric UTLs will not be calculated until a minimum of 60 background samples have been collected (to achieve 95 percent coverage).

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

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

$\overline{x}$ = background sample mean

s = background sample standard deviation

$\kappa\,(n, \gamma, \alpha - 1)$ = one-sided normal tolerance factor based on the chosen coverage (γ) and confidence level (α -1) and the size of the background dataset (n). Values are tabulated in Table 17-3 in Appendix D of the *Unified Guidance*. If exact values are not provided, then κ values can be estimated by linear interpolation.

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

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

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

s_y = background sample log-standard deviation

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

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

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

3.1.2 Parametric Confidence Intervals around a Mean

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

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

$\overline{x}$ = compliance sample mean

s = compliance sample standard deviation

n = compliance sample size

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

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

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

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

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

s_y = compliance sample log-standard deviation

3.1.3 Non-Parametric Confidence Intervals around a Median

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

The sample size n will be ordered from least to greatest. Given *P* = 0.50, candidate interval endpoints will be chosen by ordered data values with ranks close to the product of (n+1) x 0.50. If the result of (n+1) x 0.50 is a fraction (for even-numbered sample sizes), the rank values immediately above and below will be selected as possible candidate endpoints. If the result of (n+1) x 0.50 is an integer (for odd-numbered sample sizes), one will be added to and subtracted

from the result to get the upper and lower candidate endpoints. The ranks of the endpoints will be denoted L* and U*. For a one-sided LCL, the confidence level associated with endpoint L* will be computed as:

$$1 - \alpha = Bin(L^* - 1; n, 0.50) = \sum_{x=L^*}^{n} \binom{n}{x} \left(\frac{1}{2}\right)^n$$

If the candidate endpoint(s) do not achieve the desired confidence level, new candidate endpoints (L*–1) and (U*+1) and achieved confidence levels will be calculated. If one candidate endpoint equals the data minimum or maximum, only the rank of the other endpoint will be changed. Achievable confidence levels are tabulated using these equations in Table 21-11 in Appendix D of the *Unified Guidance*.

Both parametric and non-parametric confidence limits will then be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance monitoring wells. A GWPS exceedance is determined if the LCL exceeds the GWPS.

3.1.4 The Upper Prediction Limit for a Future Mean

The parametric UPL for a future mean will be used to calculate the GWPS if the pooled background data contain 50 to 70 percent non-detects and normality can be achieved. The Kaplan-Meier or ROS methods will be used to estimate the mean and standard deviation. The non-parametric UPL for a future median will be calculated as the GWPS if background samples cannot be normalized or contain greater than 70 percent non-detects. The parametric UPL for a future mean will be calculated from the background dataset at follows:

$$UPL_{1-\alpha} = \overline{x} + \kappa s$$

$\overline{x}$ = background sample mean

s = background standard deviation

κ = multiplier based on the order (p) of the future mean to be predicted, the number of compliance wells to be tested (w), the background sample size (n) the number (c) of constituents of concern (COCs), the "1-of-m" retesting scheme, and the evaluation schedule (annual, semi-annual, quarterly). Values are tabulated in 19-5 to 19-9 in Appendix D of the *Unified Guidance*.

The mean of order p will be computed for each well and compared against the UPL. For any compliance point mean that exceeds the limit, p additional resamples may be collected at that well for a 1-of-2 retesting scheme. Resample means will then be compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when the initial mean and all resample means exceed the UPL.

3.1.5 The Non-Parametric Upper Prediction Limit for a Future Median

The non-parametric UPL for a future median will be used to calculate the GWPS if the pooled background data contain greater than 70 percent non-detects and normality cannot be achieved. Non-parametric methods assume that the data does not have an underlying distribution. To calculate the non-parametric UPL on a future value, the target per-constituent false positive rate (α_{const}) will be determined as follows:

$$\alpha_{const} = 1 - (1 - \alpha)^{1/c}$$

α = the site-wide false positive rate (SWFPR) of 0.10 recommended by the *Unified Guidance*

c = the number of monitoring constituents

The number of yearly statistical evaluation (nE) will be multiplied by the number of compliance wells (w) to determine the look-up table entry, w*. The background sample size (n) and w* will be used to select an achievable per-constituent false positive rate value in Table 19-24 of Appendix D in the *Unified Guidance*. The chosen achievable per-constituent false positive rate value will determine the type of non-parametric prediction limit (maximum or 2nd highest value in background) and a retesting scheme for a future median. The background data will be sorted in ascending order, and the upper prediction limit will be set to the appropriate order statistic previously determined by the achievable per-constituent false positive rate value in Table 19-24. If all constituent measurements in a background sample are non-detect, the Double Quantification rule will be used. The use of the Double Quantification rule in Compliance Monitoring will only be applicable if the RL is above the 35 I.A.C. § 845.600(a)(1) constituent concentration or a constituent concentration is not specified in § 845.600(a)(1). This scenario is highly unlikely. The constituent will also be removed from calculations identifying the target false positive rate.

Two initial measurements per compliance well will be collected. If both do not exceed the upper prediction limit, a third initial measurement will not be collected since the median of order 3 will also not exceed the limit. If both exceed the prediction limit, a third initial measurement will not be collected since the median will also exceed the limit. If one initial measurement is above and one below the limit, a third initial observation may be collected to determine the position of the median relative to the UPL. Up to three resamples will be collected in order to assess the resample median. In all cases, if two or more of the compliance point observations are non-detect, the median will be set equal to the RL. The median value for each compliance well will be compared to the UPL. For the 1-of-2 retesting scheme, if any compliance point median exceeds the limit, up to three additional resamples will may be collected from that well. The resample median will be computed and compared to the UPL. A GWPS exceedance has been deemed to occur at a compliance well when either the initial median, or both the initial median and resample median exceed the UPL.

If the concentrations of detected constituents are below the established GWPS, Compliance Monitoring will continue.

3.1.6 Parametric Linear Regression and Confidence Band

If the t-test detects a significant trend in the parametric linear regression line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. If this is not accounted for, a wider confidence interval will inevitably be calculated for a given confidence level and sample size (n). A wider confidence interval will result in less statistical power, or ability to demonstrate an exceedance or return to compliance. When a linear trend line has been estimated, a series of confidence intervals is estimated at each point along the trend. This creates a simultaneous confidence band that follows the trend line. As the underlying population mean increases or decreases, the confidence band does also to reflect this change at that point in time.

Linear regression will be used when background or compliance data are approximately normally distributed, with a constant sample variance around the mean, and the frequency of non-detects is low. The linear regression of concentration against sampling date (time) will be computed as follows:

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

x_i = i^{th} concentration value and

t_i = i^{th} sampling date

$\overline{t}$ = sampling mean date

s_t^2 = variance of the sampling dates

This estimate leads to the following regression equation:

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

$\overline{x}$ = mean concentration level

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

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

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

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

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

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

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

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

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

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

For background data, the UCL around the linear regression line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the linear regression line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is determined when the LCL based on the trend line first exceeds the GWPS.

3.1.7 Non-Parametric Thiel-Sen Trend Line and Confidence Band

If the Mann-Kendall test detects a significant trend in the non-parametric Thiel-Sen line using either background or compliance data for a particular constituent, confidence bands accounting for trends will be constructed to account for the trend-induced variation. The Thiel-Sen trend line will be used as a non-parametric alternative to linear regression when trend residuals cannot be normalized or if there are a higher percentage of non-detects in either background or compliance data. The Thiel-Sen trend line estimates the median concentration over time by combining the median pairwise slope with the median concentration value and the median sample date. To compute the Thiel-Sen line, the data will first be ordered by sampling event x1, x2, xn. All possible distinct pairs of measurements (x_i, x_j) for j > i will be considered and the simple pairwise slope estimate will be computed for each pair as follows:

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

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

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

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

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

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

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

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

For background data, the UCL around the Thiel-Sen trend line will be used as the GWPS for the trending constituent. For compliance data, confidence bands around the Thiel-Sen trend line will be compared to the GWPS. The CCR unit is considered to be in compliance if the LCL is equal to or lower than the GWPS for all detected constituents at all compliance wells. A GWPS exceedance is confirmed when the LCL based on the trend line first exceeds the GWPS.

3.2 Determination of Statistically Significant Increases over Background

In accordance with 35 I.A.C. §§ 845.610(b)(3)(B) and 845.640(h), individual monitoring event concentrations for each constituent detected in the compliance monitoring wells during compliance monitoring sampling events will be compared to the background concentration as determined by the methods described above. An exceedance of the background concentration for any constituent measured at any compliance monitoring well, or constituent detection if not detected in the background samples, constitutes a Statistically Significant Increase (SSI). An exception to this method is pH, where two-sided (upper and lower) tolerance limits are established from the distribution of the background groundwater quality data. An exceedance of either the UTL or lower tolerance limit (LTL) would constitute an SSI for pH.

4. REFERENCES

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United States Environmental Protection Agency (USEPA), 2009. *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities: Unified Guidance*. EPA 530-R-09-007. March 2009.

ATTACHMENT J

October 2021

Memorandum

BURNS McDONNELL

Date: 25 October 2021

Subject: 35 I.A.C. Section 845.430 – Slope Maintenance Documentation for Ash Pond at Kincaid Power Plant

Kincaid Generation, LLC operates the coal-fired Kincaid Power Plant (Plant) located in Christian County, Illinois. The Kincaid Ash Pond is an inactive surface impoundment storing coal combustion residuals (CCR). The requirements for the Kincaid Ash Pond 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)(2)(F), the initial operating permit application for existing or inactive CCR surface impoundments that have not completed an Agency approved closure before prior to July 30, 2021, must contain documentation that the CCR surface impoundment, if not incised, will be operated, and maintained with one of the forms of slope protection specified in Section 845.430. This statement addresses the requirements of Part 845, Section 845.430 Slope Maintenance, which states:

> *Section 845.430: 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).*
>
> *Section 845.430(a): 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).*
>
> *Section 845.430(b): 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 Kincaid Ash Pond, and is inspected, maintained, and repaired as needed. Based on observations from weekly inspections conducted in accordance with Section 845.540(a), and the 2020 annual inspections conducted by Hanson Professional Services Inc., the vegetative cover is described to be in good working condition with a maximum vegetation height of 12 inches. The owner's Operations and Maintenance Plan (O&M Plan) provides details for maintaining grass and removing woody vegetation and addressing erosion features on the slopes. Based on a review of the documentation described above, the owner is implementing the O&M Plan, including the completion of repairs and maintenance as needed and when issues are identified during weekly and/or annual inspections. The slope maintenance portion of the O&M Plan and the Annual Inspection performed by Hanson in 2020 are included in Attachment J. The surface impoundment slope protection (vegetative cover) installed and maintained on the slopes and pertinent areas around the slopes is depicted in the aerial photograph provided below.

SECTION 3.0

MAINTENANCE

3.1 GENERAL

Adequate maintenance of the spillway, embankment, and appurtenant structures are vital to ensure the integrity of the reservoir system as initially designed. The inspection and maintenance activities specified in the following sections are minimum requirements. Adherence to the specified procedures and additional procedures based on common sense and good husbandry will ensure that the spillway, embankment, and appurtenant structures remain in a safe operating condition for many decades.

3.2 VEGETATION

Maintenance of good vegetative cover on the slopes of the embankment, of the service spillway, and of the emergency spillway are necessary to control erosion and prolong the life of the project. In some areas, i.e., emergency spillway and the downstream slope of the dam, maintenance of proper vegetative cover is essential to the safety of the project.

Protected slopes should be carefully examined during the monthly monitoring and following severe rainfall events. Where vegetation is inadequate, or has been destroyed or damaged, it should be replaced in accordance with the following, or other approved, procedure.

1. Prepare a Seedbed

Fill eroded areas with acceptable material. Remove stones larger than 4-inches and other debris. Apply lime and fertilizer and work the seedbed to a depth of 3-inches.

2. Lime

Commercial agricultural limestone should be applied in accordance with the results of a soil test.

3. Fertilizer

The following amounts of fertilizer per acre should be applied:

Nitrogen (N)	-	120 pounds
Phosphorus (P)	-	180 pounds of P_2O_5
Potassium (K)	-	180 pounds of K_2O_5

4. Seed

Seeding mixtures used for maintenance reseeding shall result in a cover compatible with adjacent cover. The seed mix used on the earth embankments is:

Variety	Application Rate (pounds per acre)
Tall Fescue	50
Perennial Ryegrass	20
Cereal Rye or Wheat	20
Total	90

Other areas where grass cover is to be maintained shall receive maintenance reseeding as required using the following seed mix:

Variety	Application Rate (pounds per acre)
Kentucky Bluegrass	75
Perennial Ryegrass	20
Redtop or Creeping Red Fescue	10
Total	105

5. Time of Seeding

Seeding may be done from early spring to June 1 or during August. Supplemental watering may be required.

6. Sowing the Seed

The seed will be broadcast and then covered approximately 1/4-inch to 1/2-inch deep with a light harrow, culti-packer or other suitable equipment. Seeding may also be done by drilling and culti-packing or using a culti-packer seeder. When seed is applied by sowing, the rate of application will be as shown in Item 4 Seed, above.

7. Mulching

The areas seeded should be mulched immediately after seeding by one of the following methods:

a. Small grain straw or grass hay applied at the rate of 2 tons per acre. The mulch should be anchored with 1-inch or 2-inch mesh plastic netting. The netting should be secured with 6-inch staples placed approximately 3-feet apart on each side and the center of each strip. The center row of staples to be staggered with the staples on the sides.

b. Excelsior blanket may be secured in a place as indicated above for the plastic netting.

Vegetation should be maintained to obtain a vigorous stand.

After growth has been established, repeat applications of fertilizer should be undertaken, as required.

Woody vegetation, such as shrubs, brush, and willows should be cut and removed from embankment areas, the floor of the emergency spillway, the slopes of the outlet channel, and the freeboard dikes except where the freeboard dikes are part of the state wildlife area.

All seeded areas should be mowed to control weeds and brush. Mowing should be accomplished a minimum of 2 times per year, in June and September.

3.3 MAINTENANCE OF SERVICE SPILLWAY

The principal maintenance of the area will have to do with vegetation, as discussed above, and the clean-up and disposal of accumulated natural debris.

Particularly following large flood inflows during the reservoir life, there may be substantial accumulations of trees, limbs, and other floating debris.

Special attention should be afforded the protection of the service spillway from heavy timbers during times of overflow. Regular patrols, should be undertaken during floods to remove heavy floating debris from the vicinity of the service and emergency spillways.

Appropriate disposal of debris would be to regularly pull material from the water and place it in a pile for disposal. Similar activity may be performed at the upper end of the reservoir near the power plant.

Stone riprap at the entrance to the service spillway and on the slopes adjacent to the hydraulic jump basin should be maintained free of logs and other trash. If stone is dislodged during maintenance work, if should be replaced. It is normally better to use too much riprap than to use too little. However, care should be taken in placing the riprap such that it does not extend above the spillway crest, thereby reducing the spillway discharge capacity.

3.4 MAINTENANCE OF SPILLWAY OUTLET CHANNEL

The channel is designed to have a good stand of grass which is mowed to a height of not less than six inches. Woody growth and shrubbery must be eliminated, especially on the channel bottom.

Dam Inspection Report

Name of Dam: Kincaid Power Station Ash Pond Dam ID No.: NA

Permit Number: NA Class of Dam: II

Location: _____ Section: 11 & 12 Township: 13N Range: 4W

Owner: Dynegy Midwest (Name) 217 237 4311 (Telephone Number (Day))

IL Route 104 (Street) 217 237 4311 (Telephone Number (Night))

Sicily (City) 62540 (Zip Code) County: Christian

Type of Dam: Earth Embankment with Drop Structure Spilllway

Type of Spillway: Drop structure to outlet condiut

Date(s) Inspected: 9-Nov-20

Weather When Inspected: Clear

Temperature When Inspected: 65 F

Pool Elevation When Inspected: _____

Tailwater Elevation When Inspected: NA

12/29/2020

Professional Engineer's Seal

Exp 11/30/21

Inspection Personnel:

Name	Title
James Knutelski P.E.	Geotechnical Engineer
Jason Campbell, P.E.	Luminant Dam Safety
David Huber	Plant Personnel
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	OB	Some depressions probably due to abandoned animal burrows.	Observe these areas for erosion and repair if necessary.
Upstream Face Slope Protection	NA		
Seepage	OB	West side toe wet area/ruts filled with water.	Observe for increased seepage rate.
Filter and Filter Drains	NA		

EARTH EMBANKMENT

(Continued)

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Animal Damage	MM	Animal burrows on downstream slopes and near outlet structure steps.	Fill animal burrows.
Embankment Drainage Ditches	NA		
Vegetative Cover	OB	Downstream slopes - minor rutting/track marks and bare areas due to mowing equipment and game trails.	Observe and repair or reseed if areas erode or if vegetation does not regrow.
Sinkhole	NE	Sinkhole at south toe not apparent.	Observe this area for changed condition.
Other			
Other			
Other			

PRINCIPAL SPILLWAY
APPROACH CHANNEL

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Debris	NA		
Side Slope Stability	NA		
Slope Protection	NA		
Other (Name)			
Other			
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	NE		
Structure to Embankment Junction	NA		
Drains	NA		
Seepage Around or Into Structure	NE		
Surface Cracks	NE		
Structural Cracks	NE		

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

PRINCIPAL SPILLWAY

(Continued)

[X] Drop Inlet Spillway [ ] Overflow Spillway Structure [ ] Gated

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Alignment of Abutment Walls	NA		
Construction Joints	GC		
Filter and Filter Drains	NA		
Trash Racks	GC		
Bridge and Piers	GC		
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	NE		
Seepage Around of Into Conduit	NE		
Surface Cracks	NE		
Structural Cracks	NE		
Trash Racks	NA		
Differential Settlement	NE		
Alignment	GC		
Conduit Pipe	MM	Small tress adjacent to conduit.	Cut/remove before trees are established.

IF THE SPILLWAY IS GATED FILL OUT THE GATES SECTION

EMERGENCY SPILLWAY

[X] Earth

Other: Name _____

ITEM	CONDITION CODE	DEFICIENCIES	RECOMMENDED REMEDIAL MEASURES AND IMPLEMENTATION SCHEDULE
Erosion	NE		
Weeds, Logs, Other Obstructions	NE		
Side Slope Sloughing	NE		
Vegetation	GC		
Sedimentation	NE		
Riprap	NA		
Settlement of Crest	NE		
Downstream Channel	NA		
Other (Name)			

SUMMARY OF MAINTENANCE DONE AND/OR

REPAIRS MADE SINCE THE LAST INSPECTION

DATE OF PRESENT INSPECTION 9-Nov-20

DATE OF LAST INSPECTION 20-Aug-19

1. EARTH EMBANKMENT DAMS
   Mowed slopes and downstream toe. Filled animal burrows and sinkhole.

2. CONCRETE MASONRY DAMS
   NA

3. PRINCIPAL SPILLWAY
   None.

4. OUTLET WORKS
   NA

5. EMERGENCY SPILLWAY
   None.

Owner's Maintenance Statement

I, _____, owner of Kincaid Ash Pond dam,

Dam Identification Number NA, in Christian County,

am maintaining the dam in accordance with the accepted maintenance plan which is part of

Permit Number NA.

_____
Signature

_____
Date

Owner's Operation and Maintenance Plan Statement

I, _____, owner of Kincaid Ash Pond dam,

Dam Identification Number NA, in Christian County,

have reviewed the operation and maintenance plan including the Emergency Action Plan (EAP),

which is part of, Permit Number NA.

I _____ have enclosed the appropriate revisions or

_____ have determined that no revisions to the plan are necessary.

_____
Signature

_____
Date

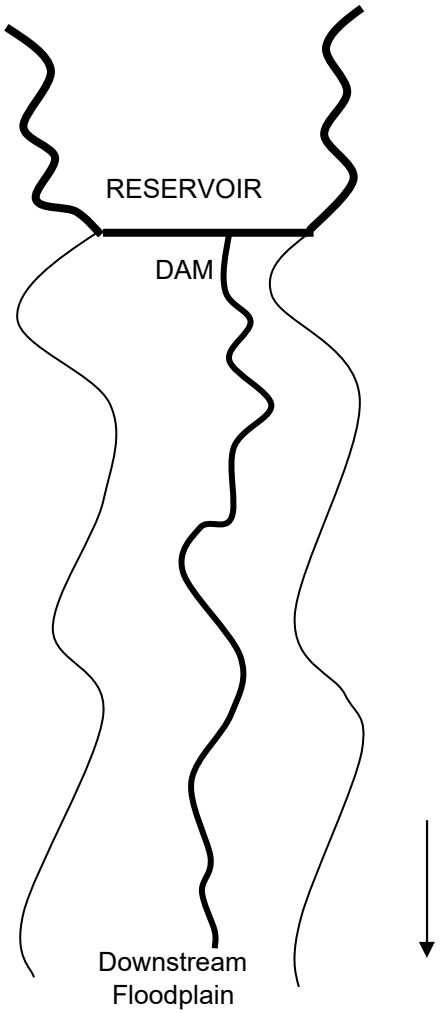
The Department of Nautural Resources is requesting information that is necessary to accomplish the statutory purpose as outlined under the River, Lakes and Streams Act, 615 ILCS 5. Submittal of this information is REQUIRED. Failure to provide the required information could result in the initiation of non-compliance procedures as outlined in Section 3702.160 of the "Rules for Construction and Maintenance of Dams".

DOWNSTREAM DEVELOPMENT

APPROXIMATE WIDTH OF AFFECTED FLOODPLAIN NA MILES

MILES DOWNSTREAM FROM DAM	DOWNSTREAM DEVELOPMENT												Loss of Life Potential			Economic Loss Potential		
	OCCUPIED HOMES	UNOCCUPIED HOMES	AGRICULTURAL BUILDINGS	INDUSTRIAL BUILDINGS	COMMERCIAL BUILDINGS	SCHOOLS	HOSPITALS	ROADS & BRIDGES	DAMS	OVERHEAD UTILITIES	OTHER DEVELOPMENT (Name	OTHER DEVELOPMENT (Name	NONE	1 TO 10	OVER 10	MINIMAL EXPECTED	APPRECIABLE EXPECTED	EXCESSIVE EXPECTED
0 to 1/4										1						x		
1/4 to 1/2																x		
1/2 to 3/4																x		
3/4 to 1																x		
1 to 1-1/4																x		
1-1/4 to 1-1/2																x		
1-1/2 to 1-3/4																x		
1-3/4 to 2																x		
OVER 2										1						x		

SKETCH IN DEVELOPMENTS DOWNSTREAM OF THE DAM



The number of homes, buildings, or other items in the floodplain downstream of the dam should be placed in the appropriate row and column to designate their location.

Spillway structure

Spillway conduit outlet – remove woody vegetation adjacent to conduit

Downstream slope south side emergency spillway

Downstream slope south side

East side downstream slope

East side crest & interior slope

North downstream slope

North side crest

North side stability berm

West side downstream slope

West side interior and crest

West side wet area/rutting – observe for increased seepage rate

South side downstream slope

South side crest and interior

Inlet pipes

Typical bare areas west side – observe and repair if necessary

Animal trail north side – observe and repair if necessary.

Animal damage north side – observe and repair if necessary

Typical animal burrow – fill

Typical animal burrow – fill

Animal burrow near outlet structure steps– fill

Typical depressions in embankment slope – observe and repair if necessary.

ATTACHMENT K

October 2021

POST-CLOSURE PLAN FOR EXISTING CCR SURFACE IMPOUNDMENT
40 C.F.R. § 257.104 and 35 I.A.C. 845.780
REV 0 –10/30/2021

SITE INFORMATION

Site Name / Address	Kincaid Power Plant / 199 Illinois Route 104, Kincaid, IL 62234		
Owner Name / Address	Kincaid Generation, LLC / 6555 Sierra Drive Irving, Texas 75039		
CCR Unit	Ash Pond	Closure Method and Final Cover Type	Close In-Place Clayey Soil Cover with Vegetation

POST-CLOSURE PLAN DESCRIPTION

40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1) – Length of post-closure care period.	Post-closure care will be conducted for a period of 30 years as required by 40 C.F.R. § 257.104(c)(1) and 35 I.A.C. 845.780(c)(1), except as provided by 40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2).
40 C.F.R. § 257.104(c)(2) and 35 I.A.C. 845.780(c)(2) - Circumstances extending the post closure care period.	If at the end of the post-closure care period the CCR unit is operating under assessment monitoring in accordance with §257.95, the post-closure care as described in this plan will continue until returning to detection monitoring in accordance with §257.95. Under 35 I.A.C. 845.780(c)(2), the post-closure care period will be extended until groundwater monitoring data demonstrate that concentrations are below the groundwater protection standards in Section 845.600 and are not increasing for those constituents over background, using the statistical procedures and performance standards in Section 845.640(f) and (g), provided that concentrations have been reduced to the maximum extent feasible and concentrations are protective of human health and the environment.
40 C.F.R. § 257.104(d)(1)(i) and 35 I.A.C. 845.780(d)(1)(A) – A description of the monitoring and maintenance activities required in 40 C.F.R. § 257.104(b) and 35 I.A.C. 845.780(b), and the frequency at which these activities will be performed, to maintain the integrity and effectiveness of the final cover system, maintain the groundwater monitoring system and monitor the groundwater.	Pursuant to § 257.104(b)(1) and 35 I.A.C. 845.780(b)(1), throughout the post-closure care period, periodic visual observations of the final cover system and stormwater management system will be performed at least annually for evidence of settlement, subsidence, erosion, or other damage that may adversely affect the integrity and effectiveness of the final cover system. When practical, visual observations of the final cover will be made concurrent with groundwater monitoring activities. Noted evidence of damage, such as rills, surface cracks and settlement, will be repaired to maintain the integrity and effectiveness of the final cover system. Vegetation will be established and maintained on the final cover system, including storm drainage areas, where appropriate, to provide long-term erosion control. Established vegetation and the slope design of the final cover system will prevent potential erosion and damage that may be caused by run-on and run-off. Repair activities may include, but are not limited to, replacing and

	compacting soil cover, repairing drainage channels that have been eroded, filling in depressions with soil, regrading, and reseeding areas of failed vegetation, as necessary. Pursuant to § 257.104(b)(3) and 35 I.A.C. 845.780(b)(3), the groundwater monitoring system will be maintained, and groundwater will be monitored as required by 40 C.F.R. § 257.90 through 40 C.F.R. § 257.98 and 35 I.A.C. 845.600 through 35 I.A.C. 845.680. Monitoring wells will be inspected during each groundwater sampling event. Monitoring wells and associated instrumentation will be maintained so that they perform to the design specifications throughout the life of the monitoring program. Groundwater monitoring frequency will be at least quarterly, except as provided in 40 C.F.R. § 257.94(d) and 35 I.A.C. 845.650(b)(4).
40 C.F.R. § 257.104(d)(1)(ii) and 35 I.A.C. 845.780(d)(1)(B) – The name, address, telephone number and email address of the person or office to contact about the facility during the post-closure care period.	Kincaid Generation, LLC 6555 Sierra Drive Irving, Texas 75039 800.633.4704 ccr@dynegy.com
40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) – A description of the planned uses of the property during the post-closure period.	The CCR unit is located at an operating electric generation facility. Planned uses of the property during the post-closure period are currentlyunknown, except for post-closure care of the CCR unit. Post-closure use of the property will not disturb the integrity of the final cover system or other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements of 40 C.F.R. Part § 257, Subpart D and 35 I.A.C. Part 845. Any other disturbance will be conducted following a demonstration that it will not increase the potential threat to human health or the environment, as required by 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780 (d)(1)(C). The demonstration will be certified by a qualified professional engineer and submitted to the Illinois Environmental Protection Agency (IEPA). Per 40 C.F.R. § 257.104(d)(1)(iii) notification shall be provided to the State Director that the demonstration has been placed in the operating record and on the owners or operator's publicly accessible internet site. Following closure of the CCR unit, a notation on the deed to the property, or some other instrument that is normally examined during title search, will be recorded in accordance with 40 C.F.R. § 257.102(i) and 35 I.A.C. 845.760(h). The notation will notify potential purchasers of the property that the land has been used as a CCR unit and its use is restricted under the post-closure care requirements in 40 C.F.R. § 257.104(d)(1)(iii) and 35 I.A.C. 845.780(d)(1)(C) or groundwater monitoring requirements per 35 I.A.C. 845.740(b). Within 30 days of recording the deed notation, a notification stating that the notation has been recorded will be submitted to the IEPA and placed in the facility's operating record per 35 I.A.C. 845.760(h)(3). The notification will be placed on the owner or operator's publicly accessible CCR Web site in accordance with 40 C.F.R. 40 C.F.R. § 257.107(i)(9) and 35 I.A.C. 845.810(e) and placed in the facility's operating record as required by 35 I.A.C. 845.800(d)(26) and §257.105(i)(9).

40 C.F.R. § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3) - Amendments to the initial or subsequent written post-closure plan.	Pursuant to 40 C.F.R. § 257.104(d), the initial post closure care plan for the Kincaid Ash Pond was prepared on October 17, 2016. That plan is being amended pursuant to 40 C.F.R. § 257.104(d)(3)(i). This plan also serves as the initial post-closure care plan, prepared in accordance with 35 I.A.C. 845.780(d). Pursuant to § 257.104(d)(3) and 35 I.A.C. 845.780(d)(3), an operating permit modification application to amend the initial or any subsequent written post-closure care plan developed under 35 I.A.C. 845.780 (d)(1) and § 257.104(d)(1) will be submitted to IEPA. The written post-closure care plan will be amended whenever there is a change in the operation of the CCR surface impoundment that would substantially affect the written post-closure care plan in effect; or unanticipated events necessitate a revision of the written post-closure care plan, after post-closure activities have started. The written post-closure care plan will be amended at least 60 days before a planned change in the operation of the facility or CCR surface impoundment, or within 60 days after an unanticipated event requires the need to revise the existing plan. If the plan is revised after post-closure activities have started, a request to modify the operating permit, including an amended written post-closure care plan, will be submitted to the IEPA within 30 days following the triggering event.
40 C.F.R. § 257.104(d)(4) and 35 I.A.C. 845.780(d)(4) – Qualified professional engineering certification.	Certification by a qualified professional engineer will be appended to this plan and any amendment of this plan.
35 I.A.C. 845.780(e) – Termination of post-closure care	Upon completion of the post-closure period, a request to terminate post-closure care will be submitted to the IEPA. The request will include a certification by a qualified professional engineer verifying that post-closure care has been completed in accordance with the post-closure care plan specified in 35 I.A.C. 845.780(d) and the requirements of 35 I.A.C. 845.780.
40 C.F.R. § 257.104(e) and 35 I.A.C. 845.780(f) – Notification of completion of the post-closure care period.	A notification of completion of post-closure care will be prepared and placed in the facility's operating record within 30 days after IEPA approval of the request to terminate post-closure care. The notification will be placed in the facility's operating record in accordance with 35 I.A.C. 845.800(d)(31) and § 257.105(i)(13). The notification will be placed on the owner or operator's publicly accessible CCR Internet site in accordance with the requirements of § 257.107(i)(13) and 35 I.A.C. 845.810(e). The IEPA will be notified when the notification has been placed in the operating record and on the owner or operator's publicly accessible Internet site in accordance with the requirements of § 257.106(i)(13).

Certification Statement 40 C.F.R. § 257.104 (d)(4) and 35 I.A.C. 845.780(d)(4) – Amended/Initial Written Post Closure Plan for a CCR Surface Impoundment

CCR Unit: Kincaid Generation, LLC; Kincaid Power Plant; Ash Pond

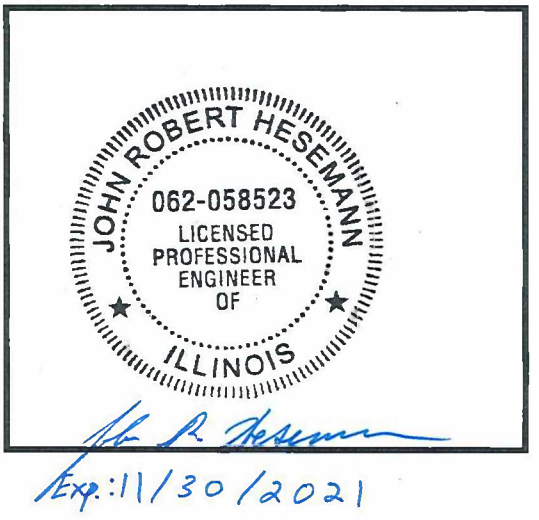
I, John R. Hesemann, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief, that the information contained in this certification has been prepared in accordance with the accepted practice of engineering. I certify, for the above referenced CCR Unit, that the information contained in the amended/initial written post closure plan, dated October 30, 2021, meets the requirements of 40 C.F.R. § 257.104 and 35 I.A.C. 845.780.

John R. Hesemann

Printed Name

9/29/2021

Date



ATTACHMENT M

October 2021

HISTORY OF POTENTIAL EXCEEDANCES

This presentation of the History of Potential Exceedances, and any corrective action taken to remediate groundwater, is provided to meet the requirements of Title 35 of the Illinois Administrative Code (35 I.A.C.) § 845.230(d)(2)(M) for the Kincaid Power Plant Ash Pond, Illinois Environmental Protection Agency (IEPA) ID No. W0218140002-01.

Note

Groundwater concentrations from 2015 to 2021 presented in the Hydrogeologic Site Characterization Report (HCR) Table 4-1, and evaluated and summarized in the following tables, are considered potential exceedances because the methodology used to determine them is proposed in the Statistical Analysis Plan (Appendix A to Groundwater Monitoring Plan [GMP]), which has not been reviewed or approved by IEPA at the time of submittal of the 35 I.A.C. § 845 Operating Permit application.

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

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

Background Concentrations

Background monitoring wells identified in the GMP include MW-1 and MW-2.

For monitoring wells that have been historically monitored in accordance with Title 40, Code of Federal Regulations, Part 257, Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments), background concentrations calculated from sampling events in 2015-2017 were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations in 2015-2017 greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as Groundwater Protection Standards (GWPSs) for comparing to statistical calculation results for each compliance well to determine potential exceedances. Compliance well statistical calculations consider concentrations from all sampling events in 2015-2021.

For all other monitoring wells, either newly constructed in 2021 or existing wells not monitored under Title 40, Code of Federal Regulations, Part 257, Subpart D, background concentrations calculated from the eight sampling events required by 35 I.A.C. § 845.650(b)(1)(A), to be collected within 180 days from April 21, 2021, were compared to the standards identified in 35 I.A.C. § 845.600(a)(1). For constituents with calculated background concentrations greater than the standards in 35 I.A.C. § 845.600(a)(1), those calculated background concentrations were used as GWPSs. Compliance well statistical calculations from that same time period were compared to the GWPSs to determine potential exceedances.

Corrective Action

No corrective actions have been taken to remediate the groundwater.

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-3	UA	845	Antimony, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-3	UA	845	Arsenic, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.010	0.0048	0.01	Standard
MW-3	UA	845	Barium, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.047	2.0	0.15	2	Standard
MW-3	UA	845	Beryllium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-3	UA	845	Boron, total	mg/L	02/25/2021 - 08/10/2021	CI around median	1.6	2.0	0.30	2	Standard
MW-3	UA	845	Cadmium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-3	UA	845	Chloride, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	31	200	18	200	Standard
MW-3	UA	845	Chromium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-3	UA	845	Cobalt, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.001	0.006	0.0039	0.006	Standard
MW-3	UA	845	Fluoride, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	0.24	4.0	0.51	4	Standard
MW-3	UA	845	Lead, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-3	UA	845	Lithium, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.003	0.040	0.012	0.04	Standard
MW-3	UA	845	Mercury, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-3	UA	845	Molybdenum, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-3	UA	845	pH (field)	SU	02/25/2021 - 08/10/2021	CI around mean	6.5	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-3	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/10/2021	CI around mean	-0.0162	5.0	1.0	5	Standard
MW-3	UA	845	Selenium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-3	UA	845	Sulfate, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	138	400	151	400	Standard
MW-3	UA	845	Thallium, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.002	0.002	0.002	0.002	Standard
MW-3	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/10/2021	CB around T-S line	540	1200	494	1200	Standard
MW-4	UA	845	Antimony, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-4	UA	845	Arsenic, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.010	0.0048	0.01	Standard
MW-4	UA	845	Barium, total	mg/L	02/25/2021 - 06/09/2021	CI around mean	0.096	2.0	0.15	2	Standard
MW-4	UA	845	Beryllium, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-4	UA	845	Boron, total	mg/L	02/25/2021 - 06/09/2021	CI around mean	0.39	2.0	0.30	2	Standard
MW-4	UA	845	Cadmium, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-4	UA	845	Chloride, total	mg/L	02/25/2021 - 06/09/2021	CI around mean	25	200	18	200	Standard
MW-4	UA	845	Chromium, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-4	UA	845	Cobalt, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.006	0.0039	0.006	Standard
MW-4	UA	845	Fluoride, total	mg/L	02/25/2021 - 06/09/2021	CI around mean	0.27	4.0	0.51	4	Standard
MW-4	UA	845	Lead, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-4	UA	845	Lithium, total	mg/L	02/25/2021 - 05/19/2021	CI around mean	0.00151	0.040	0.012	0.04	Standard
MW-4	UA	845	Mercury, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-4	UA	845	Molybdenum, total	mg/L	02/25/2021 - 05/19/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-4	UA	845	pH (field)	SU	02/25/2021 - 06/09/2021	CI around mean	6.3	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-4	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 06/09/2021	CI around mean	-0.0508	5.0	1.0	5	Standard
MW-4	UA	845	Selenium, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-4	UA	845	Sulfate, total	mg/L	02/25/2021 - 06/09/2021	CI around mean	20	400	151	400	Standard
MW-4	UA	845	Thallium, total	mg/L	02/25/2021 - 06/09/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-4	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 06/09/2021	CI around mean	469	1200	494	1200	Standard
MW-5	UA	257	Antimony, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-5	UA	257	Arsenic, total	mg/L	06/16/2015 - 09/01/2021	CI around median	0.001	0.010	0.0022	0.01	Standard
MW-5	UA	257	Barium, total	mg/L	06/16/2015 - 09/01/2021	CI around mean	0.14	2.0	0.13	2	Standard
MW-5	UA	257	Beryllium, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-5	UA	257	Boron, total	mg/L	06/16/2015 - 09/01/2021	CI around mean	0.53	2.0	0.27	2	Standard
MW-5	UA	257	Cadmium, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-5	UA	257	Chloride, total	mg/L	06/16/2015 - 09/01/2021	CB around linear reg	44	200	18	200	Standard
MW-5	UA	257	Chromium, total	mg/L	06/16/2015 - 09/01/2021	CB around T-S line	0.001	0.10	0.0025	0.1	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-5	UA	257	Cobalt, total	mg/L	06/16/2015 - 09/01/2021	CI around median	0.001	0.006	0.0012	0.006	Standard
MW-5	UA	257	Fluoride, total	mg/L	06/04/2015 - 09/01/2021	CI around median	0.15	4.0	0.47	4	Standard
MW-5	UA	257	Lead, total	mg/L	06/16/2015 - 09/01/2021	CI around median	0.001	0.0075	0.0014	0.0075	Standard
MW-5	UA	257	Lithium, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	0.00286	0.040	0.0068	0.04	Standard
MW-5	UA	257	Mercury, total	mg/L	06/04/2015 - 09/01/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-5	UA	257	Molybdenum, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.0015	0.10	0.0053	0.1	Standard
MW-5	UA	257	pH (field)	SU	06/16/2015 - 09/01/2021	CI around mean	6.7	6.3/9.0	6.3/7.7	6.5/9	Background/Standard
MW-5	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/15/2015 - 09/01/2021	CB around T-S line	-0.291	5.0	2.0	5	Standard
MW-5	UA	257	Selenium, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.050	0.0048	0.05	Standard
MW-5	UA	257	Sulfate, total	mg/L	06/16/2015 - 09/01/2021	CI around median	10	400	202	400	Standard
MW-5	UA	257	Thallium, total	mg/L	06/16/2015 - 09/01/2021	CB around linear reg	0.00197	0.002	0.001	0.002	Standard
MW-5	UA	257	Total Dissolved Solids	mg/L	06/16/2015 - 09/01/2021	CI around mean	641	1200	685	1200	Standard
MW-6	UA	257	Antimony, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-6	UA	257	Arsenic, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.010	0.0022	0.01	Standard
MW-6	UA	257	Barium, total	mg/L	06/16/2015 - 09/01/2021	CI around geomean	0.032	2.0	0.13	2	Standard
MW-6	UA	257	Beryllium, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-6	UA	257	Boron, total	mg/L	06/16/2015 - 09/01/2021	CI around mean	0.93	2.0	0.27	2	Standard
MW-6	UA	257	Cadmium, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-6	UA	257	Chloride, total	mg/L	06/16/2015 - 09/01/2021	CI around median	5.0	200	18	200	Standard
MW-6	UA	257	Chromium, total	mg/L	06/16/2015 - 09/01/2021	CI around median	0.001	0.10	0.0025	0.1	Standard
MW-6	UA	257	Cobalt, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.0012	0.006	Standard
MW-6	UA	257	Fluoride, total	mg/L	06/04/2015 - 09/01/2021	CB around linear reg	0.19	4.0	0.47	4	Standard
MW-6	UA	257	Lead, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.001	0.0075	0.0014	0.0075	Standard
MW-6	UA	257	Lithium, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	0.00259	0.040	0.0068	0.04	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-6	UA	257	Mercury, total	mg/L	06/04/2015 - 09/01/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-6	UA	257	Molybdenum, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.0015	0.10	0.0053	0.1	Standard
MW-6	UA	257	pH (field)	SU	06/16/2015 - 09/01/2021	CI around mean	6.5	6.3/9.0	6.3/7.7	6.5/9	Background/Standard
MW-6	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/15/2015 - 09/01/2021	CI around geomean	0.19	5.0	2.0	5	Standard
MW-6	UA	257	Selenium, total	mg/L	06/16/2015 - 09/01/2021	CI around median	0.001	0.050	0.0048	0.05	Standard
MW-6	UA	257	Sulfate, total	mg/L	06/16/2015 - 09/01/2021	CB around linear reg	63	400	202	400	Standard
MW-6	UA	257	Thallium, total	mg/L	06/16/2015 - 09/01/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
MW-6	UA	257	Total Dissolved Solids	mg/L	06/16/2015 - 09/01/2021	CB around linear reg	373	1200	685	1200	Standard
MW-7	UA	257	Antimony, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-7	UA	257	Arsenic, total	mg/L	06/17/2015 - 09/01/2021	CI around median	0.001	0.010	0.0022	0.01	Standard
MW-7	UA	257	Barium, total	mg/L	06/17/2015 - 09/01/2021	CI around mean	0.049	2.0	0.13	2	Standard
MW-7	UA	257	Beryllium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-7	UA	257	Boron, total	mg/L	06/17/2015 - 09/01/2021	CI around mean	0.21	2.0	0.27	2	Standard
MW-7	UA	257	Cadmium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-7	UA	257	Chloride, total	mg/L	06/17/2015 - 09/01/2021	CB around linear reg	3.2	200	18	200	Standard
MW-7	UA	257	Chromium, total	mg/L	06/17/2015 - 09/01/2021	CI around median	0.001	0.10	0.0025	0.1	Standard
MW-7	UA	257	Cobalt, total	mg/L	06/17/2015 - 09/01/2021	CI around median	0.001	0.006	0.0012	0.006	Standard
MW-7	UA	257	Fluoride, total	mg/L	06/04/2015 - 09/01/2021	CI around mean	0.25	4.0	0.47	4	Standard
MW-7	UA	257	Lead, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.0075	0.0014	0.0075	Standard
MW-7	UA	257	Lithium, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	0.003	0.040	0.0068	0.04	Standard
MW-7	UA	257	Mercury, total	mg/L	06/04/2015 - 09/01/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-7	UA	257	Molybdenum, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	0.00262	0.10	0.0053	0.1	Standard
MW-7	UA	257	pH (field)	SU	06/17/2015 - 09/01/2021	CI around mean	7.0	6.3/9.0	6.3/7.7	6.5/9	Background/Standard
MW-7	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/15/2015 - 09/01/2021	CI around mean	0.55	5.0	2.0	5	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-7	UA	257	Selenium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.050	0.0048	0.05	Standard
MW-7	UA	257	Sulfate, total	mg/L	06/17/2015 - 09/01/2021	CI around geomean	167	400	202	400	Standard
MW-7	UA	257	Thallium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
MW-7	UA	257	Total Dissolved Solids	mg/L	06/17/2015 - 09/01/2021	CI around mean	558	1200	685	1200	Standard
MW-7S	USCU	845	Antimony, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.001	0.006	0.001	0.006	Standard
MW-7S	USCU	845	Arsenic, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00349	0.010	0.0048	0.01	Standard
MW-7S	USCU	845	Barium, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.035	2.0	0.15	2	Standard
MW-7S	USCU	845	Beryllium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-7S	USCU	845	Boron, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	3.5	2.0	0.30	2	Standard
MW-7S	USCU	845	Cadmium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-7S	USCU	845	Chloride, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	10	200	18	200	Standard
MW-7S	USCU	845	Chromium, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	-0.000952	0.10	0.0095	0.1	Standard
MW-7S	USCU	845	Cobalt, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00107	0.006	0.0039	0.006	Standard
MW-7S	USCU	845	Fluoride, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	0.30	4.0	0.51	4	Standard
MW-7S	USCU	845	Lead, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.000776	0.0075	0.0051	0.0075	Standard
MW-7S	USCU	845	Lithium, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.003	0.040	0.012	0.04	Standard
MW-7S	USCU	845	Mercury, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-7S	USCU	845	Molybdenum, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00121	0.10	0.0062	0.1	Standard
MW-7S	USCU	845	pH (field)	SU	02/24/2021 - 08/11/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-7S	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/24/2021 - 08/11/2021	CI around mean	-0.113	5.0	1.0	5	Standard
MW-7S	USCU	845	Selenium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-7S	USCU	845	Sulfate, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	379	400	151	400	Standard
MW-7S	USCU	845	Thallium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-7S	USCU	845	Total Dissolved Solids	mg/L	02/24/2021 - 08/11/2021	CI around mean	1010	1200	494	1200	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-8	UA	257	Antimony, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-8	UA	257	Arsenic, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.010	0.0022	0.01	Standard
MW-8	UA	257	Barium, total	mg/L	06/17/2015 - 09/01/2021	CB around linear reg	0.023	2.0	0.13	2	Standard
MW-8	UA	257	Beryllium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-8	UA	257	Boron, total	mg/L	06/17/2015 - 09/01/2021	CI around geomean	0.96	2.0	0.27	2	Standard
MW-8	UA	257	Cadmium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-8	UA	257	Chloride, total	mg/L	06/17/2015 - 09/01/2021	CB around linear reg	15	200	18	200	Standard
MW-8	UA	257	Chromium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.0015	0.10	0.0025	0.1	Standard
MW-8	UA	257	Cobalt, total	mg/L	06/17/2015 - 09/01/2021	CB around T-S line	0.000724	0.006	0.0012	0.006	Standard
MW-8	UA	257	Fluoride, total	mg/L	06/04/2015 - 09/01/2021	CB around linear reg	0.22	4.0	0.47	4	Standard
MW-8	UA	257	Lead, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.0075	0.0014	0.0075	Standard
MW-8	UA	257	Lithium, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	0.00279	0.040	0.0068	0.04	Standard
MW-8	UA	257	Mercury, total	mg/L	06/04/2015 - 09/01/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-8	UA	257	Molybdenum, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.0015	0.10	0.0053	0.1	Standard
MW-8	UA	257	pH (field)	SU	06/17/2015 - 09/01/2021	CI around mean	6.6	6.3/9.0	6.3/7.7	6.5/9	Background/Standard
MW-8	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/15/2015 - 09/01/2021	CI around median	0.15	5.0	2.0	5	Standard
MW-8	UA	257	Selenium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.001	0.050	0.0048	0.05	Standard
MW-8	UA	257	Sulfate, total	mg/L	06/17/2015 - 09/01/2021	CB around linear reg	241	400	202	400	Standard
MW-8	UA	257	Thallium, total	mg/L	06/17/2015 - 09/01/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
MW-8	UA	257	Total Dissolved Solids	mg/L	06/17/2015 - 09/01/2021	CB around linear reg	780	1200	685	1200	Standard
MW-8S	USCU	845	Antimony, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-8S	USCU	845	Arsenic, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	-0.00072	0.010	0.0048	0.01	Standard
MW-8S	USCU	845	Barium, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	0.042	2.0	0.15	2	Standard
MW-8S	USCU	845	Beryllium, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

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HISTORY OF POTENTIAL EXCEEDANCES
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-8S	USCU	845	Boron, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	0.60	2.0	0.30	2	Standard
MW-8S	USCU	845	Cadmium, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-8S	USCU	845	Chloride, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	7.1	200	18	200	Standard
MW-8S	USCU	845	Chromium, total	mg/L	02/24/2021 - 05/21/2021	CI around median	0	0.10	0.0095	0.1	Standard
MW-8S	USCU	845	Cobalt, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	-0.000368	0.006	0.0039	0.006	Standard
MW-8S	USCU	845	Fluoride, total	mg/L	02/24/2021 - 05/21/2021	CI around geomean	0.12	4.0	0.51	4	Standard
MW-8S	USCU	845	Lead, total	mg/L	02/24/2021 - 05/21/2021	CI around median	0	0.0075	0.0051	0.0075	Standard
MW-8S	USCU	845	Lithium, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.003	0.040	0.012	0.04	Standard
MW-8S	USCU	845	Mercury, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-8S	USCU	845	Molybdenum, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	0.000473	0.10	0.0062	0.1	Standard
MW-8S	USCU	845	pH (field)	SU	02/24/2021 - 05/21/2021	CI around mean	6.2	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-8S	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/24/2021 - 05/21/2021	CI around mean	-1.13	5.0	1.0	5	Standard
MW-8S	USCU	845	Selenium, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-8S	USCU	845	Sulfate, total	mg/L	02/24/2021 - 05/21/2021	CI around mean	361	400	151	400	Standard
MW-8S	USCU	845	Thallium, total	mg/L	02/24/2021 - 05/21/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-8S	USCU	845	Total Dissolved Solids	mg/L	02/24/2021 - 05/21/2021	CI around mean	1050	1200	494	1200	Standard
MW-9	UA	845	Antimony, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.006	0.001	0.006	Standard
MW-9	UA	845	Arsenic, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.010	0.0048	0.01	Standard
MW-9	UA	845	Barium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.053	2.0	0.15	2	Standard
MW-9	UA	845	Beryllium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.004	0.001	0.004	Standard
MW-9	UA	845	Boron, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.092	2.0	0.30	2	Standard
MW-9	UA	845	Cadmium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.005	0.001	0.005	Standard
MW-9	UA	845	Chloride, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	1.0	200	18	200	Standard
MW-9	UA	845	Chromium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.0015	0.10	0.0095	0.1	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-9	UA	845	Cobalt, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.006	0.0039	0.006	Standard
MW-9	UA	845	Fluoride, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.20	4.0	0.51	4	Standard
MW-9	UA	845	Lead, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.0075	0.0051	0.0075	Standard
MW-9	UA	845	Mercury, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
MW-9	UA	845	pH (field)	SU	06/10/2021 - 06/10/2021	Most recent sample	6.8	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-9	UA	845	Radium-226 + Radium 228, tot	pCi/L	06/10/2021 - 06/10/2021	Most recent sample	0.89	5.0	1.0	5	Standard
MW-9	UA	845	Selenium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.050	0.0018	0.05	Standard
MW-9	UA	845	Sulfate, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	33	400	151	400	Standard
MW-9	UA	845	Thallium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.002	0.002	0.002	0.002	Standard
MW-9	UA	845	Total Dissolved Solids	mg/L	06/10/2021 - 06/10/2021	Most recent sample	244	1200	494	1200	Standard
MW-10	UA	845	Antimony, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.006	0.001	0.006	Standard
MW-10	UA	845	Arsenic, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.010	0.0048	0.01	Standard
MW-10	UA	845	Barium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.026	2.0	0.15	2	Standard
MW-10	UA	845	Beryllium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.004	0.001	0.004	Standard
MW-10	UA	845	Boron, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	1.4	2.0	0.30	2	Standard
MW-10	UA	845	Cadmium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.005	0.001	0.005	Standard
MW-10	UA	845	Chloride, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	11	200	18	200	Standard
MW-10	UA	845	Chromium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.0015	0.10	0.0095	0.1	Standard
MW-10	UA	845	Cobalt, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.006	0.0039	0.006	Standard
MW-10	UA	845	Fluoride, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.21	4.0	0.51	4	Standard
MW-10	UA	845	Lead, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.001	0.0075	0.0051	0.0075	Standard
MW-10	UA	845	Mercury, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.0002	0.002	0.0002	0.002	Standard
MW-10	UA	845	pH (field)	SU	06/10/2021 - 06/10/2021	Most recent sample	6.1	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-10	UA	845	Radium-226 + Radium 228, tot	pCi/L	06/10/2021 - 06/10/2021	Most recent sample	1.1	5.0	1.0	5	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-10	UA	845	Selenium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.0036	0.050	0.0018	0.05	Standard
MW-10	UA	845	Sulfate, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	311	400	151	400	Standard
MW-10	UA	845	Thallium, total	mg/L	06/10/2021 - 06/10/2021	Most recent sample	0.002	0.002	0.002	0.002	Standard
MW-10	UA	845	Total Dissolved Solids	mg/L	06/10/2021 - 06/10/2021	Most recent sample	758	1200	494	1200	Standard
MW-11	UA	257	Antimony, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-11	UA	257	Arsenic, total	mg/L	12/15/2015 - 09/01/2021	CI around median	0.0011	0.010	0.0022	0.01	Standard
MW-11	UA	257	Barium, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	0.11	2.0	0.13	2	Standard
MW-11	UA	257	Beryllium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-11	UA	257	Boron, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	1.5	2.0	0.27	2	Standard
MW-11	UA	257	Cadmium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-11	UA	257	Chloride, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	32	200	18	200	Standard
MW-11	UA	257	Chromium, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	0.00148	0.10	0.0025	0.1	Standard
MW-11	UA	257	Cobalt, total	mg/L	12/15/2015 - 09/01/2021	CI around median	0.001	0.006	0.0012	0.006	Standard
MW-11	UA	257	Fluoride, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	0.49	4.0	0.47	4	Standard
MW-11	UA	257	Lead, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.0075	0.0014	0.0075	Standard
MW-11	UA	257	Lithium, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	0.00234	0.040	0.0068	0.04	Standard
MW-11	UA	257	Mercury, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-11	UA	257	Molybdenum, total	mg/L	12/15/2015 - 09/01/2021	CI around geomean	0.00217	0.10	0.0053	0.1	Standard
MW-11	UA	257	pH (field)	SU	12/15/2015 - 09/01/2021	CB around linear reg	6.6	6.3/9.0	6.3/7.7	6.5/9	Background/Standard
MW-11	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/15/2015 - 09/01/2021	CI around mean	0.51	5.0	2.0	5	Standard
MW-11	UA	257	Selenium, total	mg/L	12/15/2015 - 09/01/2021	CI around median	0.001	0.050	0.0048	0.05	Standard
MW-11	UA	257	Sulfate, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	86	400	202	400	Standard
MW-11	UA	257	Thallium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
MW-11	UA	257	Total Dissolved Solids	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	573	1200	685	1200	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-12	UA	257	Antimony, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-12	UA	257	Arsenic, total	mg/L	12/15/2015 - 09/01/2021	CI around median	0.001	0.010	0.0022	0.01	Standard
MW-12	UA	257	Barium, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	0.052	2.0	0.13	2	Standard
MW-12	UA	257	Beryllium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-12	UA	257	Boron, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	2.5	2.0	0.27	2	Standard
MW-12	UA	257	Cadmium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-12	UA	257	Chloride, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	18	200	18	200	Standard
MW-12	UA	257	Chromium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.0015	0.10	0.0025	0.1	Standard
MW-12	UA	257	Cobalt, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.006	0.0012	0.006	Standard
MW-12	UA	257	Fluoride, total	mg/L	12/15/2015 - 09/01/2021	CI around median	0.18	4.0	0.47	4	Standard
MW-12	UA	257	Lead, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.001	0.0075	0.0014	0.0075	Standard
MW-12	UA	257	Lithium, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	0.00819	0.040	0.0068	0.04	Standard
MW-12	UA	257	Mercury, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-12	UA	257	Molybdenum, total	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	0.00139	0.10	0.0053	0.1	Standard
MW-12	UA	257	pH (field)	SU	12/15/2015 - 09/01/2021	CB around linear reg	6.4	6.3/9.0	6.3/7.7	6.5/9	Background/Standard
MW-12	UA	257	Radium-226 + Radium 228, tot	pCi/L	12/15/2015 - 09/01/2021	CI around median	0.28	5.0	2.0	5	Standard
MW-12	UA	257	Selenium, total	mg/L	12/15/2015 - 09/01/2021	CI around median	0.001	0.050	0.0048	0.05	Standard
MW-12	UA	257	Sulfate, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	357	400	202	400	Standard
MW-12	UA	257	Thallium, total	mg/L	12/15/2015 - 09/01/2021	All ND - Last	0.002	0.002	0.001	0.002	Standard
MW-12	UA	257	Total Dissolved Solids	mg/L	12/15/2015 - 09/01/2021	CB around linear reg	983	1200	685	1200	Standard
MW-12S	USCU	845	Antimony, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-12S	USCU	845	Arsenic, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00205	0.010	0.0048	0.01	Standard
MW-12S	USCU	845	Barium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.064	2.0	0.15	2	Standard
MW-12S	USCU	845	Beryllium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

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HISTORY OF POTENTIAL EXCEEDANCES
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-12S	USCU	845	Boron, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	1.0	2.0	0.30	2	Standard
MW-12S	USCU	845	Cadmium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-12S	USCU	845	Chloride, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.91	200	18	200	Standard
MW-12S	USCU	845	Chromium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-12S	USCU	845	Cobalt, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00117	0.006	0.0039	0.006	Standard
MW-12S	USCU	845	Fluoride, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.17	4.0	0.51	4	Standard
MW-12S	USCU	845	Lead, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-12S	USCU	845	Lithium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.003	0.040	0.012	0.04	Standard
MW-12S	USCU	845	Mercury, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-12S	USCU	845	Molybdenum, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00326	0.10	0.0062	0.1	Standard
MW-12S	USCU	845	pH (field)	SU	02/25/2021 - 08/11/2021	CI around mean	6.3	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-12S	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/11/2021	CI around mean	0.15	5.0	1.0	5	Standard
MW-12S	USCU	845	Selenium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-12S	USCU	845	Sulfate, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	131	400	151	400	Standard
MW-12S	USCU	845	Thallium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-12S	USCU	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/11/2021	CI around mean	608	1200	494	1200	Standard
MW-12D	BCU	845	Antimony, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-12D	BCU	845	Arsenic, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.001	0.010	0.0048	0.01	Standard
MW-12D	BCU	845	Barium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	1.4	2.0	0.15	2	Standard
MW-12D	BCU	845	Beryllium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-12D	BCU	845	Boron, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.75	2.0	0.30	2	Standard
MW-12D	BCU	845	Cadmium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-12D	BCU	845	Chloride, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	200	200	18	200	Standard
MW-12D	BCU	845	Chromium, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.0015	0.10	0.0095	0.1	Standard

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HISTORY OF POTENTIAL EXCEEDANCES
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-12D	BCU	845	Cobalt, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.001	0.006	0.0039	0.006	Standard
MW-12D	BCU	845	Fluoride, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.33	4.0	0.51	4	Standard
MW-12D	BCU	845	Lead, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.001	0.0075	0.0051	0.0075	Standard
MW-12D	BCU	845	Lithium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00926	0.040	0.012	0.04	Standard
MW-12D	BCU	845	Mercury, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-12D	BCU	845	Molybdenum, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-12D	BCU	845	pH (field)	SU	02/25/2021 - 08/11/2021	CI around median	6.7	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-12D	BCU	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/11/2021	CI around mean	1.1	5.0	1.0	5	Standard
MW-12D	BCU	845	Selenium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-12D	BCU	845	Sulfate, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	10	400	151	400	Standard
MW-12D	BCU	845	Thallium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-12D	BCU	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/11/2021	CI around mean	602	1200	494	1200	Standard
MW-20	UA	845	Antimony, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-20	UA	845	Arsenic, total	mg/L	02/26/2021 - 08/10/2021	CB around linear reg	0.00127	0.010	0.0048	0.01	Standard
MW-20	UA	845	Barium, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	0.11	2.0	0.15	2	Standard
MW-20	UA	845	Beryllium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-20	UA	845	Boron, total	mg/L	02/26/2021 - 08/10/2021	CB around linear reg	0.46	2.0	0.30	2	Standard
MW-20	UA	845	Cadmium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-20	UA	845	Chloride, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	23	200	18	200	Standard
MW-20	UA	845	Chromium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-20	UA	845	Cobalt, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.0039	0.006	Standard
MW-20	UA	845	Fluoride, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	0.38	4.0	0.51	4	Standard
MW-20	UA	845	Lead, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-20	UA	845	Lithium, total	mg/L	02/26/2021 - 08/10/2021	CB around linear reg	0.00557	0.040	0.012	0.04	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-20	UA	845	Mercury, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-20	UA	845	Molybdenum, total	mg/L	02/26/2021 - 08/10/2021	CI around geomean	0.00477	0.10	0.0062	0.1	Standard
MW-20	UA	845	pH (field)	SU	02/26/2021 - 08/10/2021	CI around mean	6.7	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-20	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/26/2021 - 08/10/2021	CI around mean	0.096	5.0	1.0	5	Standard
MW-20	UA	845	Selenium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-20	UA	845	Sulfate, total	mg/L	02/26/2021 - 08/10/2021	CB around linear reg	136	400	151	400	Standard
MW-20	UA	845	Thallium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-20	UA	845	Total Dissolved Solids	mg/L	02/26/2021 - 08/10/2021	CI around mean	584	1200	494	1200	Standard
MW-20S	USCU	845	Antimony, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-20S	USCU	845	Arsenic, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.010	0.0048	0.01	Standard
MW-20S	USCU	845	Barium, total	mg/L	02/26/2021 - 08/10/2021	CI around median	0.0005	2.0	0.15	2	Standard
MW-20S	USCU	845	Beryllium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-20S	USCU	845	Boron, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	0.67	2.0	0.30	2	Standard
MW-20S	USCU	845	Cadmium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-20S	USCU	845	Chloride, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	20	200	18	200	Standard
MW-20S	USCU	845	Chromium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-20S	USCU	845	Cobalt, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.0039	0.006	Standard
MW-20S	USCU	845	Fluoride, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	0.17	4.0	0.51	4	Standard
MW-20S	USCU	845	Lead, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-20S	USCU	845	Lithium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.003	0.040	0.012	0.04	Standard
MW-20S	USCU	845	Mercury, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-20S	USCU	845	Molybdenum, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-20S	USCU	845	pH (field)	SU	02/26/2021 - 08/10/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-20S	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/26/2021 - 08/10/2021	CI around mean	0.002	5.0	1.0	5	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-20S	USCU	845	Selenium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-20S	USCU	845	Sulfate, total	mg/L	02/26/2021 - 08/10/2021	CB around linear reg	336	400	151	400	Standard
MW-20S	USCU	845	Thallium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-20S	USCU	845	Total Dissolved Solids	mg/L	02/26/2021 - 08/10/2021	CI around mean	835	1200	494	1200	Standard
MW-22	UA	845	Antimony, total	mg/L	02/26/2021 - 05/18/2021	Most recent sample	0.001	0.006	0.001	0.006	Standard
MW-22	UA	845	Arsenic, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.001	0.010	0.0048	0.01	Standard
MW-22	UA	845	Barium, total	mg/L	02/26/2021 - 05/18/2021	CI around mean	0.065	2.0	0.15	2	Standard
MW-22	UA	845	Beryllium, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-22	UA	845	Boron, total	mg/L	02/26/2021 - 05/18/2021	CI around mean	1.4	2.0	0.30	2	Standard
MW-22	UA	845	Cadmium, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-22	UA	845	Chloride, total	mg/L	02/26/2021 - 05/18/2021	CI around mean	23	200	18	200	Standard
MW-22	UA	845	Chromium, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-22	UA	845	Cobalt, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.001	0.006	0.0039	0.006	Standard
MW-22	UA	845	Fluoride, total	mg/L	02/26/2021 - 05/18/2021	CI around median	0	4.0	0.51	4	Standard
MW-22	UA	845	Lead, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-22	UA	845	Lithium, total	mg/L	02/26/2021 - 05/18/2021	CI around mean	0.00151	0.040	0.012	0.04	Standard
MW-22	UA	845	Mercury, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-22	UA	845	Molybdenum, total	mg/L	02/26/2021 - 05/18/2021	CI around mean	0.00166	0.10	0.0062	0.1	Standard
MW-22	UA	845	pH (field)	SU	02/26/2021 - 05/18/2021	CI around mean	6.3	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-22	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/26/2021 - 05/18/2021	CI around mean	-0.165	5.0	1.0	5	Standard
MW-22	UA	845	Selenium, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-22	UA	845	Sulfate, total	mg/L	02/26/2021 - 05/18/2021	CI around mean	97	400	151	400	Standard
MW-22	UA	845	Thallium, total	mg/L	02/26/2021 - 05/18/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-22	UA	845	Total Dissolved Solids	mg/L	02/26/2021 - 05/18/2021	CI around mean	487	1200	494	1200	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-23	UA	845	Antimony, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-23	UA	845	Arsenic, total	mg/L	02/26/2021 - 08/10/2021	CI around median	0.001	0.010	0.0048	0.01	Standard
MW-23	UA	845	Barium, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	0.071	2.0	0.15	2	Standard
MW-23	UA	845	Beryllium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-23	UA	845	Boron, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	1.4	2.0	0.30	2	Standard
MW-23	UA	845	Cadmium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-23	UA	845	Chloride, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	29	200	18	200	Standard
MW-23	UA	845	Chromium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-23	UA	845	Cobalt, total	mg/L	02/26/2021 - 08/10/2021	CI around geomean	0.000944	0.006	0.0039	0.006	Standard
MW-23	UA	845	Fluoride, total	mg/L	02/26/2021 - 08/10/2021	CI around mean	0.34	4.0	0.51	4	Standard
MW-23	UA	845	Lead, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-23	UA	845	Lithium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.003	0.040	0.012	0.04	Standard
MW-23	UA	845	Mercury, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-23	UA	845	Molybdenum, total	mg/L	02/26/2021 - 08/10/2021	CI around median	0.0015	0.10	0.0062	0.1	Standard
MW-23	UA	845	pH (field)	SU	02/26/2021 - 08/10/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-23	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/26/2021 - 08/10/2021	CI around mean	0.066	5.0	1.0	5	Standard
MW-23	UA	845	Selenium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-23	UA	845	Sulfate, total	mg/L	02/26/2021 - 08/10/2021	CI around median	42	400	151	400	Standard
MW-23	UA	845	Thallium, total	mg/L	02/26/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-23	UA	845	Total Dissolved Solids	mg/L	02/26/2021 - 08/10/2021	CI around mean	571	1200	494	1200	Standard
MW-24	UA	845	Antimony, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-24	UA	845	Arsenic, total	mg/L	03/01/2021 - 05/19/2021	Most recent sample	0.001	0.010	0.0048	0.01	Standard
MW-24	UA	845	Barium, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	0.15	2.0	0.15	2	Standard
MW-24	UA	845	Beryllium, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-24	UA	845	Boron, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	0.081	2.0	0.30	2	Standard
MW-24	UA	845	Cadmium, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-24	UA	845	Chloride, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	14	200	18	200	Standard
MW-24	UA	845	Chromium, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-24	UA	845	Cobalt, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	0.00039	0.006	0.0039	0.006	Standard
MW-24	UA	845	Fluoride, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	0.20	4.0	0.51	4	Standard
MW-24	UA	845	Lead, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-24	UA	845	Lithium, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	0.00142	0.040	0.012	0.04	Standard
MW-24	UA	845	Mercury, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-24	UA	845	Molybdenum, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	0.0021	0.10	0.0062	0.1	Standard
MW-24	UA	845	pH (field)	SU	03/01/2021 - 05/19/2021	CI around mean	5.8	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-24	UA	845	Radium-226 + Radium 228, tot	pCi/L	03/01/2021 - 05/19/2021	CI around mean	-0.382	5.0	1.0	5	Standard
MW-24	UA	845	Selenium, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-24	UA	845	Sulfate, total	mg/L	03/01/2021 - 05/19/2021	CI around mean	49	400	151	400	Standard
MW-24	UA	845	Thallium, total	mg/L	03/01/2021 - 05/19/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-24	UA	845	Total Dissolved Solids	mg/L	03/01/2021 - 05/19/2021	CI around mean	585	1200	494	1200	Standard
MW-25	USCU	845	Antimony, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-25	USCU	845	Arsenic, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00195	0.010	0.0048	0.01	Standard
MW-25	USCU	845	Barium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.047	2.0	0.15	2	Standard
MW-25	USCU	845	Beryllium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-25	USCU	845	Boron, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	1.0	2.0	0.30	2	Standard
MW-25	USCU	845	Cadmium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-25	USCU	845	Chloride, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0	200	18	200	Standard
MW-25	USCU	845	Chromium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00133	0.10	0.0095	0.1	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-25	USCU	845	Cobalt, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00372	0.006	0.0039	0.006	Standard
MW-25	USCU	845	Fluoride, total	mg/L	02/25/2021 - 08/11/2021	Most recent sample	0.17	4.0	0.51	4	Standard
MW-25	USCU	845	Lead, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.000583	0.0075	0.0051	0.0075	Standard
MW-25	USCU	845	Lithium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00189	0.040	0.012	0.04	Standard
MW-25	USCU	845	Mercury, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-25	USCU	845	Molybdenum, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00118	0.10	0.0062	0.1	Standard
MW-25	USCU	845	pH (field)	SU	02/25/2021 - 08/11/2021	CI around mean	6.1	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-25	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/11/2021	CI around mean	0.0092	5.0	1.0	5	Standard
MW-25	USCU	845	Selenium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-25	USCU	845	Sulfate, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0	400	151	400	Standard
MW-25	USCU	845	Thallium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-25	USCU	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/11/2021	CI around mean	433	1200	494	1200	Standard
MW-26	UA	845	Antimony, total	mg/L	02/25/2021 - 05/21/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-26	UA	845	Arsenic, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	-0.000205	0.010	0.0048	0.01	Standard
MW-26	UA	845	Barium, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	0.021	2.0	0.15	2	Standard
MW-26	UA	845	Beryllium, total	mg/L	02/25/2021 - 05/21/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-26	UA	845	Boron, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	0.88	2.0	0.30	2	Standard
MW-26	UA	845	Cadmium, total	mg/L	02/25/2021 - 05/21/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-26	UA	845	Chloride, total	mg/L	02/25/2021 - 05/21/2021	CI around median	0	200	18	200	Standard
MW-26	UA	845	Chromium, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	-0.00563	0.10	0.0095	0.1	Standard
MW-26	UA	845	Cobalt, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	0.000679	0.006	0.0039	0.006	Standard
MW-26	UA	845	Fluoride, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	0.20	4.0	0.51	4	Standard
MW-26	UA	845	Lead, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	-0.00253	0.0075	0.0051	0.0075	Standard
MW-26	UA	845	Lithium, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	0.000161	0.040	0.012	0.04	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-26	UA	845	Mercury, total	mg/L	02/25/2021 - 05/21/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-26	UA	845	Molybdenum, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	0.000888	0.10	0.0062	0.1	Standard
MW-26	UA	845	pH (field)	SU	02/25/2021 - 05/21/2021	CI around mean	6.2	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-26	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 05/21/2021	CI around mean	-1.2	5.0	1.0	5	Standard
MW-26	UA	845	Selenium, total	mg/L	02/25/2021 - 05/21/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-26	UA	845	Sulfate, total	mg/L	02/25/2021 - 05/21/2021	CI around mean	162	400	151	400	Standard
MW-26	UA	845	Thallium, total	mg/L	02/25/2021 - 05/21/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-26	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 05/21/2021	CI around mean	637	1200	494	1200	Standard
MW-27	USCU	845	Antimony, total	mg/L	02/24/2021 - 08/11/2021	Most recent sample	0.001	0.006	0.001	0.006	Standard
MW-27	USCU	845	Arsenic, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00322	0.010	0.0048	0.01	Standard
MW-27	USCU	845	Barium, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.083	2.0	0.15	2	Standard
MW-27	USCU	845	Beryllium, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.001	0.004	0.001	0.004	Standard
MW-27	USCU	845	Boron, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	0.91	2.0	0.30	2	Standard
MW-27	USCU	845	Cadmium, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.001	0.005	0.001	0.005	Standard
MW-27	USCU	845	Chloride, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	14	200	18	200	Standard
MW-27	USCU	845	Chromium, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00306	0.10	0.0095	0.1	Standard
MW-27	USCU	845	Cobalt, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00187	0.006	0.0039	0.006	Standard
MW-27	USCU	845	Fluoride, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.17	4.0	0.51	4	Standard
MW-27	USCU	845	Lead, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00141	0.0075	0.0051	0.0075	Standard
MW-27	USCU	845	Lithium, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00246	0.040	0.012	0.04	Standard
MW-27	USCU	845	Mercury, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.0002	0.002	0.0002	0.002	Standard
MW-27	USCU	845	Molybdenum, total	mg/L	02/24/2021 - 08/11/2021	CI around geomean	0.00152	0.10	0.0062	0.1	Standard
MW-27	USCU	845	pH (field)	SU	02/24/2021 - 08/11/2021	CI around mean	6.5	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-27	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/24/2021 - 08/11/2021	CI around geomean	0.26	5.0	1.0	5	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-27	USCU	845	Selenium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-27	USCU	845	Sulfate, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	248	400	151	400	Standard
MW-27	USCU	845	Thallium, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.002	0.002	0.002	0.002	Standard
MW-27	USCU	845	Total Dissolved Solids	mg/L	02/24/2021 - 08/11/2021	CI around median	344	1200	494	1200	Standard
MW-28	UA	845	Antimony, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-28	UA	845	Arsenic, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.010	0.0048	0.01	Standard
MW-28	UA	845	Barium, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	0.020	2.0	0.15	2	Standard
MW-28	UA	845	Beryllium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-28	UA	845	Boron, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	8.7	2.0	0.30	2	Standard
MW-28	UA	845	Cadmium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-28	UA	845	Chloride, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	12	200	18	200	Standard
MW-28	UA	845	Chromium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-28	UA	845	Cobalt, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.001	0.006	0.0039	0.006	Standard
MW-28	UA	845	Fluoride, total	mg/L	02/24/2021 - 08/11/2021	CI around median	0.12	4.0	0.51	4	Standard
MW-28	UA	845	Lead, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-28	UA	845	Lithium, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	0.00605	0.040	0.012	0.04	Standard
MW-28	UA	845	Mercury, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-28	UA	845	Molybdenum, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-28	UA	845	pH (field)	SU	02/24/2021 - 08/11/2021	CI around mean	6.5	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-28	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/24/2021 - 08/11/2021	CI around mean	0.00393	5.0	1.0	5	Standard
MW-28	UA	845	Selenium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-28	UA	845	Sulfate, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	799	400	151	400	Standard
MW-28	UA	845	Thallium, total	mg/L	02/24/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-28	UA	845	Total Dissolved Solids	mg/L	02/24/2021 - 08/11/2021	CI around mean	1580	1200	494	1200	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-29	UA	845	Antimony, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-29	UA	845	Arsenic, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.010	0.0048	0.01	Standard
MW-29	UA	845	Barium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.080	2.0	0.15	2	Standard
MW-29	UA	845	Beryllium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-29	UA	845	Boron, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	1.6	2.0	0.30	2	Standard
MW-29	UA	845	Cadmium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-29	UA	845	Chloride, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	46	200	18	200	Standard
MW-29	UA	845	Chromium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-29	UA	845	Cobalt, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.0039	0.006	Standard
MW-29	UA	845	Fluoride, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.11	4.0	0.51	4	Standard
MW-29	UA	845	Lead, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-29	UA	845	Lithium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00796	0.040	0.012	0.04	Standard
MW-29	UA	845	Mercury, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-29	UA	845	Molybdenum, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-29	UA	845	pH (field)	SU	02/25/2021 - 08/11/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-29	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/11/2021	CI around mean	0.050	5.0	1.0	5	Standard
MW-29	UA	845	Selenium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-29	UA	845	Sulfate, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	147	400	151	400	Standard
MW-29	UA	845	Thallium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-29	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/11/2021	CI around mean	759	1200	494	1200	Standard
MW-30	UA	845	Antimony, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-30	UA	845	Arsenic, total	mg/L	02/25/2021 - 08/10/2021	CB around linear reg	0.0033	0.010	0.0048	0.01	Standard
MW-30	UA	845	Barium, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	0.15	2.0	0.15	2	Standard
MW-30	UA	845	Beryllium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-30	UA	845	Boron, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	1.0	2.0	0.30	2	Standard
MW-30	UA	845	Cadmium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-30	UA	845	Chloride, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	50	200	18	200	Standard
MW-30	UA	845	Chromium, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.0015	0.10	0.0095	0.1	Standard
MW-30	UA	845	Cobalt, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	0.00195	0.006	0.0039	0.006	Standard
MW-30	UA	845	Fluoride, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	0.22	4.0	0.51	4	Standard
MW-30	UA	845	Lead, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-30	UA	845	Lithium, total	mg/L	02/25/2021 - 08/10/2021	CB around linear reg	0.00157	0.040	0.012	0.04	Standard
MW-30	UA	845	Mercury, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-30	UA	845	Molybdenum, total	mg/L	02/25/2021 - 08/10/2021	CB around linear reg	-0.0000855	0.10	0.0062	0.1	Standard
MW-30	UA	845	pH (field)	SU	02/25/2021 - 08/10/2021	CI around mean	6.3	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-30	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/10/2021	CI around geomean	0.50	5.0	1.0	5	Standard
MW-30	UA	845	Selenium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-30	UA	845	Sulfate, total	mg/L	02/25/2021 - 08/10/2021	CB around linear reg	-22.3	400	151	400	Standard
MW-30	UA	845	Thallium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-30	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/10/2021	CI around mean	676	1200	494	1200	Standard
MW-31	UA	845	Antimony, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-31	UA	845	Arsenic, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.00252	0.010	0.0048	0.01	Standard
MW-31	UA	845	Barium, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.22	2.0	0.15	2	Standard
MW-31	UA	845	Beryllium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-31	UA	845	Boron, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.24	2.0	0.30	2	Standard
MW-31	UA	845	Cadmium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-31	UA	845	Chloride, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	48	200	18	200	Standard
MW-31	UA	845	Chromium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-31	UA	845	Cobalt, total	mg/L	02/24/2021 - 08/10/2021	CI around median	0.001	0.006	0.0039	0.006	Standard
MW-31	UA	845	Fluoride, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.17	4.0	0.51	4	Standard
MW-31	UA	845	Lead, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-31	UA	845	Lithium, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.00489	0.040	0.012	0.04	Standard
MW-31	UA	845	Mercury, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-31	UA	845	Molybdenum, total	mg/L	02/24/2021 - 08/10/2021	CB around linear reg	0.000828	0.10	0.0062	0.1	Standard
MW-31	UA	845	pH (field)	SU	02/24/2021 - 08/10/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-31	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/24/2021 - 08/10/2021	CI around mean	0.38	5.0	1.0	5	Standard
MW-31	UA	845	Selenium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-31	UA	845	Sulfate, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	10	400	151	400	Standard
MW-31	UA	845	Thallium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-31	UA	845	Total Dissolved Solids	mg/L	02/24/2021 - 08/10/2021	CI around mean	567	1200	494	1200	Standard
MW-31S	USCU	845	Antimony, total	mg/L	02/24/2021 - 08/10/2021	CI around median	0.001	0.006	0.001	0.006	Standard
MW-31S	USCU	845	Arsenic, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.00316	0.010	0.0048	0.01	Standard
MW-31S	USCU	845	Barium, total	mg/L	02/24/2021 - 08/10/2021	CI around geomean	0.20	2.0	0.15	2	Standard
MW-31S	USCU	845	Beryllium, total	mg/L	02/24/2021 - 08/10/2021	CI around median	0.001	0.004	0.001	0.004	Standard
MW-31S	USCU	845	Boron, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.048	2.0	0.30	2	Standard
MW-31S	USCU	845	Cadmium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-31S	USCU	845	Chloride, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	14	200	18	200	Standard
MW-31S	USCU	845	Chromium, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	-0.00343	0.10	0.0095	0.1	Standard
MW-31S	USCU	845	Cobalt, total	mg/L	02/24/2021 - 08/10/2021	CI around geomean	0.00292	0.006	0.0039	0.006	Standard
MW-31S	USCU	845	Fluoride, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.22	4.0	0.51	4	Standard
MW-31S	USCU	845	Lead, total	mg/L	02/24/2021 - 08/10/2021	CI around geomean	0.001	0.0075	0.0051	0.0075	Standard
MW-31S	USCU	845	Lithium, total	mg/L	02/24/2021 - 08/10/2021	CI around geomean	0.00256	0.040	0.012	0.04	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-31S	USCU	845	Mercury, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-31S	USCU	845	Molybdenum, total	mg/L	02/24/2021 - 08/10/2021	CI around mean	0.00299	0.10	0.0062	0.1	Standard
MW-31S	USCU	845	pH (field)	SU	02/24/2021 - 08/10/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-31S	USCU	845	Radium-226 + Radium 228, tot	pCi/L	02/24/2021 - 08/11/2021	CI around mean	1.0	5.0	1.0	5	Standard
MW-31S	USCU	845	Selenium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-31S	USCU	845	Sulfate, total	mg/L	02/24/2021 - 08/10/2021	CB around linear reg	29	400	151	400	Standard
MW-31S	USCU	845	Thallium, total	mg/L	02/24/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-31S	USCU	845	Total Dissolved Solids	mg/L	02/24/2021 - 08/10/2021	CI around mean	770	1200	494	1200	Standard
MW-32	UA	845	Antimony, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
MW-32	UA	845	Arsenic, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.001	0.010	0.0048	0.01	Standard
MW-32	UA	845	Barium, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	0.079	2.0	0.15	2	Standard
MW-32	UA	845	Beryllium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
MW-32	UA	845	Boron, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	1.5	2.0	0.30	2	Standard
MW-32	UA	845	Cadmium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
MW-32	UA	845	Chloride, total	mg/L	02/25/2021 - 08/10/2021	CI around median	13	200	18	200	Standard
MW-32	UA	845	Chromium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0095	0.1	Standard
MW-32	UA	845	Cobalt, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.001	0.006	0.0039	0.006	Standard
MW-32	UA	845	Fluoride, total	mg/L	02/25/2021 - 08/10/2021	CI around median	0.16	4.0	0.51	4	Standard
MW-32	UA	845	Lead, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.0075	0.0051	0.0075	Standard
MW-32	UA	845	Lithium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.003	0.040	0.012	0.04	Standard
MW-32	UA	845	Mercury, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
MW-32	UA	845	Molybdenum, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.0015	0.10	0.0062	0.1	Standard
MW-32	UA	845	pH (field)	SU	02/25/2021 - 08/10/2021	CI around mean	6.2	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
MW-32	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/10/2021	CI around mean	-0.0551	5.0	1.0	5	Standard

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

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-32	UA	845	Selenium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
MW-32	UA	845	Sulfate, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	440	400	151	400	Standard
MW-32	UA	845	Thallium, total	mg/L	02/25/2021 - 08/10/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
MW-32	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/10/2021	CI around median	1150	1200	494	1200	Standard
PZ-4C	UA	845	Antimony, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.006	0.001	0.006	Standard
PZ-4C	UA	845	Arsenic, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.000521	0.010	0.0048	0.01	Standard
PZ-4C	UA	845	Barium, total	mg/L	02/25/2021 - 08/11/2021	CB around linear reg	0.28	2.0	0.15	2	Standard
PZ-4C	UA	845	Beryllium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.004	0.001	0.004	Standard
PZ-4C	UA	845	Boron, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	1.4	2.0	0.30	2	Standard
PZ-4C	UA	845	Cadmium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.005	0.001	0.005	Standard
PZ-4C	UA	845	Chloride, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	37	200	18	200	Standard
PZ-4C	UA	845	Chromium, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.0015	0.10	0.0095	0.1	Standard
PZ-4C	UA	845	Cobalt, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.001	0.006	0.0039	0.006	Standard
PZ-4C	UA	845	Fluoride, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.39	4.0	0.51	4	Standard
PZ-4C	UA	845	Lead, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.001	0.0075	0.0051	0.0075	Standard
PZ-4C	UA	845	Lithium, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	0.00635	0.040	0.012	0.04	Standard
PZ-4C	UA	845	Mercury, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.0002	0.002	0.0002	0.002	Standard
PZ-4C	UA	845	Molybdenum, total	mg/L	02/25/2021 - 08/11/2021	CI around median	0.0015	0.10	0.0062	0.1	Standard
PZ-4C	UA	845	pH (field)	SU	02/25/2021 - 08/11/2021	CI around mean	6.4	5.6/9.0	5.6/7.6	6.5/9	Background/Standard
PZ-4C	UA	845	Radium-226 + Radium 228, tot	pCi/L	02/25/2021 - 08/11/2021	CI around mean	0.34	5.0	1.0	5	Standard
PZ-4C	UA	845	Selenium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.001	0.050	0.0018	0.05	Standard
PZ-4C	UA	845	Sulfate, total	mg/L	02/25/2021 - 08/11/2021	CI around mean	65	400	151	400	Standard
PZ-4C	UA	845	Thallium, total	mg/L	02/25/2021 - 08/11/2021	All ND - Last	0.002	0.002	0.002	0.002	Standard
PZ-4C	UA	845	Total Dissolved Solids	mg/L	02/25/2021 - 08/11/2021	CI around mean	561	1200	494	1200	Standard

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

Notes:
Potential exceedance of GWPS
HSU = hydrostratigraphic unit:
  BCU = Bedrock Confining Unit
  UA = Uppermost Aquifer
  USCU = Upper Semi-Confining Unit
Program = regulatory program data were collected under:
  257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
  845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picoCuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
  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
  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
KINCAID POWER PLANT
ASH POND
KINCAID, ILLINOIS

Sample Location	HSU	Program	Constituent	Result Unit	Sample Date Range	Statistical Calculation	Statistical Result	GWPS	Background	Part 845 Standard	GWPS Source
MW-7S	USCU	845	Boron, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	3.5	2.0	0.30	2	Standard
MW-12	UA	257	Boron, total	mg/L	12/15/2015 - 09/01/2021	CI around mean	2.5	2.0	0.27	2	Standard
MW-28	UA	845	Boron, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	8.7	2.0	0.30	2	Standard
MW-28	UA	845	Sulfate, total	mg/L	02/24/2021 - 08/11/2021	CI around mean	799	400	151	400	Standard
MW-28	UA	845	Total Dissolved Solids	mg/L	02/24/2021 - 08/11/2021	CI around mean	1580	1200	494	1200	Standard
MW-32	UA	845	Sulfate, total	mg/L	02/25/2021 - 08/10/2021	CI around mean	440	400	151	400	Standard

Notes:
HSU = hydrostratigraphic unit:
UA = Uppermost Aquifer
USCU = Upper Semi-Confining Unit
Program = regulatory program data were collected under:
257 = 40 C.F.R. Part 257 Subpart D (Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments)
845 = 35 I.A.C. Part 845 (Sampling events completed to assess well locations for inclusion in the Part 845 monitoring well network)
mg/L = milligrams per liter
pCi/L = picoCuries per liter
SU = standard units
Sample Count = number of samples from Sampled Date Range used to calculate the Statistical Result
Statistical Calculation = method used to calculate the statistical result:
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

October 2021

Certification of Financial Assurance Requirements

On June 17, 2021, Kincaid Generation, L.L.C. provided financial assurance in the form of a performance bond to the Illinois Environmental Protection Agency in the amount of $48,731,439 for the Ash Pond at the Kincaid Power Plant.

I, Matthew A. Goering, Senior Vice President of Kincaid Generation, L.L.C., do hereby certify to the best of my knowledge for the above referenced CCR Unit that the financial assurance instrument satisfies the requirements of 35 I.A.C. Part 845, Subpart I.

Matthew A. Goering
Senior Vice President
Kincaid Generation, L.L.C.

ATTACHMENT O

October 2021

Documentation of Initial Hazard Potential Classification Assessment

Ash Pond
Kincaid Power Station
Christian County, Illinois

Stantec Consulting Services Inc.
Design with community in mind
www.stantec.com

Prepared for:
Dynegy

October 12, 2016

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Executive Summary

This report documents the hazard potential classification assessment for the Ash Pond at the Kincaid Power Station as required per the CCR Rule in 40 C.F.R. § 257.73-(a)(2). The applicable hazard potential classifications are defined in 40 C.F.R. § 257.53 as follows:

> (1) High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.
>
> (2) Significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.
>
> (3) Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Based on these definitions and the analysis herein, the Ash Pond is classified as a Significant hazard potential CCR surface impoundment.

This report contains supporting documentation for the hazard potential classification assessment. The hazard potential classification for this CCR unit was determined by a breach analysis conducted by Stantec in July, 2016.

1. Introduction

1.1. Background

The CCR Rule was published in the Federal Register on April 17, 2015. The Rule requires that a hazard potential classification assessment be performed for existing CCR surface impoundments that are not incised. A previously completed assessment may be used in lieu of the initial assessment provided the previous hazard assessment was completed no earlier than April 17, 2013. The applicable hazard potential classifications are defined in the CCR Rule 40 C.F.R. § 257.53 as follows:

High Hazard Potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

Significant Hazard Potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Low Hazard Potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Dynegy has contracted Stantec Consulting Services Inc. (Stantec) to prepare hazard potential classification assessments for selected impoundments[1].

It was determined that there was no existing available hazard potential classification assessment documentation for the Ash Pond.

1.2. Location

Kincaid Power Station is located near Highway 104 and the unincorporated community of Sicily in Christian County, south of the Sangchris Lake State Park and approximately 4 miles west of Kincaid, Illinois. The Ash Pond is located northeast of the Kincaid Power Station. The Ash Pond is bounded to the northwest and southeast by Sangchris Lake and to the northeast by farm land. A site overview figure is included in Appendix C.

2. Source Data

The following information was used to perform the hazard assessment of the Ash Pond:

[1] Dynegy Administrative Services Company (Dynegy) contracted Stantec on behalf of the Kincaid Power Station owner, Kincaid Generation, LLC. Thus, Dynegy is referenced in this report.

- Aerial Imagery - 2015 NAIP Imagery Server (Reference 2)
- CCR facilities with Ash Pond outlet pipe drawings (dated 1964-1979) provided by Dynegy (Reference 3)
- Pipe Inspection Summary with drawings references - Excel file provided by Dynegy (dated 05/12/2016) (Reference 4)
- Topographic Survey and Hydrographic Survey for the area around the Ash Pond (Reference 5)
- Dam Safety Assessment (Reference 6)

3. Potential Failure Scenarios

3.1. Facility Description

Including the embankment, the Ash Pond has a footprint of approximately 185 acres with dimensions of about 3,000 by 3,000 feet. The dam crest is approximately 11,500 feet long with a typical crest width of about 12 feet. The Ash Pond is a diked facility in which the only surface runoff is generated within the interior of the dam crest. The minimum crest elevation is located near the southeastern corner of the impoundment where there is a dam height of approximately 20 feet. The maximum dam height is approximately 35 feet. The Ash Pond maintains a water volume of approximately 213 acre-feet at normal pool operating level (603.5 feet, 1.5 feet below the crest) with the capacity being approximately 322 acre-feet at the crest.

Flow typically enters the Ash Pond from the plant through the southwest embankment via eight discharge pipes. Flow circulates through the Ash Pond until reaching the normal pool which is approximately 60 acres of open water on the east side of the Ash Pond. Flow is primarily circulated through a 60 inch diameter pipe located at the base of the recycle intake screen house. The screen house intake has an approximate crest elevation of 603.5 feet. The 60 inch diameter pipe conveys flow to the recycle pump house. An emergency spillway at the same location consists of a concrete weir chamber structure with three sides. Each side is approximately 3 feet in length with an elevation of approximately 604.5 feet. Flow out of this structure is routed via a 48 inch diameter corrugated metal pipe (CMP) to the adjacent discharge channel ("hot ditch") which conveys flows to the east toward Sangchris Lake. This flow is controlled by a valve structure.

3.2. Failure Scenarios

3.2.1. "Sunny Day" Scenario

Stantec analyzed two "Sunny Day" failure scenarios (no storm water runoff draining to the facility) assuming a piping failure of the Ash Pond. Stantec assumed the primary recycle pump was not in operation; therefore, normal pool was assumed to be at 604.5 feet based on the emergency spillway elevation.

3.2.2. PMP Scenario

Probable Maximum Precipitation (PMP) values were based on *Procedural Guidelines for Preparation of Technical Data to be Included in Applications for Permits for Construction and Maintenance of Dams*, Illinois Department of Natural Resources (IDNR) (Reference 7). PMP rainfall depths for 1 square mile were used and the spatial extent of the storm was assumed to be equal to the size of the drainage basin. The rainfall depth (33.7 inches) for the 24-hour event was obtained from HMR51 (Reference 8). The SCS - Type II rainfall distribution was used as the temporal distribution for this event.

3.2.3. Breach Locations

The "Sunny Day" scenario was analyzed at two potential breach locations on the east embankment. Initial piping elevations were set to the bottom of the breach as a conservative assumption. The piping failures of the Ash Pond would discharge flow onto the adjacent farm land and then disperse over the local topography into Sangchris Lake immediately downstream. A fixed water surface elevation boundary of 585 feet was applied to represent the normal pool elevation of Sangchris Lake during "Sunny Day" conditions.

The PMP breach scenario assumes the Ash Pond begins at normal pool elevation (603.5 feet) and receives storm water runoff from a 24-hour PMP event, which is routed through the reservoir. The simulated PMP water surface elevation exceeds the crest elevation of Ash Pond, so a failure by overtopping was assumed to occur at the time of overtopping. A single breach location centered at the lowest crest elevation on the Ash Pond embankment was used for the PMP scenario. A fixed water surface elevation boundary of 593 feet was applied to represent the approximate 100-year flood elevation of Sangchris Lake.

3.3. Breach Hydrograph Development

Breach hydrographs were developed using HEC-HMS, version 4.0 (Reference 9) and HEC-RAS, version 5.0.1 (Reference 10). The dam breach function of HEC-RAS requires input of estimated breach parameters and impounded volumes. Breach parameters were determined using empirical equations. Since there is uncertainty in predicting dam breach parameters, Stantec used several empirical equations and based final breach parameters on engineering judgment (References 11 - 19).

Table 1 summarizes the breach parameters estimated for this analysis. These values are based on the assumed failure conditions, height of breach, impoundment water volume above breach, and width of the embankment. B_{avg} is the average width of a breach failure and t_f is the time for the breach to fully develop. The empirical calculations that served as the basis for the breach parameters' estimation are included in Appendix A.

Table 1 Summary of Estimated of Dam Breach Parameters

	Sunny Day 1	Sunny Day 2	PMP
Range of Breach Width Estimates (feet)	8.3 - 63.0	11.5 – 57.5	8.8 – 61.9
Range of Failure Time Estimates (hours)	0.0 - 0.6	0.0 - 0.7	0.0 -2.0
B_{avg} (feet)	42.9	40.2	58.8
t_f (hours)	0.4	0.4	0.5

Runoff calculations were performed within the HEC-HMS model consistent with methodology described in the US Department of Agriculture (USDA) Soil Conservation Service (SCS) *Technical Release-55* (Reference 20). The total contributing drainage area to the Ash Pond is 167.5 acres which consists of a single watershed. The hydrologic parameters for the area are summarized in Table 2 and a watershed figure is included in Appendix B.

Table 2 Summary of Hydrologic Parameters

	Area (acres)	Weighted CN	T_c (minutes)
Ash Pond	167.5	92.1	42.4

A stage-storage curve for the pond was developed based on topographic survey and hydrographic survey for the area around the Ash Pond from December of 2015. The stage-storage relationship used in development of the breach hydrographs is shown in Appendix A.

To route the storm hydrograph through the pond, a rating curve was developed for the Ash Pond emergency spillway. Based on record drawings and survey data, the pond has an emergency spillway consisting of a concrete weir chamber structure with three sides; each side approximately 3 feet in length. The riser weir was assigned a crest elevation of 604.5 feet (based on information from the 2011 Dam Safety Assessment). Flow out of this structure is controlled by a 36 inch diameter gated orifice which is then discharged to the adjacent "hot ditch" via a 48 inch diameter CMP outlet pipe. An orifice invert of 597.5 feet was applied based on the Dynegy provided drawing #869D4-C37. The rating curve used for discharge through the emergency spillway is shown in Appendix A.

The resulting breach hydrographs developed from HEC-RAS are presented in Appendix A.

3.4. Hydraulic Model Development

For the breach inundation, Stantec used HEC-RAS, version 5.0.1, computer program (Reference 10) to perform hydraulic routing calculations. The HEC-RAS breach simulation was configured as an unsteady flood routing model. A two-dimensional

flood routing model was selected for simulating potential breach impacts from the Ash Pond.

3.4.1. Hydraulic Parameters

For the breach analysis in the hydraulic model, the initial water elevations within the Ash Pond were set at the lowest crest elevation for the PMP overtopping event based on the WSE identified from the hydrologic model and reservoir routing. Additionally, the remaining runoff inflow hydrograph after the start of breach was included as part of the breach analysis. The Sunny Day breach simulation had a normal pool initial elevation set to 604.5 feet; the crest of the emergency spillway.

The PMP breach scenario was set to overtopping failure mode with a final bottom elevation of 600 feet; the top of the stored ash on the interior embankment slope. For the two Sunny Day scenarios, a piping coefficient was set to 0.6 at initial piping elevations of 598 feet and 599 feet; the top of the stored ash on the interior embankment slope for the two Sunny Day breach locations. The three breaches were set to have 1:1 side slopes and a breach weir coefficient of 2.6.

The PMP event hydraulic model has a constant water surface elevation of 593 feet as a two-dimensional boundary condition representing the approximate 1-Percent WSE of Sangchris Lake as observed in the FEMA FIS of Christian County (Reference 21). The Sunny Day boundary condition was the normal pool of the Sangchris Lake (585 feet).

A Manning's "n" value of 0.04 was used for the downstream area, representing farmland.

3.5. Breach Modeling Results

Inundation limits for each of the breach scenarios were evaluated to determine the potential impacts on property and structures and the potential risk to human life. Model results have been summarized below for selected areas of interest. Maximum flood depths and velocities at the time they occur relative to the start of the breach are recorded. Faster moving water creates greater risk for damage to infrastructure and a greater chance of loss of life; according to the National Flood Insurance Program (NFIP), water moving at more than 5 feet per second is considered to be moving with high velocity (Reference 22).

1. Adjacent farm land ("Sunny Day 1" and "Sunny Day 2")

    a. Maximum approximate flood depth is 1.5 feet occurring 25 minutes after the breach develops.

    b. Maximum approximate flood velocity is 5 feet/second.

The PMP model results show minimal impact from the overtopping breach scenario. During the breach simulation, the WSE in the Sangchris Lake "Hot Ditch" increases by

a maximum of about 1 foot immediately downstream of the breach location; however, the flow does not exceed the banks. Maximum approximate flood velocities of 10 feet/second are isolated to the breach location on the south embankment.

4. Hazard Classification

Areas of potential impact were identified with results discussed in Section 3.5 of this report. Adjacent farm land to the east of the Ash Pond is the only area identified as impacted from a breach. Discharge would ultimately flow into Sangchris Lake, located 1,500-2,500 feet downstream of the "Sunny Day" breach locations, by way of the farm land, with no structures identified in-between. Failure or mis-operation of the Ash Pond would result in no probable loss of human life. However, a potential breach event would likely result in the off-site release of CCR material onto adjacent farm land and/or into Sangchris Lake resulting in environmental damage. Therefore, the impoundment fits the definition for a Significant hazard potential CCR surface impoundment (as defined in the CCR Rule §257.53) (Reference 1).

5. References

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20. US Department of Agriculture. (1986). Technical Release – 55: *Urban Hydrology for Small Watersheds*. Soil conservation Services.

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22. Federal Emergency Management Association (FEMA). (2012). *Assessing the Consequences of Dam Failure*. A How-to-Guide.

23. Federal Emergency Management Association (FEMA). (2004). *Hazard Potential Classification System for Dams.*

Appendix A

Breach Parameters

Figure A.1 - "Sunny Day - 1" Dam Breach Parameter Estimation
Earthen Embankment Comparative Spreadsheet

Project Data (Optional):

Dam: *Kincaid Ash Pond*
Location: *Christian County, Illinois*
Notes: *"Sunny Day" Breach of East Embankment*
Piping Failure Assumed

Inputs:

		English Units		SI Units	
Height of dam	h_d	18.0	feet	5.5	meters
Height of breach	h_b	18.0	feet	5.5	meters
Height/depth of water at breach	h_w	6.5	feet	2.0	meters
Storage	S	321.5	ac-feet	396502.7	m^3
Volume of water at breach	V_w	276.7	ac-feet	341353.8	m^3
Width of dam at base	W_{base}	250.0	feet	76.2	meters
Width of dam at crest	W_{crest}	12.0	feet	3.7	meters
Estimated breach side slope	Z	1.0		1.0	
Baseflow	Q_{base}	0.0	ft^3/s	0.00	m^3/s
Type of Failure		Piping			
Dam has core wall?		No			
Erosion resistant embankment?		No			

Data Convention:
- User Input Data
- Default calculation, user can change.
- Calculated value.

Average of Calculated Values:

Breach width	B_{AVG}	42.9	feet	13.1	meters
Breach bottom width	B_W	23.9	feet	7.3	meters
Breach formation time	t_f	0.4	hours	0.37	hours
Peak discharge	Q_p	23,841	ft^3/s	675.1	m^3/s
Breach side slope	Z	1.00		1.00	
Volume of embankment eroded	V_{er}	150878.2	ft^3	4272.6	m^3
Volume of water discharged	V_o,V_{out}	250.96	ac-feet	309558.3	m^3

Estimates of Breach Width & Dimensions

Source Equation (See Attached Equation Reference)	B (m)	B (ft)	Z	V_{er} (m^3)	K_o	$\overline{W}$ (m)	K_c	C_b
1 - Johnson and Illes 1976	9.6	31.5						
2 - Singh and Snorrason 1982, 1984	19.2	63.0						
3 - MacDonald and Langridge-Monopolis 1984	2.5	8.3		822.7				
4 - MacDonald and Langridge-Monopolis 1984			0.500					
5 - FERC 1987	16.5	54.0						
6 - FERC 1987			0.625					
7 - Froehlich 1987	18.1	59.2			1.0			
8 - Froehlich 1987			0.645			39.9	1.0	
9 - USBR 1988	5.9	19.5						
10 - Von Thun and Gillette 1990			1.000					
11 - Von Thun and Gillette 1990	11.1	36.3						6.1
12 - Froehlich 1995	14.7	48.2			1.0			
13 - Froehlich 1995			1.000					

Estimates of Failure Time

Source Equation (See Attached Equation Reference)	t_f (hours)
14 - Singh and Snorrason 1982, 1984	0.625
15 - MacDonald and Langridge-Monopolis 1984	0.206
16 - FERC 1987	0.550
17 - Froehlich 1987	0.637
18 - USBR 1988	0.144
19 - Von Thun and Gillette 1990	
20 - Von Thun and Gillette 1990	
21 - Von Thun and Gillette 1990	0.030
22 - Von Thun and Gillette 1990	0.186
23 - Froehlich 1995	0.470

Figure A.2 - "Sunny Day - 2" Dam Breach Parameter Estimation
Earthen Embankment Comparative Spreadsheet

Project Data (Optional):

Dam: *Kincaid Ash Pond*
Location: *Christian County, Illinois*
Notes: *"Sunny Day" Breach of East Embankment*
Piping Failure Assumed

Inputs:

		English Units		*SI Units*	
Height of dam	h_d	16.0	feet	4.9	meters
Height of breach	h_b	16.0	feet	4.9	meters
Height/depth of water at breach	h_w	5.5	feet	1.7	meters
Storage	S	321.5	ac-feet	396502.7	m^3
Volume of water at breach	V_w	264.5	ac-feet	326293.0	m^3
Width of dam at base	W_{base}	250.0	feet	76.2	meters
Width of dam at crest	W_{crest}	12.0	feet	3.7	meters
Estimated breach side slope	Z	1.0		1.0	
Baseflow	Q_{base}	0.0	ft^3/s	0.00	m^3/s
Type of Failure		Piping			
Dam has core wall?		No			
Erosion resistant embankment?		No			

Data Convention:
- User Input Data
- Default calculation, user can change.
- Calculated value.

Average of Calculated Values:

Breach width	B_{AVG}	40.2	feet	12.2	meters
Breach bottom width	B_W	23.2	feet	7.1	meters
Breach formation time	t_f	0.4	hours	0.38	hours
Peak discharge	Q_p	22,710	ft^3/s	643.1	m^3/s
Breach side slope	Z	1.00		1.00	
Volume of embankment eroded	V_{er}	89498.6	ft^3	2534.4	m^3
Volume of water discharged	V_o,V_{out}	246.82	ac-feet	304451.7	m^3

Estimates of Breach Width & Dimensions

Source Equation (See Attached Equation Reference)	**B** (m)	**B** (ft)	**Z**	**V_{er}** (m^3)	**K_o**	**$\overline{W}$** (m)	K_c	**C_b**
1 - Johnson and Illes 1976	8.5	28.0						
2 - Singh and Snorrason 1982, 1984	17.1	56.0						
3 - MacDonald and Langridge-Monopolis 1984	3.5	11.5		727.6				
4 - MacDonald and Langridge-Monopolis 1984			0.500					
5 - FERC 1987	14.6	48.0						
6 - FERC 1987			0.625					
7 - Froehlich 1987	17.5	57.5			1.0			
8 - Froehlich 1987			0.651			39.9	1.0	
9 - USBR 1988	5.0	16.5						
10 - Von Thun and Gillette 1990			1.000					
11 - Von Thun and Gillette 1990	10.3	33.8						6.1
12 - Froehlich 1995	14.2	46.5			1.0			
13 - Froehlich 1995			1.000					

Estimates of Failure Time

Source Equation (See Attached Equation Reference)	**t_f** (hours)
14 - Singh and Snorrason 1982, 1984	0.625
15 - MacDonald and Langridge-Monopolis 1984	0.197
16 - FERC 1987	0.550
17 - Froehlich 1987	0.709
18 - USBR 1988	0.135
19 - Von Thun and Gillette 1990	
20 - Von Thun and Gillette 1990	
21 - Von Thun and Gillette 1990	0.025
22 - Von Thun and Gillette 1990	0.178
23 - Froehlich 1995	0.510

Figure A.3 - PMP Dam Breach Parameter Estimation
Earthen Embankment Comparative Spreadsheet

Project Data (Optional):

Dam: *Kincaid Ash Pond*
Location: *Christian County, Illinois*
Notes: *PMP breach assumes dam failure is initiated when overtopping begins at dam crest.*
Overtopping failure assumed

Inputs:

		English Units		*SI Units*	
Height of dam	h_d	5.0	feet	1.5	meters
Height of breach	h_b	5.0	feet	1.5	meters
Height/depth of water at breach	h_w	5.0	feet	1.5	meters
Storage	S	321.5	ac-feet	396502.7	m^3
Volume of water at breach	V_w	276.9	ac-feet	341563.5	m^3
Width of dam at base	W_{base}	150.0	feet	45.7	meters
Width of dam at crest	W_{crest}	30.0	feet	9.1	meters
Estimated breach side slope	Z	1.0		1.0	
Baseflow	Q_{base}	0.0	ft^3/s	0.00	m^3/s
Type of Failure		Overtopping			
Dam has core wall?		No			
Erosion resistant embankment?		No			

Data Convention:
- User Input Data
- Default calculation, user can change.
- Calculated value.

Average of Calculated Values:

Breach width	B_{AVG}	58.8	feet	17.9	meters
Breach bottom width	B_W	47.3	feet	14.4	meters
Breach formation time	t_f	0.50	hours	0.50	hours
Peak discharge	Q_p	26,627	ft^3/s	754.0	m^3/s
Breach side slope	Z	1.00		1.00	
Volume of embankment eroded	V_{er}	60947.6	ft^3	1725.9	m^3
Volume of water discharged	V_o,V_{out}	390.64	ac-feet	481848.6	m^3

Estimates of Breach Width & Dimensions

Source Equation (See Attached Equation Reference)	**B** (m)	**B** (ft)	**Z**	**V_{er}** (m^3)	**K_o**	**$\overline{W}$** (m)	K_c	**C_b**
1 - Johnson and Illes 1976	2.7	8.8						
2 - Singh and Snorrason 1982, 1984	5.3	17.5						
3 - MacDonald and Langridge-Monopolis 1984	18.9	61.9		1816.8				
4 - MacDonald and Langridge-Monopolis 1984			0.500					
5 - FERC 1987	4.6	15.0						
6 - FERC 1987			0.625					
7 - Froehlich 1987	18.3	60.2			1.4			
8 - Froehlich 1987			6.186			27.4	1.0	
9 - USBR 1988	4.6	15.0						
10 - Von Thun and Gillette 1990			1.000					
11 - Von Thun and Gillette 1990	9.9	32.5						6.1
12 - Froehlich 1995	16.1	52.9			1.4			
13 - Froehlich 1995			1.000					

Estimates of Failure Time

Source Equation (See Attached Equation Reference)	**t_f** (hours)
14 - Singh and Snorrason 1982, 1984	0.625
15 - MacDonald and Langridge-Monopolis 1984	0.275
16 - FERC 1987	0.550
17 - Froehlich 1987	2.043
18 - USBR 1988	0.197
19 - Von Thun and Gillette 1990	
20 - Von Thun and Gillette 1990	
21 - Von Thun and Gillette 1990	0.023
22 - Von Thun and Gillette 1990	0.232
23 - Froehlich 1995	1.489

Figure A.4 - Ash Pond Stage-Storage Relationships

Elevation	Cumulative Water Volume (Acre-Feet)
594	0
595	0
596	0
597	1
598	6
599	18
600	45
601	84
602	130
603	182
604	244
605	321
606	414
607	515

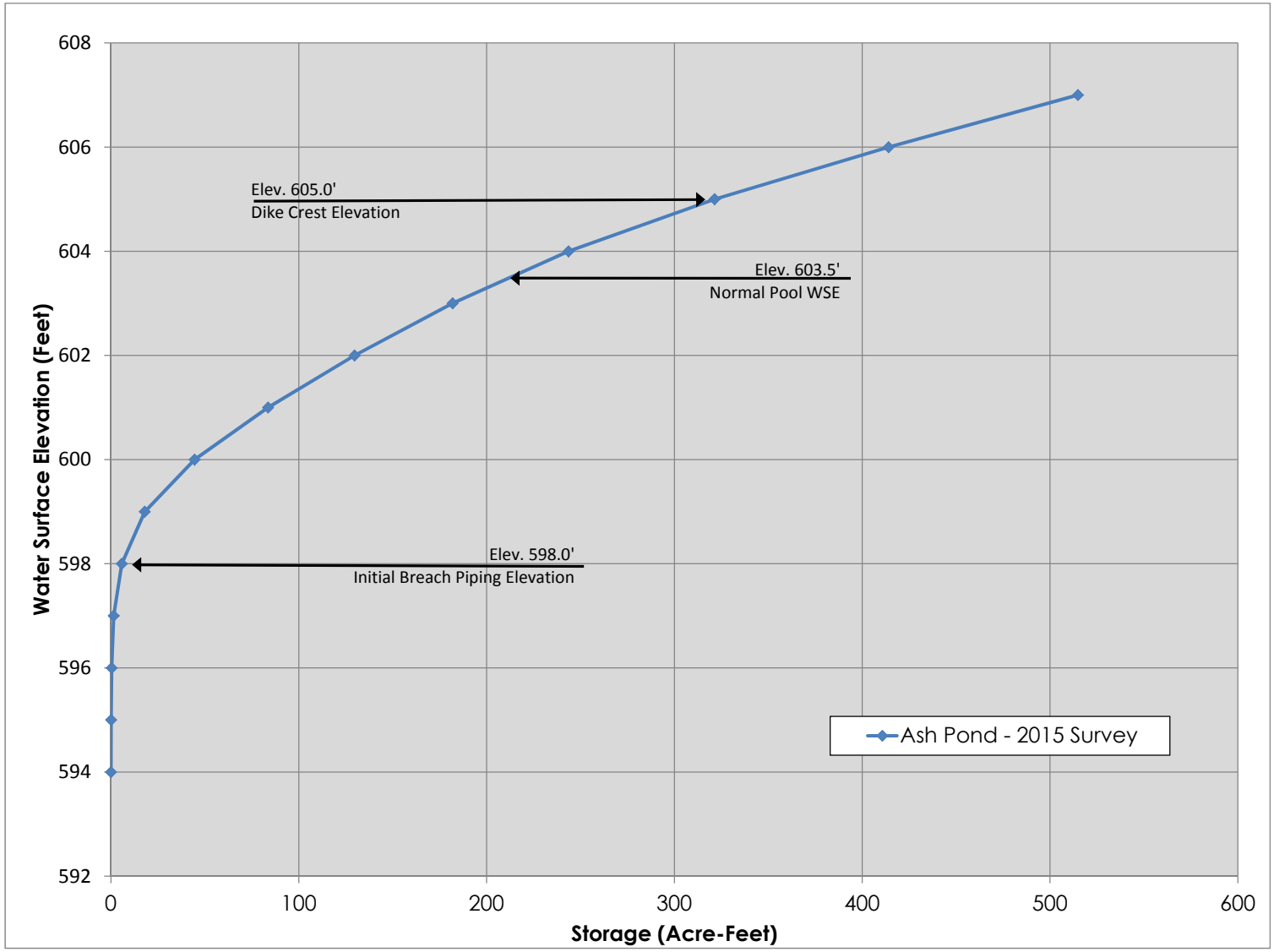
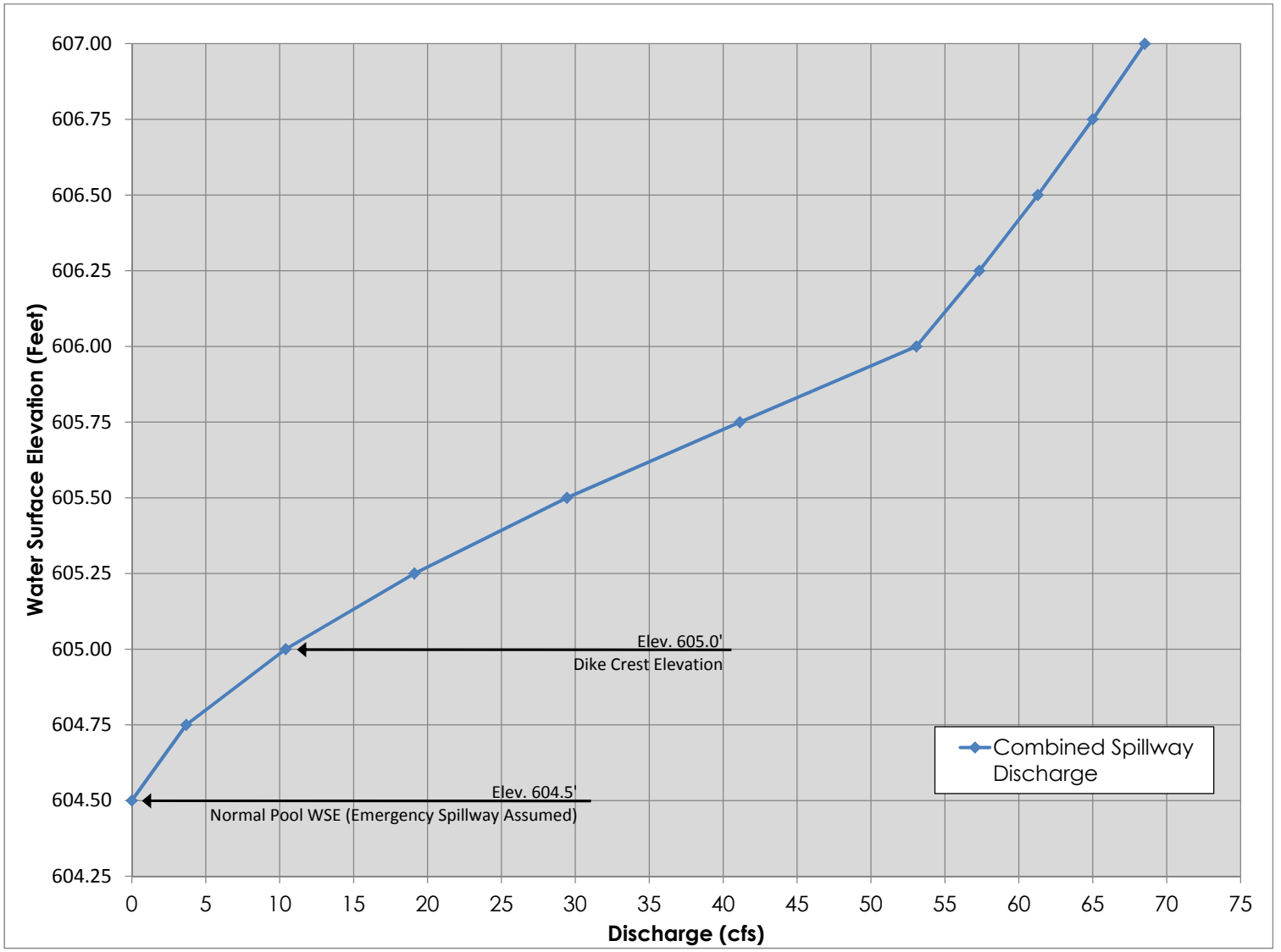


Figure A.5 - Ash Pond Emergency Spillway Rating Curve

Facility Name: Kincaid Power Station Ash Pond

Elevation	Combined Spillway Discharge (cfs)
604.50	0
604.75	4
605.00	10
605.25	19
605.50	29
605.75	41
606.00	53
606.25	57
606.50	61
606.75	65
607.00	69



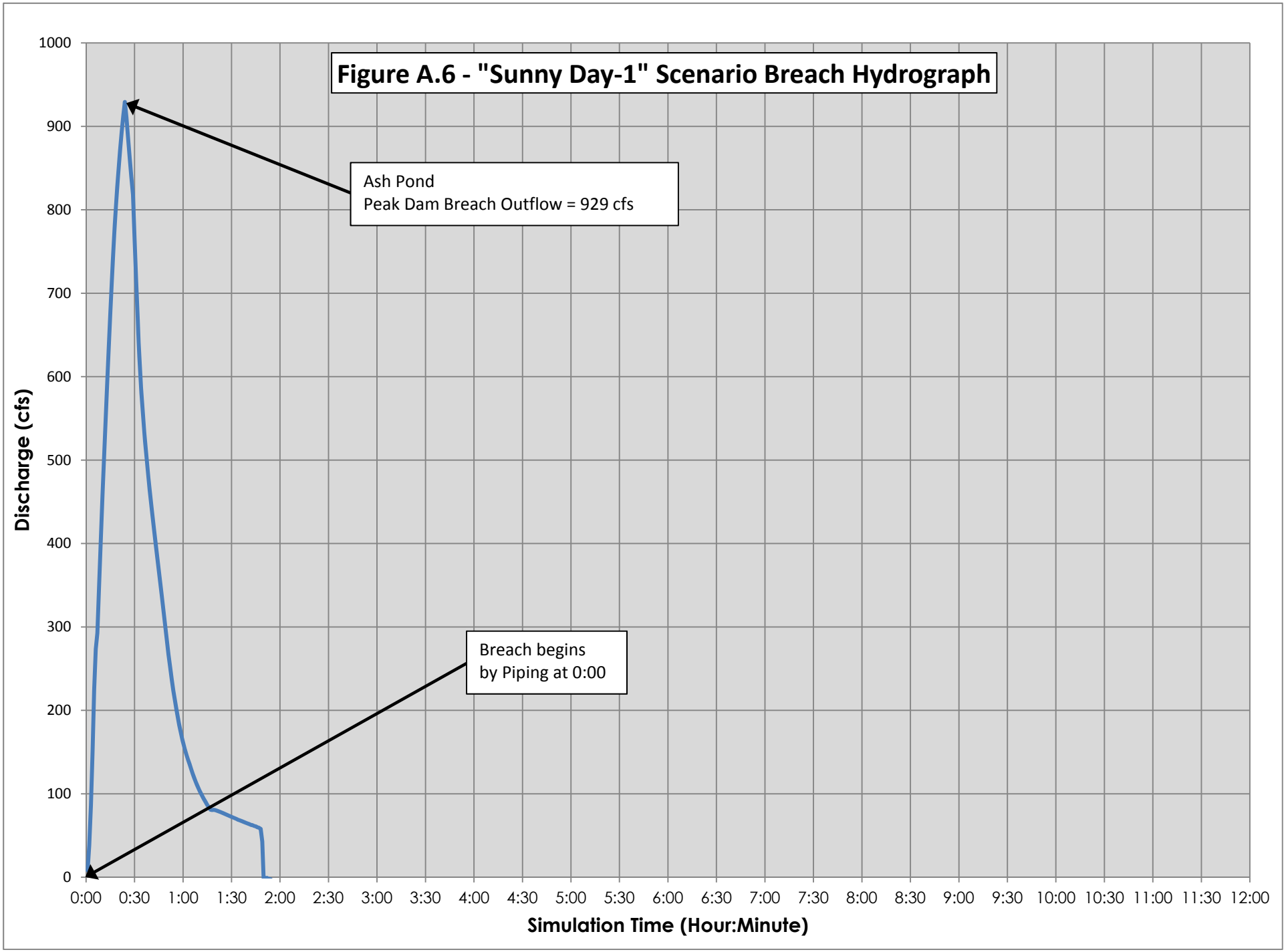


Figure A.6 - "Sunny Day-1" Scenario Breach Hydrograph
Ash Pond
Peak Dam Breach Outflow = 929 cfs
Breach begins
by Piping at 0:00
Discharge (cfs)
1000
900
800
700
600
500
400
300
200
100
0
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00
Simulation Time (Hour:Minute)

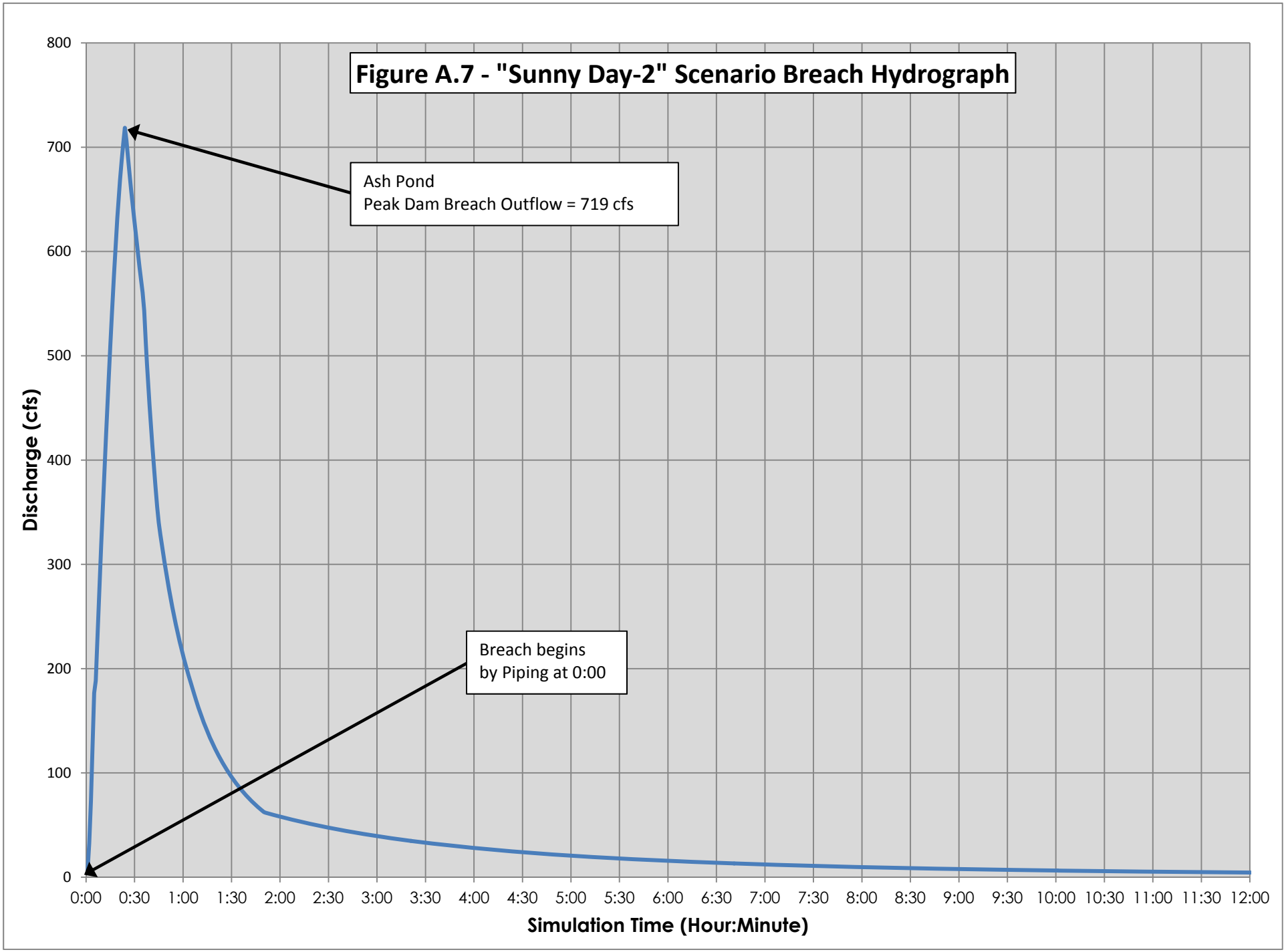


Figure A.7 - "Sunny Day-2" Scenario Breach Hydrograph
Ash Pond
Peak Dam Breach Outflow = 719 cfs
Breach begins
by Piping at 0:00
Discharge (cfs)
800
700
600
500
400
300
200
100
0
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00
Simulation Time (Hour:Minute)

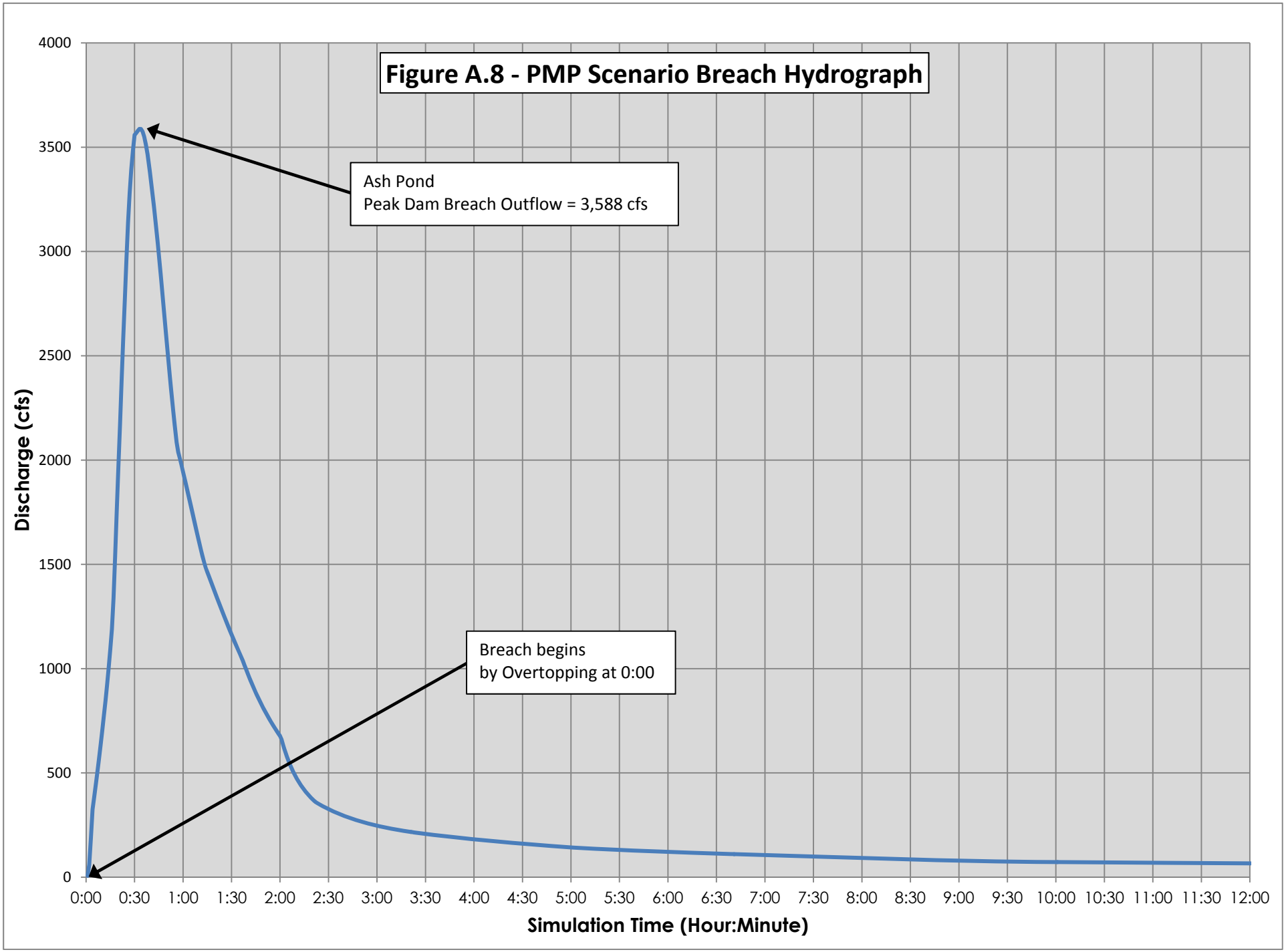


Figure A.8 - PMP Scenario Breach Hydrograph
Ash Pond
Peak Dam Breach Outflow = 3,588 cfs
Breach begins
by Overtopping at 0:00
Discharge (cfs)
Simulation Time (Hour:Minute)
4000
3500
3000
2500
2000
1500
1000
500
0
0:00
0:30
1:00
1:30
2:00
2:30
3:00
3:30
4:00
4:30
5:00
5:30
6:00
6:30
7:00
7:30
8:00
8:30
9:00
9:30
10:00
10:30
11:00
11:30
12:00

Dam Breach Parameter Spreadsheet

Equations, Procedures, and Notes

Last Updated/By: 8-24-12 – Erman Caudill (Stantec)

Assumptions:

- Equations here were extracted from the USBR Report "Prediction of Embankment Dam Breach Parameters" and the Journal of Hydraulic Engineering article "Uncertainty of Predictions of Embankment Dam Breach Parameters" by the same author (Tony L. Wahl, USBR). Citation for that reference is included below, but recursive references have been omitted.
- All earthen embankments.
- Measurements are in SI units (meters, m^3/s, hours) unless otherwise noted. Spreadsheet is set up to do the English-SI input conversions, then convert answers back to English units.

Input Parameters, Constants, and Variables:

h_d = height of dam: input
h_b = height of breach: input, generally = h_d
h_w = height (depth) of water at failure above breach bottom: input
S = storage: input parameter
V_w = volume of water above breach invert at time of breach: input, generally = S
W = Embankment width: input
Z = breach opening side slope: input or calculated

g = acceleration of gravity = 9.8 m/s^2 =127,008,000 m/hr^2

B = average breach width: calculated (see below)
B_W = breach bottom width: calculated using B, h_b, and Z (see equation 39)
t_f = breach formation time, hours: calculated (see below)
Q_p = peak breach outflow: calculated (see below)
Z = breach opening side slope: input or calculated (see below)
V_{er} = volume of embankment material eroded: generally calculated (see Equation 40)
V_o,V_{out} = volume of water discharged: calculated = S + inflow during breach

Breach Width & Dimension Equations:

Johnson and Illes 1976

(1) $0.5h_d \leq B \leq 3h_d$

Singh and Snorrason 1982, 1984

(2) $2h_d \leq B \leq 5h_d$

MacDonald and Langridge-Monopolis 1984

(3) $V_{er} = 0.0261(V_{out}h_w)^{0.769}$

(4) $Z = 1H{:}2V$

FERC 1987

(5) $2h_d \leq B \leq 4h_d$

(6) $0.25 \leq Z \leq 1.0$

Froehlich 1987

$$\overline{B^*} = \frac{\overline{B}}{h} = 0.47K_o(S^*)^{0.25}$$

$$S^* = \frac{S}{{h_b}^3}$$

(7) $\overline{B} = 0.47 h_b K_o \left(\frac{S}{h_b{}^3}\right)^{0.25}$ Ko = 1.4 overtopping; 1.0 otherwise

$$Z = 0.75 K_c (h_w{}^*)^{1.57} \left(\overline{W^*}\right)^{0.73}$$

$$h_w{}^* = \frac{h_w}{h_b}$$

$$\left(\overline{W^*}\right) = \frac{\overline{W}}{h} = \frac{W_{crest} + W_{bottom}}{2h}$$

(8) $Z = 0.75 K_c \left(\frac{h_w}{h_b}\right)^{1.57} \left(\frac{\overline{W}}{h_b}\right)^{0.73}$ Kc = 0.6 with corewall; 1.0 without a corewall

USBR 1988

(9) $B = 3h_w$

Von Thun and Gillette 1990

(10) $Z = 1H{:}1V$

(11) $\overline{B} = 2.5 h_w + C$

$$C_b = f(\text{reservoir size}, m^3) = \begin{Bmatrix} Size & C_b \\ < 1.23x10^6 & 6.1 \\ 1.23x10^6 - 6.17x10^6 & 18.3 \\ 6.17x10^6 - 1.23x10^7 & 42.7 \\ > 1.23x10^7 & 54.9 \end{Bmatrix}$$

Froehlich 1995

(12) $\overline{B} = 0.1803 K_o V_w{}^{0.32} h_b{}^{0.19}$ Ko = 1.4 overtopping; 1.0 otherwise

(13) Z = 1.4 for overtopping, 0.9 otherwise

Failure Time Equations:

Singh and Snorrason 1982, 1984

(14) $0.25 \text{ hr} \leq t_f \leq 1.0 \text{ hr}$

MacDonald and Langridge-Monopolis 1984

(15) $t_f = 0.0179 (V_{er})^{0.364}$

FERC 1987

(16) $0.10 \text{ hr} \leq t_f \leq 1.0 \text{ hr}$

Froehlich 1987 (t_f* equation was corrected from the report)

$$S^* = \frac{S}{h_b{}^3}$$

$$t_f{}^* = 79 (S^*)^{0.47} = 79 \left(\frac{S}{h_b{}^3}\right)^{0.47}$$

$$t_f{}^* = t_f \sqrt{\frac{g}{h}}$$

(17) $t_f = \frac{79 \left(\frac{S}{h_b{}^3}\right)^{0.47}}{\sqrt{\frac{g}{h_b}}}$

USBR 1988

(18) $t_f = 0.011 B$

Von Thun and Gillette 1990

Erosion Resistant

(19) $t_f = 0.020h_w + 0.25$

(20) $t_f = \frac{\overline{B}}{4h_w}$

Highly Erodible

(21) $t_f = 0.015h_w$

(22) $t_f = \frac{\overline{B}}{4h_w+61.0}$

Froehlich 1995

(23) $t_f = 0.00254{V_w}^{0.53}{h_b}^{(-0.90)}$

Peak Flow Equations:

Kirkpatrick 1977

(24) $Q_p = 1.268(h_w + 0.3)^{2.5}$

SCS 1981

(25) $Q_p = 16.6(h_w)^{1.85}$

Hagen 1982

(26) $Q_p = 0.54(S \times h_d)^{0.5}$

USBR 1982

(27) $Q_p = 19.1(h_w)^{1.85}$

Singh and Snorrason 1984

(28) $Q_p = 13.4(h_d)^{1.89}$

(29) $Q_p = 1.776(S)^{0.47}$

MacDonald and Langridge-Monopolis 1984

(30) $Q_p = 1.154(V_w h_w)^{0.412}$

(31) $Q_p = 3.85(V_w h_w)^{0.411}$

Costa 1985

(32) $Q_p = 1.122(S)^{0.57}$

(33) $Q_p = 0.981(S \times h_d)^{0.42}$

(34) $Q_p = 2.634(S \times h_d)^{0.44}$

Evans 1986

(35) $Q_p = 0.72(V_W)^{0.53}$

Froehlich 1995

(36) $Q_p = 0.607{V_w}^{0.295}{h_w}^{1.24}$

Webby 1996

(37) $Q_p = 0.0443g^{0.5}{V_w}^{0.367}{h_w}^{1.40}$

Dam Breach Parameter Spreadsheet

Equations, Procedures, and Notes

Last Updated/By: 8-24-12 – Erman Caudill (Stantec)

Walder and O'Connor 1997

$$\eta = \frac{kV_o}{g^{0.5}d^{3.5}}$$

k = vertical erosion rate = 10 m/hr – 100 m/hr
d = 50-100% of dam height

$$(38) \qquad Q_p = \begin{Bmatrix} 1.51(g^{0.5}d^{2.5})^{0.06}\left(\frac{kV_o}{d}\right)^{0.94} & \eta < \sim 0.6 \\ 1.94g^{0.5}d^{2.5}\left(\frac{h_d}{d}\right)^{0.75} & \eta \gg 1 \end{Bmatrix}$$

Other Equations:

Breach Bottom Width

$$(39) \qquad B_W = B - h_b Z$$

Embankment Volume

$$(40) \qquad V_{er} = \left(B_w h_b + Z h_b{}^2\right)\left(\frac{W_{crest} + W_{base}}{2}\right) = (Bh_b)\left(\frac{W_{crest} + W_{base}}{2}\right)$$

$$B = \frac{V_{er}}{h_b\left(\frac{W_{crest} + W_{base}}{2}\right)}$$

References:

U.S. Department of the Interior, Bureau of Reclamation, Dam Safety Office. July 1998. "Prediction of Embankment Dam Breach Parameters, A Literature Review and Needs Assessment, DSO-98-004, Dam Safety Research Report", Tony L. Wahl, Water Resources Research Laboratory. 67 pp.

"Uncertainty of Predictions of Embankment Dam Breach Parameters", Tony L. Wahl. Journal of Hydraulic Engineering, Vol. 130, No. 5, May 1, 2004. 9 pp.

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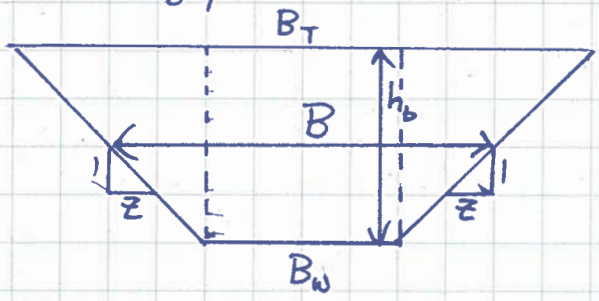
DAM BREACH EQUATIONS

DERIVATIONS NOT SHOWN

1. BREACH BOTTOM WIDTH GIVEN AVG. BREACH WIDTH B, BREACH HEIGHT H_b, AND BREACH SIDE SLOPES Z



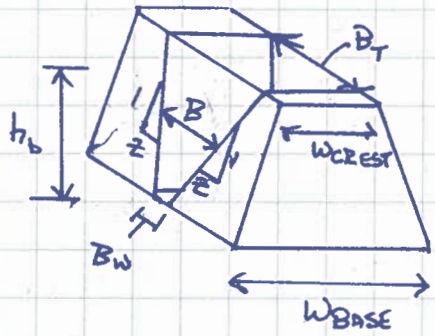
$$B = \frac{B_T + B_W}{2}$$

$$B_T = B_W + 2h_b Z$$

$$B = \frac{(B_W + 2h_b Z) + B_W}{2} = \frac{2B_W + 2h_b Z}{2} = B_W + h_b Z$$

$$B_W = B - h_b Z$$

2. VOLUME OF EMBANKMENT ERODED



AREA AT CENTER

$$A_c = B_W h_b + Z h_b^2$$

$$\forall = A_c W_{CREST} + 2\frac{A_c}{Z}\frac{(W_{BASE} - W_{CREST})}{2}$$

$$= A_c W_c + \frac{A_c}{2} W_B - \frac{A_c}{2} W_c$$

$$= \frac{A_c W_c}{2} + \frac{A_c W_B}{2}$$

$$= A_c\left(\frac{W_c + W_B}{2}\right)$$

$$\forall = \left(B_W h_b + Z h_b^2\right)\left(\frac{W_c + W_B}{2}\right)$$

$$\forall = B h_b \left(\frac{W_c + W_B}{2}\right) \rightarrow B = \frac{\forall}{h_b\left(\frac{W_c + W_B}{2}\right)}$$

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Appendix B

Watershed Figure

Figure No.
B.1

Title
Watershed Figure
Ash Pond
Kincaid Power Station

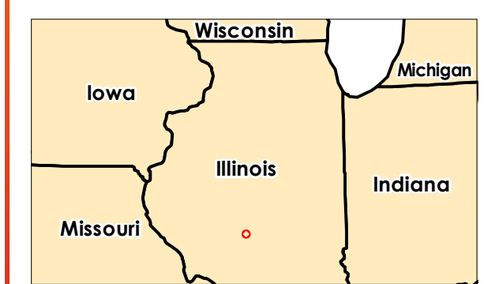
Client/Project
Dynegy
Kincaid Power Station
Hazard Potential Classification Assessment

Project Location
Latitude: 38.877193
Longitude: -84.229495
SE. of Cincinnati, Clermont Co., OH

175666013
Prepared by NS on 2016-10-05
Technical Review by PV on 2016-10-05
Independent Review by MH on 2016-10-05

0 500 Feet
1:6,000 (At original document size of 11x17)

Legend
Ash Pond Watershed Area



Notes
1. Coordinate System: NAD 1983 StatePlane Illinois West FIPS 1202 Feet
2. Base features: produced from project design elements.
3. Base Imagery: Orthoimagery - Clermont County, 2015.

Stantec DYNEGY

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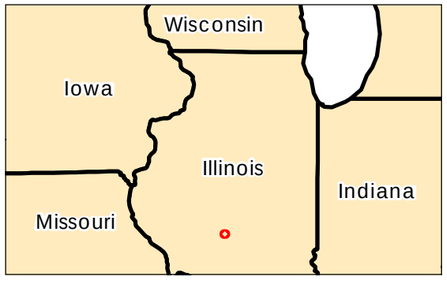
Appendix C

Site Overview Figure



Notes
1. Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
2. Aerial Source: 2015 NAIP Imagery
3. Impoundment Boundaries Provided by Client (Dated 9/9/2015)

0 1,000 Feet

1:12,000 (At original document size of 11x17)

Stantec DYNEGY

Project Location
Latitude: 39.592011
Longitude: -89.497012
Christian County, Illinois

175605019
Prepared by WSW on 2016-10-06
Technical Review by NS on 2016-10-06
Independent Review by MH on 2016-10-06

Client/Project
Dynegy
Kincaid Power Station
Hazard Potential Classification Assessment

Figure No.
C.1

Title
Site Overview Figure
Ash Pond
Kincaid Power Station

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Stantec Consulting Services Inc.
1859 Bowles Avenue Suite 250, Fenton MO 63026-1944

October 12, 2016
File: let_015_175666013_certification
Revision 0

Initial Hazard Potential Classification Assessment
EPA Final CCR Rule
Ash Pond
Kincaid Power Station
Christian County, Illinois

1.0 PURPOSE

This report documents Stantec's certification of the initial hazard potential classification assessment for the Kincaid Power Station Ash Pond.

40 CFR 257.73(a)(2) requires the owner or operator of an existing CCR surface impoundment to conduct an initial hazard potential classification assessment and document the hazard potential classification, and the basis for the classification, of the CCR unit as either a high hazard potential CCR surface impoundment, a significant hazard potential CCR surface impoundment, or a low hazard potential CCR surface impoundment.

2.0 FINDINGS

A breach analysis was performed to evaluate potential hazards associated with a failure of the Ash Pond's perimeter containment dike. Breach locations were selected based on nearby downstream areas that could be potentially impacted. Breach failures for the "sunny day" scenario were modeled at two locations on the east embankment. Breach failure for the "PMP" scenario was modeled at one location near the lowest crest elevation on the Ash Pond embankment.

Analyses indicate that a potential breach of the Ash Pond results in farm land to the east of the Ash Pond as potentially being impacted. The results also indicated depths less than two feet and velocities approximately five feet per second. Velocities exceeding five feet per second were isolated to the breach location. The analysis indicated that discharge from the "Sunny Day" breach locations would flow into Sangchris Lake. The analyses did not result in any structures being impacted. Therefore, failure or mis-operation of the Ash Pond would likely result in no probable loss of human life. However, a potential breach event would likely result in the off-site release of CCR material onto adjacent farm land and/or into Sangchris Lake, resulting in environmental damage.

40 CFR 257.53 defines a "significant hazard potential CCR surface impoundment" as a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

Based on the results of the analysis summarized above, the Ash Pond was assigned a Significant hazard potential classification per 40 CFR 257.53.

3.0 QUALIFIED PROFESSIONAL ENGINEER CERTIFICATION

I, Matthew Hoy, being a Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that;

1. the information contained in this report and the underlying data in the operating record was prepared in accordance with the accepted practice of engineering and is accurate as of the date of my signature below; and

2. the initial hazard potential classification assessment for the Kincaid Power Station Ash Pond was conducted in accordance with the requirements specified in 40 CFR 257.73.

SIGNATURE _____ DATE 10/12/2016

ADDRESS: Stantec Consulting Services Inc.
1859 Bowles Avenue Suite 250
Fenton MO 63026-1944

TELEPHONE: (636) 343-3880

ATTACHMENT P

October 2021

Luminant

Office Memorandum

Date: November 17, 2020

To: Cynthia Vodopivec

cc: Matt Ballance
Jason Campbell
Charles Koudelka

From: Vic Modeer

Subject: Ash Pond Structural Stability Assessment
Kincaid Generation, LLC
Kincaid Power Station

BACKGROUND

The October 2016 certified "CCR Rule Report: Initial Structural Stability Assessment for the Kincaid Ash Pond at the Kincaid Power Station" (CCR Certification Report) prepared by AECOM for Kincaid Generation, LLC (Kincaid Generation) describes the outlets for the Ash Pond. There are two hydraulic structures that pass through the dike of the Ash Pond, the 48-inch corrugated metal pipe (CMP) emergency outlet structure and a 60-inch reinforced concrete recycle intake pipe (RCP) that passes through the dike and travels back to the plant on the downstream side of the southern dike. The recycle pipe is 20-feet from the toe of the dike with 6 feet of soil cover. No other hydraulic structures pass through the dike of or underlie the base of the Kincaid Ash Pond. The AECOM report states that the Kincaid Ash Pond hydraulic structures cannot be structurally certified due to inability to complete a closed-circuit television (CCTV) inspection of the recycle intake structure pipe. However, the recycle pipes have been inspected numerous times thereafter and found to be structurally sufficient. Thus, both hydraulic structures are structurally sufficient.

Pipe Inspections and Structural Stability Statements. AECOM's 2016 report states that the CMP was able to be internally inspected via a CCTV inspection and found to be "free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris." In addition, the AECOM report states that "[e]valuation of design drawings and information about operations and maintenance for [the CMP] did not identify any issues." However, AECOM could not certify that all of the Kincaid Ash Pond hydraulic structures meet the requirements of § 257.73(d)(1)(vi) because it was not able to be internally inspect the RCP due to the

high flow volume. However, the intake structure that includes the section of the RCP through the embankment was observed in the field by AECOM and no structural defects were found as noted in AECOM's report.

The 60-inch RCP was constructed with a lean concrete bedding to prevent settlement during and after construction. The pipe is flowing freely as it is a key part of the plant operation water balance. Inspections of the ground surface above the pipe are performed weekly as part of the weekly inspections in compliance with § 257.83 and do not show any deformation or loss of ground surrounding the pipe.

EVALUATION

Analyses. The critical cross section for the 60-inch RCP is at Station 119+00, at the outlet. The remainder of the southern dike is flatter and does not have pooled water on the upstream face. The results of the 2016 AECOM report address conditions of steeper slope with saturated ash on the upstream face. In order to certify the complete 60-inch RCP is structurally sound in accordance with § 257.73(d)(1)(vi) the following analyses were performed at the critical outlet cross section at Station 119+00:

- § 257.73(e)(1)(i), Maximum storage pool safety factor must be at least 1.50. Figure 1 provides the graphic results of the analysis. The calculated safety factor is 2.86.

- § 257.73(e)(1)(ii), Maximum surcharge pool safety factor must be at least 1.40. Figure 2 provides the graphic results of the analysis. The calculated safety factor is 2.04.

- § 257.73(e)(1)(iii), Seismic safety factor must be at least 1.00, Figures 3 and 3A provide the graphic results of the analysis. The calculated safety factor is greater than 1.00 as shown in Figure 3 and the soils do not sustain perceptible movement according to the results shown in Figure 3A.

    - The analysis of the movement shown in Figure 3A is to determine the integrity of the pipe should earthquake movement occur at the outlet.

    - The design earthquake parameters were taken from the results of the Probabilistic Seismic Hazard Analysis (PSHA) from the 2016 AECOM report.

    - The analysis of Figure 3A is based on the state of the practice method by Jibson, et.al. (Jibson, R.W., Rathje, E.M., Jibson, M.W. and Lee, Y.W., 2013. *SLAMMER: Seismic landslide movement modeled using earthquake records* (No. 12-B1). US Geological Survey).

- § 257.73(e)(1)(iv) For dikes constructed of soils that have susceptibility to liquefaction safety factor must be at least 1.20. The soils are not susceptible to liquefaction, and the results of the analysis have a calculated safety factor of 2.83.

Evaluation. The above evaluation shows that the 60-inch RCP that runs from the pond outlet to the plant does not affect the stability of the impoundment that would cause a release of CCR material. Moreover, a failure within the 60-inch RCP would not cause the dike to become unstable and the dike instability to cause a release of CCR material. The evaluation also shows that the stability of the dike at the inlet structure meets the requirements of the CCR rule so any dike instability will not cause a pipe failure. The inlet structure does not have any structural defects.

Accordingly, based on the above analyses and evaluation of the 60-inch RCP and the information included in the 2016 AECOM report for the CMP, the hydraulic structures at the Ash Pond are structurally sufficient and meet the requirements of § 257.73(d)(1)(vi).

Please let me know if you have any questions.

Sincerely,

Vic Modeer, PE, D.GE
(IL, MO, IN, KY, OH, LA)
Consulting Engineer

FIGURE 1

§257.73(e)(1)(l) Maximum Storage Pool Safety Factor must be at least 1.5

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- Drained shear strengths were used in this analysis

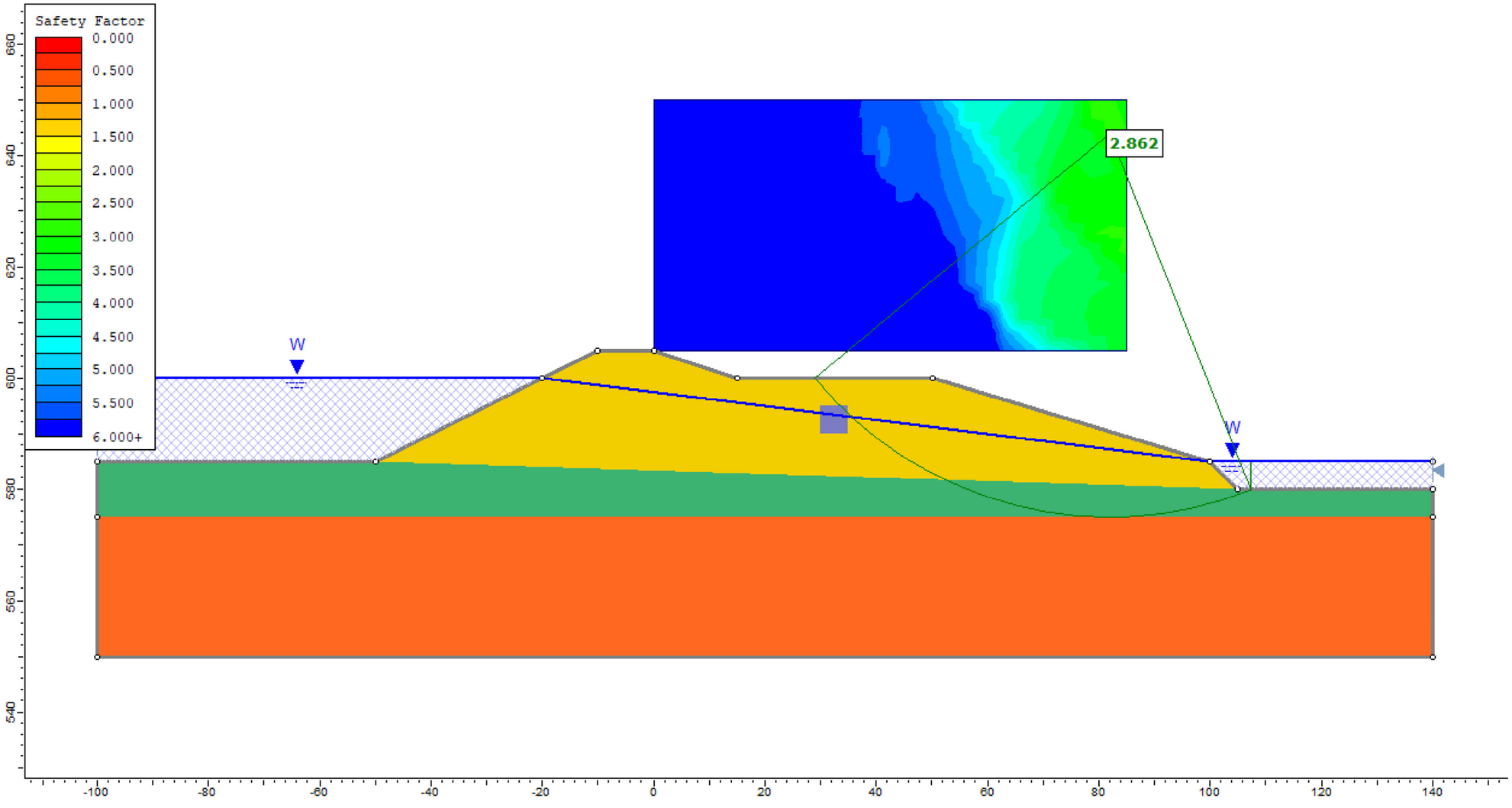


FIGURE 2

§257.73(e)(1)(II) Maximum Surcharge Pool Safety Factor must be at least 1.4

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- Short term undrained strengths were used in this analysis

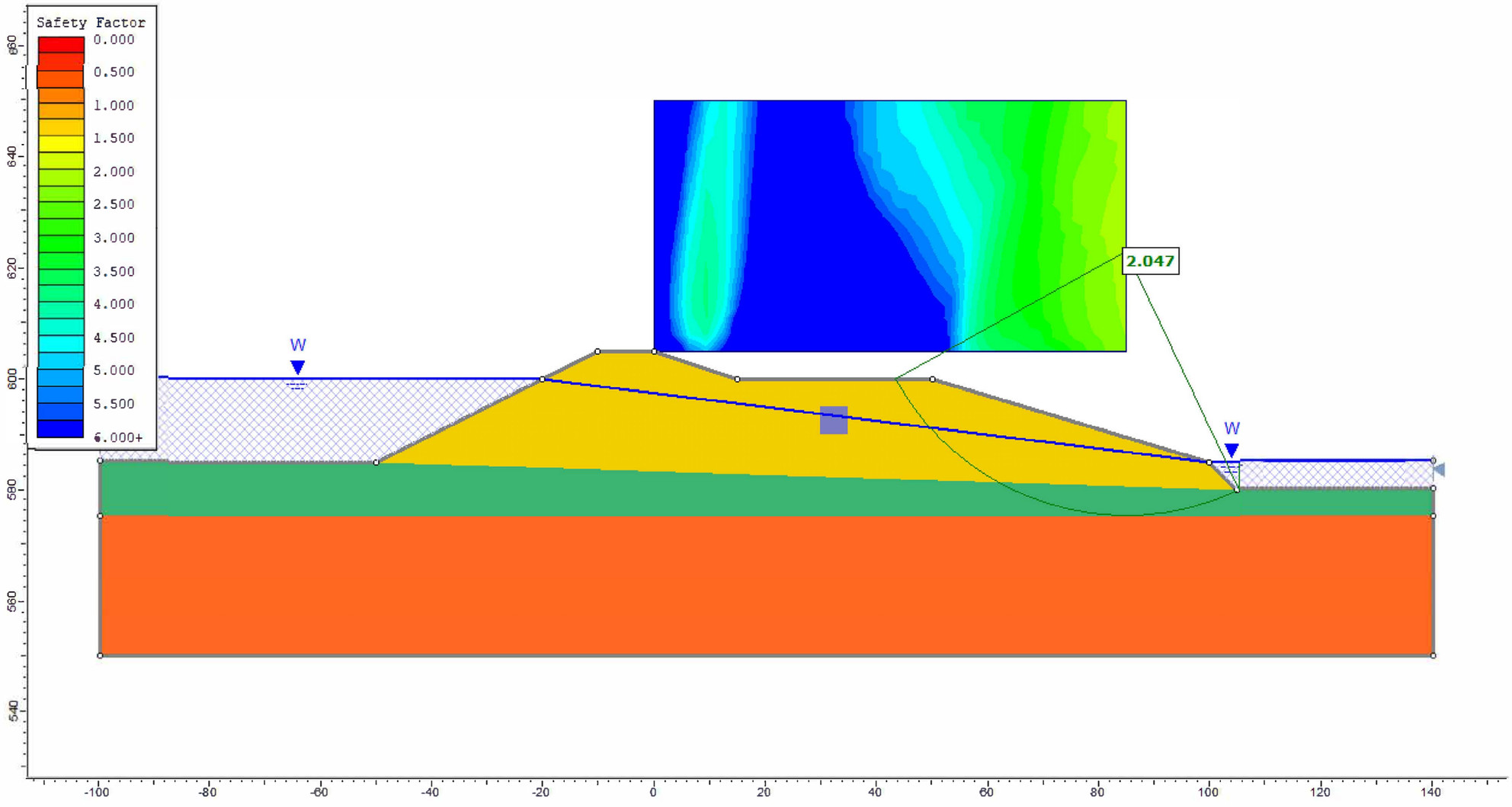


FIGURE 3

257.73(e)(1)(III) Seismic Safety Factor must be at least 1.0

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- The horizontal acceleration from certification report is 0.07
- This analysis finds the lowest horizontal acceleration for a safety factor 1.0
- Lowest horizontal acceleration = 0.204 < 0.07, therefore embankment meets rule

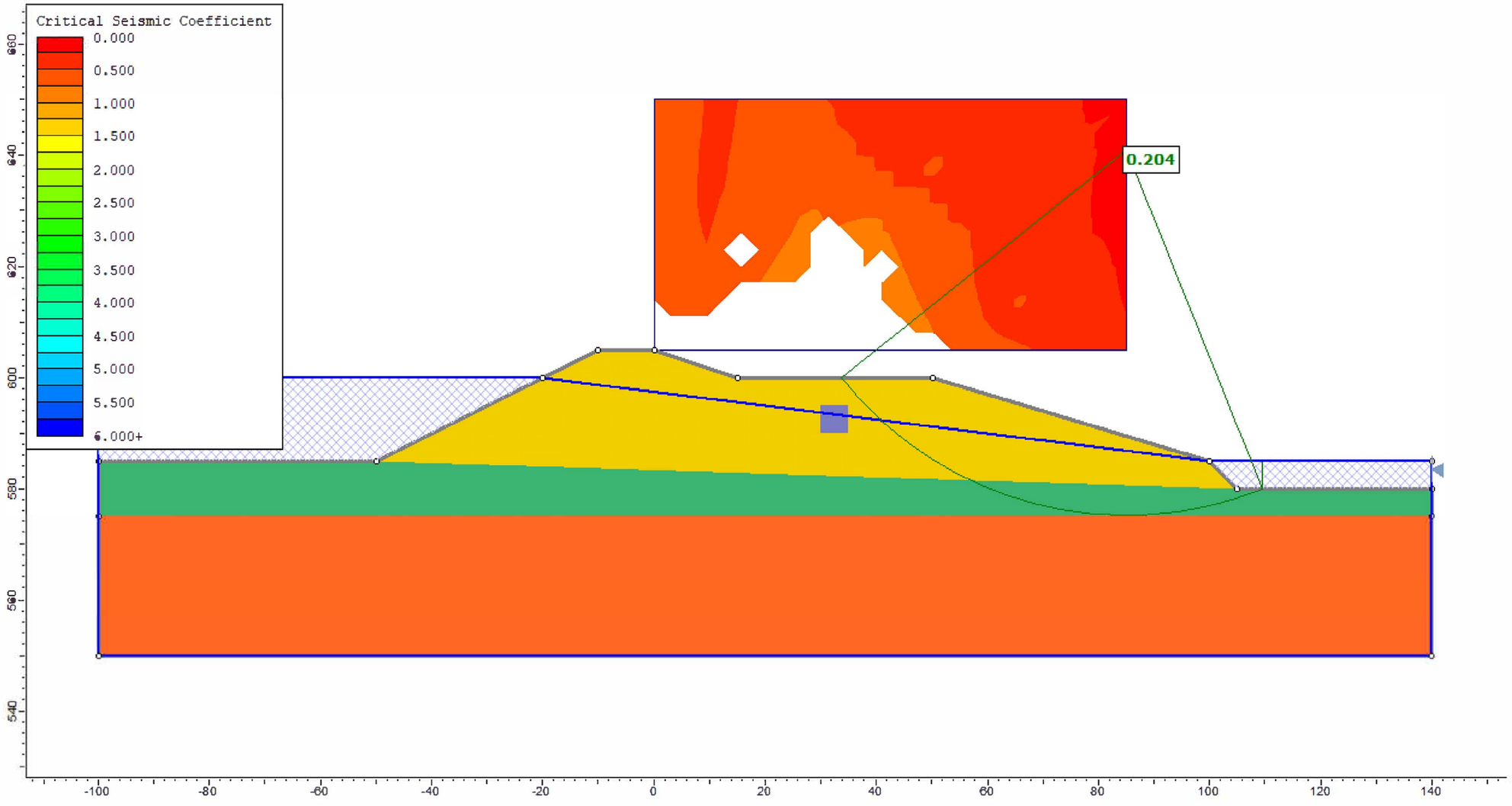


FIGURE 3A

§257.73(e)(1)(III) Seismic Safety Factor must be at least 1.0

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- This analysis shows the displacement from the modeled earthquake in the PSHA from the certification report
- Referece: Jibson, R.W., Rathje, E.M., Jibson, M.W. and Lee, Y.W., 2013. SLAMMER: Seismic landslide movement modeled using earthquake records (No. 12-B1). US Geological Survey.

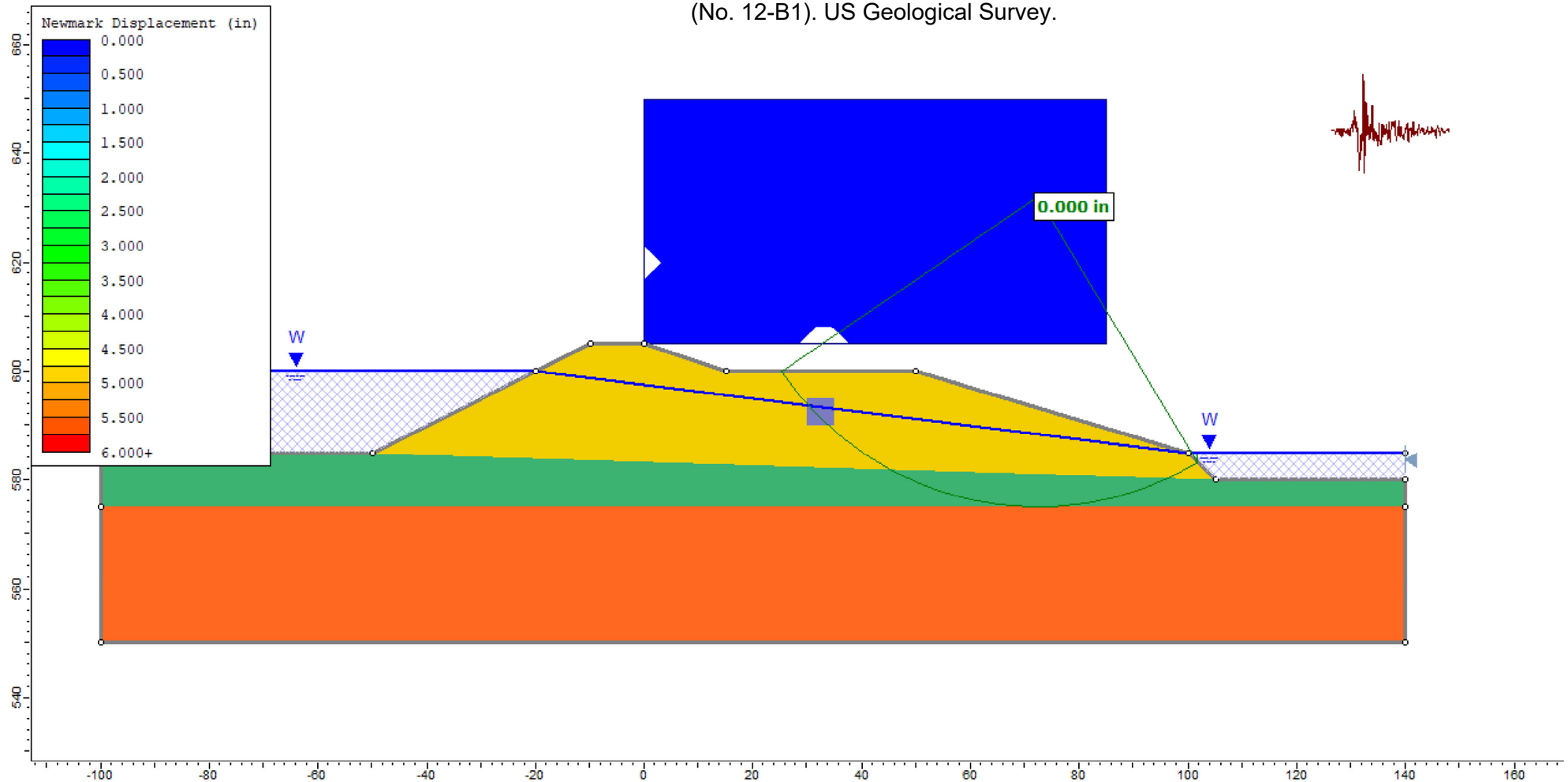
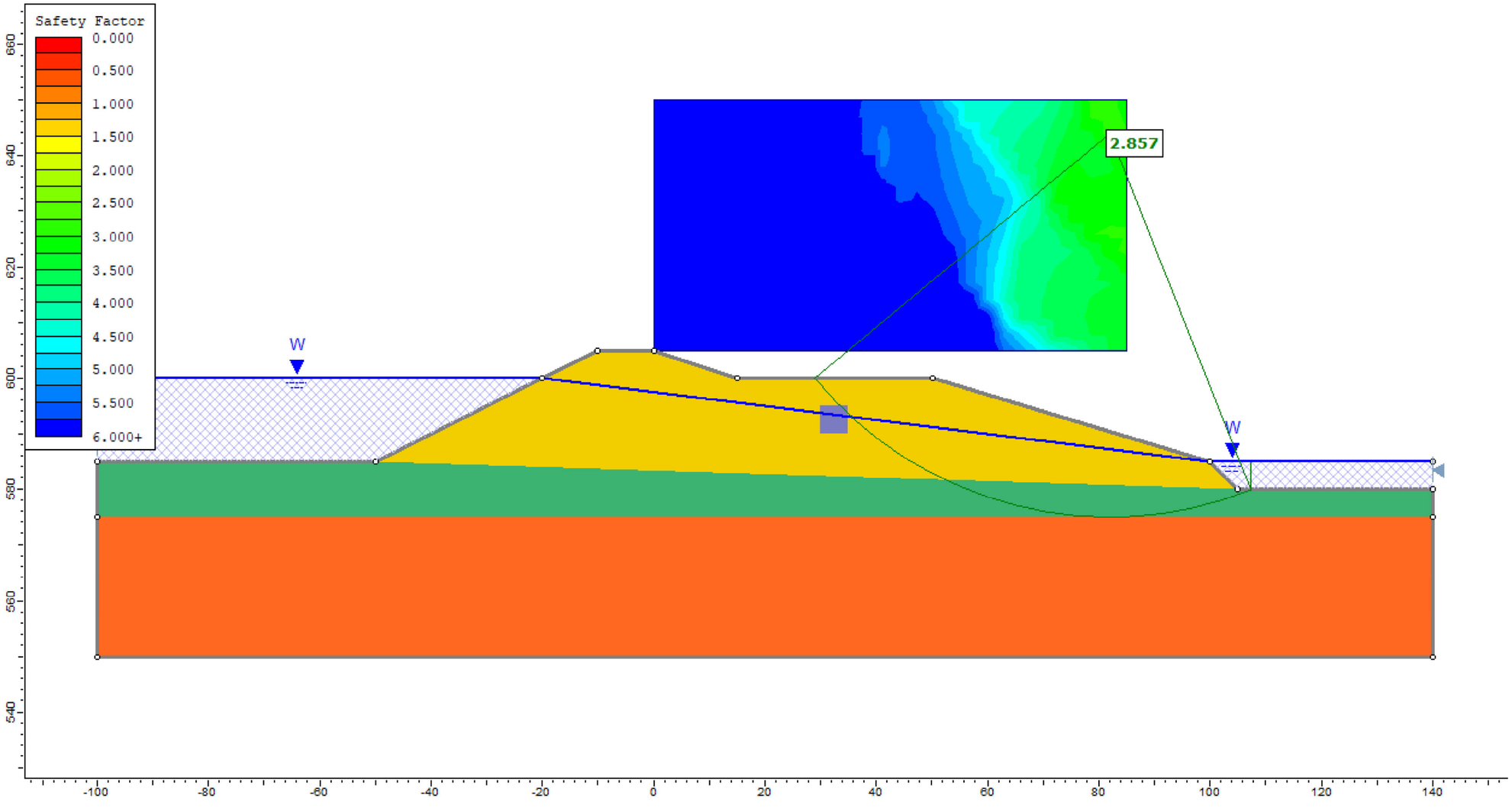


FIGURE 4

§257.73(e)(1)(IV) For dikes constructed of soils that have susceptibility to liquefaction safety factor must be at least 1.2

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- The soils immediately below embankment were shown in certification report to be susceptible to earthquake or strain softening
- This analyses slope with strain softened strengths



AECOM

Attorney Client Privileged

Submitted to
Kincaid Generation, LLC
West Route 104
Kincaid, IL 62540

Submitted by
AECOM
1001 Highlands Plaza Drive West,
Suite 300
St. Louis, MO 63110

October 2016

CCR Certification Report: Structural Stability Assessment, Safety Factor Assessment, and Hydrologic and Hydraulic Analyses

For

Kincaid Ash Pond

At Kincaid Power Station

Revision 0

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Executive Summary

This structural stability assessment, safety factor assessment, and hydrologic and hydraulic analysis for Kincaid Ash Pond at the Kincaid Power Station has been prepared in accordance with the requirements specified in 40 Code of Federal Regulations (CFR) §257.73(d), §257.73(e), and §257.82(a), respectively. These regulations require that the specified structural stability, safety factor, and hydrologic and hydraulic assessments for an existing CCR surface impoundment be completed by October 17, 2016.

The engineering investigations, analyses, and evaluations determined that Kincaid Ash Pond meets all requirements for safety factor assessment and hydrologic and hydraulic analysis, as summarized in Table ES-1. All requirements for structural stability are met, except for the structural integrity of hydraulic structures (§257.73(d)(1)(vi)). AECOM is currently treating this issue as a "deficiency" that will require action as soon as feasible, pursuant to §257.73(d)(2) in order to certify.

Table ES-1 – Certification Summary

Report Section	CCR Rule Reference	Requirement Summary	Requirement Met?	Comments
Structural Stability				
3.1	§257.73(d)(1)(i)	Stable foundations and abutments	Yes	Foundations and abutments were found to be stable.
3.2	§257.73(d)(1)(ii)	Adequate Slope Protection	Yes	Slope protection is adequate.
3.3	§257.73(d)(1)(iii)	Sufficiency of Dike Compaction	Yes	Dike compaction is sufficient for expected ranges in loading conditions.
3.4	§257.73(d)(1)(iv)	Presence and condition of slope vegetation	**Yes – After Update to CCR Rule**	**Vegetation is present and maintained, but exceeds 6 inches in height. The 6 inch minimum height criteria will be removed from CCR Rule §257.73(d)(1)(iv) in the future, and this requirement will be met at that time.**
3.5	§257.73(d)(1)(v)(A) and (B)	Adequacy of spillway design and construction	Yes	Spillways are adequately designed and constructed and adequately manage flow during 1,000-year flood.
3.6	§257.73(d)(1)(vi)	Structural integrity of hydraulic structures	**No[1]**	**Recycle pipe was unable to be inspected due to plant flow. AECOM recommends inspecting this pipe as feasible to address this issue.**
3.7	§257.73(d)(1)(vii)	Stability of downstream slopes inundated by water body	Yes	Downstream slopes adjacent to Sangchris Lake are expected to remain stable during inundation.
Safety Factor				
4.1	§257.73(e)(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	Safety factors were calculated to be 1.57 and higher.
4.2	§257.73(e)(1)(ii)	Maximum surcharge pool safety factor must be at least 1.40	Yes	Safety factors were calculated to be 1.46 and higher.
4.3	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factors were calculated to be 1.27 and higher.
4.4	§257.73(e)(1)(iv)	Liquefaction safety factor must be at least 1.20	Yes	Safety factors were calculated to be 1.43 and higher.
Hydrologic and Hydraulic				
5.1	§257.82(a)(1), (2), (3)	Adequacy of inflow design flood control system	Yes	Flood control system adequately manages inflow and peak discharge during the 1,000 year Inflow Design Flood.

[1] Item cannot be certified at this time due to a lack of information.

1 Introduction

The purpose of the structural stability assessment, safety factor assessment, and hydrologic and hydraulic analysis presented in this report is to document that the requirements specified in 40 CFR §257.73(d), §257.73(e), and §257.82(a) have been met to support the certification required under each of those regulatory provisions for the Kincaid Power Station, Kincaid Ash Pond. For requirements that are not met, recommendations for addressing the requirements are included. The Kincaid Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the specified structural stability assessment, safety factor assessment, and hydrologic and hydraulic analysis for an existing CCR surface impoundment be completed by October 17, 2016.

The Kincaid Power Station has one existing CCR surface impoundment, Kincaid Ash Pond. Kincaid Ash Pond has been evaluated to determine whether structural stability, safety factor, and hydrologic and hydraulic requirements are met. The following sections summarize the evaluations performed and the results from the analyses.

Table 1 – CCR Rule Cross Reference Table

Report Section	Title	CCR Rule Reference
3.1	Foundations and Abutments	§257.73(d)(1)(i)
3.2	Slope Protection	§257.73(d)(1)(ii)
3.3	Dike Compaction	§257.73(d)(1)(iii)
3.4	Vegetated Slopes	§257.73(d)(1)(iv)
3.5	Spillways	§257.73(d)(1)(v)(A) and (B)
3.6	Stability and Structural Integrity of Hydraulic Structures	§257.73(d)(1)(vi)
3.7	Downstream Slope Inundation/Stability	§257.73(d)(1)(vii)
4.1	Factor of Safety: Maximum Storage Pool Loading	§257.73(e)(1)(i)
4.2	Factor of Safety: Maximum Surcharge Pool Loading	§257.73(e)(1)(ii)
4.3	Factor of Safety: Seismic	§257.73(e)(1)(iii)
4.4	Factor of Safety: Soils Susceptible to Liquefaction	§257.73(e)(1)(iv)
5.1	Inflow Design Flood Control Systems	§257.82(a)(1),(2),(3)

2 Facility Description and Location Map

2.1 Overview of Existing Surface Impoundments

The Kincaid Power Station is a coal-fired power plant located near Kincaid, Illinois in Christian County. The Station is located in a primarily rural area and is bordered to the north and west by the Sangchris Lake, to the south by Route 104, and to the east and northeast by agricultural land owned by others. A site location map showing the Kincaid Power Station is in Figure 1. Figure 2 presents the Kincaid Power Station site plan.

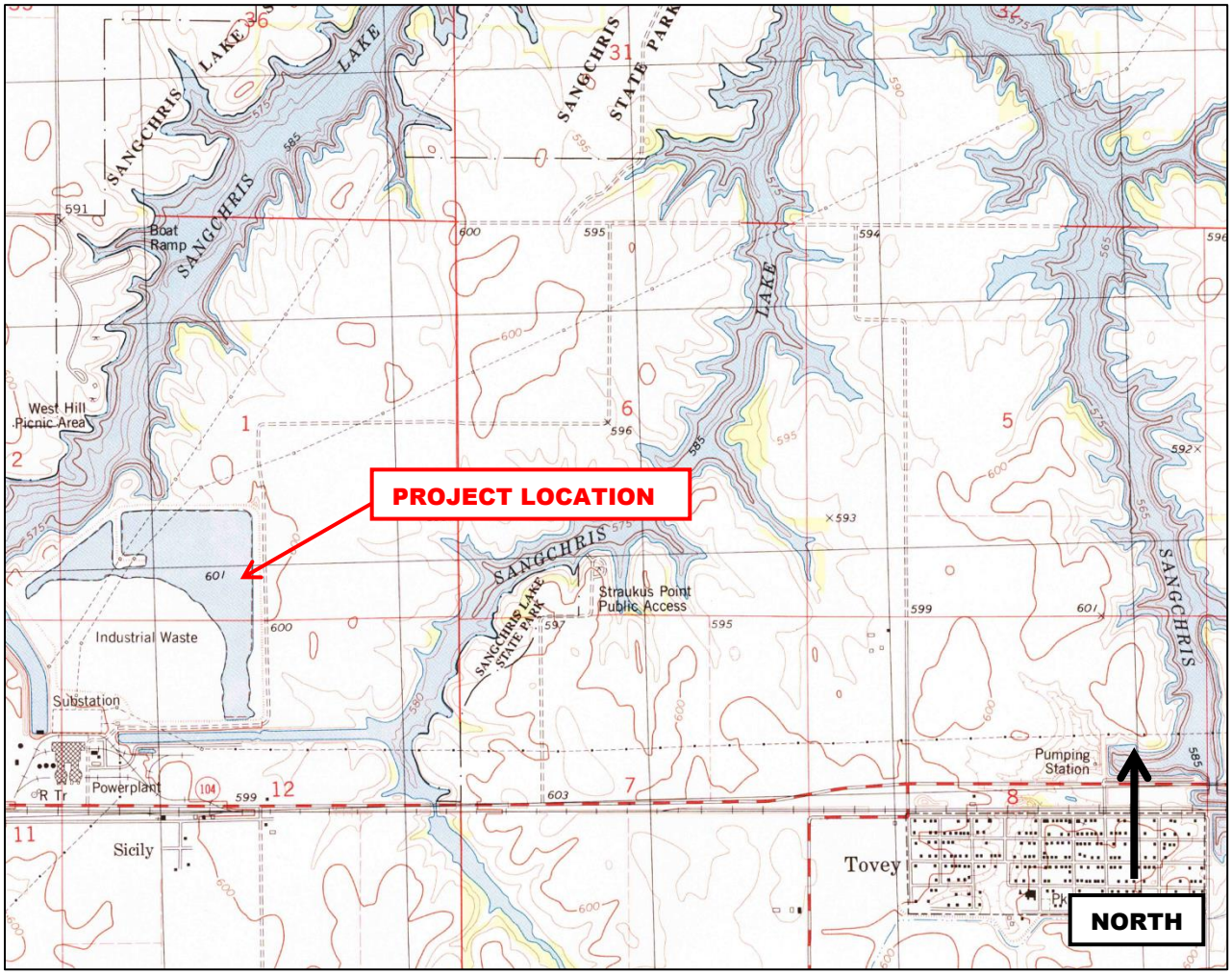

Figure 1 – Kincaid Power Station Location Map
(from United States Geological Survey Kincaid, Illinois 7.5' Topographic Map, 1988)

One CCR surface impoundment – the Kincaid Ash Pond – is utilized for managing CCR waste materials generated by the Kincaid Power Station. At this time, Kincaid Ash Pond is considered to have a significant hazard potential, based on a preliminary, qualitative hazard potential evaluation performed by AECOM.

The Kincaid Ash Pond serves as the primary wet ash impoundment basin and contains materials such as bottom ash, fly ash, boil slag, water and wastewater treatment solids, excavation spoils, and dredge spoils. The Kincaid Ash Pond receives sluiced bottom ash from the power station through eight sluice pipes, which discharge into the southwest side of the basin. A third-party recycling company recovers acceptable ash for beneficial reuse, and unacceptable materials are left in the Kincaid Ash Pond. Due to the volumes of ash removed for beneficial reuse, the quantity of ash within the Kincaid Ash Pond does not significantly change from year to year.

Normal outflow from the Kincaid Ash Pond is conveyed into the recycle intake structure (screen house) located at the southeast corner of the embankment. This structure is comprised of a concrete headwall, a fiberglass and steel grating system to control (screen) debris, and a 60-inch recycle pipe with a centerline elevation of 589.45 feet (all elevations in this report are in the NAVD88 datum unless stated otherwise), which is used to convey water approximately 2,000 feet westward to the recycle pump house, where it is recycled for use in plant processes. Outflow from the Kincaid Ash Pond into the recycle pipe is controlled by a steel gate valve installed on the pipe inlet, which can be operated from inside the screen house. A concrete weir is also present in front of the recycle pipe, but has a crest elevation of 595.21 feet, which is lower than the maximum normal operating pool of the Kincaid Ash Pond (El. 603.3 feet). Therefore, the weir is completely submerged during normal operations. The pipe material is reportedly reinforced concrete pipe (RCP), but has not been verified.

An emergency outlet (effluent) structure is also located at the southeast corner of the impoundment, and serves to discharge pond water into the adjacent discharge flume during emergency or upset conditions. The discharge flume feeds into Lake Sangchris. The emergency outlet structure consists of a square concrete riser structure with an exterior steel 3 foot circular gate valve (invert El. 597.21 feet) and opening discharging into the center of the structure, which leads into an ungated 48-inch corrugated metal pipe (CMP) emergency outlet (approximate centerline elevation of 529.5 feet, based on historic drawings). The gate valve can be operated from an access walkway leading to the emergency outlet structure. The top of the emergency outlet structure is open to the Kincaid Ash Pond on three sides, with open dimensions of 3 foot square. The opening effectively acts as a 9 foot wide overflow weir that is activated when the pool level in the Kincaid Ash Pond exceeds El. 604.3 feet. As the 48-inch CMP is ungated, flow is transmitted freely into the emergency outlet structure when the pond level exceeds El. 604.3 feet and outflows to the discharge flume via the 48-inch CMP, without needing to manually operate the exterior gate valve.

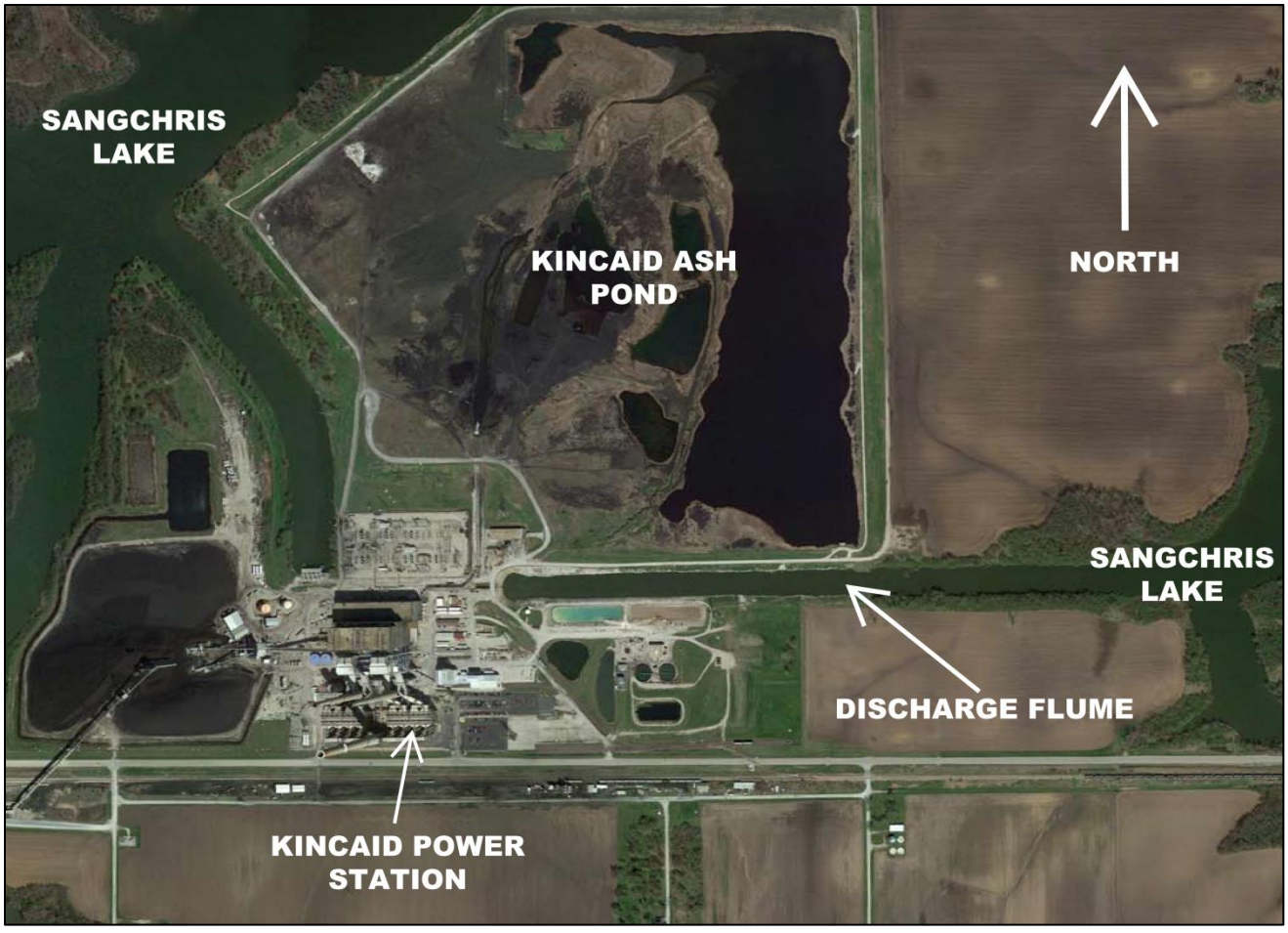

Figure 2 – Kincaid Power Station Site Plan
(Imagery from Google Earth Pro, 2016)

An approximately 1,100-foot long section of the south embankment, adjacent to the discharge flume, has a crest elevation around 6 to 17 feet lower than the rest of the embankment, and is intended to act as an secondary emergency spillway.

Outside of the gravel crest access road and riprap erosion protection at the embankment toe adjacent to the discharge channel, this area is not lined with erosion-resistant material.

An engineered liner system is not present beneath the Kincaid Ash Pond. The surface area of the impoundment is approximately 178 acres, and the embankment portion of the Kincaid Ash Pond has a total length of approximately 11,000 feet and a maximum height above the exterior grade of 30 feet. The embankment was constructed as a homogenous earthen structure with well-compacted clayey fill. Portions of the north embankment adjacent to Sangchris Lake include crushed stone near the waterline for erosion protection. The north, northwest, and south embankment sections exhibit approximately 1.4H:1V (horizontal: vertical) downstream slopes, and the south embankment sections near the southeast corner exhibit a 6H:1V slope. Upstream slopes are typically around 3H:1V. Embankment crest width ranges from approximately 10 to 25 feet, and the crest is covered with a gravel access road.

As currently operated, the normal pool elevation ranges from 601.8 to 602.5 feet during non-winter conditions. A maximum pool elevation of 603.3 feet may be used during winter conditions to alleviate problems with freezing. Crest elevations range from approximately 605.2 to 608 feet for the south embankment and 614 to 622 feet for all other embankments. Additional details about the geometry and configuration of the Kincaid Ash Pond are provided in the Geotechnical Report in **Appendix B** and the Hydrologic and Hydraulic Report in **Appendix C**.

3 Structural Stability Assessments

Regulatory Citation: 40 CFR §257.73(d)(1); Conduct initial and periodic structural stability assessments and document whether the design, construction, operation, and maintenance of the CCR unit is consistent with recognized and generally accepted good engineering practices for the maximum volume of CCR and CCR wastewater which can be impounded therein.

Analyses completed for the structural stability for the Kincaid Power Station's CCR Kincaid Ash Pond are described in this section. Data and analysis results in the following subsections were developed using recent and historical data provided by Dynegy, including impoundment design information, spillway design information, survey data, historical data, and analysis reports, and information about operational and maintenance procedures. This data was supplemented with subsurface investigation and laboratory data collected by AECOM in 2015.

Dynegy's operations of the surface impoundment are consistent with the design and construction of the CCR unit. Dynegy follows an established maintenance program that quickly identifies and resolves issues of concern.

3.1 Foundations and Abutments (§257.73(d)(1)(i))

CCR unit designed, constructed, operated and maintained with stable foundations and abutments.

Stability of the foundations of the Kincaid Ash Pond was evaluated by reviewing soil consistencies and phreatic data estimated from Standard Penetration Test (SPT) values, Cone Penetration Test (CPT) tip resistances, and collected soil laboratory test data from the 2015 AECOM field investigation, which is discussed in more detail in **Section 4**. Based on this data, foundation materials generally consist of 6 to 22 feet of soft to very stiff alluvium (lean clay) overlying hard glacial till (typically lean sandy clay with some sand zones). Explorations were terminated in the glacial till and were not extended to bedrock. The phreatic surface within the foundation is typically at or slightly above the embankment/foundation interface, and is likely controlled by the pool level in the Kincaid Ash Pond as well as Sangchris Lake. As the Kincaid Ash Pond is a ring-dike structure, abutments are not present.

This information was used to perform slope stability analyses as required by §257.73(e)(1), which is discussed in more detail in **Section 4**. Safety factors for slip surfaces passing through the dike and foundation were found to meet or exceed the minimum requirements required by §257.73(e)(1), which indicates that the foundation of Kincaid Ash Pond is stable.

Based on this evaluation, Kincaid Ash Pond meets the requirements presented in §257.73(d)(1)(i). A detailed presentation of the field and laboratory data collected for the foundations, and the completed slope stability analyses, can be found in **Appendix B**.

3.2 Slope Protection (§257.73(d)(1)(ii))

CCR unit designed, constructed, operated and maintained with adequate slope protection to protect against surface erosion, wave action and adverse effects of sudden drawdown.

The adequacy of slope protection present at Kincaid Ash Pond was evaluated by reviewing design drawings, operational and maintenance procedures, and conditions observed in the field during AECOM's June 9 and 10, 2015 site visit.

The exterior dike slopes have a 1.4H:1V to 6H:1V orientation and are generally covered with vegetation. Areas of the exterior dike adjacent to Sangchris Lake include crushed stone erosion protection near and above the waterline to protect against wave erosion and the adverse effects of sudden drawdown. Areas of the exterior dike not adjacent to Sangchris Lake are not susceptible to wave action or sudden drawdown as a downstream water body is not present.

The interior dike slopes have a 3H:1V orientation. Over most of the Kincaid Ash Pond, the interior dike slopes are not exposed and are covered with mechanically-stacked ash. The only areas where significant amounts of the interior slopes are exposed to the free water pool in the Kincaid Ash Pond are the entire eastern embankment and about 400 feet of the southern embankment, adjacent to the outflow structures. Effectively, the mechanically-stacked ash is acting as protection for the upstream slopes in these areas. The ash isolates the upstream slopes from wave action and sudden drawdown and causes the effective upstream slope to be relatively flat. This thereby reduces the potential for surface erosion. Where the upstream

slopes are adjacent to the free water pool, they are generally covered with dense non-woody vegetation with some limited areas of riprap. Dynegy regularly maintains the upstream slopes adjacent to the free water pool, including repairing observed surface erosion or wave action by backfilling the erosion with soil or riprap and addressing areas of poor vegetation growth.

The pool level in the Kincaid Ash Pond is controlled by the recycle intake structure, which includes a concrete spillway structure (screen house) and outlet pipe. The pond is operated to maintain a maximum normal operating pool of El. 603.3 feet, but fully opening the intake structure gate would allow for the pool level to be operated as low as El. 595.21 feet. Additionally, fully opening the gate valve for the emergency outlet structure would allow for the pool level to be operated as low as El. 597.5 feet; however, this structure is only intended for operation during emergency conditions. Although lowering the pool level below El. 603.3 ft is not anticipated, Dynegy has instituted operational controls to limit the rate of pool lowering to 1 foot per week under normal conditions. This rate is expected to allow phreatic water from the embankments to drain concurrently with the pool level in the Kincaid Ash Pond, and to reduce the potential for sudden drawdown conditions developing in the embankment. Therefore, sudden drawdown conditions are not expected to occur due to the operational controls, and slope protection to protect against the adverse effects of sudden drawdown is not required.

Based on this evaluation, Kincaid Ash Pond meets the requirements in §257.73(d)(1)(ii).

3.3 Dike Compaction (§257.73(d)(1)(iii))

CCR unit designed, constructed, operated and maintained with dikes mechanically compacted to a density sufficient to withstand the range of loading conditions in the CCR unit.

Compaction of the Kincaid Ash Pond dikes was evaluated using field data obtained from the 2015 AECOM geotechnical investigation, as historic records of compaction during construction of the dikes are not available. Based on the 2015 AECOM data, the dike materials consist of lean clay with some zones of fat clay. SPT values and CPT tip resistances indicate that the material is medium stiff to very stiff, with only occasionally soft zones. This is indicative of mechanically compacted dikes. Slope stability analyses found acceptable safety factors for each required loading condition, as presented in **Section 4**. Therefore the dike compaction and density is sufficient for withstanding required ranges in loading conditions.

Based on this evaluation, Kincaid Ash Pond meets the requirements in §257.73(d)(1)(iii). A detailed presentation of the field and laboratory data collected for the dikes, and the completed slope stability analyses, can be found in **Appendix B**.

3.4 Vegetated Slopes (§257.73(d)(1)(iv))

CCR unit designed, constructed, operated and maintained with vegetated slopes of dikes and surrounding areas not to exceed a height of 6 inches above the slope of the dike, except for slopes which have an alternate form or forms of slope protection.

The adequacy of slope protection at the Kincaid Ash Pond was evaluated by reviewing conditions observed in the field during AECOM's June 9 and 10, 2015 site visit. At the time of the site visit, the exterior slopes were vegetated, and the interior slopes were either vegetated or covered in ash, which is an alternate form of slope protection. Thus, the embankment slopes are effectively isolated from the pool in the Kincaid Ash Pond. The vegetation on the slopes is well-maintained, but doesoften exceed a height of 6 inches. It should be noted that the maximum height criteria of 6 inches will be removed from the §257.73(d)(1)(iv) regulation in the future. Regular maintenance maintains the vegetation as described in this section.

Based on this evaluation, the Kincaid Ash Pond will meet the requirements in §257.73(d)(1)(iv), after the 6 inch maximum height criteria is removed.

3.5 Spillways (§257.73(d)(1)(v)(A) and (B))

CCR unit designed, constructed, operated and maintained with a single spillway or a combination of spillways configured as specified in paragraph (A) and (B):

(A) all spillways must be either: (1) of non-erodible construction and designed to carry sustained flows; or (2) earth- or grass-lined and designed to carry short-term, infrequent flows at non-erosive velocities where sustained flows are not expected;

(B) the combined capacity of all spillways must adequately manage flow during and following the peak discharge from a:

(1) probable maximum flood (PMF) for a high hazard potential CCR surface impoundment
(2) 1000-year flood for a significant hazard potential CCR surface impoundment; or
(3) 100-year flood for a low hazard potential CCR surface impoundment

The spillways at Kincaid Ash Pond were evaluated using hydrologic and hydraulic analyses, conditions observed during AECOM's June 9 and 10, 2015 site visit, and well as historic design and construction information provided by Dynegy.

The primary spillway system for Kincaid Ash Pond is the recycle intake structure. This structure is located in the screen house and contains a concrete inlet structure and steel gate valve with a 60 inch diameter outlet conduit (the recycle pipe). The recycle pipe conveys flow back to the Kincaid Station for use as plant process water. The recycle intake structure is comprised of concrete, and the recycle pipe is either RCP or CMP, and the gate valve is comprised of steel, all of which are non-erodible materials that are designed to carry sustained flow. The emergency outlet pipe is also comprised of CMP with a concrete inlet structure and steel gate valve, all of which are non-erodible materials that are designed to carry sustained flows, as shown by the hydrologic and hydraulic analysis discussed in more detail in **Section 5**.

At this time, Kincaid Ash Pond is considered to have a significant hazard potential, based on a preliminary, qualitative hazard potential evaluation performed by AECOM. Based on hydrologic and hydraulic analyses described in **Section 5**, the spillway system adequately manages flow during the 1,000-year storm event, which is the design flood event for a significant hazard potential surface impoundment, per §257.73(d)(1)(v). It should be noted that the lowered section of crest on the south embankment, although originally intended to act as an emergency spillway, is not activated during the 1,000-year storm event. Therefore, flow over this spillway is not expected, and the requirements of §257.73(d)(v)(A) and (B) are not applicable to this spillway.

Based on these evaluations, Kincaid Ash Pond meets the requirements in §257.73(d)(1)(v). A detailed presentation of the hydraulic and hydrologic analyses can be found in **Appendix C**.

3.6 Stability and Structural Integrity of Hydraulic Structures (§257.73(d)(1)(vi))

CCR unit designed, constructed, operated and maintained with hydraulic structures underlying the base of the CCR unit or passing through the dike of the CCR unit that maintain structural integrity and are free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris which may negatively affect the operation of the hydraulic structure.

The structural stability and integrity of the Kincaid Ash Pond hydraulic structures were evaluated using inspection data and structural analyses collected and performed by AECOM. There are two active hydraulic structures at the Kincaid Ash Pond. The structures include the recycle intake structure and the emergency outlet structure. The recycle intake structure includes a concrete headwall and steel gate valve affixed directly to the inlet of a 60-inch recycle (outlet) pipe for controlling outflow The emergency outlet structure includes a square vertical concrete riser structure and an exterior steel gate valve and an ungated 48-inch CMP outflow pipe.

Video inspection of the 60-inch recycle pipe has not yet been performed due to high sustained flows within the pipe, which are critical to station operations and preclude camera inspection. However, the 48-inch CMP emergency outlet pipe has been inspected, as this pipe does not transmit flow during normal operations. Because a thorough visual inspection of the 60-inch recycle pipe has not yet been completed, AECOM will treat this information as a "deficiency" until the inspection can be performed and evaluated. As a corrective measure, AECOM recommends that the 60-inch recycle pipe be inspected using closed-circuit television (CCTV) equipment as soon as feasible. This assessment will be updated and documented at that time.

The 48-inch emergency outlet pipe was inspected on October 29, 2015, using CCTV inspection equipment. The inspection found that the outlet structure is free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris accumulation that may negatively affect the hydraulic operation of the structure. Some minor bulging and deterioration was noted. Per United States Army Corps of Engineers (USACE) Public Law 84-99 levee inspection guidance, such conditions are considered "minimally acceptable" for culverts and discharge pipes that penetrate a levee, which means that the intended function of the pipe will not be seriously impaired during the next flood event.

The structure stability of the square emergency outlet structure was evaluated for overturning, sliding, bearing capacity, and flotation using structural calculation, as applicable. Resulting factors of safety were compared to criteria presented in the USACE Engineer Manual (EM) 1110-2-2100, as factor of safety criteria for structural stability of outlet structures is not explicitly stated as a requirement in §257.73(d)(1)(vi). The emergency outlet structure was found to meet the minimum factors of safety listed in EM 1110-2-2100. Resulting factors of safety are presented in **Table 2**.

Table 2 – Summary of Stability and Structural Integrity Analysis of Emergency Outlet Structure

Analysis	Minimum Factor of Safety (per USACE EM 1110-2-2100)	Calculated Factor of Safety (Extreme Conditions)
Overturning (Seismic Conditions)[1]	-	1.6
Sliding (Seismic Conditions)	1.1	1.9
Bearing Capacity (Seismic Conditions)	1.0	2.9
Bearing Capacity (Usual Conditions)	3.0	6.3
Floatation (Usual Conditions)	1.3	1.8
Flotation (Extreme Conditions)	1.1	1.6

[1]Location of resultant was checked and found to be within the base of the structure, which is the EM 1110-2-2100 acceptance criteria.

Structural calculations were not performed for the recycle intake structure, as this structure only consists of a concrete headwall with the outflow control gate valve directly affixed to the end of the recycle pipe. The surrounding concrete structure is not critical for managing inflow quantity into the recycle pipe and only serves to screen debris from the inflow water; therefore, structural analyses were not performed for the concrete portions of the recycle intake structure. Conversely, the emergency outflow structure includes a gate valve on the outside of the square concrete structure, which discharges into the center of the riser structure and the ungated inlet of the emergency outflow pipe, which is located several feet below the invert of the gate valve. Therefore, the stability of the emergency outlet concrete structure is critical for managing inflow into the emergency outflow pipe, and structural calculations were performed.

Based on the lack of information regarding the integrity of the 60-inch recycle pipe, AECOM cannot provide certification of §257.73(d)(1)(vi) at this time. A detailed presentation of the CCTV inspection of the 48-inch emergency outlet pipe and the structural stability calculations for the emergency outflow structure can be found in **Appendix A**.

3.7 Downstream Slope Inundation/Stability (§257.73(d)(1)(vii))

CCR unit designed, constructed, operated and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.

The structural stability of the downstream slope of the Kincaid Ash Pond was evaluated by comparing the location of the Ash Pond relative to published flood maps for the area and by performing sudden drawdown slope stability analyses. Most of the Kincaid Ash Pond is outside the flood zone shown on the FEMA Federal Insurance Rate Map (FIRM) for Christian County, Illinois. Portions of the Kincaid Ash Pond embankments are adjacent to Sangchris Lake on the northwest side and may be subjected to pool fluctuations in Sangchris Lake. **Figure 3** shows the area of the Kincaid Ash Pond within the FIRM map (FEMA, 2011). It should be noted that the flood zone indicated on the south side of the Kincaid Ash Pond includes the plant access road beyond the embankment toe, but not the embankment itself.

A sudden drawdown slope stability analysis was performed for a cross-section at Station 63+00. This cross-section is located along the northwest embankment of the Kincaid Ash Pond, where the embankment is adjacent to Sangchris Lake. Although Sangchris Lake is also adjacent to the Kincaid Ash Pond along the north embankment, the north embankment includes a crushed stone toe buttress and a gentler slope into Sangchris Lake, along with a higher toe elevation than the northwest embankment. Therefore, the cross-section at Station 63+00 is the critical cross-section for sudden drawdown slope stability analysis.

The sudden drawdown slope stability analysis considered complete drawdown in Sangchris Lake from normal pool to empty pool, thereby also evaluating the effects of a low pool. The analysis was performed as a staged analysis using drained and undrained soil strengths, but otherwise used the same methodology as the other slope stability analyses discussed in **Section 4**. The resulting factor of safety was compared to criteria presented in the USACE EM 1110-2-1902, as factor of safety criteria for sudden drawdown slope stability is not expressly stated as a requirement in §257.73(d)(1)(vii). The embankment was found to meet the minimum factors of safety listed in EM 1110-2-1902. The resulting factor of safety is presented in **Table 3**.

Table 3 – Summary of Sudden Drawdown Slope Stability Analysis

Analysis	Minimum Factor of Safety (per USACE EM 1110-2-2100)	Calculated Factor of Safety
Sudden Drawdown Sangchris Lake Normal to Empty Pool	1.3	1.41

Based on this evaluation, the Kincaid Ash Pond meets the requirements in §257.73(d)(1)(vii).

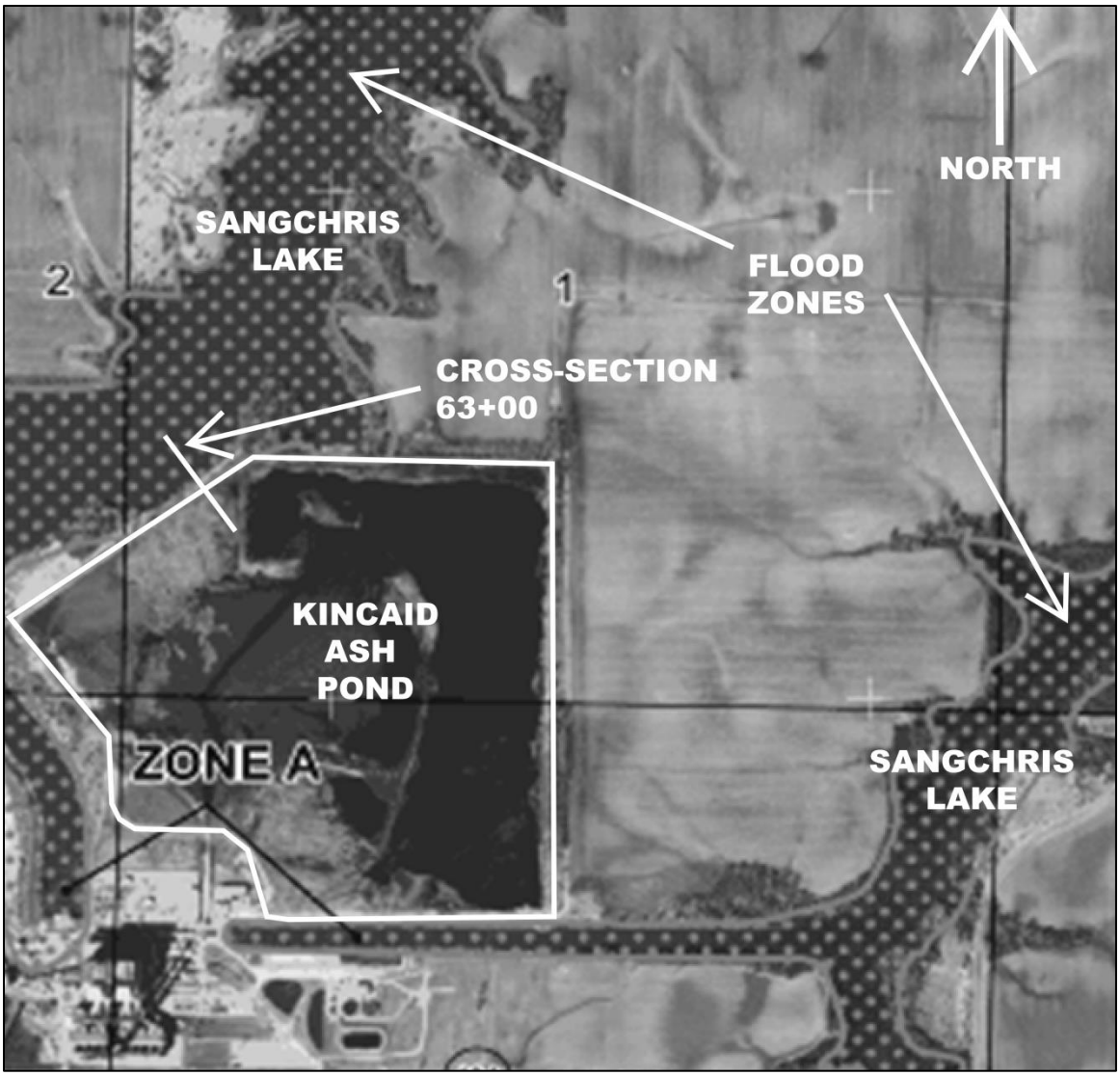

Figure 3. Kincaid Ash Pond Flood Zone Map
(from FEMA Flood Hazard Boundary Map, Christian County, Illinois, 2011)

4 Safety Factor Assessments

Regulatory Citation: 40 CFR §257.73(e)(1); Conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

A geotechnical investigation program and stability analyses were performed by AECOM in 2015 to evaluate the design, performance, and condition of the earthen dikes of the Kincaid Ash Pond. The exploration consisted 12 soil borings, installation of 12 piezometers (9 open standpipe and 3 vibrating wire) to monitor groundwater, a program of 39 cone penetration test (CPT) soundings, with seismic wave velocity measurements and pore pressure dissipation testing. The laboratory program included strength, hydraulic conductivity, consolidation, and index testing. Data collected from the 2015 AECOM investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

In general, the subsurface conditions at the Kincaid Ash Pond consist of an embankment comprised of compacted lean clay with some zones of fat clay. The embankment is generally medium stiff to very stiff, with only occasional soft zones, and overlies alluvial foundation materials. The alluvial foundation materials consists of 6 to 22 feet of soft to very stiff lean clay overlying hard glacial till (typically lean sandy clay with some sand zones). Explorations were terminated in the glacial till and were not extended to bedrock. The phreatic surface is typically at or slightly above the embankment/foundation interface, and is likely controlled by the pool level in the Kincaid Ash Pond as well as Sangchris Lake.

Five (5) representative cross-sections (18+50, 48+50, 63+00, 71+00, and 94+50) were analyzed using GeoStudio SLOPE/W limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. Slip surface search routines in SLOPE/W relied on circular slip surfaces using entry and exit point-based methods to define the initial critical slip surface. The slip surface was then optimized to find a critical, non-circular slip surface, and factors of safety were calculated using the Spencer method. The sections were located to represent critical surface geometry, subsurface stratigraphy, and phreatic conditions across the site. Sections were generally selected to include the most critical configurations of the dike system along each side of the dike system, in terms of embankment height and slope and subsurface conditions. Each cross-section was evaluated for each of the loading conditions stipulated in §257.73(e)(1).

The results of the stability analysis are summarized in the following sub-sections. A detailed presentation of the analyses performed, including development of site stratigraphy, strength parameters, and stability analysis methodology can be found in **Appendix B**.

4.1 Factor of Safety: Maximum Storage Pool Loading (§257.73(e)(1)(i))

Calculated static factor of safety under long-term, maximum storage pool loading condition must equal or exceed 1.50.

This calculation models the dike stability under static, long-term conditions. A water level of El. 603.5 feet, which corresponds to a water level 0.2 feet above the maximum operating pool level of 603.3 feet, was used in this analysis to be conservative. It was assumed that the pool level in Kincaid Ash Pond will not be permanently increased above El. 603.5 feet during future operations. Drained (effective stress) shear strength parameters were used for all materials, and phreatic conditions were estimated based on available piezometer, boring, and CPT test data. The calculated minimum factors of safety are identified in **Table 4.**

Table 4 – Summary of Factors of Safety – Maximum Storage Pool Loading Condition

Cross-Section	Calculated Factor of Safety (§257.73 Minimum = 1.50)
18+50	2.50
48+50	1.57*
63+00	1.63
71+00	1.78
94+50	2.06

*Indicates critical (e.g. lowest calculated factor of safety) cross-section

The calculated factors of safety exceed 1.50 for all cross-sections analyzed, which meets the requirements in §257.73(e)(1)(i).

4.2 Factor of Safety: Maximum Surcharge Pool Loading (§257.73(e)(1)(ii))

Calculated static factor of safety under maximum surcharge pool loading condition must equal or exceed 1.40.

This calculation models the dike stability under short-term surcharge pool conditions. The pool level for analysis (El. 609.9 feet) represents a conservative 6.6 ft rise from the normal pool level, which is higher than the 1,000-yr IDF pool elevation of 605.1 ft (See **Section 5**). Due to the low permeability of the clayey embankment and foundation soils, undrained soil strengths were used for analysis. Pore pressures in the embankment were assumed to be similar to the static drained conditions; however, the pool level in the Ash Pond was increased to model additional loadings from the surcharge pool. The calculated factors of safety are identified in **Table 5**.

Table 5 – Summary of Factors of Safety – Maximum Surcharge Pool Loading Condition

Cross-Section	Calculated Factor of Safety (§257.73 Minimum = 1.40)
18+50	2.15
48+50	1.46*
63+00	1.63
71+00	1.85
94+50	1.91

*Indicates critical (e.g. lowest factor of safety) cross-section

The calculated factors of safety exceed 1.40 for all cross-sections analyzed, which meets the requirements in §257.73(e)(1)(ii).

4.3 Factor of Safety: Seismic (§257.73(e)(1)(iii))

Calculated seismic factor of safety must equal or exceed 1.00.

This calculation models the dike stability under short-term seismic loading conditions during the design 2,500-year return period seismic event. Seismic loading is modeled as a horizontal force acting outward on the dike and foundation. Peak undrained (total stress) shear strength parameters were used for clayey soils and peak drained (effective stress) shear strength parameters were used for free-draining materials, as this analysis is intended to model conditions during earthquake shaking, when seismically-induced material strength losses have not yet occurred. The pool elevation and phreatic conditions were assumed to be the same as the Maximum Storage Pool case (**Section 4.1**), and correspond to normal operating conditions at Kincaid Ash Pond. The calculated factors of safety are identified in **Table 6**.

Table 6 – Summary of Factors of Safety – Seismic Loading Condition

Cross-Section	Calculated Factor of Safety (§257.73 Minimum = 1.00)
18+50	1.69
48+50	1.27*
63+00	1.46
71+00	1.65
94+50	1.54

*Indicates critical (e.g. lowest factor of safety) cross-section

The calculated factors of safety exceed 1.00 for all cross-sections analyzed, which meets the requirements in §257.73(e)(1)(iii).

4.4 Factor of Safety: Soils Susceptible to Liquefaction (§257.73(e)(1)(iv))

For dikes constructed of soils that have susceptibility to liquefaction, calculated liquefaction factor of safety must equal or exceed 1.20.

Two separate analyses were performed to evaluate the requirements of §257.73(e)(1)(iv): a liquefaction and cyclic softening triggering analysis and a post-liquefaction slope stability analysis.

Liquefaction and cyclic softening triggering analyses were performed for the 2,500-year return period design seismic event in order to delineate soils susceptible to liquefaction within the dike and foundation. The analyses were performed using borings and CPTs advanced through the dike and foundations of Kincaid Ash Pond, the methodology presented by Idriss and Boulanger (2008), and laboratory index test data. The analyses found the alluvial foundation may be susceptible to cyclic softening in areas where the seismically-induced cyclic stress ratio is above 0.14. Sluiced CCR materials retained within the Kincaid Ash pond were assumed to be susceptible to liquefaction during the design seismic event, due to the wet-sluiced method of placement. All other soils evaluated at the site were not found to be susceptible to liquefaction during the design seismic event.

Post-liquefaction slope stability analyses were performed assuming residual cyclically-softened strengths in the portions of the alluvial clay susceptible to cyclic softening and post-liquefaction strengths in the sluiced fly ash retained by the dike. Horizontal seismic loads are not included in this analysis, as it is intended to model the conditions immediately after earthquake shaking stops. The pool elevation and phreatic conditions were assumed to be the same as the Maximum Storage Pool case (**Section 4.1**), and correspond to normal operating conditions at Kincaid Ash Pond. The calculated factors of safety are identified in **Table 7.**

Table 7 – Summary of Factors of Safety – Soils Susceptible to Liquefaction

Cross-Section	Calculated Factor of Safety (§257.73 Minimum = 1.20)
18+50	1.76
48+50	1.50
63+00	1.43*
71+00	1.52
94+50	1.54

*Indicates critical (e.g. lowest factor of safety) cross-section

The calculated factors of safety exceed 1.20 for all cross-sections analyzed, which meets the requirements in §257.73(e)(1)(iv).

5 Hydrologic and Hydraulic Analyses

Regulatory Citation: 40 CFR §257.82(a); Design, construct, operate, and maintain an inflow design flood control system as specified:

(1) Inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflows design flood specified in paragraph (3);

(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (3);

(3) The inflow design flood is: (i) For a high hazard potential CCR surface impoundment, the probable maximum flood; (ii) For a significant hazard potential CCR surface impoundment, the 1,000-year flood; (iii) For a low hazard potential CCR surface impoundment, the 100-year flood; or (iv) For an incised CCR surface impoundment, the 25-year flood.

Analyses completed for the hydrologic and hydraulic assessments of Kincaid Ash Pond are described in this section. Data and analysis results in the following subsection are based on spillway design information shown on design drawings, topographic surveys, information about operational and maintenance procedures provided by Dynegy, and limited field measurements collected by AECOM. The analysis approach and results of the hydrologic and hydraulic analyses are presented in the following subsection. A detailed presentation of the analyses performed can be found in **Appendix C**.

At this time, Kincaid Ash Pond is considered to have a significant hazard potential, based on a preliminary, qualitative hazard potential evaluation performed by AECOM.

5.1 Inflow Design Flood Control Systems (§257.82(a)(1), (2), (3))

In accordance with the requirements of 40 CFR §257.82(a)(3), an Inflow Design Flood Control System Plan was developed for Kincaid Ash Pond. This was accomplished by evaluating the effects of a 24-hour duration design storm for the 1,000-year Inflow Design Flood (IDF) using a HydroCad (Version 10) computer model. The computer model evaluated the Kincaid Ash Pond's ability to collect and control the 1,000-yr IDF under existing operational and maintenance procedures. Rainfall data for the 1,000-yr IDF was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 Volume 2, Version 3. The NOAA Atlas 14 rainfall depth is 8.88 inches.

The HydroCad model results for Kincaid Ash Pond indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage inflows and collect and control outflows during peak discharge conditions created by the 1,000-yr IDF. The peak water surcharge elevation is 605.1 feet during the IDF, and the minimum crest elevation of Kincaid Ash Pond dike is approximately El. 605.2 feet. Therefore, overflow is not expected.

Based on this evaluation, Kincaid Ash Pond meets the requirements in §257.82(a)(1), (2), and (3), and the hydrologic and hydraulic analysis (**Appendix C**) is the Inflow Design Control System Plan for the surface impoundment.

6 Conclusions

The Kincaid Ash Pond at the Kincaid Power Station was evaluated relative to the USEPA CCR Rule requirements for structural stability assessments (§257.73(d)), safety factor assessments (§257.73(e)(1)), and hydrologic and hydraulic analyses (§257.82(a)). Based on the evaluations presented herein, the referenced requirements are satisfied for safety factor assessments and hydrologic and hydraulic analyses, but are not satisfied for structural stability (§257.73(d)).

At this time, the structural integrity of the hydraulic structures (§257.73(d)(1)(vi)) cannot be certified as the recycle pipe has not been inspected due to high plant flows precluding inspection, and its structural integrity has therefore not been evaluated. Accordingly, AECOM will treat this issue as a “deficiency” that needs to be addressed as soon as feasible, pursuant to §257.73(d)(2). To address this issue, AECOM recommends performing a CCTV inspection of the recycle pipe as soon as feasible, and updating this assessment once the inspection has been performed.

7 References

AECOM (2016). Geotechnical Report for Dynegy Kincaid Power Station, Kincaid Ash Pond Kincaid, Illinois.

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8 Appendices

A. Structural Analyses

B. Geotechnical Report

C. Hydrologic and Hydraulic Report

Appendix A. Structural Analyses

AECOM

QMS Form 3-3 (MM)

Date: February 19, 2016

Dynegy CCR Program Quality Management — Calculation Check and Review Record

Project Name	Kincaid Power Station	**Client Name**	Dynegy
Project Location	Central Illinois	**PM Name**	Eric Glazier
Project Number / Office Code	60480698 01 – Eng.& Design	**PIC Name**	

This form may be used instead of Form 3-4 – Check and Review Record for Detail Checks of calculations. If the calculation is a standalone deliverable, an Independent Technical Review (ITR) may be required, and this form can be used for that purpose as well.

Type	☒ Calculation Detail Check	☐ Calculation ITR

IDENTIFYING INFORMATION

(This section is to be completed by the PM, PM's Designee, or Originator.)

Calculation Medium: *(Select as appropriate)*	☒ Electronic	File Name: 3-14-15 Kincaid Emerg Effluent Stability Checks.pdf
	☐ Hard-copy	Unique Identification:
		Number of pages *(including cover sheet)*: 24

Discipline:	Structural Evaluation
Title of Calculation:	Structural Evaluation for Kincaid Power Station
Calculation Originator Name:	Rick J. Cox
Calculation Contributor Names:	Elizabeth Fuerschbach
Calculation Checker Names:	Andy Clemens
Calculation Reviewer Names:	NA

DESCRIPTION & PURPOSE

The objective of this calculation is to structurally qualify the active riser Emergency Outlet Structure. The Riser will be structurally reviewed for postulated loadings per the Programmatic Document dated 8.12.2015 Rev. 0.0 including Gravity, Hydrostatic, Hydrodynamic, Uplift loads, and Seismic loads.

BASIS / REFERENCE / ASSUMPTIONS

Emergency Outlet Structure analysis was based on structural drawing C37 and supplemented by drawing C36 and field measurements. The drawings do not show reinforcement of the concrete. Assumed #5 at 12-inch both directions, both faces. Further field testing and/or retrofit are required to certify outlet riser. The physical condition of the outlets under the water surface was not observed. The assumption is made that the physical condition of the existing construction is good. Normal and Extreme water elevations at Kincaid Ash Pond are NOT based on a hydrology study. It was conservatively assumed that water depth over the weir of the Emergency Outlet would be no more than ½ foot. The Emergency Outlet Structure was analyzed using STAAD by Bentley and hand calculations methods. The Emergency Outlet Structure analysis considered static and dynamic loads under extreme conditions. The factor of safety is calculated and compared to allowable.
References : ASCE 7, IBC, ACI,
Inputs : EM 1110-2-2502, EM 1110-2-2100, & EM 1110-2-2400, Drawings C36, C37.

ISSUE / REVISION RECORD

For comments, select N (None), HC (Hard Copy), EF (Electronic File), or Form 3-5 from drop-down. For a given Revision, indicate P (Preliminary), S (Superseded) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

Rev. No.	Description	Comments	P	S	F	Originator Initials	Date	Checker Initials	Date	Reviewer Initials	Date
0	Initial Issue	N	☒	☐	☐	RC	3/14/16	AC	3/14/16		
3		N	☐	☐	☐						

APPROVAL and DISTRIBUTION

☒ The below individuals confirm that the Calculation Check and Review process has been followed.

AECOM	QMS Form 3-3 (MM) Date: February 19, 2016
Dynegy CCR Program Quality Management	Calculation Check and Review Record

	15-Mar-16
Originator Signature	**Date**
	15-Mar-16
Checker Signature	**Date**
	8-Feb-16
Reviewer Signature	**Date**
	8-Mar-16
Project Manager (or Designee) Signature	**Date**

DISTRIBUTION	Project Central File – Quality File Folder Other – Specify:

AECOM **CALCULATION SHEET**

Calc. by: R.Cox Date: 3/14/16
Checked by: A. Clemens Date: 3/15/16

Project Title: Dynegy Kincaid Ash Pond Emergency Outlets Structure Evaluation

Subject Feature: Emergency Outlet Structure (aka Emergency Effluent Sump), Ash Pond, Kincaid Power Station

Objective: The objective of this calculation is to structurally qualify the existing outlet at Kincaid that falls under the programmatic criteria of being sensitive to creating a direct release of CCR to the outside surroundings should they fail. The active outlets are 1) the Recycle Water Intake Structure that does not penetrate the embankment and 2) the Emergency Outlet Structure which does penetrate the embankment. Only the Emergency Outlet Structure was reviewed for postulated loadings per the Programmatic Document dated 8.12.2015 Rev.0.0 including gravity, hydrostatic, hydrodynamic, uplift, and seismic loads. Factors of safety were calculated for overturning, sliding, bearing capacity and floatation.

References: ASCE 7-10, EM 1110-2-2400, IBC, ACI and EM 1110-2-2100

Inputs: -Drawing 869D4-C37 (referred to as C37 in this report), Drawing 869D4-C36 (referred to as C36 in this report), Ash Sluice Water Stilling Well and Emergency Effluent Sump Structures.

Assumptions:

1. Drawing C37 is the only available drawing. It does not include information on the reinforcement in the "existing structure" as shown in Section EE. For this analysis, it is assumed that the wall vertical reinforcement is #5 bar at 12-inch centers with mats in both faces of the 1-ft walls.
2. The drawings show a 48-inch penetration of an interior wall with a dimension of only 37 inches (as measured by AECOM, 5'1" minus two 1-ft walls). For this analysis, the weight of the structure is reduced by a 48-inch opening, even though this is not possible, given the dimensions measured and shown on Drawing C37.
3. The dimension of the base of the structure is assumed to be 18 inches. It is reasonable to assume that it would not be less than this dimension based on the wall thicknesses and if the details on the drawing are to scale.
4. The physical condition of the outlet under the water surface, e.g. pipes or foundations is unknown. The assumption is made that the physical condition of the existing construction is good, without a subsurface exploration or draining the pond. At this time, the condition is assumed to be good due to lack of any other information or inspection data.
5. Considered riser structure free standing in basin. Analysis of the bridge structure is outside the scope of the programmatic criteria, as its failure would not constitute an immediate release to the outside environment.
6. Kincaid Emergency Outlet Structure is analyzed using the Army Corps reference for water and liquefied ash. The riser structure is analyzed with liquefiable ash up to the overflow weir of the

Ash Sluice Water Stilling Well or elevation 595.5 shown in Foundation Plan on Drawing C36.

7. It is also assumed that the concrete has a compressive strength of 3000 psi. There is no information on the drawings to confirm this but it is a conservative assumption.

Acceptance Criteria is per Part 1 of Dynegy Programmatic Document dated August 12, 2015 and EM 1100-2-2100 and EM 1100-2-2502

Results:

Kincaid Ash Pond – Emergency Outfall Structures

		Criteria
FS Seismic Overturning 137/88 = 1.56	OK	Resultant must be within base.
FS Seismic Sliding: 15.4/8=1.93	OK	FS>1.5 (normal condition, normal structure)
FS Seismic Bearing Capacity: 2.85< 6.4 kips ultimate		Extreme bearing < ultimate
FS Gravity Bearing Capacity: 6400/1008 psf = 6.3	OK	FS >3 Usual Load Combination
FS Floatation: 50.8/29 = 1.75 usual water condition	OK	FS>1.3 Usual Load Combination
FS Floatation for Extreme Condition 50.8/31.4=1.62	OK	FS>1.1 Extreme water condition

Conclusion:

The Kincaid Emergency Outlet Structure meets all programmatic criteria for stability. The assumed riser wall vertical reinforcement is acceptable. Field verify size and spacing of riser wall reinforcement on each face.

Dynegy Energy - Kindaid Emergency Effluent Structure Check

Plant: **Kincaid**
Riser: **Emergency Effluent Structure**
Location: **Ash Pond**

Hazard?	high	moderate	low
Code:			
latitude:	39°35'36" N		
long.:	89°29'16"W	2% in 50 yrs.	
wind:	120 mph	period	g
wind:	ASCE 7-10	0	
exposure:	B	0.01	0.11
		0.02	0.15
		0.03	0.17
seismic		0.04	0.18
site:	B/C (firm rock)	0.1	0.25
	Vs30 760 m/sec	0.2	0.21
		0.4	0.13
		1	0.1
		2	0.06
		3	0.04
		4.0	0.03
		5.0	0.03
Note:	All elevations used	(2,475 yr. event)	

Drawing 869D4-C37. Survey datum not provided

g provided by:
Site-Specific Probabilistic Seismic Hazard Analysis
Site Response Analysis and Development of
Time Histories for the Kincaid Power Station
in Central Illinois, dated Jan. 6, 2016

Table on page ES-2, 2,500 yr Return
Period Mean SEE UHS for the Ground Surface

Reinforcing Check in Emerg. Outlet Structure

The Kincaid Ash Pond Emergency Effluent structure details are shown on Drawing 869D4-C37. The discharge structure consists of reinforced concrete. The structure base thickness is unknown. Based on the 12-inch walls, an 18-inch thick base is assumed.
The structure is 5-1" x 5'-1" in plan. It is assumed for this analysis that the base extends 12-inches beyond the walls.
The reinforcement is not shown on the drawings. For this analysis, vertical bar is assumed to be #5s at 12.
The 12" thick walls have 36" and 48" pipe penetrations.
Riser is constructred with 3,000 psi concrete at 28 days (assumed).
The structure is 16 feet from top of base to overflow.

Ix of sump structure (12" walls portion)	Ix	1,009,442 in^4
Iy of sump structure (12" walls portion)	Iy	1,009,442 in^4

Calculate weight of riser: = weight of concrete foundation and walls of discharge structure:

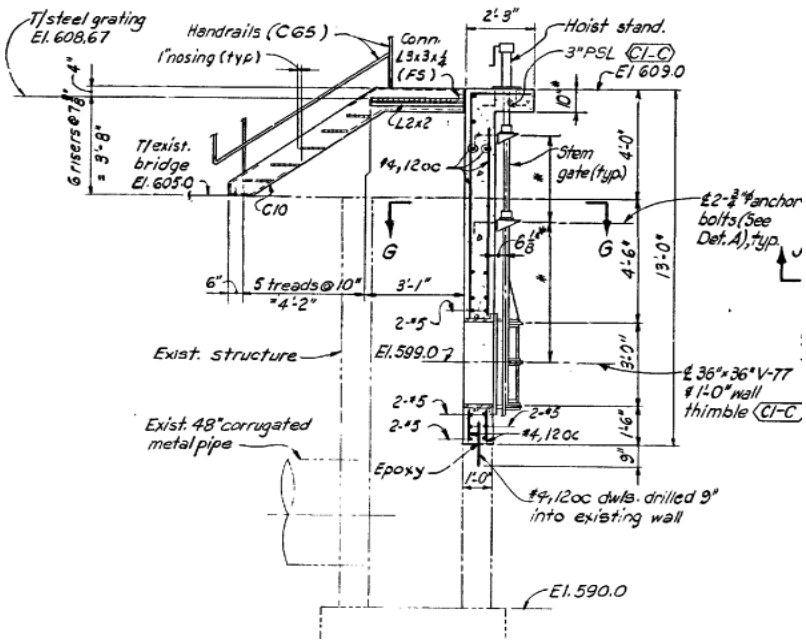
Opening in walls area = area of one 36" pipe pen. And one 48" pen. =			19.63	sf See Note1.
Area of walls = (16* (5.1*2)+(16'x(3.1*2)) - I53) =	242.78	sf	(4 full walls,minus pipe penetrations)	
Weight of riser = 0.15 ksf * 1.5 thick*base + 0.15ksf * wall area*1.0 =	50.82	kips		
Includes wt of 4' gate wall but NOT ash over footing				

Gate wall	
kips	3.06

At base of the weir box outlet structure:
Moment from Seismic and Hydrodynamic forces = 76.3 kft from Staad (already factored load)

Note 1: A 48 inch pentration is not possible. Interior wall surface is only 37 inches.
Either the wall is wider than drawings show or pipe is smaller.
Reducing the weight by 48-inch penetration is conservative.

Soil	
lb/cf	110
boyant Density	47.6
area (SF)	24.4
depth (ft)	6
Kips	6.96864



Both axis are the same. Structure is square.

Conservatively check sump structure using the maximum moment.
The moment at the base may utilize the
full section modulus of 1,009,442 in ^4 since wall pentrations are above the base and
openings are additionally reinforced.

Check As required based on full moment using the weak axis divided by 5.1'' wall width for moment per unit width.

Use d =5.1' - 1.' =	4.10	49.2 inches		
Design moment =	76.3		915600	in lbs
design moment not divided by 2, full moment =			915600	
Mn = Mu/ϕ	(ϕ = 0.9 per ACI350-06; C.9.3.2.1)		1017333.3	
		49.2 d, inches		
Mu/phi*b*d^2 =			35.02	"= R"
	kip ft	which equals		
rho required =				
rho required =			0.0005878	=ρ'
As required = 1.33* rho*12*rho =		0.46		
As actual =	**#5 at 12**	0.62 is > than	0.46	OK
(assumed)	Two number 5's in each ft of wall.			
	ρ required=	.85f'c/fy(1-sqrt(1-2R/0.85f'c))		

Therefore reinforced concrete Kincaid Emergency Outlet structure is flexurally **capable** of handling seismic and hydrodynamic load, provided #5 at 12 inches or at least 0.46 in^2 per ft is provided in walls. For example #4's at 10 or #5's at 12.

Conclusions: The Kincaid Emergency Outlet is structurally adequate to withstand seismic and hydrodynamic loading imparted during a seismic event.

Riser details:

Geotech Properties:

Original soil (mat bearing)		
ultimate bearing:	6,400	
coefficient of friction:	0.3	
	between concrete and soil	
	site class: B	
Ash:		
Ka:	0.4	(prelim.)
Kp:	2.3	(prelim.)
friction angle:	25 deg.	(prelim.)
coeficient of friction	0.3	
density:	90	pcf
buoyant density:	27.5	pcf

Water & sat. buoyant ash pressures

	depth (ft.)	elev. (ft.)	pressure (psf)
t/water	0	604.50	0
intermed.	4.50	600.00	280
ash el.	9.00	595.50	561
intermed.	10.75	593.75	689
intermed.	12.50	592.00	818
intermed.	14.25	590.25	946
b/riser foun	16.00	588.50	1,074

Floatation

Factor of safety (per EM-1110-2-2100): 1.3 for Usual conditions (10 year return period)
1.2 for Unusual conditions (10-300 year return period)
1.1 for Extreme conditions (>300 year return period)

Usual water level = * (NAVD 88; "Usual" condition)
Max. water level = 606.50 (NAVD 88; "Extreme" condition) An assumed elevation No study supporting elev.
Bottom fdn. mat = 588.50 (from drawing C37)

	water el. (ft)	b/fdn el. (ft)	base mat depth(ft)	base foot print (sf)	submerg'd shaft depth (ft)	shaft foot print (sf)	submerged volume (cu. ft.)	displaced water wt. (kips)	riser DL (kips)
Usual water	604.50	588.50	1.50	50.4	15.00	26.01	466	29.0	50.8
Extreme water	606.50	588.50	1.50	50.4	16.50	26.01	505	31.4	50.8

(Page2)

condition	uplift (kips)	resistance (kips)	FOS	min. FOS	o.k.?
Usual water	29.0	50.8	1.75	1.3	OK
Extreme water	31.4	50.8	1.62	1.1	OK

conclusion: riser is o.k for floatation without adding the additional buoyant weight of ash

Wind overturning: consider wind pressure = 31.50 psf, avg., on exposed portions of risers
20 psf, avg., on gross area of rail & bridge
30 lb/linear ft for bridge load for W18)
20 lb/linear ft for bridge load for railing)
Lowest expected water level under current conditions: at current ash level. 0.75 kips for bridge load
Existing ash level at riser = 595.5 15 Bridge Length
(estimated from photo)

t/slab	605.00
low water	595.50
b/base mat	588.50

max. exposed ht.:	9.50
ht. base to water:	7.00

Buoyant DL of riser =
Riser DL 50.8 kips (page 2)
displaced water at low water = liner height. -15.42 At elevation 595.5
35.40 Kip Buoyant Riser DL @ low water el.

Consider Wind Overturning on Riser. Check Riser in Weak Axis Direction

Reference Table 29.1-1 of ASCE 7-10

Risk Category IV
Basic Wind Speed 120 mph
Kd = 0.95 Table 26.6-1 As Max exposed surface
Exposure C Section 26.7 As= 48.45
Kzt = 1 Section 26.8
Kz= Kh = 0.9 Table 29.3-1 for Exposure C with 20' height
G = 0.85 Section 26.9
qz= 0.00256Kz*kzt*Kd*v^2 31.52 PSF
Wind Pressure on flat wall shaped riser has shape coefficent of Cf =1.5 Figure 29.5-1 conservative

Wind pressure = F = qzGCfAs = 31.52psf*0.85*1.5*As +(w/o bridge 2.70 kip
Equiv. ht. of wind pressure is halfway between ash level and top of riser= 600.25 elevation

Overturning Moment = wind pressure in kip
* moment arm from base = 31.68 kip - ft (Factored)
Resisting Moment = bouyant riser weight times
footing 'x' width/2 = 125.67 ft/kips

FS Overturning due to wind = 125.67/31.68 3.97 **0.00 OK**

Check Sliding:
Sliding Resistance = 0.4*34.5 = 14.16 kip

Sliding Force due to wind = Wind = 2.70 kip

FS Sliding due to Wind = 14.16/2.7 = **5.25 OK**

Soil Bearing Capacity (psf)	6,400
Weight of Structure (psf)	50,819
Area of footing	50.41
Bearing on soil (psf)	1,008
FOS = Cap/structure	6.3

Seismic - summary check. See following sheets for back up information;

Staad Analysis results:	Mx (k-ft)	Vy (vert)_ (kips)	defl. (in)	Vx (horiz) (kips)
top of open riser	-	0	0.003	0
base of sump walls	76.3	38.59	-	8
bottom of footing	88		-	8

Sliding check:

sliding: 8.0 kips < 0.4* bouyant load B247 kips = 15.43687 **FOS =** **1.93** > 1.3 Normal and 1.1 Extreme
OK

Overturning check:

DL riser =	57.79	kips, with ash overburden on footing	Footing width	7.1	ft.
Weight of water above top of riser within riser	0.81	kips (BxLX max pool to top of riser)	Mr =	137.00	k-ft
	9.01	kips 3.1-(2*1)x5.1-(2*1.) (605-590)*62.4			
buoyant uplift	-29.02	kips, normal water level	Mo =	88	k-ft
	38.59	net DL (ignore Buoyant Ash DL as it may liquefy during EQ)	**OK - Mr exceeds Mo**		
			FOS =	**1.56**	Extreme Condition
				OK	

Footing soil bearing pressure:

1.269745 e'

Mx: (Mr - Mo) k-ft / net DL = e' , eccentricity from center e = (footing width/2)-e' = 2.28 > 7.1/6 = 1.66667
out of kern.

3.8' out of 7.1' in bearing resultes in 54% in bearing — partial bearing < 75% Bearing
(3*D245)= 3.81 — for Extreme Conditions, OK if resultant is within Base
Max. pressure = R / (1/2 x b x L) where b = area in bearing = 3xe'
= 2*38.59/(3*e')/7.1 **2.85 KSF** **OK**
2.24 FS 6.4 KSF ult. soil pressure per geotechnical engineer

Check riser concrete:

shear: Vu max (open riser) = 8 kips
ϕVc = 2*0.75(2)[SQR(3000)]*h*d = 120.6742
where : h= 12.0
d= 5.10 ft 61.2 inches

ϕ(Vc) =120 kip >> Vu 8.0 kip **O.K.**

shaft flexure: See page 3 **Not acceptable**

Seismic (cont'd. - background calcs)

USACE 1110-2-2400 Hydrodynamic Added Mass Calculation
(assuming ash liquifies under seismic event)

water density	62.4	pcf	
liq. ash density	90.0	pcf	
t/overflow el.	605.0	ft.	
normal water el.	604.5	ft.	
ash el.	595.5	ft.**	
b/ftg. el.	588.5	ft.	
ftg. thickness	1.50	ft.	Area shaft
tower 'x' width	5.10	ft.	26.01
tower 'y' width	5.1	ft.	Area ftg
ftg. 'x' width	7.1	ft.	50.41
ftg. 'y' width	7.1	ft.	
gravity accel.	32.2	ft/sec^2	
H_2O mass density	1.938	lb_m/ft^3	
ash mass density	2.795	lb_m/ft^3	
ext. water (H_o)	16.0	ft.	
Ix shaft	1,009,442	in^4	
Iy shaft	1,009,442	in^4	
Ix pedestal	n/a	in^4	
Iy pedestal	n/a	in^4	
Ix base	4,391,138	in^4	
Iy base	4,391,138	in^4	
A base	7,259	in^2	
int. water (H_i) assum	16.0	ft.	

EM 1110-2-2400
2 June 03

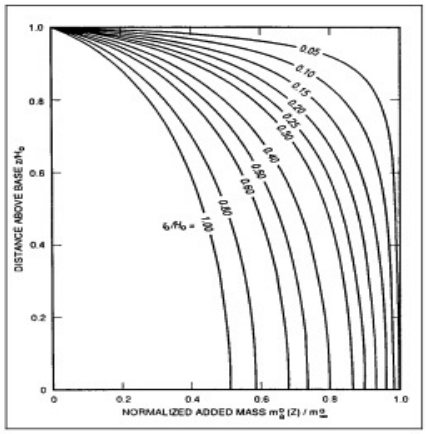


Figure B-4. Hydrodynamic added mass m_a^* from the two-mode approximate analysis procedure

** Elevation of Sluice Intake Weir, Dwg C36 Plan Limits height of ash within basin due to CCR release regulations.

Outside Water

segment	location	top el. (ft.)	bott. el. (ft)	height (ft.)	material	avg. dist. from base 'z' (ft.)	outside x-sect. A_o ft^2	equiv. radius r_o (ft.)	r_o/H_o
11	shaft	605.0	603.5	1.5	water	15.75	26.01	2.88	0.180
10	shaft	603.5	602	1.5	water	14.25	26.01	2.88	0.180
9	shaft	602	600.5	1.5	water	12.75	26.01	2.88	0.180
8	shaft	600.5	599	1.5	water	11.25	26.01	2.88	0.180
7	shaft	599	597.5	1.5	water	9.75	26.01	2.88	0.180
6	shaft	597.5	596	1.5	water	8.25	26.01	2.88	0.180
5	shaft	596	595.5	1.5	water	6.75	26.01	2.88	0.180
4	shaft	595.5	594	1.5	ash	6.25	26.01	2.88	0.180
3	shaft	594	592.5	1.5	ash	4.75	26.01	2.88	0.180
2	shaft	592.5	591	1.5	ash	3.25	26.01	2.88	0.180
1	footing	590.0	588.5	1.5	concrete	0.75	50.4	4.01	0.250

16.5

6 Depth of Ash above bottom of footing

Seismic (cont'd. - background calcs)

USACE 1110-2-2400 Hydrodynamic Added Mass Calculation (continued)

Outside Water (cont'd.) ft.

segment	avg. dist. from base 'z' (ft.)	H_o = 16.0 r_o/H_o	z/H_o	(from chart B-4:) m_a^o/m^o_∞	a_o/b_o (x/y) (avg.)	$m^o_\infty/\rho_w A_o$ (fig. C-6)	$\rho_w A_o$ k_m/ft.	m^o_∞ k_m/ft.	m_a^o k_m/ft.
11	15.75	0.180	0.984	0.02	1.00	1.202	0.050	0.061	0.001
10	14.25	0.180	0.891	0.7	1.00	1.202	0.050	0.061	0.042
9	12.75	0.180	0.797	0.8	1.00	1.202	0.050	0.061	0.048
8	11.25	0.180	0.703	0.88	1.00	1.202	0.050	0.061	0.053
7	9.75	0.180	0.609	0.91	1.00	1.202	0.050	0.061	0.055
6	8.25	0.180	0.516	0.93	1.00	1.202	0.050	0.061	0.056
5	6.75	0.180	0.422	0.94	1.00	1.202	0.050	0.061	0.057
4	6.25	0.180	0.391	0.94	1.00	1.202	0.073	0.087	0.082
3	4.75	0.180	0.297	0.94	1.00	1.202	0.073	0.087	0.082
2	3.25	0.180	0.203	0.94	1.00	1.202	0.073	0.087	0.082
1	0.75	0.250	0.047	0.9	1.00	1.202	0.141	0.169	0.152

ρw = mass density of liquified ash or of water

segment	height (ft.)	m_a^o k_m/ft.	distributed hydrodyn. wt. k_f/ft.	**(outside)** total segment hydro. wt. (kips)	**(inside)** total segment hydro. wt. (kips)	**(total)** **TOTAL added hydro.wt. (kips)**	node (in Staad)	hydro.wt. added at node (staad) (kips)	node el. (ft.)
11	1.5	0.001	0.039	0.059	0.585	0.643	12	0.322	16.50
10	1.5	0.042	1.366	2.049	0.846	2.894	11	1.769	15.00
9	1.5	0.048	1.561	2.341	0.864	3.205	10	3.050	13.50
8	1.5	0.053	1.717	2.576	0.891	3.466	9	3.336	12.00
7	1.5	0.055	1.776	2.663	0.891	3.554	8	3.510	10.50
6	1.5	0.056	1.815	2.722	0.891	3.612	7	3.583	9.00
5	1.5	0.057	1.834	2.751	0.891	3.642	6	3.627	7.50
4	1.5	0.082	2.645	3.968	0.891	4.859	5	4.250	6.00
3	1.5	0.082	2.645	3.968	0.891	4.859	4	4.859	4.50
2	1.5	0.082	2.645	3.968	0.891	4.859	3	4.859	3.00
1	1.5	0.152	4.908	7.362	0.000	7.362	2	6.110	1.50
				34.427	8.527	42.954	1	3.681	0.00
					from next page			42.954	(total added weight)

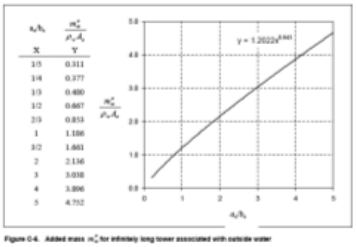


Figure C-6

Seismic (cont'd. - background calcs)

consider inside water as well - assume almost completely full of water, conservative

Inside Water H_i= 16.5 ft. $\rho_w A_i$ = 0.019 k_m/ft.

segment	avg. dist. from base 'z' (ft.)	height (ft.)	material	z/H_i	a_i/b_i (x/y) (avg.)	equiv. radius r_i (ft.)	r_i/H_i	$m^i_a/\rho_w A_i$ (fig. B-5)	m^i_a k_m/ft.
11	15.8	1.5	water	0.955	1	1.75	0.106	0.65	0.012
10	14.3	1.5	water	0.864	1	1.75	0.106	0.94	0.018
9	12.8	1.5	water	0.773	1	1.75	0.106	0.96	0.018
8	11.3	1.5	water	0.682	1	1.75	0.106	0.99	0.018
7	9.8	1.5	water	0.591	1	1.75	0.106	0.99	0.018
6	8.3	1.5	water	0.500	1	1.75	0.106	0.99	0.018
5	6.8	1.5	water	0.409	1	1.75	0.106	0.99	0.018
4	6.3	1.5	water	0.379	1	1.75	0.106	0.99	0.018
3	4.8	1.5	water	0.288	1	1.75	0.106	0.99	0.018
2	3.3	1.5	water	0.197	1	1.75	0.106	0.99	0.018
1	0.8	1.5	footing						

(inside)

segment	height (ft.)	m^i_a k_m/ft.	distributed hydrodyn. wt. k_f/ft.	total segment hydro. wt. (kips)	
0	0	0.000			enter
0	0	0.000			in table
0	0	0.000			on
11	1.5	0.012	0.390	0.585	previous
10	1.5	0.018	0.564	0.846	page to
9	1.5	0.018	0.576	0.864	combine
8	1.5	0.018	0.594	0.891	with
7	1.5	0.018	0.594	0.891	outside
6	1.5	0.018	0.594	0.891	water
5	1.5	0.018	0.594	0.891	
4	1.5	0.018	0.594	0.891	
3	1.5	0.018	0.594	0.891	
2	1.5	0.018	0.594	0.891	
1	1.5	0.000	0.000	0.000	

8.527

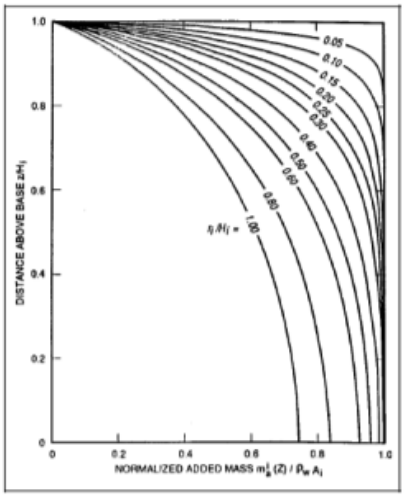


Figure B-5. Hydrodynamic added mass m_a^i from the two-mode analysis procedure

Staad Model Input (for seismic analysis)

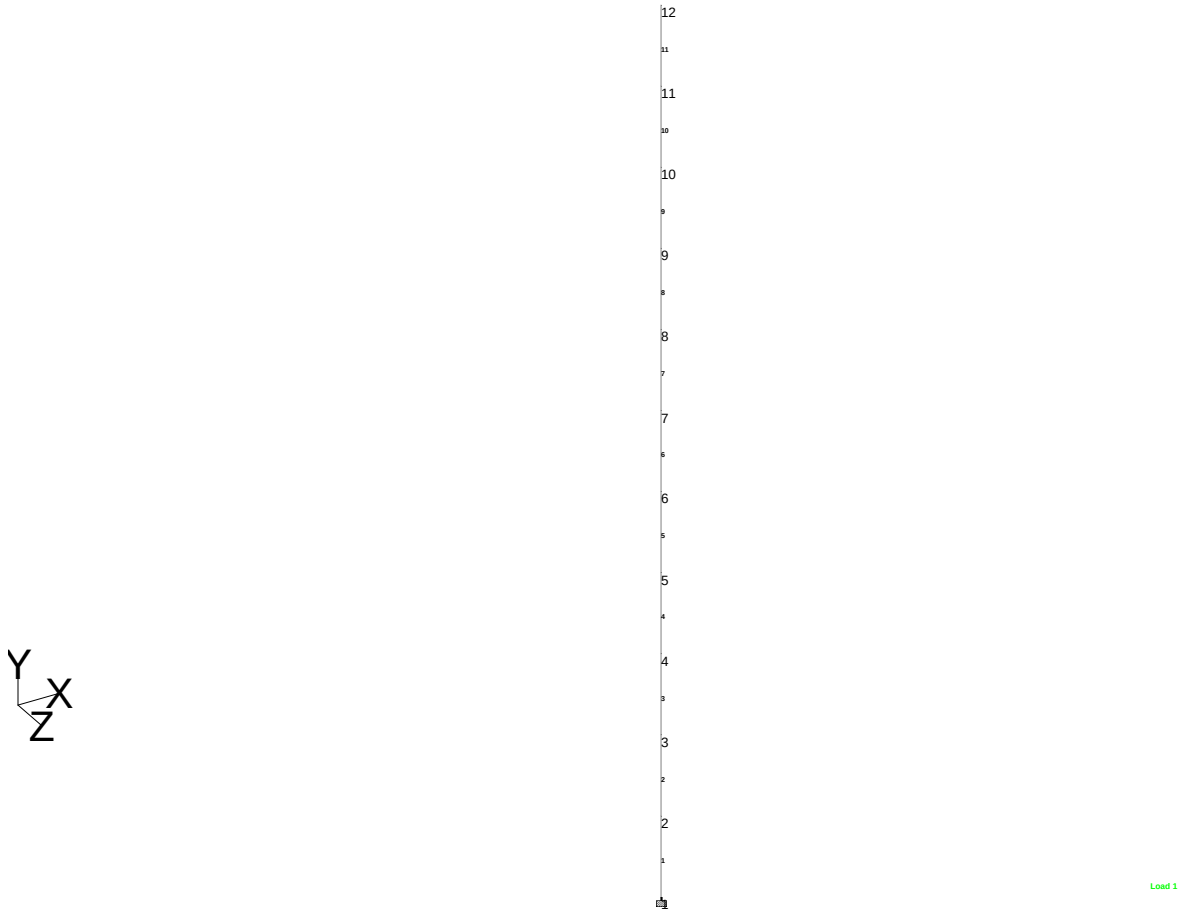
segment	item	A (ft^2)	A (in^2)	Ixx (in^4)	Iyy (in^4)	node	node el. (ft.)	hydro.wt. added at node (staad (kips)	other wt. added at node (kips)
11	shaft	26.01	3,745	1,009,442	1,009,442	12	16.5	0.322	
10	shaft	26.01	3,745	1,009,442	1,009,442	11	15	1.769	
9	shaft	26.01	3,745	1,009,442	1,009,442	10	13.5	3.050	
8	shaft	26.01	3,745	1,009,442	1,009,442	9	12	3.336	
7	shaft	26.01	3,745	1,009,442	1,009,442	8	10.5	3.510	
6	shaft	26.01	3,745	1,009,442	1,009,442	7	9	3.583	
5	shaft	26.01	3,745	1,009,442	1,009,442	6	7.5	3.627	
4	shaft	26.01	3,745	1,009,442	1,009,442	5	6	4.250	
3	shaft	26.01	3,745	1,009,442	1,009,442	4	4.5	4.859	
2	shaft	26.01	3,745	1,009,442	1,009,442	3	3	4.859	
1	footing					2	1.5	6.110	
						1	0	3.681	
								42.954	

Other issues:

DYNEGY KINCAID EMERGENCY EFFLUENT
OUTLET STRUCTURE STAAD INPUT FILE

```
STAAD PLANE
START JOB INFORMATION
ENGINEER DATE 09-Mar-16
JOB NAME Kincaid Power Station Effluent
ENGINEER NAME EAF
JOB NO 60440378
CHECKER NAME ACC
CHECKER DATE 14-Mar-16
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 0 0 0; 2 0 1.5 0; 3 0 3 0; 4 0 4.5 0; 5 0 6 0; 6 0 7.5 0; 7 0 9 0;
8 0 10.5 0; 9 0 12 0; 10 0 13.5 0; 11 0 15 0; 12 0 16.5 0;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 4 5; 5 5 6; 6 6 7; 7 7 8; 8 8 9; 9 9 10; 10 10 11;
11 11 12;
DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 453600
POISSON 0.17
DENSITY 0.14999
ALPHA 5.5e-006
DAMP 0.05
TYPE CONCRETE
STRENGTH FCU 576
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1 PRIS YD 6.1 ZD 6.1
MEMBER PROPERTY AMERICAN
2 TO 10 -
11 PRIS AX 16.4 AY 10.2 AZ 10.2 IX 39.4 IY 48.68 IZ 48.68 YD 5.1 ZD -
5.1 YB 5.1 ZB 5.1
UNIT INCHES KIP
SUPPORTS
1 FIXED
UNIT FEET KIP
CONSTANTS
BETA 0 ALL
MATERIAL CONCRETE ALL
LOAD 1 LOADTYPE Dead  TITLE DEAD LOAD GRAVITY
SELFWEIGHT Y -1
LOAD 2 LOADTYPE Seismic  TITLE SEISMIC ANALYSIS — RESPONSE SPECTRUM IN X DIR
SELFWEIGHT X 1
SELFWEIGHT Y 1
*hydrodynamic weight added at nodes based on procedure outlined in EM 1100—2—240O
JOINT LOAD
1 FX 3.681 FY 3.681
2 FX 6.11 FY 6.11
3 FX 4.859 FY 4.859
4 FX 4.859 FY 4.859
5 FX 4.25 FY 4.25
6 FX 3.627 FY 3.627
7 FX 3.583 FY 3.583
8 FX 3.51 FY 3.51
9 FX 3.336 FY 3.336
10 FX 3.05 FY 3.05
11 FX 1.769 FY 1.769
12 FX 0.322 FY 0.322
*
SPECTRUM SRSS X 1 ACC SCALE 32.2 DAMP 0.05 LIN
*
0 0.11; 0.1 0.25; 0.2 0.21; 0.4 0.13; 1 0.1; 2 0.06;
PERFORM ANALYSIS PRINT MODE SHAPES
PRINT ANALYSIS RESULTS
FINISH
```

DYNEGY KINCAID EMERGENCY EFFLUENT STRUCTURE
STAAD MODEL



Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	12	2:SEISMIC AN	**0.003**	0.000	0.000	0.003	0.000	0.000	0.000
Min X	1	1:DEAD LOAD	**0.000**	0.000	0.000	0.000	0.000	0.000	0.000
Max Y	12	2:SEISMIC AN	0.003	**0.000**	0.000	0.003	0.000	0.000	0.000
Min Y	12	1:DEAD LOAD	0.000	**-0.000**	0.000	0.000	0.000	0.000	0.000
Max Z	1	1:DEAD LOAD	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Min Z	1	1:DEAD LOAD	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000
Max rX	1	1:DEAD LOAD	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000
Min rX	1	1:DEAD LOAD	0.000	0.000	0.000	0.000	**0.000**	0.000	0.000
Max rY	1	1:DEAD LOAD	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000
Min rY	1	1:DEAD LOAD	0.000	0.000	0.000	0.000	0.000	**0.000**	0.000
Max rZ	12	2:SEISMIC AN	0.003	0.000	0.000	0.003	0.000	0.000	**0.000**
Min rZ	1	1:DEAD LOAD	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**
Max Rst	12	2:SEISMIC AN	0.003	0.000	0.000	**0.003**	0.000	0.000	0.000

Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kip)	FY (kip)	FZ (kip)	MX (kip-ft)	MY (kip-ft)	MZ (kip-ft)
Max FX	1	2:SEISMIC AN	**8.012**	0.000	0.000	0.000	0.000	87.982
Min FX	1	1:DEAD LOAD	**0.000**	45.269	0.000	0.000	0.000	0.000
Max FY	1	1:DEAD LOAD	0.000	**45.269**	0.000	0.000	0.000	0.000
Min FY	1	2:SEISMIC AN	8.012	**0.000**	0.000	0.000	0.000	87.982
Max FZ	1	1:DEAD LOAD	0.000	45.269	**0.000**	0.000	0.000	0.000
Min FZ	1	1:DEAD LOAD	0.000	45.269	**0.000**	0.000	0.000	0.000
Max MX	1	1:DEAD LOAD	0.000	45.269	0.000	**0.000**	0.000	0.000
Min MX	1	1:DEAD LOAD	0.000	45.269	0.000	**0.000**	0.000	0.000
Max MY	1	1:DEAD LOAD	0.000	45.269	0.000	0.000	**0.000**	0.000
Min MY	1	1:DEAD LOAD	0.000	45.269	0.000	0.000	**0.000**	0.000
Max MZ	1	2:SEISMIC AN	8.012	0.000	0.000	0.000	0.000	**87.982**
Min MZ	1	1:DEAD LOAD	0.000	45.269	0.000	0.000	0.000	**0.000**

NOTE: DESIGN MOMENT OF 88 KIP FT IS AT BOTTOM OF FOUNDATION.
MOMENT AT BASE OF RISER IS EQUAL TO 76.3 KIP FT

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Table of contents

Project Name:	Project number:	Date:	Contact:	
45638-102915-01-AECOM-		10/29/2015		

Profile Report 1

Inspection: 1

Legend of Classification 2

Section: 1, Emergency Overflow --- River 3

Section: 2, Pond --- Emergency Overflow 8

Section: 3, Emergency Overflow --- River 10

City :

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Email: bhi@bhug.com

/ Main sections

Project name	Project # :	Responsible :	Date :
45638-102915-01-AECOM-Denver			**10/29/2015**

No.	Start MH	End MH	Date	Street	Tape No.	Material	m	(m)
1	Emergency Overflow	River	10/29/2015	West Route 104		Corrugated Metal Pipe	155.18	155.18
2	Pond	Emergency Overflow	10/29/2015	West Route 104		Corrugated Metal Pipe	1.00	1.00
3	Emergency Overflow	River	10/29/2015	West Route 104		Corrugated Metal Pipe	0.09	0.09

Pipe size: CIRCULAR 48 = 156.26 ft (156.27 ft)

All sections = 156.26 ft (156.27 ft)

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Defect Grade Description

Project Name :	Project number :	Contact :	Date :
45638-102915-01-AECOM-Denver			**10/29/2015**

1: Excellent Condition

Minor Defects- Failure unlikley in the foreseeable future

2: Good Condition

Defects that have not begun to deteriorate- Pipe unlikely to fail for at least 20 years.

3: Fair Condition

Moderate defects that will continue to deteriorate- Pipe may fail in 10-20 years.

4: Poor Condition

Severe Defects that will become Grade 5 defects within the foerseeable future- Pipe will probably fail in 5-10 years

5: Immediate Attention

Defects require immediate attention- Pipe has failed or will likely fail within the next 5 years or sooner.

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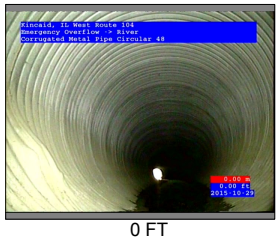
Inspection Report

Date	Section #	Weather	Cleaning	Operator	Certificate #
10/29/2015	**1**	**Dry**	**No Pre-Cleaning**	**Mike Bennett**	**U-313-17480**

Street Name:	**West Route 104**	Use of Sewer	**Stormwater**	Upstream MH	**Emergency Overflow**
City	**Kincaid, IL**	Pipe Diameter	**48 inch**	Dowstream MH	**River**
		Pipe Material	**Corrugated Metal Pipe**	Dir. of Survey	**Downstream**
		Length surveyed	**155.18 ft**	Section Length	**155.18 ft**

Add. Information :

1:392	Position	Observation
Emergency Overflow		
	0.00	Water Level, 5 %of cross sectional area
	0.00	Special Chamber / Survey Begins @ the Emergency Overflow
	3.00	Lining Failure Bulges, from 07 to 08 o'clock, within 8 inches of joint: YE
	19.81	Lining Failure Bulges, at 01 o'clock, within 8 inches of joint: YES
	27.20	Obstacles Rocks, 5 %of cross sectional area, at 06 o'clock
	128.79	Lining Failure Bulges, at 01 o'clock, within 8 inches of joint: YES
	155.18	End of Pipe / Survey Ends @ the river
River		



0 FT

3 FT

3 FT

19.81 FT

27.2 FT

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
3300	**2100**	**9**	**2**	**11**	**3**	**2**	**2.75**

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Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Kincaid, IL	**West Route 104**			**1**

Photo: 45638-102915-01-AECOM-Denver-1-29102015105557_A.JPG
0FT, Special Chamber / Survey Begins @ the Emergency Overflow

Photo: 45638-102915-01-AECOM-Denver-1-29102015112339_A.JPG
3FT, Lining Failure Bulges, from 07 to 08 o'clock, within 8 inches of joint: YES

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Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Kincaid, IL	**West Route 104**			**1**

Photo: 45638-102915-01-AECOM-Denver-1-29102015112351_B.JPG
3FT, Lining Failure Bulges, from 07 to 08 o'clock, within 8 inches of joint: YES

Photo: 45638-102915-01-AECOM-Denver-1-29102015112813_A.JPG
19.81FT, Lining Failure Bulges, at 01 o'clock, within 8 inches of joint: YES

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E-mail: bhi@bhug.com

Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Kincaid, IL	**West Route 104**			**1**

Photo: 45638-102915-01-AECOM-Denver-1-29102015112944_A.JPG
27.2FT, Obstacles Rocks, 5 %of cross sectional area, at 06 o'clock

Photo: 45638-102915-01-AECOM-Denver-1-29102015113925_A.JPG
128.79FT, Lining Failure Bulges, at 01 o'clock, within 8 inches of joint: YES

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Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Kincaid, IL	**West Route 104**			**1**

Photo: 45638-102915-01-AECOM-Denver-1-29102015114219_A.JPG
155.18FT, End of Pipe / Survey Ends @ the river

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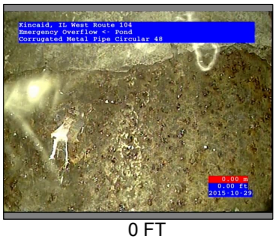
Inspection Report

Date	Section #	Weather	Cleaning	Operator	Certificate #
10/29/2015	**2**	**Dry**	**No Pre-Cleaning**	**Mike Bennett**	**U-313-17480**

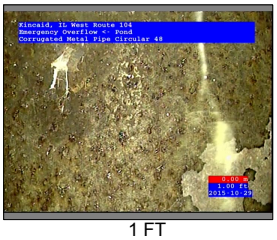
Street Name:	**West Route 104**	Use of Sewer	**Stormwater**	Upstream MH	**Pond**
City	**Kincaid, IL**	Pipe Diameter	**48 inch**	Dowstream MH	**Emergency Overflow**
		Pipe Material	**Corrugated Metal Pipe**	Dir. of Survey	**Upstream**
		Length surveyed	**1.00 ft**	Section Length	**1.00 ft**

Add. Information :

1:50	Position	Observation
	Emergency Overflow	
	0.00	Water Level, 5 %of cross sectional area
	0.00	Special Chamber / Survey Begins @ Emergency Overflow
	Pond	
	1.00	General Observation / Took pics and video inside the emergency overflow pond side



0 FT



1 FT

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	**0000**	**0**	**0**	**0**	**0**	**0**	**0**

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Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Kincaid, IL	**West Route 104**			**2**

Photo: 45638-102915-01-AECOM-Denver-2-29102015103905_A.JPG
0FT, Special Chamber / Survey Begins @ Emergency Overflow

Photo: 45638-102915-01-AECOM-Denver-2-29102015104146_A.JPG
1FT, General Observation / Took pics and video inside the emergency overflow pond side

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Web: http://www.bhug.com

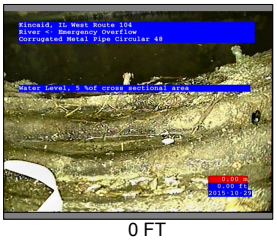
Inspection Report

Date	Section #	Weather	Cleaning	Operator	Certificate #
10/29/2015	**3**	**Dry**	**No Pre-Cleaning**	**Mike Bennett**	**U-313-17480**

Street Name:	**West Route 104**	Use of Sewer	**Stormwater**	Upstream MH	**Emergency Overflow**
City	**Kincaid, IL**	Pipe Diameter	**48 inch**	Dowstream MH	**River**
		Pipe Material	**Corrugated Metal Pipe**	Dir. of Survey	**Upstream**
		Length surveyed	**0.09 ft**	Section Length	**0.09 ft**

Add. Information :

1:50	Position	Observation
River	0.00	Special Chamber / Emergency Overflow
Emergency Overflow	0.00	Water Level, 5 %of cross sectional area
	0.09	General Observation / Looked at start of the pipe for the client



0 FT

0.09 FT

QSR	QMR	SPR	MPR	OPR	SPRI	MPRI	OPRI
0000	**0000**	**0**	**0**	**0**	**0**	**0**	**0**

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Inspection photos

City :	Street :	Date :	Pipe Segment Reference :	Section No :
Kincaid, IL	**West Route 104**			**3**

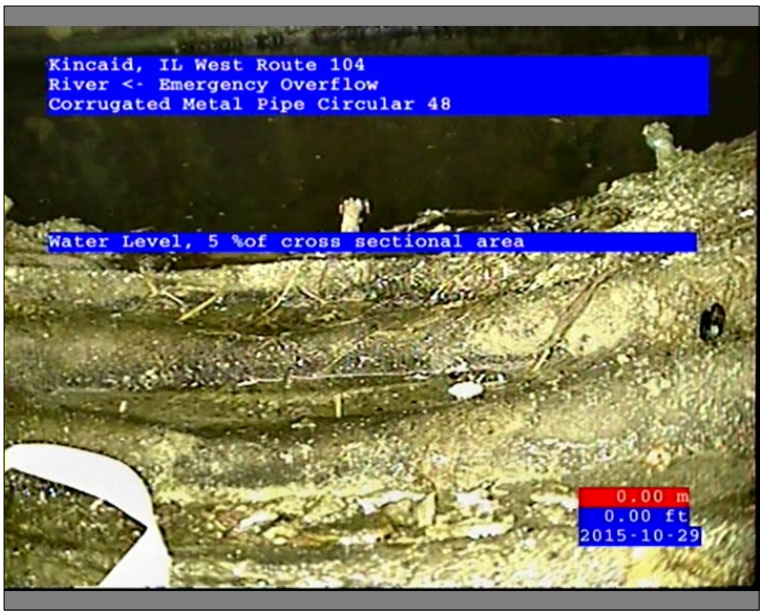

Photo: 45638-102915-01-AECOM-Denver-3-29102015115443_A.JPG
0FT, Special Chamber / Emergency Overflow

Photo: 45638-102915-01-AECOM-Denver-3-29102015115753_A.JPG
0.09FT, General Observation / Looked at start of the pipe for the client

Appendix B. Geotechnical Report

AECOM
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St. Louis, MO 63110-1337
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314.429.0462 fax

July 1, 2016

Mr. Matt Ballance, PE
Senior Project Engineer
Dynegy Inc.
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

RE: DRAFT Geotechnical Report for Dynegy Kincaid Ash Pond

Dear Mr. Ballance:

AECOM is pleased to provide this Geotechnical Report for the Dynegy Coal Combustion Residuals (CCR) Ash Pond at the Kincaid Power Station located in Christian County, Illinois. This Geotechnical Report has been prepared to document the analyses we performed to check that the facility meets the geotechnical stability requirements including Factors of Safety required by 40 CFR § 257.73.

AECOM looks forward to providing continued support to Dynegy and working together on this important program. Please do not hesitate to call Vic Modeer at 314-743-4194 (office) / 618-541-0878 (mobile), if you have any questions or comments on this Geotechnical Report.

Sincerely,

AECOM

Ronald Hager, PE
Technical Program Manager
ronald.hager@aecom.com

Victor Modeer, PE, D.GE
Program Manager
victor.modeer@aecom.com

cc: Mark Rokoff, PE – AECOM

Attachments:

A. Figures
B. Boring Logs
C. Piezometer Logs
D. CPT Data Report
E. Lab Test Data
F. Geophysical Plots
G. Analysis Section Development Calculations
H. Material Characterization Calculations
I. Slope Stability Analysis Calculations
J. Probabilistic Seismic Hazard Analysis Report
K. Dynamic Response Analysis Calculations
L. Liquefaction Analysis Calculations
M. Sudden Drawdown Slope Stability Calculations

1. INTRODUCTION

1.1. *Purpose of this Report*

This report presents the results of AECOM's geotechnical investigation and analyses of the ash retaining surface impoundment (SI), Kincaid Ash Pond, located at the Kincaid Plant in Christian County, Illinois (see Figure 1-1, Attachment A for Location Map). The purpose of the geotechnical investigation and analyses is to evaluate the design, performance, and condition of the impoundment and associated structures using available design drawings, construction records, inspection reports, previous engineering investigations, reports and analyses, Station operating records, and other pertinent documents. This information combined with subsurface investigations, laboratory testing, and engineering analyses was used to evaluate the design and operation of the surface impoundment using current regulatory and engineering practice, and to identify potential geotechnical deficiencies that may require additional investigation, repair or remediation. The regulatory criteria and current engineering practice related to the design of Coal Combustion Residual's (CCR) ash impoundments was used as guidance during development of geotechnical analysis and stability evaluations.

The geotechnical field evaluation was conducted between August 11 and August 30, 2015. The field program consisted of conventional hollow stem auger (HSA) borings, Standard Penetration Testing (SPT), Cone Penetration testing (CPT), piezometer installation, and geophysical investigation. Laboratory testing was conducted on the materials obtained through various sampling techniques to assist in characterization of the subsurface conditions. Stability analyses were performed by AECOM to evaluate the potential for slope instabilities, in accordance with the Environmental Protection Agency (EPA) regulation 40 CFR 257.73(d) and (e). The potential for slope instability is dependent on factors such as slope geometry, groundwater/phreatic surface conditions, and shear strengths of the embankment and foundation soils. A summary of the geotechnical field program, laboratory testing program and stability evaluations are presented in the following sections.

1.2. *Brief Description of Impoundments*

The Kincaid Ash Pond, commissioned in 1967, operates as an unlined impoundment that contains bottom ash, flu ash, boiler slag, and other materials including water and wastewater treatment solids, excavation spoils and dredge spoil. Bottom ash is currently sluiced from the plant into the impoundment. A third party recycling company recovers newly placed ash for beneficial reuse, and unacceptable material is returned to the site for stabilization (filling and compaction by heavy equipment traffic).

Seven connected embankment sections totaling a length of approximately 11,000 feet form a complete perimeter around the impoundment. The surface area of the impoundment is approximately 178 acres, and the storage capacity is approximately 3,500 acre-feet. Approximately 2,100 acre-feet consists of placed ash, and 1,400 acre feet consists of water. Design crest elevations are 605 for the south embankment, and 620 for all other embankments. Based on LIDAR survey data, current crest elevations range from approximately 605 to 608 for the south embankment and 614 to 622 for the other embankments. The pond typically fluctuates by no more than about 1 foot, while maintaining at least 1 to 1.5 feet of freeboard.

Embankment height ranges from approximately 5 feet (south embankment, near southeast corner) to 30 feet (north embankment), as referenced to the downstream toe. Embankment downstream slopes range from approximately 1.4H:1V (north, northwest, and south embankments) to 6.1H:1V (south embankment near southeast corner). Embankment crest width ranges from approximately 10 feet to 25 feet, with smaller crest widths along the east and north embankments, and larger crest widths along the northwest, southwest, and south embankments.

Embankment surficial instability (sloughing, scarps, depressions), erosion gullies, and animal burrows were observed along portions of the embankments during our June 2015 site visit, as detailed in our Initial Site Visit CCR Unit Summary memo dated June 29, 2015. These issues are not judged to represent immediate dam safety concerns, but should be regularly monitored and repaired as necessary to prevent them from worsening. Evidence of prior tree removal and possible inadequate root excavation were also observed along the east and north embankments; these areas should also be regularly monitored for signs of developing seepage or instability. Ponded water along the toe was also observed but was judged to be associated with either recent precipitation or with adjacent farm irrigation.

Embankment crest subsidence of up to several feet was also observed along the north, northwest, and southwest embankments during our June 2015 site visit. Along the southwest embankment, transverse cracking at the subsided area was observed and documented by Hanson Engineering in 2013 (but was not observed during our June 2015 site visit because fill had been placed over the cracks). The transverse cracking is believed to be related to underground mine workings beneath the site. AECOM performed geophysical investigation (electromagnetic resistivity imaging (ERI) and ground penetrating radar (GPR)) from August 24 to 30, 2015 in an attempt to delineate the extent of the known transverse cracking, as well as to identify any other transverse cracking along the subsided areas of the northwest and north embankments. The extent of transverse cracking was not able to be delineated, likely because the aforementioned fill placement over the cracks had infilled the cracking and/or because of insufficient crack width/depth to be detected. No other transverse cracking was identified along the northwest and north embankments. Based on the geophysical results and the estimated bottom of cracking being substantially higher than the water level in the impounded ash adjacent to the embankment, internal erosion through the transverse cracking was judged to not present a current dam safety concern; however, the area of cracking should be regularly monitored for seepage, increased subsidence, and any worsening of the transverse cracking.

Additional information on the composition, static stability, and seismic stability of the embankment and foundation is provided below.

2. SUMMARY OF FIELD INVESTIGATIONS

A subsurface exploration was performed at the Ash Pond including 12 soil borings, installation of 12 piezometers (9 open standpipe and 3 vibrating wire) to monitor groundwater, and a program of 39 cone-penetration test (CPT) soundings, with seismic wave velocity measurements and pore pressure dissipation testing. Geophysical investigation was completed at three locations along the crest, as described above.

The borings were drilled by AECOM's subcontractor Terracon Consultants, Inc. of St. Louis, MO, under the full-time supervision of AECOM geotechnical personnel. Terracon used an All-Terrain Vehicle-mounted drill rig (CME 550x) and hollow stem augers (7.75-inch outer

diameter) to drill the borings. The 9 open standpipe piezometers were also installed by Terracon. CPT soundings were performed by AECOM's subcontractor ConeTec, Inc., again with full-time oversight by AECOM personnel. ConeTec also installed fully grouted vibrating wire piezometers in 3 of the CPT sounding holes. The geophysical investigation was performed by AECOM personnel.

Boring depths ranged from 30 to 85 feet, and CPT depths ranged from 4.5 to 40 feet below existing grades. Piezometer depths (base of the screened interval) ranged from 17 to 47 feet below existing grades. The open standpipe piezometers were installed either directly in the borings or in offset borings (approximately 10 feet or less of offset), and the vibrating wire piezometers were installed as part of the CPT push, at the bottom of the sounding. Boring, CPT, and geophysical locations are depicted in Figure 2-1 (Attachment A), and piezometer locations are depicted in Figure 2-2 (Attachment A). Boring and CPT exploration location data (ID, easting, northing, and ground surface elevation) are summarized in Table 2-1. Piezometer location and water level data are summarized in Table 3-1. Boring and piezometer logs are provided in Attachments B and C, respectively, and CPT data/plots are provided in Attachment D. The reduced results of the geophysical investigation (ERI) are provided in Attachment F. The GPR method was only used for scanning, with no graphical results to present.

Representative soil samples were collected from each of the borings for classification and/or testing. The soil samples were obtained using SPT methodology with a split-spoon sampler, in general accordance with ASTM D 1586. Undisturbed samples of fly ash and/or fine-grained soils were obtained using 3-inch outside diameter steel (Shelby) tubes, either conventionally pushed in accordance with ASTM D 1587 or by utilizing a piston sampler in accordance with ASTM D 6519 (in ash and very soft soils). Most of the soil samples selected for laboratory testing were delivered to the Terracon Laboratory in St. Louis, MO. Laboratory testing associated with seismic strength characterization was performed at the Fugro Laboratory in Houston, TX.

Table 2-1
Boring and CPT Exploration Location Data

Exploration ID	Easting[1] (ft NAD83)	Northing[1] (ft NAD83)	Elevation[1] (ft NAVD88)
Borings			
KIN-B001	2487814.9	1066425.2	599.2
KIN-B002	2487797.2	1066464.2	605.2
KIN-B003	2485599.5	1066902.8	624.5
KIN-B004	2484976.5	1067820.2	621.3
KIN-B005	2484937.4	1067774.6	596.4
KIN-B006	2485451.3	1068071.6	618.6
KIN-B007	2485646.0	1069015.2	621.5
KIN-B008	2485606.7	1069056.6	592.1
KIN-B009	2486422.1	1069403.1	590.4
KIN-B010	2486428.7	1069349.9	615.3
KIN-B011	2487934.9	1068625.0	617.0
KIN-B012	2486141.1	1067643.5	605.5
CPT Soundings			
KIN-C001	2487907.4	1066424.2	598.8
KIN-C002	2486973.1	1066420.9	608.0
KIN-C003	2487907.4	1066424.2	598.8
KIN-C004	2485603.1	1066976.9	621.8
KIN-C005	2485596.9	1066849.8	601.7
KIN-C006	2484976.5	1067820.2	621.3
KIN-C007	2484722.3	1068131.8	620.0
KIN-C008	2484664.6	1068092.3	595.8
KIN-C009	2485014.6	1068573.1	599.2
KIN-C010	2485055.5	1068544.3	621.0
KIN-C011	2485646.0	1069015.2	618.9
KIN-C012	2485696.3	1068958.2	616.5
KIN-C013	2486428.7	1069349.9	615.3
KIN-C014	2487682.0	1069405.0	600.6
KIN-C015	2487685.0	1069351.8	617.6
KIN-C016	2487680.6	1069315.0	613.8
KIN-C017	2487888.9	1068628.5	608.3
KIN-C018	2488015.1	1068625.3	598.5
KIN-C019	2487913.7	1067359.7	604.9
KIN-C020	2487950.5	1067359.6	617.3
KIN-C021	2488031.2	1067329.7	597.8
KIN-C022[2]	2486144.5	1067641.9	604.1
KIN-C023	2485450.1	1068070.2	618.5
KIN-C023A[2]	2485453.3	1068073.6	618.3
KIN-C024	2485009.5	1068209.3	623.3
KIN-C024B[2]	2485002.7	1068215.6	623.3
KIN-C025	2485839.8	1068830.1	618.5
KIN-C026	2486454.2	1068739.5	604.6
KIN-C027	2485977.4	1068336.5	608.2
KIN-C028	2485077.2	1067874.6	618.0
KIN-C029	2485884.9	1067904.3	606.2
KIN-C030	2486909.0	1068398.6	604.7
KIN-C031	2486813.8	1067796.0	604.2
KIN-C032	2485603.6	1067258.6	621.0
KIN-C033	2486493.3	1067096.5	626.3
KIN-C034	2486128.0	1066932.4	624.7
KIN-C035	2486639.2	1066705.2	624.4
KIN-C036	2486977.6	1066491.2	603.9
KIN-C037	2487313.4	1066514.7	604.0

[1] Coordinates and elevations in this table are reported to the nearest tenth. Coordinates and elevations reported to the nearest thousandth are provided in Attachment B.
[2] KIN-C022, KIN-C023A and KIN-C024B were not surveyed. Locations are approximated based on handheld GPS measurements taken during investigation.

3. SUMMARY OF SITE-SPECIFIC SUBSURFACE CONDITIONS

3.1. *Site Stratigraphy*

Four materials were encountered during the geotechnical investigation at Kincaid Ash Pond:

- Embankment Fill: Embankment fill encountered in the borings was classified as low to medium plasticity sandy clay or clay with sand (CL), or high plasticity clay (CH). The CL and CH soils had occasional occurrences of trace levels of fine gravel, were medium stiff to very stiff with occasional soft zones, moist to very moist, and brown to gray. The embankment fill generally appeared to be well-compacted.

- Impounded Ash Materials: Bottom ash materials were encountered in two borings drilled in the ash impoundment area. The material was generally classified as fine- to coarse-grained sand (cinders) with clayey silt, organics or clay, very loose to very dense, moist to very wet, and dark brown to black.

- Foundation Clay: Kincaid Ash Pond is underlain predominantly by native clay of alluvial origin with occasional layers of coarse-grained soil. The fine-grained soils (clays) encountered in the borings were generally classified as low to medium plasticity silty clay, sandy clay, clay with sand, or clay (CL) with trace amounts of sand or gravel; or high plasticity clay (CH). The CL and CH soils were soft to very stiff with a CPT profile indicative of a somewhat overconsolidated crust near the top of the layer, very moist to very wet, and brown to gray with some occurrence of reddish brown silt seams. The coarse-grained soil encountered in the borings was classified as clayey sand (SC), with a trace amount of gravel, very loose, low plasticity, very wet, and brown to gray.

- Glacial Till: Encountered glacial material was predominantly classified as sandy clay (CL) with some occurrences of clayey sand (SC) or silty sand (SM), usually with a trace amount of fine gravel, generally hard, low to medium plasticity, slightly moist to very wet, and brown to gray.

Logs of the borings and CPT soundings are included in Attachments B and D, respectively, and laboratory test results are included in Attachment E. Summary plots of the field and laboratory data for the various material types are included in the Material Characterization calculation package in Attachment H.

3.2. *Groundwater Conditions*

AECOM evaluated piezometer water level (WL) data from five measurement events (8/23/15, 10/7/15, 10/30/15, 11/23/15, and 12/23/15), WL's interpreted from CPT dissipation tests, and borehole WL's measured immediately after drilling. Piezometer WL's were judged to be the most representative of in-situ, steady state conditions. CPT WL's in ash are judged to be representative of steady state water levels, but CPT WL's within and downstream of the embankment are and inconsistently representative of steady state water levels. Water was encountered in only 2 of the 12 borings during measurement immediately after drilling and is not representative of steady state conditions; borehole WL's had not equilibrated in the low-permeability clay when measurements were taken immediately after drilling.

The following observations are made from our evaluation of the WL data:

- Embankment WL's, as measured in crest piezometers and some representative CPT's, ranged from approximately Elevation 599 to 602 in piezometers close to the pond, and ranged from approximately Elevation 593 to 595 along the southwest and northwest embankments furthest from the pond and adjacent to deposited ash.
- Downstream toe water levels, as measured in piezometers and some representative CPT soundings, were highest at the southwest corner (Elevation 598 to 599) and northeast corner (Elevation 594 to 597) and lowest at the north and northwest (Elevation 583 to 585) and southeast corner (Elevation 586 to 590). The data appear to indicate groundwater gradients toward the north, and towards the northwest and southeast corners.
- Water levels measured in the ash stockpile area in the western two-thirds of the impoundment were relatively consistent across the ash stockpile, generally ranging from Elevation 602 to 603, which is 0.5 to 1.5 feet lower than the normal reservoir water surface elevation of 603.5.
- Crest and downstream toe piezometer water levels generally show a slight decrease (0.4 to 1.2 feet) from the first measurement on August 23, 2015 to the third measurement on October 30, 2015, with the exception of KIN-P001 and KIN-P012 which show a moderate to sharp decrease (3.4 to 6 feet). From October 30, 2015 to the last measurement event on December 23, 2015, the piezometer water levels generally show a slight to moderate increase (0.4 to 2.3 feet), with the exception of KIN-P012, in which the water level dropped approximately another 1.3 feet. The water level fluctuations are likely associated with a combination of post-drilling equilibration and precipitation; however, at least one year of monthly water level data would need to be evaluated to confirm this.

Piezometer location and water level measurement data are summarized in Table 3-1.

Table 3-1
Piezometer Location and Water Level Data

PZ or VWP No.	Embankment	Northing (ft NAD83)	Easting (ft NAD83)	Ground Surface Elevation (ft NAVD88)	Location	PZ Type[1,2]	Total Depth[3] (feet)	Water Surface Elevation (feet)				
								8/23/15	10/7/15	10/30/15	11/23/15	12/23/15
KIN-P001	Southeast	1066425.2	2487815.0	599.2	Toe	OSP	31.2	589.6	586.4	586.1	586.0	586.6
KIN-P002	Southeast	1066464.2	2487797.2	605.2	Crest	OSP	22.0	600.2	599.5	599.1	599.2	599.5
KIN-P003	South	1066902.7	2485599.6	623.3	Crest	OSP	47.2	601.5	601.3	601.1	601.5	601.8
KIN-P004	South	1066849.8	2485596.9	601.7	Toe	VWP	19.0	N/M[4]	597.9	597.8	599.0	599.1
KIN-P005	Southwest	1067820.1	2484976.3	619.0	Crest	OSP	42.4	593.4	593.0	592.7	592.8	593.7
KIN-P006	Southwest	1067770.4	2484941.1	596.4	Toe	OSP	36.8	586.9	586.0	Dry	Dry	587.8
KIN-P007	Northwest	1069014.5	2485646.3	618.9	Crest	OSP	32.1	595.2	594.9	594.7	594.8	595.2
KIN-P008	Northwest	1069056.5	2485606.1	589.9	Toe	OSP	27.2	585.3	584.6	584.2	584.3	585.0
KIN-P009	North	1069403.1	2486422.1	590.4	Toe	OSP	31.7	584.5	583.7	583.3	583.4	584.6
KIN-P010	North	1069349.9	2486428.7	615.3	Crest	OSP	43.5	601.7	601.4	600.8	600.9	601.3
KIN-P011[5]	North	1069405.0	2487682.0	600.6	Toe	VWP	17.0	594.5	593.8	593.6	594.1	595.9
KIN-P012[5]	North	1069351.8	2487685.0	617.6	Crest	VWP	20.0	606.2	600.8	600.2	598.8	598.9

Notes:

1. OSP = open standpipe piezometer.
2. VWP = vibrating wire piezometer installed at locations not accessible with drill rig.
3. Total Depth = Approx. bottom of screen for standpipe piezometers, or installed depth for VWPs.
4. N/M = Not measured.
5. Coordinates and ground surface elevations of KIN-P011 and KIN-P012 are the same as KIN-C014 and KIN-C015, respectively, as KIN-P011 and KIN-C014 are collocated, and KIN-P012 and KIN-C015 are collocated.

4. SUMMARY OF LABORATORY TESTING

4.1. *Summary of Laboratory Testing Scope*

The laboratory testing program performed for Kincaid Ash Pond was intended to obtain information on index properties and shear strength properties of the subsurface material at the site. The laboratory testing program for characterization of the materials at Kincaid Ash Pond are summarized in Table 4-1.

Table 4-1
Summary of Laboratory Testing Program for Kincaid Ash Pond

ASTM Designation	Test Type	Number of Tests				
		Total	Ash	Embankment	Foundation Clay	Glacial Till
D2216	Moisture Content	131	7	40	41	43
D2937	Dry Unit Weight	29		6	17	6
D4318	Atterberg Limits	47		12	25	10
T311, D1140, D422	Gradation/Hydrometer	30	5	6	10	9
D854	Specific Gravity	10	2	1	5	2
D5084	Hydraulic Conductivity	3		2	1	
D4221, D4647, D6572,	Dispersion	6		3	3	
D2435	Consolidation	6		1	5	
D4767	Consolidated Undrained Triaxial (CIU)	11		3	8	
D6528	Direct Simple Shear (DSS)	4			4	
D5311, D6528	Cyclic and Post-Cyclic DSS	2			2	

4.2. *Summary of Laboratory Testing Results*

A summary of laboratory test results for the impounded ash, embankment, foundation clay, and till at Kincaid Ash Pond are presented in Tables 4-2, 4-3, 4-4, and 4-5, respectively. Laboratory test data is included in Attachment E. Graphical displays of the shear strength characterization for the stratigraphic materials are included in the Material Characterization Calculation Package in Attachment H.

Table 4-2
Summary of Laboratory Test Results – Impounded Ash

Boring and Sample ID	Ground Surface Elevation (ft)	Material Description	Sample Depth	Moisture Content	Specific Gravity	Gradations				
						Sieve Analysis (3 inch to #200 Sieve)			Hydrometer	
						Gravel	Sand	Fines	Silt	Clay
			(ft)	(%)		(%)	(%)	(%)	(%)	(%)
KIN-B006-S1	618.62	Ash	1	34.2	2.653	6.0	61.3	32.7		
KIN-B006-S2	618.62	Ash	3.5	71.4						
KIN-B006-S5	618.62	Ash	12	48.0		0	39.5	60.5		
KIN-B006-S7	618.62	Ash	17	38.5		2.0	76.2	21.8		
KIN-B012-S1	605.54	Ash	1	11.2		5.0	90.2	4.8		
KIN-B012-S2	605.54	Ash	3.5	12	2.829	1.0	89.6	9.4		
KIN-B012-S4	605.54	Ash	8.5	19.4						

Table 4-3
Summary of Laboratory Test Results[1] – Embankment

Boring and Sample ID	Ground Surface Elevation (ft)	Material Description	Sample Depth	Moisture Content	Dry Unit Weight	Total Unit Weight	Specific Gravity	Atterberg Limits			Gradations					USCS	Hydraulic Conductivity	Dispersion[2]			Consolidation	
								Liquid Limit	Plastic Limit	Plasticity Index	Sieve Analysis (3 inch to #200 Sieve)			Hydrometer				Crumb	Pinhole	Double Hydrometer	σ'_{max}	OCR
											Gravel	Sand	Fines	Silt	Clay							
			(ft)	(%)	(pcf)	(pcf)		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)		(cm/sec)			(%)	(tsf)	
KIN-B001-S1	599.20	Embankment	1	11.8																		
KIN-B001-S3	599.20	Embankment	6	20.8				39	16	23	0	16.8	83.2	58.3	24.9	CL						
KIN-B002-S1	605.23	Embankment	1	18.1																		
KIN-B002-S2	605.23	Embankment	3	19.0				38	17	21	5.8	17.1	77.1	46.1	31.0	CL		1	ND1			
KIN-B002-S3	605.23	Embankment	6	13.9																		
KIN-B003-S1	624.45	Embankment	1	11.6																		
KIN-B003-S2	624.45	Embankment	3.5	15.5																		
KIN-B003-S3	624.45	Embankment	6	16.4																		
KIN-B003-S4	624.45	Embankment	8.5	9.5																		
KIN-B003-S5	624.45	Embankment	13.5	18.0																		
KIN-B003-S6	624.45	Embankment	18.5	23.9	116.4	144.2		54	20	34												
KIN-B004-S1	621.35	Embankment	1	9.1																		
KIN-B004-S2	621.35	Embankment	3.5	12.1			2.664	31	15	16												
KIN-B004-S3	621.35	Embankment	6	9.8							4.0	40.0	56.0									
KIN-B004-S4	621.35	Embankment	8.5	19.3																		
KIN-B004-S7	621.35	Embankment	17	14.6	117.9	135.1		29	15	14							4.1E-08				2.29	1.9
KIN-B004-S8	621.35	Embankment	19	21.6	102.9	125.1		32	18	14	1.6	22.6	75.8	41.0	34.8	CL		1	ND3			
KIN-B005-S1	596.38	Embankment	1	9.8																		
KIN-B007-S1	621.50	Embankment	1	5.5																		
KIN-B007-S2	621.50	Embankment	3.5	8																		
KIN-B007-S3	621.50	Embankment	6	20.8																		
KIN-B007-S4	621.50	Embankment	8.5	6.2																		
KIN-B007-S5	621.50	Embankment	13.5	15																		
KIN-B007-S6	621.50	Embankment	16	19.2				35	20	15							2.6E-06					
KIN-B007-S7	621.50	Embankment	18.5	10.3																		
KIN-B007-S8	621.50	Embankment	23.5	24.9																		
KIN-B008-S2	592.09	Embankment	3.5	25.4																		
KIN-B008-S3	592.09	Embankment	6	22.8																		
KIN-B009-S1	590.39	Embankment	1	20.3																		
KIN-B010-S1	615.29	Embankment	1	4.9																		
KIN-B010-S2	615.29	Embankment	3.5	8.9																		
KIN-B010-S3	615.29	Embankment	6	9.5				23	14	9	11.0	37.7	51.3			CL						
KIN-B010-S4	615.29	Embankment	8.5	11.8	121.5	135.8																
KIN-B010-S5	615.29	Embankment	13.5	19.5																		
KIN-B010-S6	615.29	Embankment	18.5	21.1	105.8	128.1		33	14	19	1.0	15.3	83.7	53.3	30.4	CL		1	ND1			
KIN-B011-S1	617.02	Embankment	1	16.6																		
KIN-B011-S2	617.02	Embankment	3.5	18.6				38	20	18												
KIN-B011-S3	617.02	Embankment	6	17.2				44	18	26												
KIN-B011-S4	617.02	Embankment	8.5	20.4																		
KIN-B011-S5	617.02	Embankment	13.5	22.9	96.0	118.0		58	21	37												

Notes: [1] Results of CIU triaxial tests are presented graphically in the Material Characterization calculation package (Attachment H).
[2] Crumb Test: 1 – Nondispersive, 2 – Intermediate, 3 – Dispersive, 4 – Highly Dispersive; Pinhole Test: ND1 & ND2 – Nondispersive, ND3 & ND4 – Slightly to Moderately Dispersive, D1 & D2 – Dispersive; Double Hydrometer: Dispersion < 30% - Nondispersive, Dispersion > 60% - Dispersive.

Table 4-4
Summary of Laboratory Test Results[1] – Foundation Clay

Boring and Sample ID	Ground Surface Elevation (ft)	Material Description	Sample Depth	Moisture Content	Dry Unit Weight	Total Unit Weight	Specific Gravity	Atterberg Limits			Gradations					USCS	Hydraulic Conductivity	Dispersion[2]			Consolidation	
								Liquid Limit	Plastic Limit	Plasticity Index	Sieve Analysis (3 inch to #200 Sieve)			Hydrometer				Crumb	Pinhole	Double Hydrometer	σ'_{max}	OCR
											Gravel	Sand	Fines	Silt	Clay							
			(ft)	(%)	(pcf)	(pcf)		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)		(cm/sec)			(%)	(tsf)	
KIN-B002-S4	605.23	Foundation Clay	8.5	28.4				48	22	26												
KIN-B002-S5	605.23	Foundation Clay	13.5	26.2																		
KIN-B002-S6	605.23	Foundation Clay	15	27.5	95.2	121.4		41	17	24	0	15.5	84.5	63.7	20.8	CL		1	ND1	47	1.32	1.3
KIN-B002-S7	605.23	Foundation Clay	18.5	27.1																		
KIN-B003-S7	624.45	Foundation Clay	22	21.4	103.5	125.6		47	20	27											3.11	2.2
KIN-B003-S8	624.45	Foundation Clay	24	18.4	109.7	129.9		31	16	15	1.7	36.3	62.0	33.2	28.8	CL		1	ND1			
KIN-B003-S9	624.45	Foundation Clay	28.5	29.7																		
KIN-B003-S10	624.45	Foundation Clay	33.5	25.2				36	19	17												
KIN-B003-S11	624.45	Foundation Clay	35	25.3	97.2	121.8	2.705	54	15	39	0	18.0	82.0	59.2	22.8	CH						
KIN-B003-S12	624.45	Foundation Clay	38.5	26.0				41	18	23												
KIN-B004-S9	621.35	Foundation Clay	23.5	19.0																		
KIN-B004-S10	621.35	Foundation Clay	28.5	29.0				55	22	33												
KIN-B004-S11	621.35	Foundation Clay	30	25.9	100.1	126.0																
KIN-B004-S12	621.35	Foundation Clay	33.5	21.2	111.9	135.6		42	17	25												
KIN-B004-S13	621.35	Foundation Clay	37	21.2	109.6	132.8		43	15	28												
KIN-B005-S2	596.38	Foundation Clay	3.5	29.2																		
KIN-B005-S3	596.38	Foundation Clay	6	23.9	102.5	127.0		35	23	12	0	4.4	95.6	66.2	29.4	CL	5.6E-07	1	ND2			
KIN-B005-S4	596.38	Foundation Clay	8	24.2	101.9	126.6		38	22	16												
KIN-B005-S5	596.38	Foundation Clay	13.5	21.9																		
KIN-B005-S6	596.38	Foundation Clay	16	13.8	122.4	139.3		22	14	8	1.0	56.2	42.8			SC						
KIN-B005-S7	596.38	Foundation Clay	18.5	10.2																		
KIN-B006-S10	618.62	Foundation Clay	28.5	30.4			2.742	36	21	15												
KIN-B006-S11	618.62	Foundation Clay	33.5	28.2																		
KIN-B007-S9	621.50	Foundation Clay	25	22.3																		
KIN-B007-S10	621.50	Foundation Clay	27	10.8																		
KIN-B007-S11	621.50	Foundation Clay	33	22.4	101.5	124.2	2.699	50	15	35	1.0	16.5	82.5	50.7	31.8	CH						
KIN-B007-S13	621.50	Foundation Clay	38.5	13.8							4.0	61.1	34.9									
KIN-B008-S4	592.09	Foundation Clay	8	11.4	125.7	140.0		19	12	7												
KIN-B009-S2	590.39	Foundation Clay	3.5	23.8				42	19	23												
KIN-B009-S3	590.39	Foundation Clay	6	21.3																		
KIN-B009-S4	590.39	Foundation Clay	7.5	19.9	103.2	123.7		28	15	13											2.02	4.1
KIN-B010-S7	615.29	Foundation Clay	20.5	11.8	123.2	137.7		31	15	16												
KIN-B010-S8	615.29	Foundation Clay	23.5	23.3	110.7	136.5																
KIN-B010-S8A	615.29	Foundation Clay	29.4	17.6																		
KIN-B010-S9	615.29	Foundation Clay	28.5	28.9				40	20	20												
KIN-B010-S10	615.29	Foundation Clay	32	20.3	102.0	122.7	2.697	54	14	40	0	32.6	67.4	35.5	31.9	CH					3.25	2.7
KIN-B010-S11	615.29	Foundation Clay	33.5	20.9							0.3	35.5	64.2	31.7	32.5							
KIN-B011-S6	617.02	Foundation Clay	18.5	27.7	110.2	140.7		49	20	29												
KIN-B011-S7	617.02	Foundation Clay	23.5	26.8							0	2.5	97.5	63.4	34.1							
KIN-B011-S8	617.02	Foundation Clay	26.5				2.68	38	19	19											3.5	3.5
KIN-B011-S9	617.02	Foundation Clay	28.5	26.5				40	19	21												
KIN-B011-S10	617.02	Foundation Clay	33.5	25				33	16	17												

Notes: [1] Results of CIU triaxial tests and DSS tests are presented graphically in the Material Characterization calculation package (Attachment H).
[2] Crumb Test: 1 – Nondispersive, 2 – Intermediate, 3 – Dispersive, 4 – Highly Dispersive; Pinhole Test: ND1 & ND2 – Nondispersive, ND3 & ND4 – Slightly to Moderately Dispersive, D1 & D2 – Dispersive; Double Hydrometer: Dispersion < 30% - Nondispersive, Dispersion > 60% - Dispersive.

Table 4-5
Summary of Laboratory Test Results – Till

Boring and Sample ID	Ground Surface Elevation (ft)	Material Description	Sample Depth	Moisture Content	Dry Unit Weight	Total Unit Weight	Specific Gravity	Atterberg Limits			Gradations					USCS
								Liquid Limit	Plastic Limit	Plasticity Index	Sieve Analysis (3 inch to #200 Sieve)			Hydrometer		
											Gravel	Sand	Fines	Silt	Clay	
			(ft)	(%)	(pcf)	(pcf)		(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	
KIN-B001-S8	599.20	Till	18.5	8.9			2.75	23	15	8	3.9	38.1	58.0			CL
KIN-B001-S9	599.20	Till	23.5	8.9												
KIN-B001-S10	599.20	Till	28.5	10.8												
KIN-B002-S8	605.23	Till	23.5	12.6	135.9	153.0		22	14	8						
KIN-B002-S9	605.23	Till	28.5	8.4							0	34.5	65.5			
KIN-B002-S10	605.23	Till	33.5	8.9												
KIN-B002-S11	605.23	Till	38.5	8.8												
KIN-B002-S12	605.23	Till	43.5	11.9							0	35.7	64.3			
KIN-B003-S13	624.45	Till	43.5	9.2												
KIN-B003-S14	624.45	Till	48.5	17.3												
KIN-B004-S14	621.35	Till	43.5	9.0												
KIN-B004-S15	621.35	Till	48.5	7.7												
KIN-B005-S8	596.38	Till	23.5	6.7				20	13	7						
KIN-B005-S9	596.38	Till	28.5	27.7												
KIN-B005-S10	596.38	Till	33.5	7.7												
KIN-B005-S11	596.38	Till	38.5	7.8												
KIN-B005-S12	596.38	Till	43.5	9.5												
KIN-B005-S12A	596.38	Till	42	8.2												
KIN-B005-S13	596.38	Till	52	17.5	110.3	129.6		36	18	18						
KIN-B005-S14	596.38	Till	62	16.6			2.748				0	45.9	54.1			
KIN-B005-S15A	596.38	Till	72	15.2												
KIN-B005-S15B	596.38	Till	72.5	8.4												
KIN-B007-S14	621.50	Till	43.5	11.2				27	14	13						
KIN-B007-S15	621.50	Till	48.5	7.7												
KIN-B008-S5	592.09	Till	13.5	13.3				25	14	11	8.0	40.3	51.7			CL
KIN-B008-S6	592.09	Till	18.5	10.7	130.8	144.8										
KIN-B008-S7	592.09	Till	23.5	7.6												
KIN-B008-S8	592.09	Till	28.5	7.1												
KIN-B009-S5	590.39	Till	13.5	10.3	103.0	113.6										
KIN-B009-S6	590.39	Till	18.5	7.5												
KIN-B009-S7	590.39	Till	23.5	11.5				19	14	5						
KIN-B009-S8	590.39	Till	28.5	9.2	96.5	105.4										
KIN-B010-S12	615.29	Till	38.5	9.8							4.0	51.8	44.2			
KIN-B010-S13	615.29	Till	43.5	10.7												
KIN-B010-S14	615.29	Till	48.5	9.9	135.9	149.4		23	14	9						
KIN-B010-S15	615.29	Till	58.5	9.5												
KIN-B010-S16	615.29	Till	68.5	17												
KIN-B011-S11	617.02	Till	38.5	8.2				23	14	9	5.0	52.1	42.9			SC
KIN-B011-S12	617.02	Till	43.5	9							2.0	38.1	59.9			
KIN-B011-S13	617.02	Till	48.5	9.6												
KIN-B012-S9	605.54	Till	28.5	8.4				19	13	6						
KIN-B012-S10	605.54	Till	33.5	7.1												
KIN-B012-S11	605.54	Till	38.5	14.9							1.0	59.5	39.5			

5. SLOPE STABILITY ANALYSES

Slope stability analyses were performed for varying loading conditions at selected cross-sections, as described in the following sub-sections. Analysis section development, soil material properties, and seismic analyses related to the slope stability analysis are also discussed in the following sub-sections.

5.1. *Cross-Sections for Analysis*

Five cross sections were identified as critical cross sections for the stability evaluation of the ash pond perimeter embankments. Because the foundation conditions underneath the embankments were fairly uniform, the critical analysis section for the west, south, east and north embankments was selected based on height and steepness of the downstream embankment slope. A critical section was also identified in the northwest area of the ash pond, where the effective height of the embankment is increased by the proximity of the lake. The location of each analysis section is listed below and shown on Figure 2-3 (Attachment A):

- Station 18+50: East embankment
- Station 48+50: North embankment.
- Station 63+00: Northwest Area (Lake)
- Station 71+00: West embankment
- Station 94+50: South embankment

The section geometry for each analysis cross-section was determined based on the ground surface topographic contours shown on Figure 2-3 (Attachment A), and subsurface information from the borings and CPT soundings. The relevant CPT soundings and test borings that were used to develop subsurface stratigraphy at the five analysis sections are shown on the geologic sections on Figures 5-1 through 5-5 (Attachment A). The piezometric surfaces for each analysis section were determined based on the normal pool elevation of 603.5 feet in the ash pond, water level readings in the piezometers, and static pore pressure profile determined from the CPT pore pressure dissipation tests. The development of the analysis sections is discussed in Attachment G.

5.2. *Stability Analysis Conditions Considered*

Consistent with the criteria provided in the USEPA CCR Rule § 257.73(e), the stability of the ash pond embankment was evaluated for five load cases:

Static, Steady-State, Normal Pool Condition*:* This case models the embankment under static, long-term conditions, at normal water level within the impoundment. Drained (effective stress) shear strength parameters were used for all materials, and phreatic conditions were estimated based on available piezometer and CPT dissipation test data. ***Target Factor of Safety of 1.50.***

Static, Maximum Surcharge Pool Condition: This case models the conditions under short-term surcharge pool conditions. Undrained (total stress) shear strength parameters were used for fine-grained materials, due to the short-term nature of the surcharge pool duration. It was assumed that the temporary surcharge load was not of a sufficient duration to significantly alter the phreatic surface (i.e. saturation line within the embankment). Therefore, the phreatic surface was modeled equivalent to the steady state case; however, higher pore pressures were applied to saturated materials due to the undrained loading condition. ***Target Factor of Safety of 1.40.***

Seismic Slope Stability Analysis: These analyses incorporate a horizontal seismic coefficient k_h selected to be representative of expected loading during the design earthquake event (i.e., a "pseudostatic" analysis). The analyses utilized peak undrained strength parameters in soils that are not considered to be rapidly draining materials, and peak drained strengths in soils considered to freely drain. The phreatic surface and pore water pressures corresponding to the steady state pool from the static analyses were utilized. ***Target Factor of Safety of 1.00***.

Post-Liquefaction Condition: These analyses were performed at each stability cross section where liquefaction triggering analysis indicates potential liquefaction of granular, non-plastic materials or cyclic softening of fine-grained soils. The purpose of the post-liquefaction stability analysis is to assess stability conditions immediately following a seismic event. No horizontal seismic coefficient is included in these analyses, but selection of strength parameters for the analyses takes into account the potential for softening/ weakening of the soils as a result of pore pressures generated in sand-like materials, or cyclic softening in clay-like materials due to the earthquake shaking. ***Target Factor of Safety of 1.20.***

Sudden Drawdown Conditions: This analysis was performed at Station 63+00 only, where the Kincaid Ash Pond Embankment is adjacent to Sangchris Lake. Sangchris Lake is also adjacent to the embankment near Station 52+00, but the toe elevation of the embankment is approximately 5 ft higher at this location than at Station 63+00 and a rock toe buttress is present. Therefore, Station 63+00 is judged to be a critical cross-section for sudden drawdown conditions due to the geometry of the embankment relative to Station 52+00. The case models the embankment under rapid drawdown of the downstream pool level in Sangchris Lake, where the stabilizing force of the downstream pool is removed from the downstream slope, but phreatic conditions in the embankment are equivalent to the static, steady-state, normal pool condition case. The analysis uses a staged approach (Duncan et al., 1990) with both drained and undrained soil strengths, and two piezometric lines are used. As factor of safety criteria for this analysis case is not included in the USEPA CCR §257.73(e) regulation, a ***Target Factor of Safety of 1.30*** was used, which is listed in USACE EM 1110-2-1902 guidance for drawdown from normal pool (maximum storage pool).

5.3. *Material Properties*

Material properties for slope stability analyses were developed using both laboratory testing data (index and strength testing) and strength correlations from CPT and SPT data. The material characterization is described in Attachment H.

Unit weights for the materials were evaluated using laboratory test results from relatively undisturbed samples. Embankment fill above the phreatic surface was conservatively assigned unit weights and shear strengths consistent with saturated embankment fill, since laboratory testing of samples above the phreatic surface demonstrated saturation values of 80% and above.

Shear strengths for the embankment fill and Foundation Clay layer were evaluated for the normal operating (steady-state) loading condition using results from the consolidated undrained triaxial (CIU) and direct simple shear (DSS) tests. Shear strengths in the embankment and foundation clay were assigned based on the orientation of the failure plane. A shear strength envelope based primarily on the CIU test results was assigned within the embankment and in foundation clays under the embankment footprint, where the failure plane is oriented sub horizontal, consistent with the

failure plane in a CIU test. A shear strength envelope based primarily on the DSS test results was used in the free-field, where the orientation of the failure plane is horizontal or above horizontal, consistent with the orientation of the failure plane in a DSS test. The peak drained shear strengths for the embankment and the foundation clay materials were characterized with a nonlinear strength envelope that assigns the shear strength as a function of the effective normal stress on the failure plane. The nonlinear envelope was curved at lower effective normal stresses, since the laboratory test data indicate that both the compacted embankment material and the native foundation clay are overconsolidated within the lower stress range. The peak undrained strength was characterized as a ratio of undrained shear strength (S_u) to steady-state vertical effective stress before the load is applied (p'). A minimum undrained shear strength was assigned for the undrained failure envelope, based on correlations with CPT data.

Liquefaction triggering analyses (discussed in Section 5.4.2.3), as well as a review of the CPT and laboratory test data, indicate a low potential of liquefaction or cyclic softening of the embankment. Therefore, peak undrained strengths are appropriate for this material under post-liquefaction (or post-earthquake) loading. Based on the results of liquefaction analyses and laboratory cyclic DSS test results, the Foundation Clay layer is susceptible to cyclic softening under the design seismic loading when the cyclic stress ratio induced by the earthquake is greater than 0.14. A post-earthquake strength was assigned to these materials based on the results of the post-cyclic monotonic DSS tests.

For the Impounded Ash and Glacial Till materials, where undisturbed Shelby tube samples were difficult to obtain, unit weights and shear strengths were based on published correlations for SPT and CPT data, and previous experience with similar materials. The shear strengths selected for these materials are conservative with respect to correlated values for the SPT and CPT data, and because the critical surfaces for slope stability analysis did not pass through these materials when they were assigned conservative strengths, refinement of the characterization was not necessary. Based on the results of the liquefaction triggering analysis, the impounded ash is susceptible to liquefaction under the design seismic loading. The ash was therefore assigned a residual undrained shear strength for the post-earthquake loading condition based on correlated values for post-liquefaction residual undrained strength from CPT results. The liquefaction triggering analysis indicates that the glacial till is not susceptible to liquefaction or cyclic softening under the design event. The glacial till was assigned a peak undrained shear strength for post-earthquake loading condition.

Soil strengths for drawdown analyses were developed using the Duncan et al. (1990) approach, as described in Duncan and Wright (2005). This approach uses both drained and undrained (R-envelope) soil strengths to evaluate sudden drawdown slope stability. The R-envelope shear strengths represent undrained shear strength on the slip surface as a function of effective stress on the slip surface prior to drawdown. The staged approach first conducts a slope stability analysis using drained soils strengths under pre-drawdown conditions. Effective stresses on the slip surface are calculated for the pre-drawdown conditions, and the lower of the drained and R-envelope strengths corresponding to the effective stress are then use to calculate the post-drawdown factor of safety without the stabilizing effect of the downstream pool.

The R-envelope strengths were developed converting the S_u/p' peak undrained shear strength ratio, which provides peak undrained shear strength as a ratio of vertical effective stress, to a R-envelope friction angle (ϕ_R) and cohesion (c_R). As the stability analysis software (SLOPE/W) only allows linear drained and R-envelope strengths for drawdown analysis, both of the shear strength envelopes were simplified to a linear envelope by neglecting minimum undrained shear strengths for the R-

envelope and neglecting the overconsolidated curved portions of the drained strength envelope, which are both conservative simplifications.

The material properties developed for use in slope stability analysis are listed in Table 5-1.

Table 5-1
Material Properties for Slope Stability Analyses

Material	Unit Weight (pcf)	Peak Drained Shear Strength		Peak Undrained Shear Strength	Post-Earthquake Shear Strength	Drawdown Undrained Strength (R-Envelope)	
		Cohesion, c' (psf)	Friction Angle, ϕ' (deg)	S_u/p'	S_{ur}/p'	Cohesion, c_R (psf)[3]	Friction Angle, ϕ_r (deg)
Ash	112	0	32	$S_u/p' = 0.40$	$S_{ur}/p' = 0.06$	Peak Drained[4]	
Embankment	135	0	40 *with curved envelope for* $\sigma'_{ff} < 1440$ psf [1]	$S_u/p' = 0.68$, Minimum S_u = 575 psf	Peak Undrained	0.1	34
Foundation Clay (Under Embankment)	125	0	32 *with curved envelope for* $\sigma'_{ff} < 2160$ psf [2]	$S_u/p' = 0.48$, Minimum S_u = 800 psf	$S_{ur}/p' = 0.30$, Minimum S_u = 400 psf	0.1	26
Foundation Clay (Free Field)	125	0	30	$S_u/p' = 0.30$, Minimum S_u = 400 psf	$S_{ur}/p' = 0.30$, Minimum S_u = 400 psf	0.1	17
Till	135	0	40	$S_u/p' = 0.64$, Minimum S_u = 800 psf	Peak Undrained	0.1	33

Notes:

1. Drained strength envelope for the embankment fill material is shown on Figure B.1 (Attachment H). A linear envelope was assumed for drawdown analyses, as SLOPE/W software cannot use a curved envelope for drawdown strength calculations.
2. Drained strength envelope for the foundation clay material (under the embankment) is shown on Figure C.1 (Attachment H).
3. The SLOPE/W software cannot use a cohesion value of 0 for sudden drawdown analysis. Therefore, a nominal cohesion of 0.1 psf was assigned to address this. This value is small enough to not affect the results of the slope stability analysis.
4. Ash material is retained by the embankment and isolated from Sangchris Lake and therefore not subjected to drawdown conditions caused by a lowering of the pool level in Sangchris Lake. Therefore, peak drained strengths are used for ash in drawdown calculations.

5.4. ***Methodology of Analyses***

Limit equilibrium stability analysis was completed using the two-dimensional Slope/W (v. 8.15.1.11236 by GeoStudio) computer program. Factors of safety were calculated using Spencer's method and using both circular and wedge search routines to determine the critical failure surface for each analysis section and load case. The circular search routines included the optimization option, which allows the program to develop non-circular sliding planes through soft layers for the final solution. Shallow, infinite-slope type failure surfaces were neglected as they correspond to sloughing failure which can be addressed as part of regular maintenance. Critical surfaces with respect to dam safety were considered to be those which intersected the dam crest at or upstream of the centerline, which are considered to have the potential to create an immediate threat to dam safety. Pore pressures were assigned as hydrostatic pressure under the piezometric line. Tension cracks were added if necessary to reduce interslice tensile forces for all loading cases except pseudostatic stability. For pseudostatic stability, the short-duration nature of the loading was assumed to prevent a tension crack from opening. Where included, the tension crack was assumed to be full of water.

A brief summary of the analyses is presented in the following sections. A more detailed discussion is provided in Attachment I.

5.4.1. *Static Analysis Conditions*

Static stability was evaluated for steady-state conditions using a normal pool elevation of 603.5 feet, and a maximum flood surcharge pool elevation of 609.9 feet.

5.4.2. *Earthquake Analysis Conditions*

A site specific seismic hazard assessment (PSHA) was performed to identify the earthquake loads at the site, and dynamic response analysis was performed to determine the appropriate seismic loads and material properties for the earthquake stability analysis load cases. Liquefaction triggering analyses were completed to assess the potential for liquefaction or cyclic softening of the materials and determine the appropriate material properties for use in post-liquefaction slope stability analysis.

5.4.2.1. Probabilistic Seismic Hazard Analysis

A site-specific PSHA was completed for the Kincaid Power Station to develop 2,500-year earthquake ground motions for use in liquefaction and dynamic response analyses of the facility. The PSHA results were used to compute a 2,500-yr return period Uniform Hazard Spectrum (UHS) for top of rock (shear wave velocity = 9,200 ft/s). Parameters were developed including magnitude, distance, style of faulting, response spectra, and Arias Intensity for the current study. All seismically capable faults in the project region were considered. Near field and directivity effects were also considered. Because the top of hard rock at the Kincaid site is about 6,500 feet deep, a one-dimensional site response analysis was performed to account for the effect of the overlying soft rock and quaternary glacial till (shear wave velocities ranging from about 2,200 to 8,500 ft/s) and generate a UHS Spectrum for the top of the glacial till layer at this site.

Three sets of time histories were developed for the UHS spectrum at the top of till. The time histories represent the site-specific ground motions associated with the controlling near-field or far-field earthquake event, and consider the magnitude, distance, and Arias Intensity. The site-specific acceleration time histories for top of glacial till were developed for use in two-dimensional dynamic

response analysis to estimate site-specific seismic loads for liquefaction triggering and seismic (pseudo-static) stability analysis.

The calculated site-specific peak ground acceleration (PGA) for a 2,500-year event was 0.12g for top of hard rock and 0.11g for top of glacial till. These values are comparable to the PGA value of 0.11g indicated for the Kincaid site on the USGS website. Because the majority of the PGA hazard at the site comes from background events with moment magnitudes (M) of 5.0 to 6.0, a magnitude of 6.0 is appropriate for use with simplified analysis using seismic loads defined by PGA and M. Details of the PSHA are included in Attachment J.

5.4.2.2. Dynamic Response Analysis

The dynamic response of the ash pond embankments was evaluated by analyzing three of the analysis cross-sections using the most recent version of the finite element program QUAD4M (Hudson et al. 1994). This is a modified version of the program QUAD4, originally developed by Idriss, et al. (1973). The dynamic response analysis was useful for more precisely estimating the amplification / attenuation characteristics of the dam structure and local foundation soils to the design ground motions at the top of glacial till and to estimate site-specific PGA values at the embankment crest and toe for use in liquefaction triggering and seismic (pseudo-static) slope stability analysis. In addition, the dynamic response analysis was used to estimate the cyclic stress ratios (CSR) induced by the earthquake loading at Station 48+50. Input to the dynamic response analyses includes the acceleration time histories developed as part of the PSHA for the Kincaid Power Station.

The QUAD4M program uses a two-dimensional, dynamic finite-element formulation that utilizes equivalent-linear, strain-dependent modulus and damping properties. The program performs a time-domain analysis that allows variable damping throughout the model, and uses an iterative process to approximate the nonlinear behavior of soil. Shear moduli and damping ratios are estimated initially for each element in the model, and the system is analyzed using those properties. After each iteration, values of the effective shear strain are computed and the modulus and damping values are updated to correspond to the computed strain level for each element. The analysis iterations are repeated until compatibility between moduli, damping, and strain levels is achieved in all elements.

Dynamic response analysis was completed for the analysis sections at Station 48+50, 63+00, and 94+50, which were identified as critical sections with respect to seismic stability. The calculated site-specific PGA values for a 2,500-year event were 0.20g at the embankment crest and 0.18g at the embankment toe, which were the highest PGA values from the QUAD4 analysis on all three sections. These values were used to define the earthquake loading for simplified liquefaction triggering analysis and pseudostatic stability analysis for all 5 sections. Because the post-liquefaction factor of safety for Station 48+50 did not meet USEPA CRR criteria using the conservative assumption that the entire Foundation Clay layer would experience cyclic softening, CSR values were estimated separately for this section using QUAD4 to better define the locations where cyclic softening would be expected under the design earthquake load. Details of the dynamic response analysis are included in Attachment K.

5.4.2.3. Seismic Coefficient

Seismic coefficients were calculated for use in the pseudostatic slope stability analysis based on the simplified procedure developed by Makdisi and Seed (1978). For the site-specific value of PGA at the embankment crest of 0.20g and the full-height critical slip surfaces that were identified in the

analysis (presented in Attachment I), a seismic coefficient of 0.07g was used in the pseudo-static analysis.

5.4.2.4. Liquefaction Triggering Analysis

A liquefaction triggering analysis was used to evaluate the potential for liquefaction or cyclic softening under the 2,500-year event. The analysis consists of comparing the calculated cyclic resistance ratio (CRR) from the CPT soundings to the cyclic stress ratio (CSR) calculated from a simplified site response analysis as described in Idriss and Boulanger (2008). The ratio of CRR to CSR is the triggering factor of safety. CRR ratios were calculated for liquefaction resistance of sand-like materials or for cyclic softening resistance of clay-like materials. CSR ratios were calculated using empirical correlations in the triggering analysis based on earthquake magnitude and site-specific PGA values at the ground surface. For calculated triggering factors of safety less than 1.20, the material was considered to be potentially liquefiable. All of the CPT soundings were evaluated for liquefaction triggering potential.

A CPT-based liquefaction evaluation was also performed to evaluate whether the materials would behave in a contractive or dilative manner during loading. This evaluation provides a first-principles approach to soil material behavior under dynamic loading conditions that can be informative for evaluating the liquefaction potential of sand-like materials.

Details of the liquefaction triggering analysis are provided in Attachment L.

6. RESULTS

The calculated factors of safety from the limit equilibrium slope stability analysis satisfy the USEPA CCR Rule § 257.73(e) requirements for all the load cases analyzed at the critical analysis sections for each of the embankments that comprise the perimeter of the ash pond. Load cases analyzed for this study included static (steady-state) normal pool, maximum flood surcharge pool, seismic (pseudo-static), and static post-liquefaction.

6.1. *Results of Static Stability Analyses*

The results of the limit equilibrium slope stability analyses for the static load cases are summarized in Table 6-1: The Slope/W output figures showing the critical slip surfaces and details of the analyses are included in Attachment I.

Table 6-1
Summary of Minimum Slope Stability Factors of Safety for Static Load Cases

Load Case	Program Criteria	Station 18+50	Station 48+50	Station 63+00	Station 71+00	Station 94+50
Steady State (Normal Pool)	FS ≥ 1.50	2.50	1.57	1.63	1.78	2.06
Surcharge Pool (Flood Pool)	FS ≥ 1.40	2.15	1.46	1.63	1.85	1.91

6.2. *Results of Earthquake Stability Analyses*

6.2.1. *Liquefaction Triggering Analysis*

Liquefaction triggering analysis factors of safety calculated for the clay-like embankment fill are above 1.20, indicating that this material is not expected to experience cyclic softening in the design earthquake event. In addition, the static laboratory strength test results do not indicate post-peak softening of the embankment fill, which is also indicative of a material that would not be susceptible to cyclic softening. The embankment fill was therefore assigned peak undrained strengths in the Post-Liquefaction slope stability analysis load case.

Liquefaction triggering analysis factors of safety calculated for the Foundation Clay layer are below 1.20 in a few locations, indicating a potential for cyclic softening of this material in isolated areas for the design earthquake event. In addition, the cyclic DSS tests showed a potential for cyclic softening for CSR values above 0.14. For the majority of the analyses, the entire Foundation Clay material was conservatively assigned residual strengths in the post-liquefaction slope stability analysis load case. However, because the cyclic DSS tests indicated that cyclic softening would only occur for CSR values above 0.14, the liquefaction triggering assessment for Station 48+50 was refined and residual strengths were only applied in the locations where CSR values from dynamic response analysis were above 0.14.

Liquefaction triggering analysis factors of safety calculated for the saturated portion of the Impounded Ash are below 1.2 and indicate a potential for liquefaction of this material for the design event. The results of the CPT-based liquefaction evaluation for the Impounded Ash indicate that the majority of the saturated sand-like material is dilative. Therefore, while the material would undergo pore pressure build up and lose strength during cyclic loading (liquefaction), similar to contractive materials, it may undergo strain hardening more consistent with cyclic mobility, resulting in a higher post-liquefaction strength than contractive materials. However, the strain hardening potential of this material was conservatively neglected and instead a residual strength consistent with contractive material was used in the post-liquefaction slope stability analysis load case.

Liquefaction triggering analysis factors of safety in the Glacial Till are above 1.20 and do not indicate a potential for liquefaction or cyclic softening for the design earthquake event. The Glacial Till was assigned peak undrained shear strengths for the post-earthquake loading condition.

6.2.2. *Slope Stability Analysis*

The results of the slope stability analyses for the seismic load cases are summarized in Table 6-2. The Slope/W output figures showing the critical slip surfaces and details of the analyses are included in Attachment I.

Table 6-2
Summary of Minimum Slope Stability Factors of Safety for Earthquake Load Cases

Load Case	Program Criteria	Station 18+50	Station 48+50	Station 63+00	Station 71+00	Station 94+50
Seismic (Pseudostatic)	FS ≥ 1.00	1.69	1.27	1.46	1.65	1.54
Post-Liquefaction	FS ≥ 1.20	1.76	1.50	1.43	1.52	1.54

6.2.3. Results of Sudden Drawdown Stability Analyses

The result of the slope stability analysis for the sudden drawdown load case is summarized in Table 6-3. The Slope/W output figures showing the critical slip surfaces and details of the analyses are included in Attachment M.

Table 6-3
Summary of Minimum Slope Stability Factor of Safety from Sudden Drawdown Load Case

Load Case	Program Criteria	Station 63+00
Sudden Drawdown	FS ≥ 1.30	1.41

7. CONCLUSIONS

The calculated factors of safety from the limit equilibrium slope stability analysis satisfy the USEPA CCR Rule § 257.73(e) requirements for all the load cases analyzed at the critical analysis sections for each of the embankments that comprise the perimeter of the impoundment. Load cases analyzed for this study included static (steady-state) normal pool, maximum flood surcharge pool, seismic (pseudo-static), and static post-liquefaction.

8. LIMITATIONS

Background information, design basis, and other data have been furnished to AECOM by Dynegy. AECOM has used this data in preparing this report. AECOM has relied on this information as furnished, and is not responsible for the accuracy of this information.

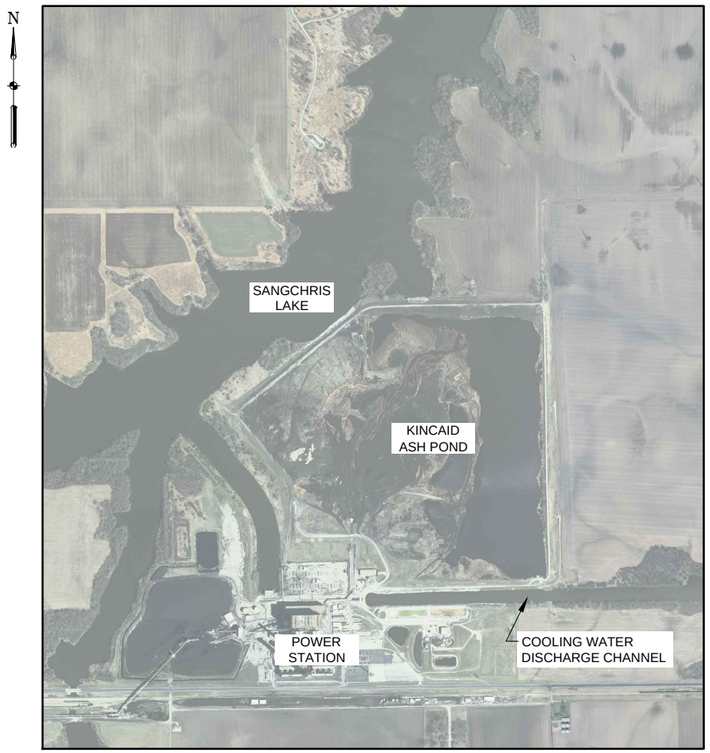
Borings have been spaced as closely as economically feasible, but variations in soil properties between borings, that may become evident at a later date, are possible. The conclusions developed in this report are based on the assumption that the subsurface soil, rock, and groundwater conditions do not deviate appreciably from those encountered in the site-specific exploratory borings. If any variations or undesirable conditions are encountered in any future exploration, we should be notified so that additional analyses can be made, if necessary.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. The conclusions and recommendations are based on AECOM's understanding of current plant operations, maintenance, stormwater handling, and ash handling procedures at the station, as provided by Dynegy. Changes in any of these operations or procedures may invalidate the findings in this report until AECOM has had the opportunity to review the findings, and revise the report if necessary.

This geotechnical investigation was performed in accordance with the standard of care commonly used as state-of-practice in our profession. Specifically, our services have been performed in accordance with accepted principles and practices of the geological and geotechnical engineering profession. The conclusions presented in this report are professional opinions based on the indicated project criteria and data available at the time this report was prepared. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

Attachment A. Figures

LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

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

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

GEOTECHNICAL REPORT
ASH POND

ISSUED FOR BIDDING — DATE BY

ISSUED FOR CONSTRUCTION — DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
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AECOM PROJECT NO:	
DRAWN BY:	GJH
DESIGNED BY:	EJV
CHECKED BY:	MCR
DATE CREATED:	12/23/2015
PLOT DATE:	2/9/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

LOCATION MAP &
SITE VICINITY MAP

1-1
SHEET 1 OF 4

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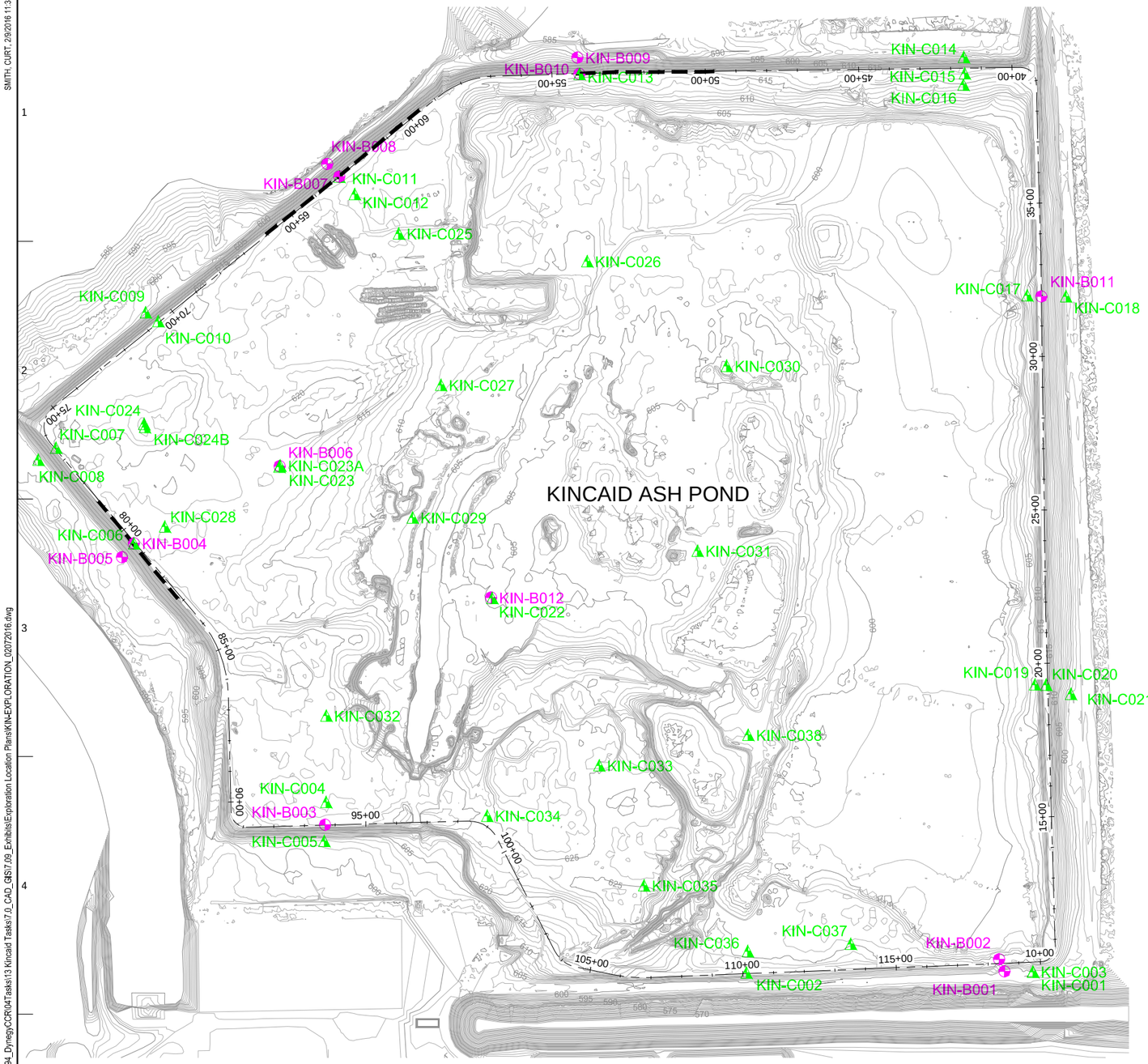

LEGEND

KIN-B000 — AECOM BORING LOCATION

KIN-C000 — AECOM CONE PENETROMETER TESTING LOCATION

— — — LOCATION OF GEOPHYSICAL INVESTIGATION

NOTES:

1. CONTOURS ARE 2 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. GROUND CONTOURS ARE INTERPRETED FROM HISTORIC TOPOGRAPHIC MAPS PROVIDED BY DYNEGY, RECENT GROUND SHOTS BY AECOM, AND FINAL RESULTS OF LIDAR SURVEYING PERFORMED BY SURDEX CORPORATION IN AUGUST 2015.
4. BATHYMETRY CONTOURS ARE BASED ON A BATHYMETRIC SURVEY PERFORMED BY WEAVER CONSULTANTS IN OCTOBER 2015.
5. STATION 10+00 IS THE BEGINNING OF STATIONING.

N

0 200 400 600

SCALE IN FEET

AECOM
1001 Highlands Plaza Drive, Suite 300
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1500 East Port Plaza Drive
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CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

GEOTECHNICAL REPORT
ASH POND

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AECOM PROJECT NO:	
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PLOT DATE:	2/9/2016
SCALE:	AS SHOWN
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SHEET TITLE

EXPLORATION LOCATIONS

2-1

SHEET 2 OF 4

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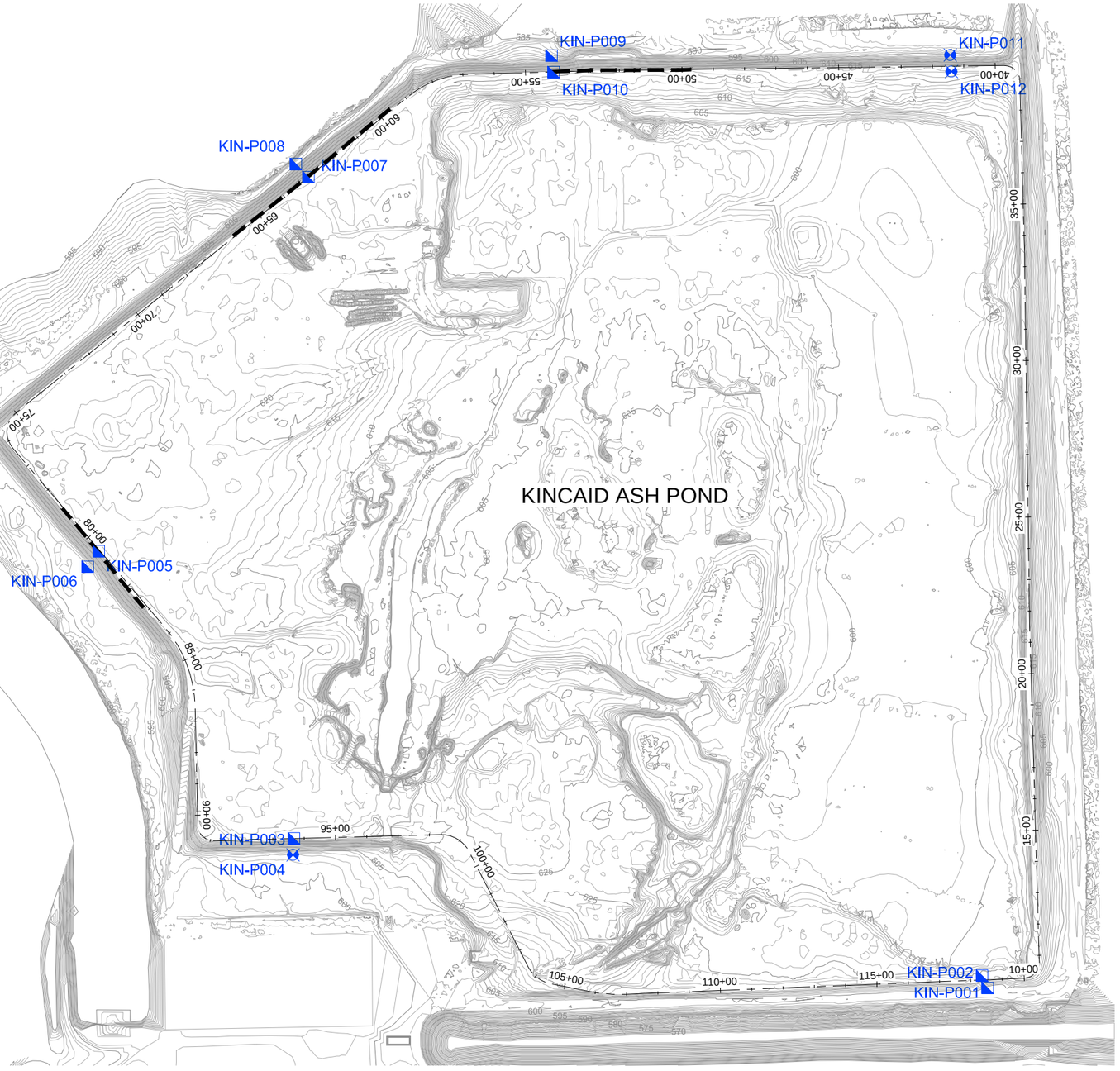

LEGEND

KIN-P000 AECOM PIEZOMETER LOCATION

KIN-P000 AECOM VIBRATING WIRE PIEZOMETER (VWP) LOCATION

NOTES:

1. CONTOURS ARE 2 FOOT ELEVATION INTERVALS.
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4. BATHYMETRY CONTOURS ARE BASED ON A BATHYMETRIC SURVEY PERFORMED BY WEAVER CONSULTANTS IN OCTOBER 2015.
5. STATION 10+00 IS THE BEGINNING OF STATIONING.

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CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

GEOTECHNICAL REPORT
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DRAWN BY:	GJH
DESIGNED BY:	EJV
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DATE CREATED:	12/23/2015
PLOT DATE:	2/9/2016
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ACAD VER:	2014

SHEET TITLE

PIEZOMETER LOCATIONS

2-2

SHEET 3 OF 4

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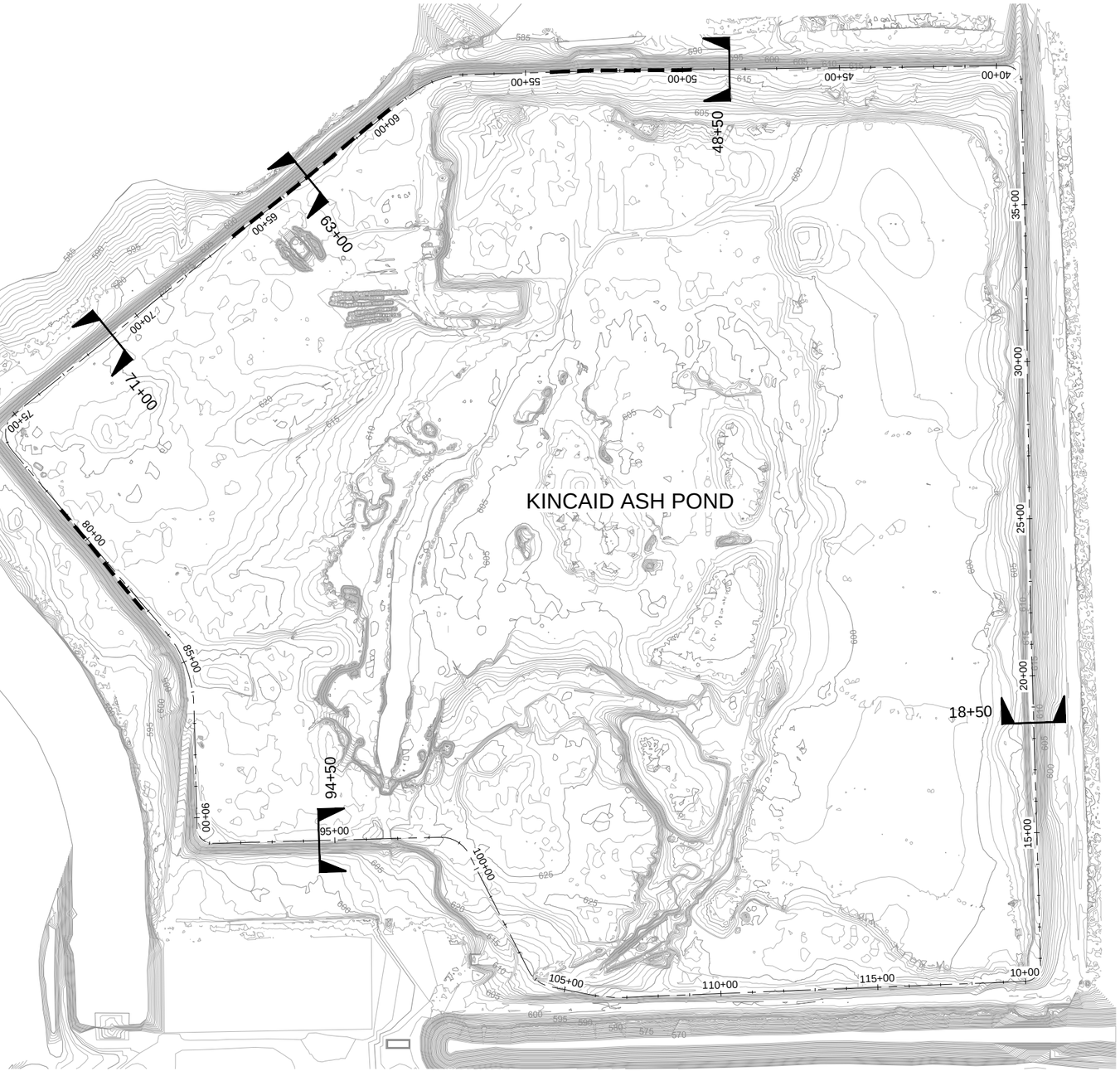

LEGEND

STUDY SECTION

NOTES:

1. CONTOURS ARE 2 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. GROUND CONTOURS ARE INTERPRETED FROM HISTORIC TOPOGRAPHIC MAPS PROVIDED BY DYNEGY, RECENT GROUND SHOTS BY AECOM, AND FINAL RESULTS OF LIDAR SURVEYING PERFORMED BY SURDEX CORPORATION IN AUGUST 2015.
4. BATHYMETRY CONTOURS ARE BASED ON A BATHYMETRIC SURVEY PERFORMED BY WEAVER CONSULTANTS IN OCTOBER 2015.
5. STATION 10+00 IS THE BEGINNING OF STATIONING.

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GEOTECHNICAL REPORT
ASH POND

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REVISIONS

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AECOM PROJECT NO:	
DRAWN BY:	GJH
DESIGNED BY:	EJV
CHECKED BY:	MCR
DATE CREATED:	12/23/2015
PLOT DATE:	2/9/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

CROSS SECTION LOCATIONS

2-3

SHEET 4 OF 4

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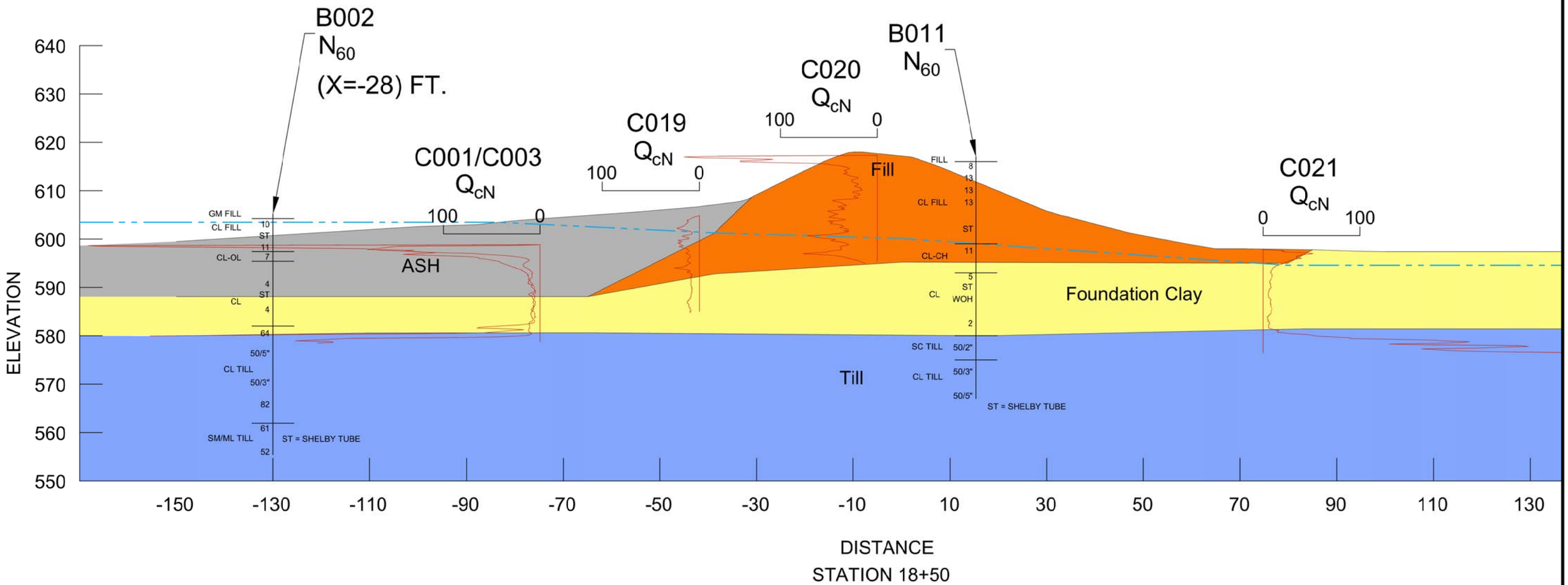

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 18+50	FIGURE 5-1
AECOM			

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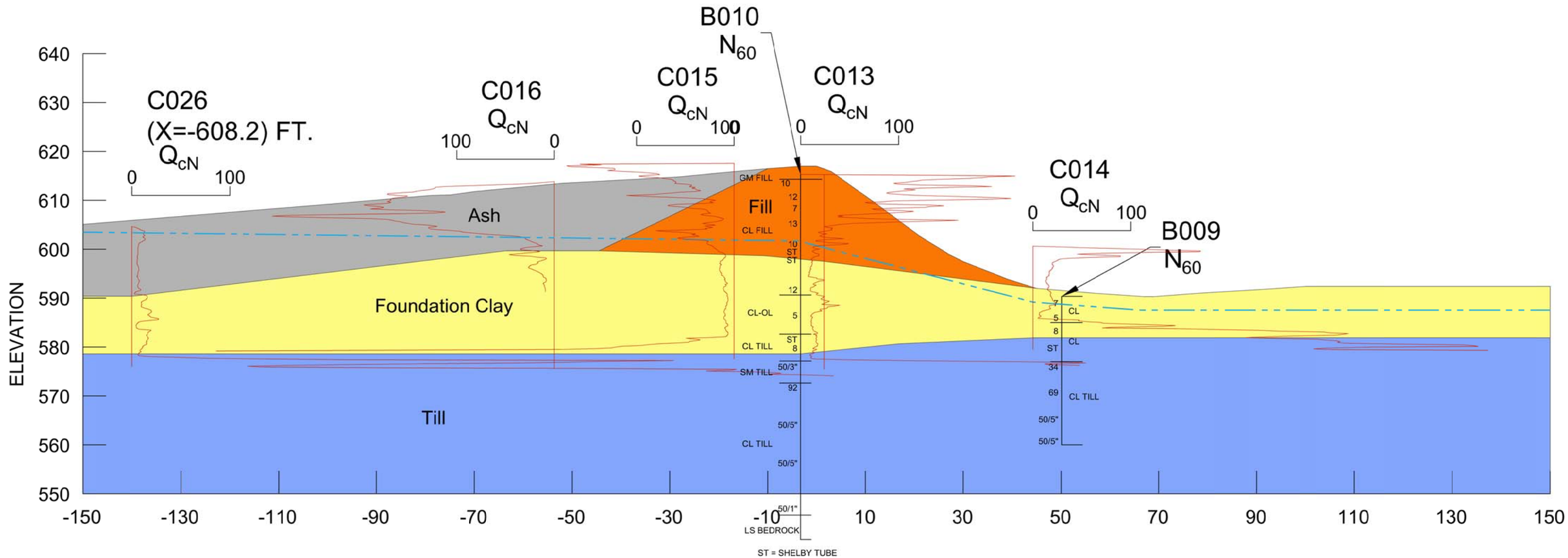

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 48+50	FIGURE 5-2
AECOM			

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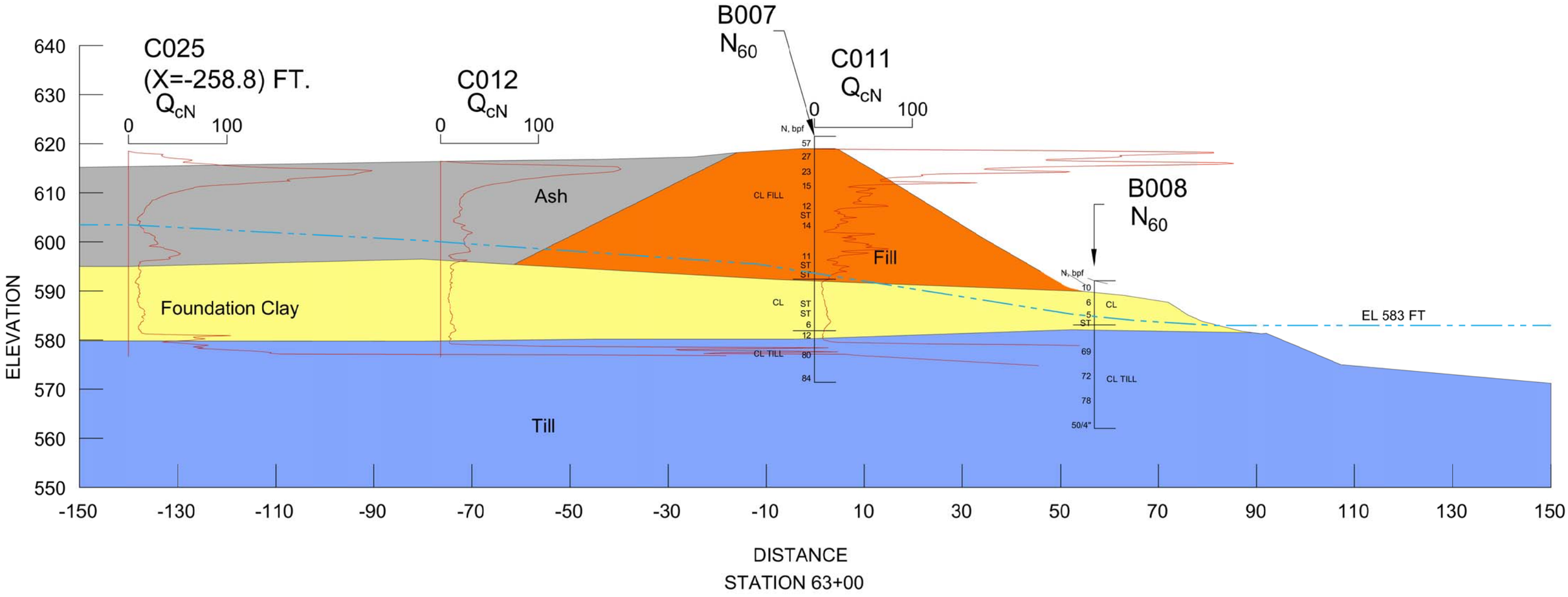

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 63+00	FIGURE 5-3
AECOM			

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C023
(X=-612.3) FT.
Q_{cN}
0 100

C024b
(X=-237.3) FT.
Q_{cN}
0 100

C024
(X=-228.0) FT.
Q_{cN}
0 100

C010
Q_{cN}
0 100

C009
Q_{cN}
0 100

Ash

Fill

Foundation Clay

Till

ELEVATION

640
630
620
610
600
590
580
570
560
550

-150 -130 -110 -90 -70 -50 -30 -10 10 30 50 70 90 110 130 150

DISTANCE
STATION 71+00

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 71+00	FIGURE 5-4
AECOM			

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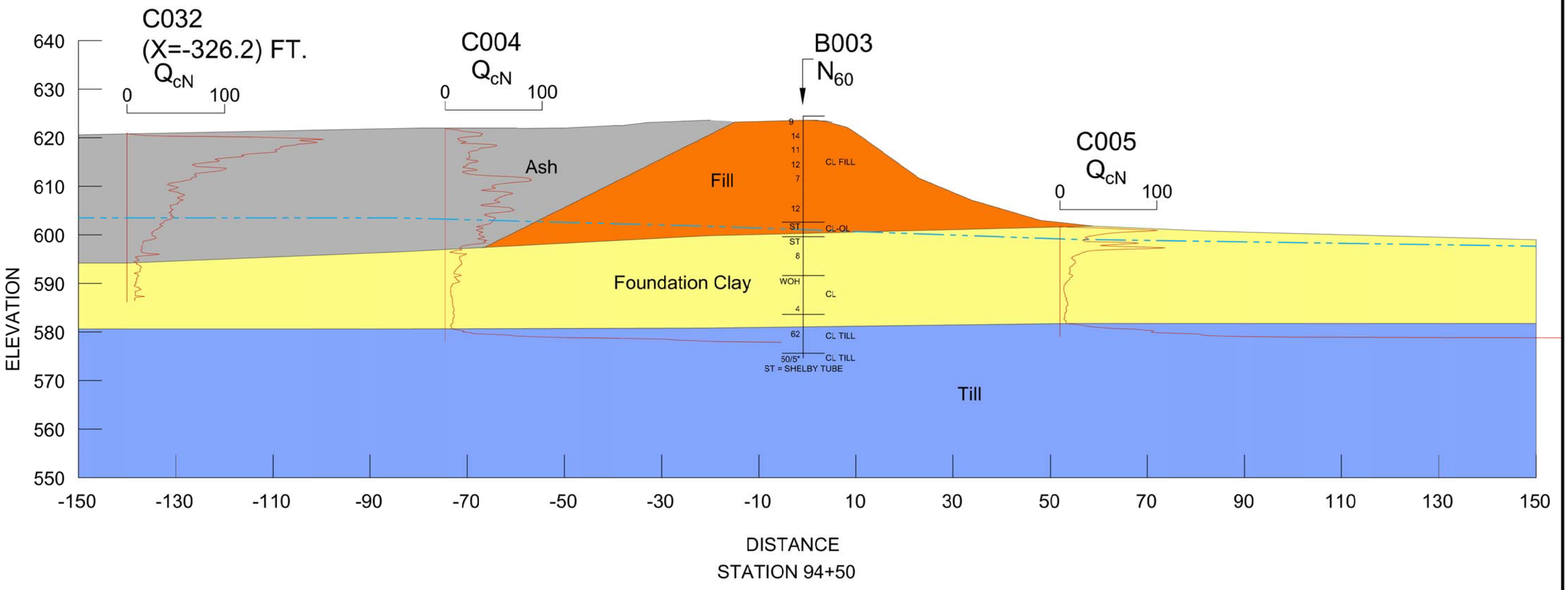

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 94+50	FIGURE 5-5
	AECOM		

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Attachment B. Boring Logs

Project:	DYNEGY CCR RULE ASSESSMENT OF PLANTS	**Key to Soil Boring Logs**
Project Location:	KINCAID POWER STATION CHRISTIAN COUNTY, ILLINOIS	
Project Number:	60480698	

	Graphic Symbol	Description	USCS Classification
SAND AND GRAVEL		SAND poorly graded	SP
		Silty SAND	SM
		Clayey SAND	SC
LOW PLASTIC SILTS AND CLAYS		Inorganic low plastic SILT	ML
		Inorganic low plastic CLAY	CL
HIGH PLASTIC CLAYS		Inorganic high plastic CLAY	CH
ROCKS		LIMESTONE	
		SHALE	
SURFACE MATERIAL		Ash	

NOTE: Dual classifications on the logs (eg. SP–SC) are represented by two graphical patterns.

TERMS DESCRIBING DENSITY OR CONSISTENCY

Coarse grained soils (major portion retained on No. 200 sieve) include gravels and sands. Density is based on the Standard Penetration Test (SPT).

Density	SPT blows per foot
Very loose	0 – 5
Loose	5 – 10
Medium dense	10 – 30
Dense	30 – 50
Very dense	Greater than 50

Fine grained soils (major portion passing No. 200 sieve) include clays and silts. Consistency is rated according to shearing strength, as indicated by uncorrected SPT blows per foot.

Descriptive Term	SPT blows per foot	Estimated undrained shear strength (ksf)	Hand Test
Very soft	0–2	< 0.25	Extrudes between fingers
Soft	2–4	0.25–0.5	Molded by slight pressure
Medium stiff	4–8	0.5–1.0	Molded by strong pressure
Stiff	8–15	1.0–2.0	Indented by thumb
Very stiff	15–30	2.0–4.0	Indented by thumbnail
Hard	> 30	> 4.0	Difficult to indent

LEGEND AND NOMENCLATURE

Standard penetration split spoon test sample

Undisturbed shelby tube sample

PP qu	Pocket penetrometer unconfined compressive strength
NMC	Natural Moisture Content, %
LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
NP	Non–plastic
▽	Depth Groundwater enters at time of drilling.
▼	Groundwater Level at some specified time after drilling
Su	Undrained Shear Strength
TXUU	Triaxial Unconsolidated Undrained
DTW	Depth to water
N/A	Not Applicable

SAMPLING RESISTANCE

P	Sample pushed by hydraulic rig action.
3 6 9	Numbers indicate blows per 6 in. of sampler penetration. Standard penetration test sampler, (2–in O.D.) and oversize penetration sample (3–in O.D.) are driven by a 140 lb hammer falling freely 30–in
50/2	Number of blows (50) used to drive a penetration sampler a certain number of inches (2)
WOH	Weight of hammer
WOR	Weight of rods

ABBREVIATIONS USED UNDER "REMARKS"

HSA	Hollow Stem Auger	No.	Number
ATD	At Time of Drilling	CIU	Isotropically Consolidated Undrained
AD	After Drilling	ST	Shelby Tube
ID	Inside Diameter	SS	Split Spoon
OD	Outside Diameter		
RQD	Rock Quality Designation		
-#200	(% Pass #200 Sieve)		
Sa (%)	Sieve Analysis (% Passing #200)		

AECOM

Filename: N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_0017.0_CAD_GIS\7.05_WORKING_FILES\FIELD EXPLORATION\KINCAID\KINCAID SOIL LOG KEY.DWG

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Date(s) Drilled	08/14/2015 8:20 AM to 08/14/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	599.204 ft NAVD 88
Borehole Backfill	Piezometer KIN-P001	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066425.165 E 2487814.897 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 599.2 / Depth (feet) 0.0								
			S1	6 6 7	100		Medium dense, brown and gray, low plasticity, CLAY with fine to medium sand, trace fine gravel, with topsoil and roots, (CL) (EMBANKMENT FILL)	11.8				3.0			
595			S2	6 6 6	0										*Rock blocked S2.*
	5						593.2 / 6.0								
			S3	4 5 7	83		Stiff, moist, brown, low plasticity, CLAY with sand, with topsoil, (CL) (EMBANKMENT FILL)	20.8		39	16	4.0			
590			S4	2 2 3	0										
	10						587.2 / 12.0								
			S5				Stiff, gray, low plasticity, silty CLAY, (CL) with reddish brown silt seams, trace fine sand								
585			S6		0										
	15		S7												
							581.2 / 18.0								
			S8	12 24 32	100		Hard, very moist, brown and gray, low plasticity, sandy silty CLAY with orange brown silt seams, trace fine gravel, (CL) (TILL)	8.9		23	8	> 4.5			*Shelby tube refusal at 18 ft.*
580	20														
575							Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
	25		S9	26 50 / 5"	67			8.9				> 4.5			
570			S10	27 41 50 / 4 "	59		Hard, wet, gray, low plasticity, sandy CLAY (CL) (TILL)	10.8				4.5			*Installed Piezometer KIN - P001 in boring.*
	30						569.2 / 30.0								

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:26:12 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					End of Boring at 30 ft								
565	35													
560	40													
555	45													
550	50													
545	55													
540	60													
535	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:26:12 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Date(s) Drilled	08/12/2015 9:00 AM to 08/13/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	605.234 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P002 5 ft East of KIN-B002)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066464.224 E 2487797.168 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
605	0						605.2 / 0.0								
							Moist, light gray, sandy GRAVEL, trace silt, (GM) (FILL)								
							604.2 / 1.0								
		S	S1	3 5 5	78		Stiff, moist, brown and gray, low plasticity, CLAY, trace sand and gravel with topsoil and roots, (CL) (EMBANKEMENT FILL)	18.1				3.5			
		S	S2		71			19.0	130.7	38	21				
600	5														
		S	S3	2 5 6	100		Stiff, moist, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	13.9				3.5			
							597.2 / 8.0								
		S	S4	2 3 4	94		Medium stiff, moist, dark gray, medium plasticity, CLAY with topsoil, (CL)	28.4		48	26	0.5			*Organic content 5.9%.*
595	10														
		S	S5	2 2 2	100		Soft, wet, brown and gray, medium plasticity, CLAY, (CL)	26.2				1.5			
590	15														
		S	S6		100		Gray and yellowish brown, trace dark gray, medium plasticity, CLAY, trace sand and gravel, (CL)	27.5	121.4	41	24				
		S	S7	WOH 2 2	100		Soft, very wet, brown and gray, medium plasticity, CLAY, trace fine sand, (CL)	27.1				0.5			
585	20														
							582.2 / 23.0								
		S	S8	12 23 41	78		Hard, very moist to wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	12.6	153.0	22	8	> 4.5			*Shelby tube refusal at 23' bgs. No recovery.*
580	25														
		S	S9	30 41 50 / 5"	94		Hard, wet, gray, low plasticity, sandy CLAY, (CL) (TILL)	8.4				> 4.5			
	30														

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
575	30													
														8/12/15
570	35	S10	16 41 50 / 3"	78		Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	8.9				> 4.5			*Rig needs to be repaired at site, work stopped 12 N.*
														8/13/15
		S11	10 32 50	89			8.8				> 4.5			*Work continued on hole at 9:45 a.m.*
565	40													
														Switch to Rotary drilling.
		S12	27 27 34	100		Hard, very wet, brown and gray, low plasticity, sandy CLAY, (CL) (TILL)	11.9				> 4.5			
560	45													
		S13	17 23 29			Hard, wet, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
555	50					555.2 / 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P002 with 5 ft offset to the East. Coordinates shown are for Boring KIN-B002.*
550	55													
545	60													
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Sheet 1 of 2

Date(s) Drilled	08/14/2015 1:20 PM to 08/15/2015 3:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	624.454 ft NAVD 88
Borehole Backfill	Piezometer KIN-P003	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066902.847 E 2485599.511 (ft NAD83)	Groundwater Level(s)	29 ft on 8/14/2015 1:20:00 PM		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 624.5 / Depth (feet) 0.0								
		S	S1	4 4 5	94		Stiff, brown and gray, low plasticity, CLAY with fine to coarse sand, trace fine gravel with roots and topsoil, (CL) (EMBANKMENT FILL)	11.6				> 4.5			
620	5	S	S2	3 4 10	94		Stiff, brown and gray, low plasticity, CLAY with fine to medium sand, trace fine gravel, (CL) (EMBANKMENT FILL)	15.5				> 4.5			
		S	S3	3 4 7	100			16.4				> 4.5			
615	10	S	S4	3 5 7	72		Stiff, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.5				3.0			
610	15	S	S5	3 4 5	100		Stiff, moist, brown and gray, low plasticity, CLAY, trace fine to medium sand, (CL) (EMBANKMENT FILL)	18.0				1.5			
							Elevation (feet) 606.0 / Depth (feet) 18.5								
605	20	S	S6	3 5 7	100		Stiff, moist, brown and gray, high plasticity, CLAY, trace fine to medium sand, (CH) (EMBANKMENT FILL)	23.9	144.2	54	34	2.0			
							Elevation (feet) 602.5 / Depth (feet) 22.0								
		S	S7		100		Moist, dark grayish brown with gray and olive, trace yellowish brown, medium plasticity, CLAY with sand, with organics (CL)	21.4	125.6	47	27				
600	25	S	S8		92		Stiff to very stiff, moist, grayish green, low plasticity, sandy CLAY, trace fine gravel with reddish brown silt seams (CL)	18.4	129.9	31	15				
							Elevation (feet) 595.5 / Depth (feet) 29.0								
595	30	S	S9	3 4 4			Medium stiff, wet, brown and gray, low plasticity, CLAY, (CL)	29.7							

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					591.5 / 33.0 Very soft, very wet, brown and gray, low plasticity, CLAY, trace fine sand, with reddish brown silt seams, (CL)								
590		S10	WOH WOH 1	100			25.2		36	17	0.5			
	35	S11		96										
585		S12	WOH 1 3	100		Soft, very wet, brown and gray, medium plasticity, sandy CLAY (CL)	26.0		41	23	0.5			
	40					583.5 / 41.0 Hard, gray, medium plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
580		S13	7 16 46	100			9.2				> 4.5			
	45													
575		S14	19 19 50 / 5"			575.5 / 49.0 Very dense, very wet, brown and gray, silty fine to medium SAND, trace clay and fine gravel (SM) (TILL) 574.5 / 50.0	17.3				2.0			
	50					End of Boring at 50 ft								*Installed Piezometer KIN-P003 in boring.*
570														
	55													
565														
	60													
560														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Sheet 1 of 2

Date(s) Drilled	08/18/2015 3:50 PM to 08/19/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.345 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout Piezometer KIN-P005	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067820.182 E 2484976.546 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 621.3 / Depth (feet) 0.0								
620	0	S1		9 9 9	72		Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.1				> 4.5			
	5	S2		4 6 10	100		Very stiff, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	12.1		31	16	> 4.5			
615		S3		4 3 4	61		Medium stiff, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.8							
	10	S4		2 2 3	67		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel with reddish brown silt seams (CL) (EMBANKMENT FILL)	19.3				1.25			
610															*No S5 Sample.*
	15	S6		6 7 7	0										
605		S7			79		Stiff, moist, dark grayish brown with dark yellowish brown, low plasticity, CLAY with sand, with reddish brown silt seams (CL) (EMBANKMENT FILL)	14.6	135.1	29	14				
	20	S8			92		Dark brown and green, low plasticity, CLAY with sand (CL) (EMBANKMENT FILL)	21.6	125.1	32	14				
600							599.3 / 22.0								
		S9		4 9 10	100		Very stiff, moist, brown and gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel, with organics (CL)	19.0				2.5			
	25						596.3 / 25.0 Very stiff, moist, greenish gray, high plasticity, silty CLAY, (CH).								
595															
		S10		2 4 5	100		Stiff, moist, brown and dark brown, high plasticity, CLAY (CH)	29.0		55	33	2.0			
	30						591.3 / 30.0								

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	S11		100		Brown and gray, CLAY (CL)	25.9	126.0						
590														
		S12	WOH 2 3	100		Medium stiff, wet, brown and gray, medium plasticity, CLAY with reddish orange silt seams (CL)	21.2	135.6	42	25	1.0			
	35													
585														
		S13				Brown and gray, medium plasticity, CLAY, trace fine gravel (CL)	21.2	132.8	43	28				
														ST refusal at 39 ft.
	40													
580														
		S14	20 50 / 3"	67		577.3 44.0 Hard, wet, brown and gray, medium plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	9.0				> 4.5			
	45													
575														
		S15	25 30 33			Hard, very moist, brownish gray, medium plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					571.3 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P005 in boring.*
570														
	55													
565														
	60													
560														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Sheet 1 of 3

Date(s) Drilled	08/21/2015 8:00 AM to 08/23/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Mud Rotary / Rock Core	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	85.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	596.38 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P006 5 ft Southeast of KIN-B005)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067774.633 E 2484937.386 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 596.4 / Depth (feet) 0.0								
	0						Stiff, moist, brown and gray with dark brown, low plasticity, CLAY, with fine to coarse sand (CL) (EMBANKMENT FILL)							
595		S1	2 4 6		83			9.8				4.5			
							593.4 / 3.0								
		S2	2 3 4		100		Medium stiff, moist, brown and gray, low plasticity, CLAY with silt seams (CL)	29.2				2.5			
	5						590.4 / 6.0								
590		S3			92		Grayish brown, low plasticity, CLAY, trace sand (CL)	23.9	127.0	35	12	1.5			
		S4			83		Stiff, moist, grayish brown, low plasticity, CLAY with sand, with reddish brown silt seams (CL).	24.2	126.6	38	16	1.25			
	10														
585															
		S5	2 2 2		100		Soft, very moist to wet, brown and gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel, (CL)	21.9				1.0			
	15														
580		S6			100		579.4 / 17.0	13.8	139.3	22	8	> 4.5			
							Brown and gray, low plasticity, clayey SAND, trace fine gravel, with reddish brown silt seams, (SC) 577.9 / 18.5								
		S7	5 6 8		78		Stiff, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL)	10.2				> 4.5			
	20														
575							572.9 / 23.5								
		S8	22 29 35		100		Hard, moist, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	6.7		20	7	2.0			
	25														
570							567.9 / 28.5								
		S9	6 10 14		100		Very stiff, dry, brownish gray, low plasticity, shaley CLAY, trace silt seams (CL)	27.7				3.5			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													
565														
		S10	13 18 23	100		562.4 / 34.0 Hard, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	35													
560														
		S11	16 24 30	100		Hard, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.8				> 4.5			
	40													
555														
		S12A	12 23 36	100			8.2				> 4.5			*Auger head broke at 10 a.m. Restart 8/23/15. Grout hole; offset 8 ft. SE, set 14 ft. HSA as casing, drill mud rotary and start sampling at 42 ft (S 12A).*
		S12	20 23 30	100			9.5				> 4.5			
	45													
550														
	50													
545														
		S13	8 14 21	100		Hard, brown, low plasticity, CLAY, trace fine sand (CL) (TILL)	17.5	129.6	36	18	> 4.5			
	55													
540														
	60													
535														
		S14	10 16 26	94		Hard, very wet, brown and gray, low plasticity, sandy CLAY (CL) (TILL)	16.6				> 4.5			
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
530																
	70															
525							524.9	71.5								
						Hard, gray, low plasticity, shaley CLAY, trace fine gravel (CL) (TILL)	523.9	72.5								
		S15A	23 50 / 5"	72		Very soft, gray, low plasticity, sandy shaley CLAY, trace fine gravel, (CL) (BEDROCK)			15.2 8.4				> 4.5			
	75						521.4	75.0								*Switch to roller bit. Hard drilling 74 - 75'. Rollerbit refusal at 75 ft. Start wireline coring on 8/24/15.*
520						Limestone, hard, medium strong, light to medium gray. qu = 6,500 psi (75.9 - 76.5 ft)			1.0	163.6						
		C1	79	100												
	80						516.8	79.6								
515						SHALE, very soft, laminated, waxy, dark gray SHALE, moderately hard, laminated, black										
		C2	53	91					8.4	116.3						
	85						511.4	85.0								*Installed Piezometer KIN-P006 with 5 ft offset to the Southeast. Coordinates shown are for Boring KIN-B005.*
510						End of Boring at 85 ft										
	90															
505																
	95															
500																
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Date(s) Drilled	08/14/2015 9:30 AM to 08/18/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Cased, Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	41.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	618.622 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1068071.624 E 2485451.262 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					618.6 / 0.0 Dry, black, fine to coarse grained sand (cinders) (ASH)								
		S1	3 3 3	100		Loose, wet, brown and gray, sand (cinders) with clayey silt (ASH)	34.2							
615						615.1 / 3.5								
		S2	WOH 1 WOH	100		Very soft, wet, brown with black, low plasticity, CLAY, with cinders (CL)	71.4				0.5			
	5	S3		0										
610		S4		100		Very wet, dark brown, low plasticity, fine to medium grained sandy CLAY with ash (CL)								*Piston sample.*
	10	S5	WOH	100		Very soft, very wet, dark brown and gray, low plasticity, sandy CLAY, with organics, with ash (CL)	48.0				0.25			
605		S6		47		603.6 / 15.0								*Piston sample. 8/14/15 12:05 work stopped.*
	15					Very loose, wet, coarse grained sand (cinders) (ASH)								
		S7	1 1 1	100		Very loose, very wet, dark brown sand (cinders), with organics and clay (ASH)	38.5							
600														*8/18/15 9:15 work resumed.*
	20	S8		0										*Piston sample.*
		S9		100		Very loose, very wet, black, fine to coarse grained sand (cinders) (ASH)								
595						Very loose, wet, coarse grained sand (cinders) (ASH)								
	25													
590		S10	2 2 3	56		589.6 / 29.0 Medium stiff, very wet, brown and gray, low plasticity, CLAY, trace fine sand, with reddish	30.4		36	15	1.0			
	30													

Report: GEO_SOIL; File \\USDEN5FP0001\GEOCIVIL$\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/8/2016 2:53:00

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					brown silt seams (CL)								
						585.1 / 33.5								
585		S11	WOH 2 3	100		Medium stiff, very wet, low plasticity, CLAY, with reddish brown silt seams (CL)	28.2				1.0			
	35													
		S12		100										
580														
	40	S13		46										
						577.6 / 41.0								
						End of Boring at 41 ft								
575														
	45													
570														
	50													
565														
	55													
560														
	60													
555														
	65													

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Sheet 1 of 2

Date(s) Drilled	08/20/2015 11:35 AM to 08/20/2015 2:15 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.499 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P007 adj. to KIN-B007).	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069015.221 E 2485646.034 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
	0						621.5 / 0.0 Hard, dry, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)								
620		S1	21 26 31		78			5.5				> 4.5			
		S2	9 12 15		100		617.5 / 4.0 Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	8.0				> 4.5			
	5														
615		S3	20 15 8		100			20.8				> 4.5			
							613.0 / 8.5								
		S4	4 6 9		100		Stiff, moist, brown to dark brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	6.2				3.0			*Organic content 3.9%.*
	10														
610															
		S5	4 5 7		100			15.0				4.25			
	15														
605		S6			83		Green, brown and gray, low plasticity, CLAY, with sand (CL) (EMBANKMENT FILL)			35	15				
		S7	3 6 8		100		Stiff, very moist, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	10.3				3.0			
	20														
600															
		S8	3 5 6		100		597.5 / 24.0 Stiff, very moist, brown and gray with dark gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel (CL) (EMBANKMENT FILL)	24.9				1.5			
	25						596.5 / 25.0 Soft, grayish brown, silty CLAY (CL)								
		S9			100							0.5			
595		S10			100		Medium stiff, very moist, brown to light brown, low plasticity, sandy CLAY, trace silt, trace fine gravel, with roots (CL)	10.8				1.0			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	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
590	30															
		S11		100				Medium stiff, wet, light brown, low plasticity, sandy CLAY (CL)								
585	35	S12		100												
						583.5	38.0									
		S13	WOH WOH 6	67				Very loose, very wet, brown, low plasticity, clayey SAND, trace fine gravel (SC)	13.8				0.75			
580	40					582.0	39.5	Medium stiff, wet, light brown, low plasticity, sandy CLAY, trace silt (CL) (TILL)								
		S14	24 38 42	100				Hard, very wet, gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	11.2		27	13	> 4.5			
575	45															
		S15	25 34 50					Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					571.5	50.0	End of Boring at 50 ft								*Installed Piezometer KIN-P007 with offset. Coordinates shown are for Boring KIN-B007.*
570																
	55															
565																
	60															
560																
	65															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B008

Sheet 1 of 1

Date(s) Drilled	08/20/2015 7:45 AM to 08/20/2015 11:10 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	592.087 ft NAVD 88
Borehole Backfill	Piezometer KIN-P008	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069056.566 E 2485606.651 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 592.1 / Depth (feet) 0.0 Rockfill (3 - 7 inch), little topsoil.								
							591.1 / 1.0								
590		S1	7 5 5		0		Medium stiff, very moist, brown and gray, low plasticity, sandy CLAY, (CL) (EMBANKMENT FILL)								*Rock lodged in S1.*
		S2	2 2 4		100			25.4				2.25			
	5						Soft to medium stiff, wet, brown, low plasticity, sandy CLAY (CL) (EMBANKMENT FILL)								
585		S3	2 2 3		100			22.8				0.25 1.0			
		S4			100		583.1 / 9.0	11.4	140.0	19	7				
	10						Low plasticity, sandy CLAY (CL) (TILL)								*Till material at the bottom of S4.*
580															
		S5	15 30 39		100		Hard, wet, brown and gray, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (TILL)	13.3		25	11	> 4.5			
	15														
575															
		S6	13 31 41		100		Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	10.7	144.8			> 4.5			
	20														
570															
		S7	20 35 43		100		Hard, slightly moist, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.6				> 4.5			
	25														
565															
		S8	18 32 50 / 4"				562.1 / 30.0	7.1				> 4.5			*Installed Piezometer KIN-P008 in boring.*
	30						End of Boring at 30 ft								

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B009

Sheet 1 of 1

Date(s) Drilled	08/14/2015 1:15 PM to 08/14/2015 2:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	590.387 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P009 adj. to KIN-B009)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069403.056 E 2486422.107 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 590.4 / Depth (feet) 0.0								
590	0	S1		3 3 4	100		Medium stiff, moist, dark brown, medium plasticity, CLAY, with fine sand, with roots (CL) (EMBANKMENT FILL)	20.3				1.75			
		S2		2 2 3	100		586.4 / 4.0 Medium stiff, moist, dark brown, medium plasticity, CLAY, with sand, with roots (CL) 585.4 / 5.0	23.8		42	23	1.5			
585	5	S3		2 3 5	100		Medium stiff, moist, brown and gray, low plasticity, CLAY, with fine to medium sand, with silt seams (CL) 582.9 / 7.5	21.3				1.0			
		S4			100		Grayish brown, low plasticity, sandy CLAY, with pebbles (CL)	19.9	123.7	28	13				
580	10														*S9 and S10 collocated hole.*
							577.4 / 13.0								
		S5		6 15 19	100		Hard, wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	10.3	113.6			> 4.5			*Shelby tube refusal.*
575	15														
		S6		16 29 40	100		Gray	7.5				> 4.5			
570	20														
		S7		18 32 50 / 5"	94		Hard, gray, low plasticity, sandy silty CLAY, trace fine gravel (CL) (TILL)	11.5				> 4.5			
565	25														*Installed Piezometer KIN-P009 in boring.*
		S8		16 33 50 / 5"	94		Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	9.2	105.4			> 4.5			
	30						560.4 / 30.0								

End of Boring at 30 ft

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Sheet 1 of 3

Date(s) Drilled	08/26/2015 8:00 AM to 08/26/2015 5:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary	Drill Bit Size/Type	7.75 in. O.D. HSA / 4 in. Roller Bit	Borehole Depth	75.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	615.29 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-010 12 ft West of KIN-B010)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069349.893 E 2486428.735 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
615	0						615.3 / 0.0 Topsoil and gravel basecourse (fill).								
							614.3 / 1.0								
		S1	4 4 6		78		Stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	4.9				> 4.5			
		S2	4 5 7		89			8.9				4.0			
610	5														
		S3	3 3 4		100		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (EMBANKMENT FILL)	9.5		23	9	1.75 3.0			
		S4	4 6 7		89		Stiff, moist, brown and dark brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	11.8	135.8			> 4.5			
605	10														
		S5	2 5 5		100		Brown and gray	19.5				0.75			
600	15														
		S6			20		Stiff, moist, grayish brown, low plasticity, CLAY, with sand (CL) (EMBANKMENT FILL)	21.1	128.1	33	19	1.5			
595	20						594.3 / 21.0								
		S7			18		Very stiff, low plasticity, CLAY, with sand (CL)	11.8	137.7	31	16	3.5			*ST refusal*
								23.3							
		S8	3 5 7		94		590.9 / 24.4	17.6	136.5			1.25			
590	25						Stiff, very wet, brown and gray with dark brown, low plasticity, CLAY, with fine to medium sand (CL)								
		S9	2 2 3		100		586.3 / 29.0 Medium stiff, dark brown, medium plasticity, CLAY (CL)	28.9		40	20	0.5			*Organic content 5.3%.*
	30														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 3:13:21 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
585	30													*30 - 32': Duttings appear as topsoil.*
						583.3 / 32.0								
		S10		22		Medium stiff, very wet, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL)					1.75			
		S11	3 4 4	100			20.9				1.75			
580	35													
						577.3 / 38.0								
		S12	13 32 50 / 3"	89		Very dense, very wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)	9.8							*38': Hard augering.*
575	40													*40': Mud rotary*
						572.3 / 43.0								
		S13	23 42 50	89		Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	10.7				> 4.5			
570	45													
		S14	27 50 / 5"	89		Low plasticity	9.9	149.4	23	9	> 4.5			
565	50													
560	55													
		S15	23 35 50 / 5"	100			9.5				> 4.5			
555	60													*61 - 63': Easier drilling.*
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
550																
		S16	13 50 50 / 1"	89		Greenish gray and brown Shale (BEDROCK)	545.8	69.5	17.0				> 4.5			*Roller bit refusal. S17-SPT bouncing. Switch to rock coring.*
545	70					Shale, dark gray, very soft, waxy	545.0	70.3								
		C1	53	95		Run #1 70.3 - 75': Limestone, gray, thinly bedded, strong, moderately hard, qu = 11,380 psi (70.6 - 71.2 ft)			0.3	165.8						
540	75					End of Boring at 75 ft	540.3	75.0								*Installed Piezometer KIN-P010 with 12 ft offset West.*
535	80															
530	85															
525	90															
520	95															
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Date(s) Drilled	08/11/2015 11:30 AM to 08/11/2015 4:30 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6.50 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	617.018 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1068624.963 E 2487934.93 (ft NAD83)	Groundwater Level(s)	26 ft on 8/11/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 617.0 / Depth (feet) 0.0 Sandy gravel fill.								
							616.0 / 1.0								
615		S1	3 4 4		33		Medium stiff, moist, brown, low plasticity, CLAY, with fine sand, (CL) (EMBANKMENT FILL)	16.6							
	5	S2	3 6 7		83		Stiff, moist, brown and dark brown, low plasticity, CLAY, with fine sand, trace fine gravel (CL) (EMBANKMENT FILL)	18.6		38	18				*Organic Content of 2.9%.*
610		S3	3 5 8		100		Stiff, brown and dark brown, medium plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	17.2		44	26				
							608.5 / 8.5								
	10	S4	3 5 8		100		Stiff, brown to gray, medium plasticity, CLAY, trace fine sand (CL) (EMBANKMENT FILL)	20.4							
605															
		S5			96		602.5 / 14.5	22.9	118.0	58	37				*Organic content 2.5%.*
	15						Dark brown, high plasticity, CLAY (CH) (EMBANKMENT FILL) 16 - 18': Possible topsoil								
600							599.0 / 18.0								
	20	S6	3 5 6		100		Stiff, brown and gray, medium plasticity, CLAY, trace fine sand (CL)	27.7	140.7	49	29				
595															
		S7	2 2 3		100		593.0 / 24.0 Medium stiff, moist, brown and gray, medium plasticity, CLAY, trace fine sand, with reddish brown silt seams (CL)	26.8				0.75			
	25						▽								
590		S8			96							0.5			
		S9	WOH		100		Very soft, moist, brown and gray, medium plasticity, CLAY, trace fine sand, with reddish	26.5		40	21	0.3			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30						brown silt seams (CL)								
585		S10		WOH 1 1	100		Very soft, wet, brown and gray, low plasticity, sandy CLAY (CL)	25.0		33	17				
	35						Elevation (feet) 580.0 / Depth (feet) 37.0								
580							Very dense, wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)								
		S11		12 21 50 / 2"	100			8.2		23	9				
	40						Elevation (feet) 575.0 / Depth (feet) 42.0								
575							Hard, wet, brownish gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
		S12		37 50 / 3"	61			9.0				> 4.5			
	45														
570															
		S13		50 / 5"	33			9.6				> 4.5			
	50						Elevation (feet) 567.0 / Depth (feet) 50.0								
							End of Boring at 50 ft								
565															
	55														
560															
	60														
555															
	65														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 3:16:07 PM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B012

Date(s) Drilled	08/25/2015 8:00 AM to 08/25/2015 12:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	40.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	605.539 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1067643.467 E 2486141.078 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
605	0						Elevation (feet) 605.5 / Depth (feet) 0.0								
		S1		7 8 12	83		Medium dense, moist, black, fine to coarse grained sand (cinders) (ASH)	11.2							
		S2		12 18 18	100			12.0							
600	5						Very dense, very wet, black, sand (cinders) (ASH)								
		S3			0										*Piston sample 6' to 8': NR. Auger to 8.5'.*
		S4		3 3 4	44		Loose, very wet, black, sand (cinders) (ASH)	19.4							*Ash flowing into auger at 8.5'. Use SPT.*
595	10														
							Elevation (feet) 591.7 / Depth (feet) 13.8								*Piston sampler.*
		S5			60		Very soft, wet, light brown, low plasticity, silty CLAY (CL)					0.25			
590	15	S6			100		Very soft to soft					0.5			
		S7			92		Soft					0.75			
585	20														
		S8			100		Soft, grayish brown, low plasticity, sandy silty CLAY, trace fine gravel (CL)					0.6			
580	25														
							Elevation (feet) 577.5 / Depth (feet) 28.0								
		S9		11 28 43	100		Hard, brown and gray, low plasticity, sandy silty CLAY, trace fine gravel (CL) (TILL)	8.4		19	6	> 4.5			*28' Harder drilling*
	30														

Report: GEO_SOIL; File \\USDEN5FP0001\GEOCIVIL$\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/8/2016 2:54:11

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

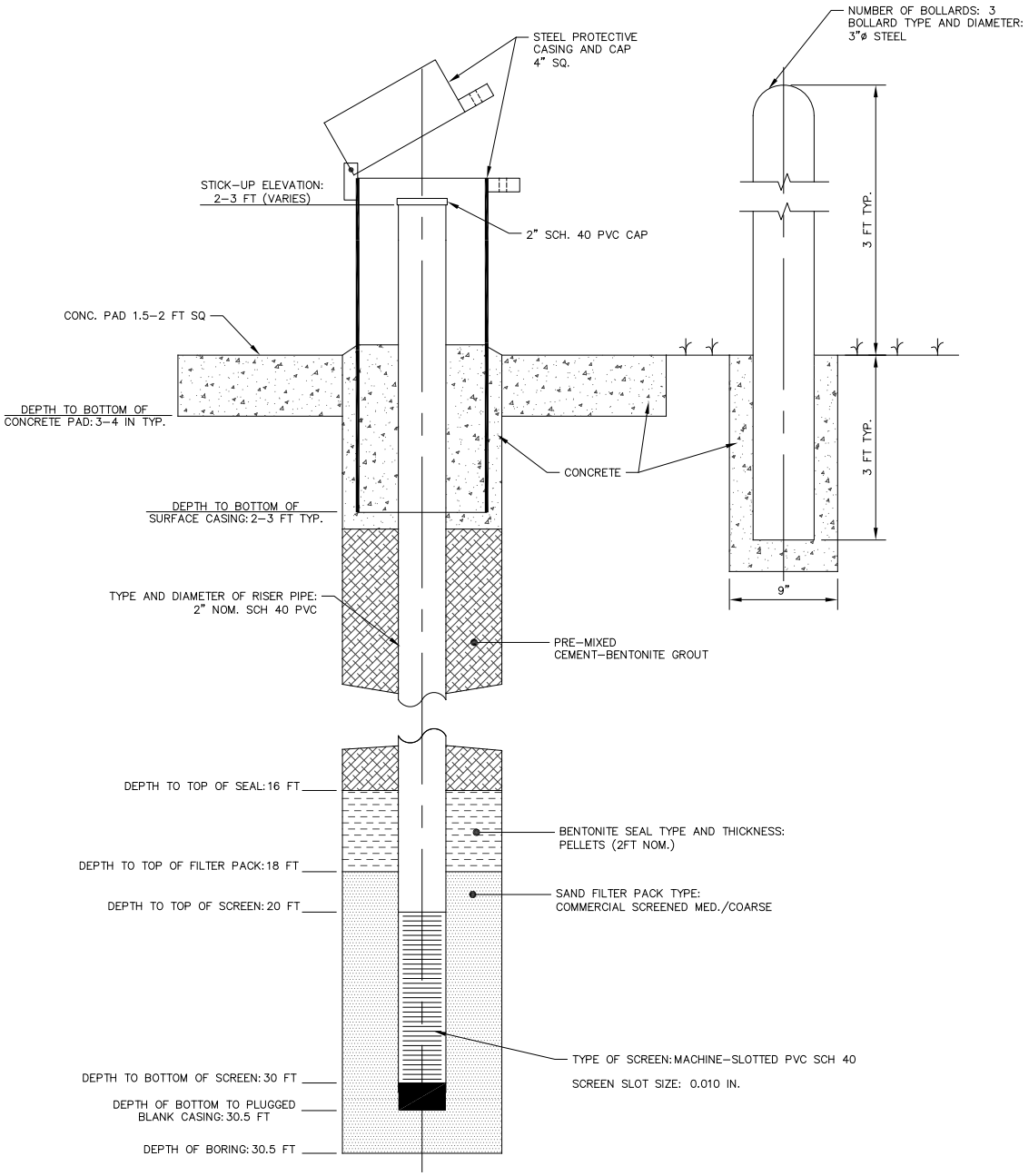
Log of Boring KIN-B012

Elevation (feet)	Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
575	30													
		S10	22 47 50 / 3"	89		Hard, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.1							*35' Very hard drilling*
570	35													
						567.5 / 38.0								
		S11	27 38 50 / 4"	89		Very dense, very wet, brown and gray, clayey SAND, trace fine gravel (SC) (TILL)	14.9							
565	40					565.5 / 40.0								
						End of Boring at 40 ft								
560	45													
555	50													
550	55													
545	60													
	65													

Attachment C. Piezometer Logs

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

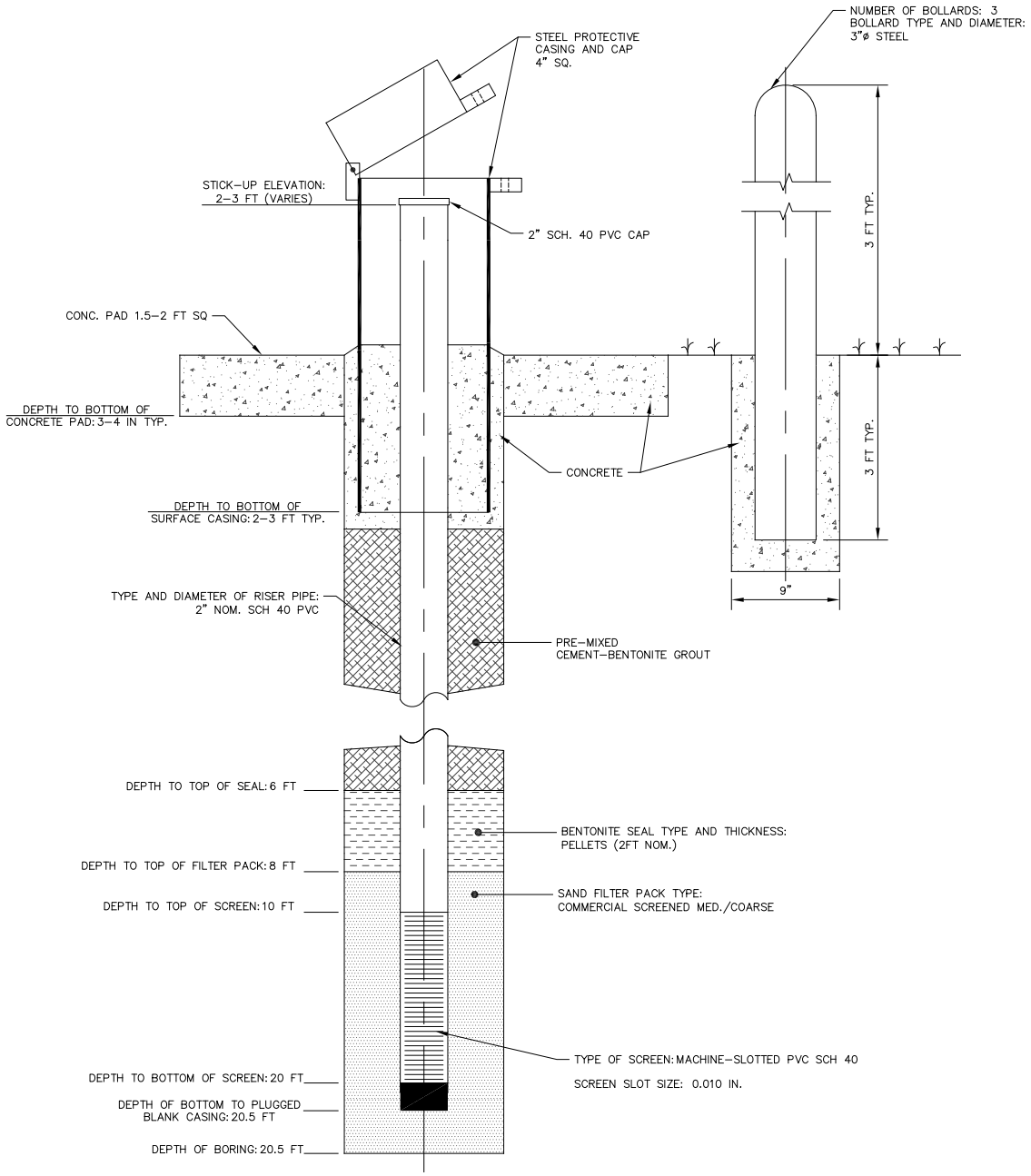
Piezometer Location	KIN-P001	Date Installed	8/14/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	599.204 FT
Screened Interval	20-30 FT	Completion Zone	FOUNDATION		
Remarks	INSTALLED IN KIN-B001	Groundwater Level(s)	12.5 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

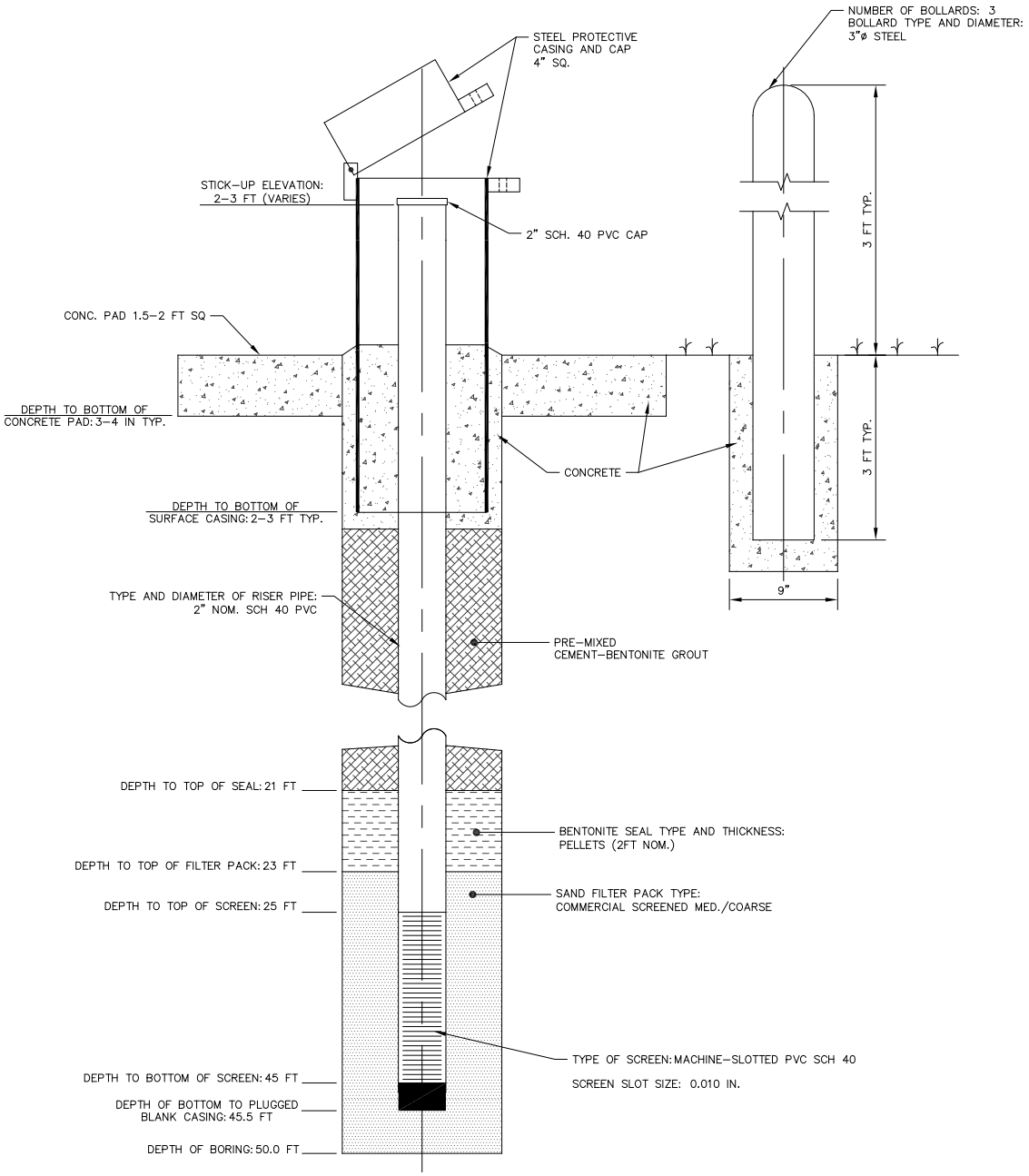
Piezometer Location	KIN-P002	Date Installed	8/13/2015	Time	
Installed By		Observed By	AECOM	Total Depth	20 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	605.234 FT
Screened Interval	10-20 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET 5 FT EAST OF KIN-B002	Groundwater Level(s)	5.9 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

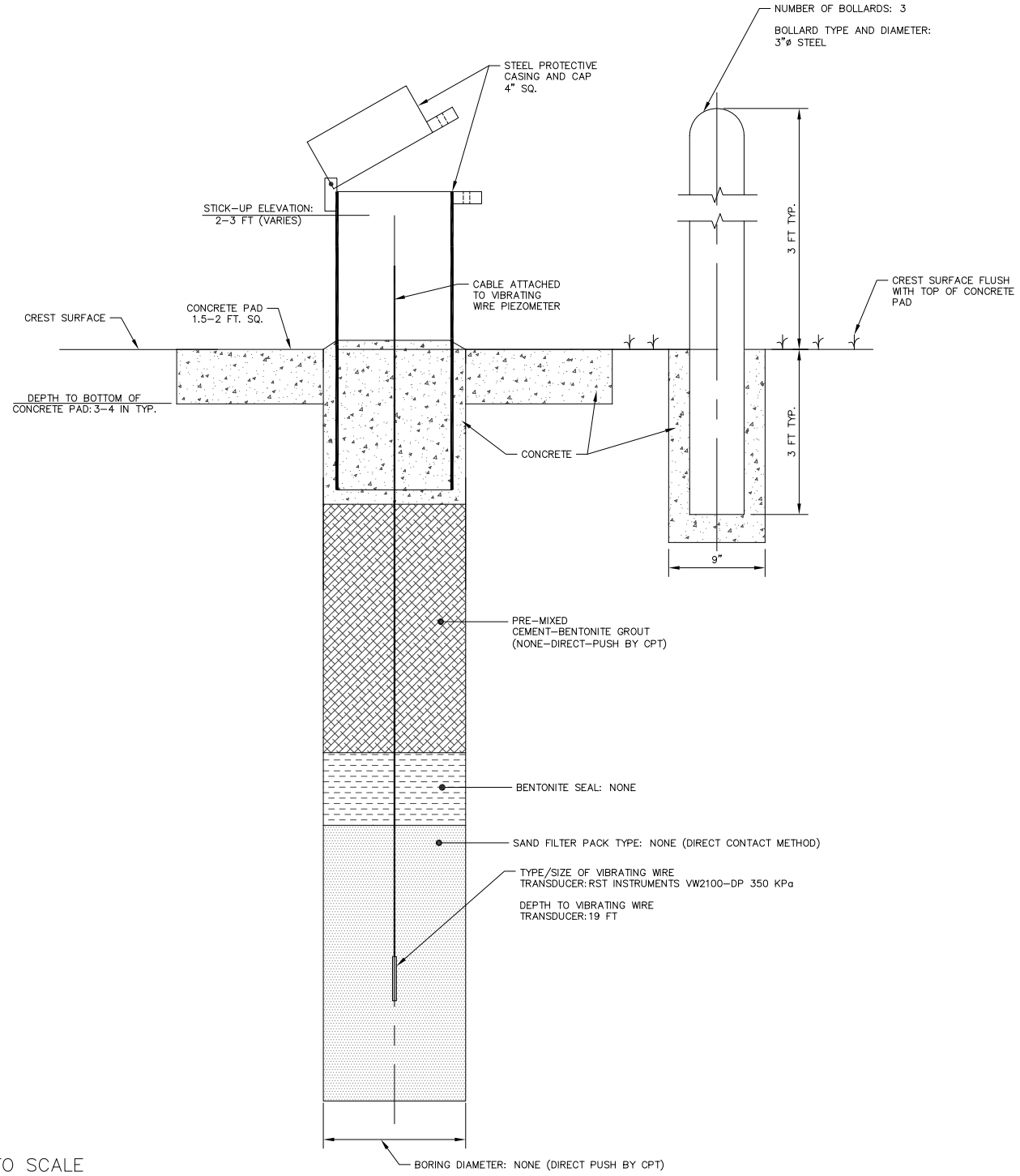
Piezometer Location	KIN-P003	Date Installed	8/15/2015	Time	
Installed By		Observed By	AECOM	Total Depth	50 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	623.303 FT
Screened Interval	25-45 FT	Completion Zone	FOUNDATION		
Remarks	INSTALL IN KIN-B003	Groundwater Level(s)	21.8 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KINCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

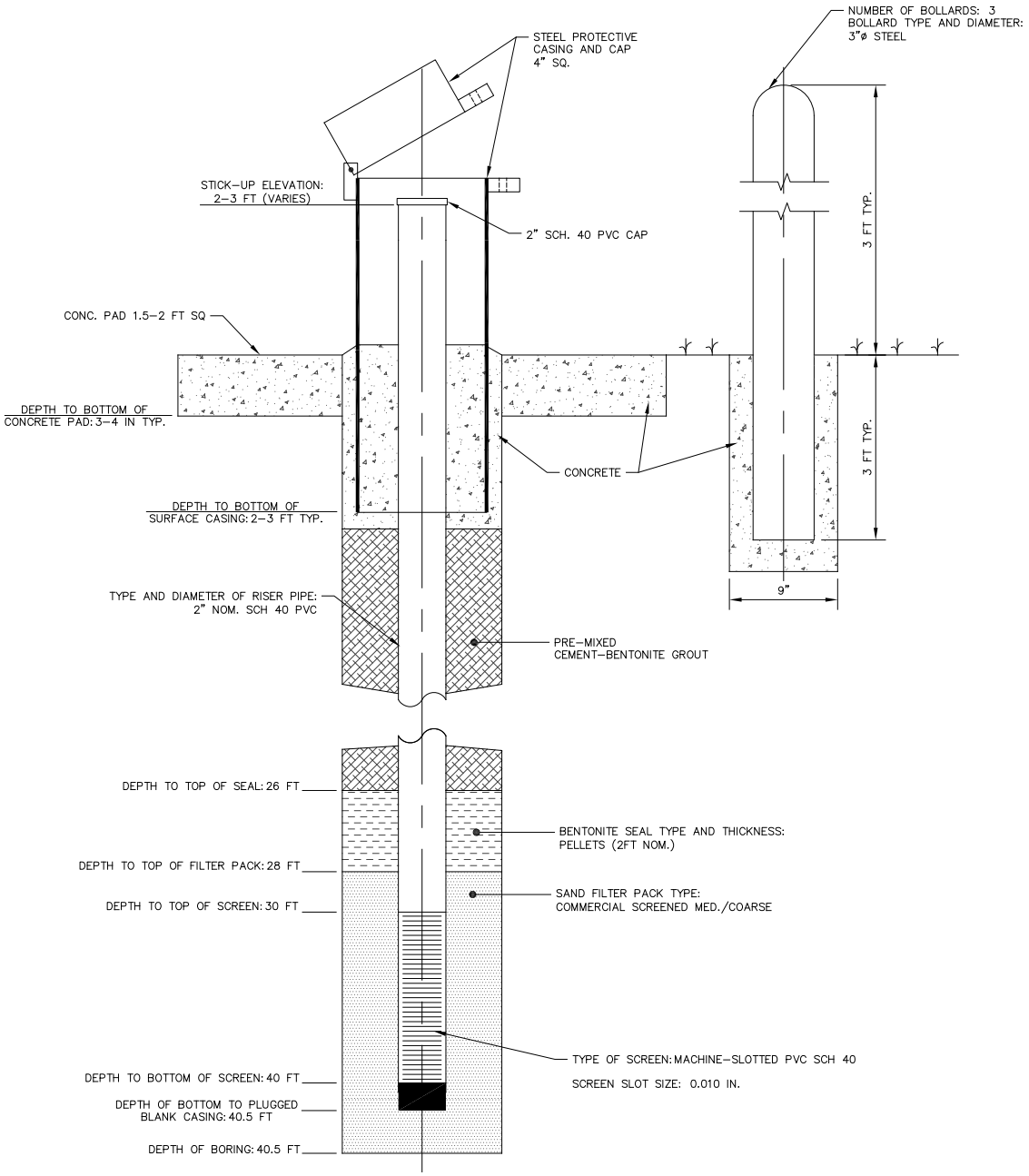
Piezometer Location	KIN-P004	Date Installed	8 / 2015	Time	
Installed By		Observed By	AECOM	Total Depth	19 FT
Method of Installation	CPT - DIRECT PUSH	Drilling Contractor	CONETEC, INC.	Surface Elevation	601.737 FT
Screened Interval	N/A	Completion Zone	FOUNDATION		
Remarks		Groundwater Level(s)	14.3 FT BGS (10/7/2015)		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

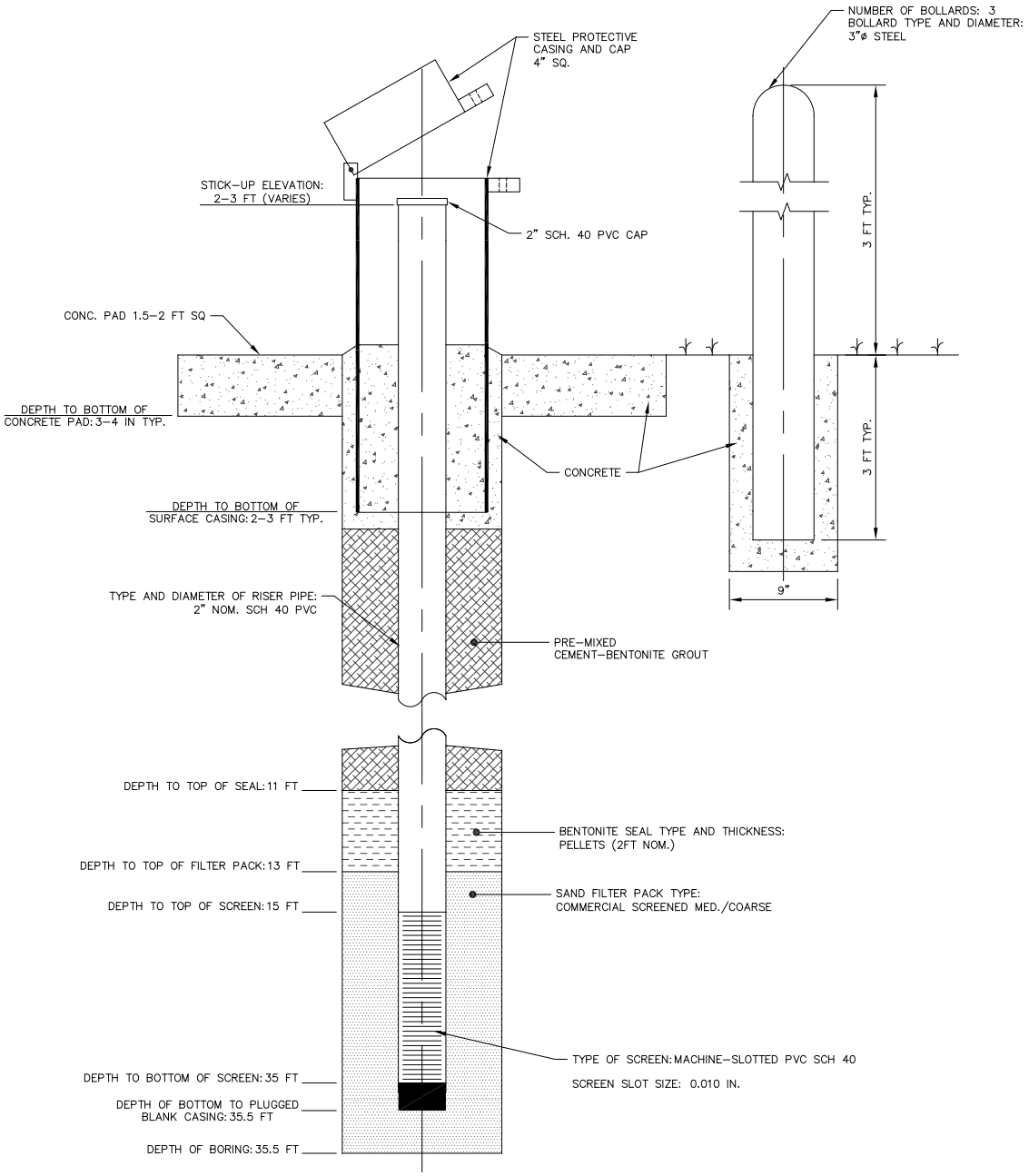
Piezometer Location	KIN-P005	Date Installed	8/19/2015	Time	
Installed By		Observed By	AECOM	Total Depth	40 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	619.019 FT
Screened Interval	30-40 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET FROM KIN-B004	Groundwater Level(s)	25.9 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

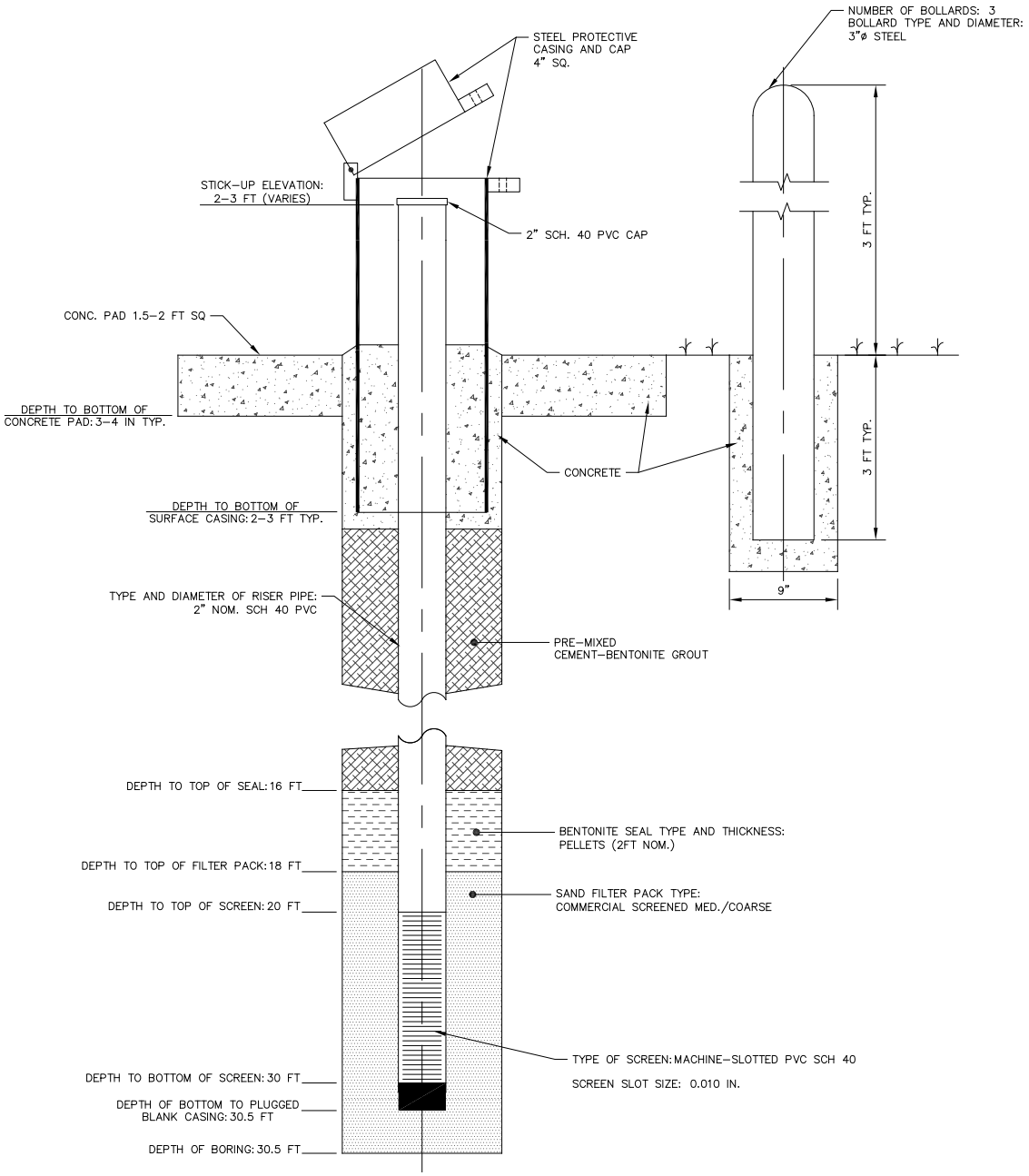
Piezometer Location	KIN-P006	Date Installed	8/23/2015	Time	
Installed By		Observed By	AECOM	Total Depth	35 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	596.419 FT
Screened Interval	15-35 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET 5 FT SE OF KIN-B005	Groundwater Level(s)	10.3 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

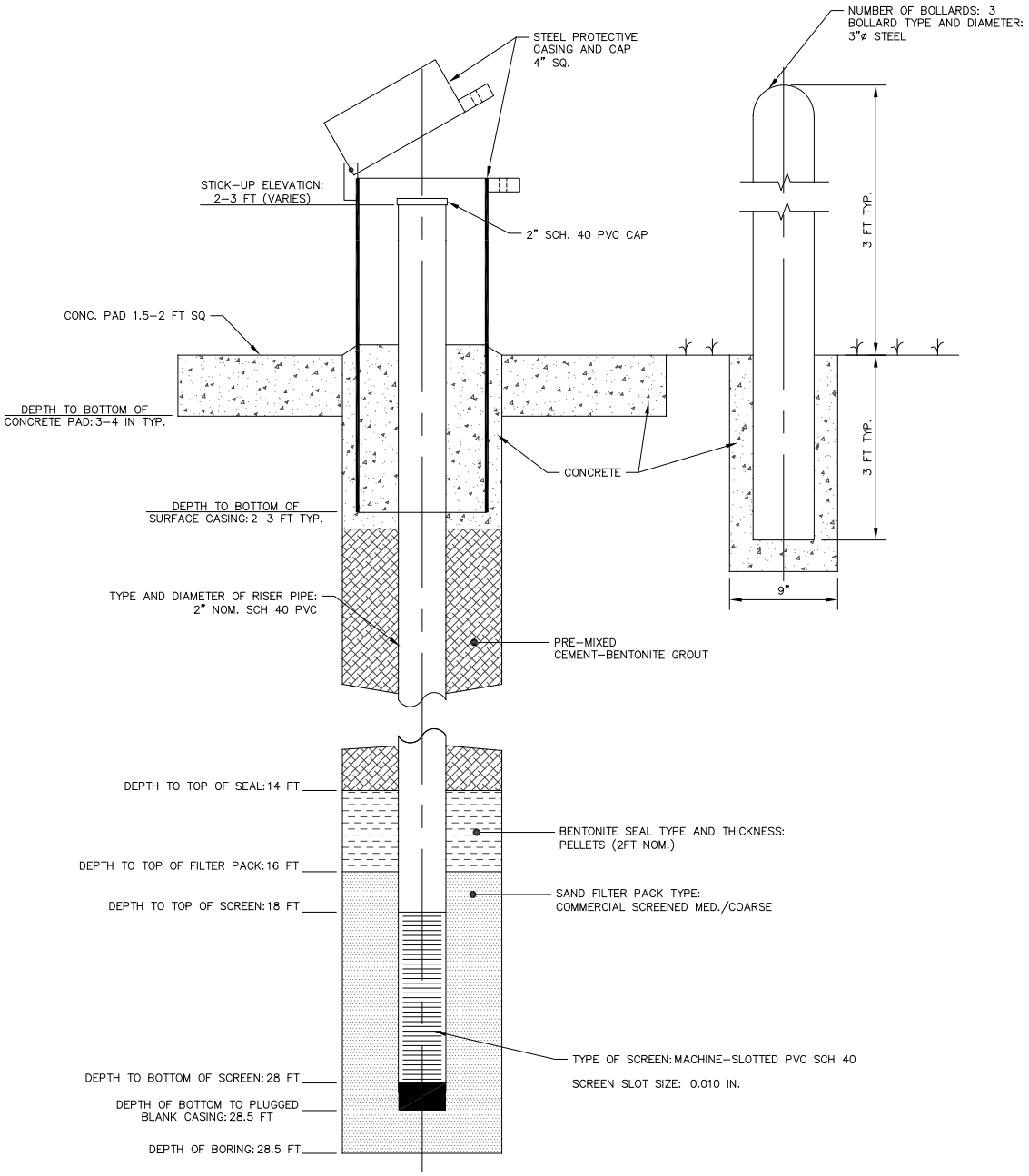
Piezometer Location	KIN-P007	Date Installed	8/20/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	618.917 FT
Screened Interval	20-30 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET FROM KIN-B007	Groundwater Level(s)	24.0 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

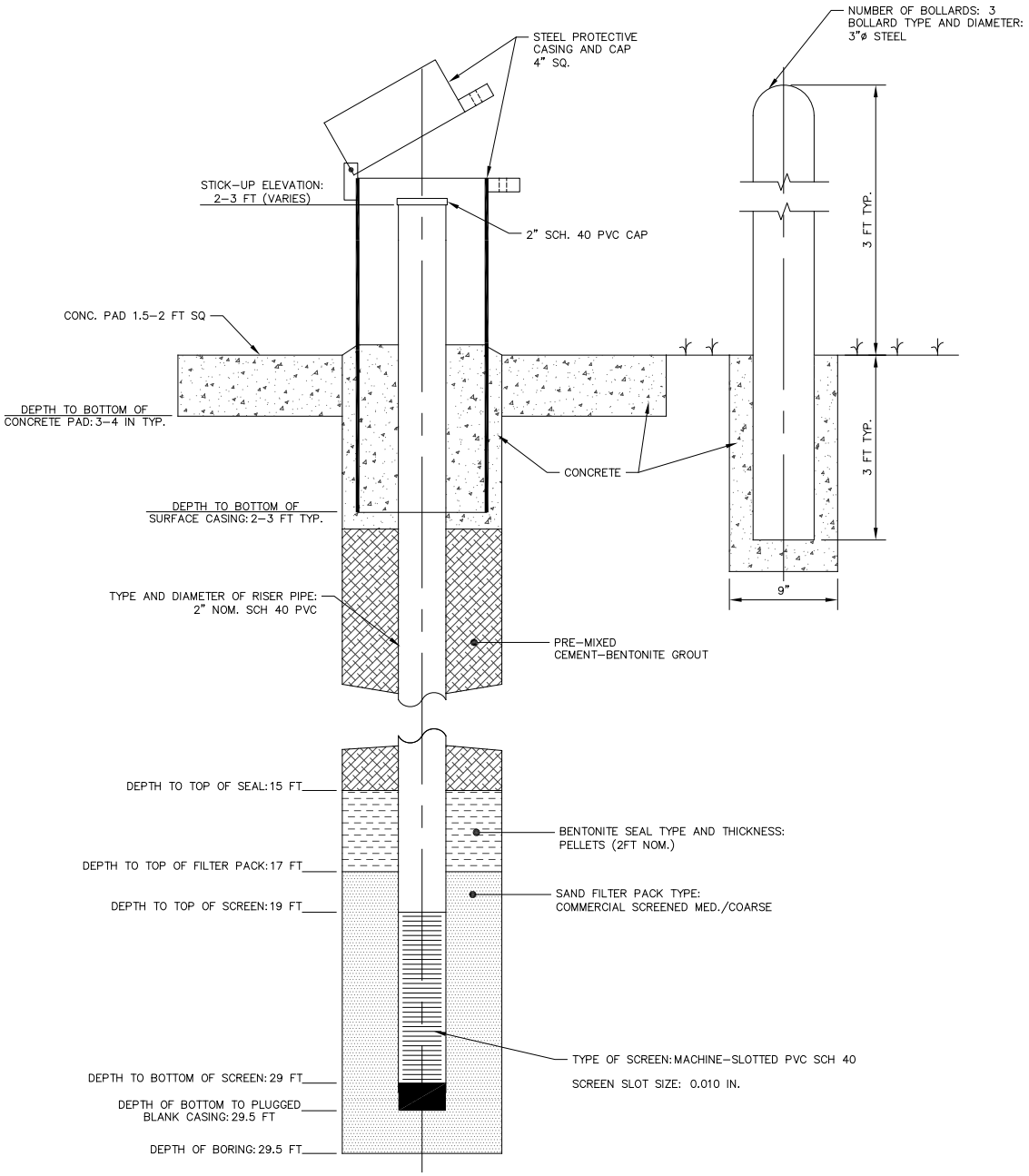
Piezometer Location	KIN-P008	Date Installed	8/20/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	589.872 FT
Screened Interval	18-28 FT	Completion Zone	FOUNDATION		
Remarks	INSTALL IN KIN-B008	Groundwater Level(s)	5.2 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

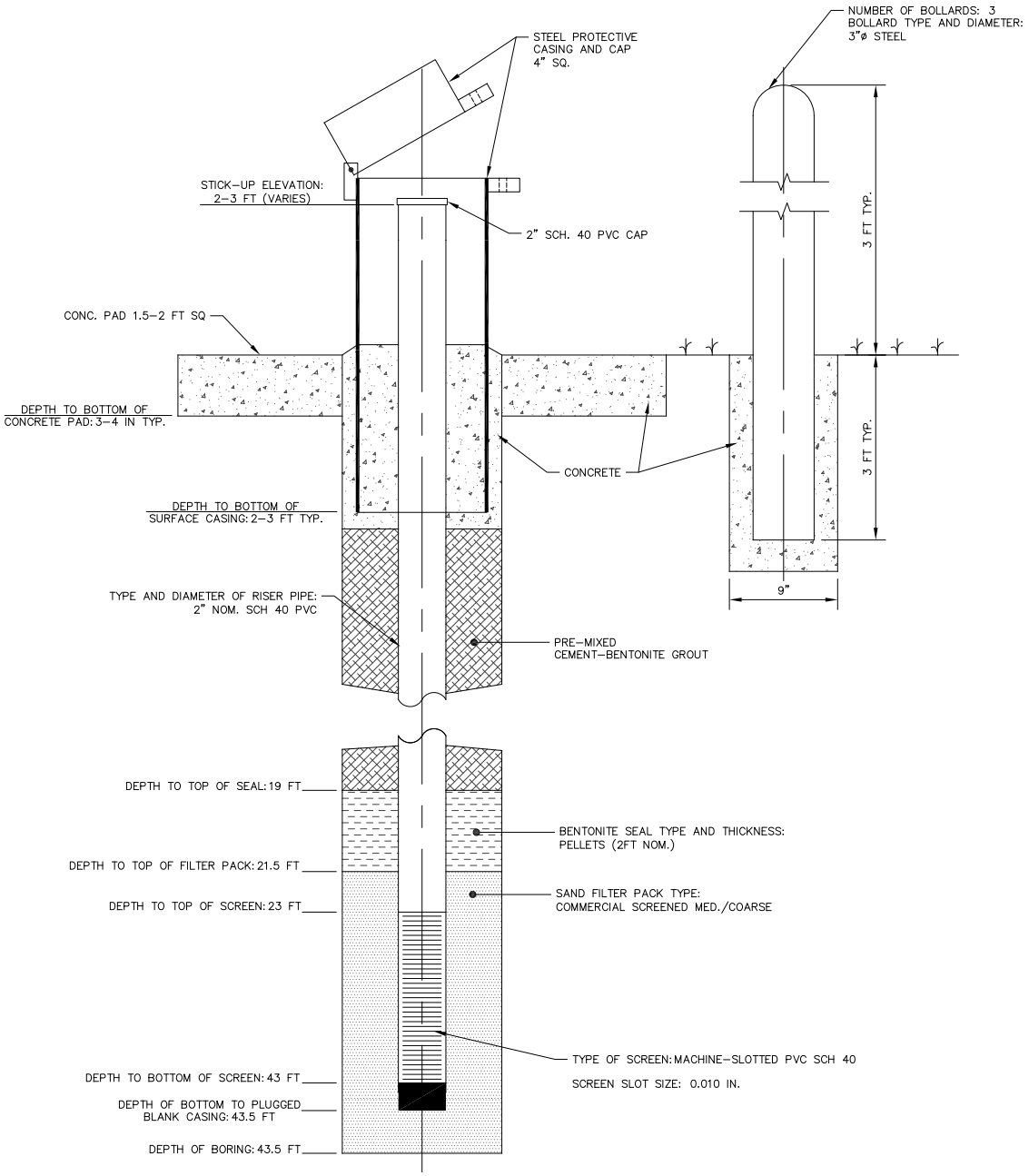
Piezometer Location	KIN-P009	Date Installed	8/20/2015	Time	
Installed By		Observed By	AECOM	Total Depth	30 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	590.387 FT
Screened Interval	19-29 FT	Completion Zone	FOUNDATION		
Remarks	INSTALL IN KIN-B009	Groundwater Level(s)	6.2 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KIDCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

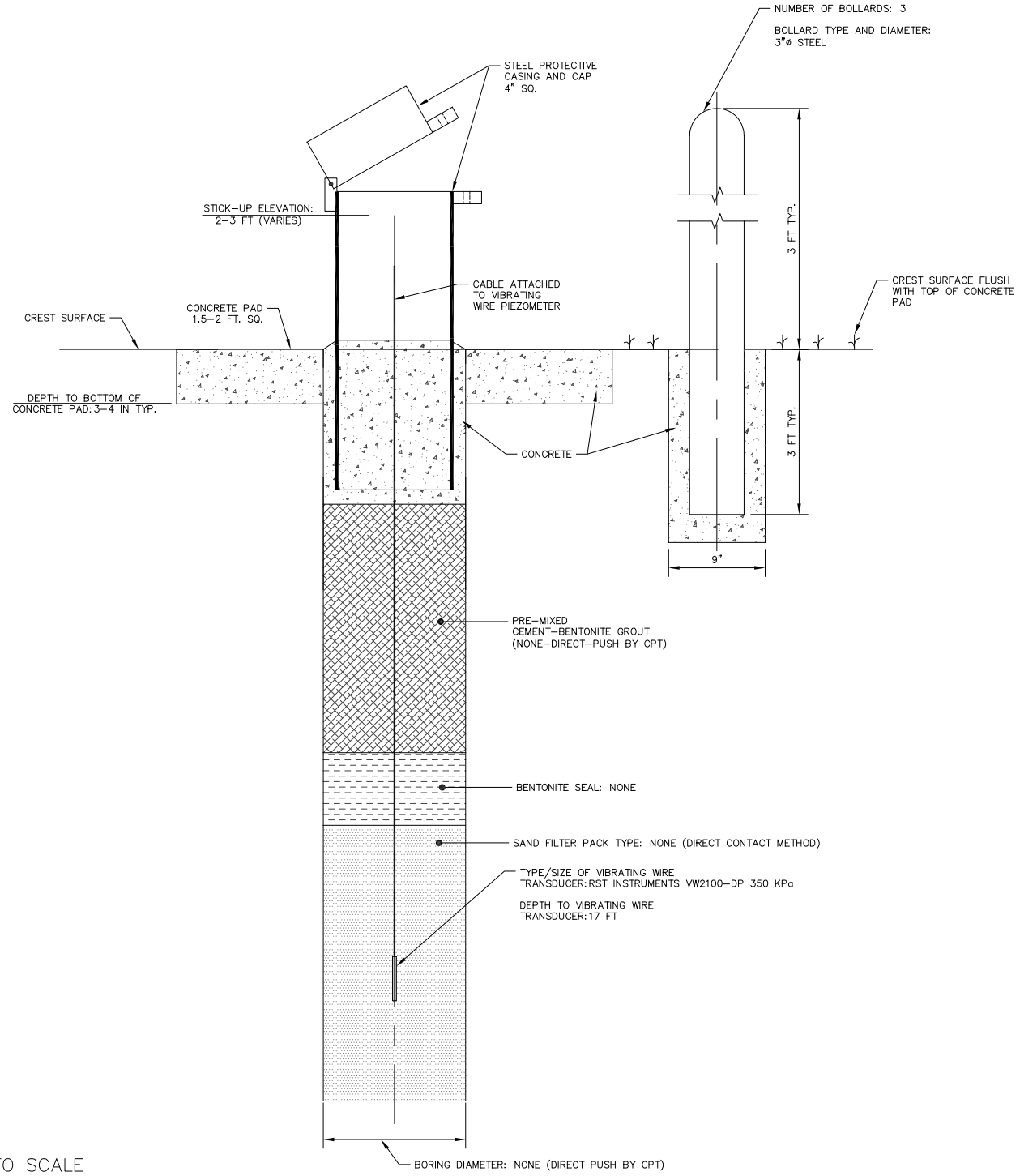
Piezometer Location	KIN-P010	Date Installed	8/26/2015	Time	
Installed By		Observed By	AECOM	Total Depth	43 FT
Method of Installation	HOLLOW STEM AUGER	Drilling Contractor	TERRACON, INC.	Surface Elevation	615.290 FT
Screened Interval	23-43 FT	Completion Zone	FOUNDATION		
Remarks	OFFSET 12 FT W OF KIN-B010	Groundwater Level(s)	13.9 FT BGS ON 10/7/2015		



NOT TO SCALE

Project: Dynegy	Log of Piezometer
Project Location: KINCAID POWER STATION, ILLINOIS	Sheet 1 of 1
Project Number: 60440697	

Piezometer Location	KIN-P011	Date Installed	8 / 2015	Time	
Installed By		Observed By	AECOM	Total Depth	17 FT
Method of Installation	CPT - DIRECT PUSH	Drilling Contractor	CONETEC, INC.	Surface Elevation	617.018 FT
Screened Interval	N/A	Completion Zone	FOUNDATION		
Remarks		Groundwater Level(s)	13.9 FT BGS (10/7/2015)		



NOT TO SCALE

AECOM

Project: Dynegy

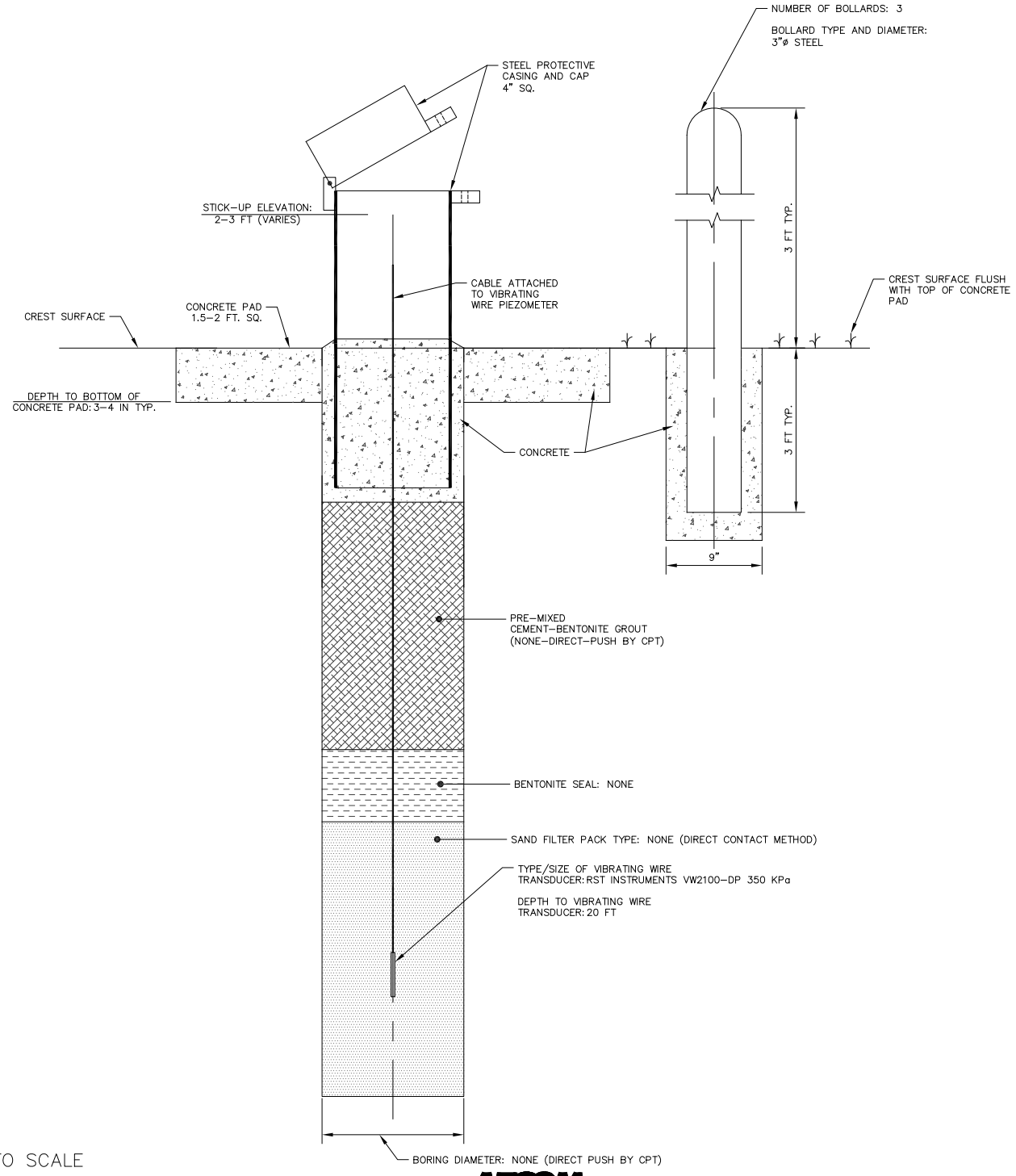
Project Location: KINCAID POWER STATION, ILLINOIS

Project Number: 60440697

Log of Piezometer

Sheet 1 of 1

Piezometer Location	KIN-P012	Date Installed	8 / 2015	Time	
Installed By		Observed By	AECOM	Total Depth	20 FT
Method of Installation	CPT - DIRECT PUSH	Drilling Contractor	CONETEC, INC.	Surface Elevation	605.539 FT
Screened Interval	N/A	Completion Zone	FOUNDATION		
Remarks		Groundwater Level(s)	16.1 FT BGS (10/7/2015)		



NOT TO SCALE

Attachment D. CPT Data Report

PRESENTATION OF SITE INVESTIGATION RESULTS

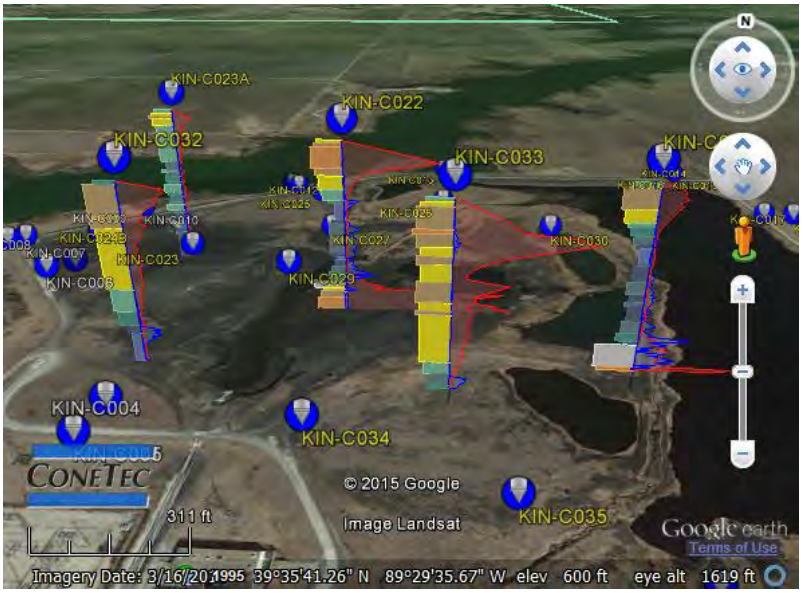
Kincaid Power Station
Kincaid, Illinois

Prepared for:

AECOM

ConeTec Job No: 15-53070

Project Start Date: 13-Aug-2015
Project End Date: 18-Aug-2015
Report Date: 20-Aug-2015



Prepared by:

ConeTec Inc.
436 Commerce Lane, Unit C
West Berlin, NJ 08091

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Toll Free: (800) 504-1116

Email: conetecNJ@conetec.com
www.conetec.com
www.conetecdataservices.com

Introduction

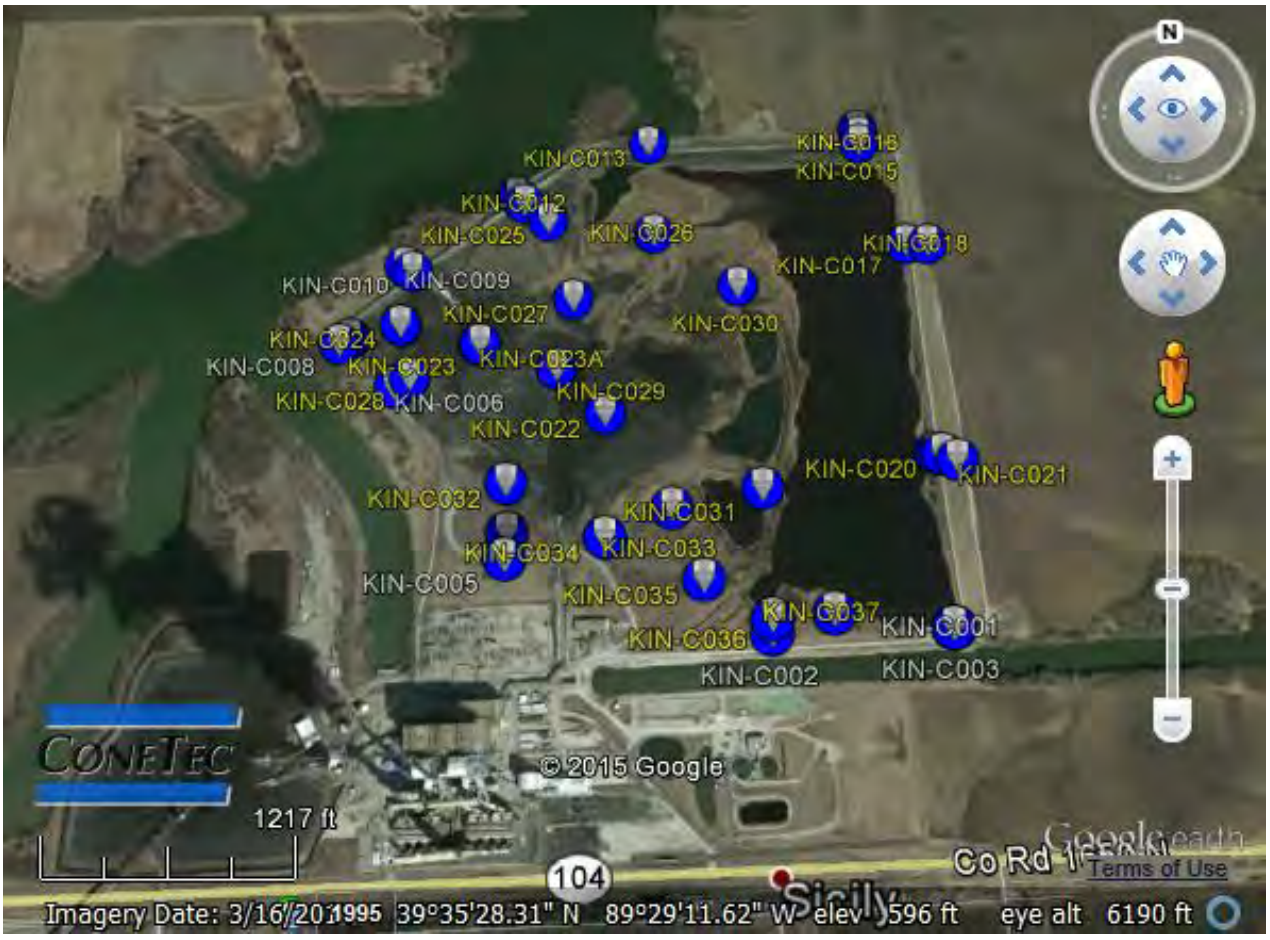
The enclosed report presents the results of a piezocone penetration testing (CPTu or CPT) and seismic piezocone penetration testing (SCPTu or SCPT) program carried out at the Kincaid Power Station site located in Kincaid, Illinois. The site investigation program was conducted by ConeTec Inc., under contract to AECOM of Denver, Colorado.

A total of one cone penetration test and thirty eight seismic cone penetration tests were completed at thirty seven locations (There were two shallow refusals). The CPT and SCPT program was performed to evaluate the subsurface soil conditions. CPT and SCPT sounding locations were selected and numbered under the supervision of AECOM personnel (Mr. Daryle Harrison and Mr. Adam Grossman).

Project Information

Project	
Client	AECOM
Project	Kincaid Power Station, Kincaid, IL
ConeTec project number	15-53070

A map from Google earth including the CPT test locations is presented below.



Rig Description	Deployment System	Test Type
CPT Truck Rig	25 ton truck mounted (twin cylinders)	CPT and SCPT
CPT Track Rig	20 ton track mounted (twin cylinders)	SCPT

Coordinates		
Test Type	Collection Method	EPSG Number
CPT and SCPT	GPS (Handheld)	32616 (WGS 84 / UTM North)

Cone Penetration Test (CPT)	
Depth reference	Ground surface at the time of the investigation.
Tip and sleeve data offset	0.1 meter. This has been accounted for in the CPT data files.
Pore pressure dissipation (PPD) tests	Seventy four pore pressure dissipation tests were completed primarily to determine the phreatic surface.
Additional Comments	Shear wave velocity tests were conducted at five foot intervals at thirty eight locations.

Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
335:T1500F15U500	335	15	225	1500	15	500
374:T1500F15U500	374	15	225	1500	15	500

Limitations

This report has been prepared for the exclusive use of AECOM (Client) for the project titled “Kincaid Power Station, Kincaid, IL”. The report’s contents may not be relied upon by any other party without the express written permission of ConeTec, Inc. (ConeTec). ConeTec has provided site investigation services, prepared the factual data reporting, and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to ConeTec by the Client. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

The cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd. of Richmond, British Columbia, Canada.

ConeTec's piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and a geophone sensor for recording seismic signals. All signals are amplified down hole within the cone body and the analog signals are sent to the surface through a shielded cable.

ConeTec penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All ConeTec piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. ConeTec's calibration criteria also meet or exceed those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

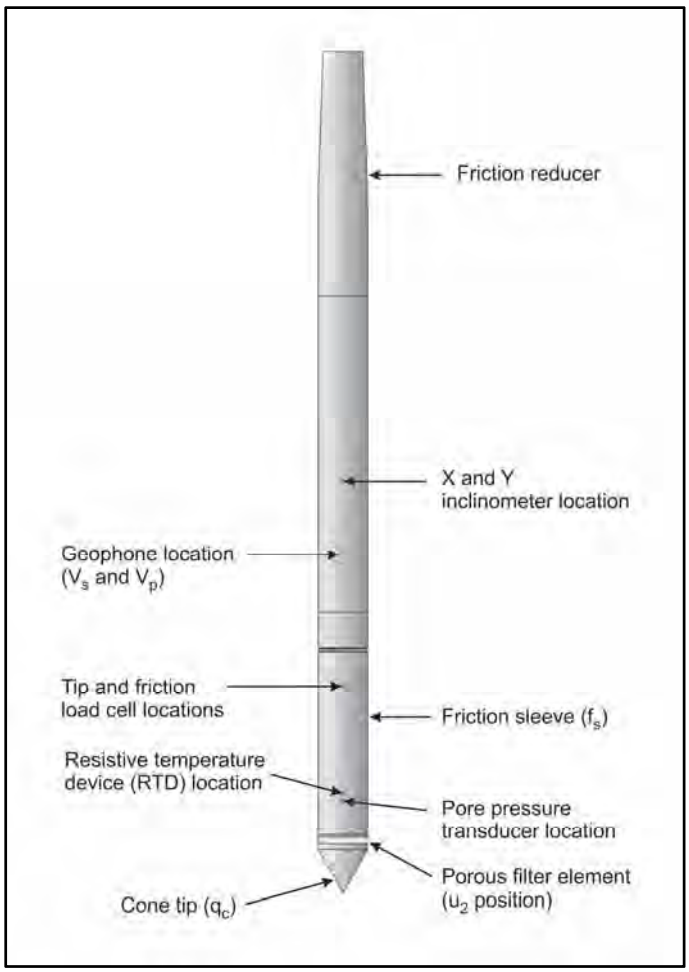


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The ConeTec data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a 16 bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording intervals are either 2.5 cm or 5.0 cm depending on project requirements; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to ConeTec's CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerin or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to ConeTec's cone penetration testing procedures:

- Each filter is saturated in silicone oil or glycerin under vacuum pressure prior to use
- Recorded baselines are checked with an independent multi-meter
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of piezocone data for this report is based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson (1990) and Robertson (2009). It should be noted that it is not always possible to accurately identify a soil type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al, 1986:

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for ConeTec probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all ConeTec piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high

friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of interpretation files were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the interpretation methods used is included in an appendix.

For additional information on CPTu interpretations, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

References

ASTM D5778-12, 2012, "Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils", ASTM, West Conshohocken, US.

Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, “Cone Penetration Testing in Geotechnical Practice”, Blackie Academic and Professional.

Mayne, P.W., 2013, “Evaluating yield stress of soils from laboratory consolidation and in-situ cone penetration tests”, Sound Geotechnical Research to Practice (Holtz Volume) GSP 230, ASCE, Reston/VA: 406-420.

Mayne, P.W. and Peuchen, J., 2012, “Unit weight trends with cone resistance in soft to firm clays”, Geotechnical and Geophysical Site Characterization *4,* Vol. 1 (Proc. ISC-4, Pernambuco), CRC Press, London: 903-910.

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Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, “Use of Piezometer Cone Data”, Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.

Robertson, P.K., 1990, “Soil Classification Using the Cone Penetration Test”, Canadian Geotechnical Journal, Volume 27: 151-158.

Robertson, P.K., 2009, “Interpretation of cone penetration tests – a unified approach”, Canadian Geotechnical Journal, Volume 46: 1337-1355.

Shear wave velocity testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave (Vp) velocity is also determined.

ConeTec's piezocone penetrometers are manufactured with a horizontally active geophone (28 hertz) that is rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances an auger source or an imbedded impulsive source maybe used for both shear waves and compression waves. The hammer and beam act as a contact trigger that triggers the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded using an up-hole integrated digital oscilloscope which is part of the SCPTu data acquisition system. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

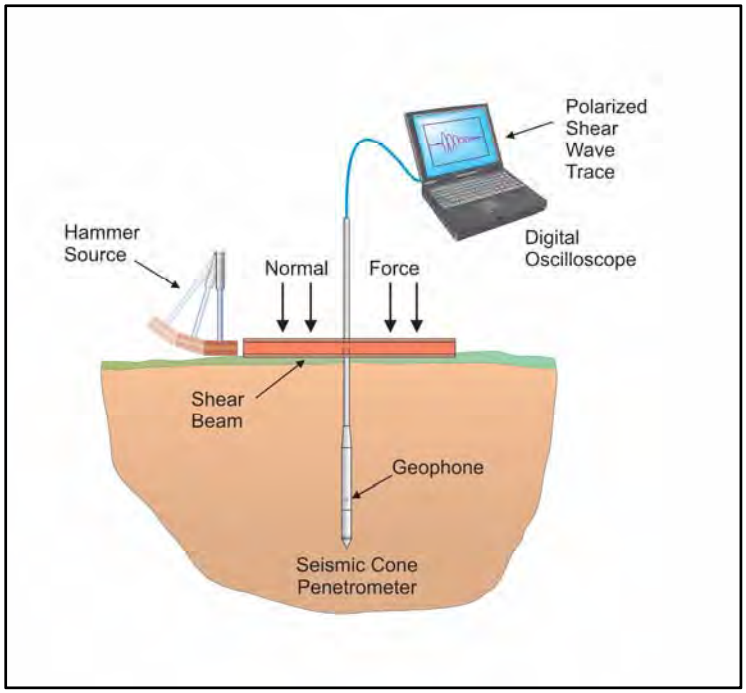


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to ConeTec's SCPTu operating procedures.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Multiple wave traces are recorded for quality control purposes. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et.al. (1986).

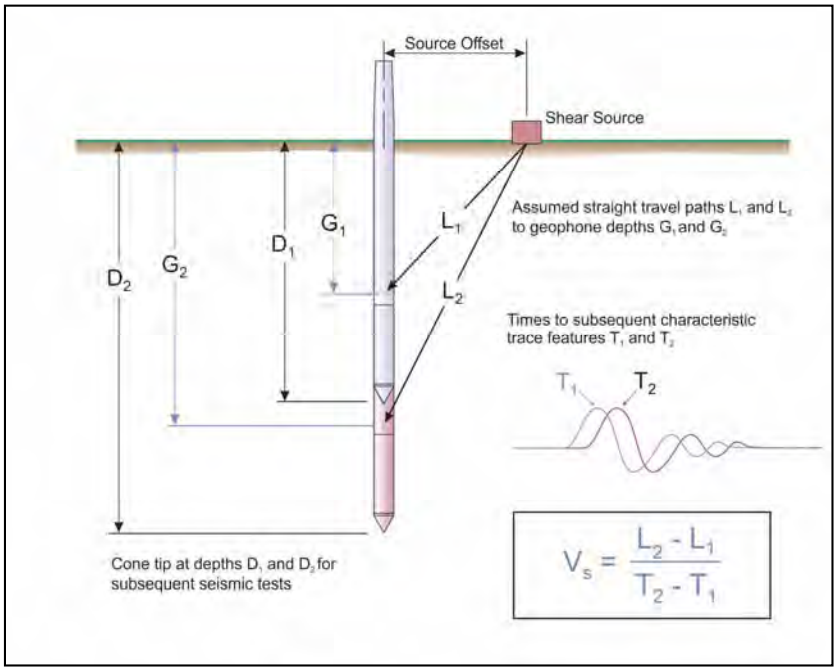


Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities are performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

The average shear wave velocity to a depth of 100 feet (30 meters) ($\bar{v}_s$) has been calculated and provided for all applicable soundings using the following equation presented in ASCE, 2010.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

where: $\bar{v}_s$ = average shear wave velocity ft/s (m/s)
d_i = the thickness of any layer between 0 and 100 ft (30 m)
v_{si} = the shear wave velocity in ft/s (m/s)
$\sum_{i=1}^{n} d_i$ = 100 ft (30 m)

Average shear wave velocity, $\bar{v}_s$ is also referenced to V_{s100} or V_{s30}.

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

Tabular results and SCPTu plots are presented in the relevant appendix.

References

American Society of Civil Engineers (ASCE), 2010, “Minimum Design Loads for Buildings and Other Structures”, Standard ASCE/SEI 7-10, American Society of Civil Engineers, ISBN 978-0-7844-1085-1, Reston, Virginia.

Robertson, P.K., Campanella, R.G., Gillespie D and Rice, A., 1986, “Seismic CPT to Measure In-Situ Shear Wave Velocity”, Journal of Geotechnical Engineering ASCE, Vol. 112, No. 8: 791-803.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

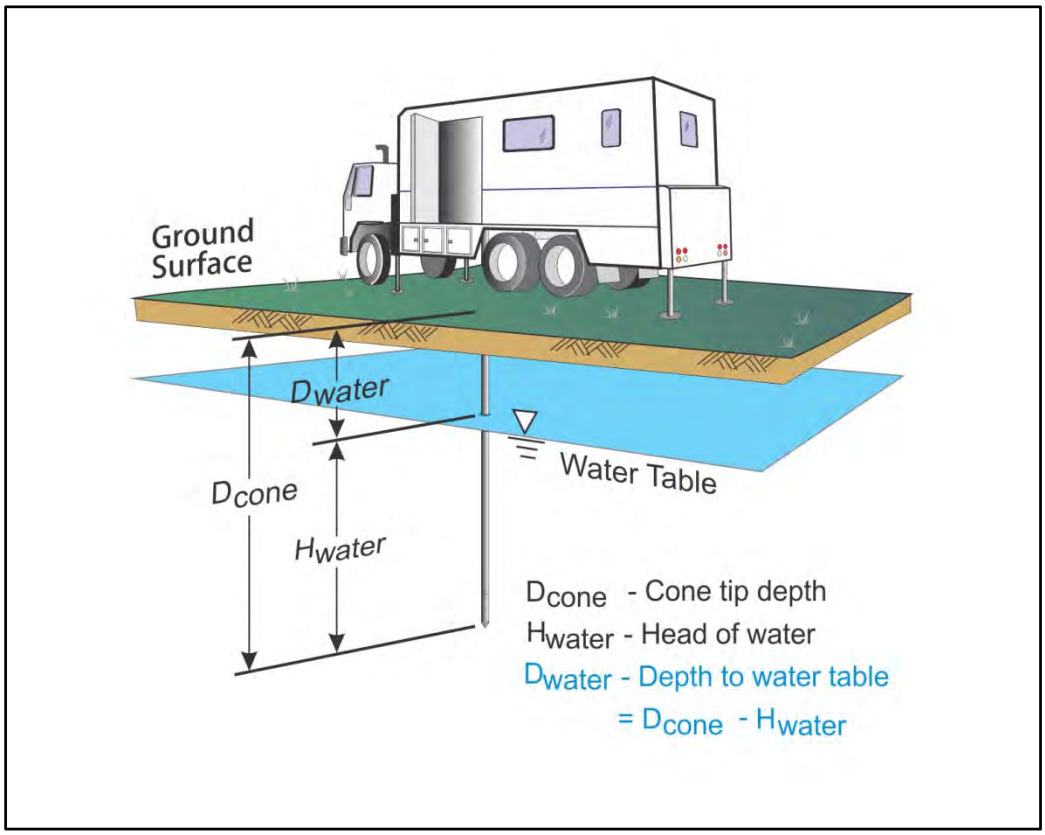


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

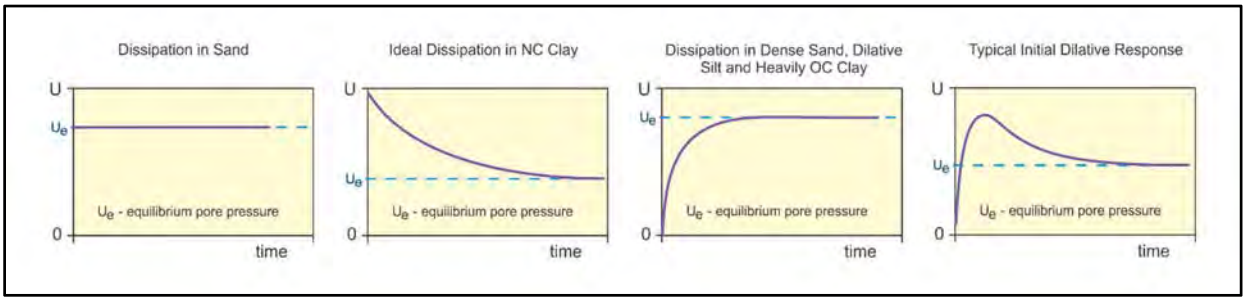


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve of Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

References

Burns, S.E. and Mayne, P.W., 1998, "Monotonic and dilatory pore pressure decay during piezocone tests", Canadian Geotechnical Journal 26 (4): 1063-1073.

Burns, S.E. and Mayne, P.W., 2002, "Analytical cavity expansion-critical state model cone dissipation in fine-grained soils", Soils & Foundations, Vol. 42(2): 131-137.

Jones, G.A. and Van Zyl, D.J.A., 1981, "The piezometer probe: a useful investigation tool", Proceedings, 10th International Conference on Soil Mechanics and Foundation Engineering, Vol. 3, Stockholm: 489-495.

Robertson, P.K., Sully, J.P., Woeller, D.J., Lunne, T., Powell, J.J.M. and Gillespie, D.G., 1992, "Estimating coefficient of consolidation from piezocone tests", Canadian Geotechnical Journal, 29(4): 551-557.

Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, "An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils", Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, "An analytical study of the cone penetration test in clay", Geotechnique, 41(1): 17-34.

Vibrating wire piezometers manufactured by RST Instruments Ltd., measure in situ water pressure and temperature. The pressure is determined by measuring the resonant frequency at which the internal tensioned wire vibrates. Calibration constants relate the recorded frequency to the applied pressure. Temperature is measured using a built-in thermistor.

Prior to deployment the piezometers are saturated as per the manufacturer's guidelines and the piezometer serial number and baselines are recorded.

The piezometers are pushed into the ground from ground surface with a CPT rig or drill rig and the installation depths are referenced to the existing ground surface at the time of installation.

An installation summary is provided in the relevant appendix.

For more details about RST vibrating wire piezometers, refer to the manufacturer's website. http://www.rstinstruments.com/Vibrating%20Wire%20Piezometer.html

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Tabular Results
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots
- VW Piezometer Installation Summary

Cone Penetration Test Summary and Standard Cone Penetration Test Plots

CONETEC

Job No: 15-53070
Client: AECOM
Project: Kincaid Power Station, Kincaid, IL
Start Date: 13-Aug-2015
End Date: 18-Aug-2015

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Shear Wave Velocity Tests	Northing[2] (m)	Easting (m)	Refer to Notation Number
KIN-C001	15-53070_SP01	17-Aug-2015	335:T1500F15U500	4.4	18.87	4	4385569	286381	
KIN-C002	15-53070_SP02	18-Aug-2015	335:T1500F15U500	12.5	29.36	6	4385577	286096	
KIN-C003	15-53070_SP03	17-Aug-2015	335:T1500F15U500	1.8	20.34	4	4385569	286381	
KIN-C004	15-53070_SP04	14-Aug-2015	335:T1500F15U500	17.6	43.96	9	4385764	285687	
KIN-C005	15-53070_SP05	14-Aug-2015	335:T1500F15U500	5.0	22.97	5	4385722	285682	3
KIN-C006	15-53070_SP06	14-Aug-2015	335:T1500F15U500	10.0	40.03	7	4386026	285506	3
KIN-C007	15-53070_SP07	14-Aug-2015	335:T1500F15U500	12.6	40.03	8	4386123	285430	
KIN-C008	15-53070_SP08	14-Aug-2015	374:T1500F15U500	6.7	20.01	5	4386114	285411	
KIN-C009	15-53070_SP09	14-Aug-2015	374:T1500F15U500	10.0	20.01	3	4386255	285522	3
KIN-C010	15-53070_SP10	14-Aug-2015	335:T1500F15U500	13.0	40.03	8	4386244	285536	
KIN-C011	15-53070_SP11	13-Aug-2015	335:T1500F15U500	27.6	40.03	8	4386382	285722	
KIN-C012	15-53070_SP12	13-Aug-2015	335:T1500F15U500	16.5	39.86	8	4386364	285736	
KIN-C013	15-53070_SP13	13-Aug-2015	335:T1500F15U500	8.1	39.04	8	4386473	285963	
KIN-C014	15-53070_SP14	15-Aug-2015	374:T1500F15U500	5.4	20.83	4	4386481	286344	
KIN-C015	15-53070_SP15	13-Aug-2015	335:T1500F15U500	10.0	38.39	8	4386468	286346	3
KIN-C016	15-53070_SP16	13-Aug-2015	335:T1500F15U500	14.0	22.47	4	4386451	286344	3
KIN-C017	15-53070_SP17	17-Aug-2015	374:T1500F15U500	6.2	20.01	4	4386242	286400	
KIN-C018	15-53070_SP18	17-Aug-2015	335:T1500F15U500	5.2	21.16	4	4386239	286438	
KIN-C019	15-53070_SP19	18-Aug-2015	374:T1500F15U500	3.5	20.01	3	4385855	286393	
KIN-C020	15-53070_SP20	13-Aug-2015	335:T1500F15U500	5.3	22.31	4	4385853	286405	
KIN-C021	15-53070_SP21	17-Aug-2015	335:T1500F15U500	3.4	21.33	4	4385842	286429	
KIN-C022	15-53070_SP22	13-Aug-2015	374:T1500F15U500	1.9	33.96	7	4385958	285856	
KIN-C023	15-53070_SP23	14-Aug-2015	335:T1500F15U500	14.3	41.34	8	4386098	285651	
KIN-C023A	15-53070_CP23A	15-Aug-2015	335:T1500F15U500	15.4	34.12		4386097	285650	
KIN-C024	15-53070_SP24	17-Aug-2015	374:T1500F15U500		6.73		4386142	285515	4
KIN-C024B	15-53070_SP24B	17-Aug-2015	374:T1500F15U500		4.59		4386140	285517	4
KIN-C025	15-53070_SP25	14-Aug-2015	374:T1500F15U500	14.5	41.67	8	4386326	285776	
KIN-C026	15-53070_SP26	17-Aug-2015	374:T1500F15U500	1.9	30.51	7	4386290	285960	
KIN-C027	15-53070_SP27	14-Aug-2015	374:T1500F15U500	4.5	30.02	6	4386171	285813	
KIN-C028	15-53070_SP28	18-Aug-2015	374:T1500F15U500	13.6	30.02	6	4386043	285531	
KIN-C029	15-53070_SP29	14-Aug-2015	374:T1500F15U500	2.0	30.02	6	4386044	285779	
KIN-C030	15-53070_SP30	13-Aug-2015	374:T1500F15U500	1.3	28.54	6	4386179	286098	
KIN-C031	15-53070_SP31	13-Aug-2015	374:T1500F15U500	7.0	30.02	6	4385813	286105	3
KIN-C032	15-53070_SP32	14-Aug-2015	335:T1500F15U500	16.8	34.45	7	4385847	285688	
KIN-C033	15-53070_SP33	13-Aug-2015	374:T1500F15U500	23.2	30.02	6	4385789	285955	
KIN-C034	15-53070_SP34	13-Aug-2015	374:T1500F15U500	20.3	30.02	6	4385747	285844	
KIN-C035	15-53070_SP35	13-Aug-2015	374:T1500F15U500	20.8	30.02	6	4385669	285997	
KIN-C036	15-53070_SP36	14-Aug-2015	374:T1500F15U500	0.8	27.89	6	4385600	286099	
KIN-C037	15-53070_SP37	14-Aug-2015	374:T1500F15U500	1.4	30.02	6	4385603	286197	
Totals	39 soundings				1124.98	215			

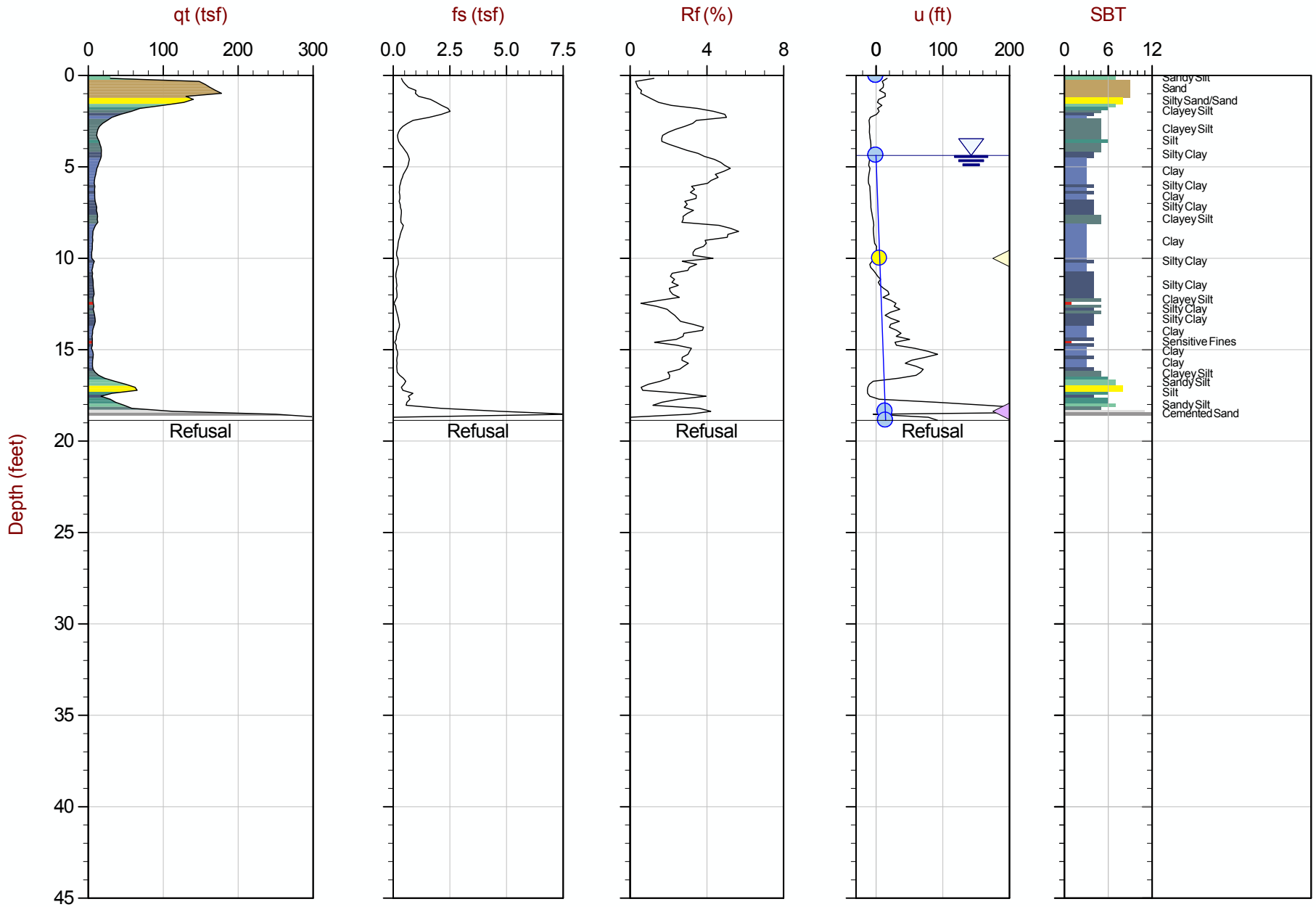
1. Assumed phreatic surface depths were determined from the pore pressure data unless otherwise noted. Hydrostatic data were used for calculated parameters.
2. Coordinates are WGS 84 / UTM Zone 16 and were collected using a handheld GPS Receiver.
3. Assumed phreatic surface estimated from dynamic pore pressure response.
4. No phreatic surface detected

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 12:44
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C001
Cone: 335:T1500F15U500



Max Depth: 5.750 m / 18.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP01.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385569m E: 286381m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

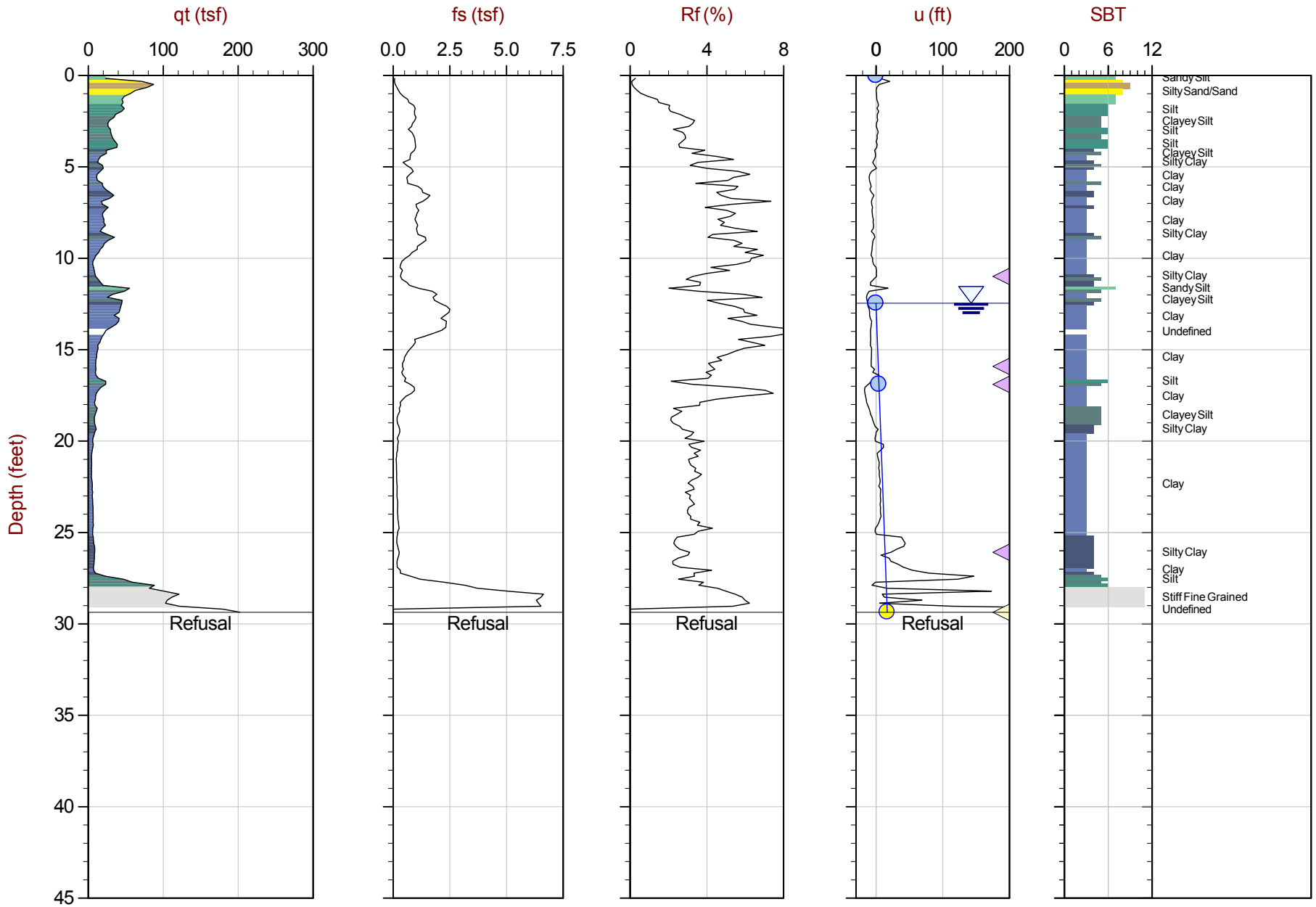
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:18:15 07:59
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335:T1500F15U500



Max Depth: 8.950 m / 29.36 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP02.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385577m E: 286096m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

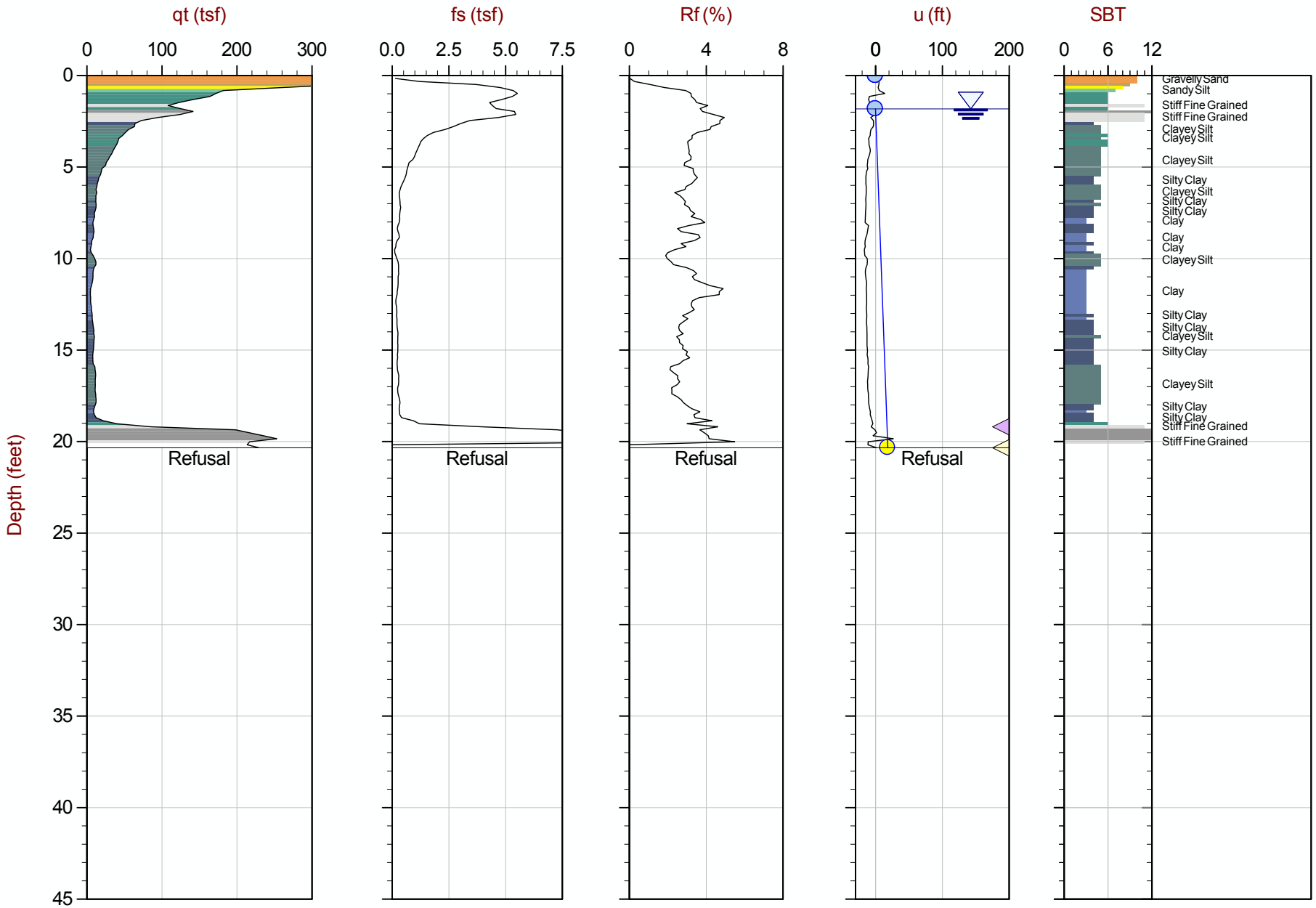
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 14:32
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C003
Cone: 335:T1500F15U500



Max Depth: 6.200 m / 20.34 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP03.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385569m E: 286381m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

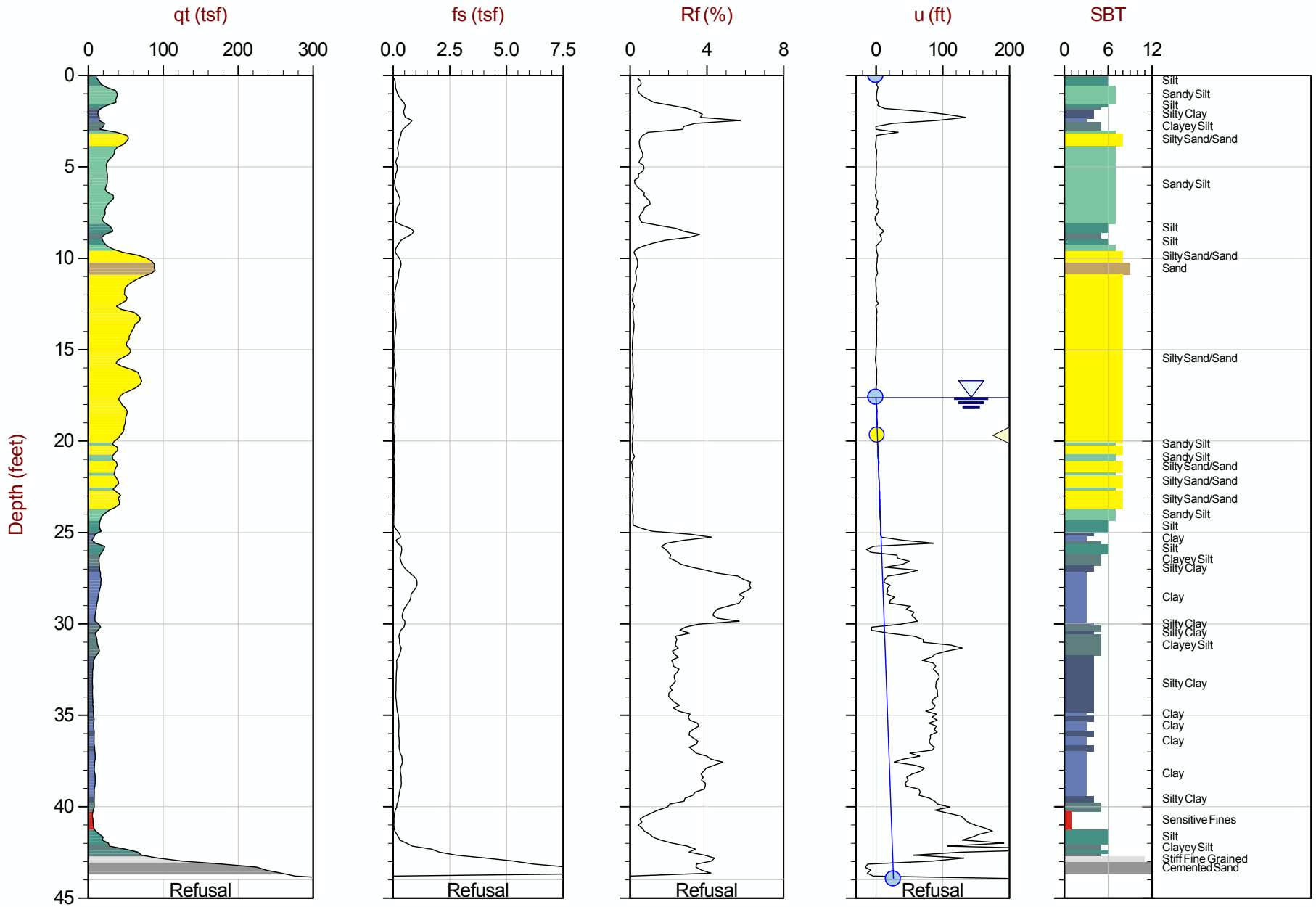
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 12:25
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C004
Cone: 335:T1500F15U500



Max Depth: 13.400 m / 43.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP04.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385764m E: 285687m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

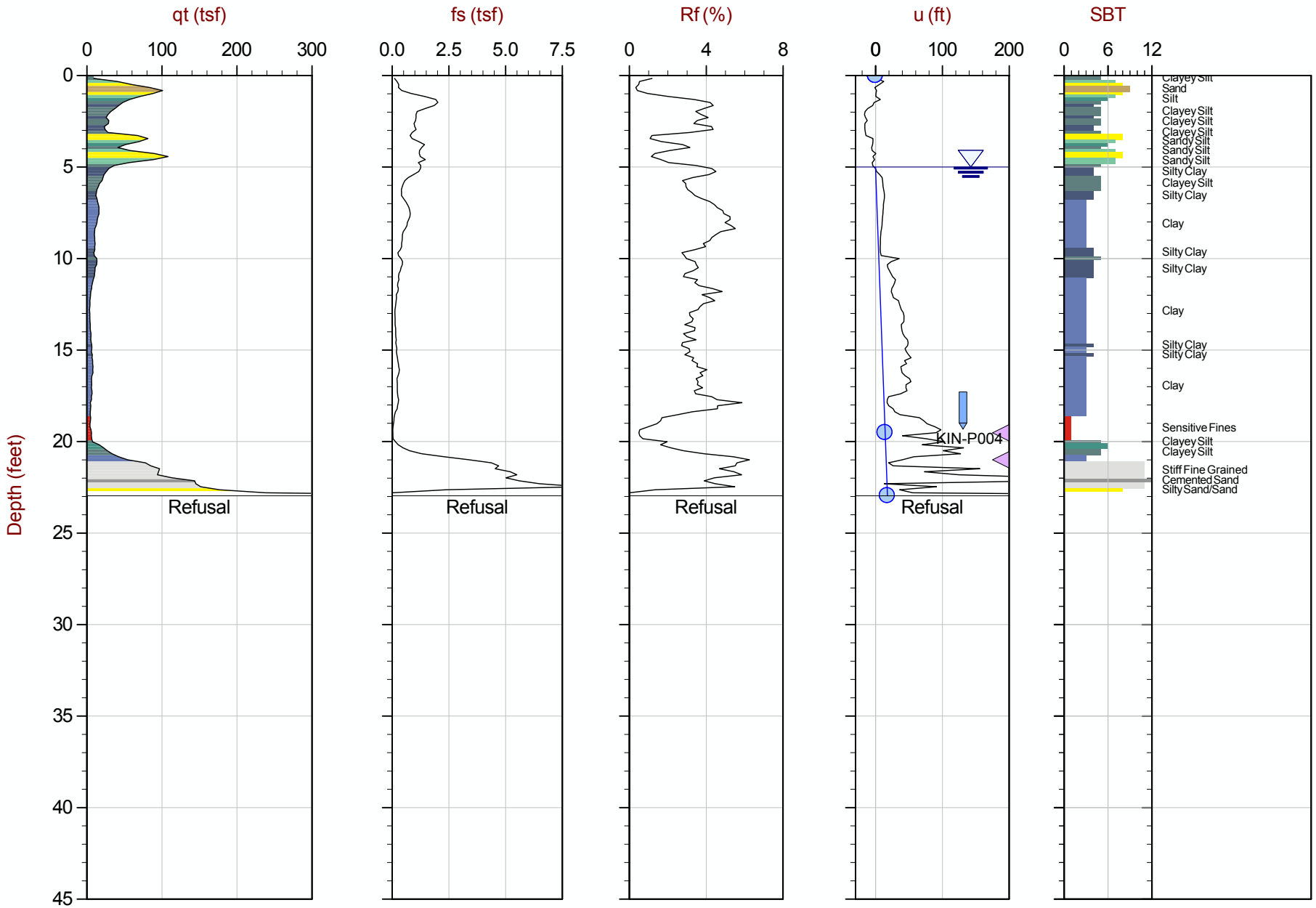
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 11:16
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C005
Cone: 335:T1500F15U500



Max Depth: 7.000 m / 22.97 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP05.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385722m E: 285682m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

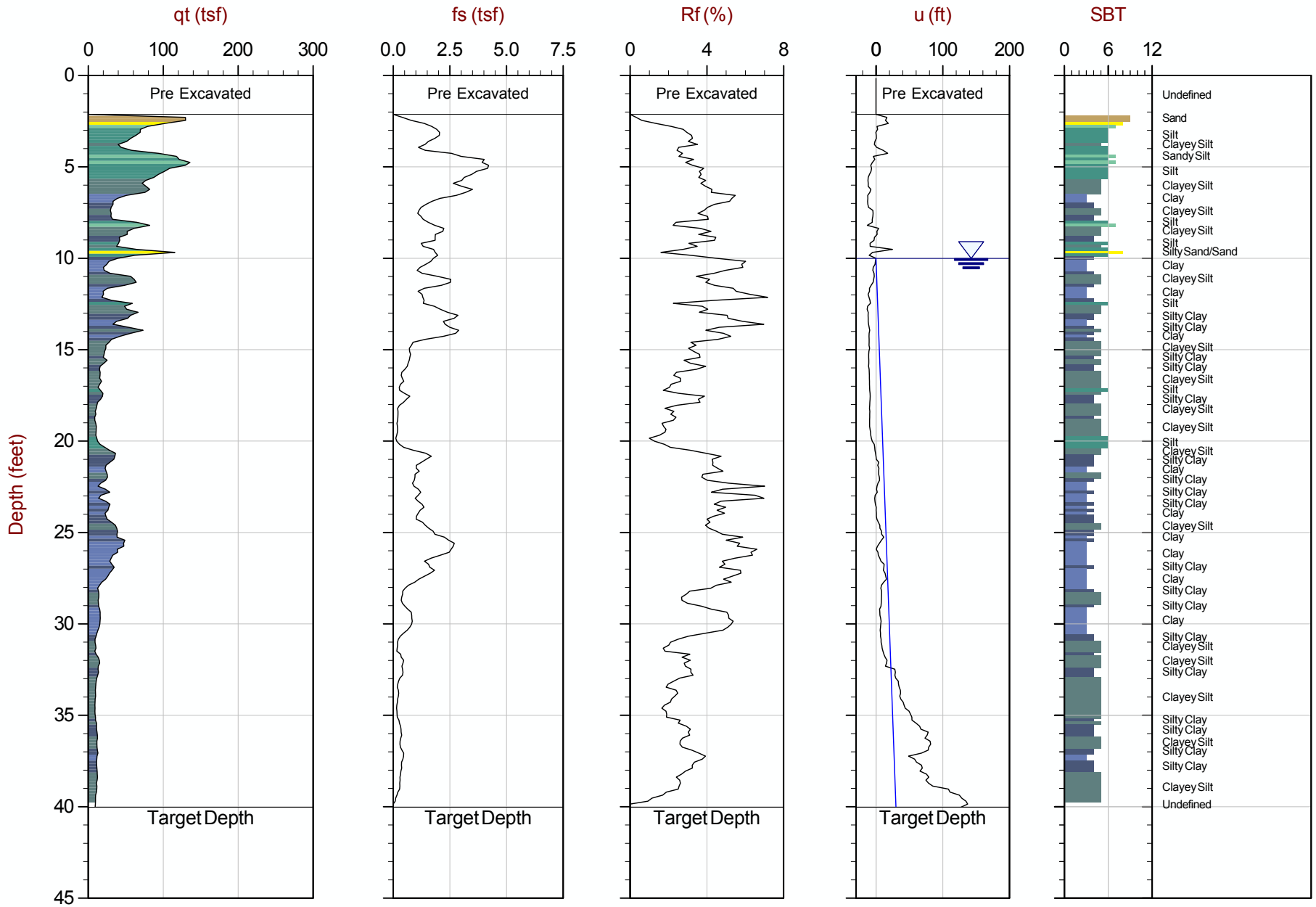
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 10:05
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C006
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP06.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386026m E: 285506m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

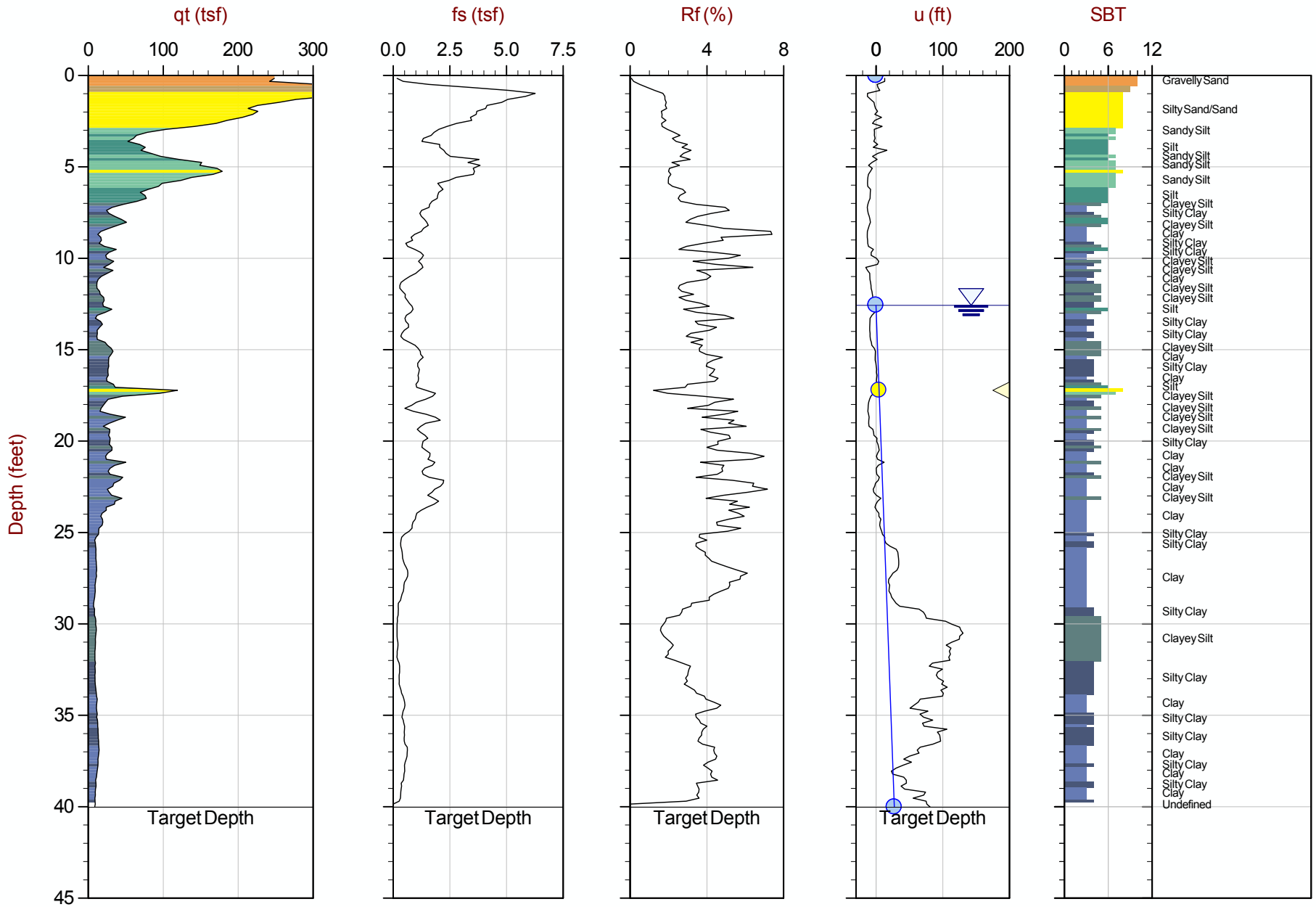
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 09:07
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C007
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP07.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386123m E: 285430m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

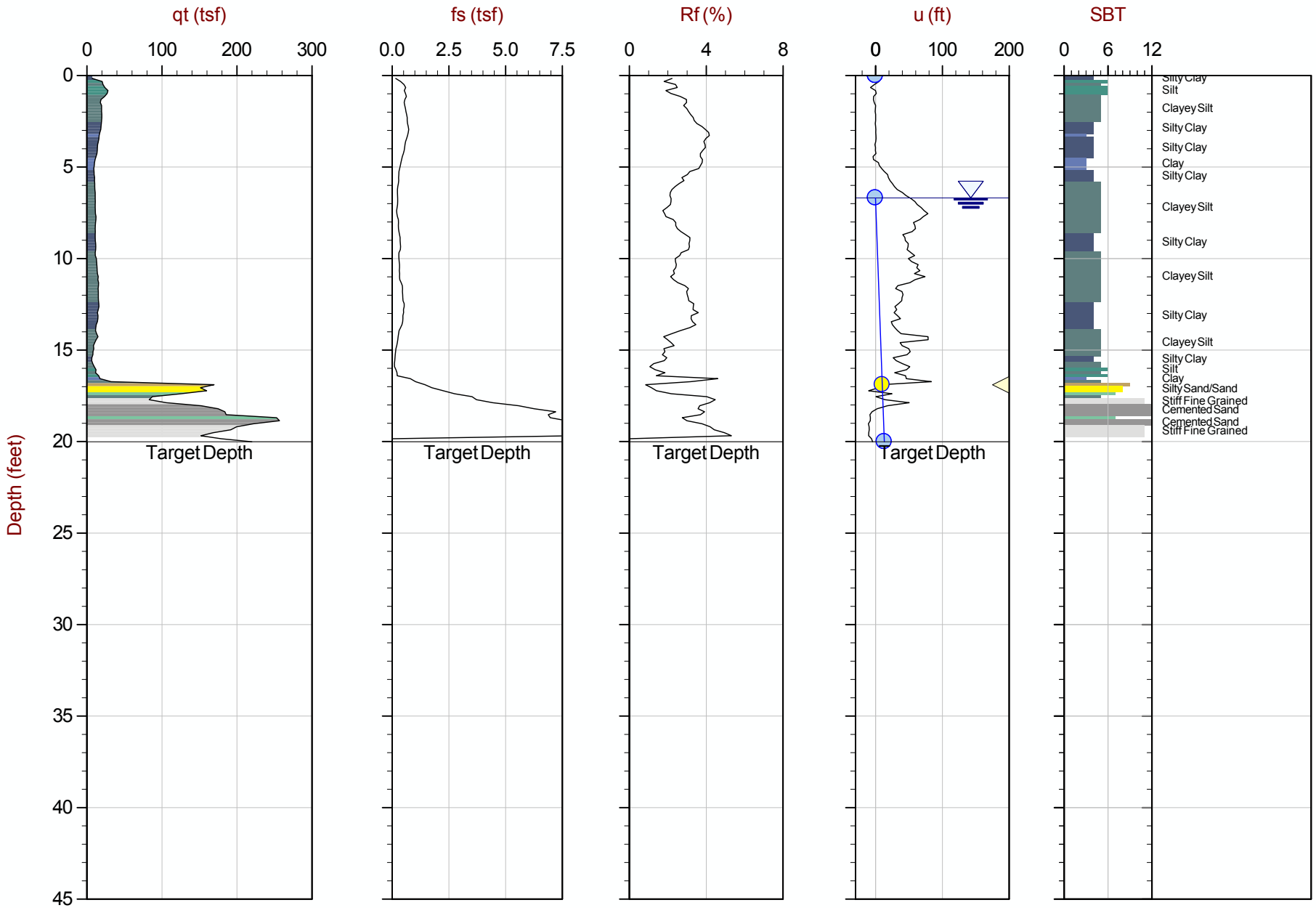
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 08:12
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C008
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP08.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386114m E: 285411m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

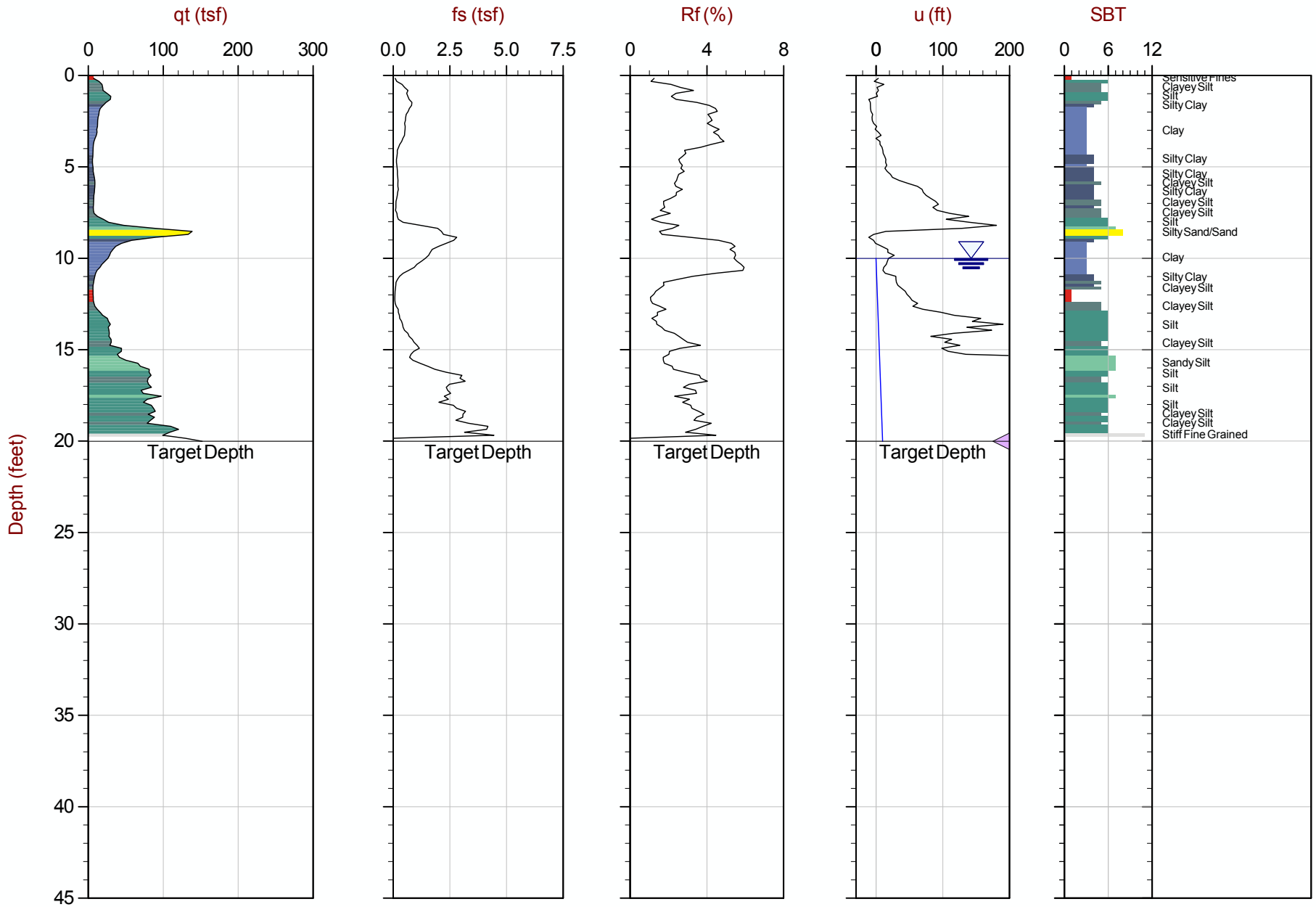
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 09:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C009
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP09.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386255m E: 285522m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

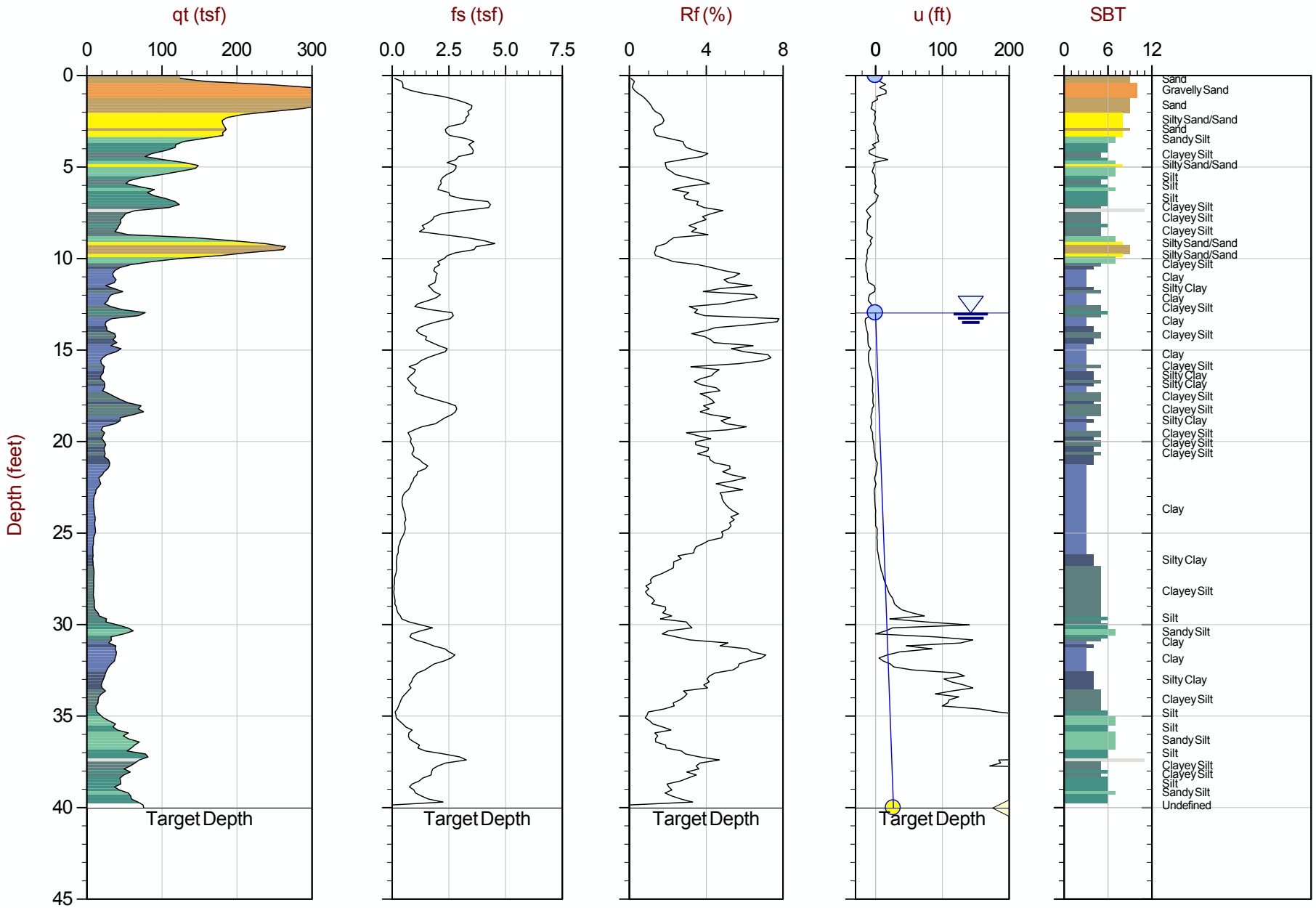
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 07:15
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C010
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP10.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386244m E: 285536m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

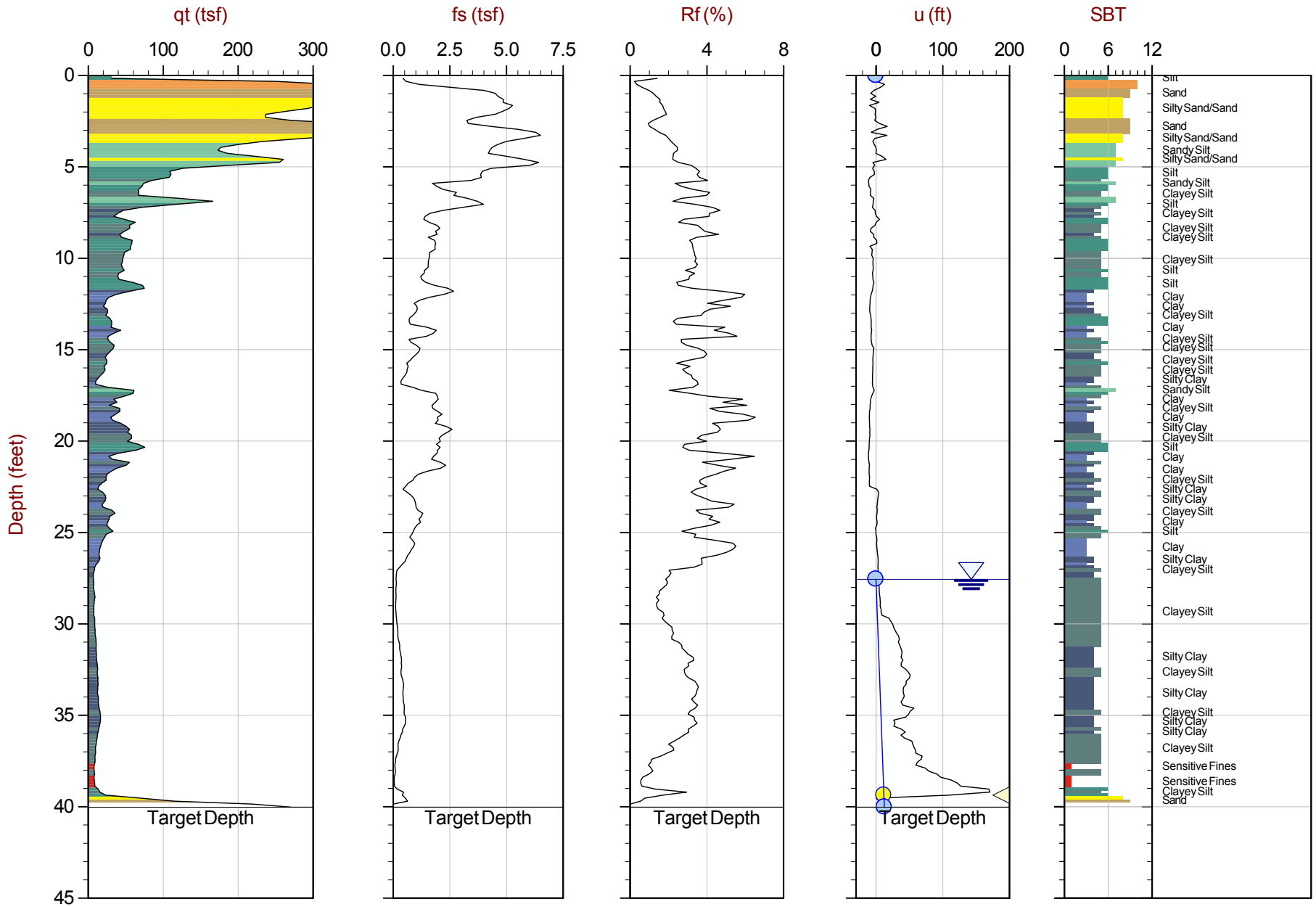
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 14:02
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C011
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP11.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386382m E: 285722m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

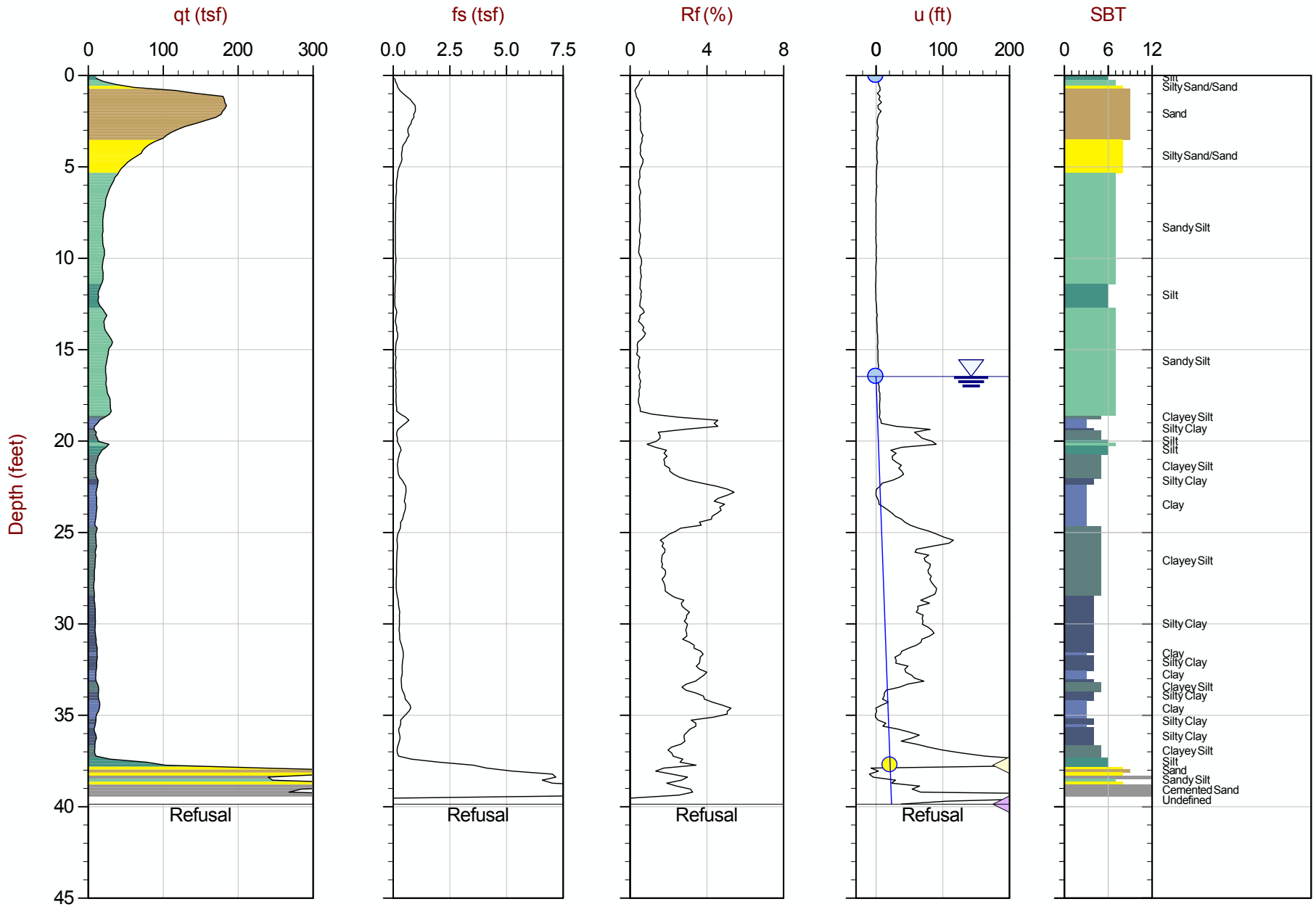
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 15:05
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C012
Cone: 335:T1500F15U500



Max Depth: 12.150 m / 39.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386364m E: 285736m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

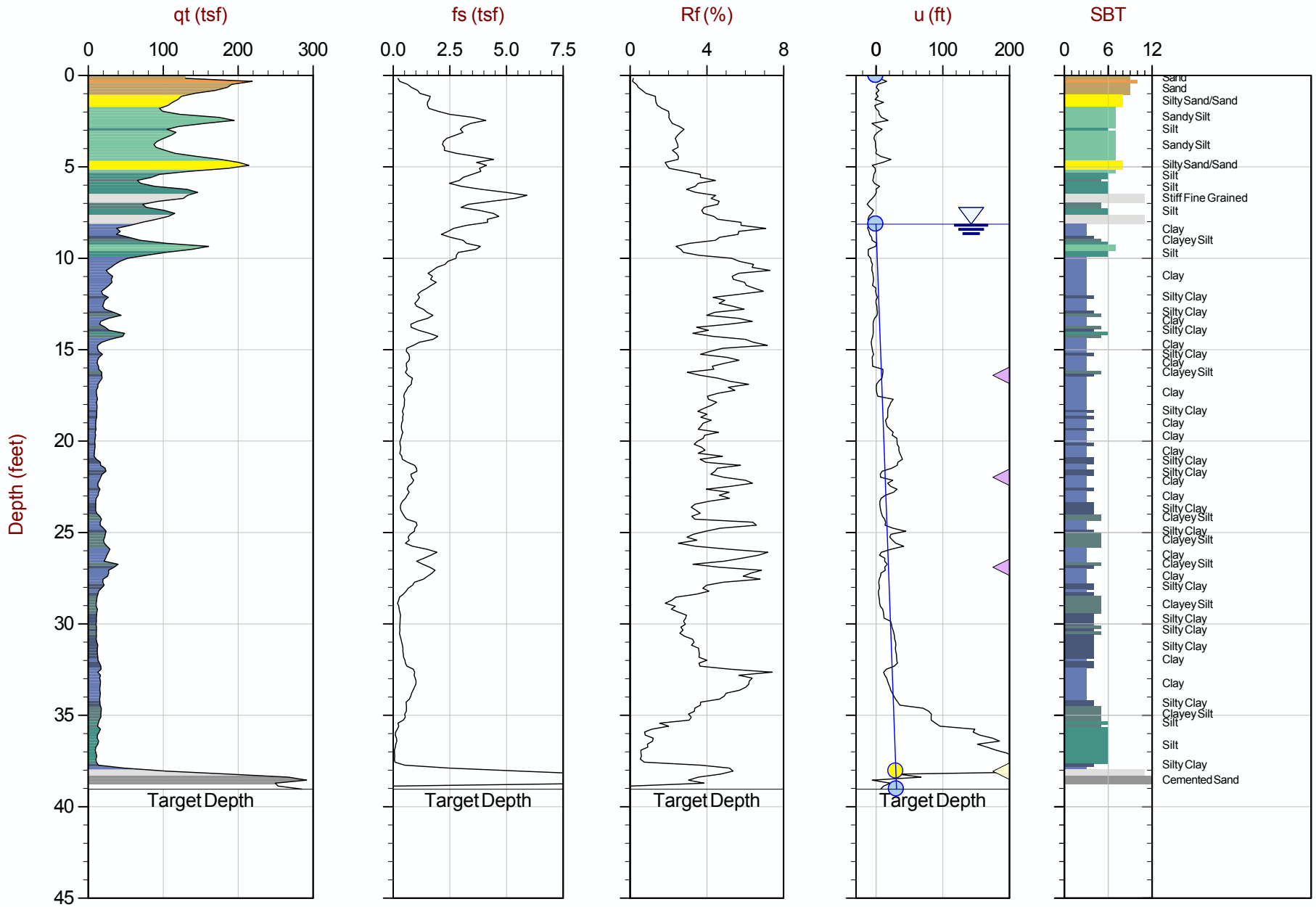
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 11:43
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C013
Cone: 335:T1500F15U500



Max Depth: 11.900 m / 39.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386473m E: 285963m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

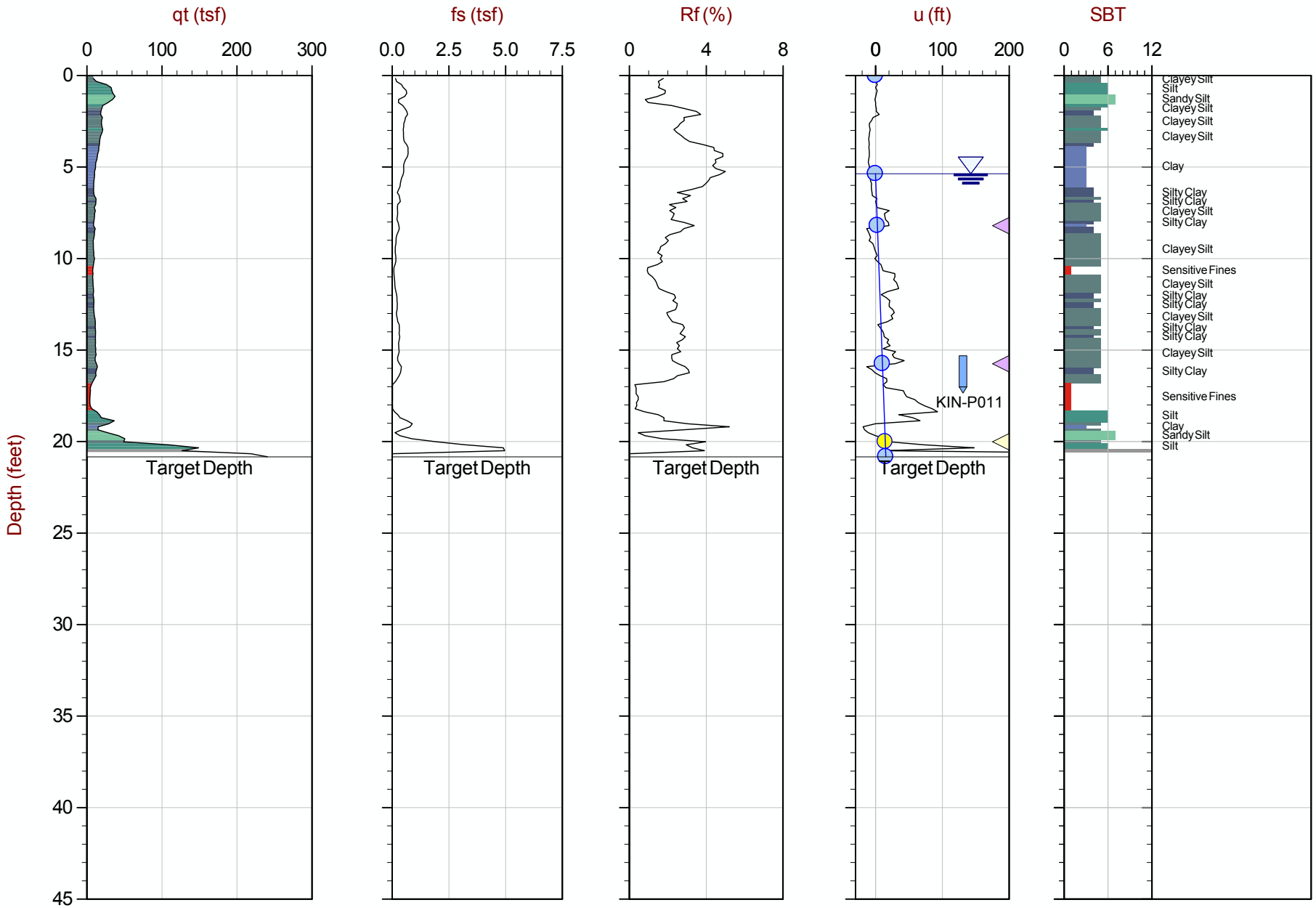
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:15:15 09:12
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C014
Cone: 374:T1500F15U500



Max Depth: 6.350 m / 20.83 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP14.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386481m E: 286344m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

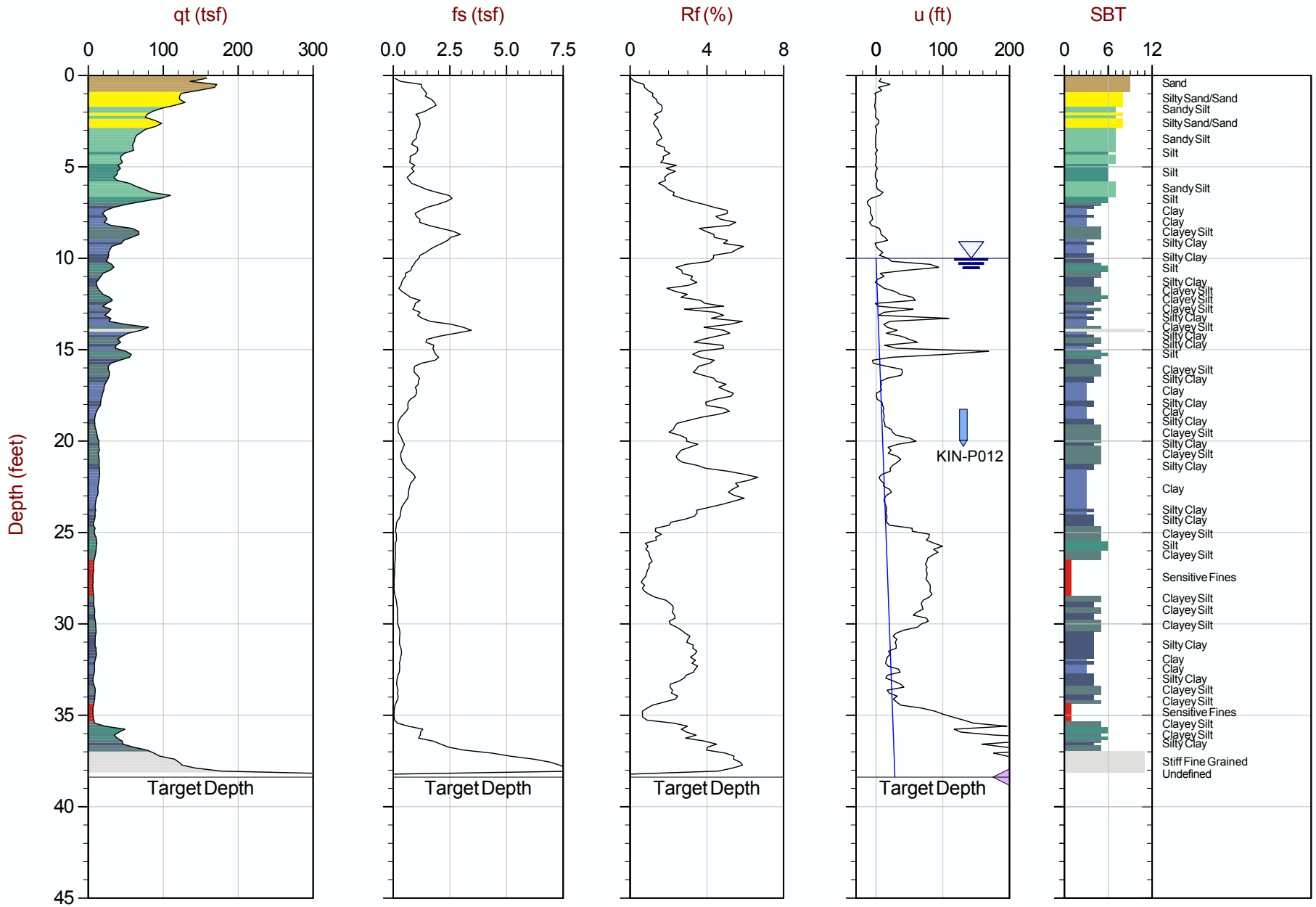
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 09:41
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C015
Cone: 335:T1500F15U500



Max Depth: 11.700 m / 38.39 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386468m E: 286346m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

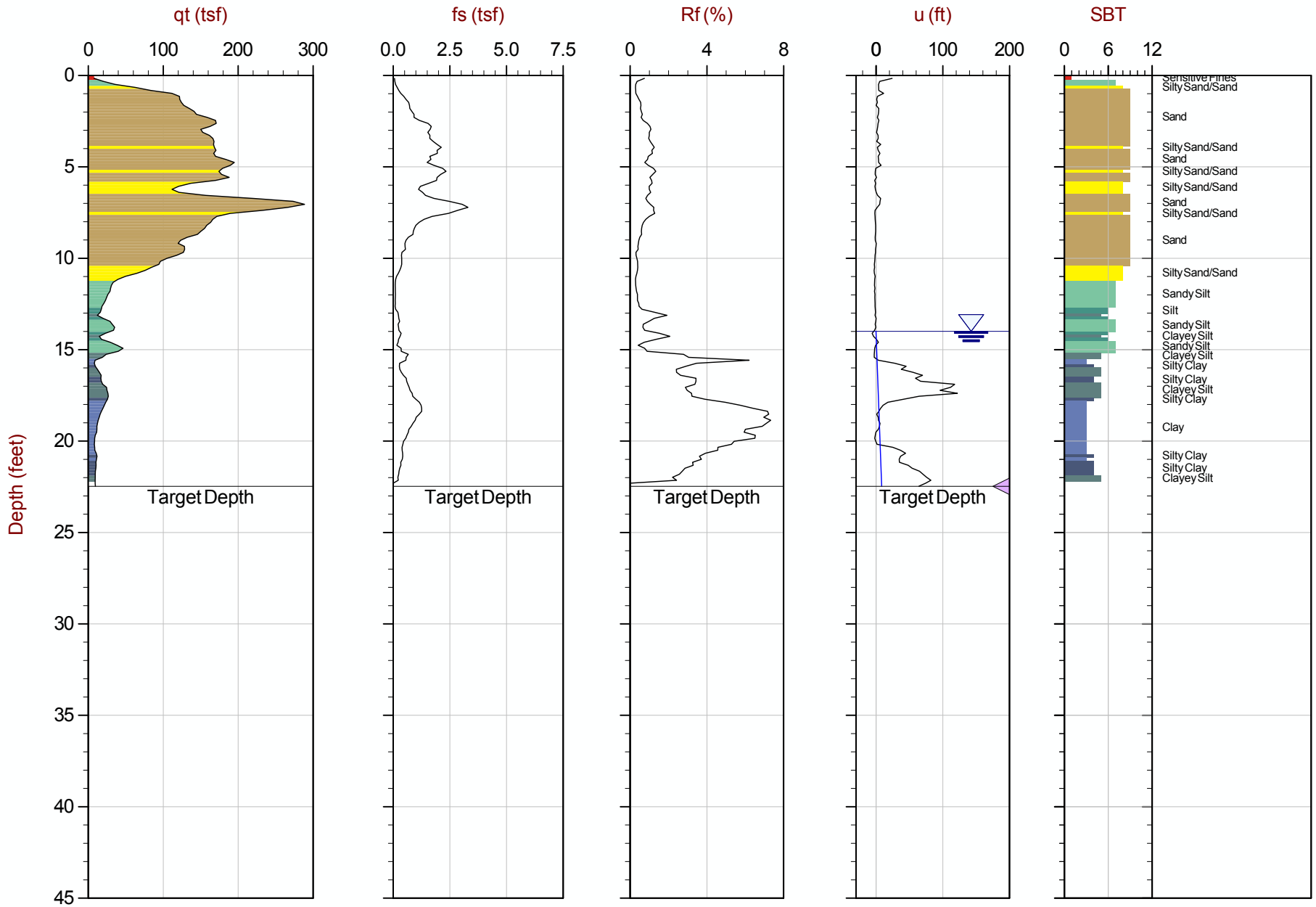
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 10:45
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C016
Cone: 335:T1500F15U500



Max Depth: 6.850 m / 22.47 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP16.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386451m E: 286344m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

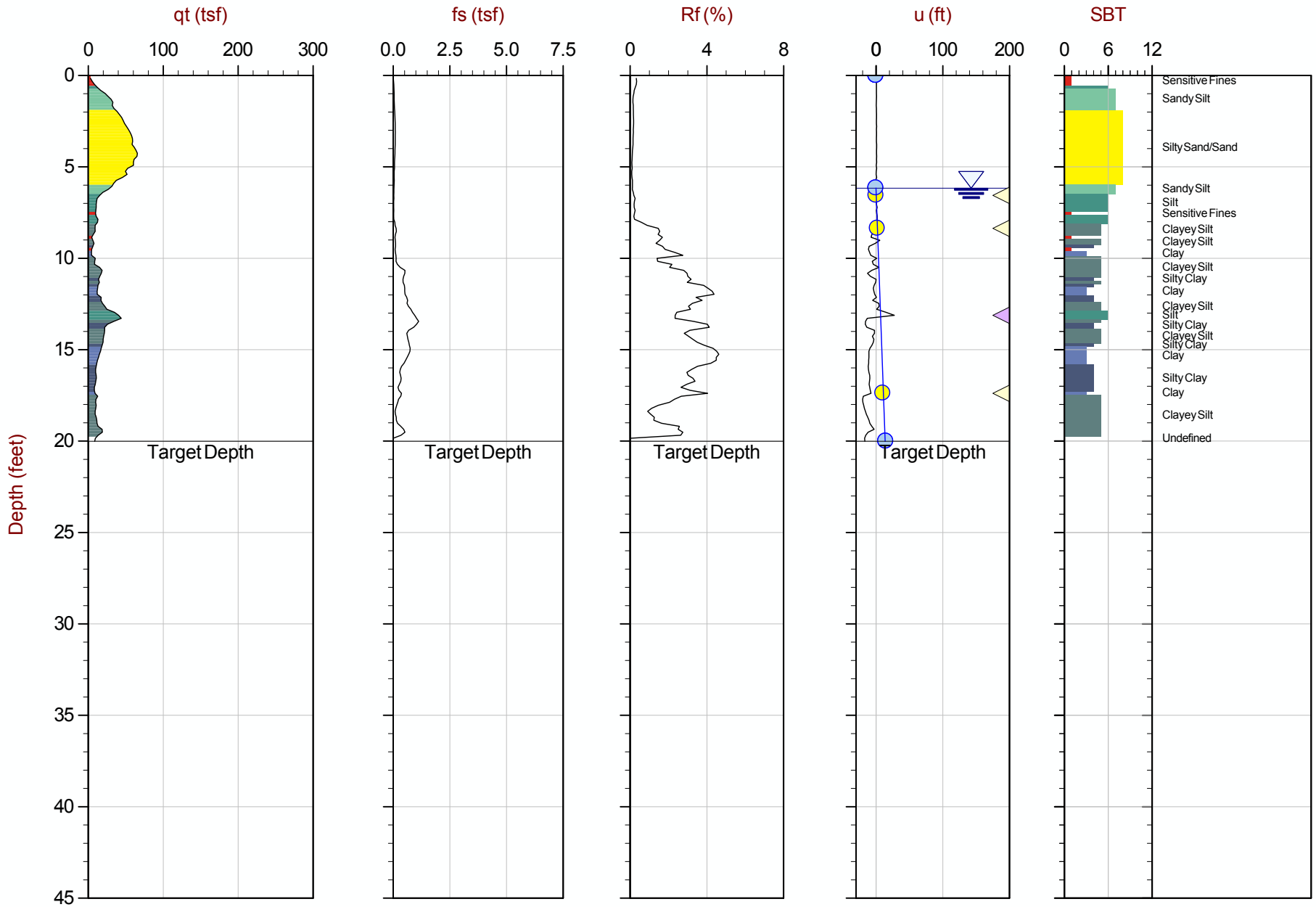
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 08:51
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C017
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386242m E: 286400m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

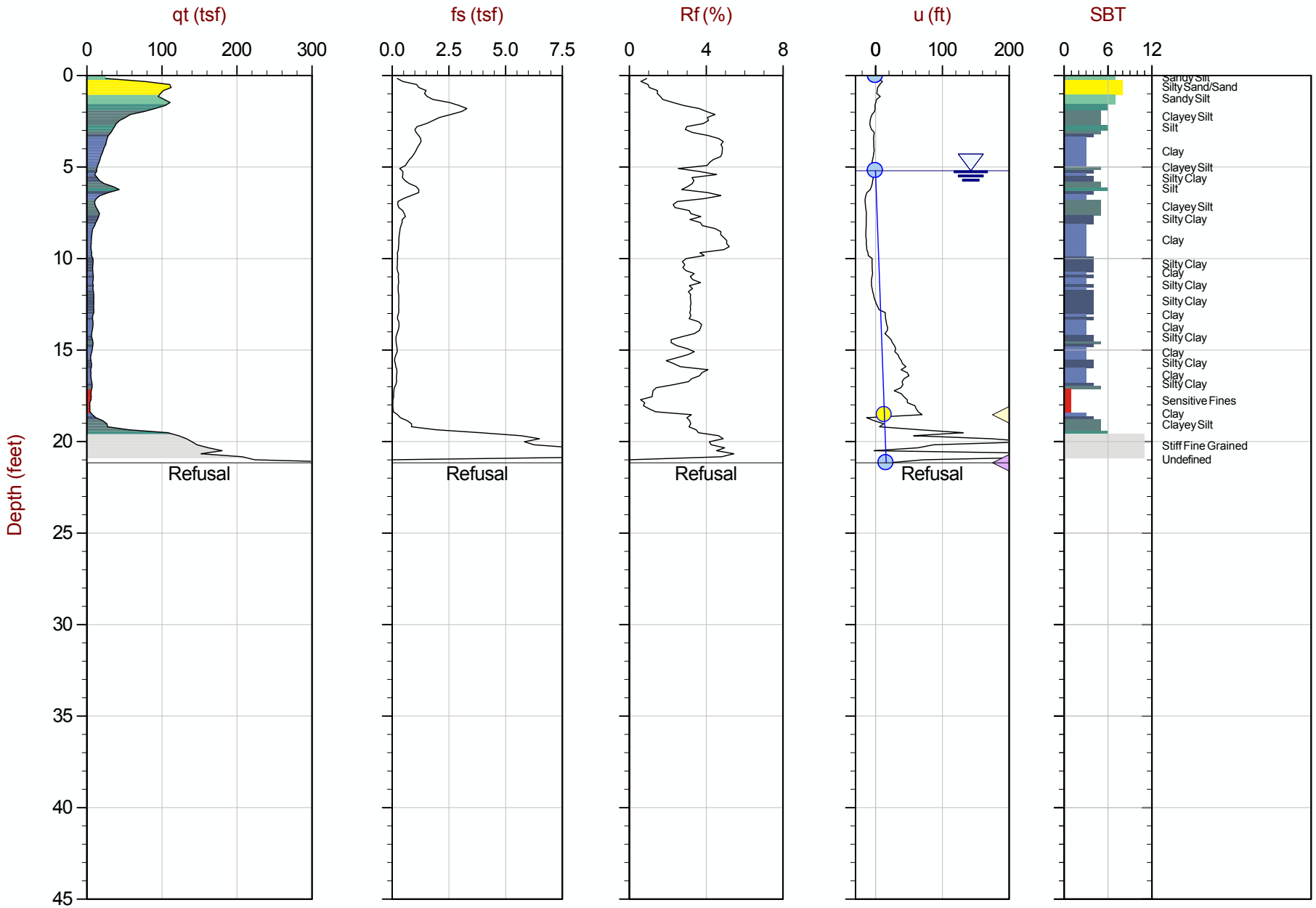
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 08:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C018
Cone: 335:T1500F15U500



Max Depth: 6.450 m / 21.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP18.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386239m E: 286438m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

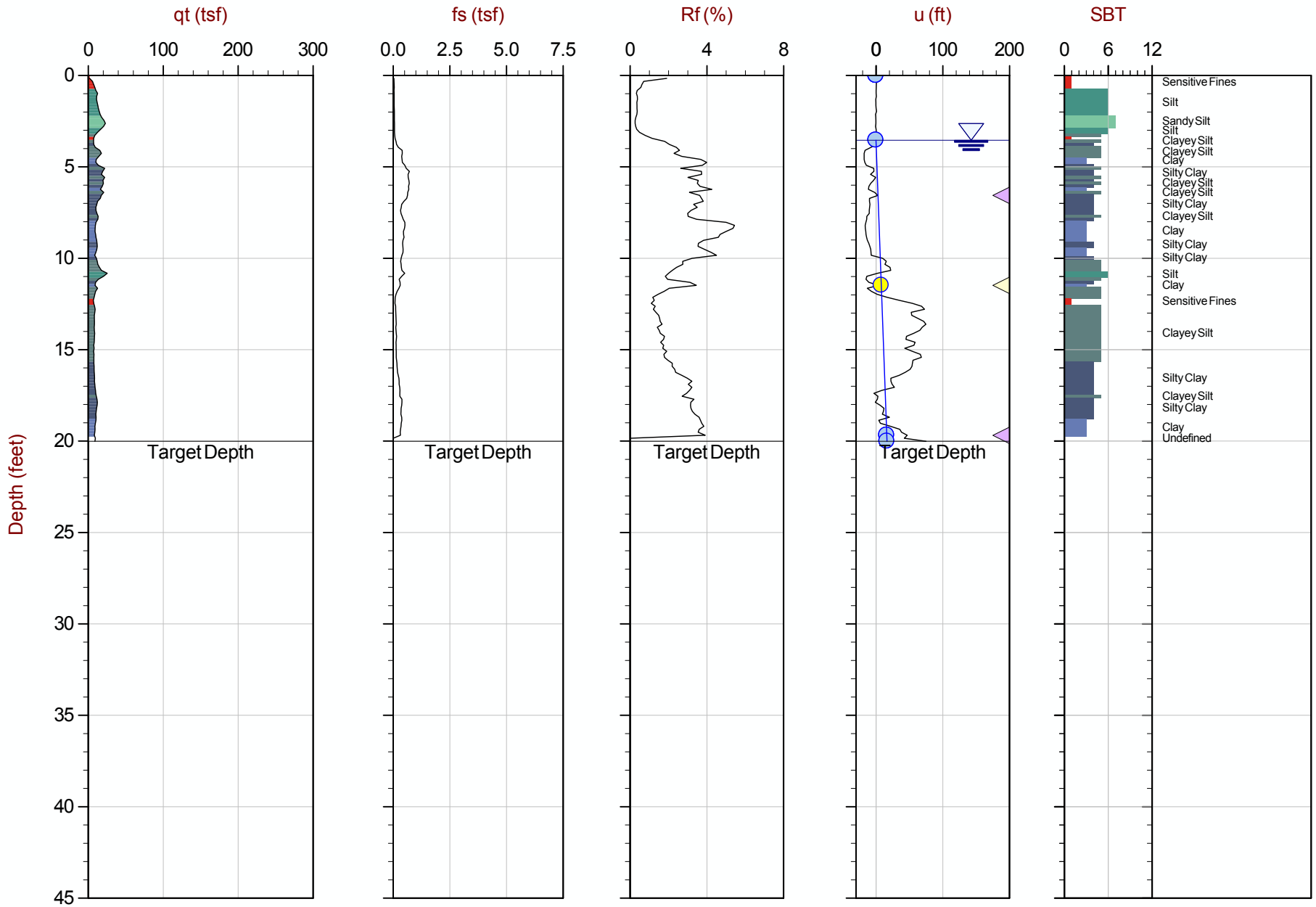
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:18:15 10:43
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C019
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP19.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385855m E: 286393m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

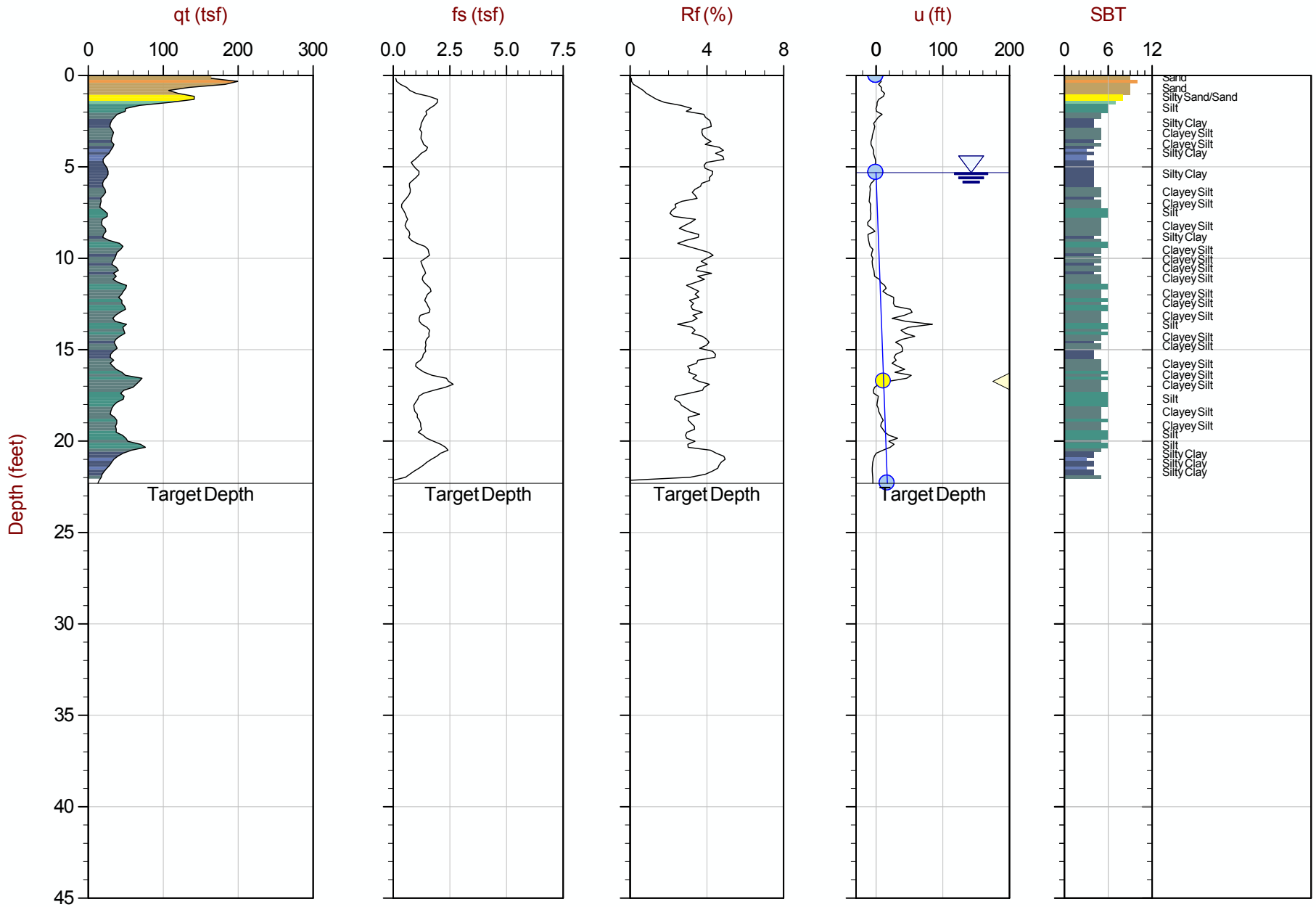
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 08:31
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C020
Cone: 335:T1500F15U500



Max Depth: 6.800 m / 22.31 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP20.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385853m E: 286405m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

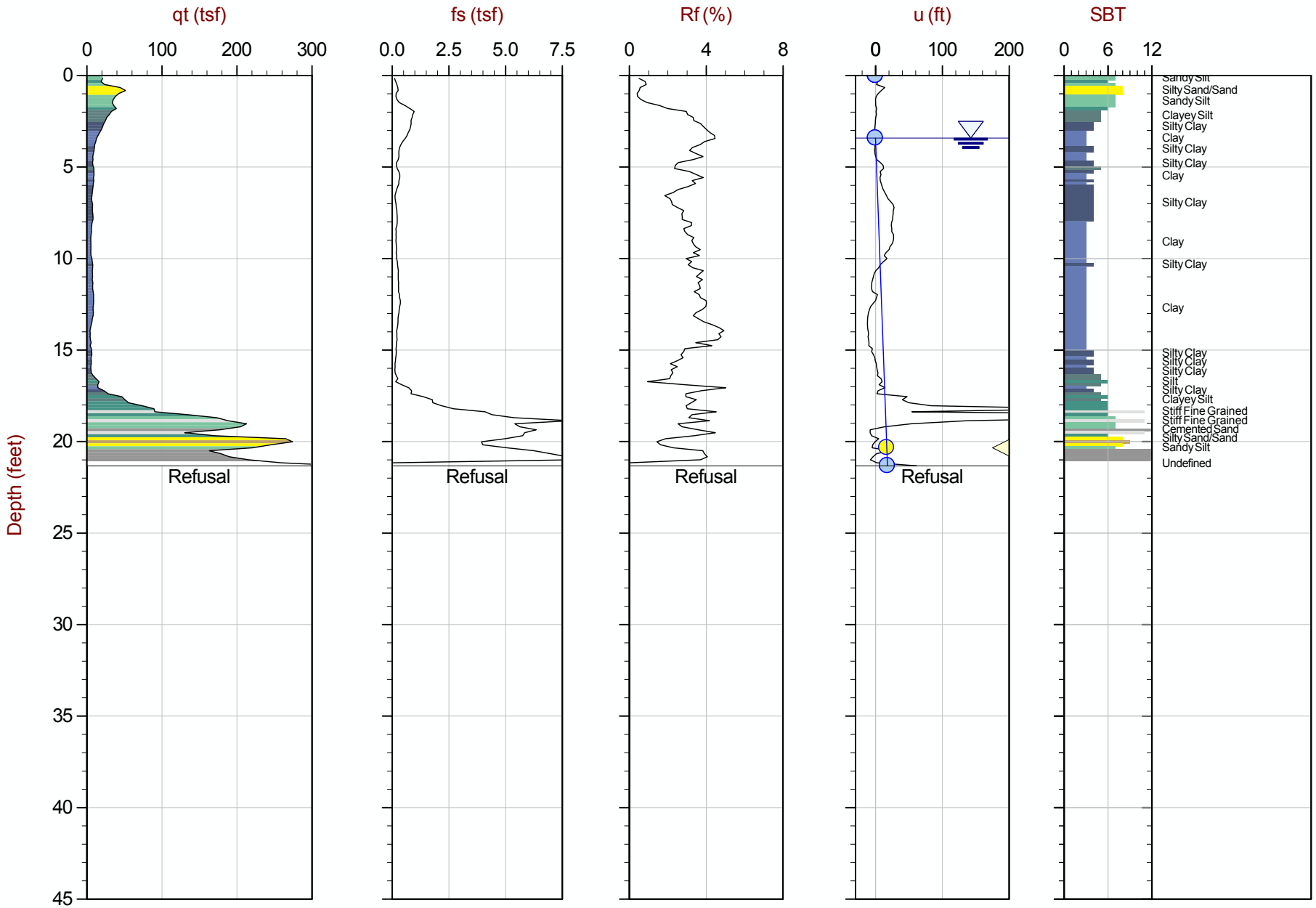
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 11:10
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C021
Cone: 335:T1500F15U500



Max Depth: 6.500 m / 21.33 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP21.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385842m E: 286429m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

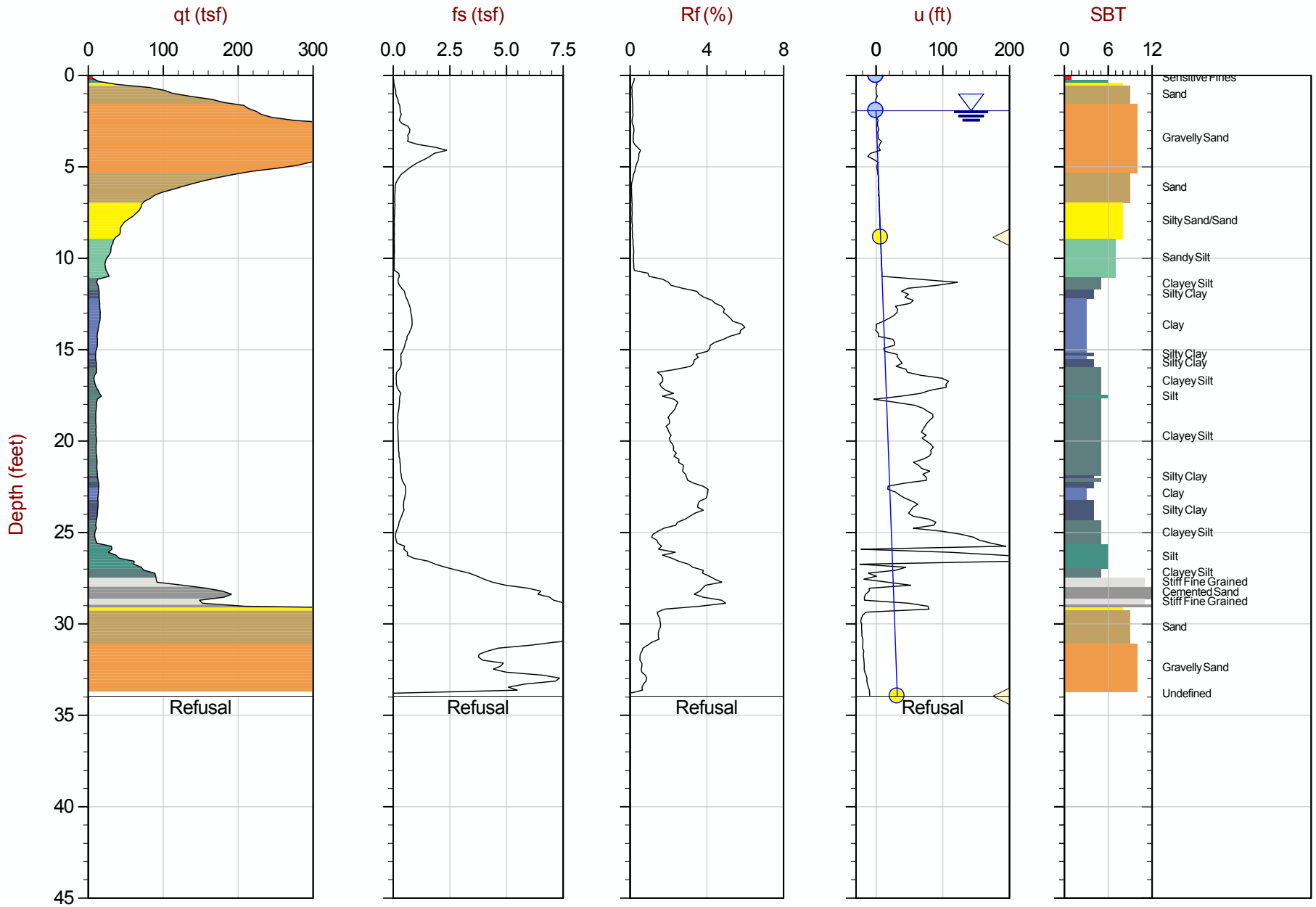
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 11:53
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C022
Cone: 374:T1500F15U500



Max Depth: 10.350 m / 33.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP22.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385958m E: 285856m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

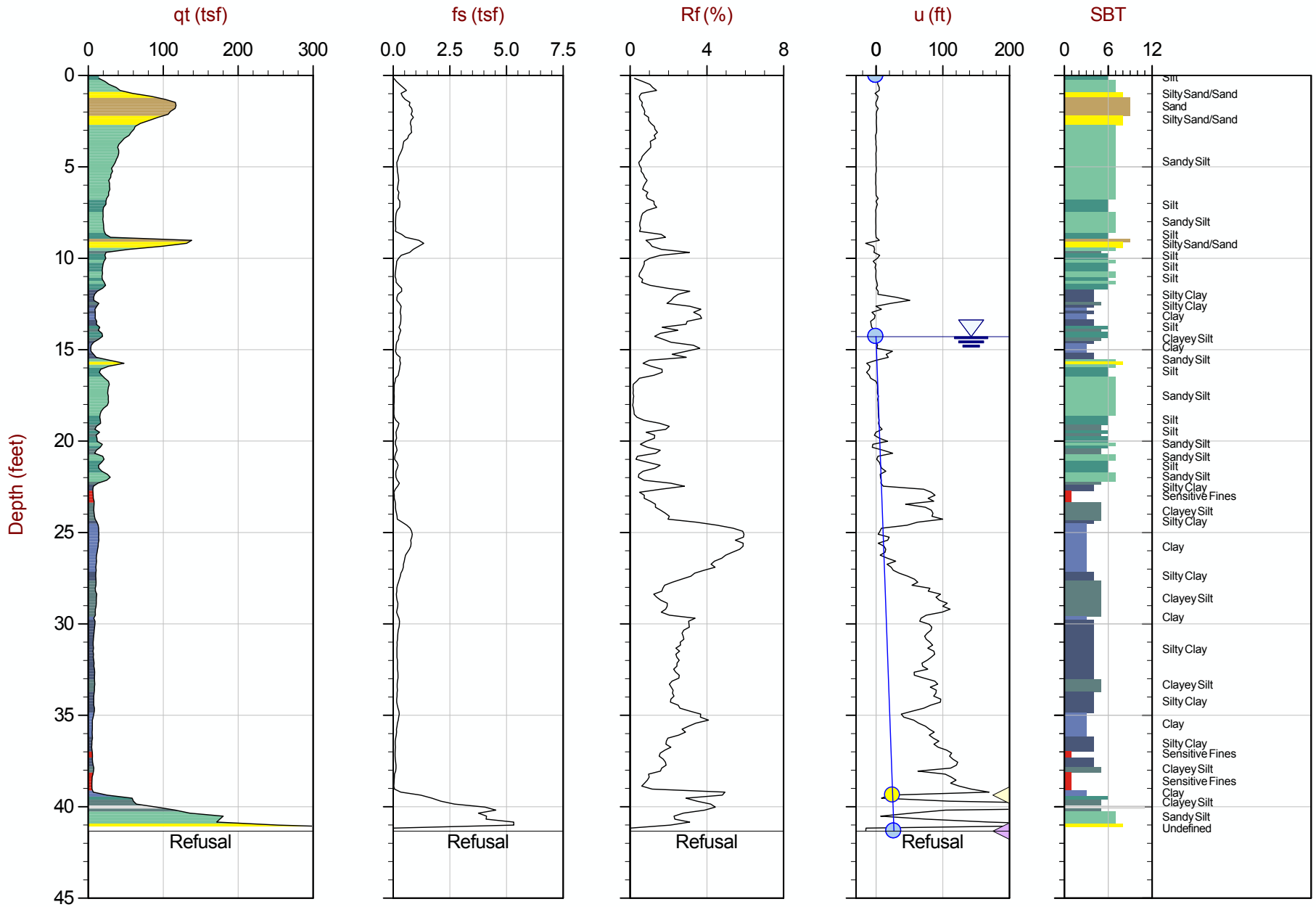
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 14:39
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023
Cone: 335:T1500F15U500



Max Depth: 12.600 m / 41.34 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP23.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386098m E: 285651m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

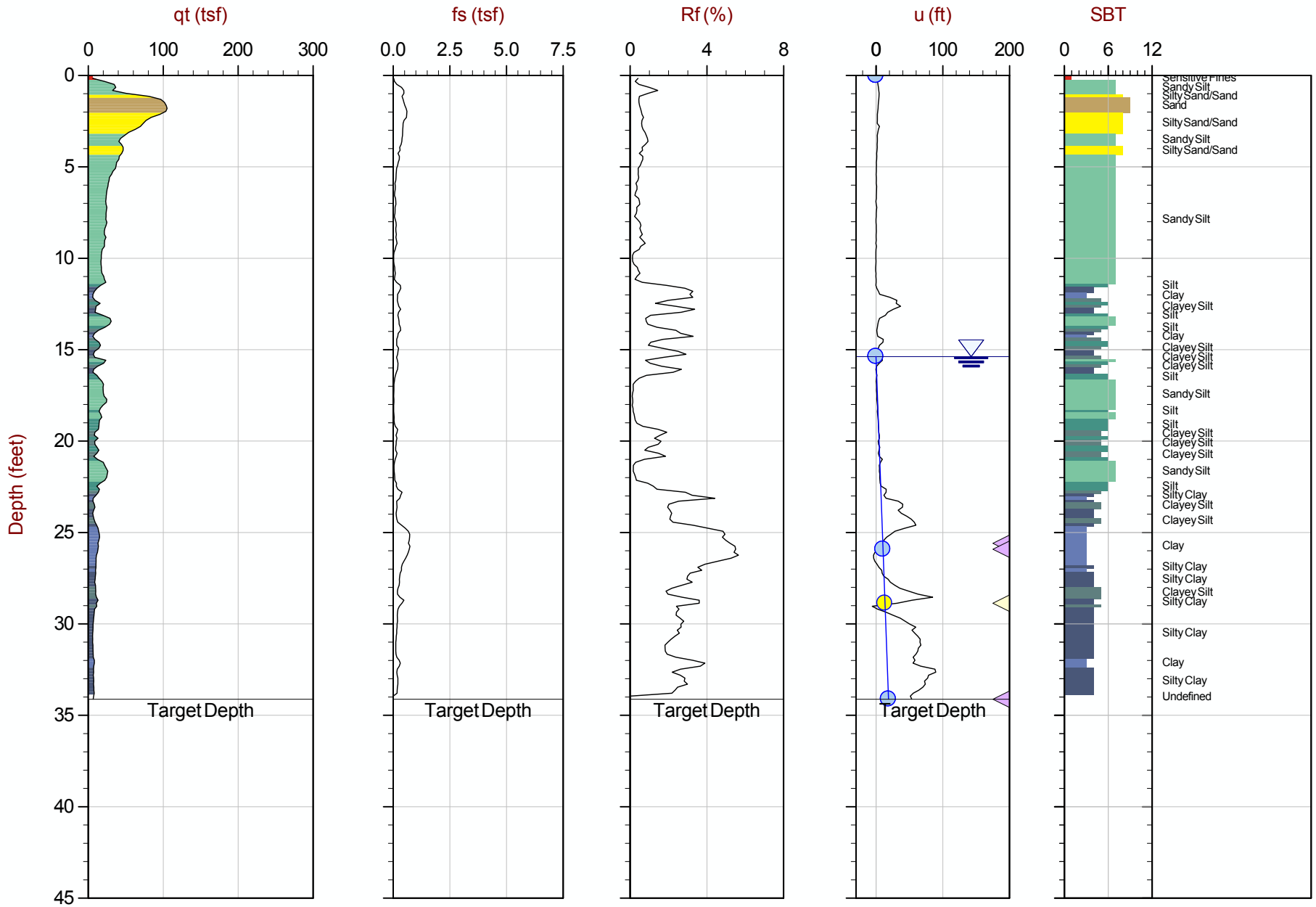
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:15:15 07:57
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023A
Cone: 335:T1500F15U500



Max Depth: 10.400 m / 34.12 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_CP23A.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386097m E: 285650m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

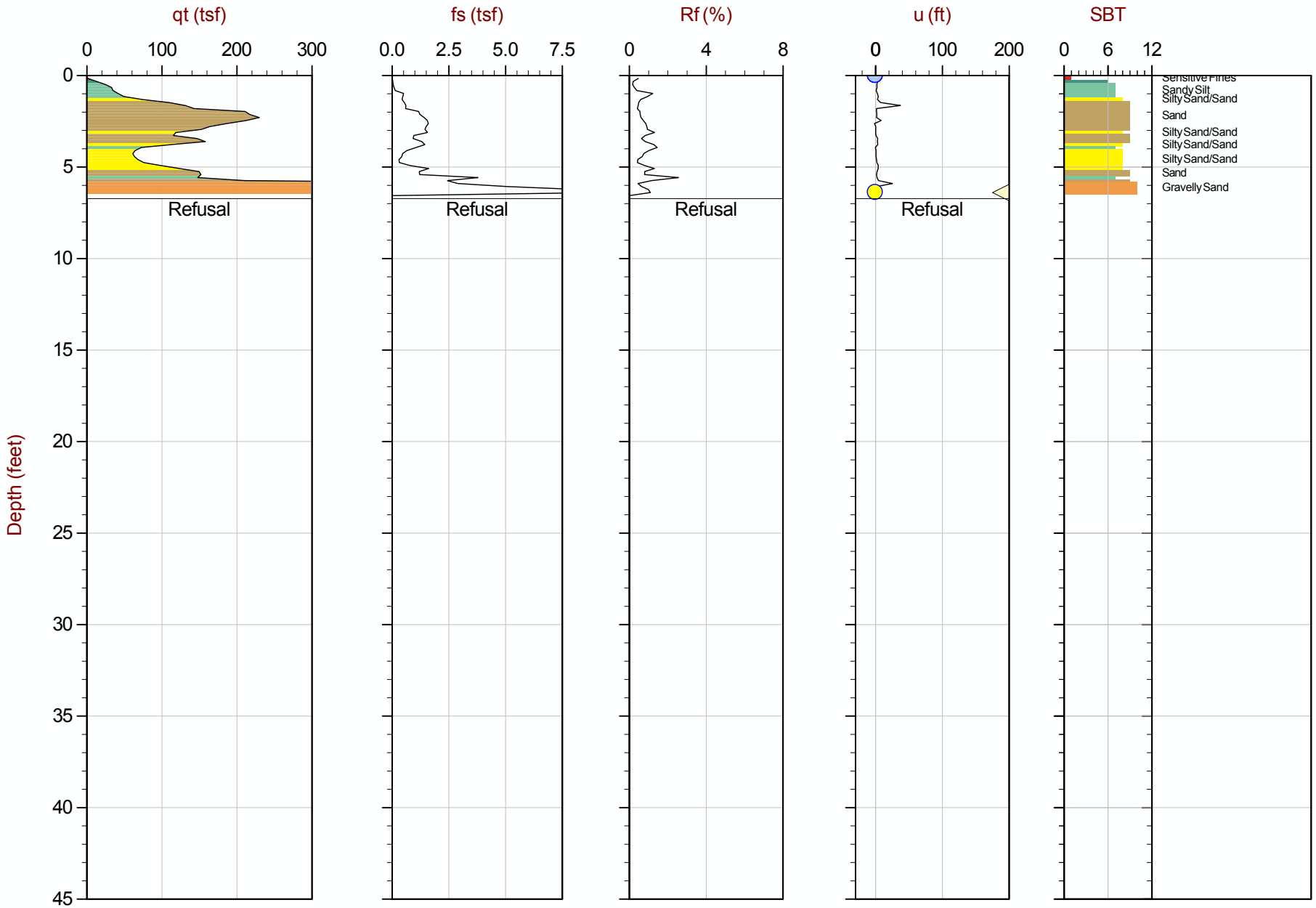
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 14:36
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C024
Cone: 374:T1500F15U500



Max Depth: 2.050 m / 6.73 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP24.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386142m E: 285515m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

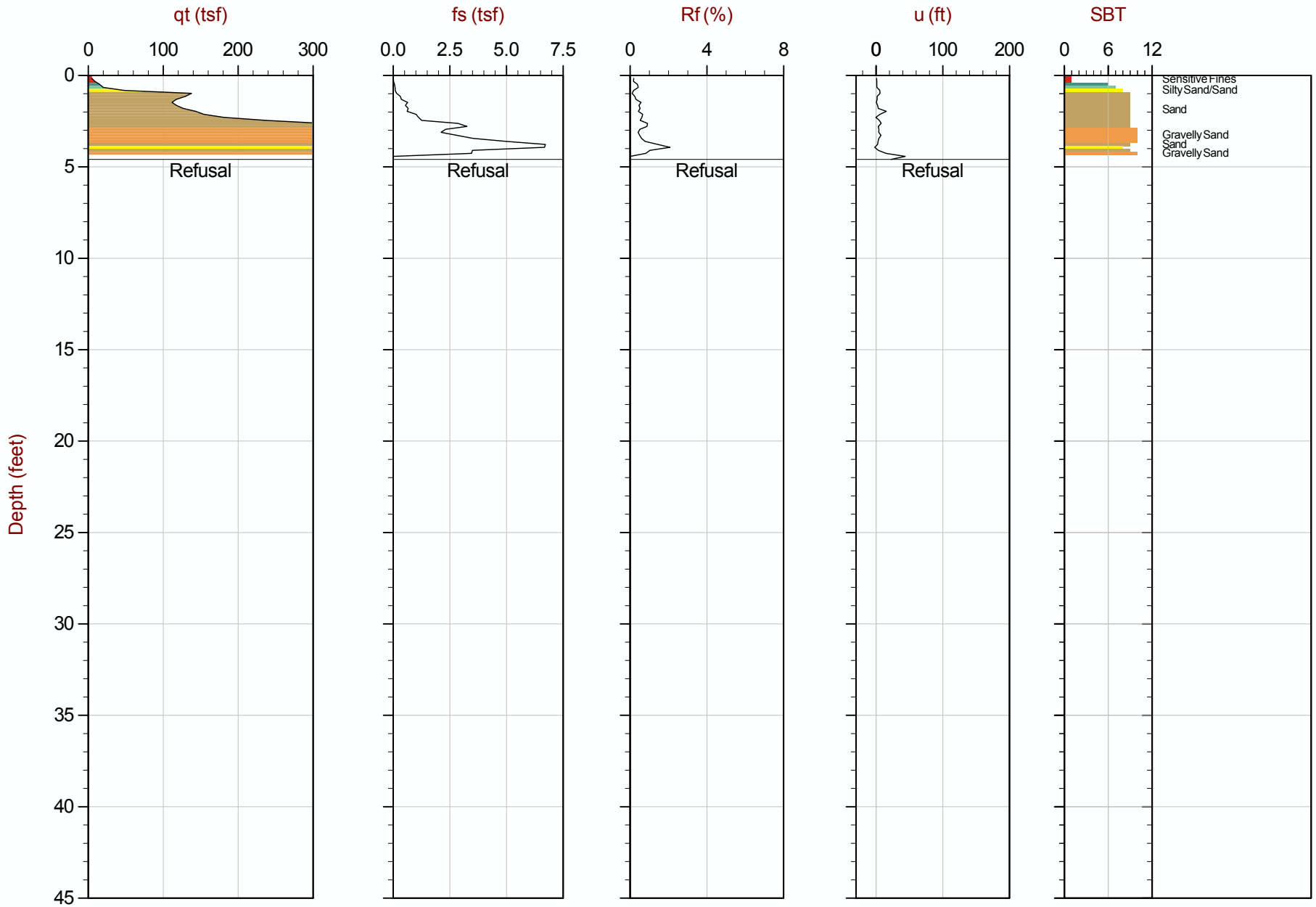
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 15:17
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C024B
Cone: 374:T1500F15U500



Max Depth: 1.400 m / 4.59 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP24B.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386140m E: 285517m

Hydrostatic Line ○ Ueq ● Assumed Ueq ◁ PPD, Ueq achieved ◁ PPD, Ueq not achieved

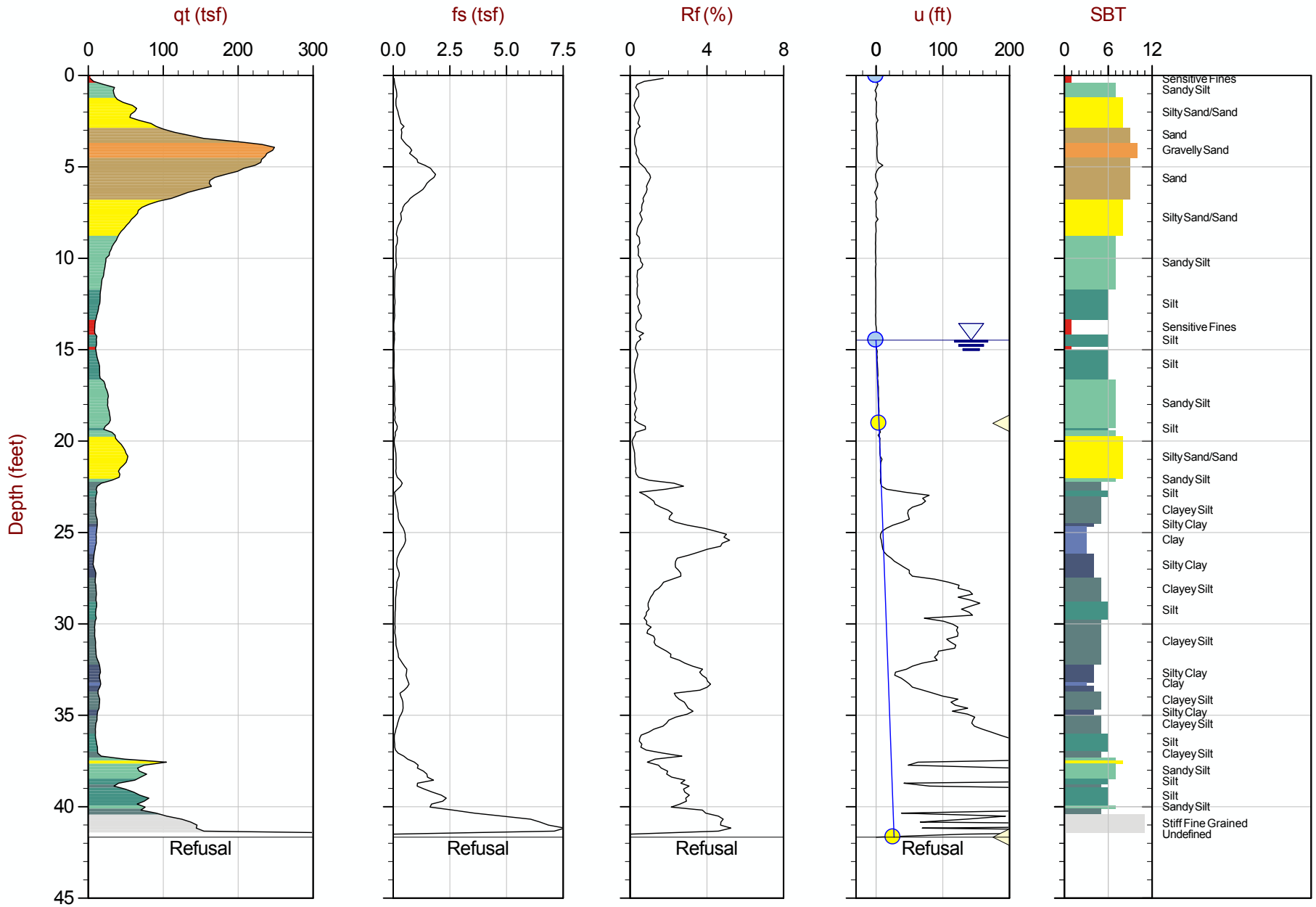
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 11:22
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C025
Cone: 374:T1500F15U500



Max Depth: 12.700 m / 41.67 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP25.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386326m E: 285776m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

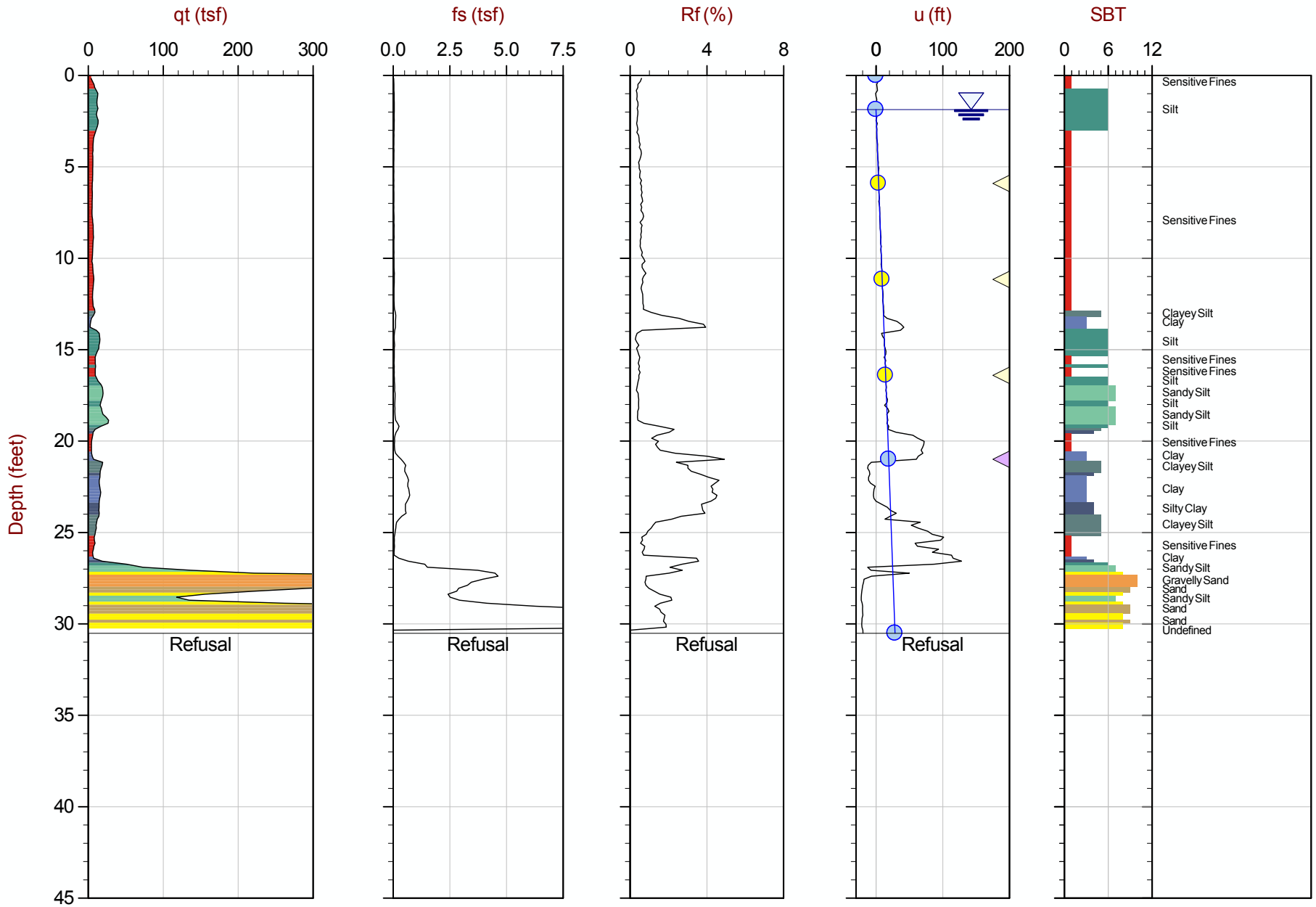
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 11:17
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C026
Cone: 374:T1500F15U500



Max Depth: 9.300 m / 30.51 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP26.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386290m E: 285960m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

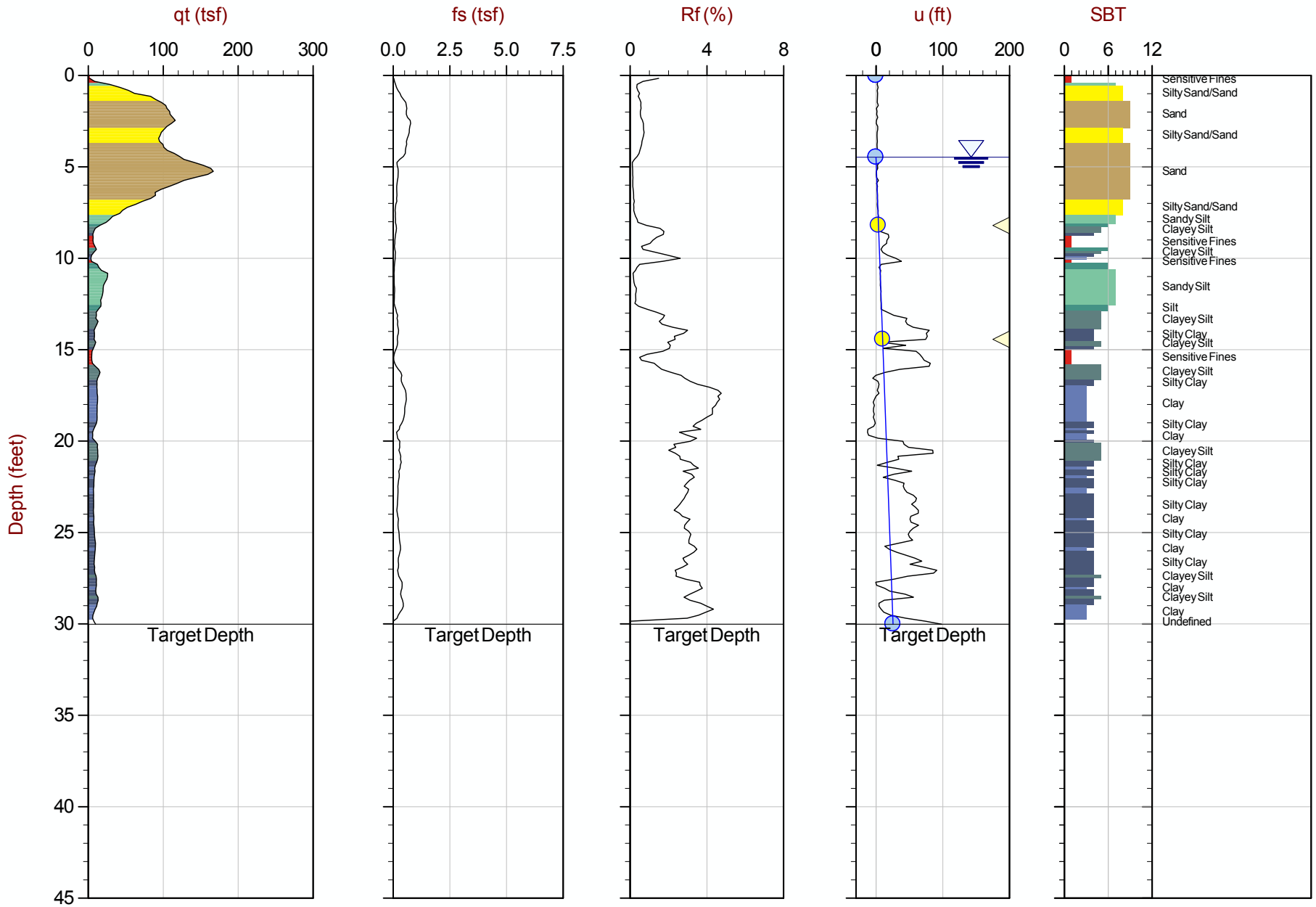
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 12:53
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C027
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP27.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386171m E: 285813m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

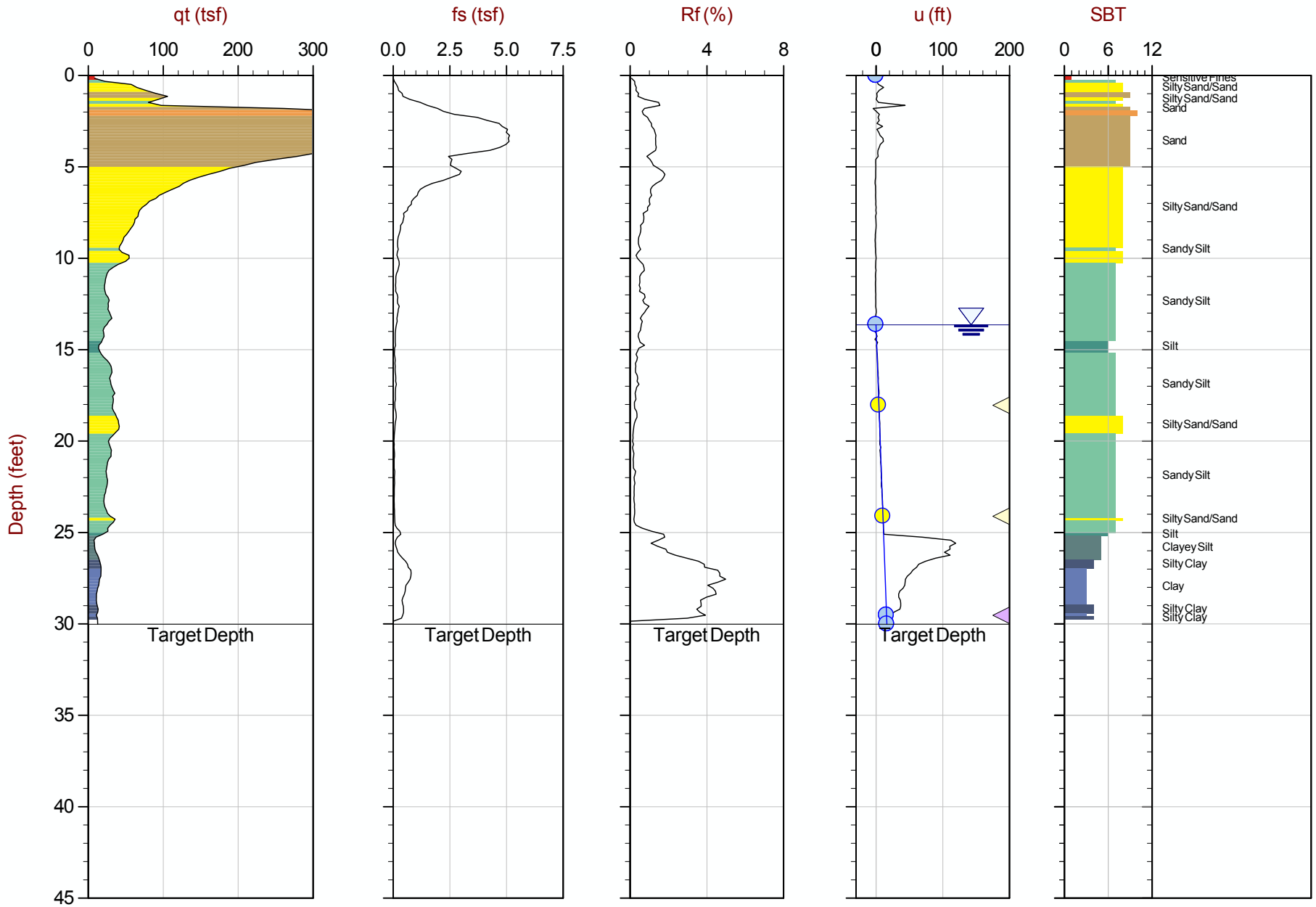
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:18:15 08:30
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C028
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP28.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386043m E: 285531m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

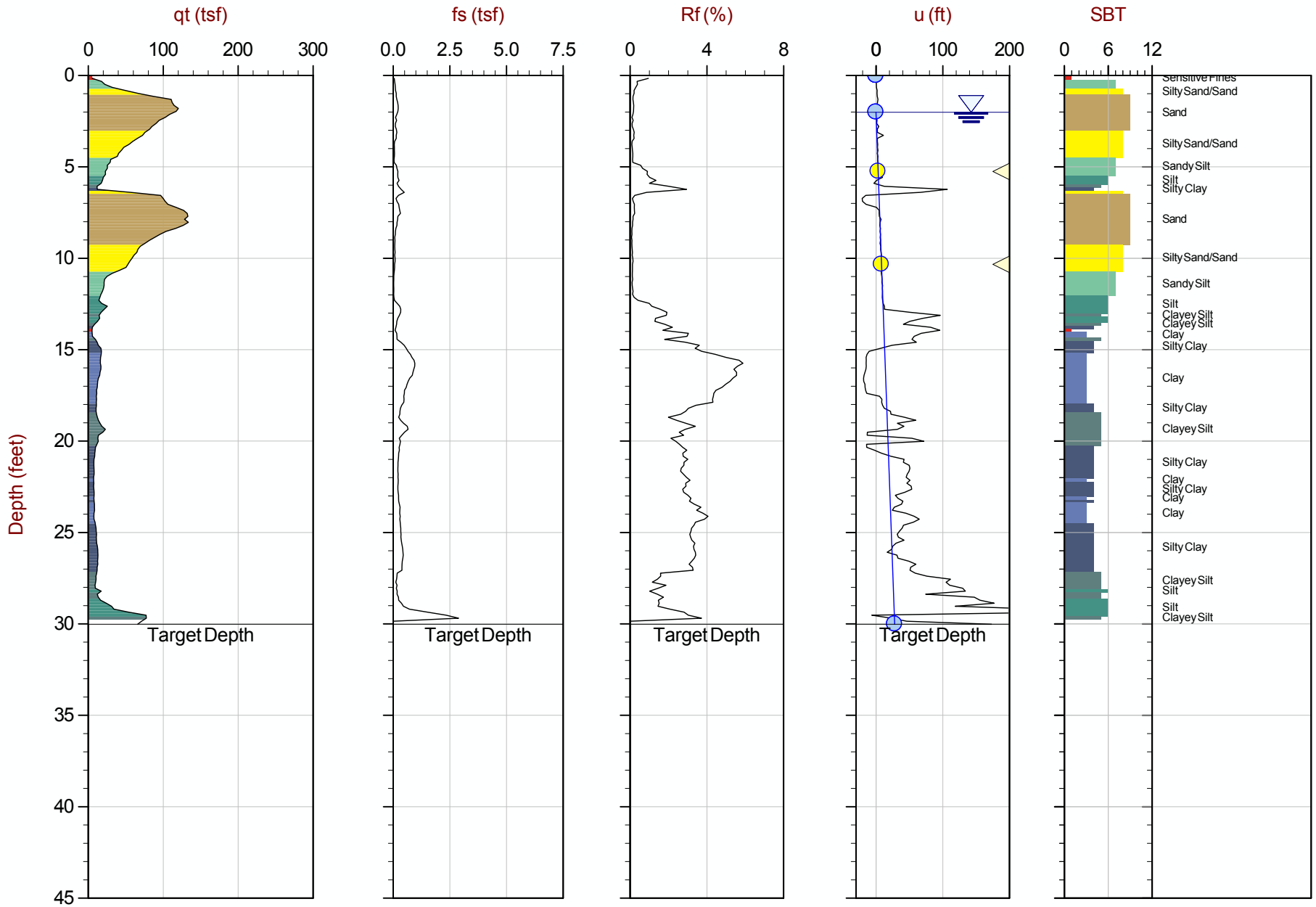
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 14:10
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C029
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP29.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386044m E: 285779m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

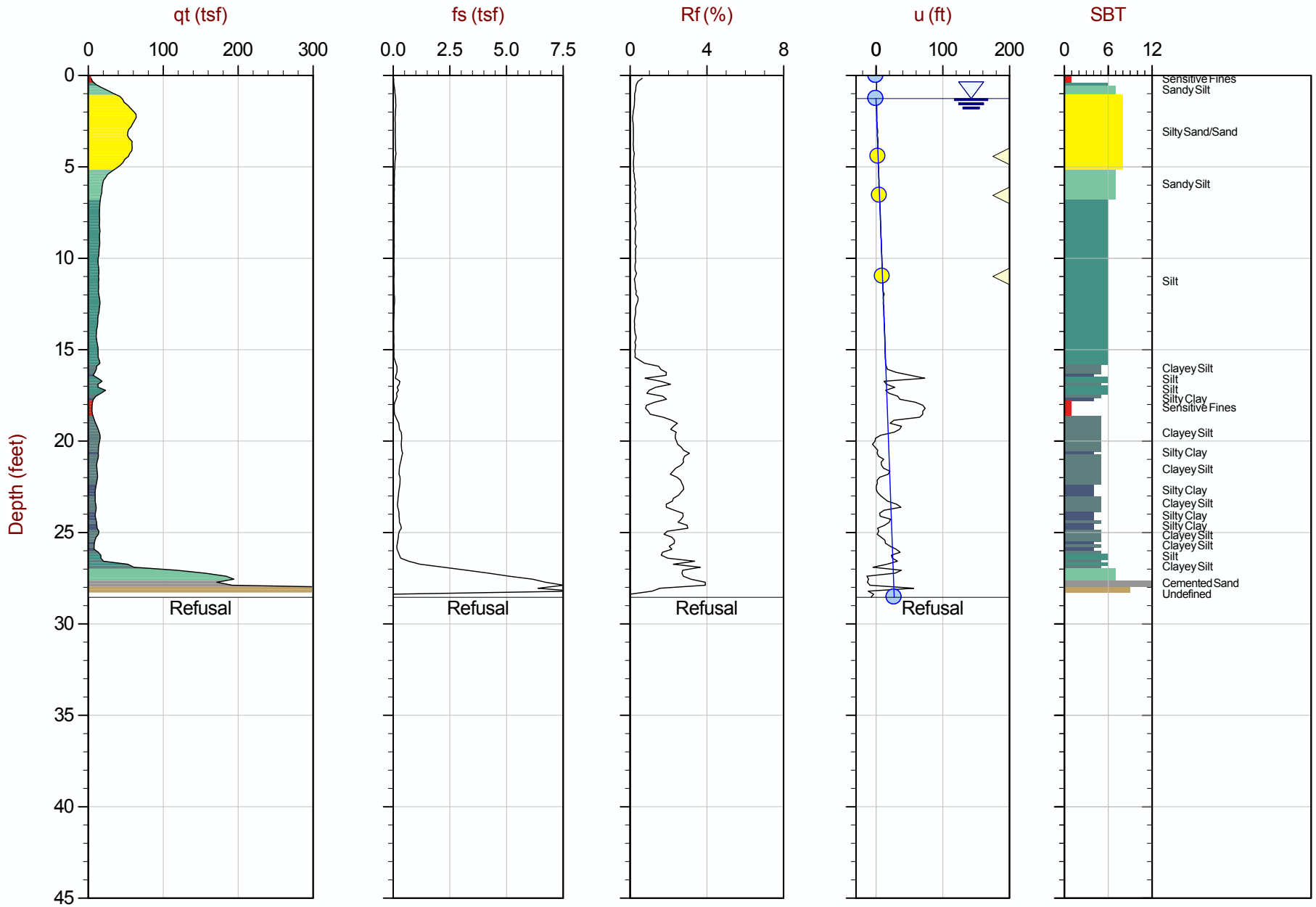
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 14:42
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C030
Cone: 374:T1500F15U500



Max Depth: 8.700 m / 28.54 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP30.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386179m E: 286098m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

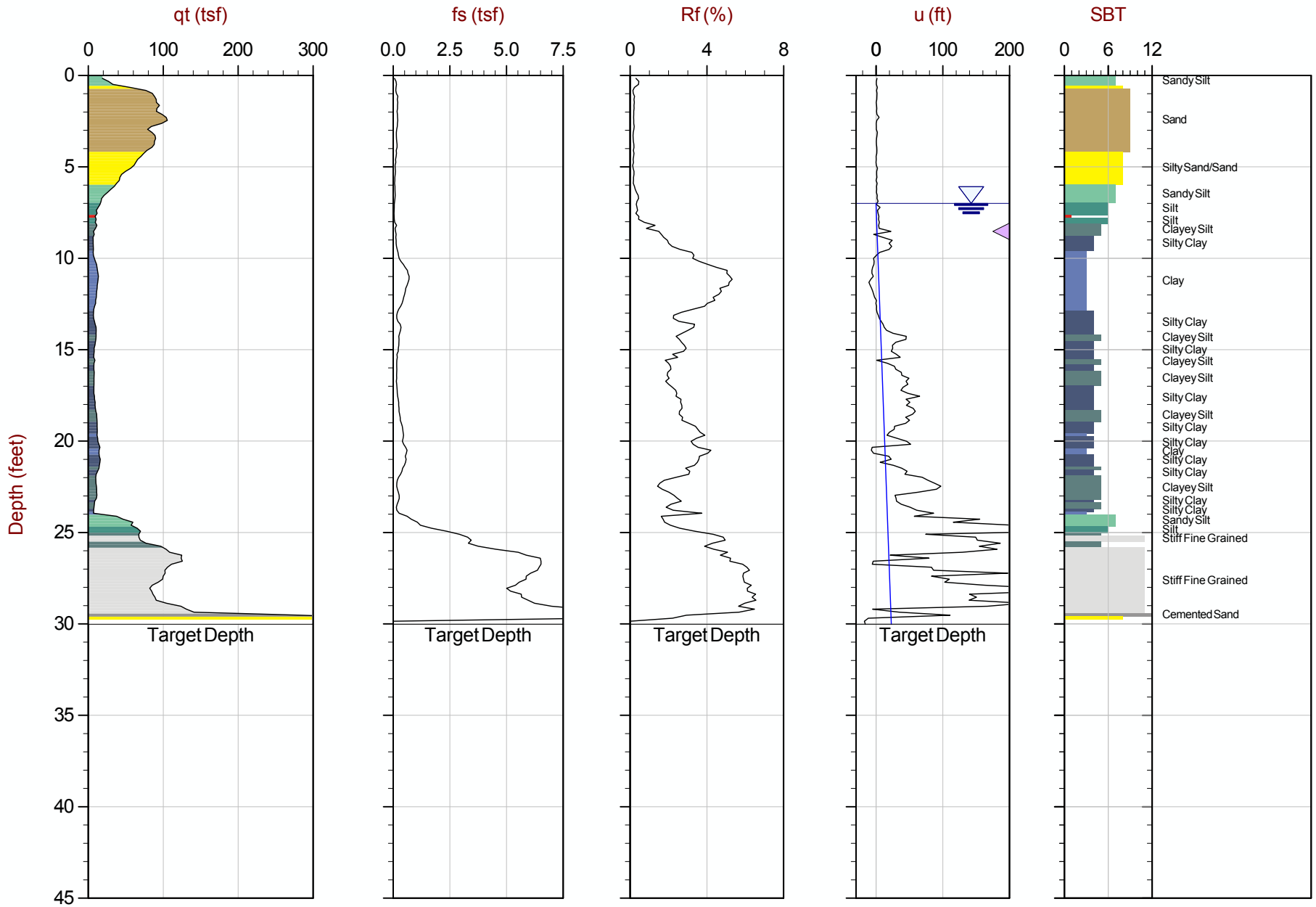
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 13:13
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C031
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP31.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385813m E: 286105m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

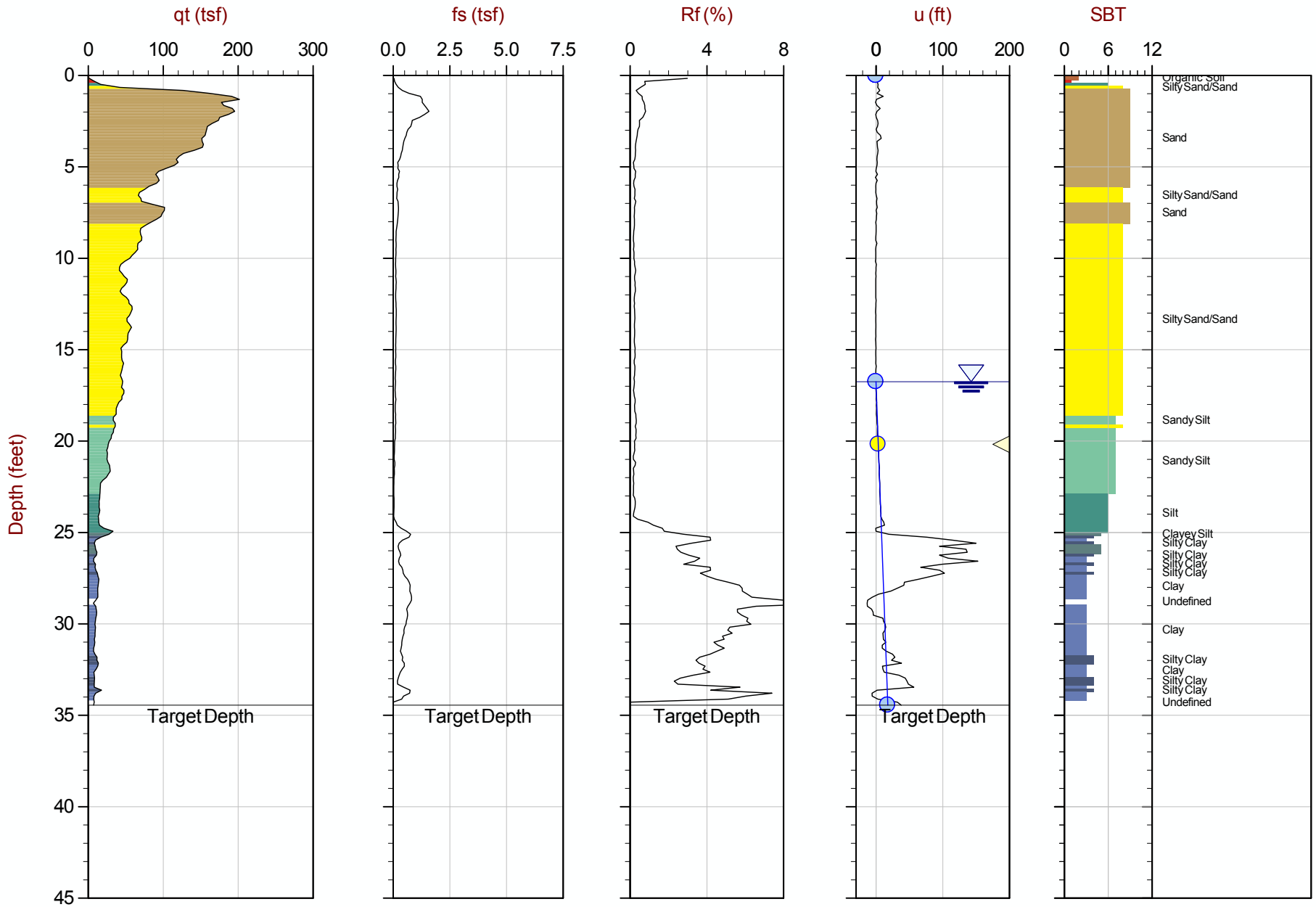
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 13:32
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C032
Cone: 335:T1500F15U500



Max Depth: 10.500 m / 34.45 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP32.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385847m E: 285688m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

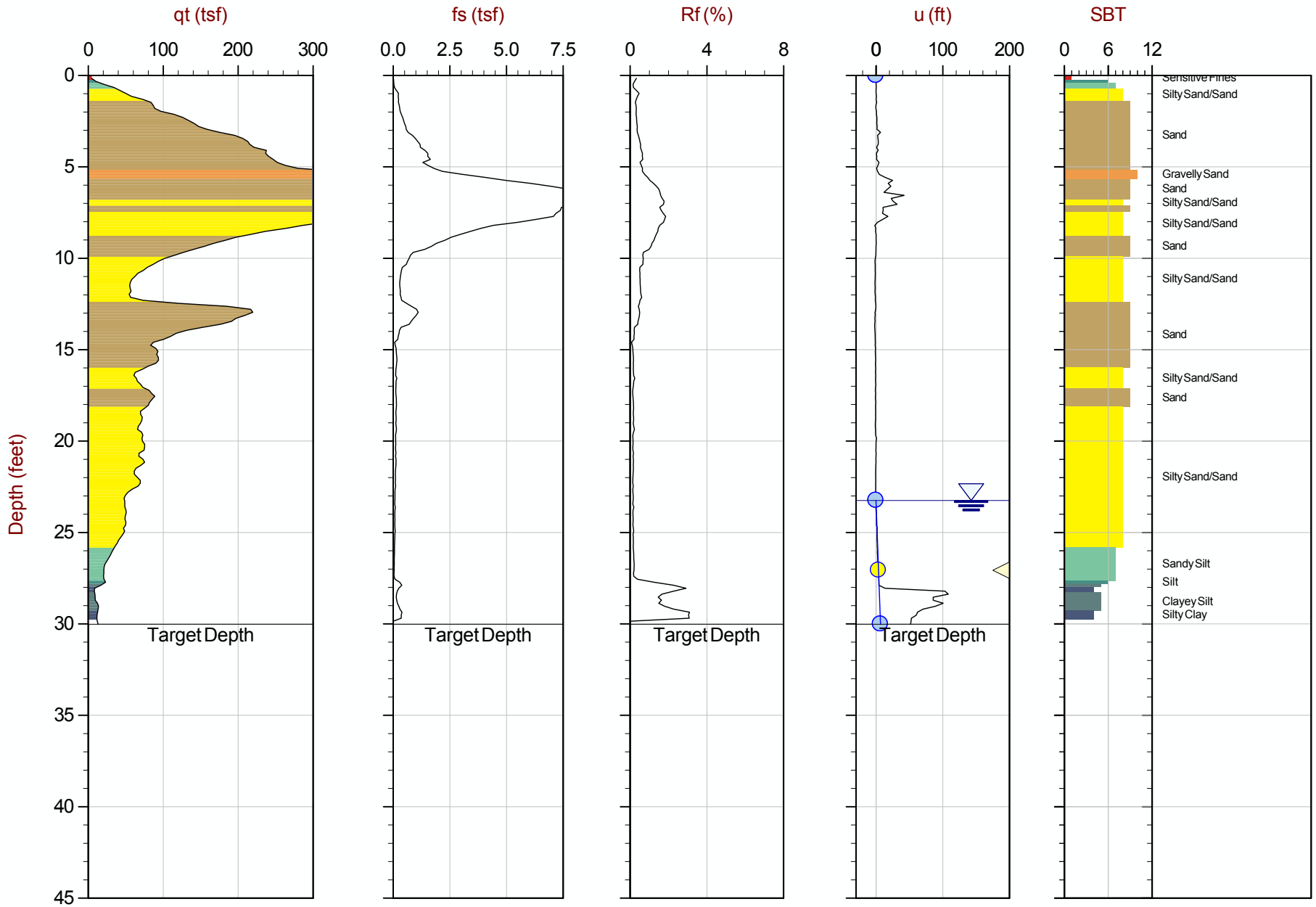
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 10:29
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C033
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP33.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385789m E: 285955m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

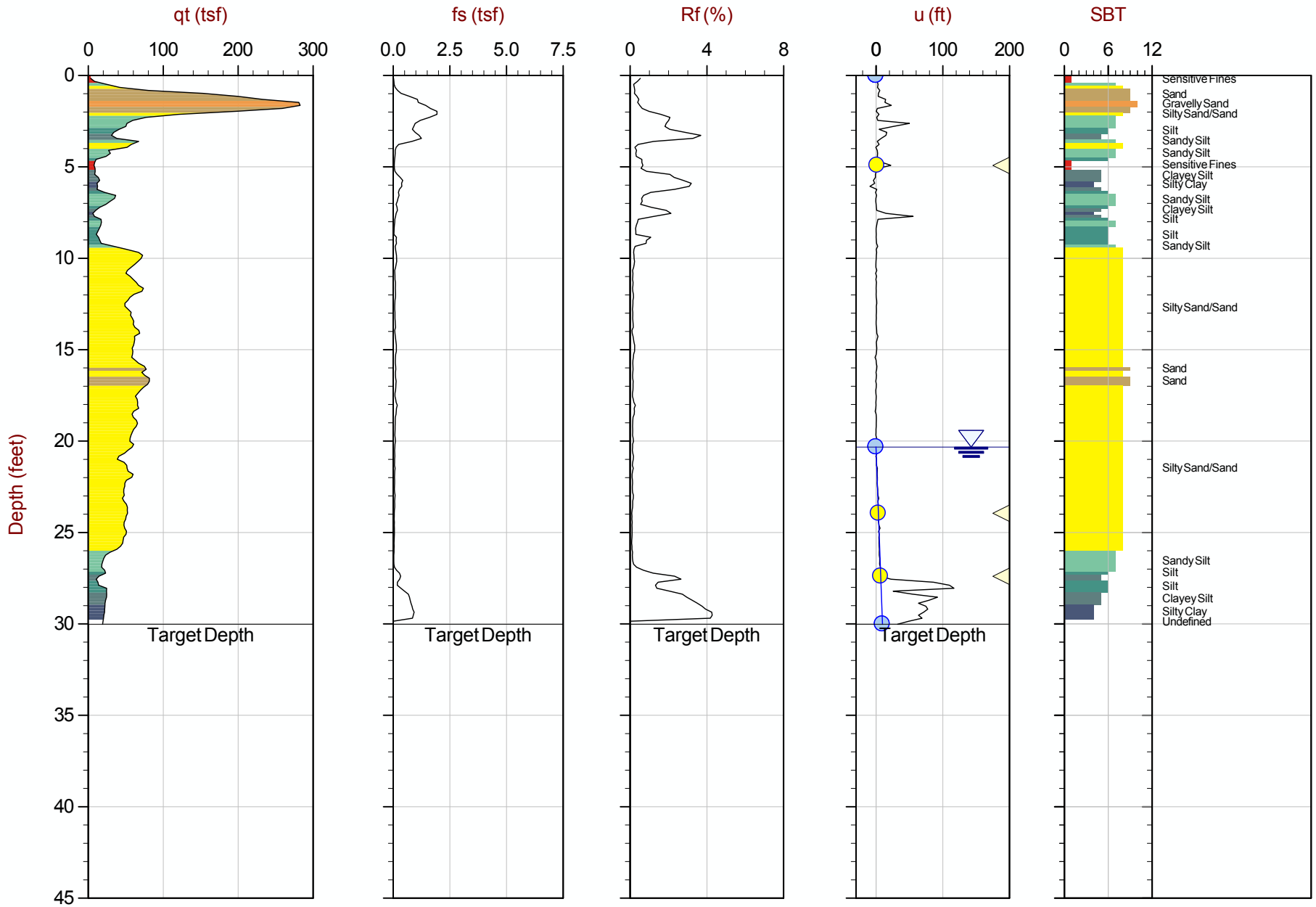
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 15:46
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C034
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP34.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385747m E: 285844m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

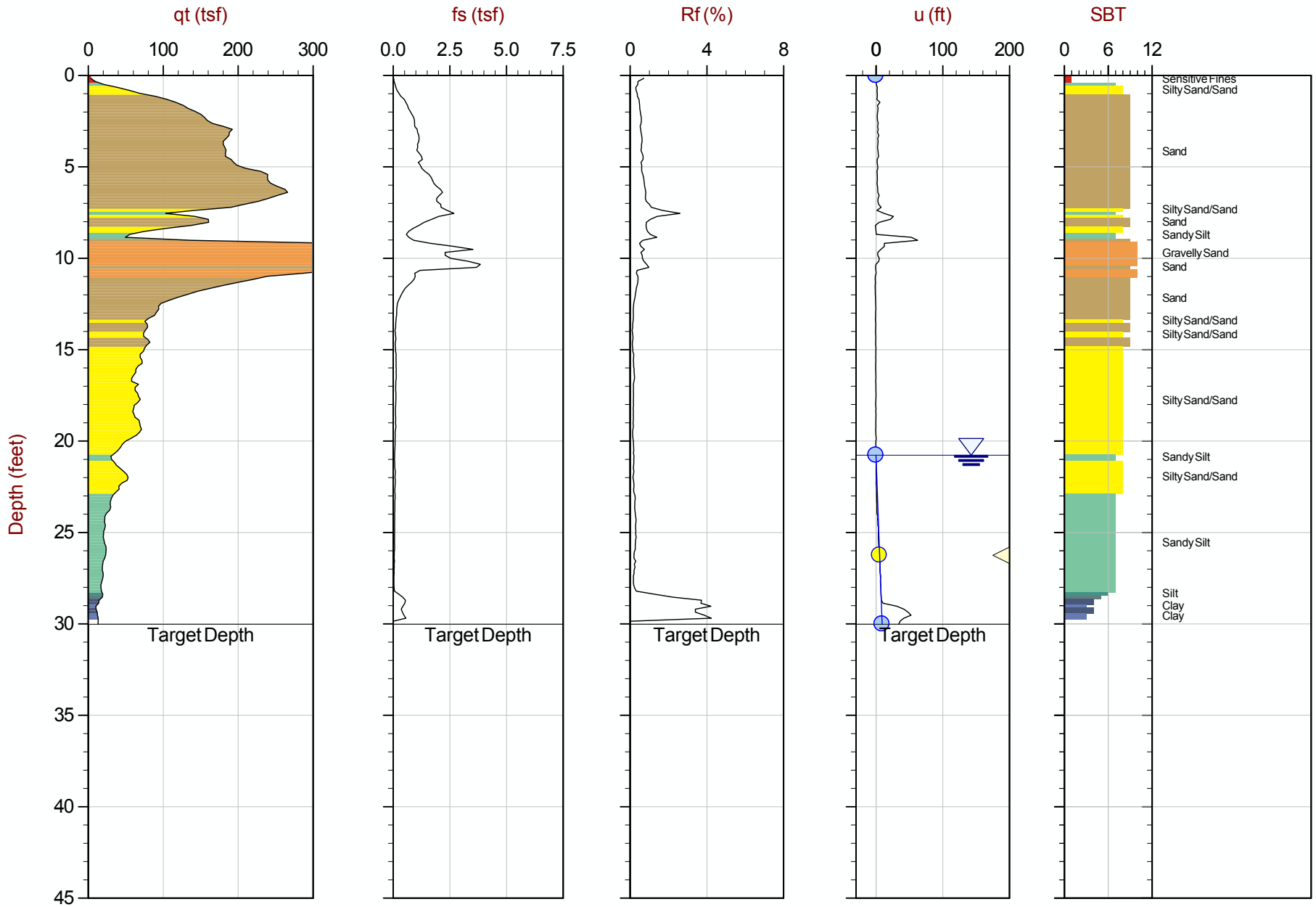
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 09:18
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C035
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP35.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385669m E: 285997m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

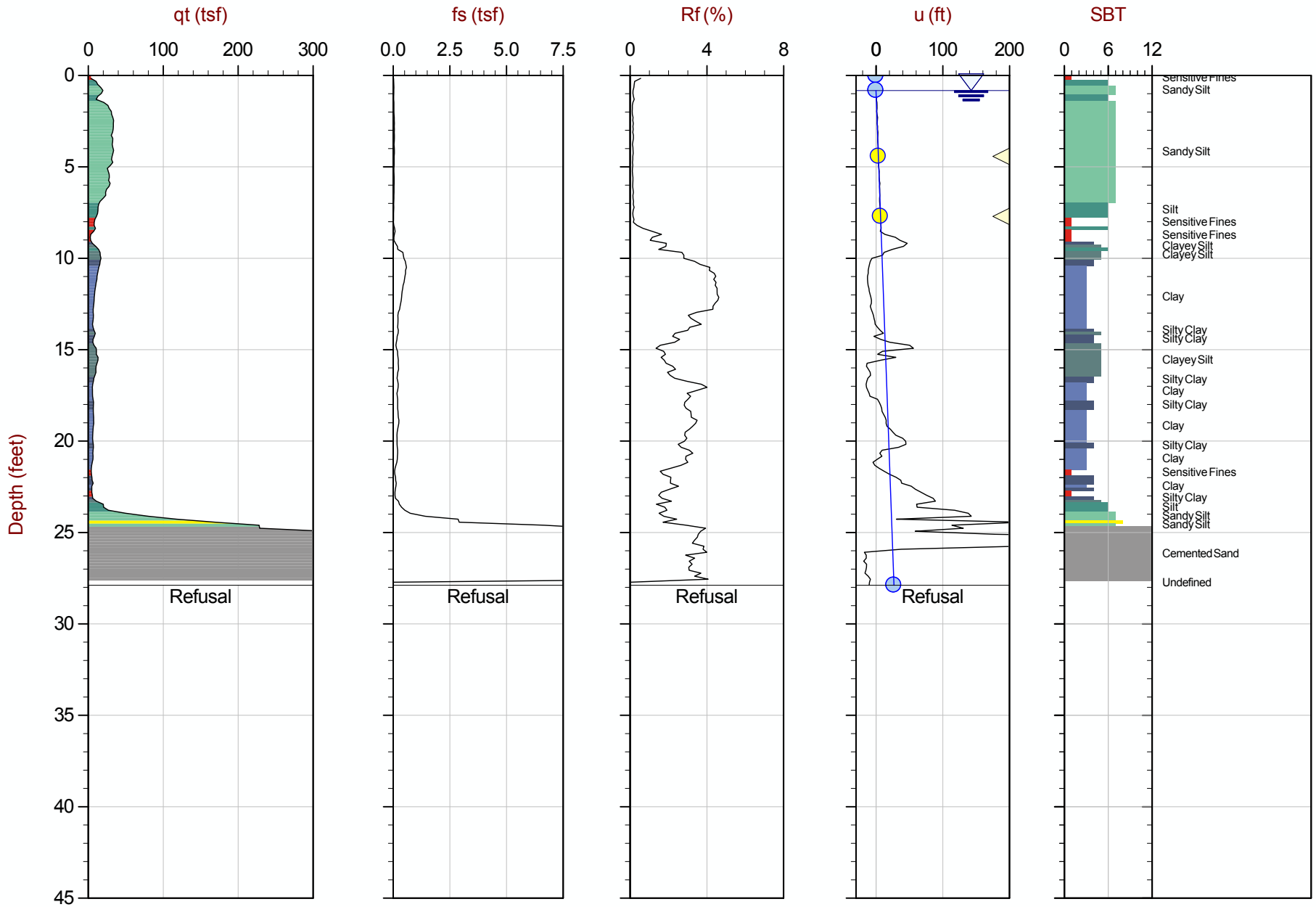
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 15:30
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C036
Cone: 374:T1500F15U500



Max Depth: 8.500 m / 27.89 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP36.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385600m E: 286099m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

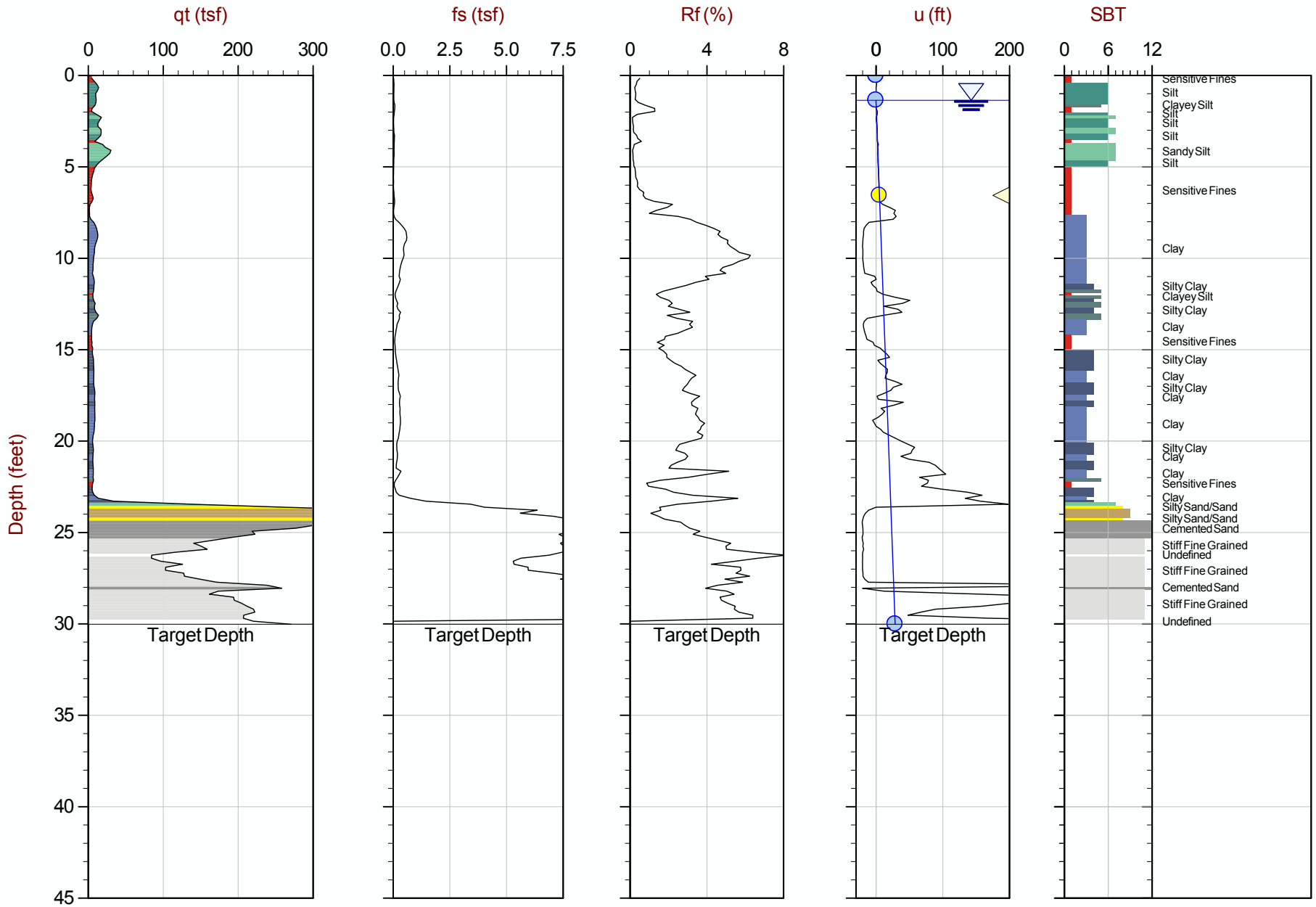
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 16:42
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C037
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP37.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385603m E: 286197m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Plots

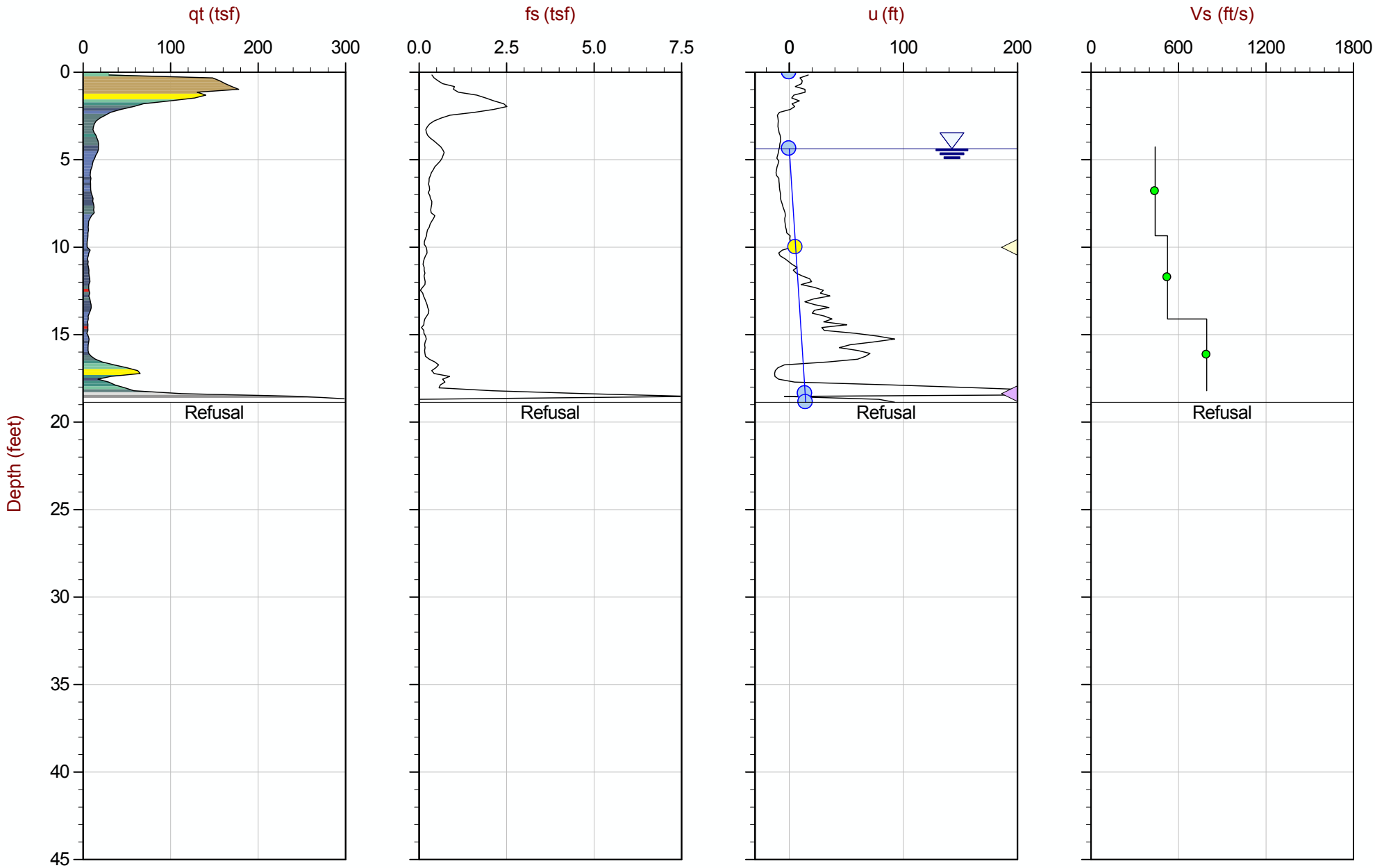
CONETEC

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 12:44
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C001
Cone: 335:T1500F15U500



Max Depth: 5.750 m / 18.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP01.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385569m E: 286381m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

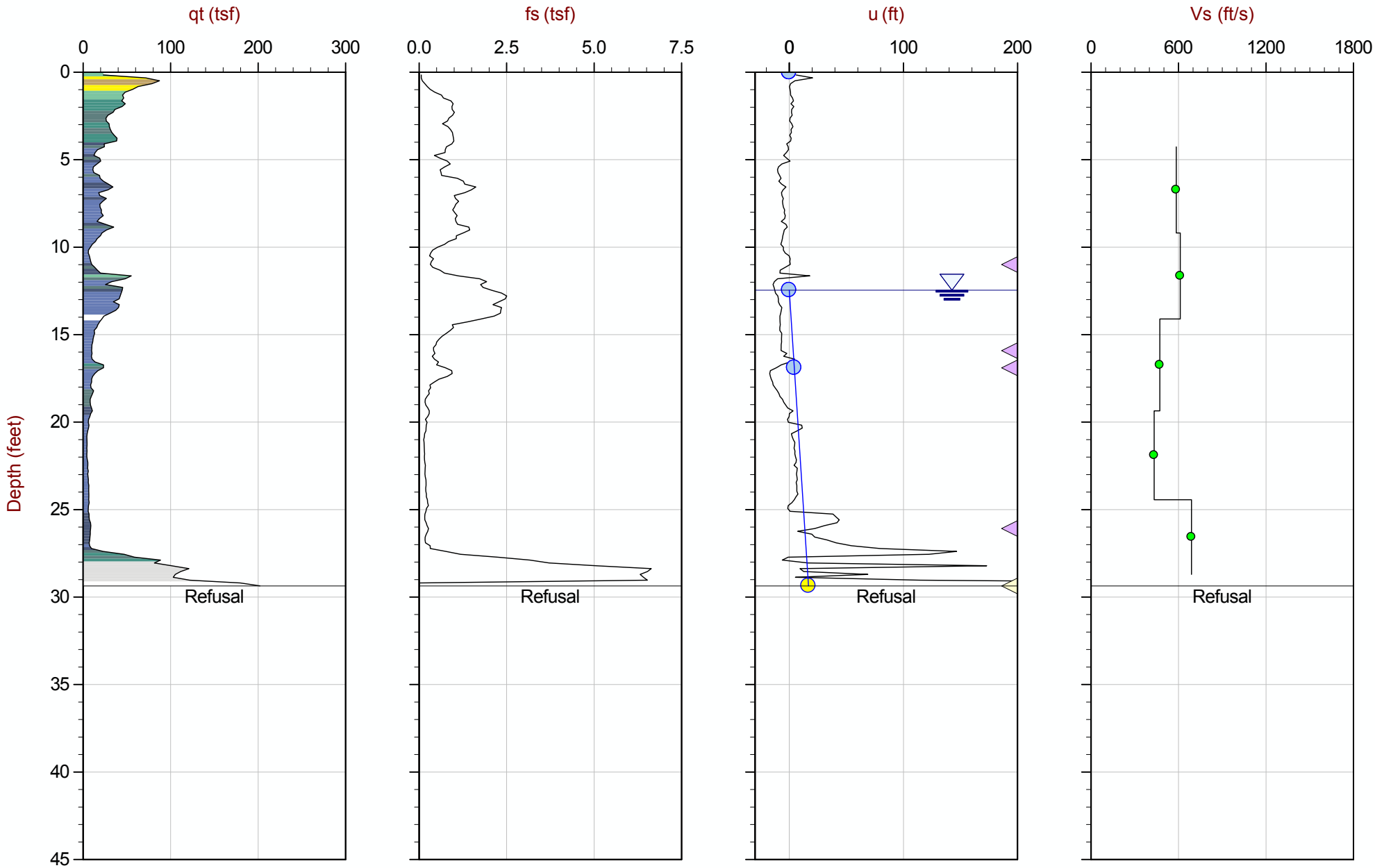
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:18:15 07:59
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335:T1500F15U500



Max Depth: 8.950 m / 29.36 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP02.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385577m E: 286096m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

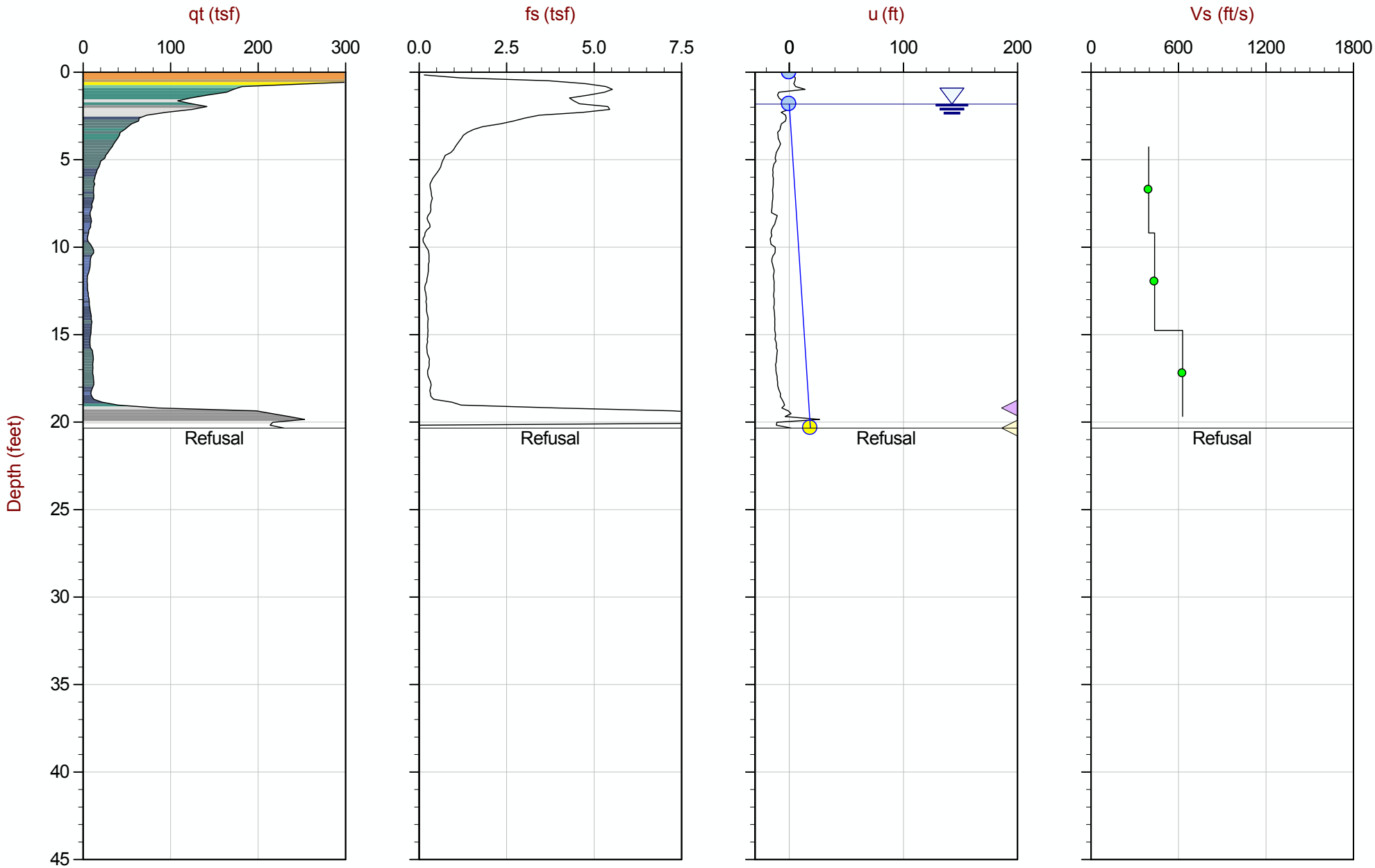
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 14:32
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C003
Cone: 335:T1500F15U500



Max Depth: 6.200 m / 20.34 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP03.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385569m E: 286381m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

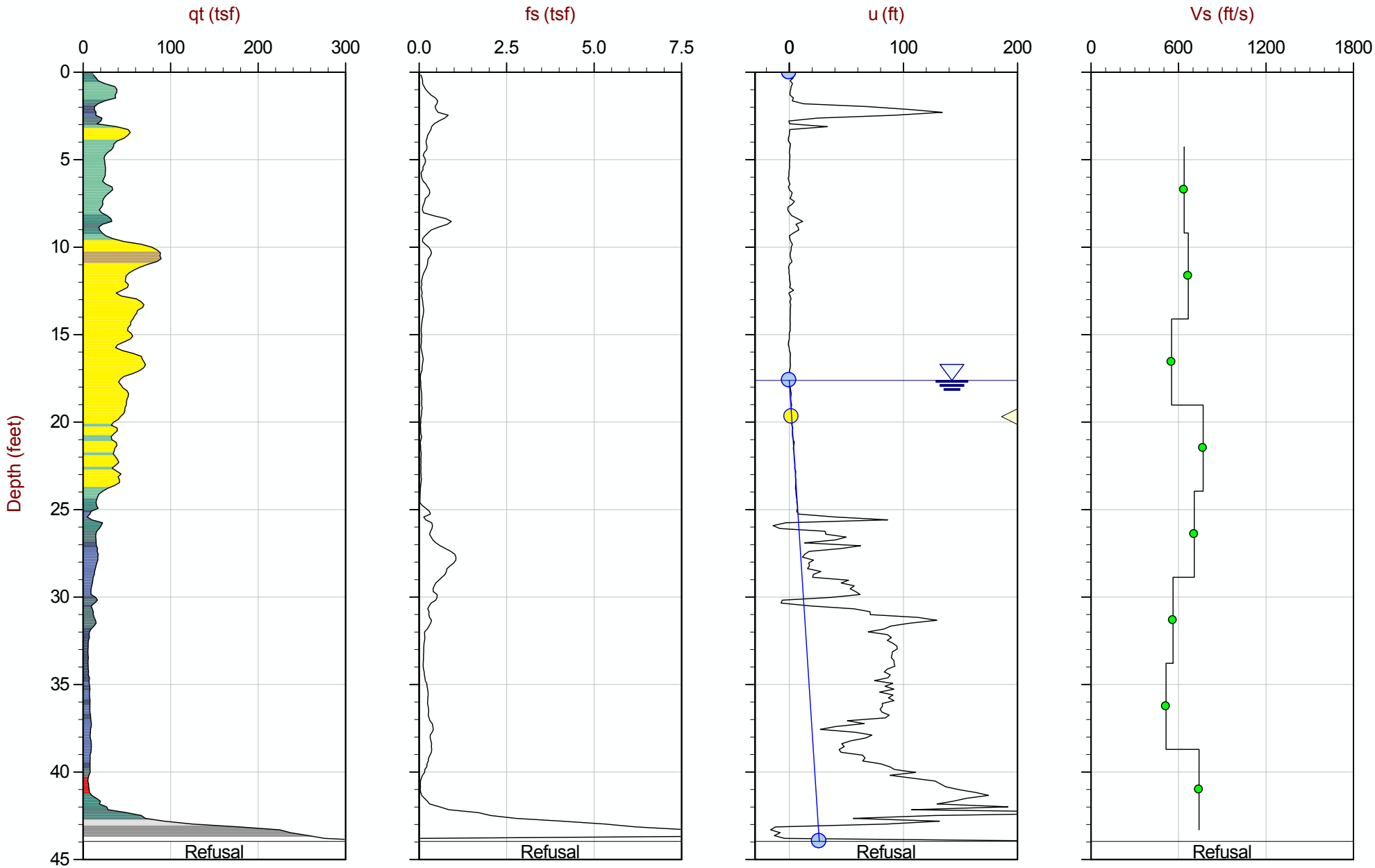
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 12:25
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C004
Cone: 335:T1500F15U500



Max Depth: 13.400 m / 43.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP04.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385764m E: 285687m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

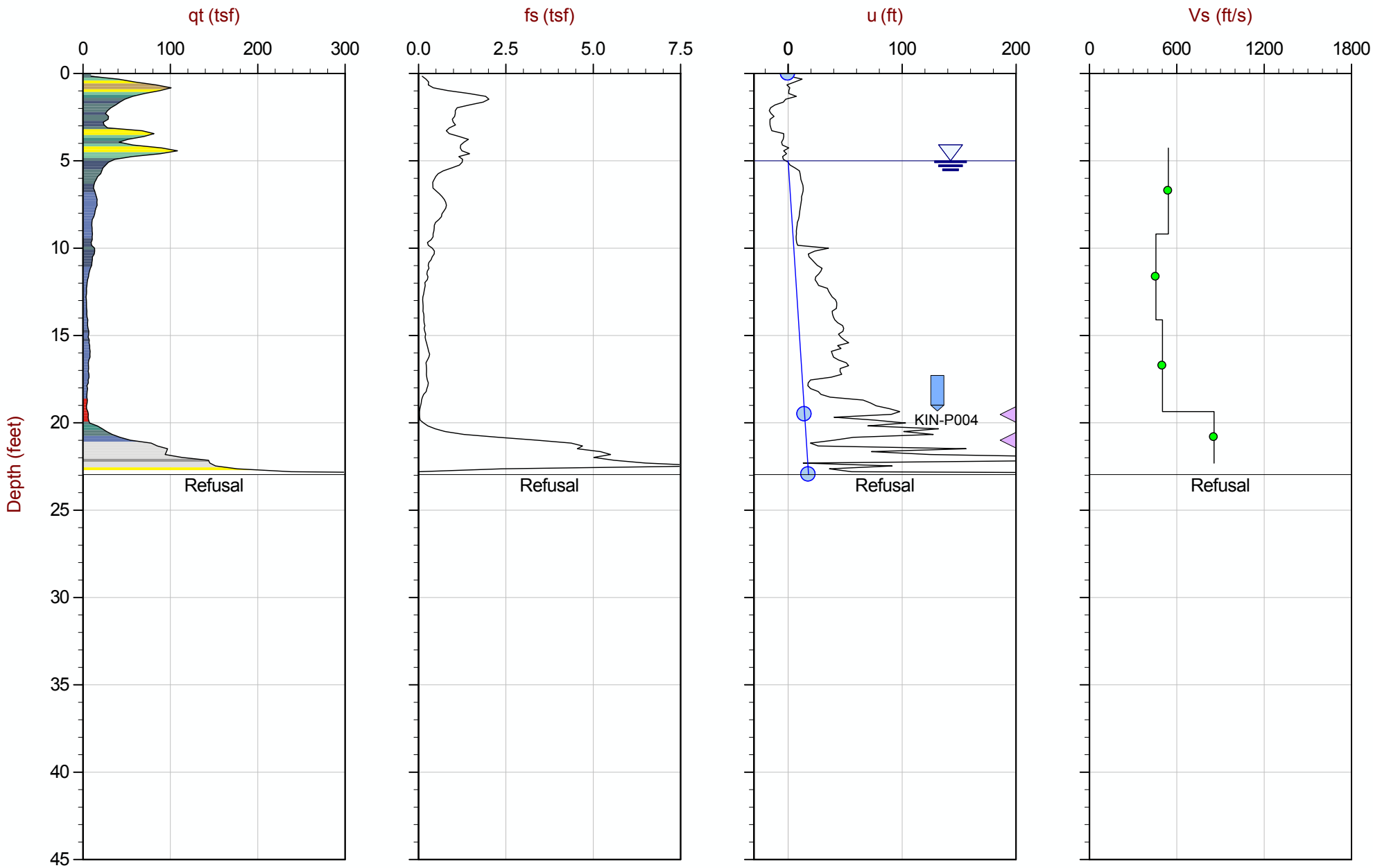
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 11:16
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C005
Cone: 335:T1500F15U500



Max Depth: 7.000 m / 22.97 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP05.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385722m E: 285682m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

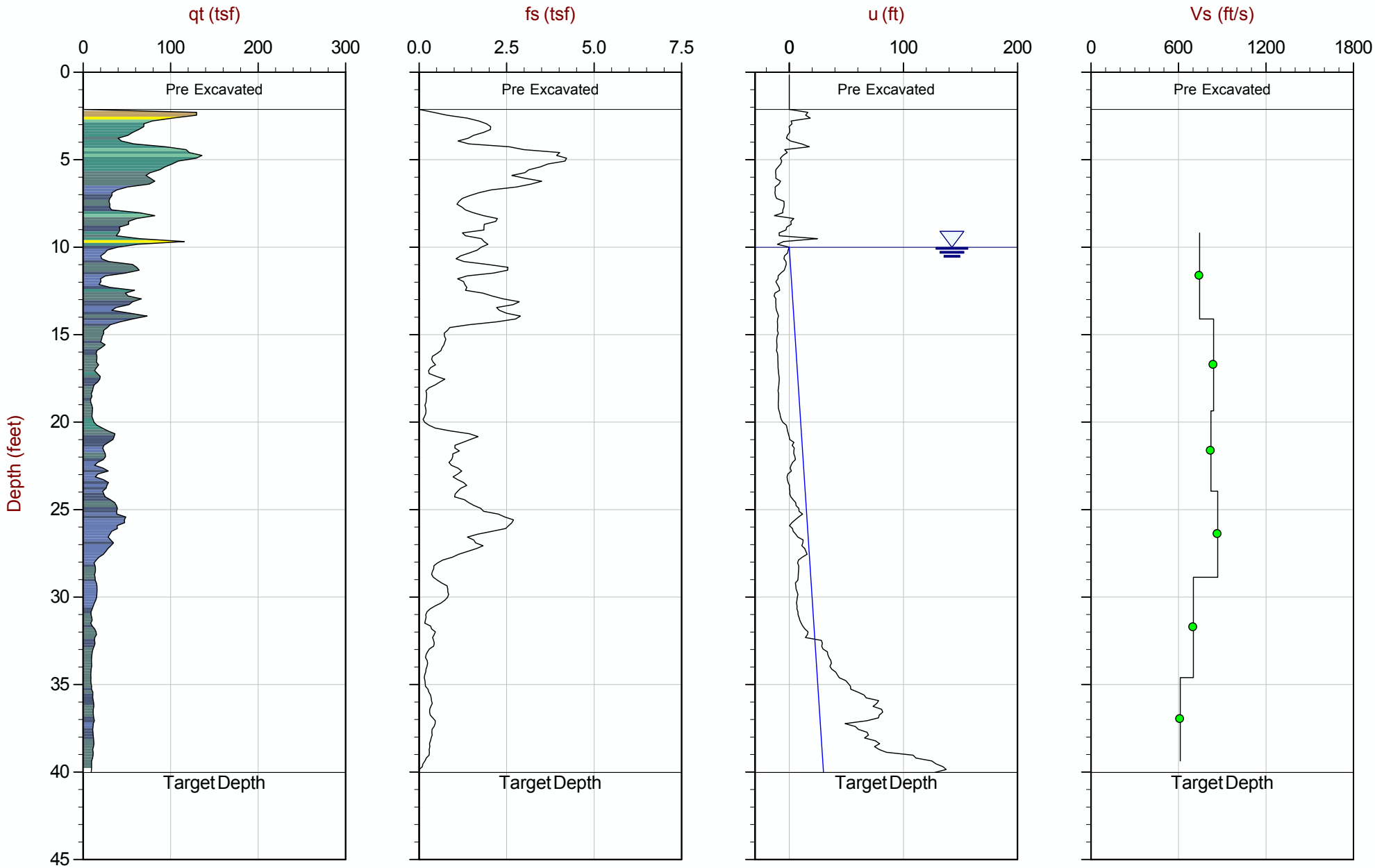
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 10:05
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C006
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP06.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386026m E: 285506m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

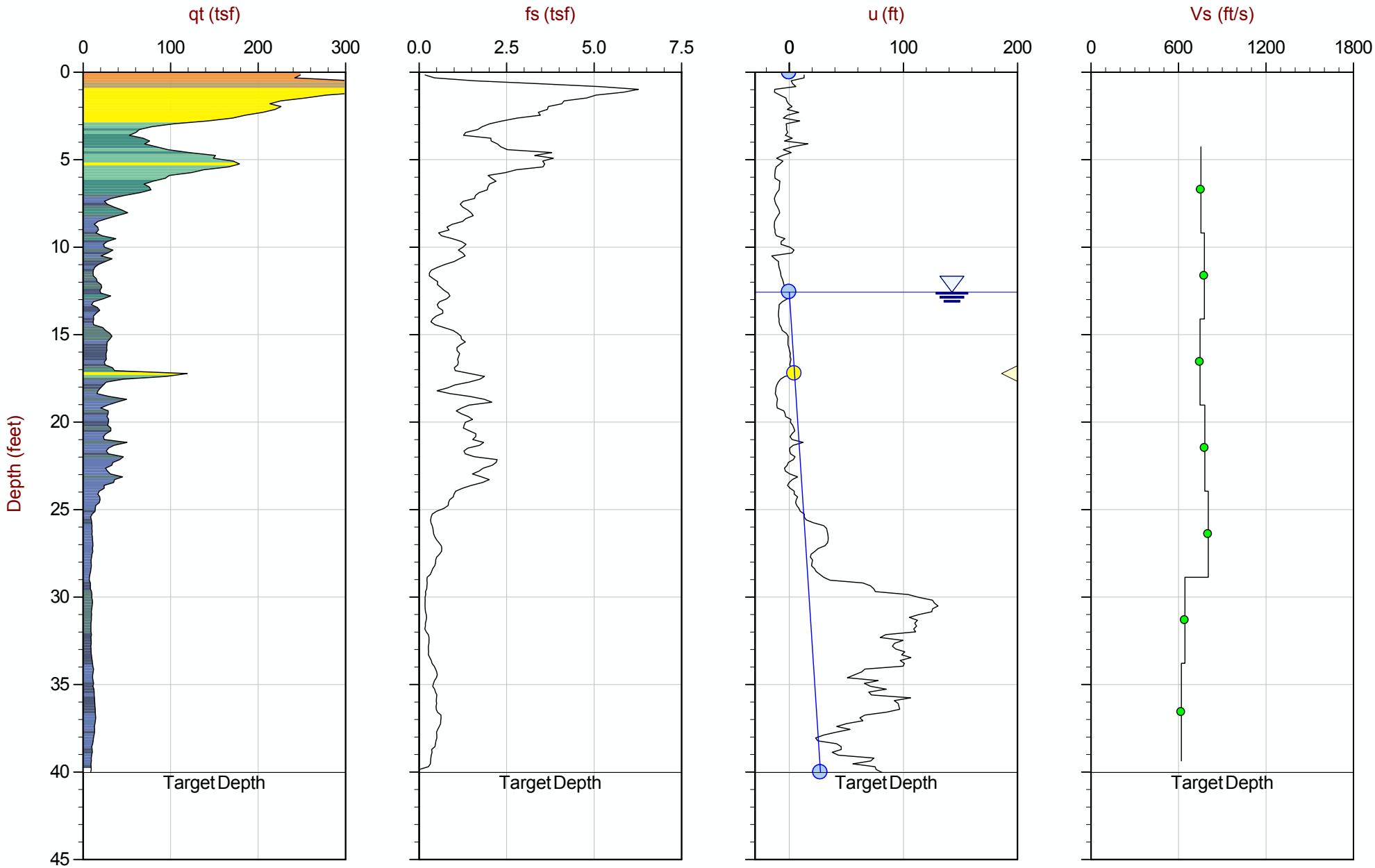
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 09:07
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C007
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP07.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386123m E: 285430m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

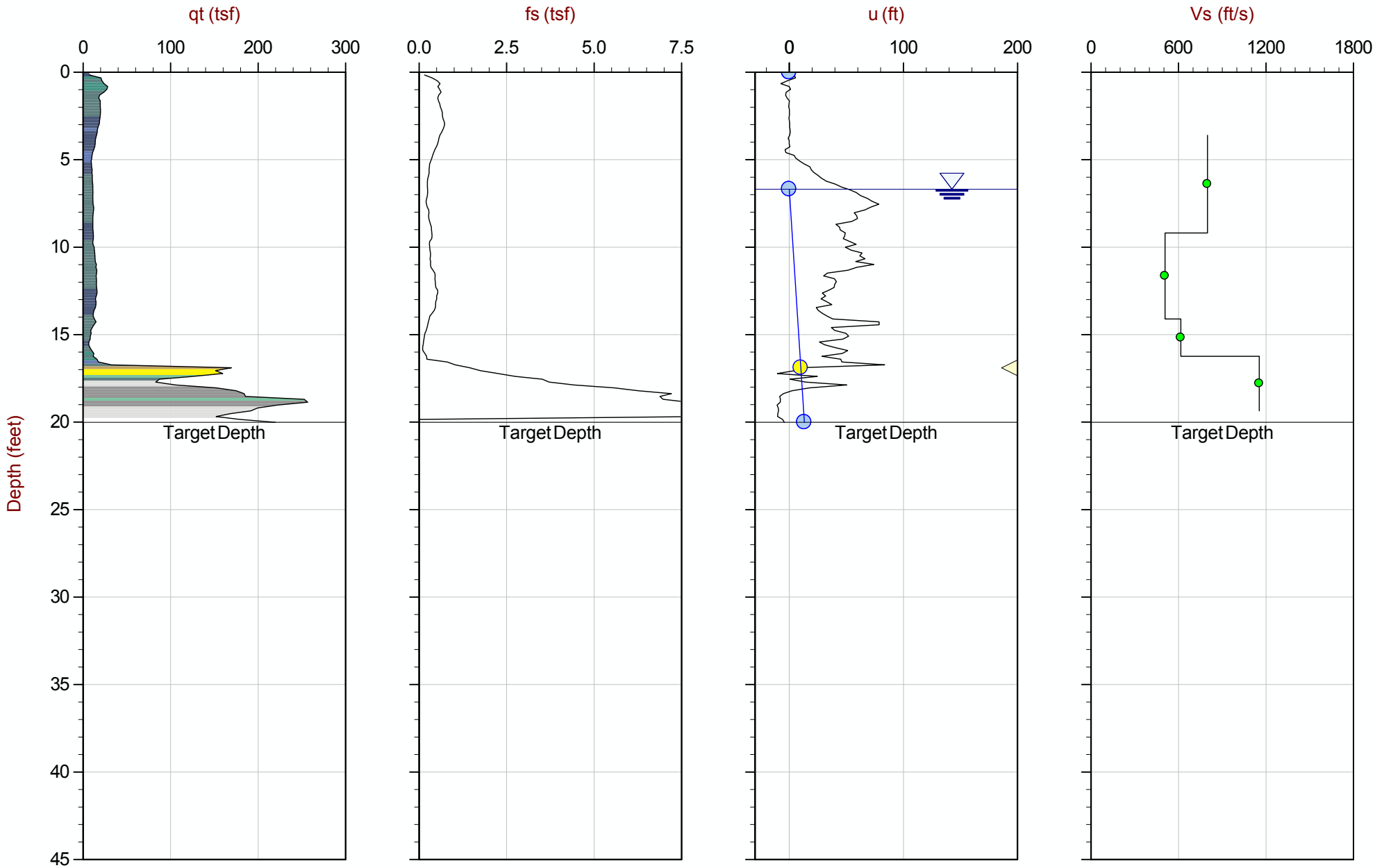
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 08:12
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C008
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP08.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386114m E: 285411m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

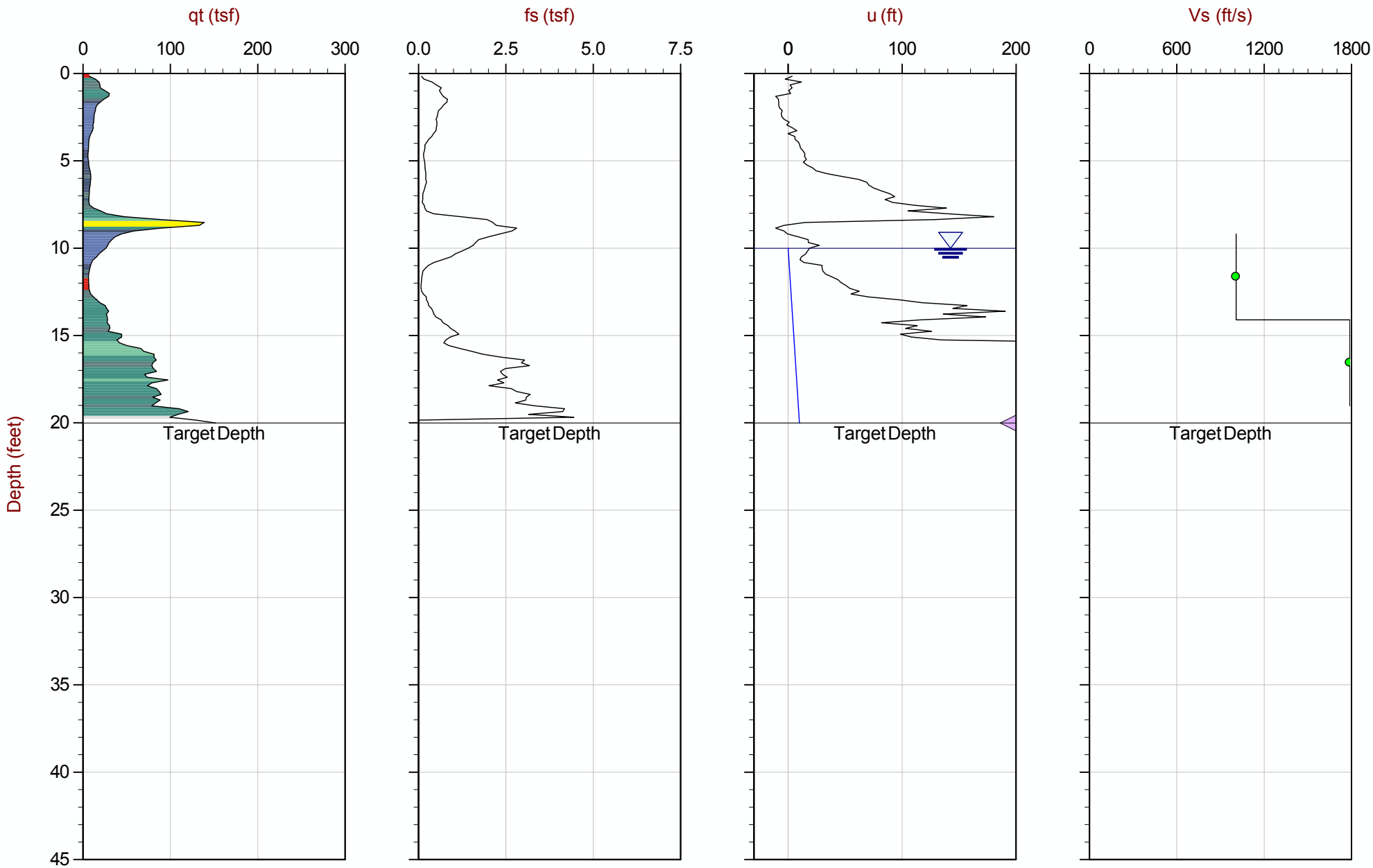
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 09:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C009
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP09.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386255m E: 285522m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

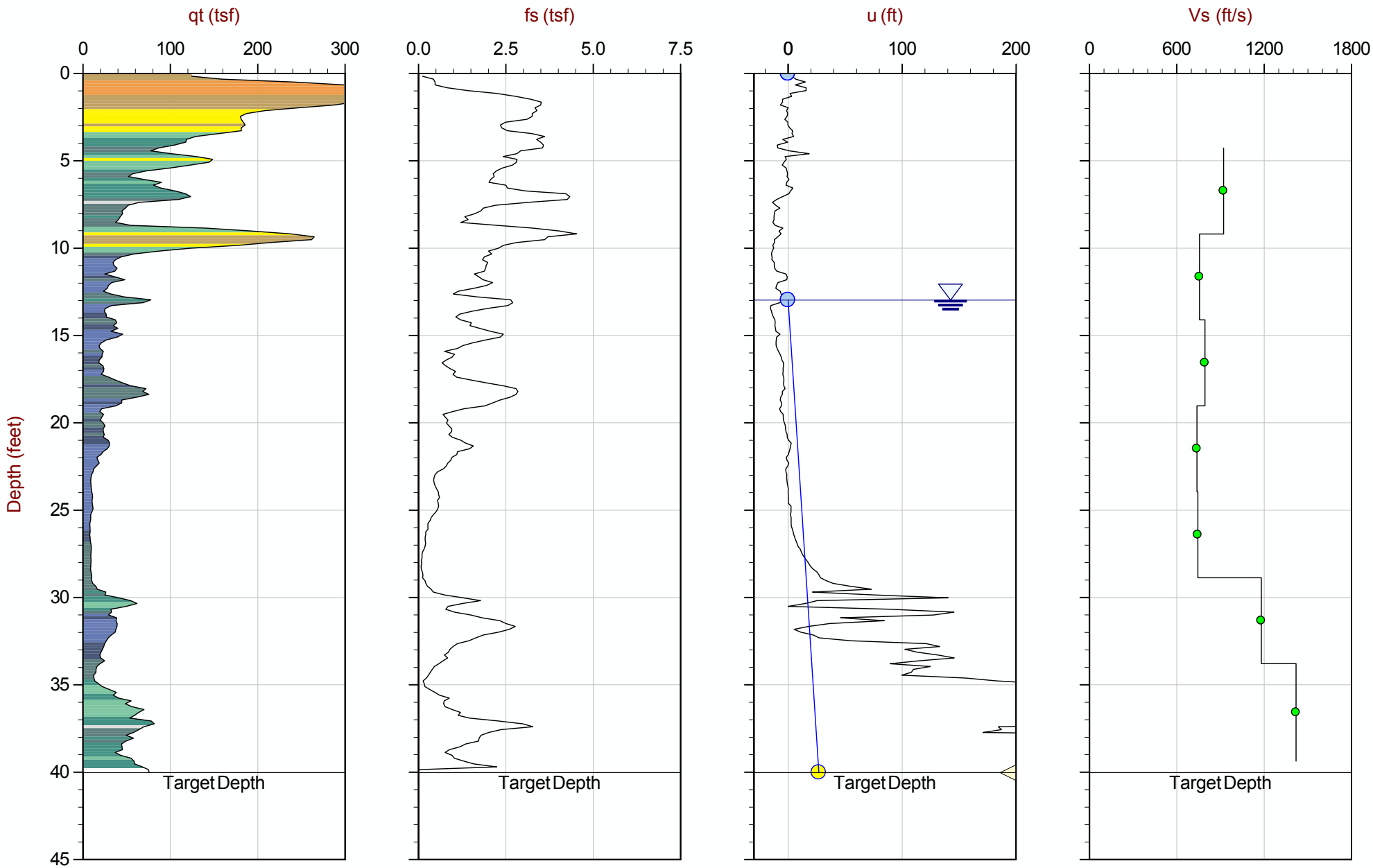
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 07:15
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C010
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP10.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386244m E: 285536m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

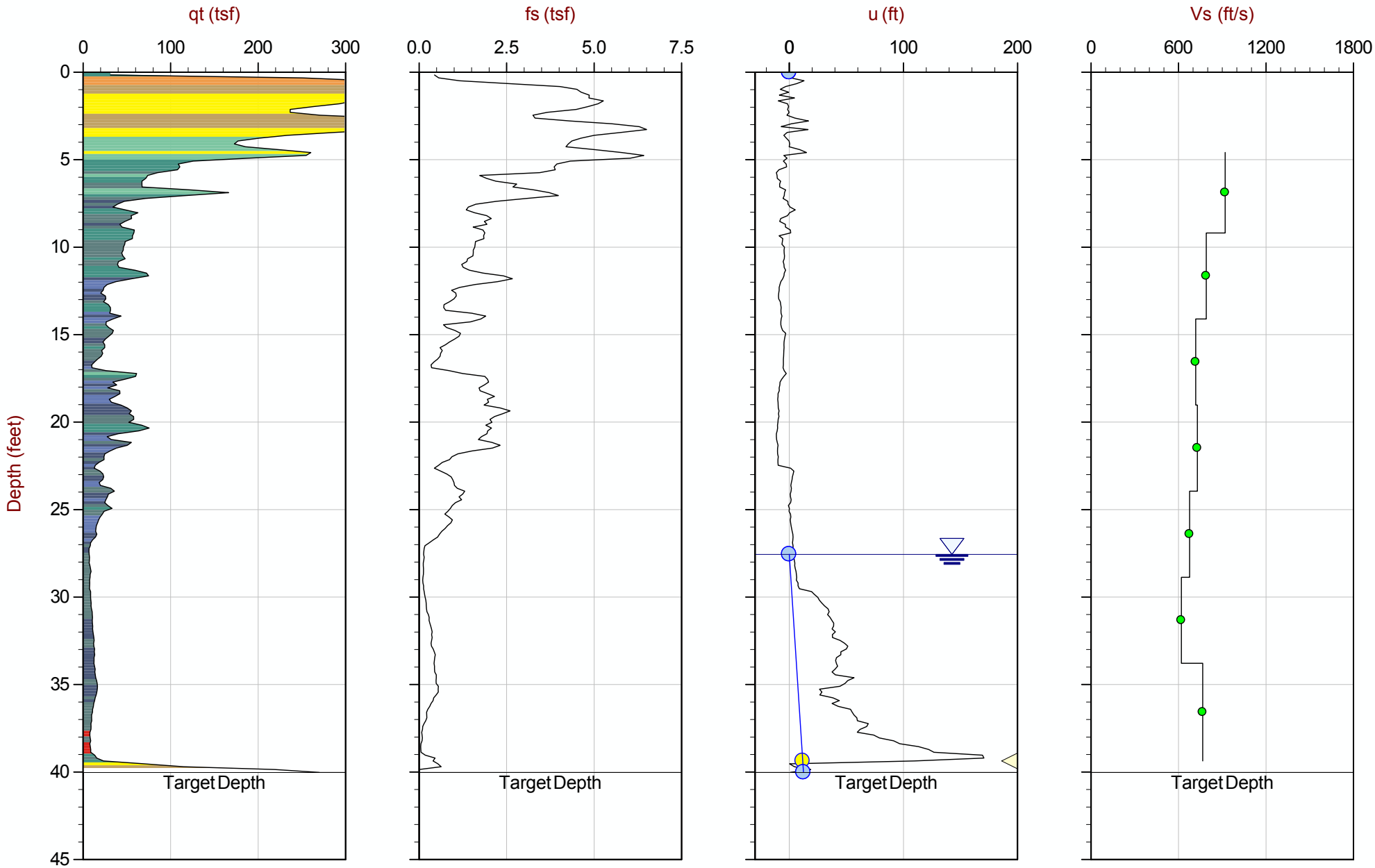
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 14:02
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C011
Cone: 335:T1500F15U500



Max Depth: 12.200 m / 40.03 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP11.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386382m E: 285722m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

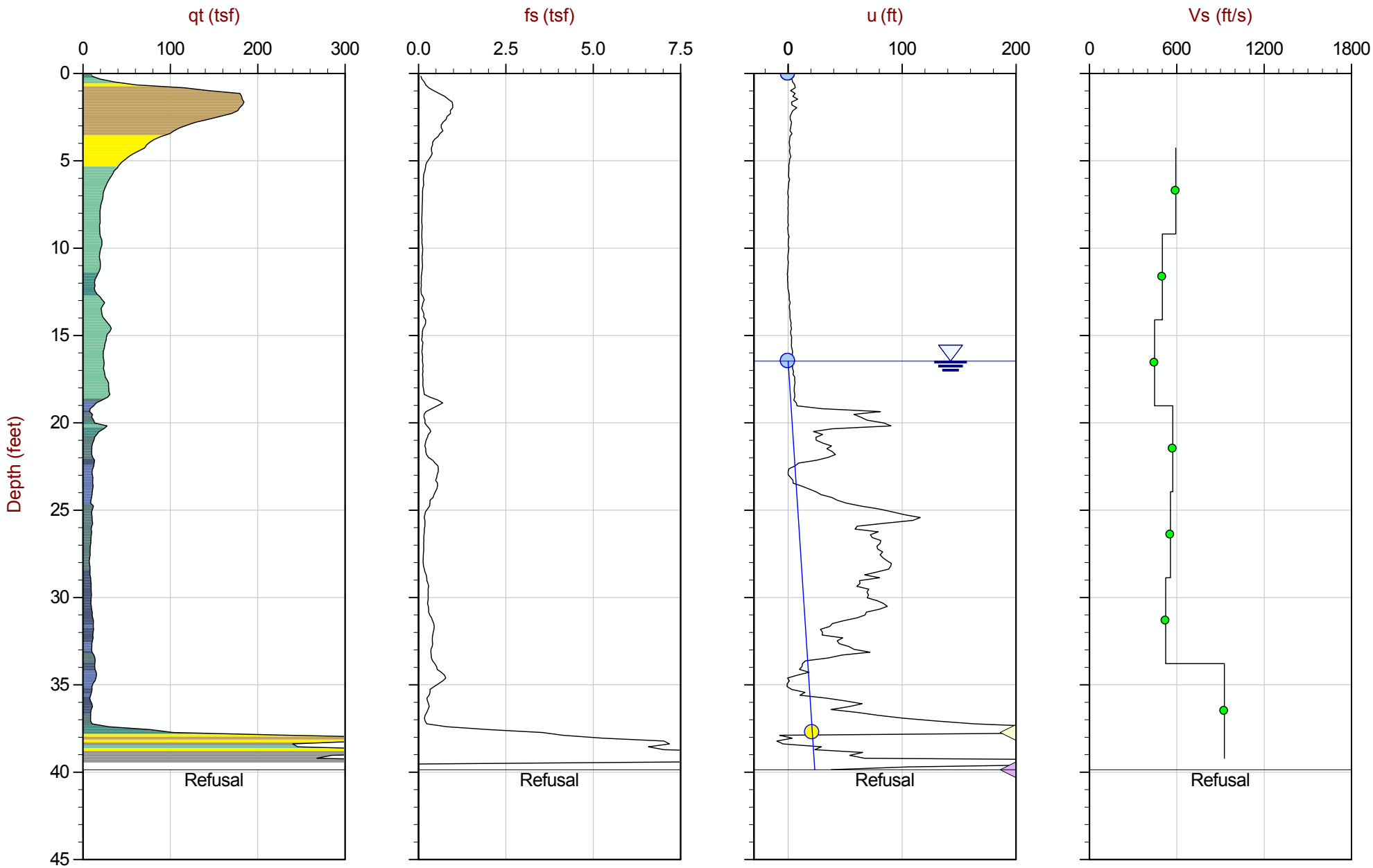
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 15:05
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C012
Cone: 335:T1500F15U500



Max Depth: 12.150 m / 39.86 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP12.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386364m E: 285736m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

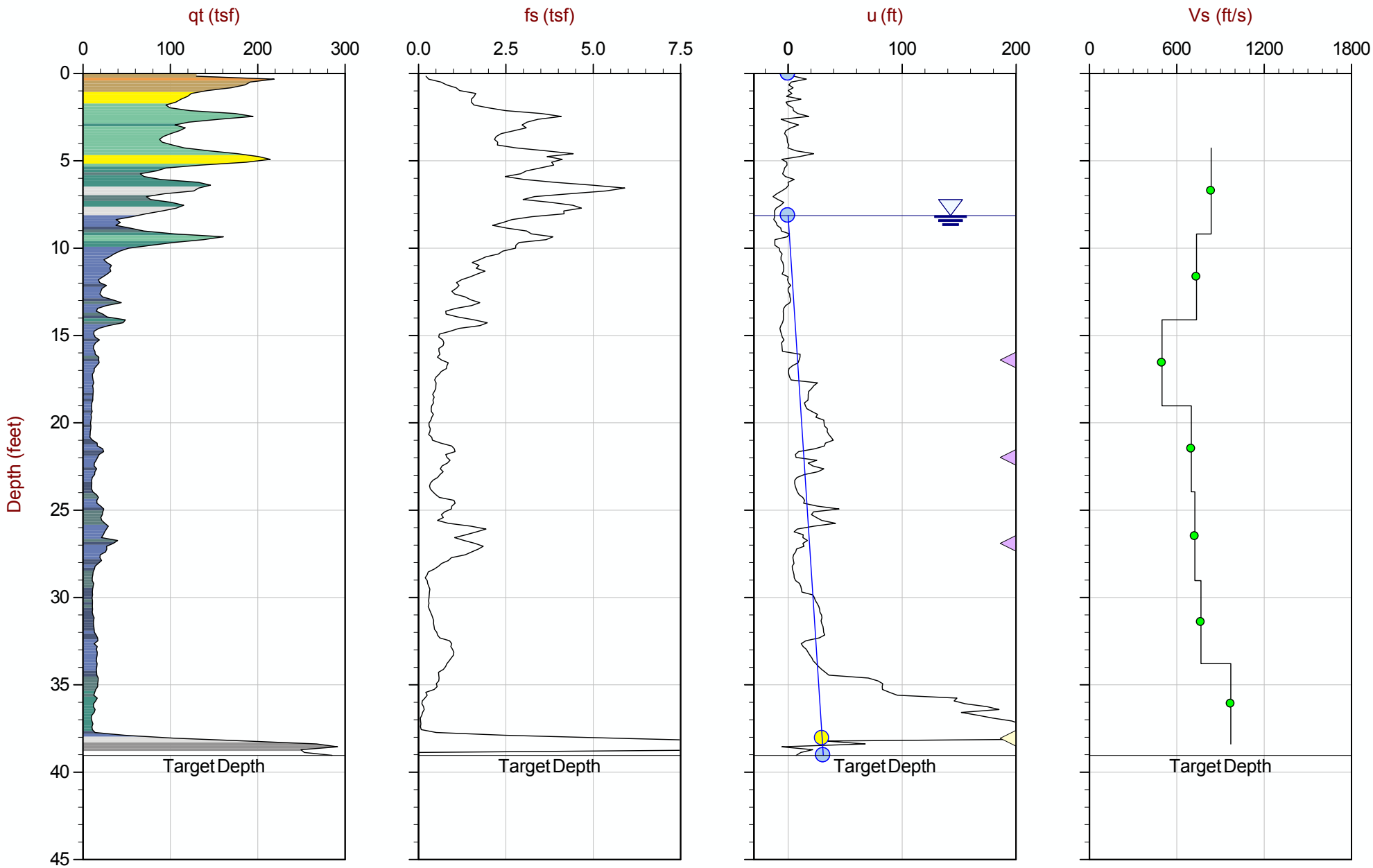
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 11:43
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C013
Cone: 335:T1500F15U500



Max Depth: 11.900 m / 39.04 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP13.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386473m E: 285963m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

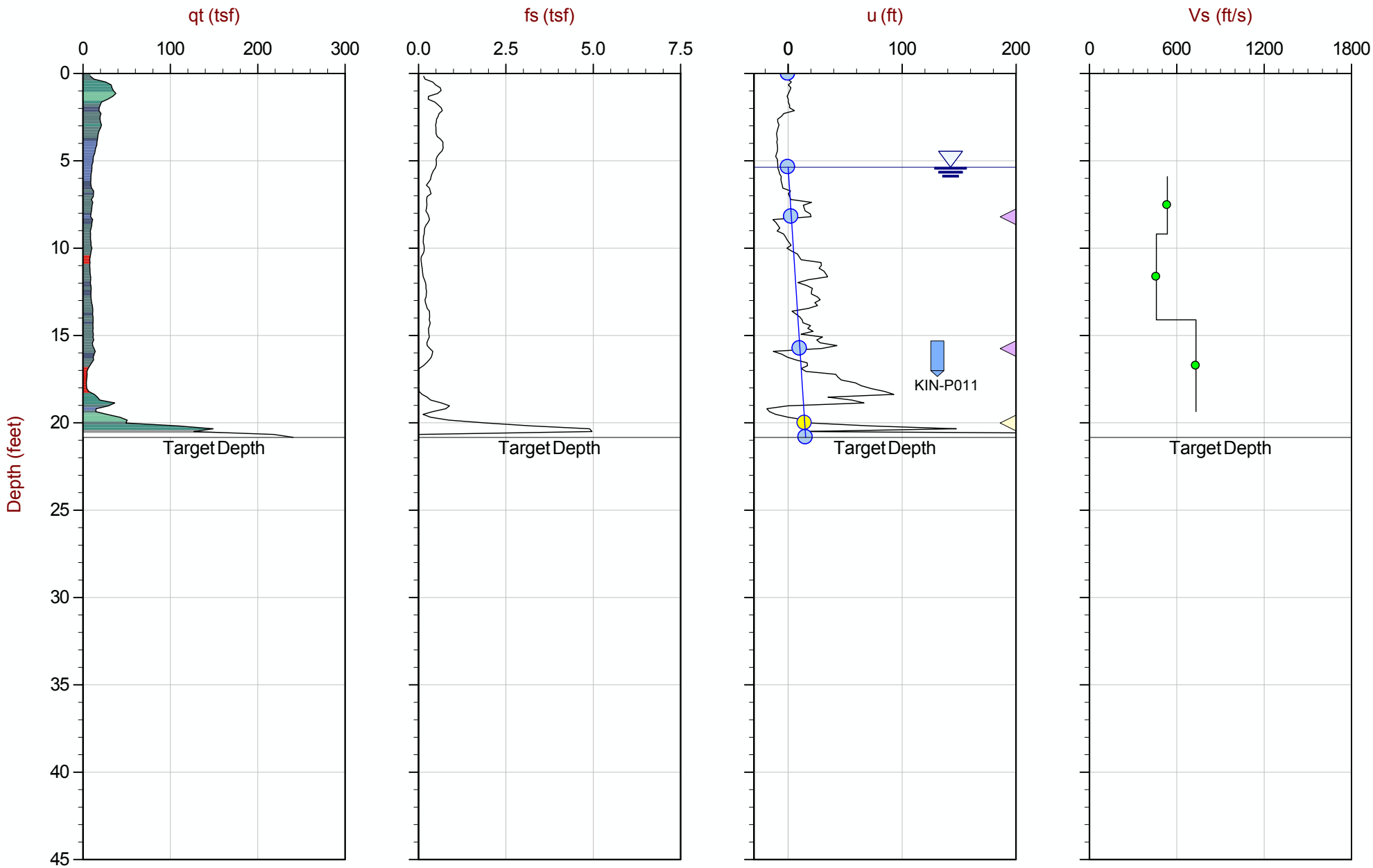
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:15:15 09:12
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C014
Cone: 374:T1500F15U500



Max Depth: 6.350 m / 20.83 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP14.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386481m E: 286344m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

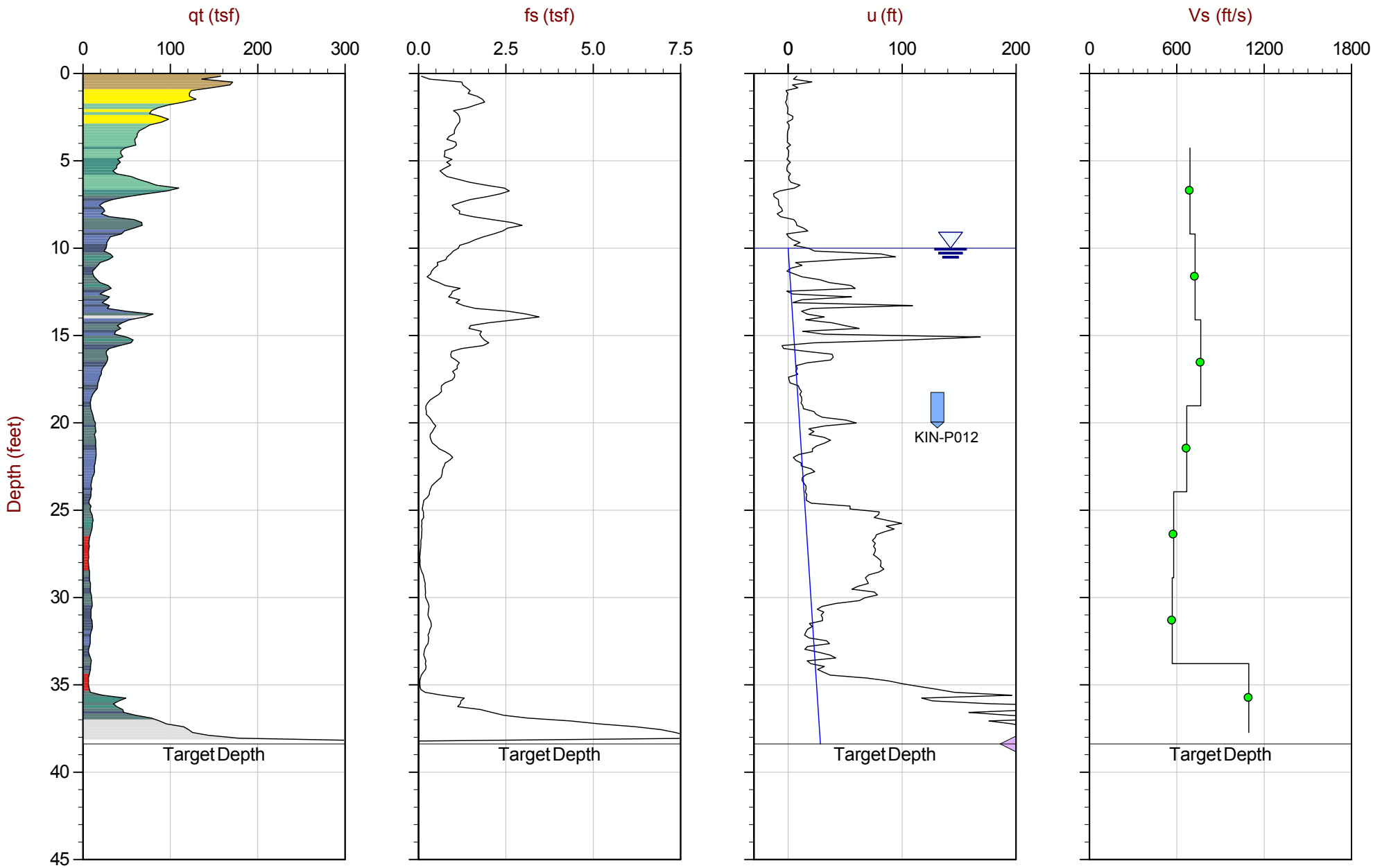
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 09:41
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C015
Cone: 335:T1500F15U500



Max Depth: 11.700 m / 38.39 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP15.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386468m E: 286346m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

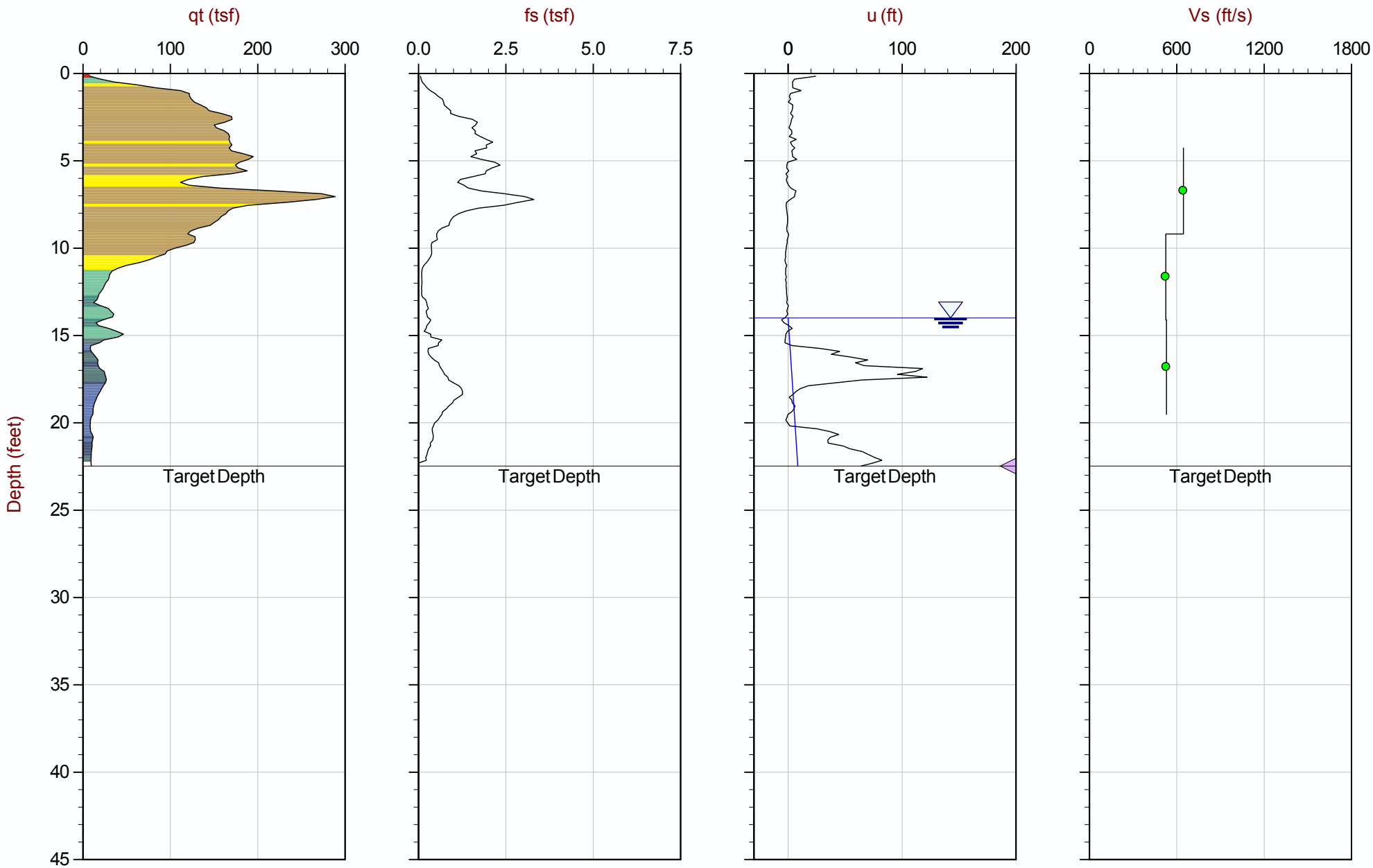
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 10:45
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C016
Cone: 335:T1500F15U500



Max Depth: 6.850 m / 22.47 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP16.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386451m E: 286344m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

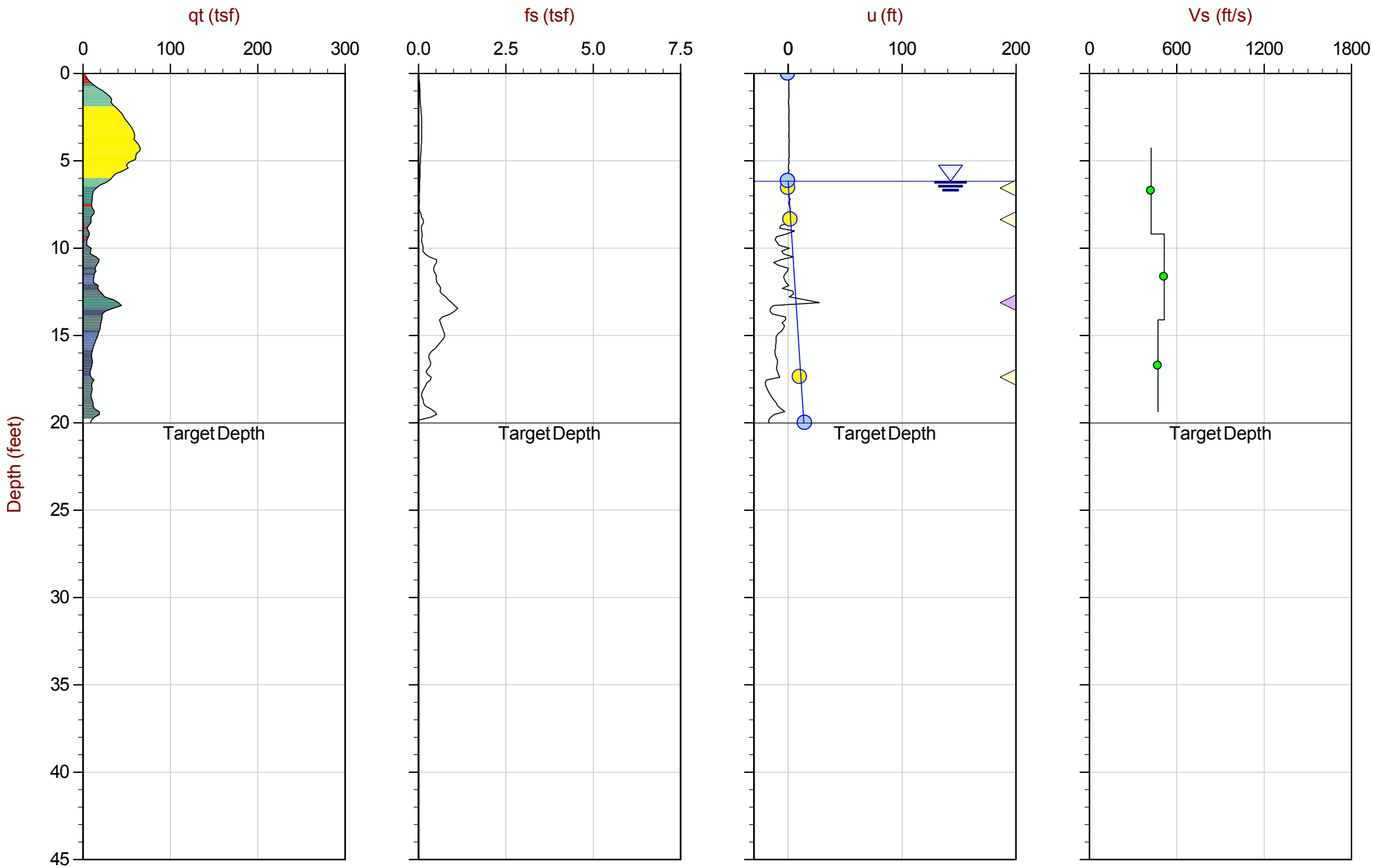
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 08:51
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C017
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP17.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386242m E: 286400m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

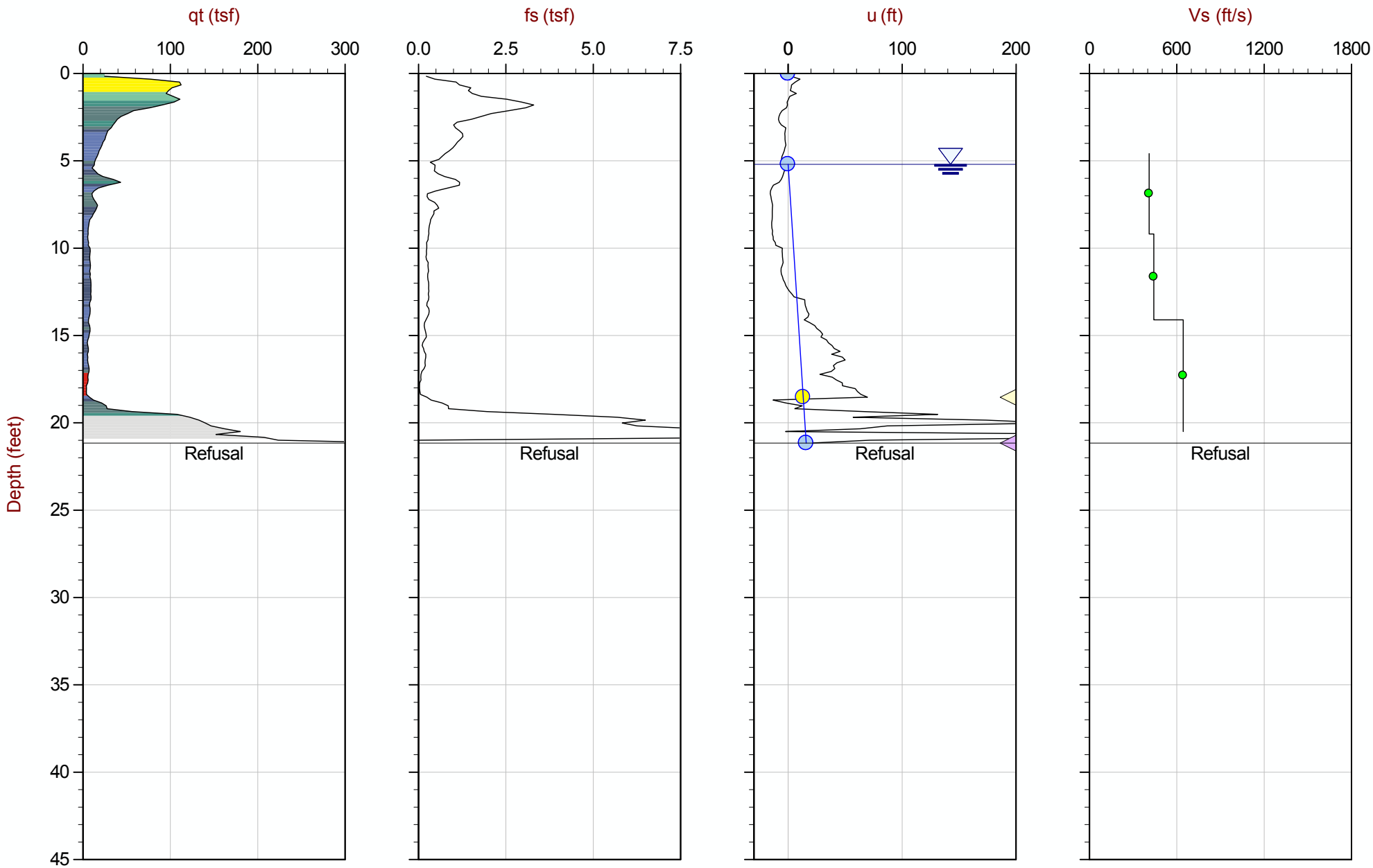
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 08:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C018
Cone: 335:T1500F15U500



Max Depth: 6.450 m / 21.16 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP18.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386239m E: 286438m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

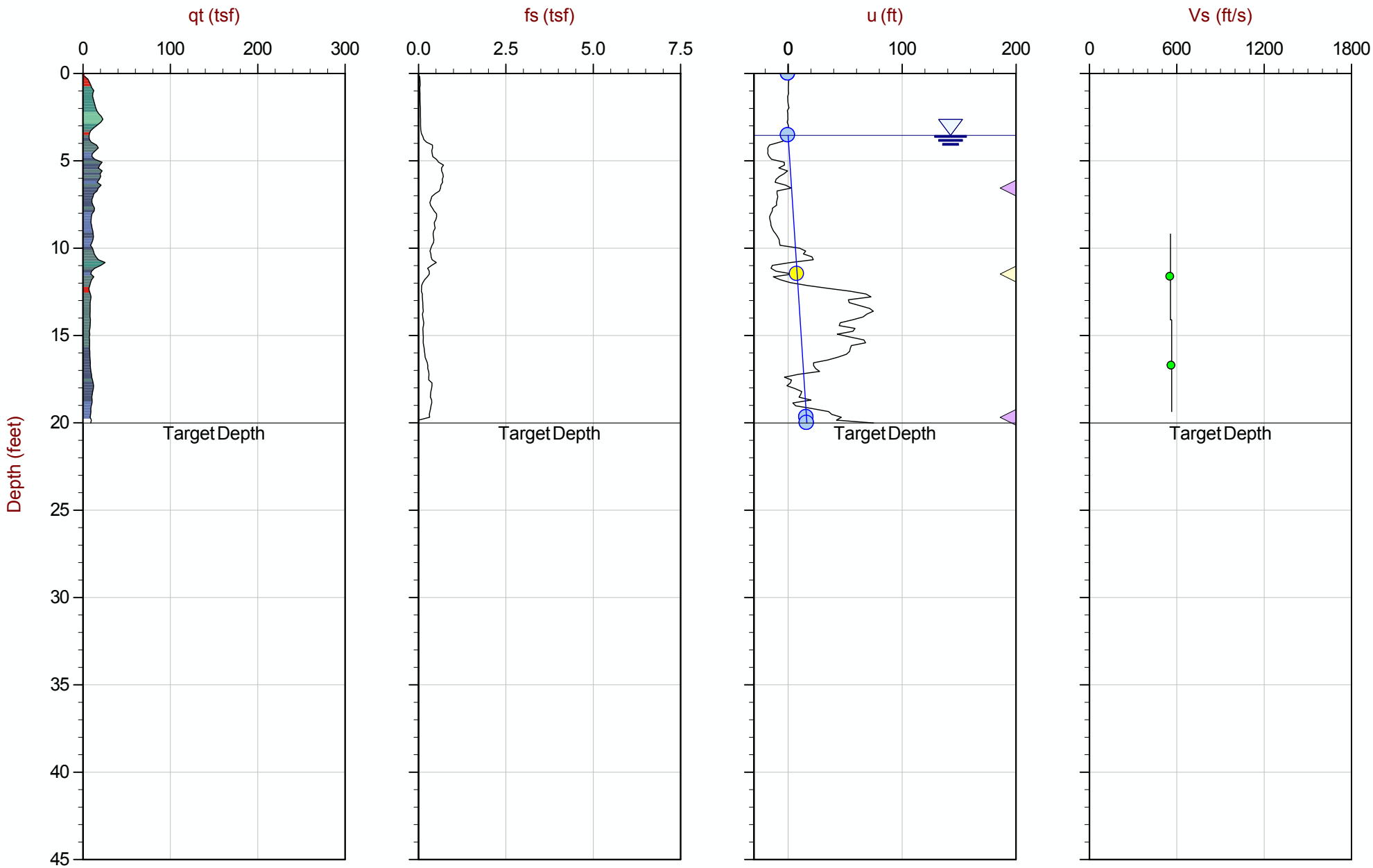
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:18:15 10:43
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C019
Cone: 374:T1500F15U500



Max Depth: 6.100 m / 20.01 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP19.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385855m E: 286393m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

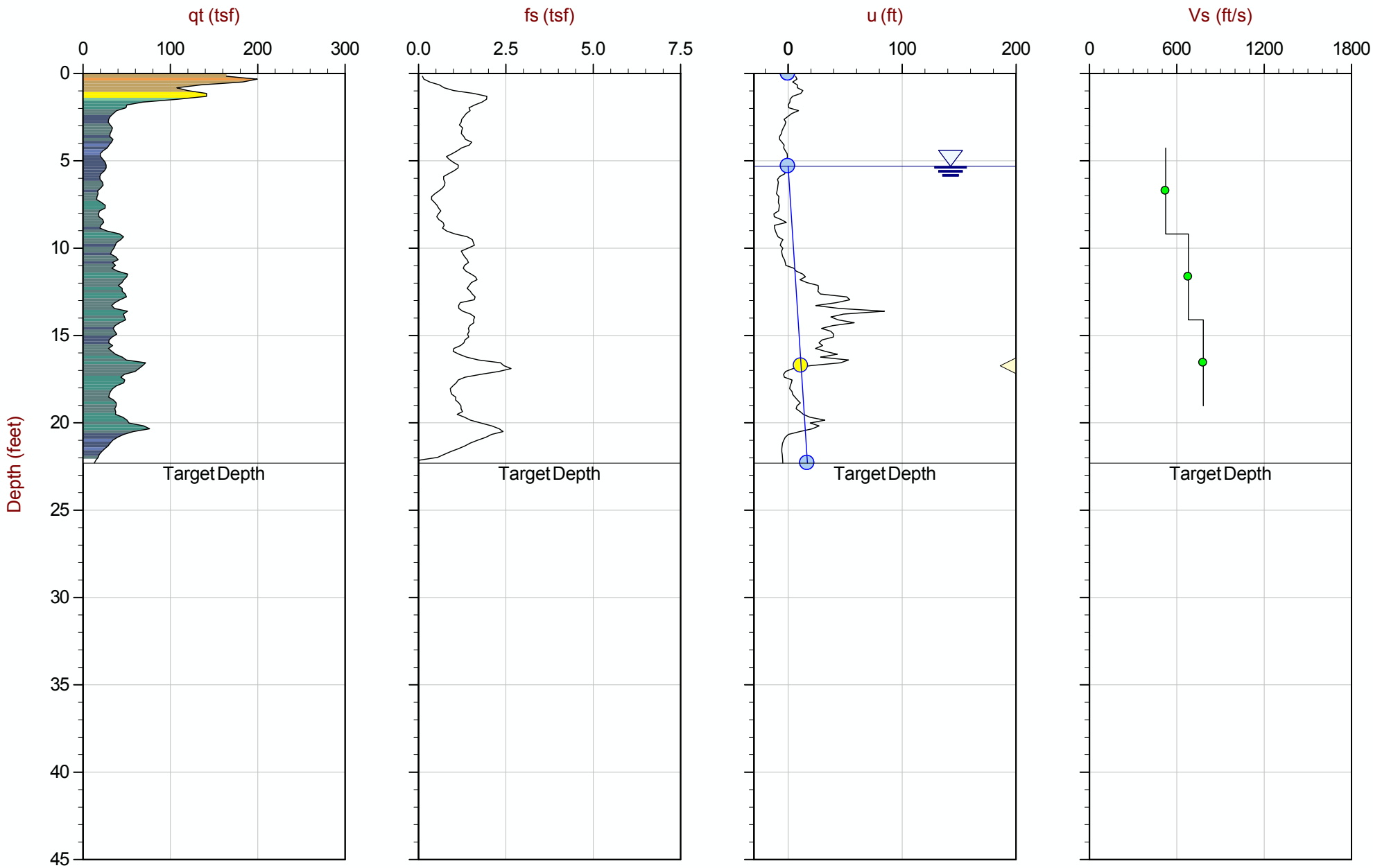
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 08:31
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C020
Cone: 335:T1500F15U500



Max Depth: 6.800 m / 22.31 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP20.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385853m E: 286405m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

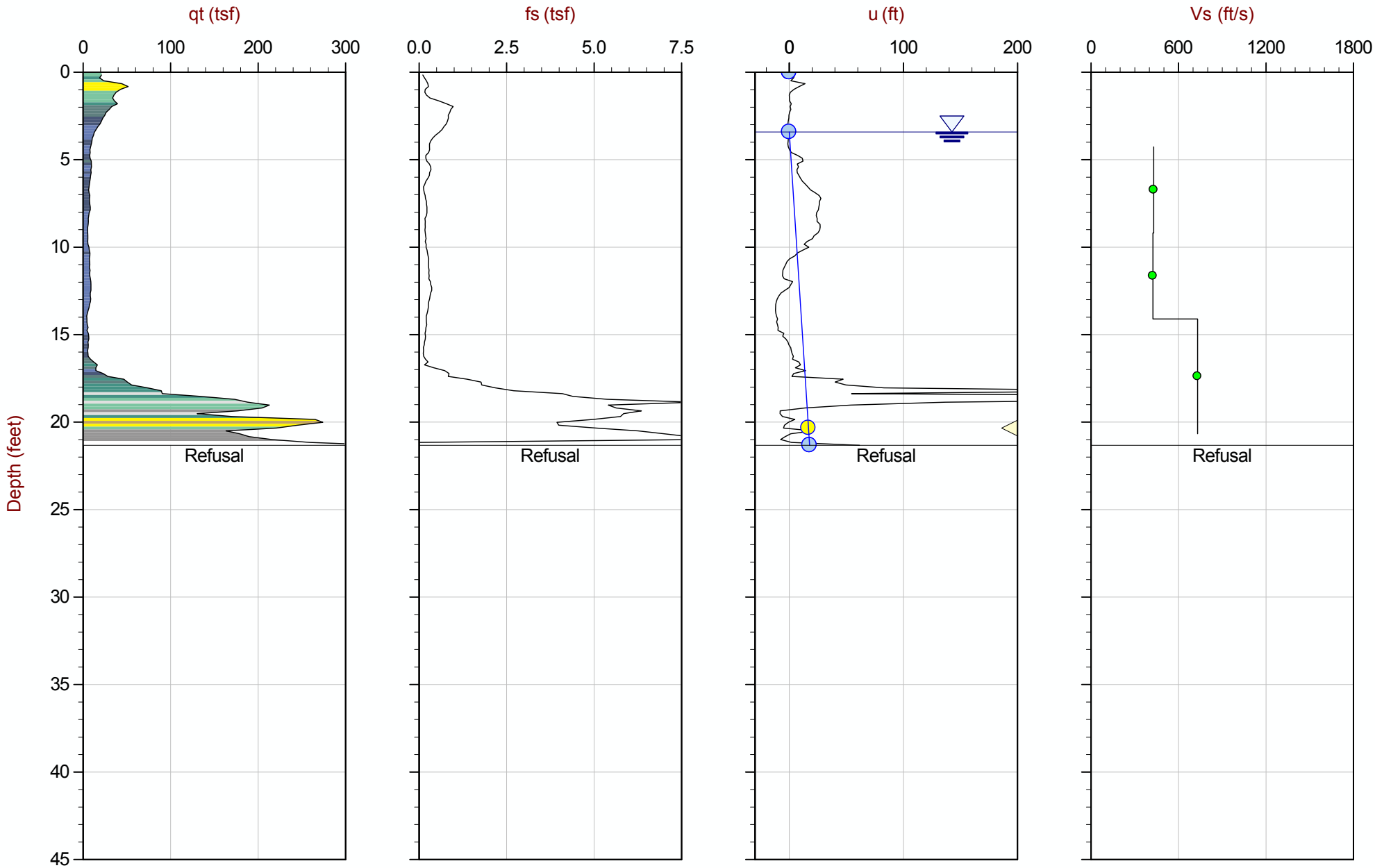
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 11:10
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C021
Cone: 335:T1500F15U500



Max Depth: 6.500 m / 21.33 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP21.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385842m E: 286429m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

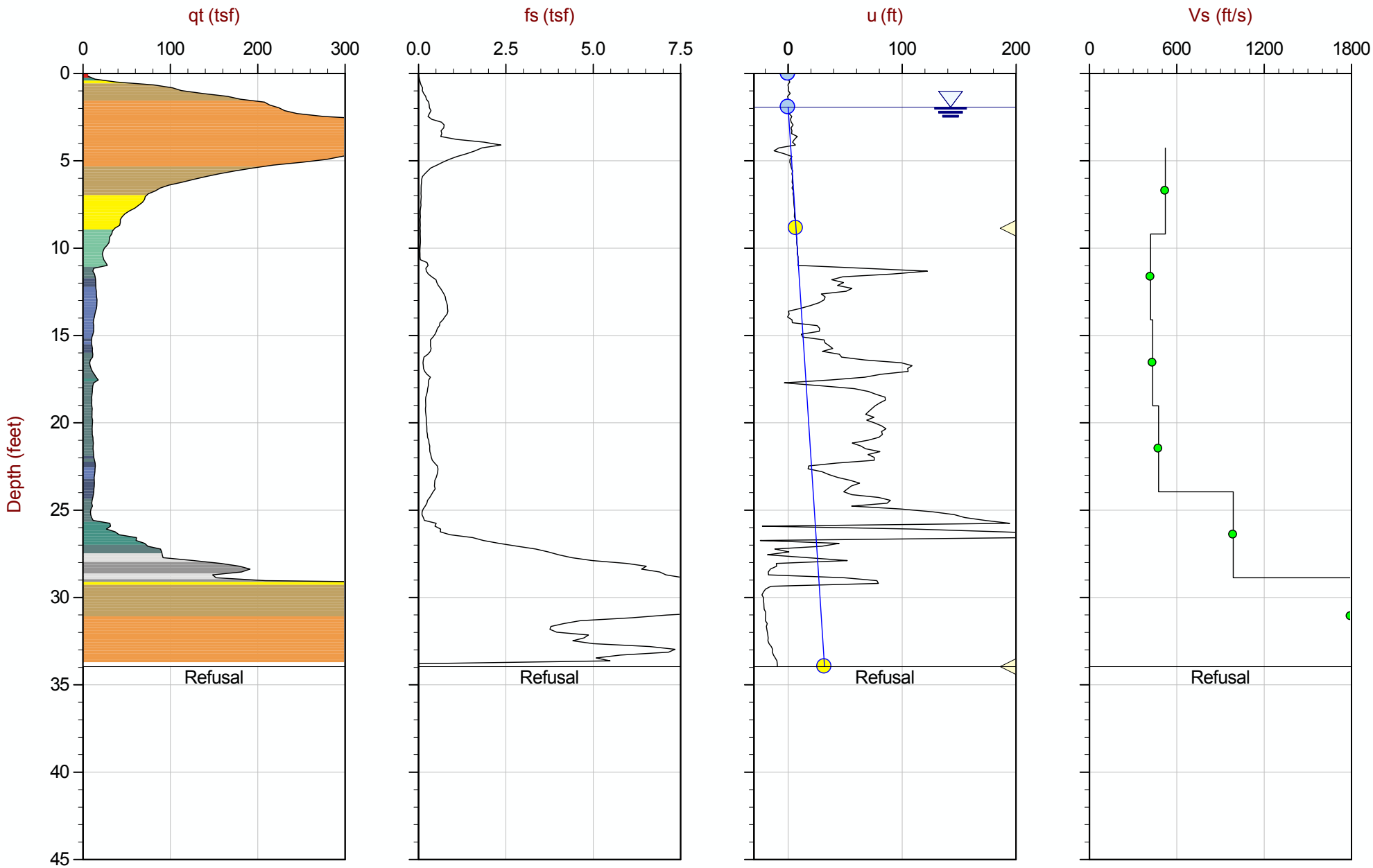
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 11:53
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C022
Cone: 374:T1500F15U500



Max Depth: 10.350 m / 33.96 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP22.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385958m E: 285856m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

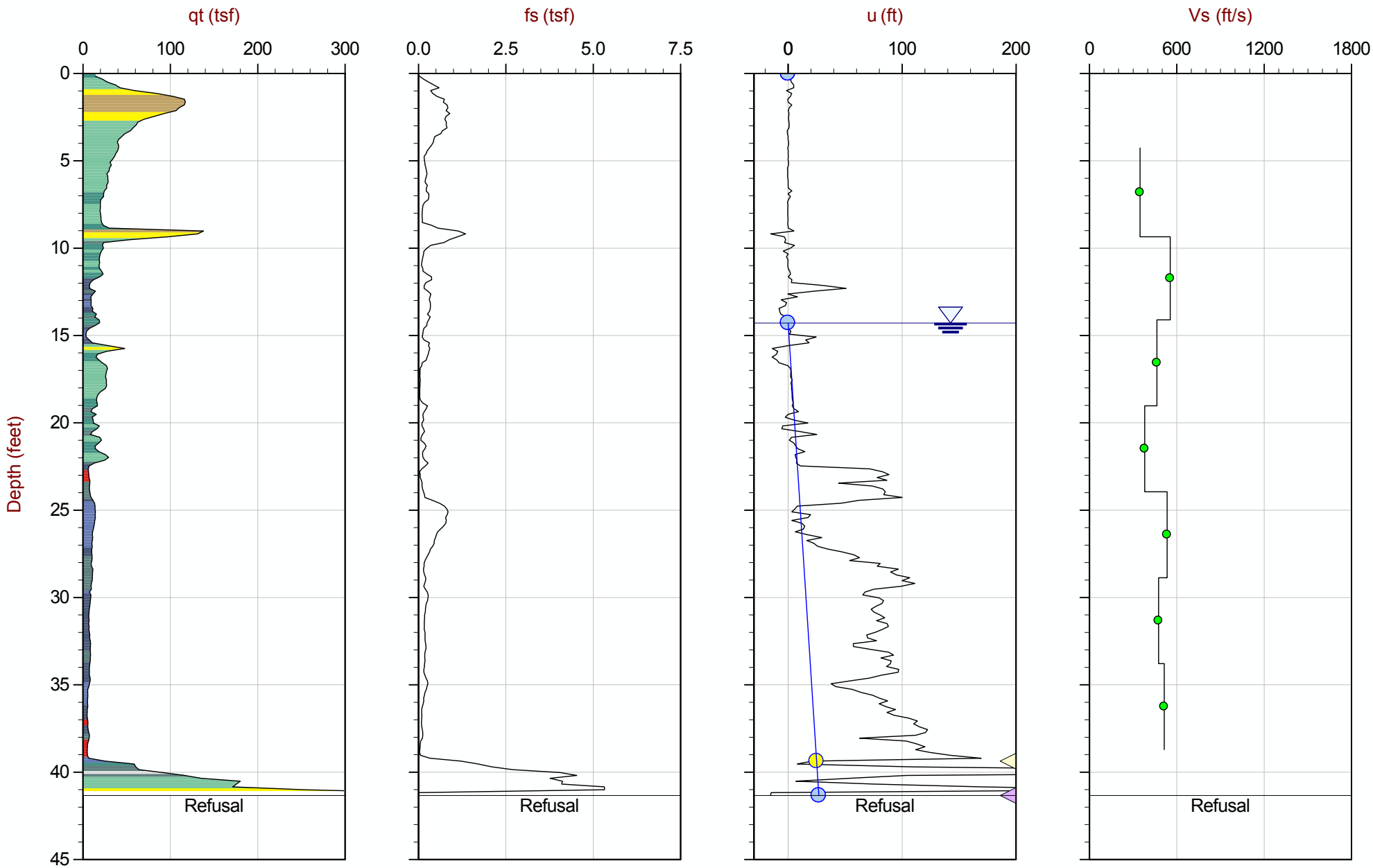
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 14:39
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023
Cone: 335:T1500F15U500



Max Depth: 12.600 m / 41.34 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP23.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386098m E: 285651m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

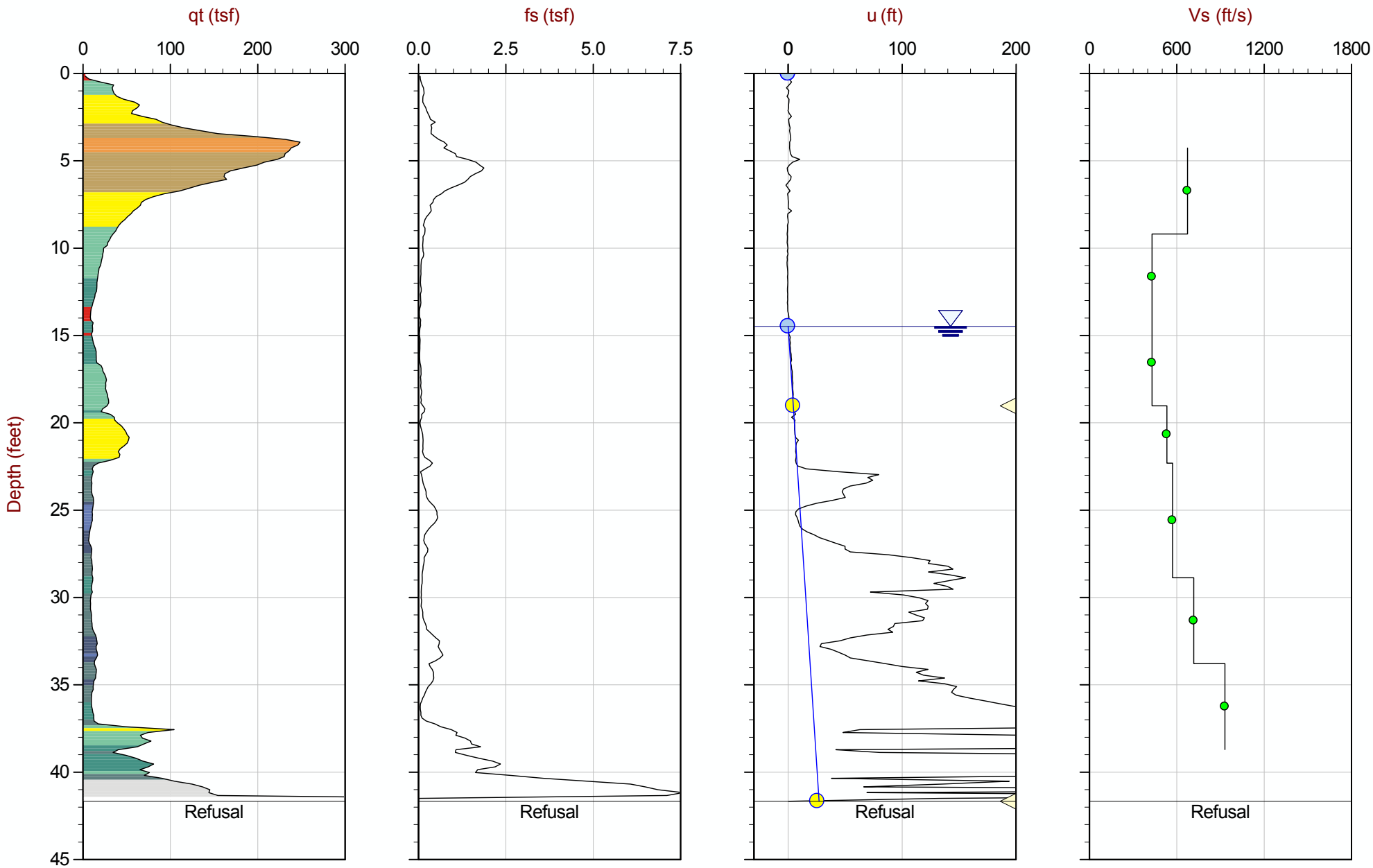
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 11:22
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C025
Cone: 374:T1500F15U500



Max Depth: 12.700 m / 41.67 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP25.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386326m E: 285776m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

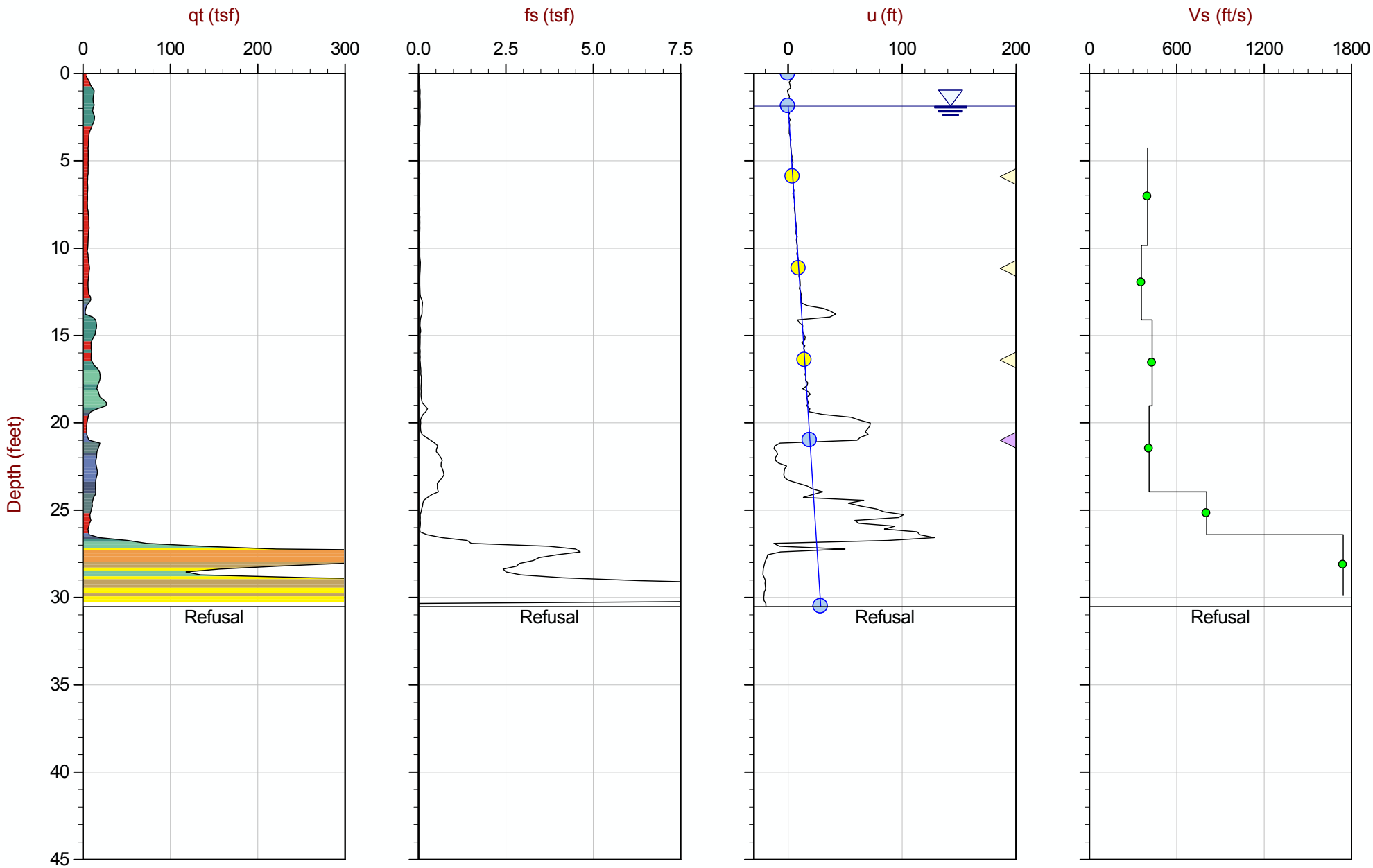
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:17:15 11:17
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C026
Cone: 374:T1500F15U500



Max Depth: 9.300 m / 30.51 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP26.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386290m E: 285960m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

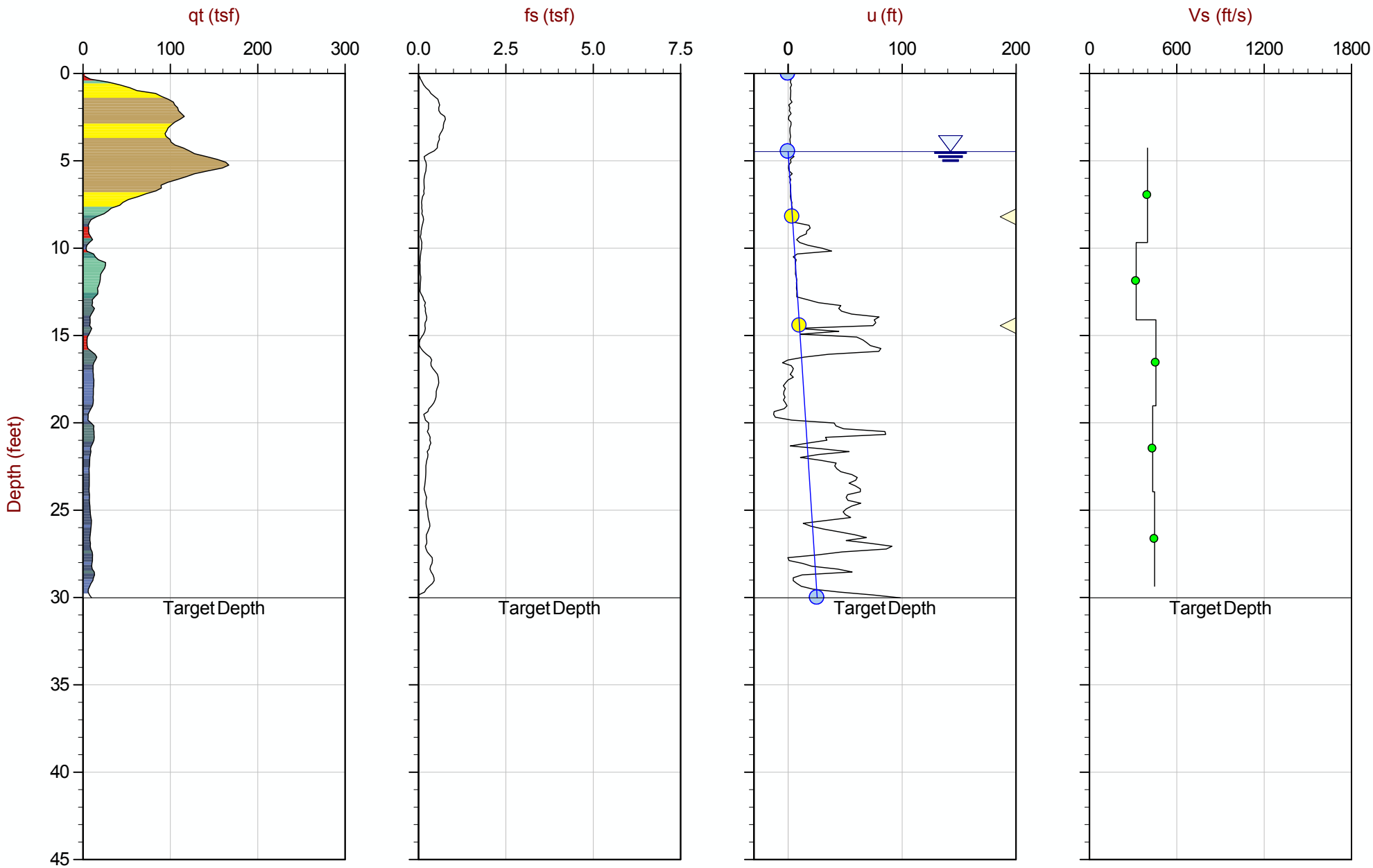
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 12:53
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C027
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP27.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386171m E: 285813m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

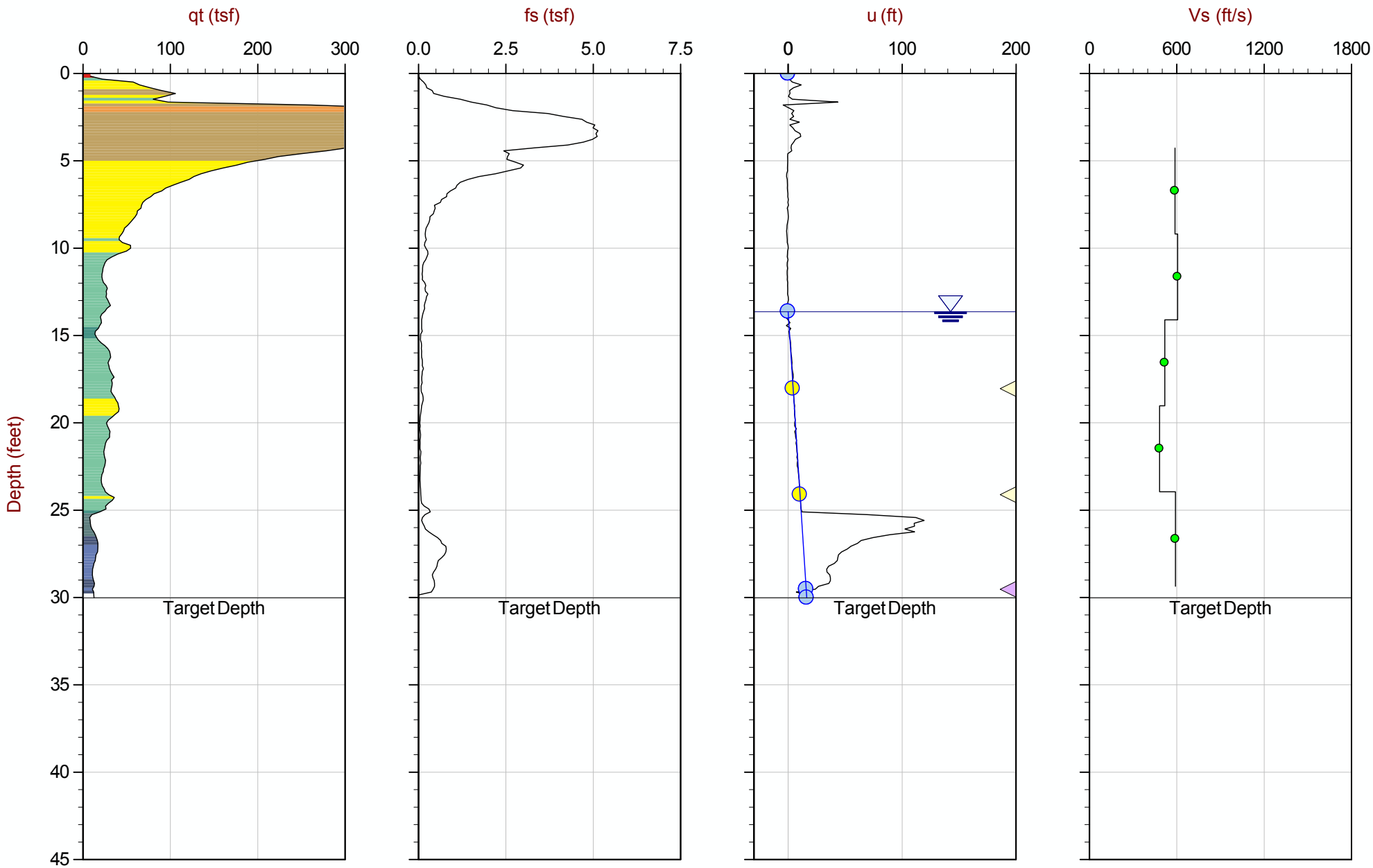
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:18:15 08:30
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C028
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP28.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386043m E: 285531m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

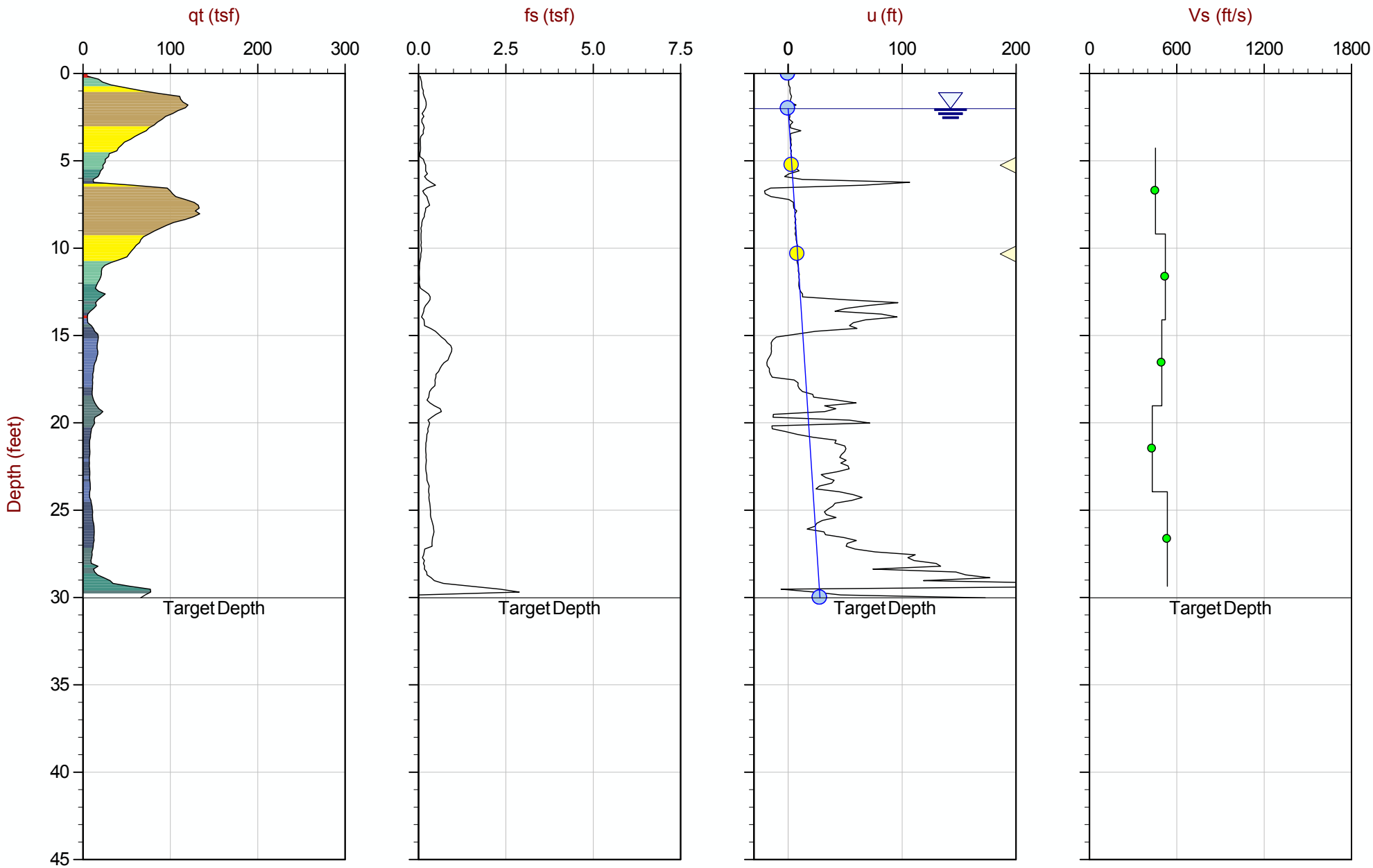
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 14:10
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C029
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP29.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386044m E: 285779m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

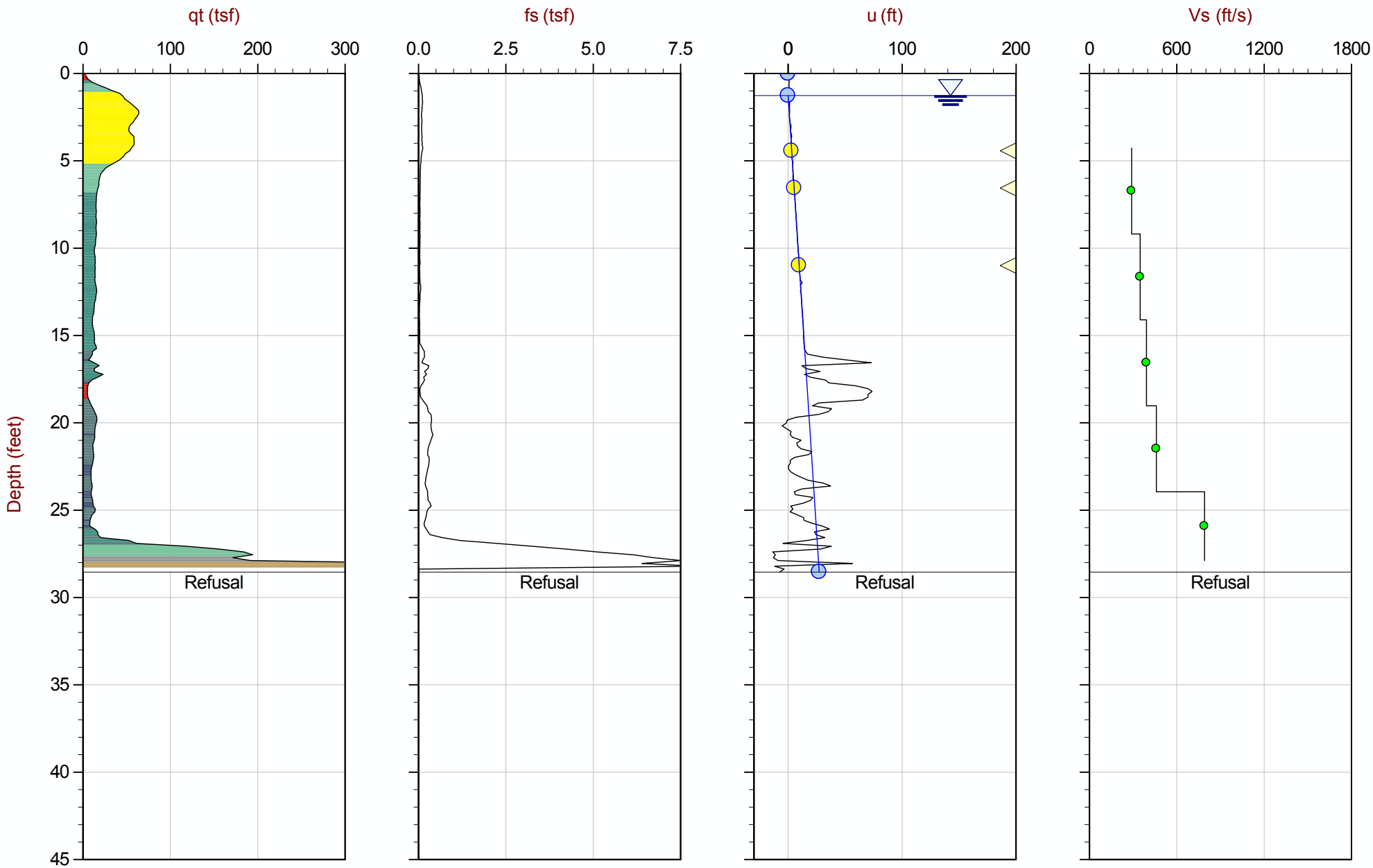
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 14:42
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C030
Cone: 374:T1500F15U500



Max Depth: 8.700 m / 28.54 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP30.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4386179m E: 286098m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

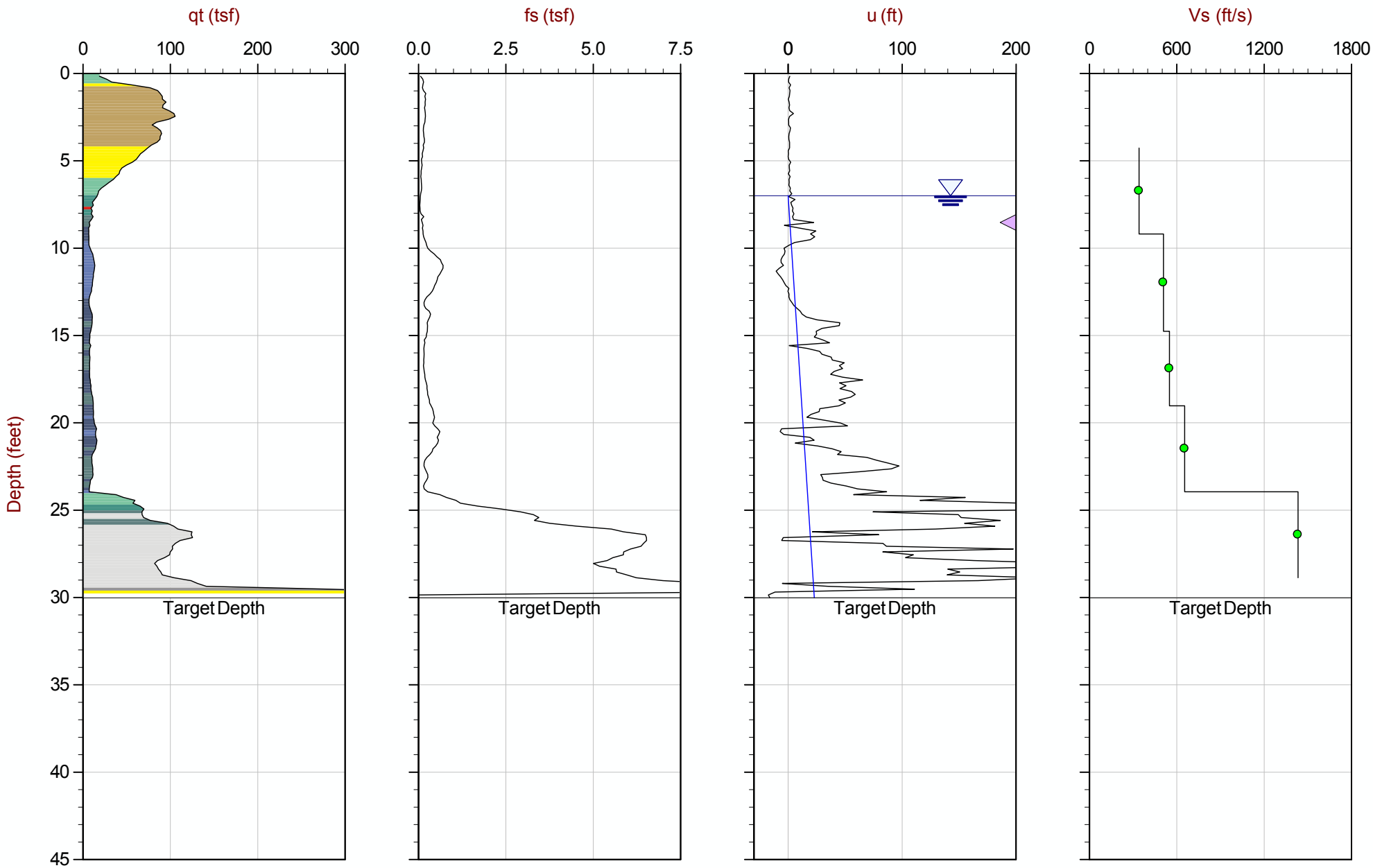
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 13:13
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C031
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP31.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385813m E: 286105m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

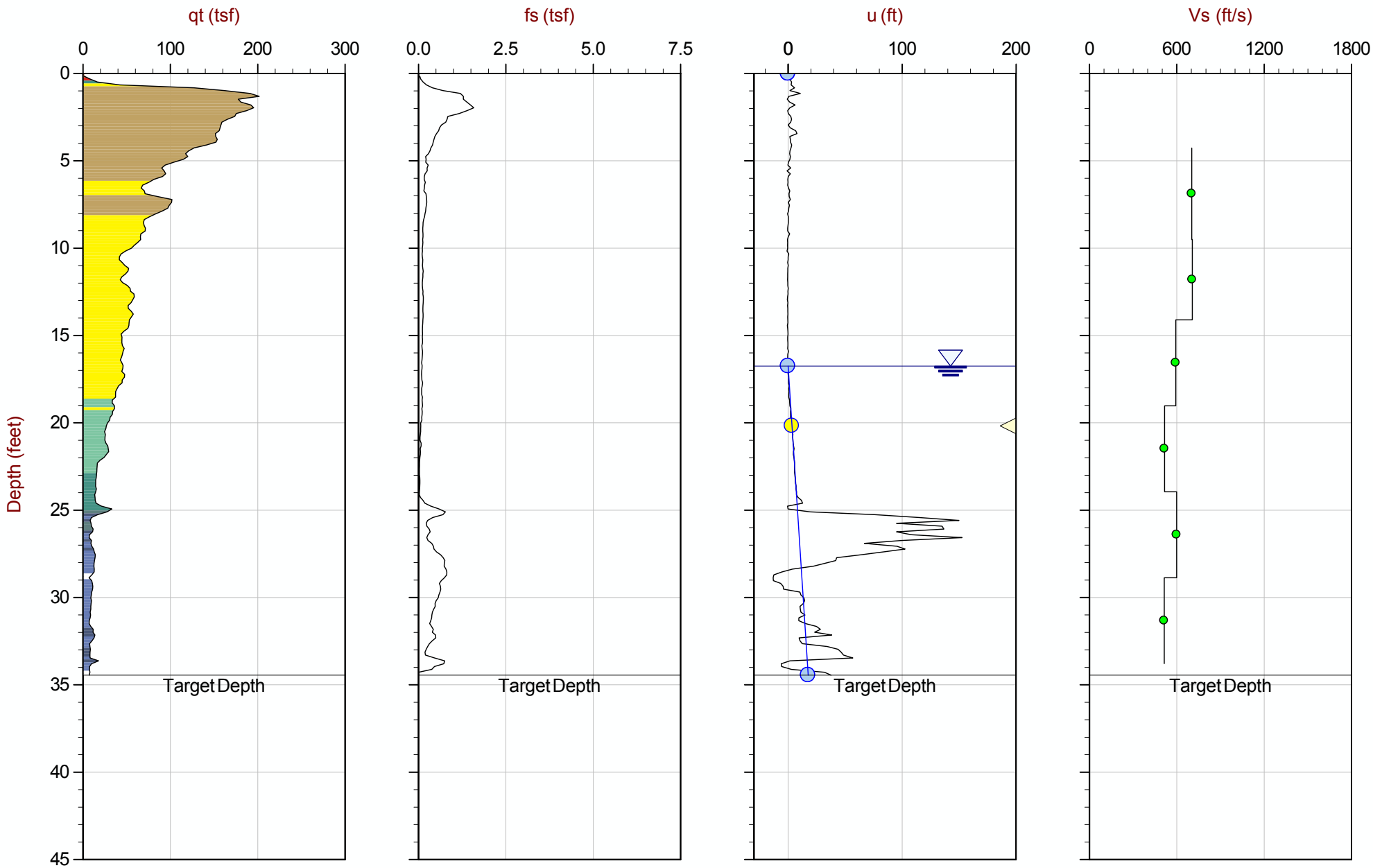
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 13:32
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C032
Cone: 335:T1500F15U500



Max Depth: 10.500 m / 34.45 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP32.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385847m E: 285688m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

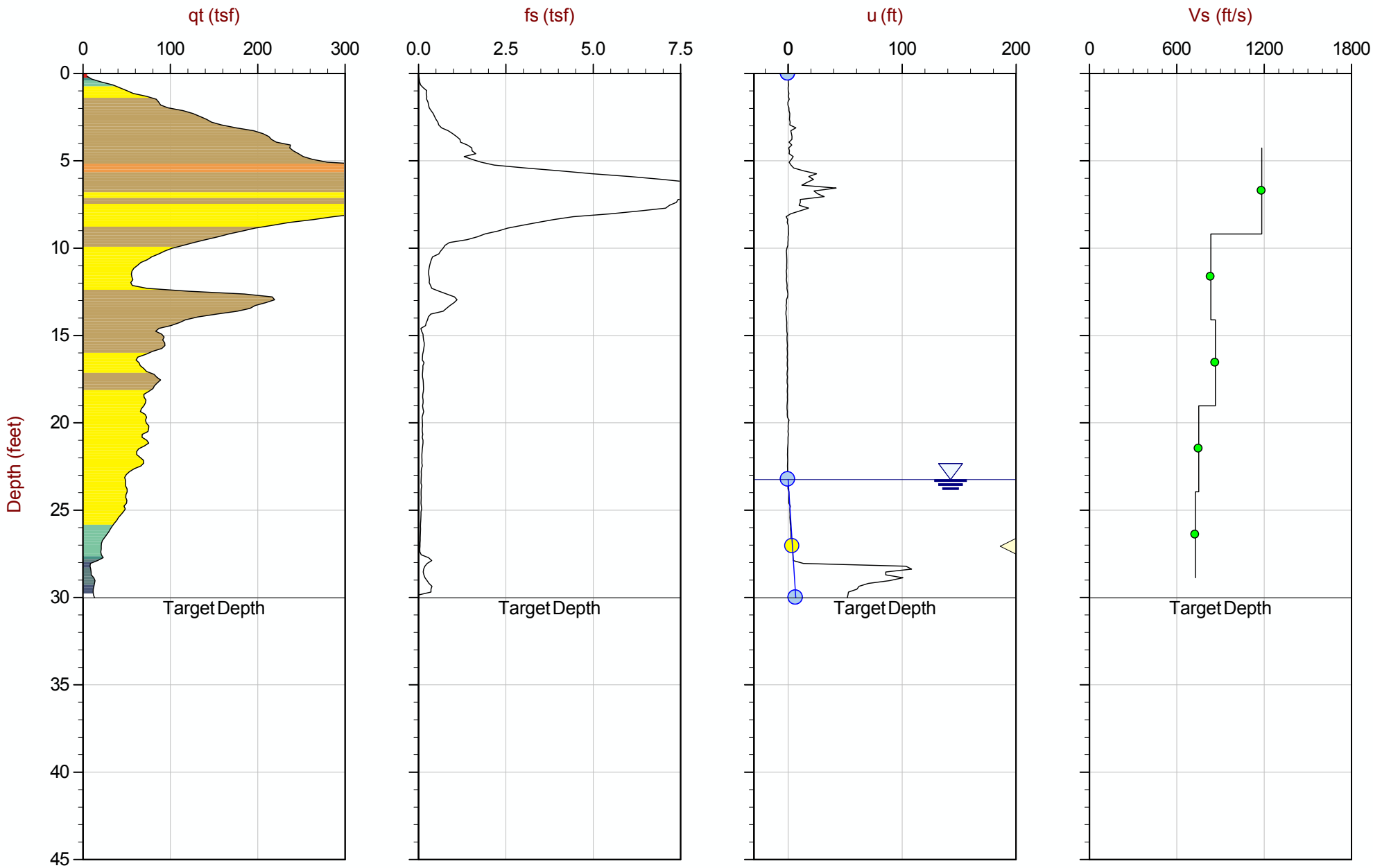
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 10:29
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C033
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP33.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385789m E: 285955m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

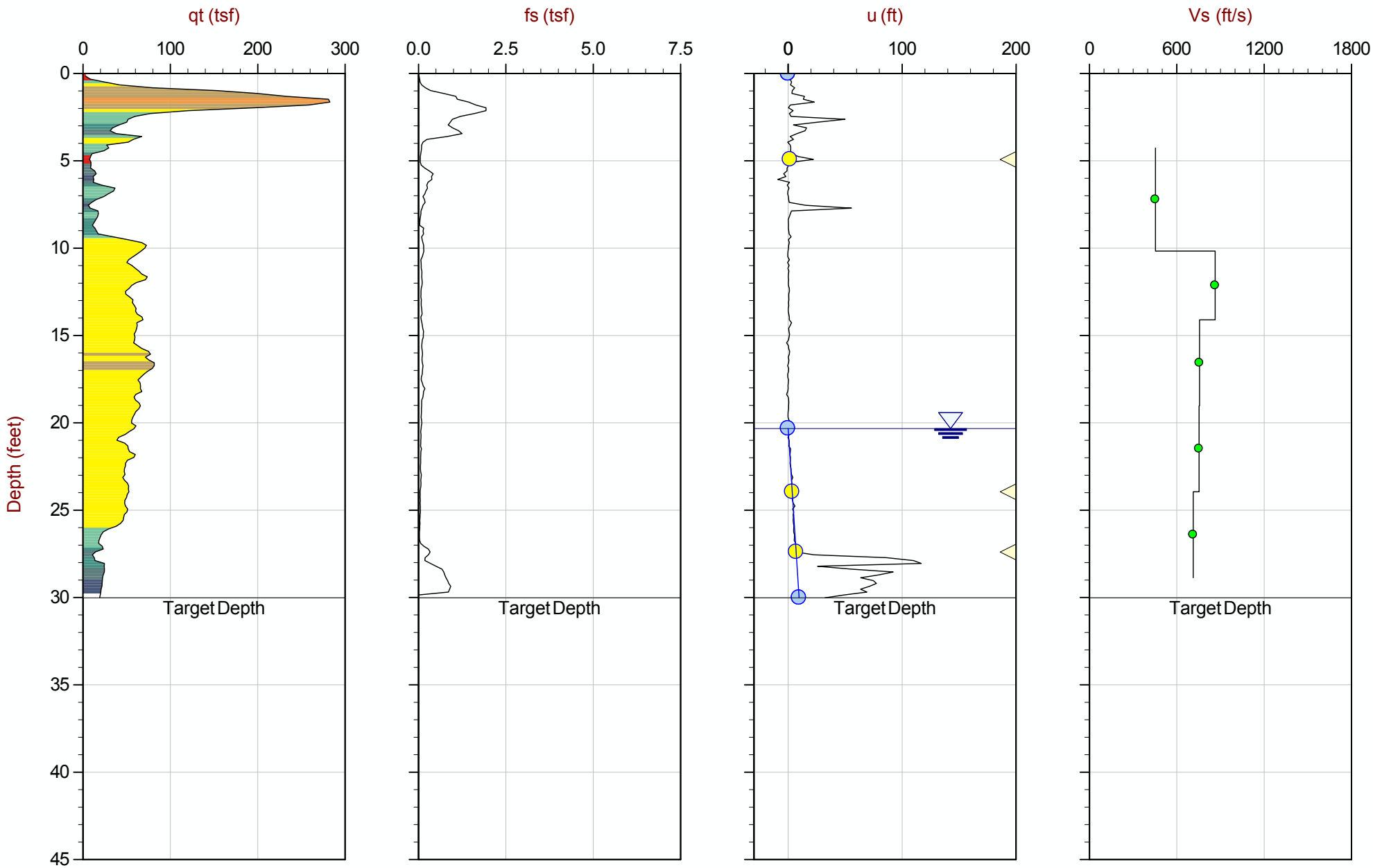
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 15:46
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C034
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP34.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385747m E: 285844m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

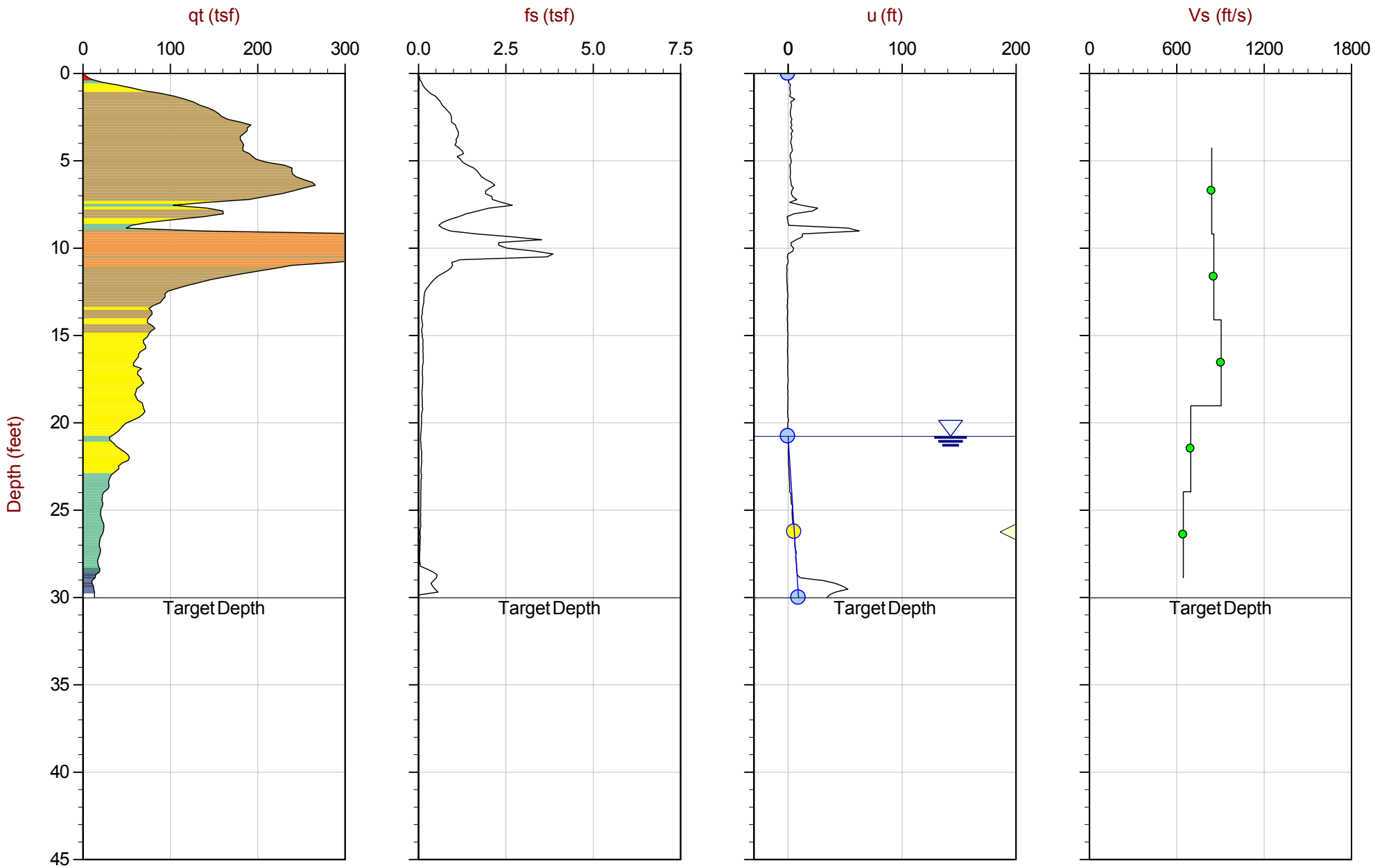
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:13:15 09:18
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C035
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP35.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385669m E: 285997m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

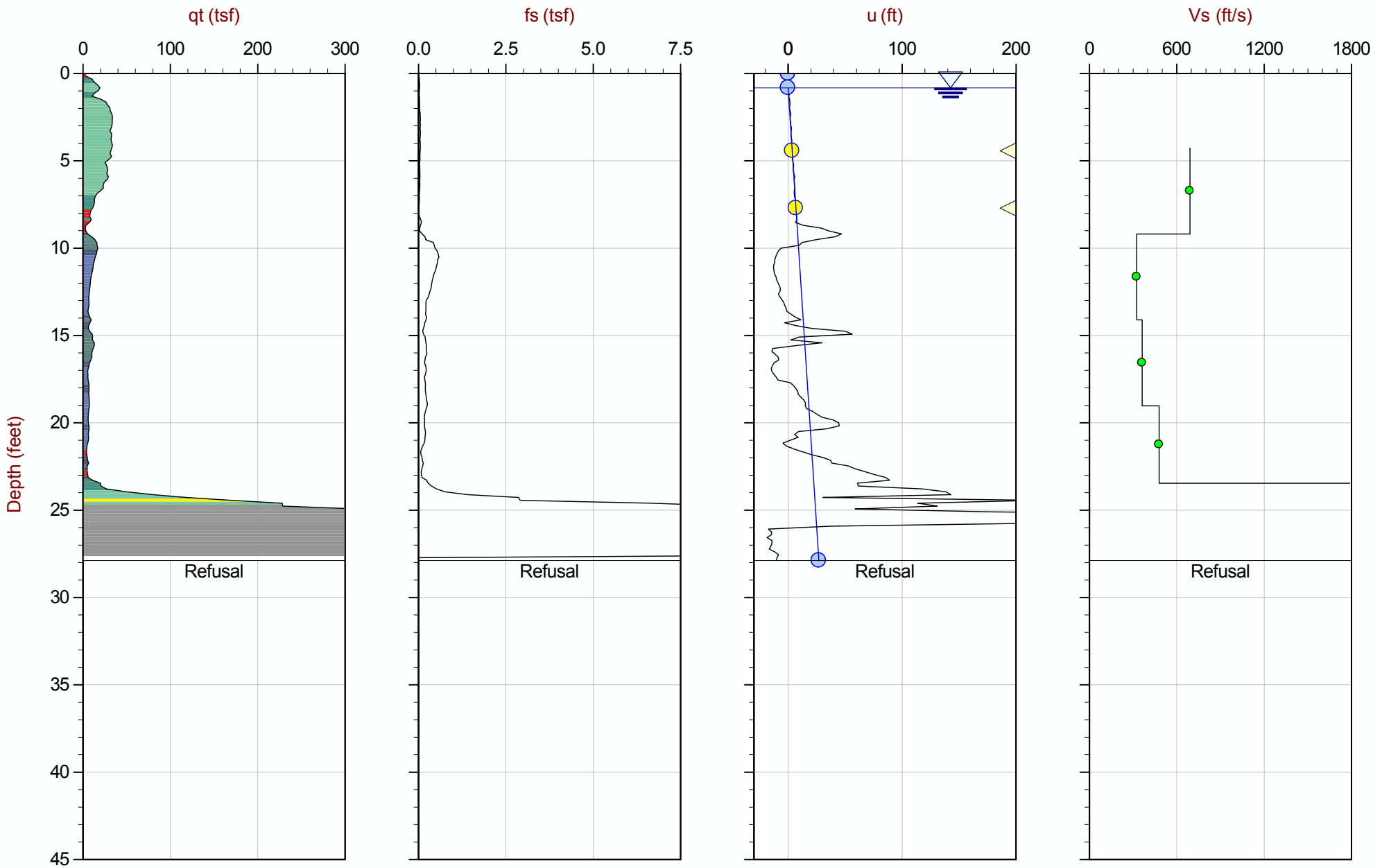
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 15:30
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C036
Cone: 374:T1500F15U500



Max Depth: 8.500 m / 27.89 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP36.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385600m E: 286099m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

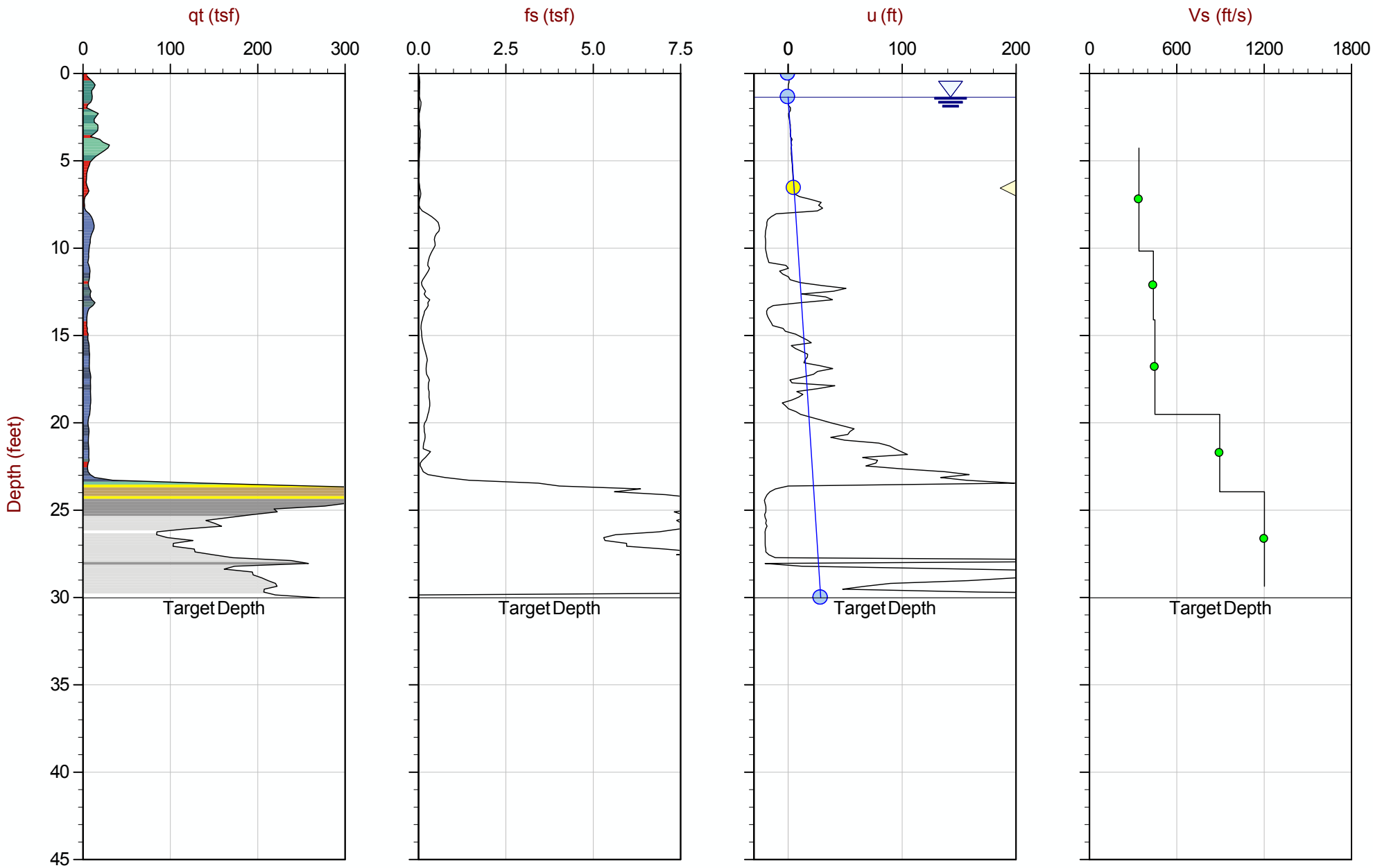
The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CONETEC

AECOM

Job No: 15-53070
Date: 08:14:15 16:42
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C037
Cone: 374:T1500F15U500



Max Depth: 9.150 m / 30.02 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 15-53070_SP37.COR

SBT: Robertson and Campanella, 1986
Coords: UTM Zone 16 N: 4385603m E: 286197m

Hydrostatic Line Ueq Assumed Ueq PPD, Ueq achieved PPD, Ueq not achieved

The reported coordinates were acquired from consumer-grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Tabular Results (Vs)

CONETEC

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C001
Date:	17-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
10.01	9.35	9.47	4.95	11.24	440
14.76	14.11	14.19	4.72	8.98	525
18.86	18.21	18.27	4.08	5.14	794

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C002
Date:	18-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	8.18	585
14.76	14.11	14.19	4.88	7.98	612
20.01	19.36	19.41	5.23	11.07	472
25.10	24.44	24.49	5.07	11.72	433
29.36	28.71	28.75	4.26	6.18	689

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C003
Date:	17-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	12.08	396
15.42	14.76	14.84	5.53	12.68	436
20.34	19.68	19.74	4.90	7.80	628

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C004
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	7.50	639
14.76	14.11	14.19	4.88	7.31	667
19.69	19.03	19.09	4.90	8.86	553
24.61	23.95	24.00	4.91	6.38	769
29.53	28.87	28.91	4.91	6.94	708
34.45	33.79	33.83	4.92	8.74	563
39.37	38.71	38.74	4.92	9.54	515
43.96	43.31	43.33	4.59	6.20	741

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C005
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	8.83	542
14.76	14.11	14.19	4.88	10.68	457
20.01	19.36	19.41	5.23	10.41	502
22.97	22.31	22.36	2.95	3.44	856

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C006
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
9.84	9.19	9.31			
14.76	14.11	14.19	4.88	6.55	745
20.01	19.36	19.41	5.23	6.22	841
24.61	23.95	24.00	4.58	5.57	823
29.53	28.87	28.91	4.91	5.66	869
35.27	34.61	34.65	5.74	8.17	702
40.03	39.37	39.40	4.75	7.77	612

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C007
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	6.35	754
14.76	14.11	14.19	4.88	6.27	778
19.69	19.03	19.09	4.90	6.55	748
24.61	23.95	24.00	4.91	6.28	781
29.53	28.87	28.91	4.91	6.11	804
34.45	33.79	33.83	4.92	7.63	644
40.03	39.37	39.40	5.57	8.98	620

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C008
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.26	3.61	8.06			
9.84	9.19	11.68	3.62	4.53	799
14.76	14.11	15.84	4.17	8.21	508
16.90	16.24	17.77	1.93	3.13	616
20.01	19.36	20.66	2.89	2.50	1154

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C009
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
9.84	9.19	11.68			
14.76	14.11	15.84	4.17	4.13	1008
19.69	19.03	20.35	4.51	2.52	1789

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C010
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	5.19	922
14.76	14.11	14.19	4.88	6.45	756
19.69	19.03	19.09	4.90	6.17	794
24.61	23.95	24.00	4.91	6.64	739
29.53	28.87	28.91	4.91	6.59	745
34.45	33.79	33.83	4.92	4.16	1181
40.03	39.37	39.40	5.57	3.93	1419

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C011
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
5.25	4.59	4.83			
9.84	9.19	9.31	4.48	4.87	920
14.76	14.11	14.19	4.88	6.17	791
19.69	19.03	19.09	4.90	6.82	718
24.61	23.95	24.00	4.91	6.72	730
29.53	28.87	28.91	4.91	7.27	676
34.45	33.79	33.83	4.92	7.93	620
40.03	39.37	39.40	5.57	7.27	766

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C012
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	8.07	593
14.76	14.11	14.19	4.88	9.75	501
19.69	19.03	19.09	4.90	10.93	448
24.61	23.95	24.00	4.91	8.57	573
29.53	28.87	28.91	4.91	8.82	557
34.45	33.79	33.83	4.92	9.38	524
39.86	39.21	39.23	5.41	5.84	927

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C013
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	5.73	836
14.76	14.11	14.19	4.88	6.63	736
19.69	19.03	19.09	4.90	9.83	499
24.61	23.95	24.00	4.91	7.01	700
29.69	29.04	29.07	5.08	7.01	724
34.45	33.79	33.83	4.75	6.20	766
39.04	38.39	38.41	4.59	4.72	971

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C014
Date:	15-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
6.56	5.91	9.32			
9.84	9.19	11.68	2.36	4.41	535
14.76	14.11	15.84	4.17	9.05	460
20.01	19.36	20.66	4.81	6.58	732

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C015
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	6.93	691
14.76	14.11	14.19	4.88	6.72	726
19.69	19.03	19.09	4.90	6.40	765
24.61	23.95	24.00	4.91	7.34	669
29.53	28.87	28.91	4.91	8.49	579
34.45	33.79	33.83	4.92	8.64	569
38.39	37.73	37.76	3.93	3.59	1095

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C016
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	7.41	646
14.76	14.11	14.19	4.88	9.30	525
20.18	19.52	19.58	5.39	10.20	529

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C017
Date:	17-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	7.79	424
14.76	14.11	15.84	4.17	8.10	514
20.01	19.36	20.66	4.81	10.22	471

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C018
Date:	17-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
5.25	4.59	4.83			
9.84	9.19	9.31	4.48	10.93	410
14.76	14.11	14.19	4.88	11.05	442
21.16	20.50	20.56	6.37	9.90	644

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C019
Date:	18-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
9.84	9.19	11.68			
14.76	14.11	15.84	4.17	7.48	557
20.01	19.36	20.66	4.81	8.51	565

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C020
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	9.13	524
14.76	14.11	14.19	4.88	7.17	680
19.69	19.03	19.09	4.90	6.27	782

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C021
Date:	17-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
9.84	9.19	9.31	4.79	11.13	430
14.76	14.11	14.19	4.88	11.49	425
21.33	20.67	20.72	6.54	8.95	731

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C022
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	6.33	522
14.76	14.11	15.84	4.17	9.91	420
19.69	19.03	20.35	4.51	10.35	435
24.61	23.95	25.01	4.66	9.81	475
29.53	28.87	29.76	4.75	4.81	988
33.96	33.30	34.07	4.31	2.40	1795

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C023
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	1.50
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
10.01	9.35	9.47	4.95	14.20	348
14.76	14.11	14.19	4.72	8.49	555
19.69	19.03	19.09	4.90	10.56	464
24.61	23.95	24.00	4.91	12.92	380
29.53	28.87	28.91	4.91	9.21	534
34.45	33.79	33.83	4.92	10.35	475
39.37	38.71	38.74	4.92	9.56	514

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C025
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	4.90	674
14.76	14.11	15.84	4.17	9.68	430
19.69	19.03	20.35	4.51	10.49	430
22.97	22.31	23.45	3.10	5.82	532
29.53	28.87	29.76	6.31	11.06	571
34.45	33.79	34.55	4.80	6.68	717
39.37	38.71	39.38	4.83	5.19	931

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C026
Date:	17-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
10.50	9.84	12.20	3.82	9.57	400
14.76	14.11	15.84	3.64	10.19	357
19.69	19.03	20.35	4.51	10.46	431
24.61	23.95	25.01	4.66	11.38	410
27.07	26.41	27.38	2.37	2.94	805
30.51	29.86	30.71	3.34	1.91	1743

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C027
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
10.33	9.68	12.07	3.69	9.25	399
14.76	14.11	15.84	3.77	11.77	321
19.69	19.03	20.35	4.51	9.86	457
24.61	23.95	25.01	4.66	10.73	435
30.02	29.36	30.24	5.22	11.66	448

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C028
Date:	18-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	5.61	588
14.76	14.11	15.84	4.17	6.87	606
19.69	19.03	20.35	4.51	8.70	518
24.61	23.95	25.01	4.66	9.68	482
30.02	29.36	30.24	5.22	8.84	591

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C029
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	7.27	454
14.76	14.11	15.84	4.17	7.97	522
19.69	19.03	20.35	4.51	9.06	497
24.61	23.95	25.01	4.66	10.79	432
30.02	29.36	30.24	5.22	9.76	535

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C030
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	11.39	290
14.76	14.11	15.84	4.17	11.94	349
19.69	19.03	20.35	4.51	11.48	392
24.61	23.95	25.01	4.66	10.14	460
28.54	27.89	28.80	3.79	4.79	791

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C031
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	9.68	341
15.42	14.76	16.43	4.75	9.34	509
19.69	19.03	20.35	3.92	7.13	550
24.61	23.95	25.01	4.66	7.13	654
29.53	28.87	29.76	4.75	3.31	1433

Job No: 15-53070
Client: AECOM
Project: Kincaid Power Station
Sounding ID: KIN-C032
Date: 14-Aug-2015

Seismic Source: Beam
Source Offset (ft): 1.50
Source Depth (ft): 0.00
Geophone Offset (ft): 0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	4.52			
10.17	9.51	9.63	5.11	7.27	703
14.76	14.11	14.19	4.56	6.44	707
19.69	19.03	19.09	4.90	8.26	593
24.61	23.95	24.00	4.91	9.51	516
29.53	28.87	28.91	4.91	8.21	599
34.45	33.79	33.83	4.92	9.56	514

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C033
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	2.79	1184
14.76	14.11	15.84	4.17	5.00	834
19.69	19.03	20.35	4.51	5.21	865
24.61	23.95	25.01	4.66	6.21	751
29.53	28.87	29.76	4.75	6.52	728

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C034
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
10.83	10.17	12.47	4.09	9.01	454
14.76	14.11	15.84	3.38	3.91	864
19.69	19.03	20.35	4.51	5.96	756
24.61	23.95	25.01	4.66	6.19	753
29.53	28.87	29.76	4.75	6.65	713

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C035
Date:	13-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	3.93	840
14.76	14.11	15.84	4.17	4.87	855
19.69	19.03	20.35	4.51	4.98	905
24.61	23.95	25.01	4.66	6.70	696
29.53	28.87	29.76	4.75	7.36	645

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C036
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
9.84	9.19	11.68	3.30	4.78	691
14.76	14.11	15.84	4.17	12.81	325
19.69	19.03	20.35	4.51	12.45	362
24.11	23.46	24.54	4.19	8.75	479
27.72	27.07	28.01	3.47	1.60	2170

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station
Sounding ID:	KIN-C037
Date:	14-Aug-2015

Seismic Source:	Beam
Source Offset (ft):	7.21
Source Depth (ft):	0.00
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)
4.92	4.27	8.38			
10.83	10.17	12.47	4.09	12.04	340
14.76	14.11	15.84	3.38	7.69	439
20.18	19.52	20.81	4.97	11.04	450
24.61	23.95	25.01	4.20	4.70	895
30.02	29.36	30.24	5.22	4.35	1202

Pore Pressure Dissipation Summary and

Pore Pressure Dissipation Plots

CONETEC

Job No:	15-53070
Client:	AECOM
Project:	Kincaid Power Station, Kincaid, IL
Start Date:	13-Aug-2015
End Date:	18-Aug-2015

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Estimated Phreatic Surface (ft)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
KIN-C001	15-53070_SP01	15	2425	10.01	5.64	4.37		305	100	2.30
KIN-C001	15-53070_SP01	15	1800	18.37	14.00		4.37	88	100	7.94
KIN-C002	15-53070_SP02	15	2520	10.99						
KIN-C002	15-53070_SP02	15	1200	15.91						
KIN-C002	15-53070_SP02	15	12000	16.90	4.44		12.46	3100	100	0.23
KIN-C002	15-53070_SP02	15	365	26.08						
KIN-C002	15-53070_SP02	15	6000	29.36	16.91	12.46		129	100	5.45
KIN-C003	15-53070_SP03	15	425	19.19						
KIN-C003	15-53070_SP03	15	10800	20.34	18.52	1.82		737	100	0.95
KIN-C004	15-53070_SP04	15	315	19.68	2.07	17.61				
KIN-C005	15-53070_SP05	15	360	19.52	14.52		5.00	117	100	5.99
KIN-C005	15-53070_SP05	15	175	21.00						
KIN-C007	15-53070_SP07	15	480	17.22	4.65	12.57				
KIN-C008	15-53070_SP08	15	1100	16.90	10.20	6.69		50	100	14.11
KIN-C009	15-53070_SP09	15	1800	20.01						
KIN-C010	15-53070_SP10	15	3600	40.03	27.05	12.98		263	100	2.67
KIN-C011	15-53070_SP11	15	1200	39.37	11.81	27.56		30	100	23.38
KIN-C012	15-53070_SP12	15	3600	37.73	21.26	16.47		4	100	170.19
KIN-C012	15-53070_SP12	15	540	39.86	23.39		16.47	92	100	7.59
KIN-C013	15-53070_SP13	15	480	16.40						
KIN-C013	15-53070_SP13	15	435	21.98						
KIN-C013	15-53070_SP13	15	1680	26.90						
KIN-C013	15-53070_SP13	15	2500	38.06	29.92	8.14		175	100	4.01
KIN-C014	15-53070_SP14	15	5900	8.20	2.84		5.37	561	100	1.25
KIN-C014	15-53070_SP14	15	1900	15.75	10.38		5.37	1274	100	0.55
KIN-C014	15-53070_SP14	15	500	20.01	14.65	5.37				
KIN-C015	15-53070_SP15	15	600	38.39						
KIN-C016	15-53070_SP16	15	900	22.47						
KIN-C017	15-53070_SP17	15	180	6.56	0.11	6.45				
KIN-C017	15-53070_SP17	15	500	8.37	2.20	6.16				
KIN-C017	15-53070_SP17	15	300	13.12						
KIN-C017	15-53070_SP17	15	1900	17.39	10.48	6.91		227	100	3.09
KIN-C018	15-53070_SP18	15	4065	18.54	13.33	5.20		49	100	14.27
KIN-C018	15-53070_SP18	15	2520	21.16						
KIN-C019	15-53070_SP19	15	300	6.56						
KIN-C019	15-53070_SP19	15	1100	11.48	7.94	3.55		61	100	11.55
KIN-C019	15-53070_SP19	15	1500	19.68	16.14		3.55	970	100	0.72
KIN-C020	15-53070_SP20	15	900	16.73	11.42	5.31				
KIN-C021	15-53070_SP21	15	2415	20.34	16.93	3.42				
KIN-C022	15-53070_SP22	15	300	8.86	6.93	1.93				
KIN-C022	15-53070_SP22	15	800	33.96	31.50	2.46				
KIN-C023	15-53070_SP23	15	4500	39.37	25.08	14.29		102	100	6.86
KIN-C023	15-53070_SP23	15	1655	41.34						
KIN-C023A	15-53070_CP23A	15	600	25.59						
KIN-C023A	15-53070_CP23A	15	10800	25.92	10.54		15.38	2125	100	0.33

Job No: 15-53070
Client: AECOM
Project: Kincaid Power Station, Kincaid, IL
Start Date: 13-Aug-2015
End Date: 18-Aug-2015

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)	Estimated Phreatic Surface (ft)	t_{50} [a] (s)	Assumed Rigidity Index (I_r)	c_h [b] (cm^2/min)
KIN-C023A	15-53070_CP23A	15	4000	28.87	13.49	15.38		266	100	2.63
KIN-C023A	15-53070_CP23A	15	10010	34.12	18.74		15.38	3117	100	0.23
KIN-C024	15-53070_SP24	15	360	6.40	0.00					
KIN-C025	15-53070_SP25	15	300	19.03	4.55	14.48				
KIN-C025	15-53070_SP25	15	900	41.67	25.78	15.89				
KIN-C026	15-53070_SP26	15	300	5.91	4.05	1.86				
KIN-C026	15-53070_SP26	15	300	11.15	9.28	1.87				
KIN-C026	15-53070_SP26	15	360	16.40	14.52	1.88				
KIN-C026	15-53070_SP26	15	7200	21.00	19.13		1.87	501	100	1.40
KIN-C027	15-53070_SP27	15	300	8.20	3.73	4.47				
KIN-C027	15-53070_SP27	15	620	14.44	10.16	4.27		7	100	97.96
KIN-C028	15-53070_SP28	15	300	18.04	4.23	13.82				
KIN-C028	15-53070_SP28	15	360	24.11	10.48	13.64				
KIN-C028	15-53070_SP28	15	2300	29.53	15.89		13.64	121	100	5.82
KIN-C029	15-53070_SP29	15	360	5.25	3.24	2.01				
KIN-C029	15-53070_SP29	15	300	10.33	8.24	2.10				
KIN-C030	15-53070_SP30	15	300	4.43	3.09	1.34				
KIN-C030	15-53070_SP30	15	300	6.56	5.46	1.11				
KIN-C030	15-53070_SP30	15	180	10.99	9.72	1.27				
KIN-C031	15-53070_SP31	15	1500	8.53						
KIN-C032	15-53070_SP32	15	900	20.18	3.42	16.76				
KIN-C033	15-53070_SP33	15	300	27.07	3.82	23.25				
KIN-C034	15-53070_SP34	15	900	4.92	1.65	3.27				
KIN-C034	15-53070_SP34	15	300	23.95	3.62	20.33				
KIN-C034	15-53070_SP34	15	500	27.39	7.09	20.31		10	100	69.31
KIN-C035	15-53070_SP35	15	300	26.25	5.47	20.77				
KIN-C036	15-53070_SP36	15	300	4.43	3.61	0.82				
KIN-C036	15-53070_SP36	15	180	7.71	6.89	0.82				
KIN-C037	15-53070_SP37	15	360	6.56	5.20	1.36				
Totals	74 dissipations		2242.1 min							

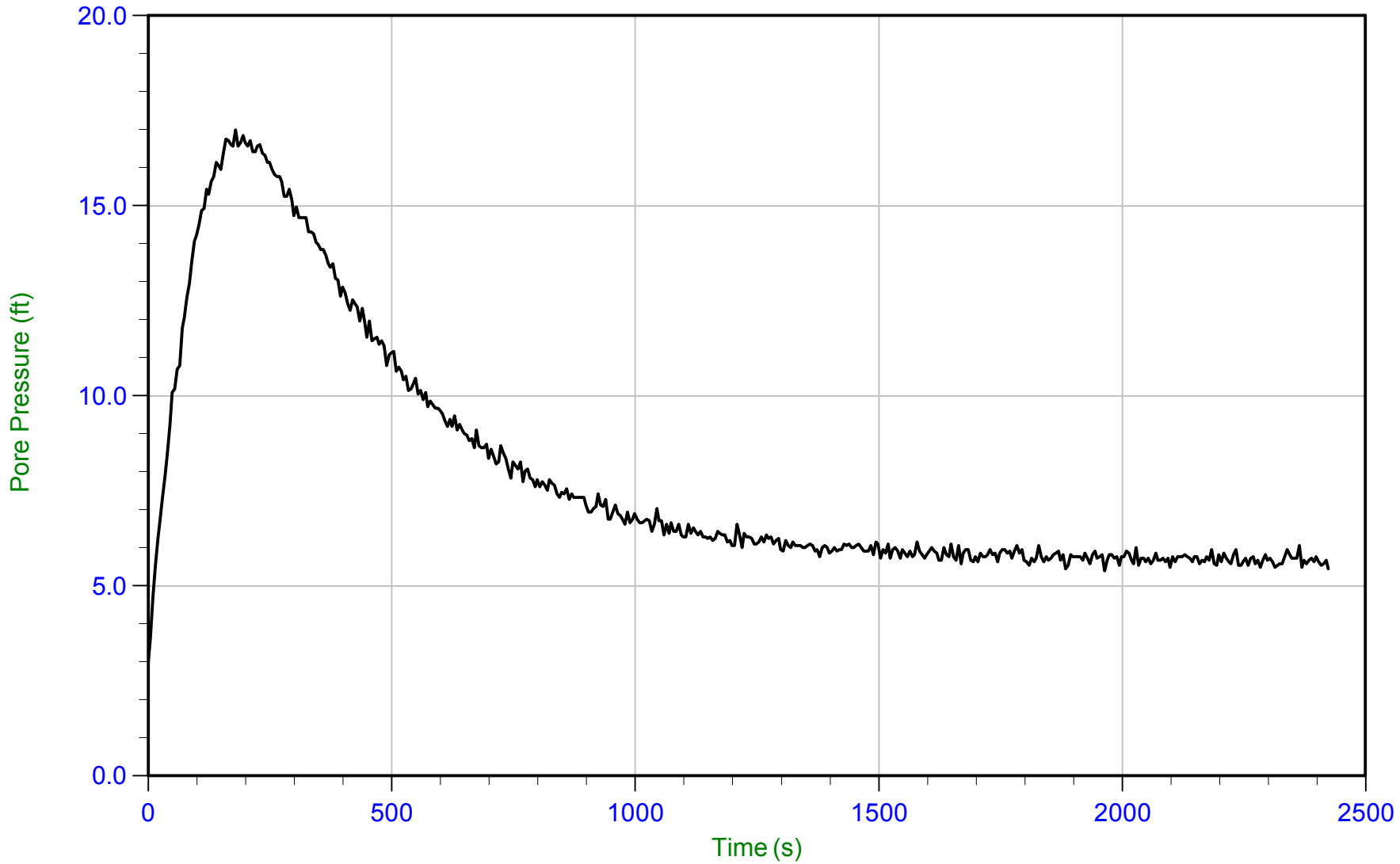
a. Time is relative to where umax occurred
b. Houlsby and Teh, 1991

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 12:44:39
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C001
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP01.PPD
Depth: 3.050 m / 10.006 ft
Duration: 2425.0 s

U Min: 3.0 ft
U Max: 17.0 ft

WT: 1.332 m / 4.370 ft
Ueq: 5.6 ft
U(50): 11.31 ft

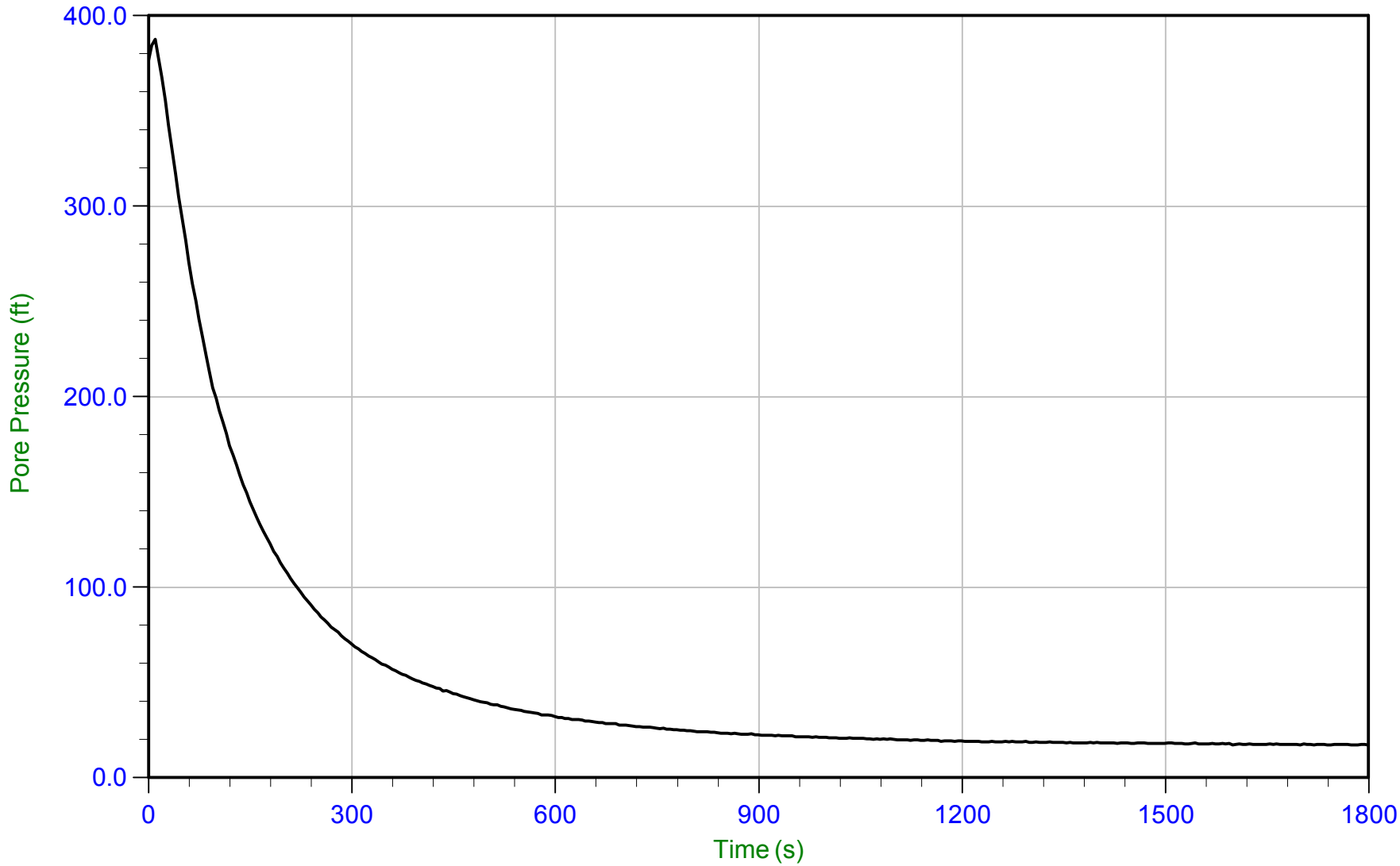
T(50): 304.9 s
Ir: 100
Ch: 2.3 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 12:44:39
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C001
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP01.PPD
Depth: 5.600 m / 18.372 ft
Duration: 1800.0 s

U Min: 17.2 ft
U Max: 387.7 ft

WT: 1.333 m / 4.373 ft
Ueq: 14.0 ft
U(50): 200.84 ft

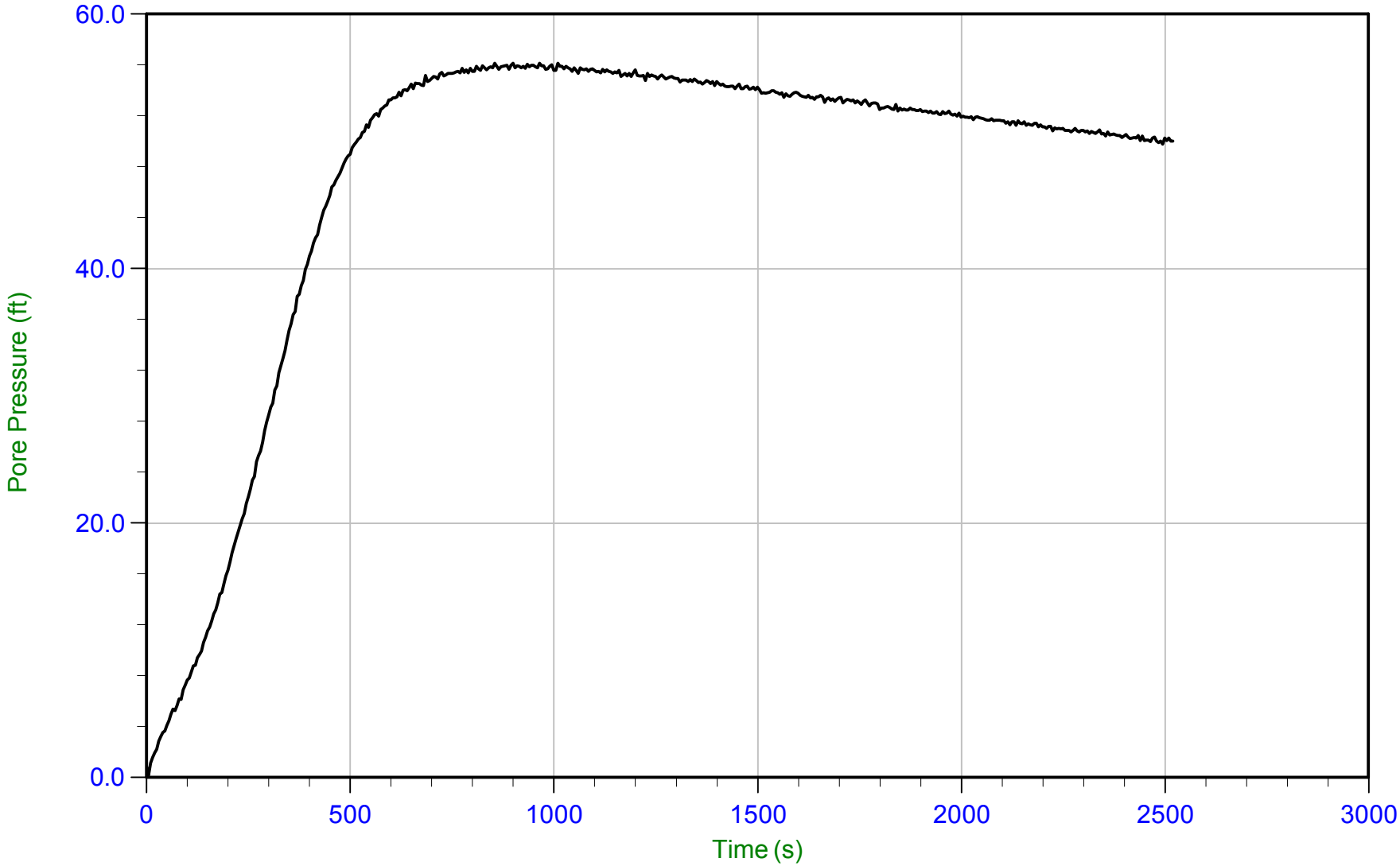
T(50): 88.4 s
Ir: 100
Ch: 7.9 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 07:59:47
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP02.PPD
Depth: 3.350 m / 10.991 ft
Duration: 2520.0 s

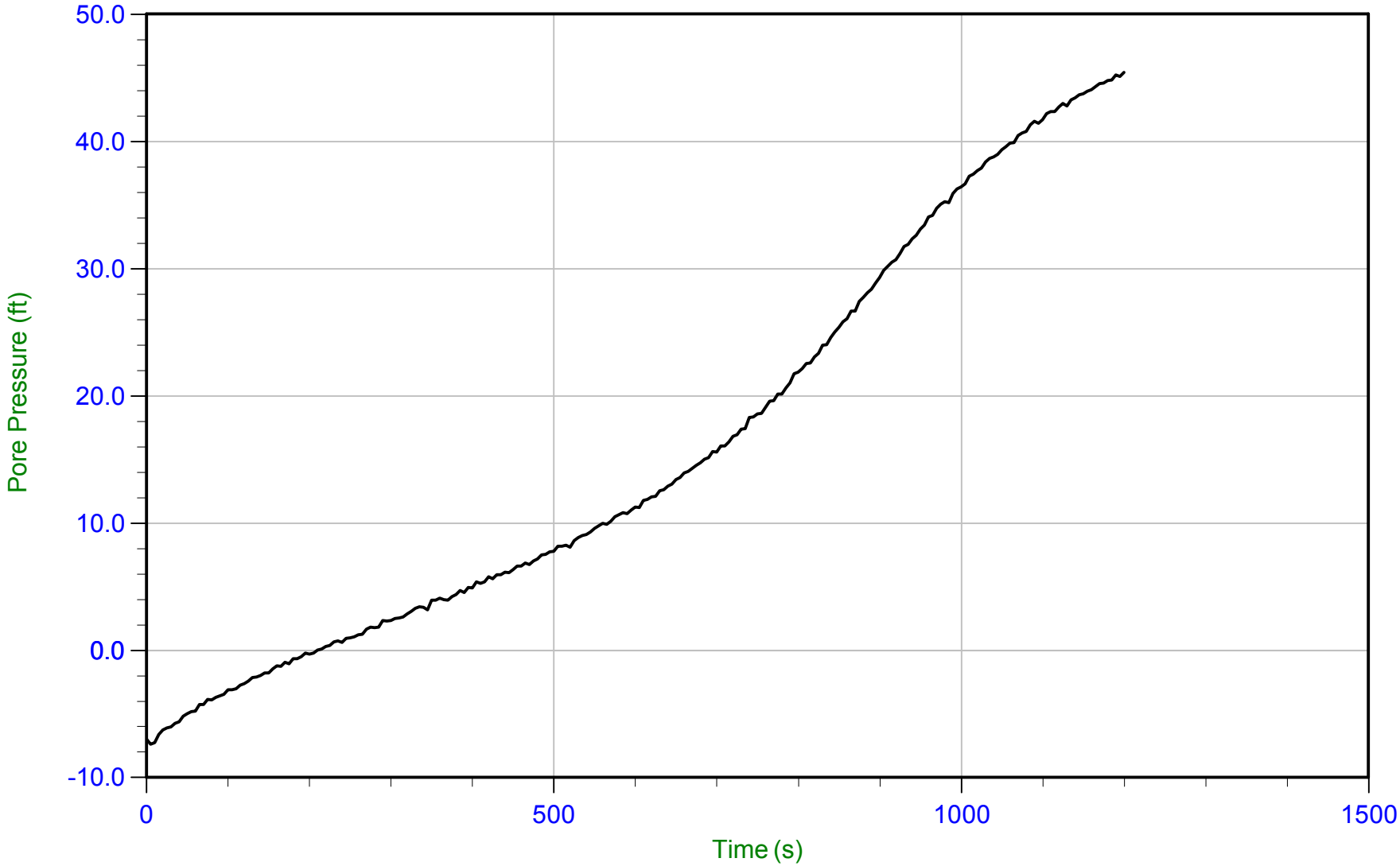
U Min: 0.2 ft
U Max: 56.1 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 07:59:47
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP02.PPD
Depth: 4.850 m / 15.912 ft
Duration: 1200.0 s

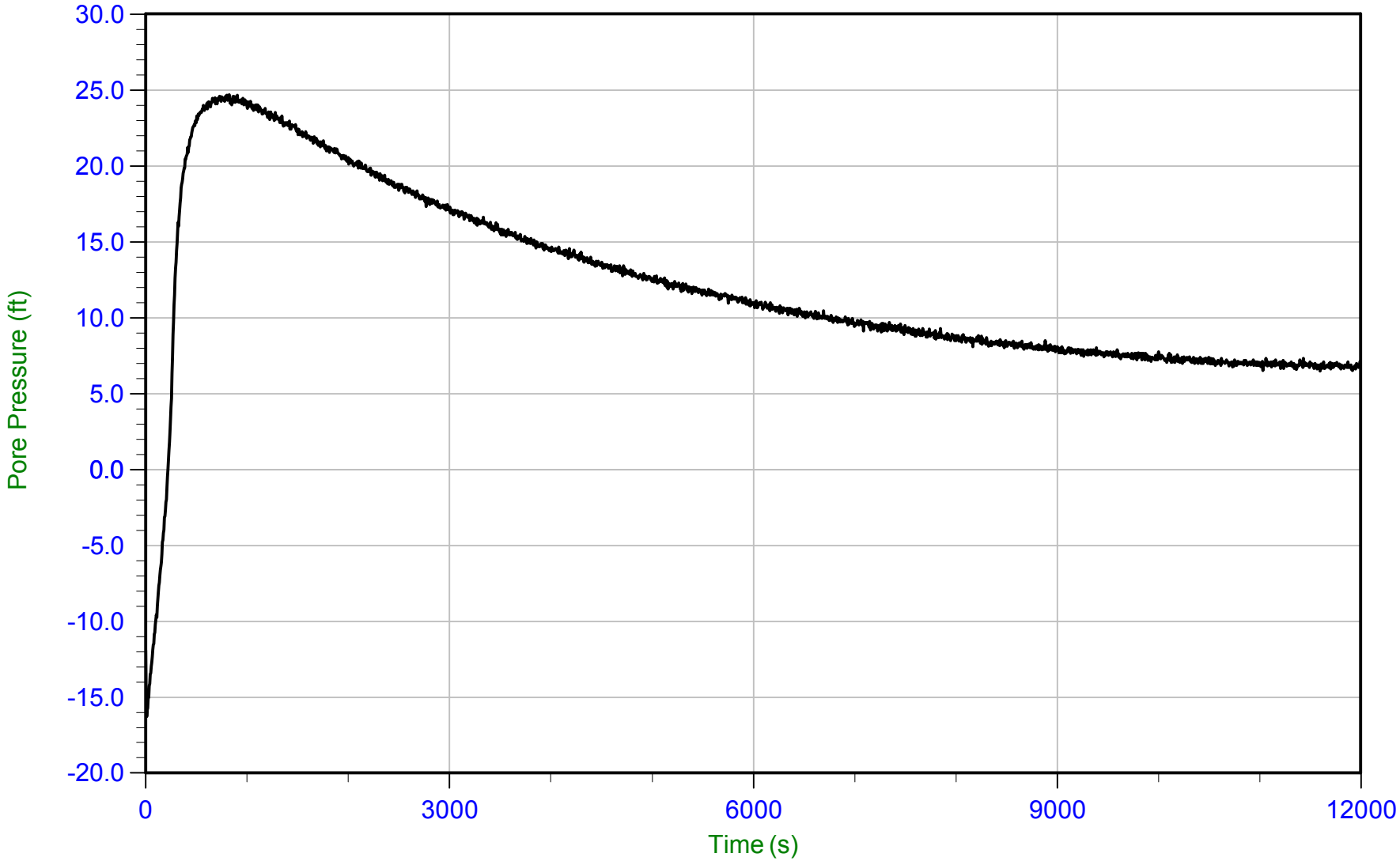
U Min: -7.4 ft
U Max: 45.4 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 07:59:47
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP02.PPD
Depth: 5.150 m / 16.896 ft
Duration: 12000.0 s

U Min: -16.3 ft
U Max: 24.7 ft

WT: 3.798 m / 12.460 ft
Ueq: 4.4 ft
U(50): 14.56 ft

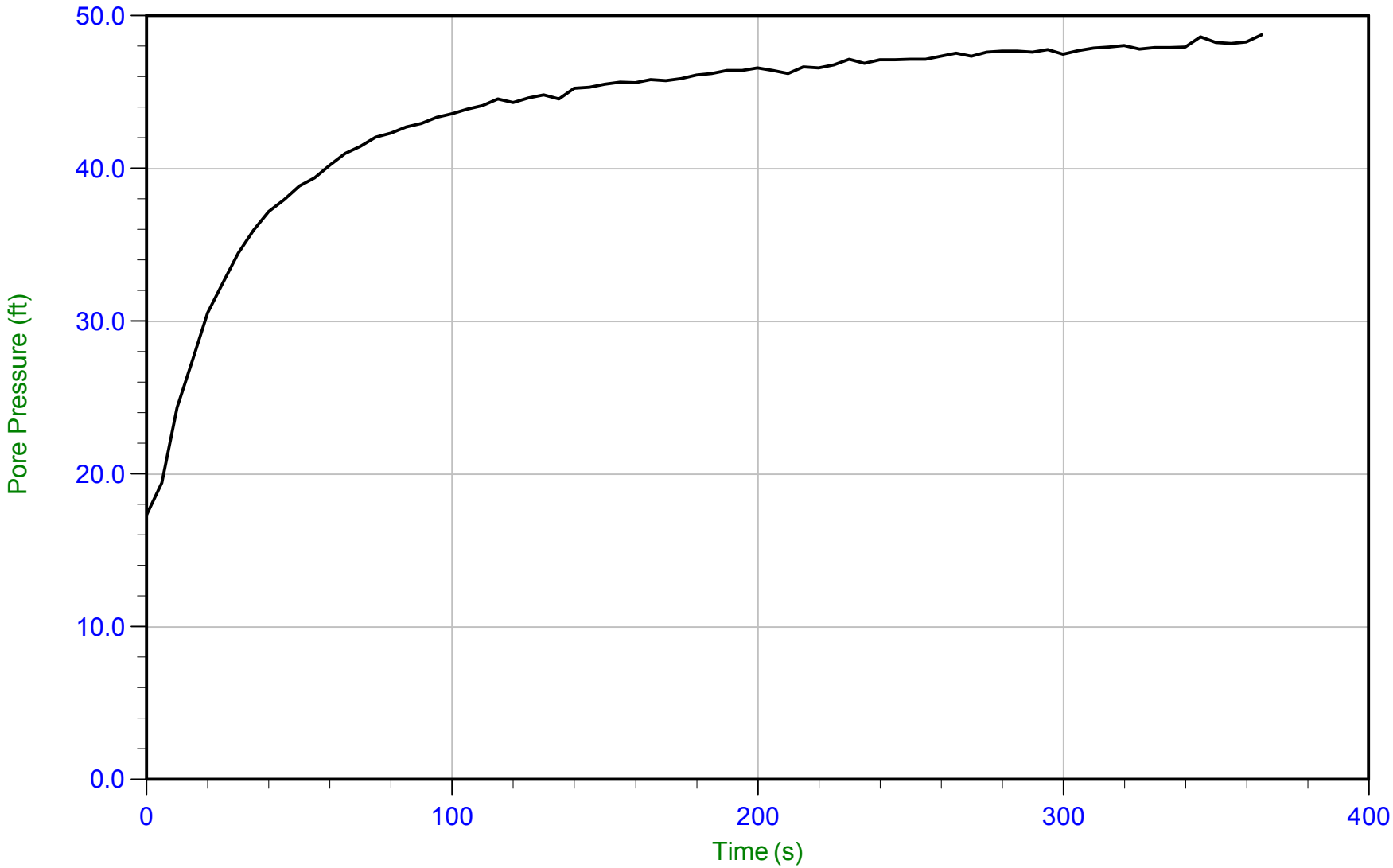
T(50): 3099.8 s
Ir: 100
Ch: 0.2 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 07:59:47
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP02.PPD
Depth: 7.950 m / 26.082 ft
Duration: 365.0 s

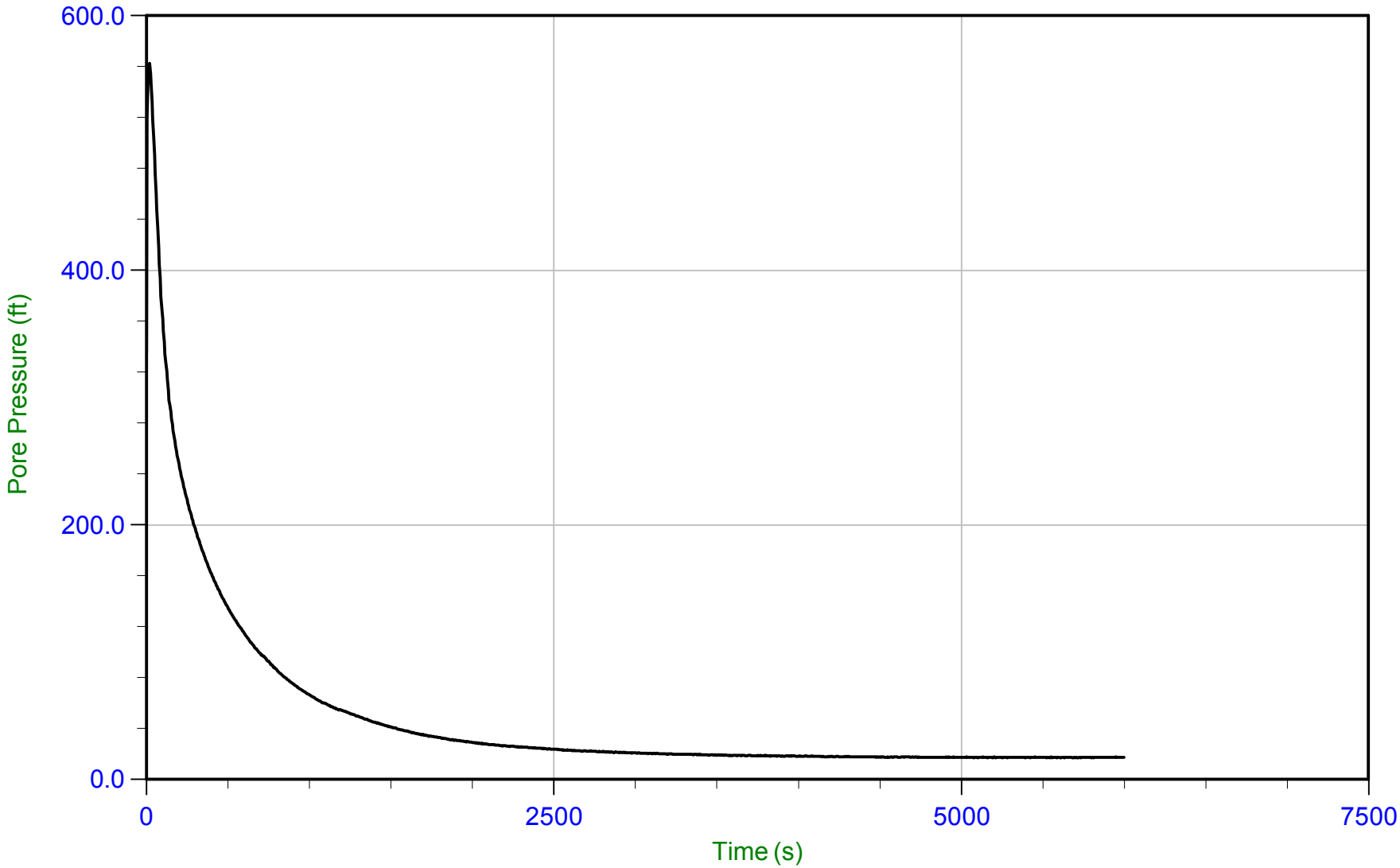
U Min: 17.3 ft
U Max: 48.7 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 07:59:47
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C002
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP02.PPD
Depth: 8.950 m / 29.363 ft
Duration: 6000.0 s

U Min: 17.0 ft
U Max: 562.5 ft

WT: 3.797 m / 12.457 ft
Ueq: 16.9 ft
U(50): 289.72 ft

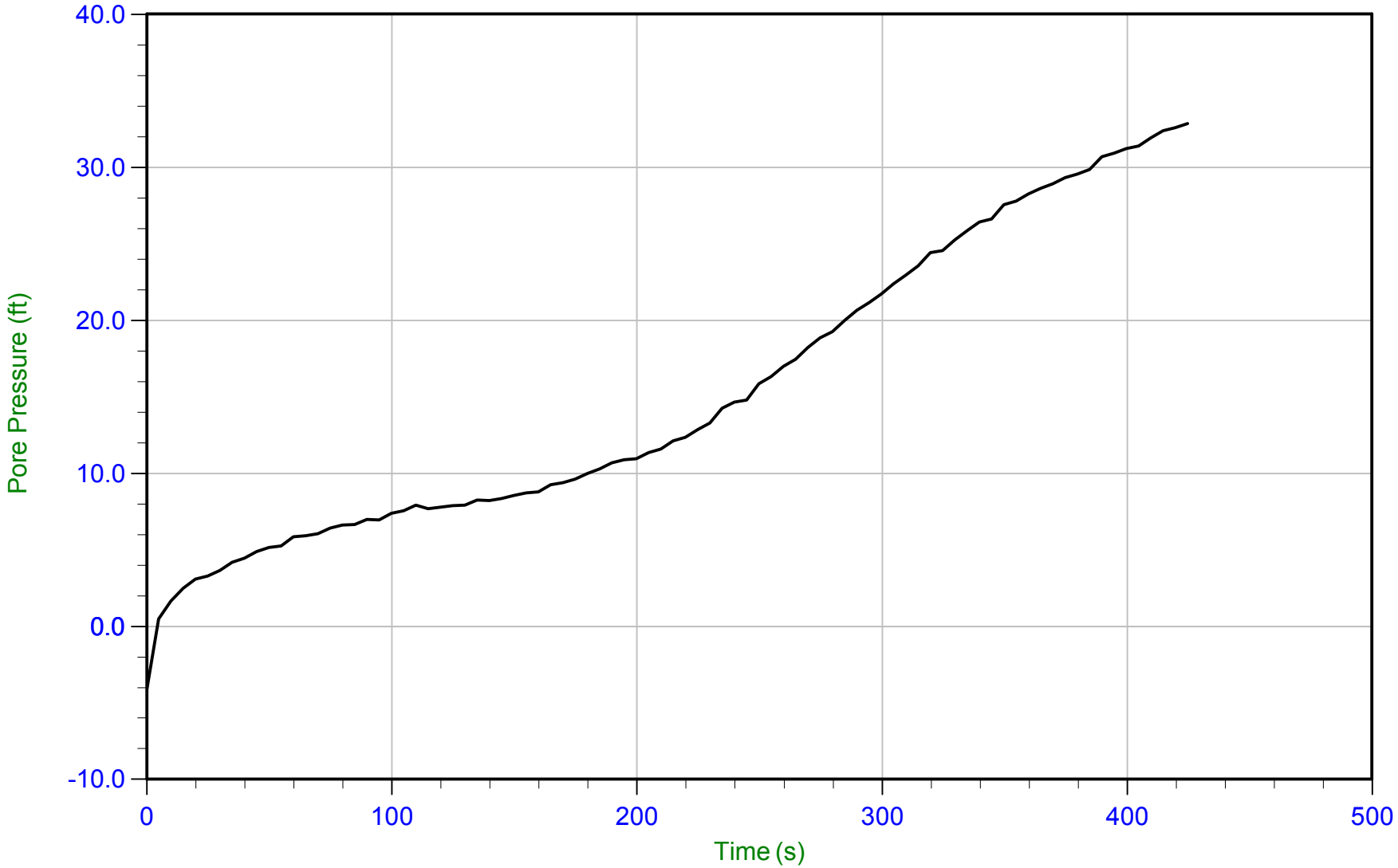
T(50): 128.8 s
Ir: 100
Ch: 5.4 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 14:32:35
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C003
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP03.PPD
Depth: 5.850 m / 19.193 ft
Duration: 425.0 s

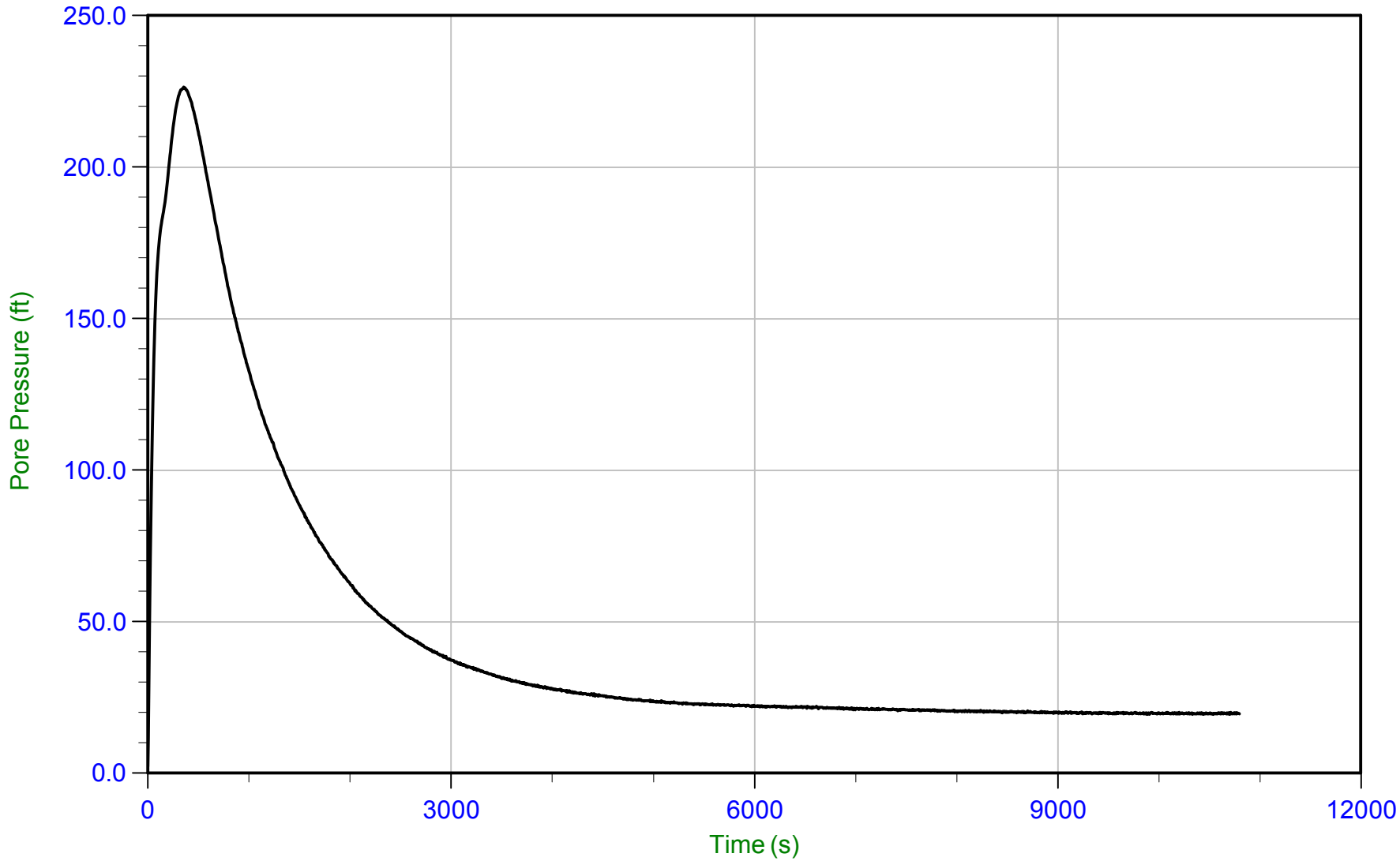
U Min: -4.1 ft
U Max: 32.9 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 14:32:35
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C003
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP03.PPD
Depth: 6.200 m / 20.341 ft
Duration: 10800.0 s

U Min: 2.2 ft
U Max: 226.4 ft

WT: 0.556 m / 1.824 ft
Ueq: 18.5 ft
U(50): 122.47 ft

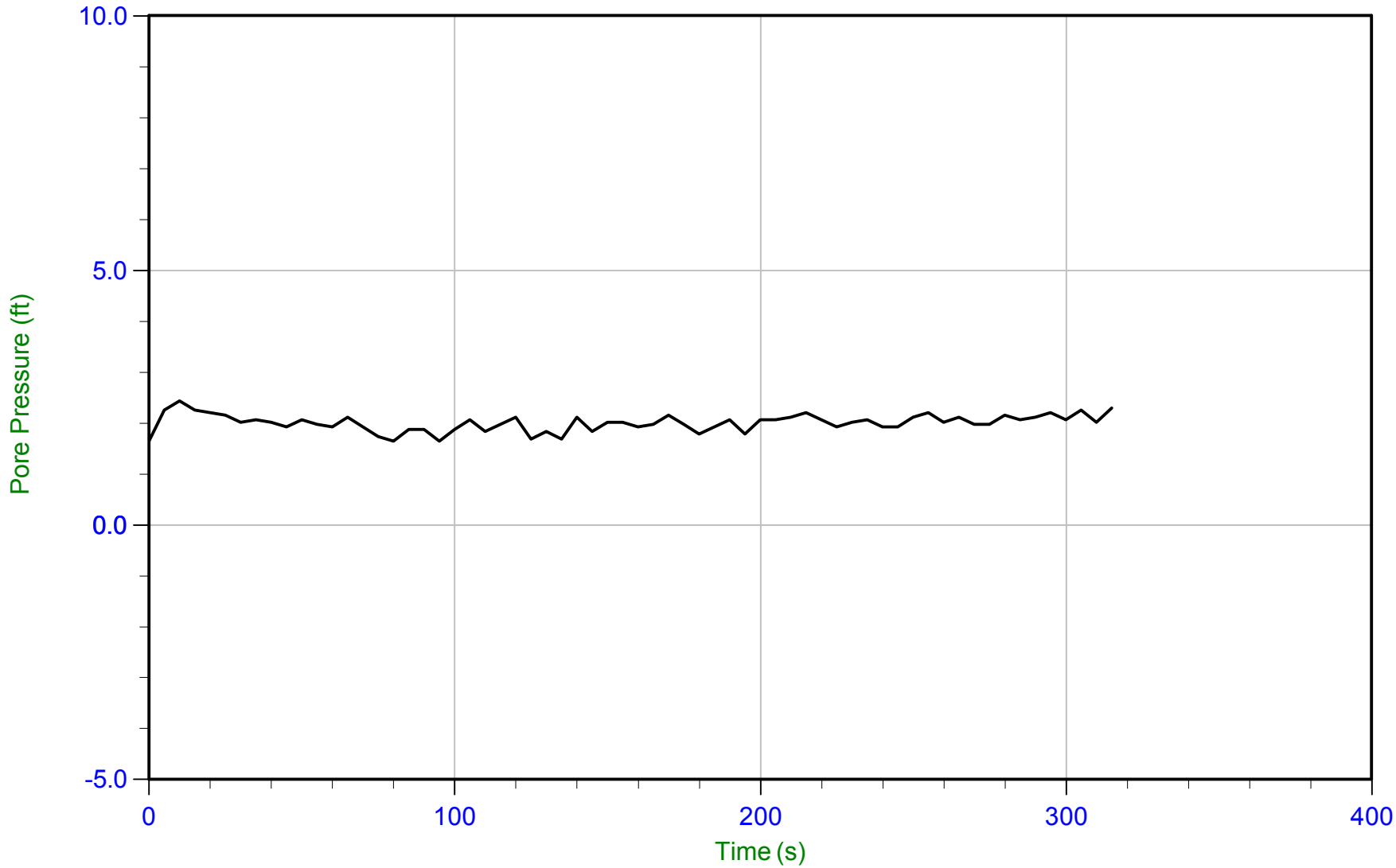
T(50): 736.6 s
Ir: 100
Ch: 1.0 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 12:25:34
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C004
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP04.PPD
Depth: 6.000 m / 19.685 ft
Duration: 315.0 s

U Min: 1.6 ft
U Max: 2.4 ft

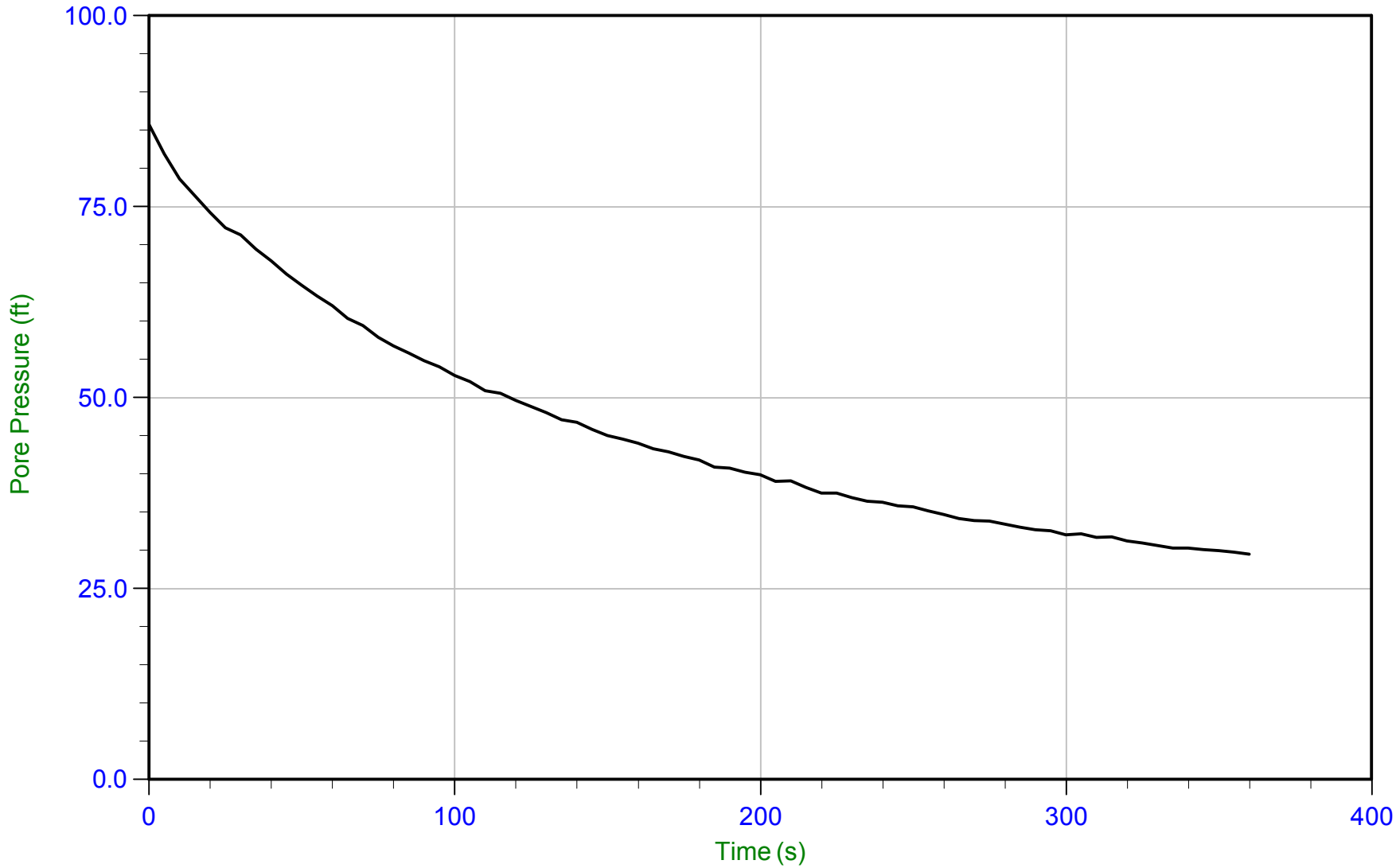
WT: 5.369 m / 17.615 ft
Ueq: 2.1 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 11:16:22
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C005
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP05.PPD
Depth: 5.950 m / 19.521 ft
Duration: 360.0 s

U Min: 29.5 ft
U Max: 85.7 ft

WT: 1.524 m / 5.000 ft
Ueq: 14.5 ft
U(50): 50.13 ft

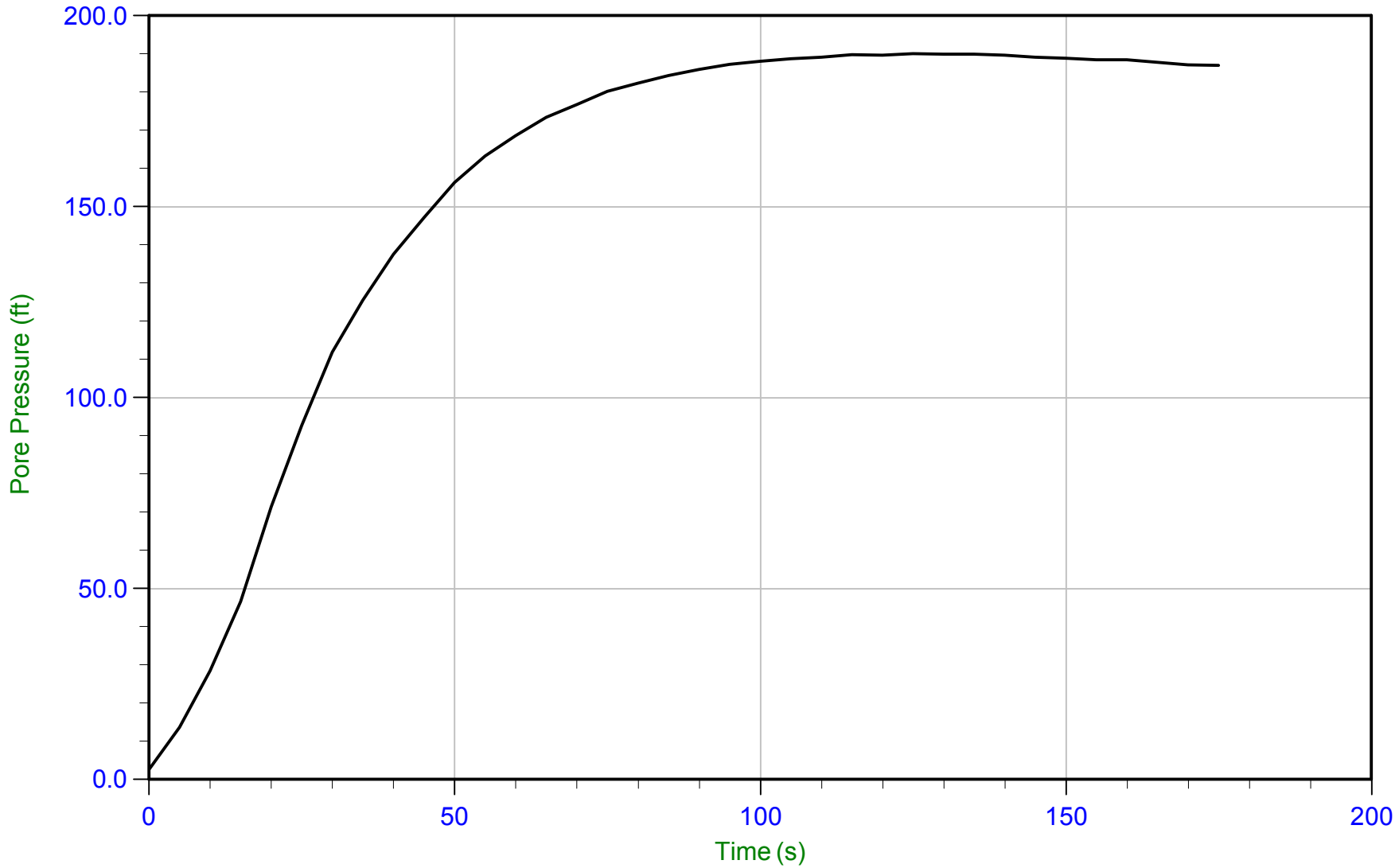
T(50): 117.2 s
Ir: 100
Ch: 6.0 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 11:16:22
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C005
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP05.PPD
Depth: 6.400 m / 20.997 ft
Duration: 175.0 s

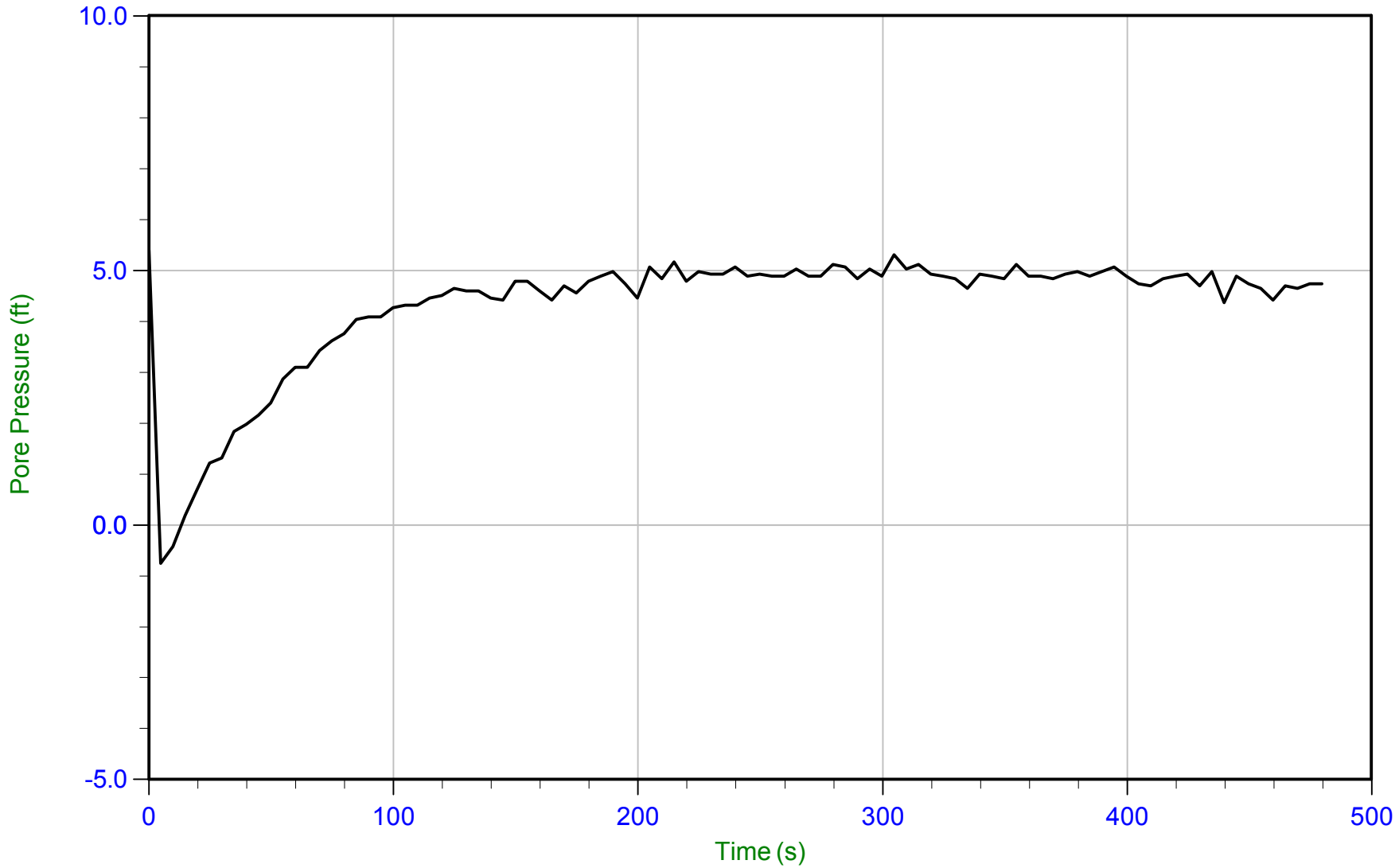
U Min: 2.5 ft
U Max: 190.0 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 09:07:45
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C007
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP07.PPD
Depth: 5.250 m / 17.224 ft
Duration: 480.0 s

U Min: -0.8 ft
U Max: 5.4 ft

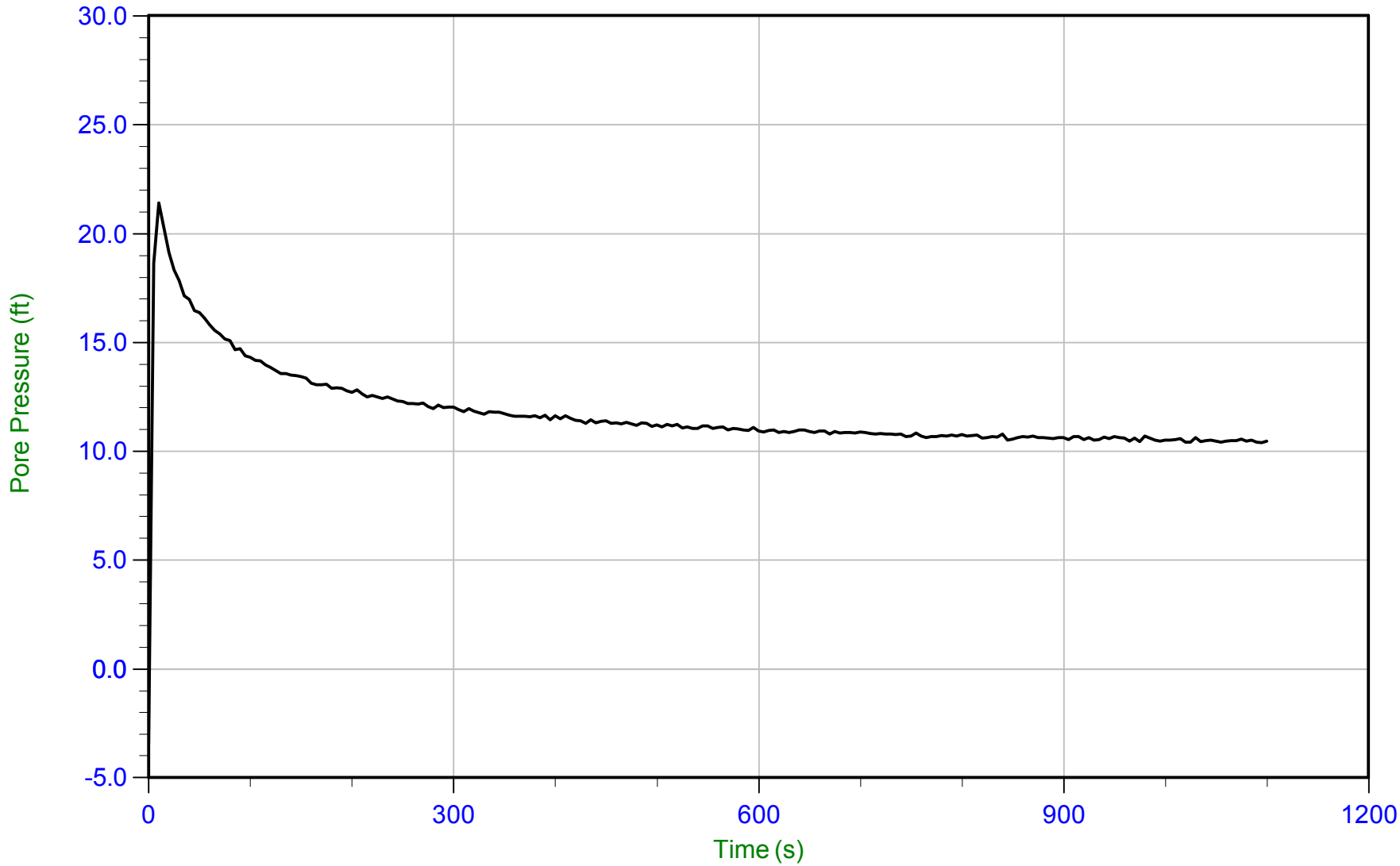
WT: 3.832 m / 12.572 ft
Ueq: 4.7 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 08:12:40
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C008
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP08.PPD
Depth: 5.150 m / 16.896 ft
Duration: 1100.0 s

U Min: -3.4 ft
U Max: 21.4 ft

WT: 2.040 m / 6.693 ft
Ueq: 10.2 ft
U(50): 15.81 ft

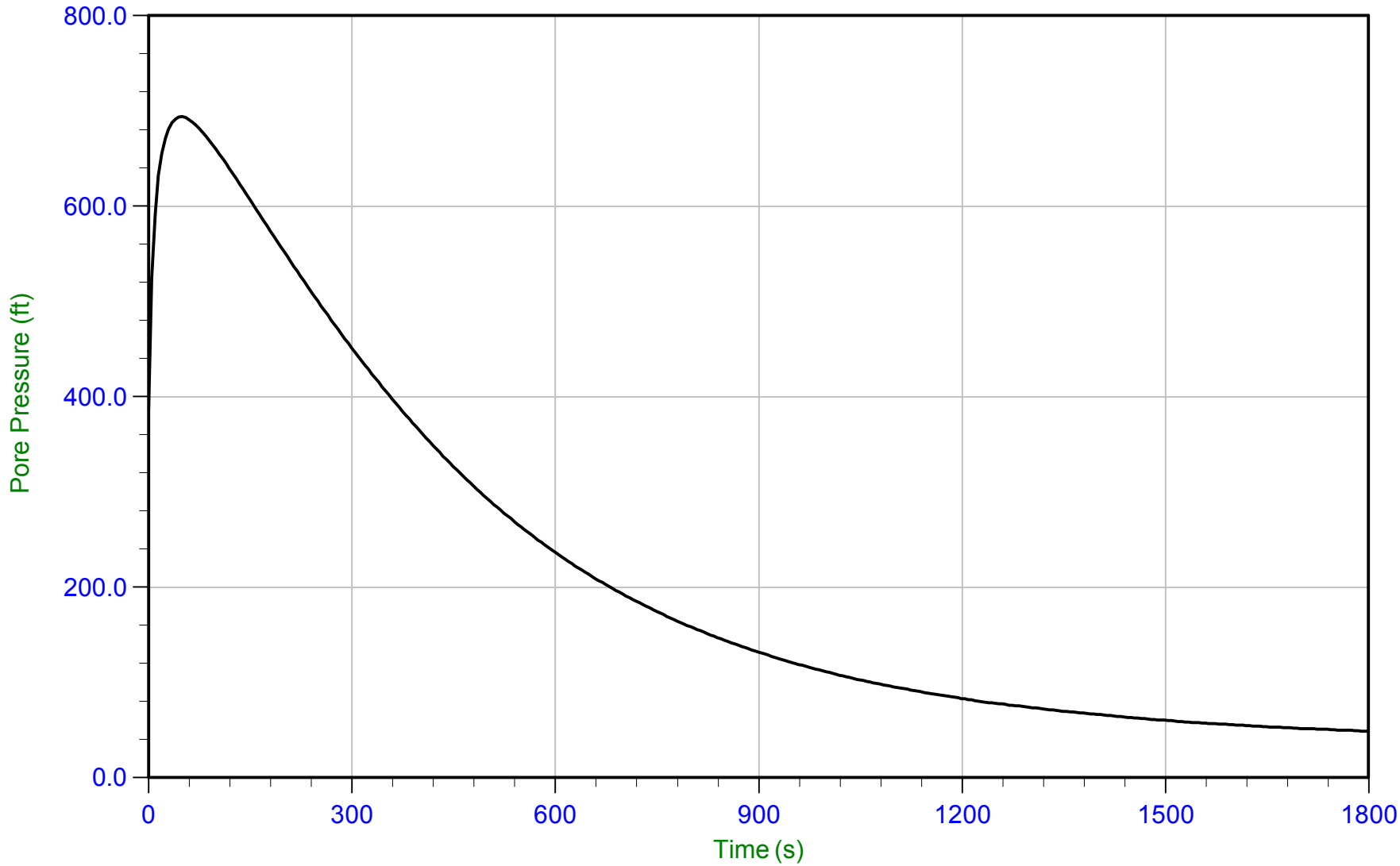
T(50): 49.8 s
Ir: 100
Ch: 14.1 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 09:33:56
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C009
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP09.PPD
Depth: 6.100 m / 20.013 ft
Duration: 1800.0 s

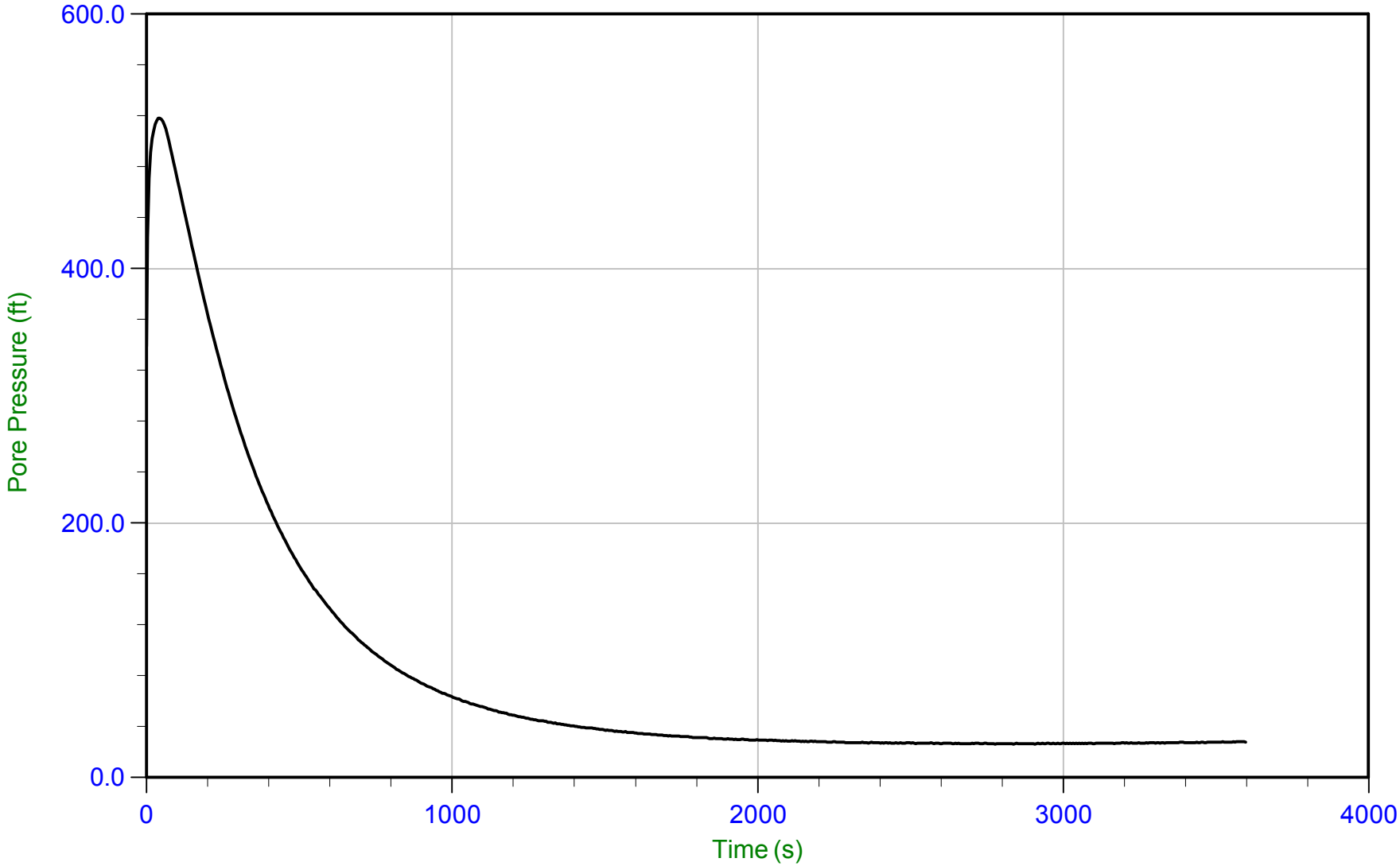
U Min: 49.0 ft
U Max: 693.9 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 07:15:37
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C010
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP10.PPD
Depth: 12.200 m / 40.026 ft
Duration: 3600.0 s

U Min: 26.2 ft
U Max: 518.2 ft

WT: 3.955 m / 12.976 ft
Ueq: 27.1 ft
U(50): 272.64 ft

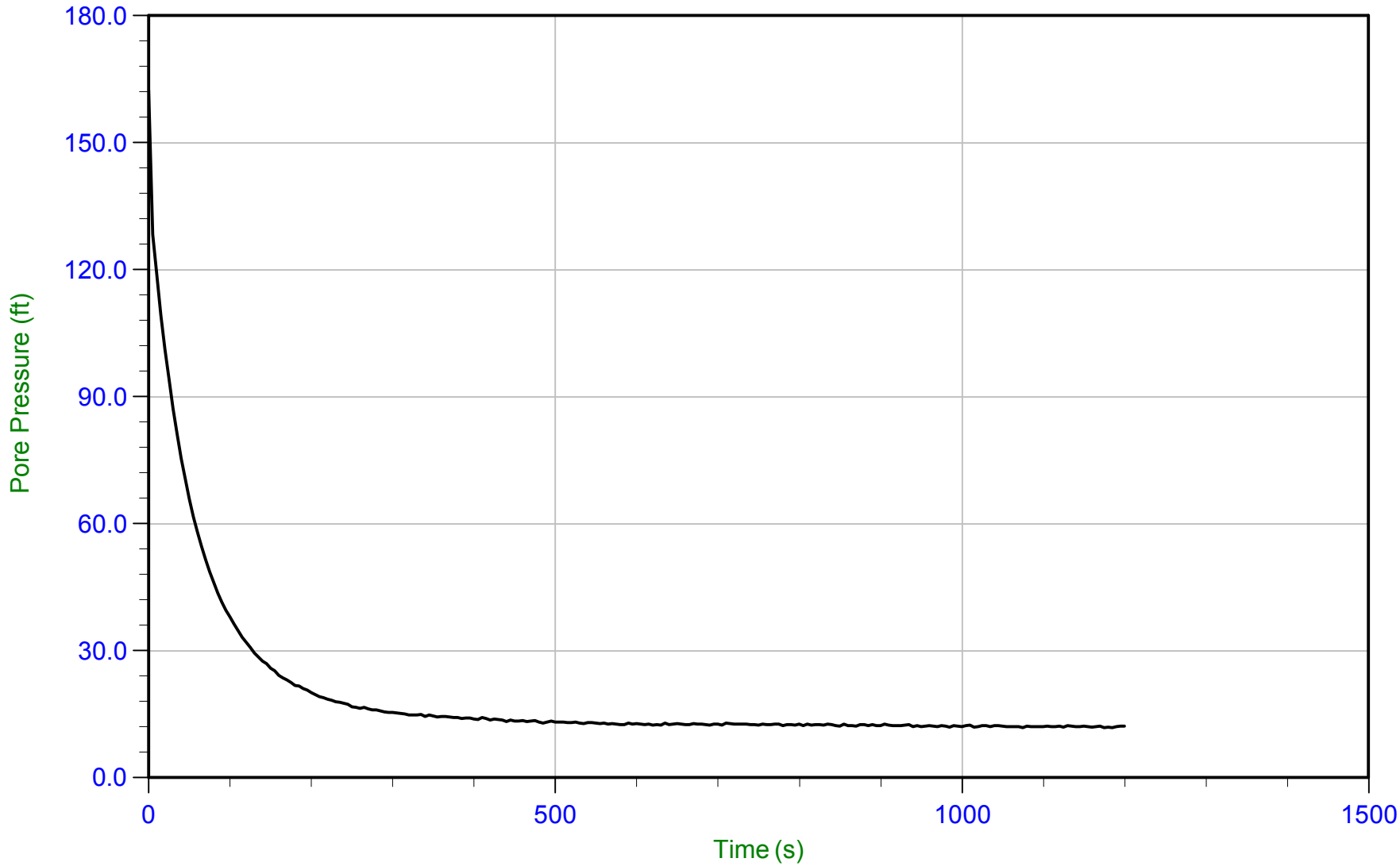
T(50): 263.0 s
Ir: 100
Ch: 2.7 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 14:02:41
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C011
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP11.PPD
Depth: 12.000 m / 39.370 ft
Duration: 1200.0 s

U Min: 11.8 ft
U Max: 162.4 ft

WT: 8.400 m / 27.559 ft
Ueq: 11.8 ft
U(50): 87.12 ft

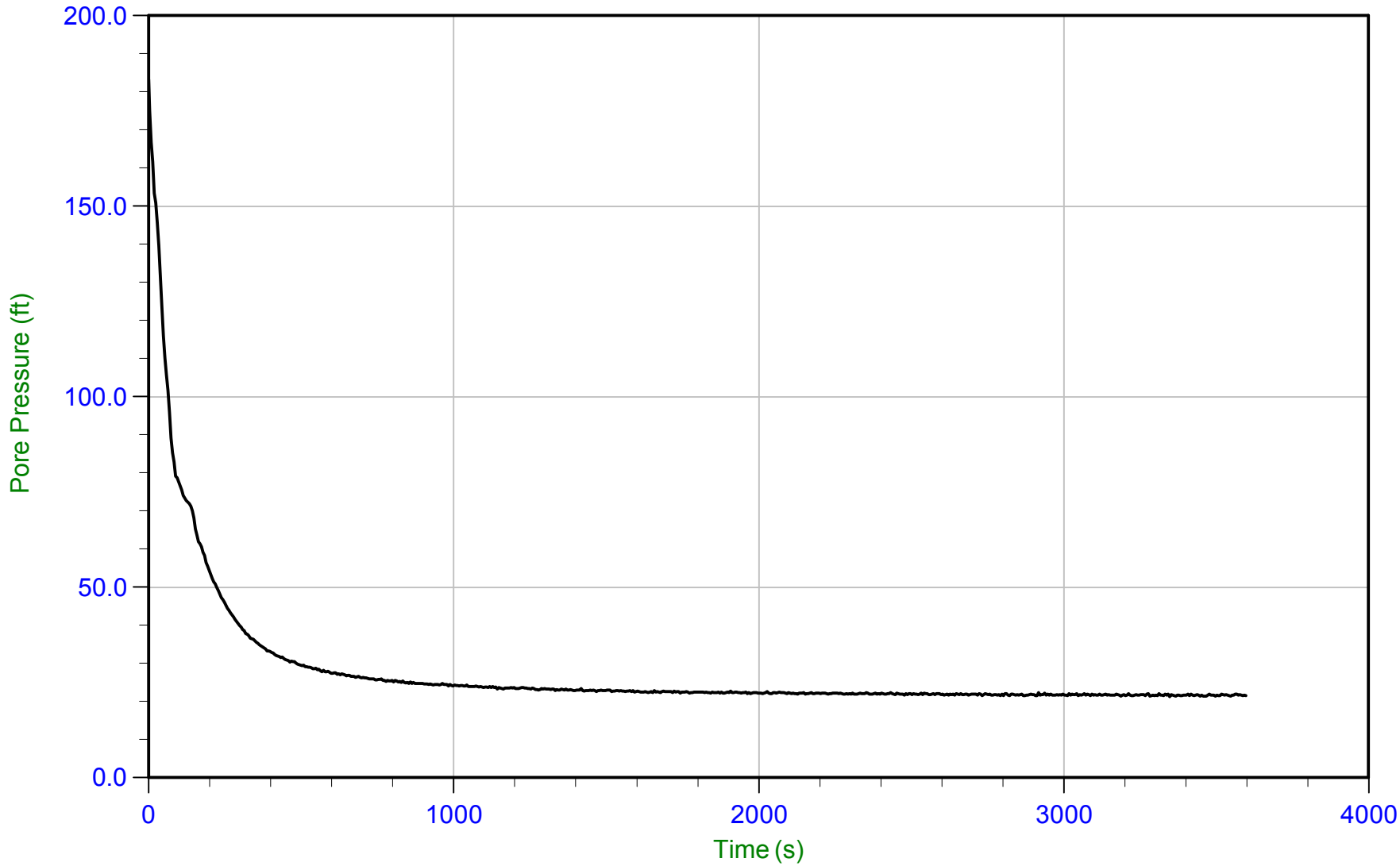
T(50): 30.0 s
Ir: 100
Ch: 23.4 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 15:05:42
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C012
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP12.PPD
Depth: 11.500 m / 37.729 ft
Duration: 3600.0 s

U Min: 21.3 ft
U Max: 183.2 ft

WT: 5.020 m / 16.470 ft
Ueq: 21.3 ft
U(50): 102.23 ft

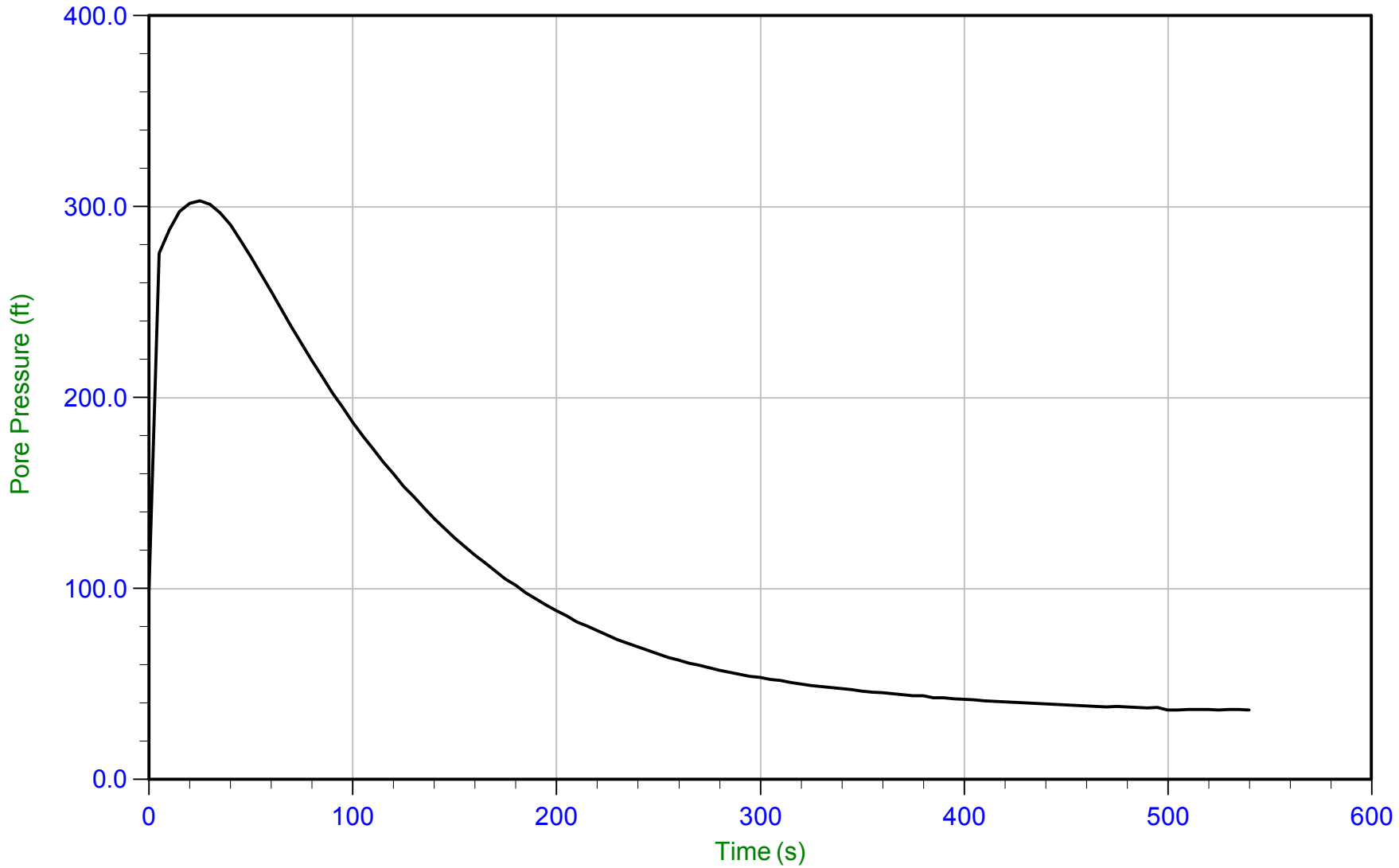
T(50): 4.1 s
Ir: 100
Ch: 170.2 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 15:05:42
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C012
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP12.PPD
Depth: 12.150 m / 39.862 ft
Duration: 540.0 s

U Min: 36.4 ft
U Max: 303.1 ft

WT: 5.020 m / 16.470 ft
Ueq: 23.4 ft
U(50): 163.23 ft

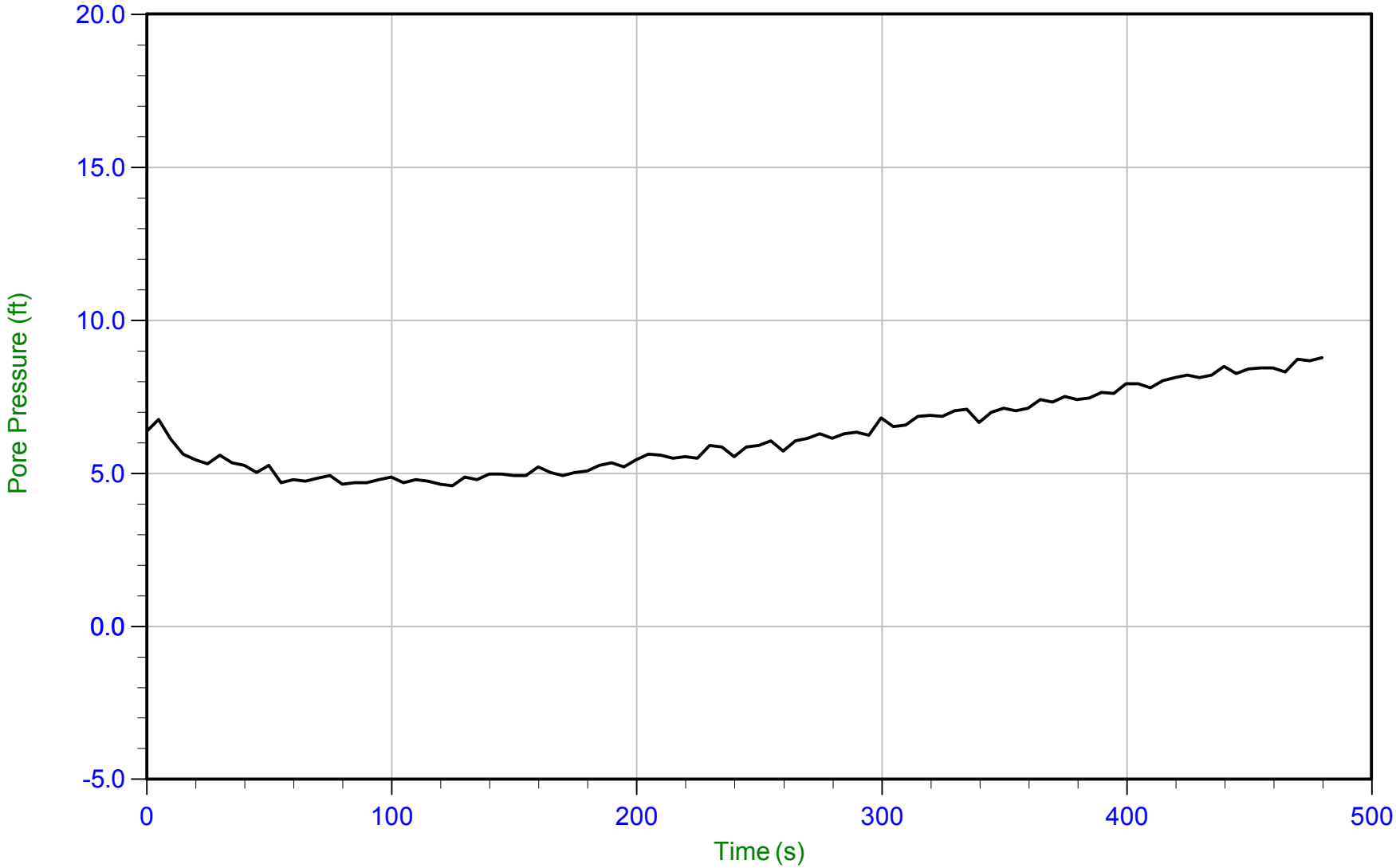
T(50): 92.4 s
Ir: 100
Ch: 7.6 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 11:43:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C013
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP13.PPD
Depth: 5.000 m / 16.404 ft
Duration: 480.0 s

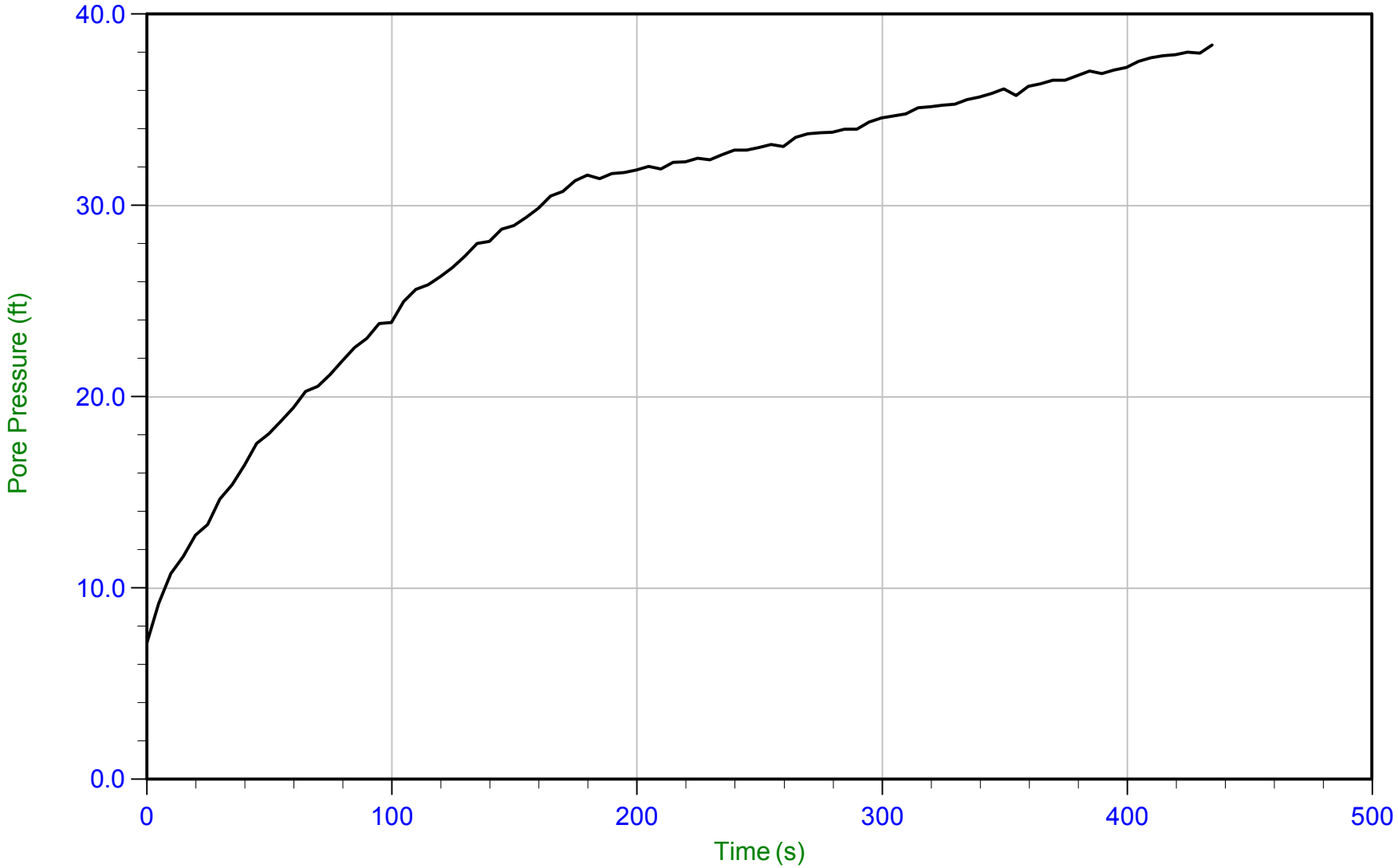
U Min: 4.6 ft
U Max: 8.8 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 11:43:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C013
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP13.PPD
Depth: 6.700 m / 21.981 ft
Duration: 435.0 s

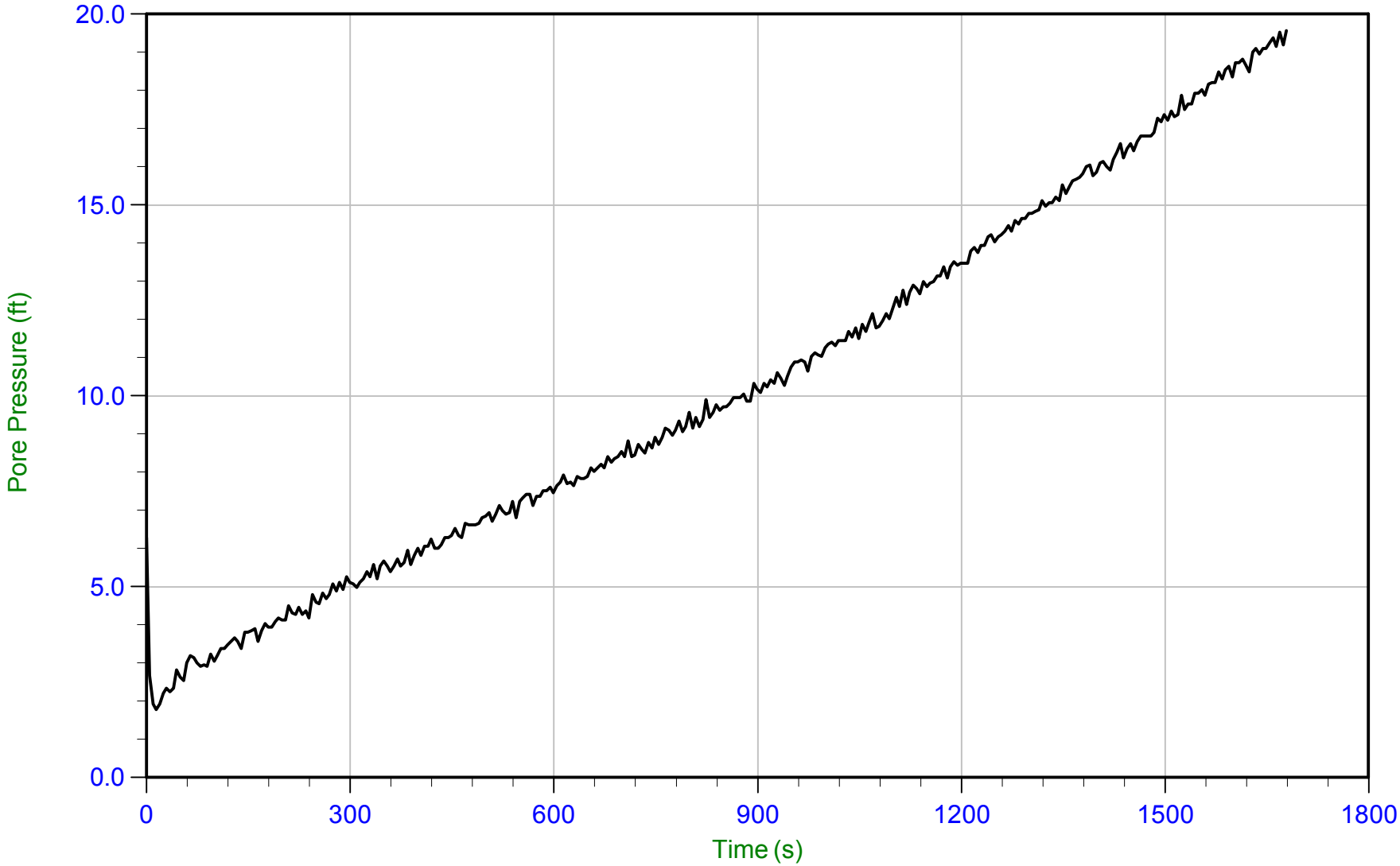
U Min: 7.1 ft
U Max: 38.4 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 11:43:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C013
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP13.PPD
Depth: 8.200 m / 26.903 ft
Duration: 1680.0 s

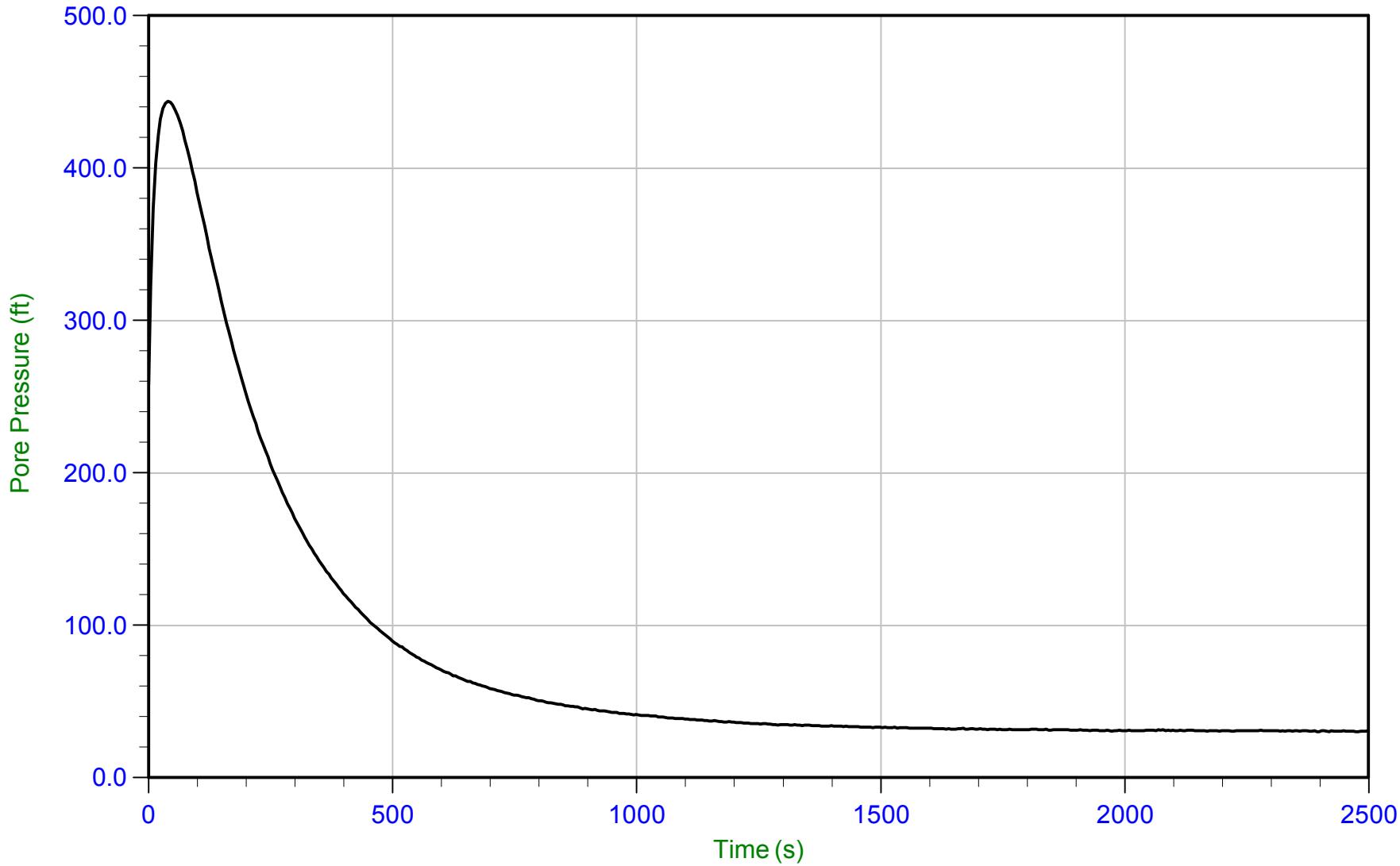
U Min: 1.8 ft
U Max: 19.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 11:43:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C013
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP13.PPD
Depth: 11.600 m / 38.057 ft
Duration: 2500.0 s

U Min: 30.2 ft
U Max: 443.8 ft

WT: 2.480 m / 8.136 ft
Ueq: 29.9 ft
U(50): 236.86 ft

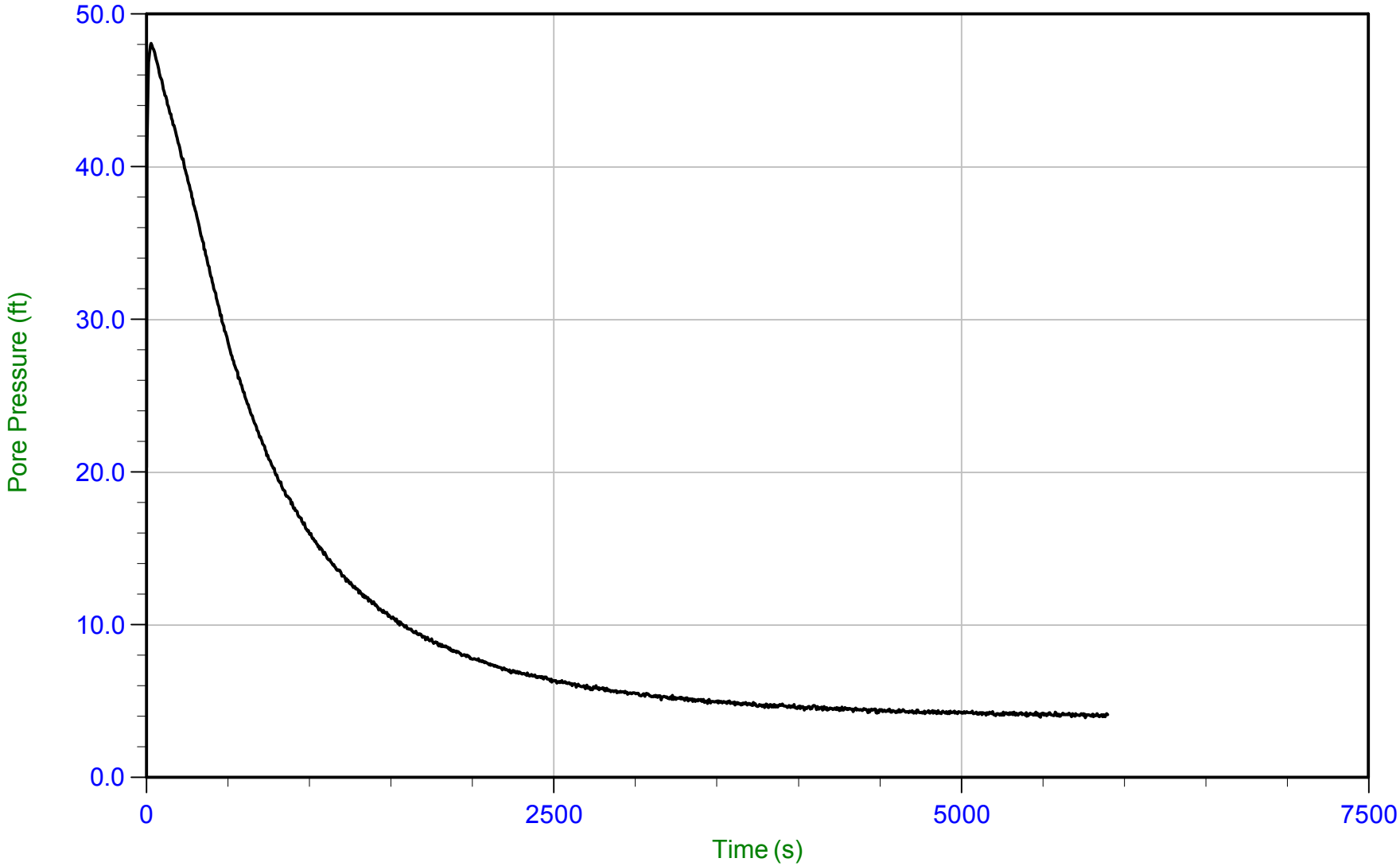
T(50): 175.1 s
Ir: 100
Ch: 4.0 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 09:12:37
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP14.PPD
Depth: 2.500 m / 8.202 ft
Duration: 5900.0 s

U Min: 3.9 ft
U Max: 48.1 ft

WT: 1.636 m / 5.367 ft
Ueq: 2.8 ft
U(50): 25.46 ft

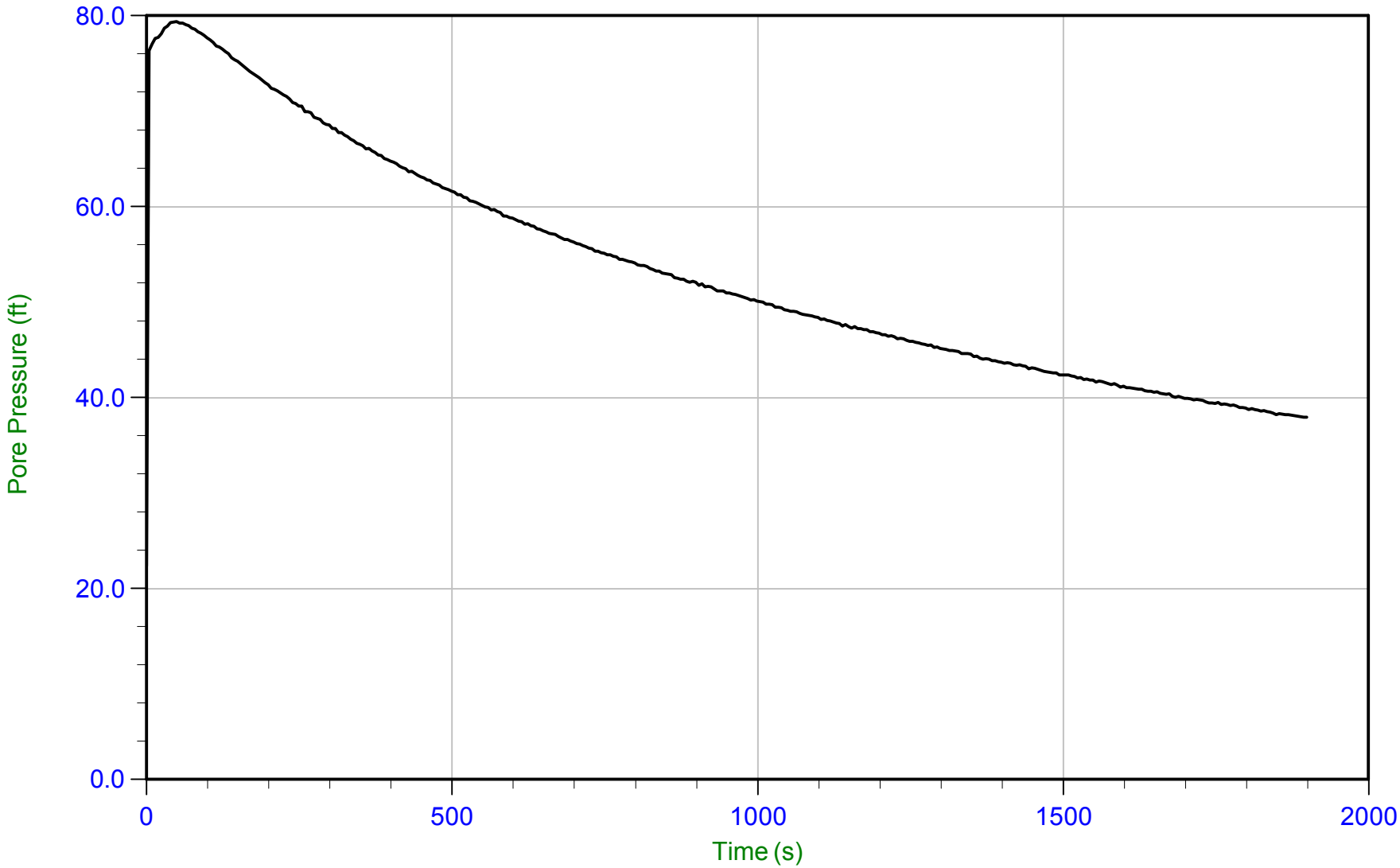
T(50): 561.3 s
Ir: 100
Ch: 1.3 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 09:12:37
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP14.PPD
Depth: 4.800 m / 15.748 ft
Duration: 1900.0 s

U Min: 22.4 ft
U Max: 79.4 ft

WT: 1.636 m / 5.367 ft
Ueq: 10.4 ft
U(50): 44.87 ft

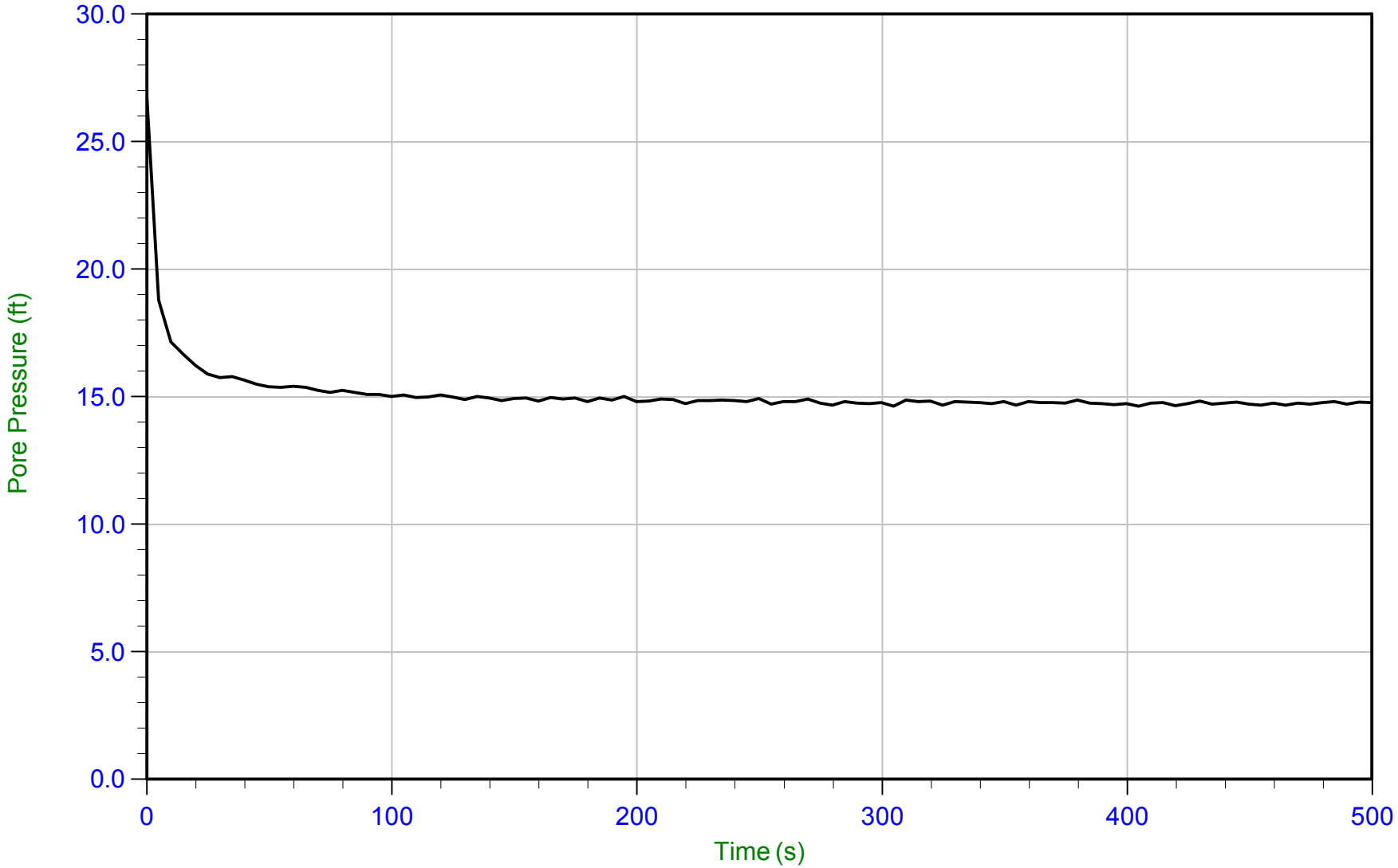
T(50): 1274.2 s
Ir: 100
Ch: 0.6 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 09:12:37
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C014
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP14.PPD
Depth: 6.100 m / 20.013 ft
Duration: 500.0 s

U Min: 14.6 ft
U Max: 26.7 ft

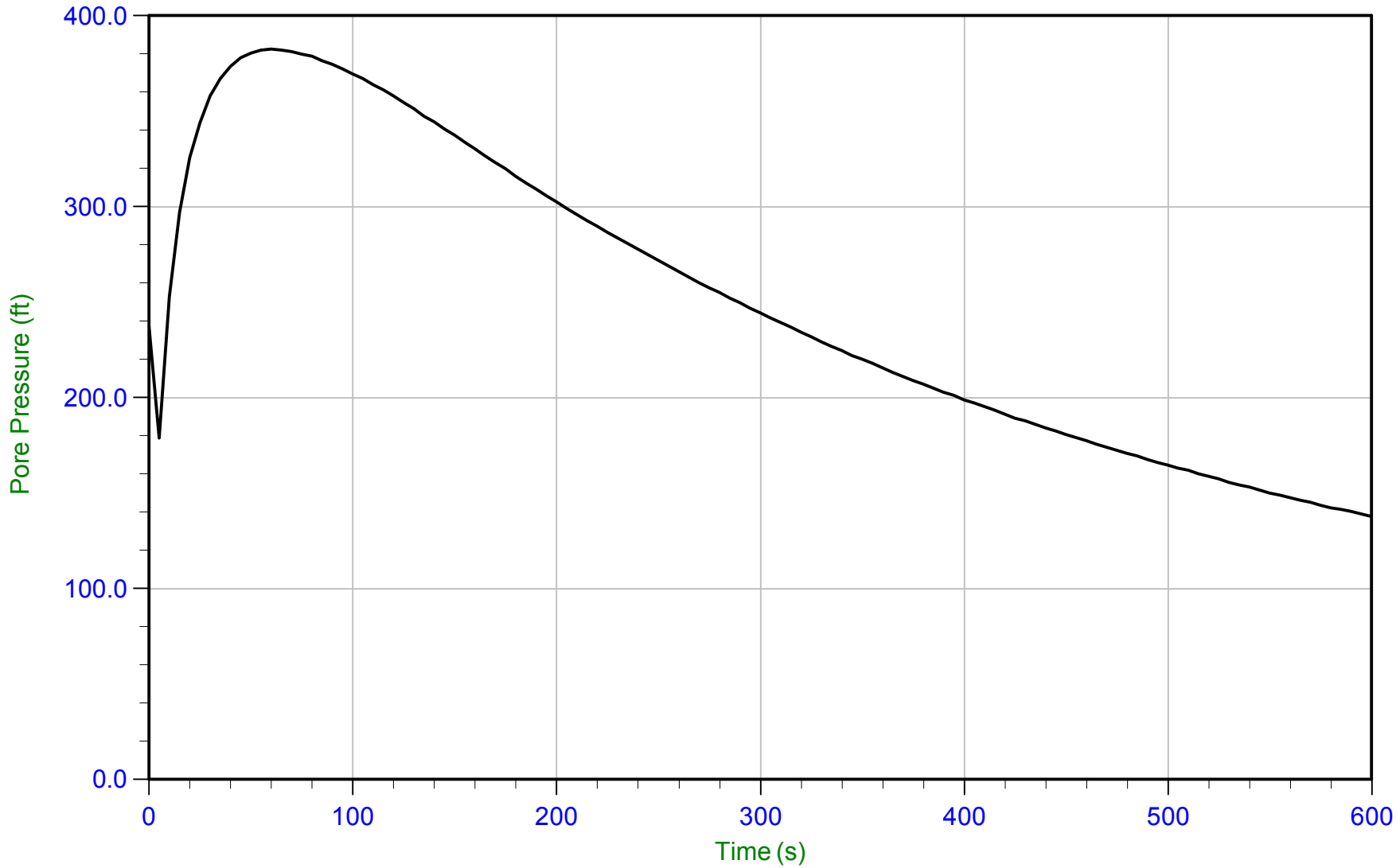
WT: 1.636 m / 5.367 ft
Ueq: 14.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 09:41:16
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C015
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP15.PPD
Depth: 11.700 m / 38.385 ft
Duration: 600.0 s

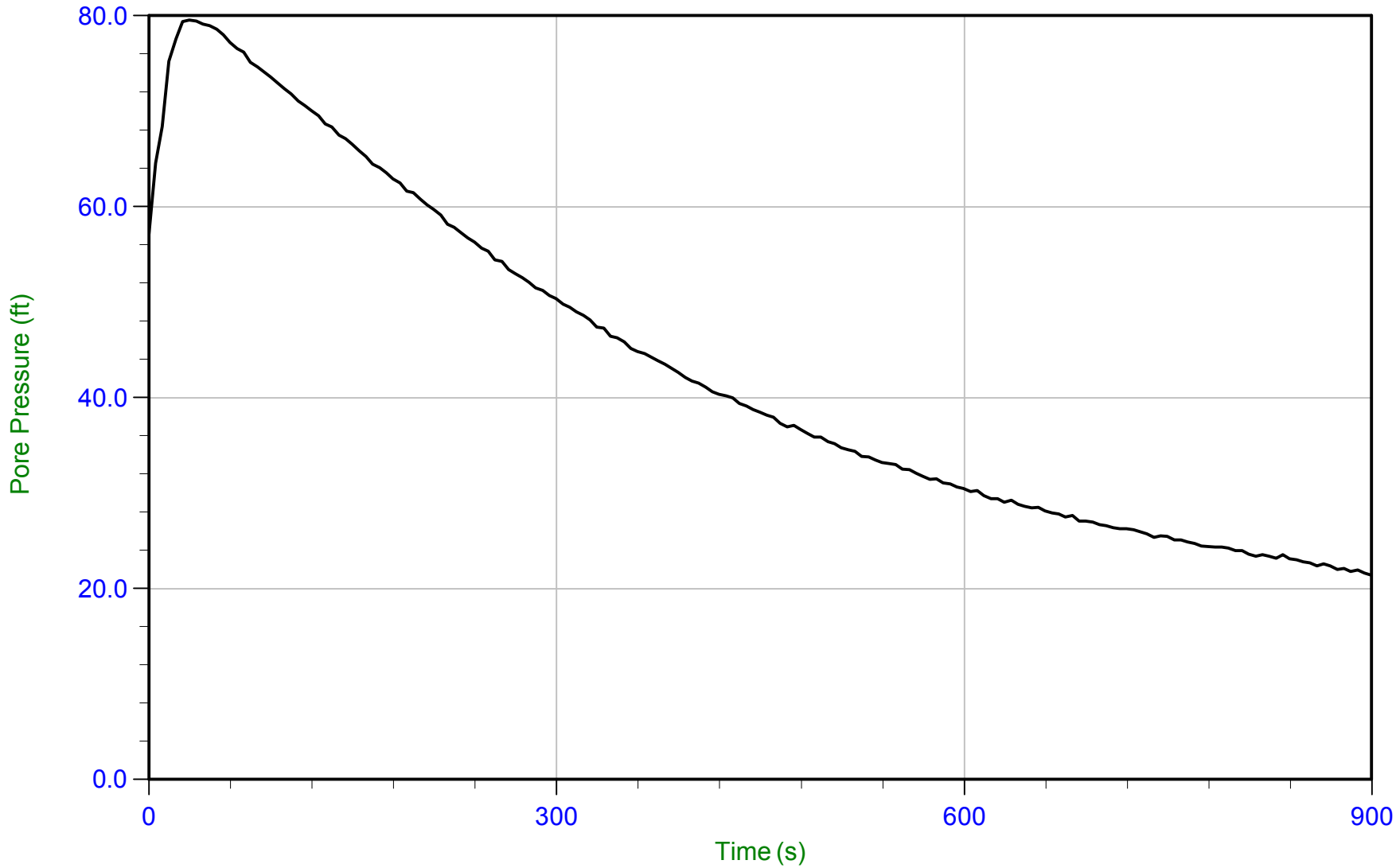
U Min: 137.7 ft
U Max: 382.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 10:45:30
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C016
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP16.PPD
Depth: 6.850 m / 22.473 ft
Duration: 900.0 s

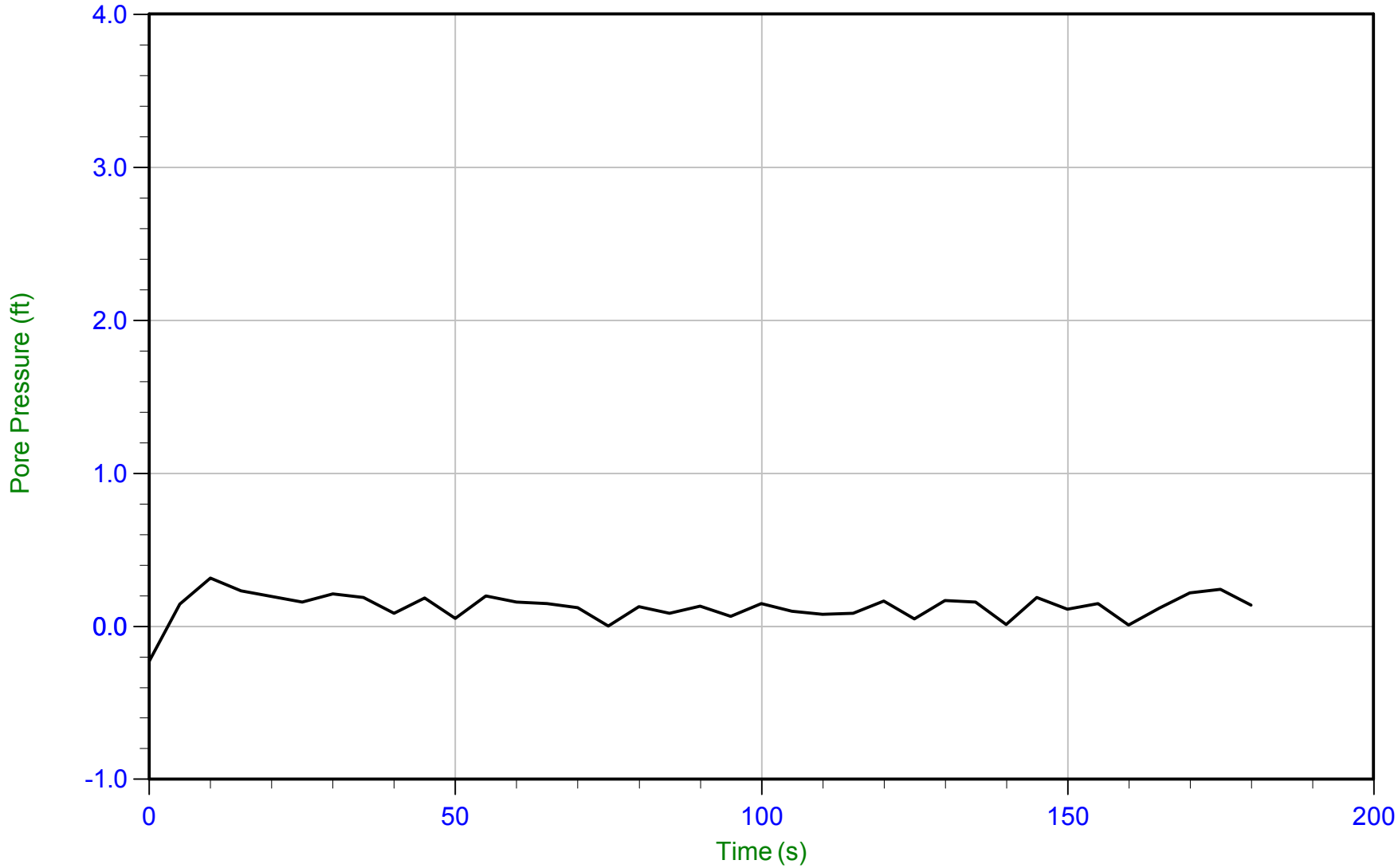
U Min: 21.4 ft
U Max: 79.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 08:51:19
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C017
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP17.PPD
Depth: 2.000 m / 6.562 ft
Duration: 180.0 s

U Min: -0.2 ft
U Max: 0.3 ft

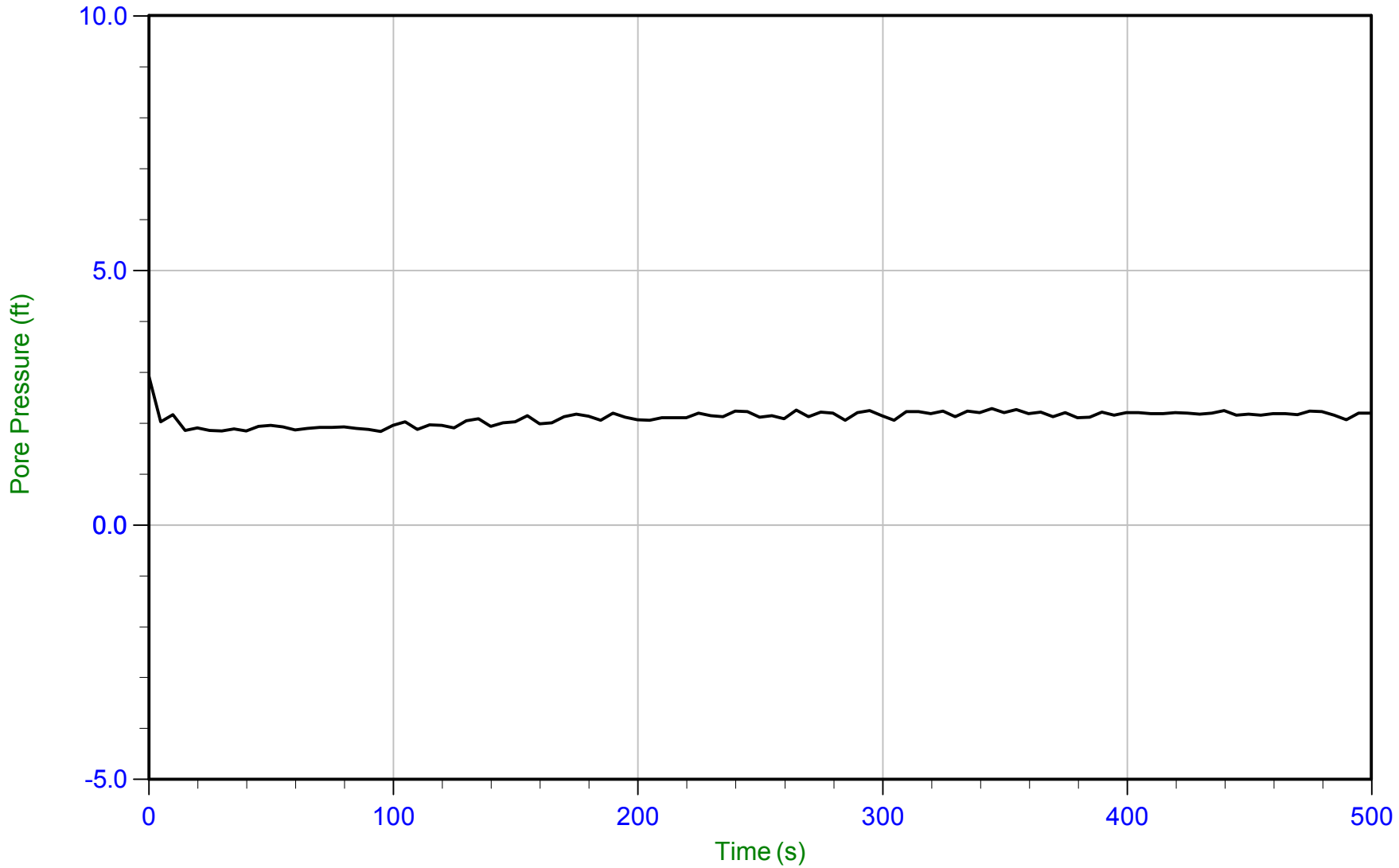
WT: 1.966 m / 6.450 ft
Ueq: 0.1 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 08:51:19
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C017
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP17.PPD
Depth: 2.550 m / 8.366 ft
Duration: 500.0 s

U Min: 1.8 ft
U Max: 2.9 ft

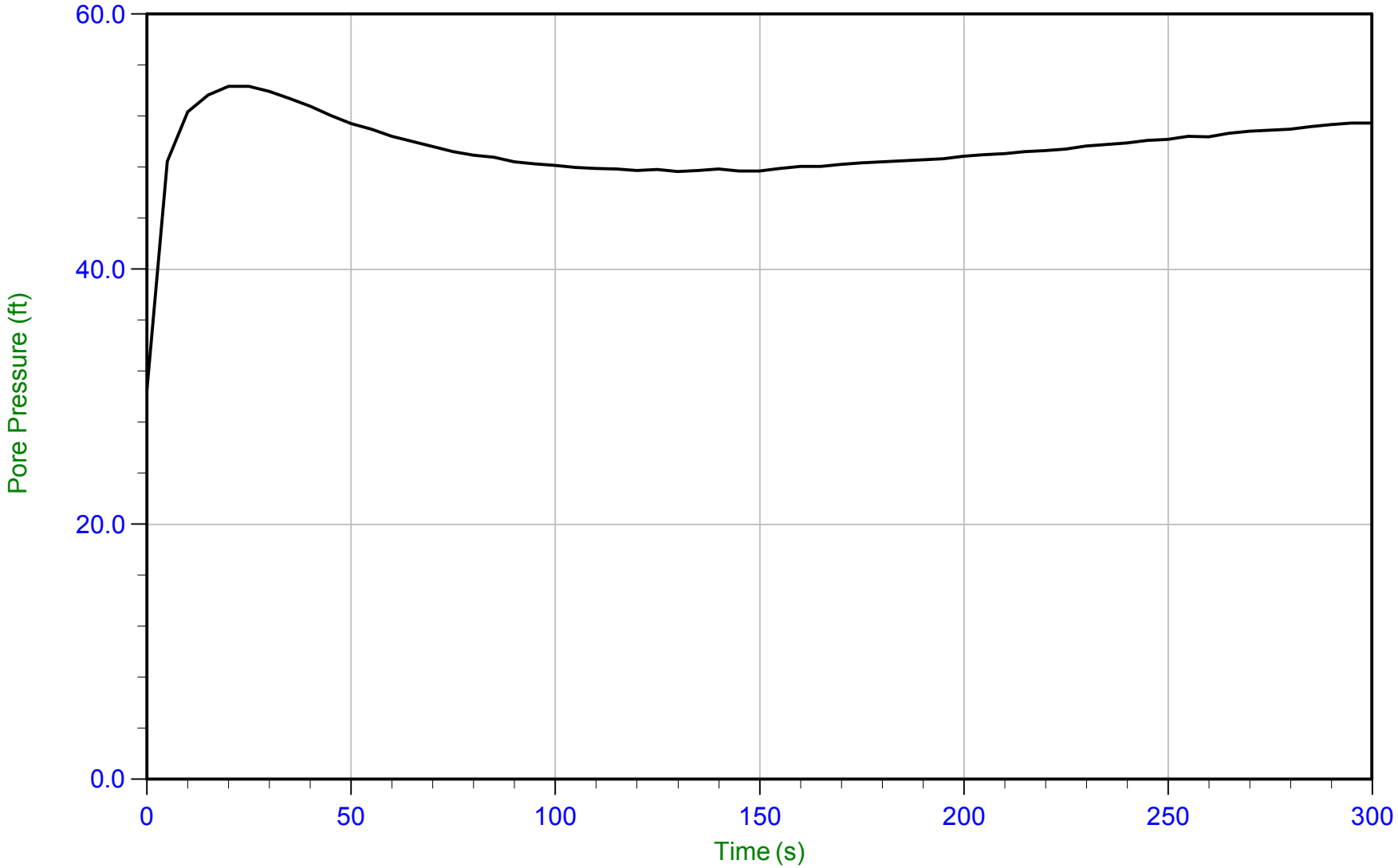
WT: 1.879 m / 6.165 ft
Ueq: 2.2 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 08:51:19
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C017
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP17.PPD
Depth: 4.000 m / 13.123 ft
Duration: 300.0 s

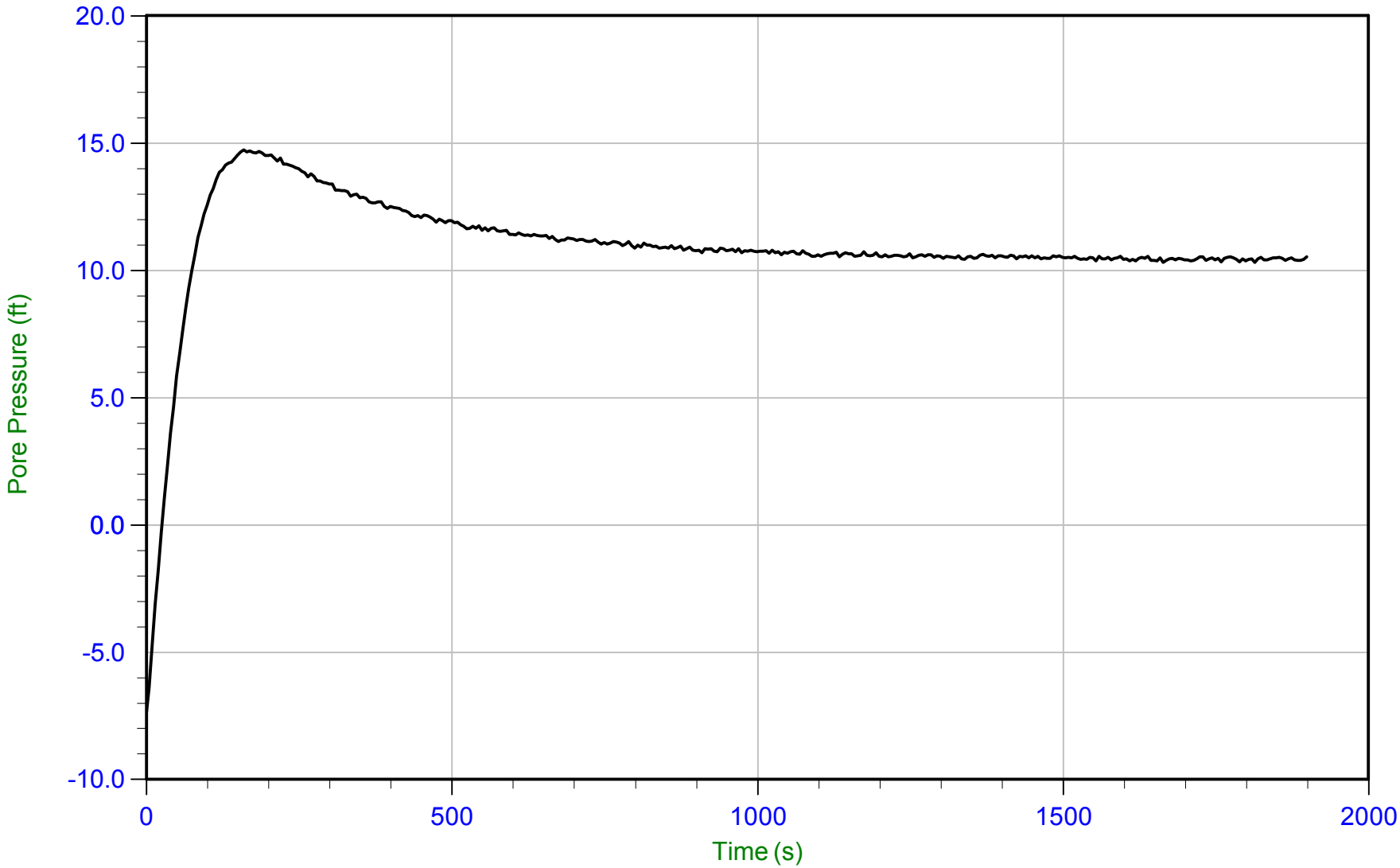
U Min: 30.5 ft
U Max: 54.3 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 08:51:19
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C017
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP17.PPD
Depth: 5.300 m / 17.388 ft
Duration: 1900.0 s

U Min: -7.3 ft
U Max: 14.7 ft

WT: 2.107 m / 6.913 ft
Ueq: 10.5 ft
U(50): 12.60 ft

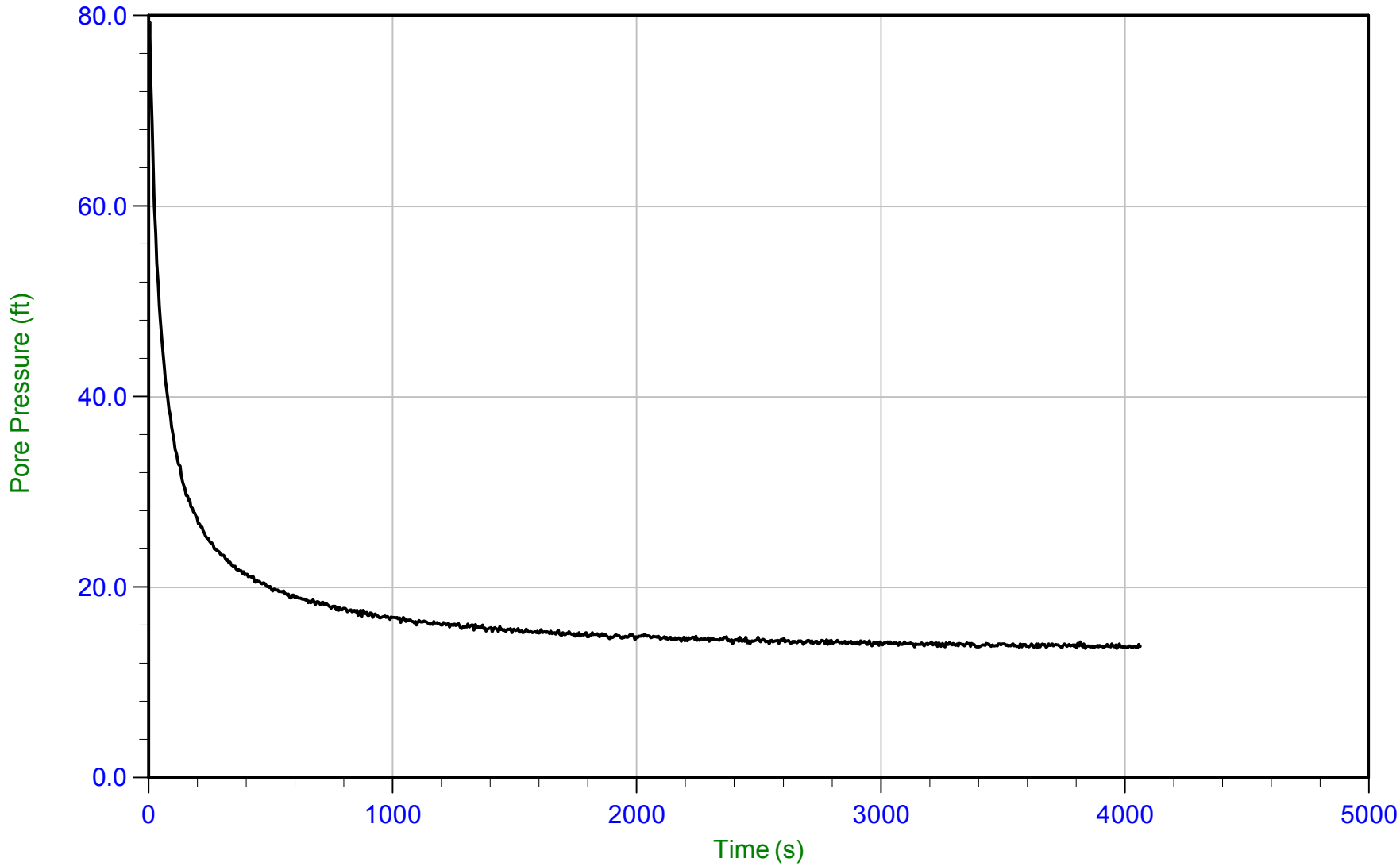
T(50): 227.4 s
Ir: 100
Ch: 3.1 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 08:33:58
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C018
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP18.PPD
Depth: 5.650 m / 18.537 ft
Duration: 4065.0 s

U Min: 13.6 ft
U Max: 79.3 ft

WT: 1.586 m / 5.203 ft
Ueq: 13.3 ft
U(50): 46.32 ft

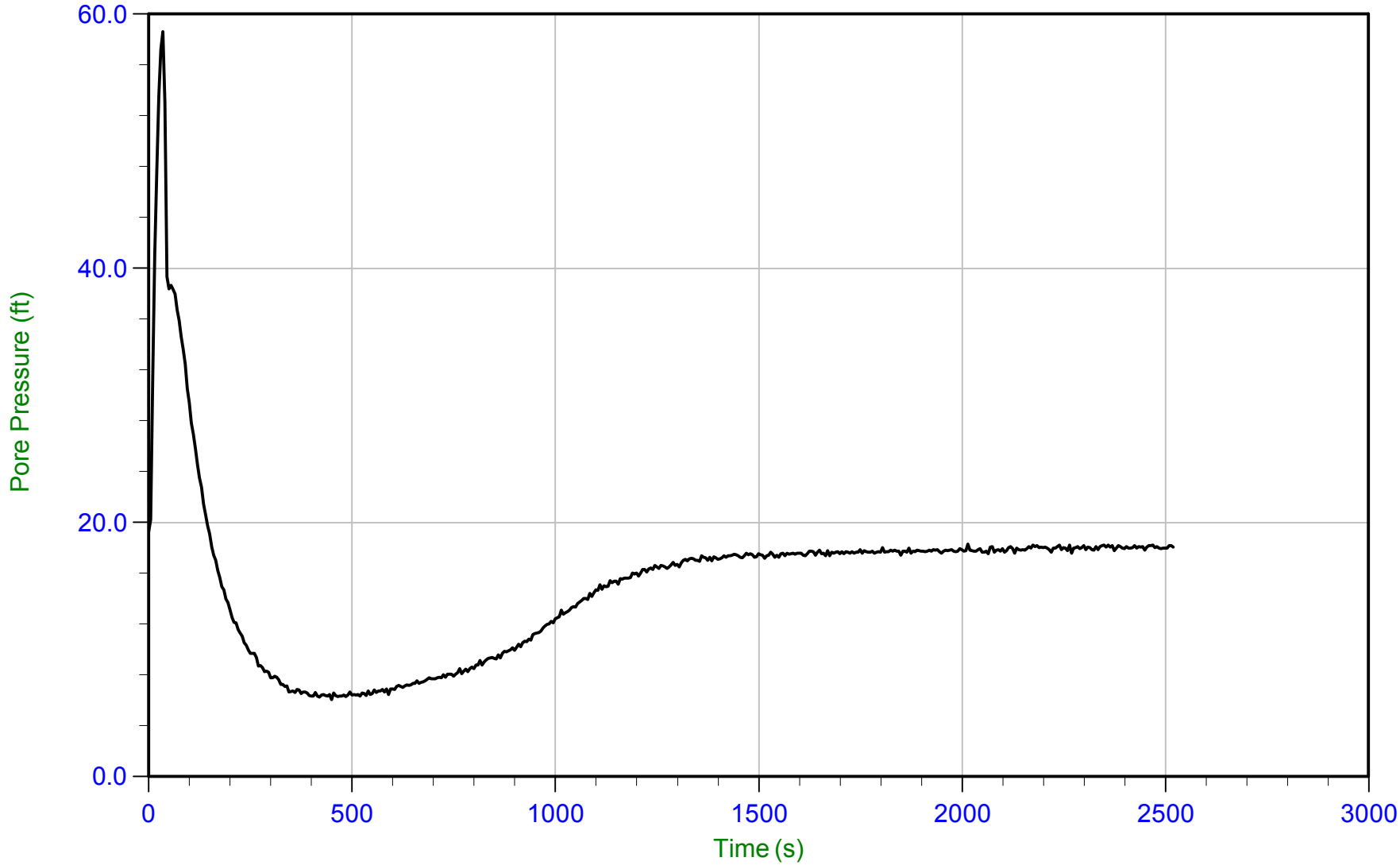
T(50): 49.2 s
Ir: 100
Ch: 14.3 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 08:33:58
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C018
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP18.PPD
Depth: 6.450 m / 21.161 ft
Duration: 2520.0 s

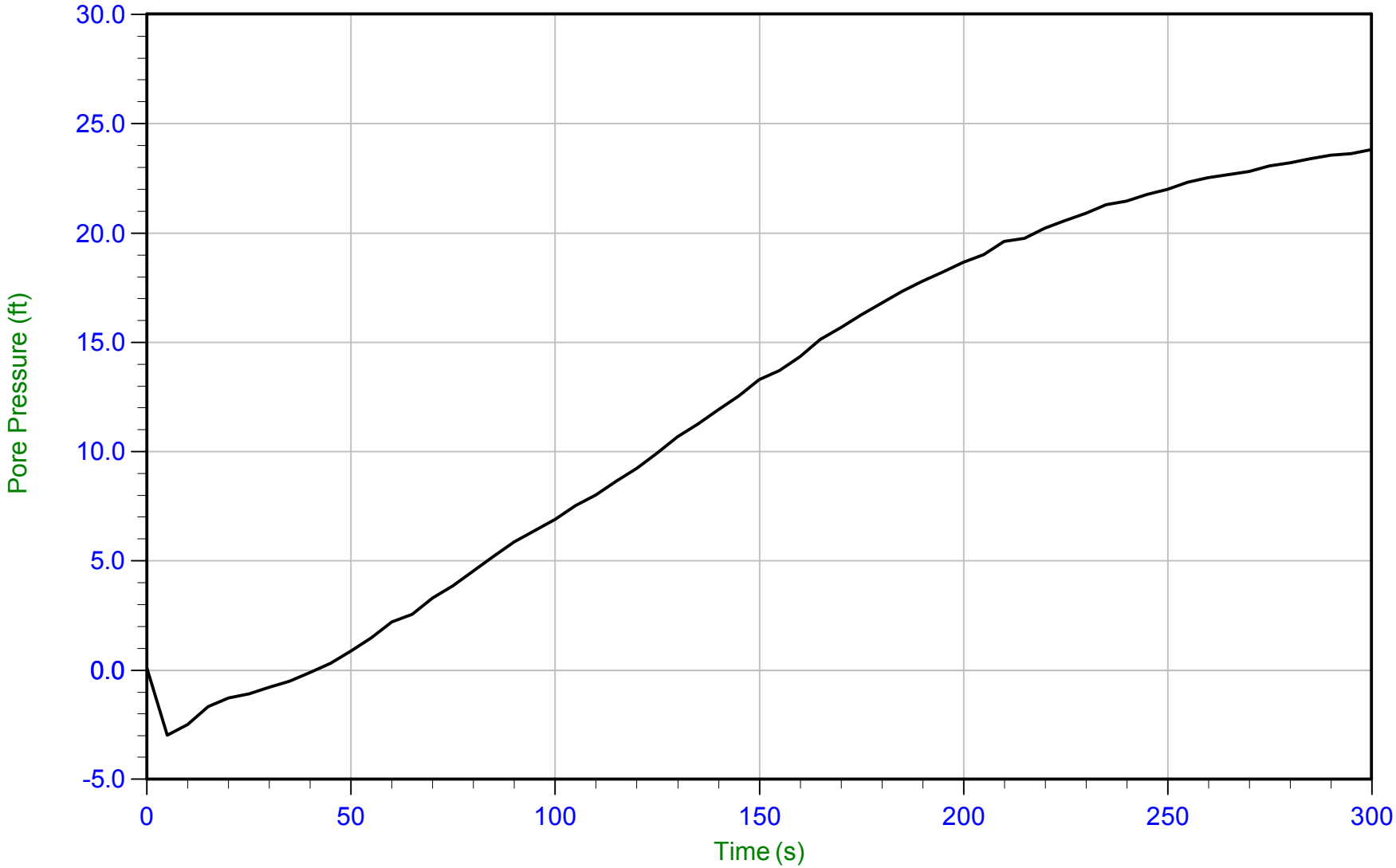
U Min: 6.1 ft
U Max: 58.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 10:43:28
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C019
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP19.PPD
Depth: 2.000 m / 6.562 ft
Duration: 300.0 s

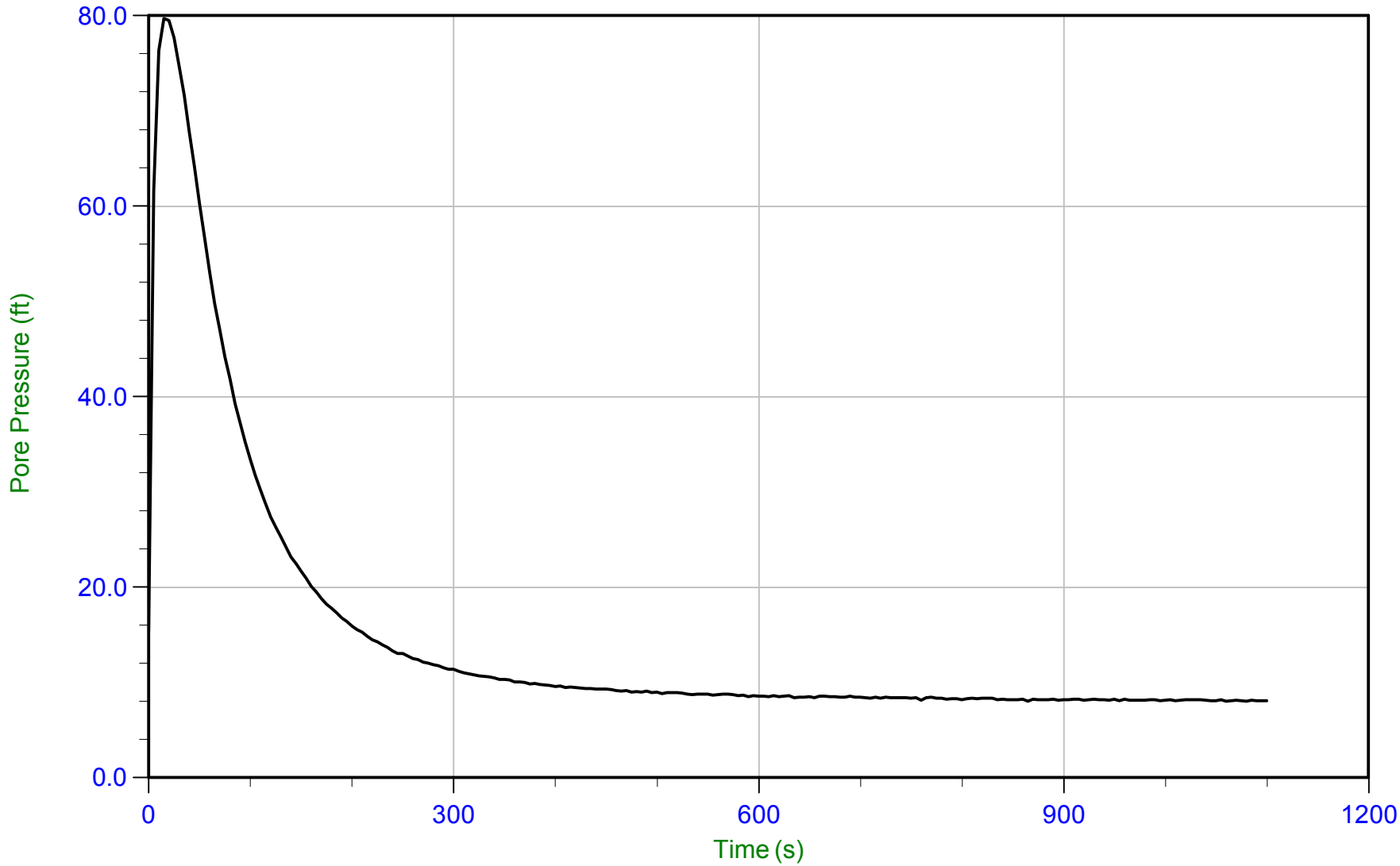
U Min: -3.0 ft
U Max: 23.8 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 10:43:28
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C019
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP19.PPD
Depth: 3.500 m / 11.483 ft
Duration: 1100.0 s

U Min: 8.0 ft
U Max: 79.7 ft

WT: 1.081 m / 3.547 ft
Ueq: 7.9 ft
U(50): 43.83 ft

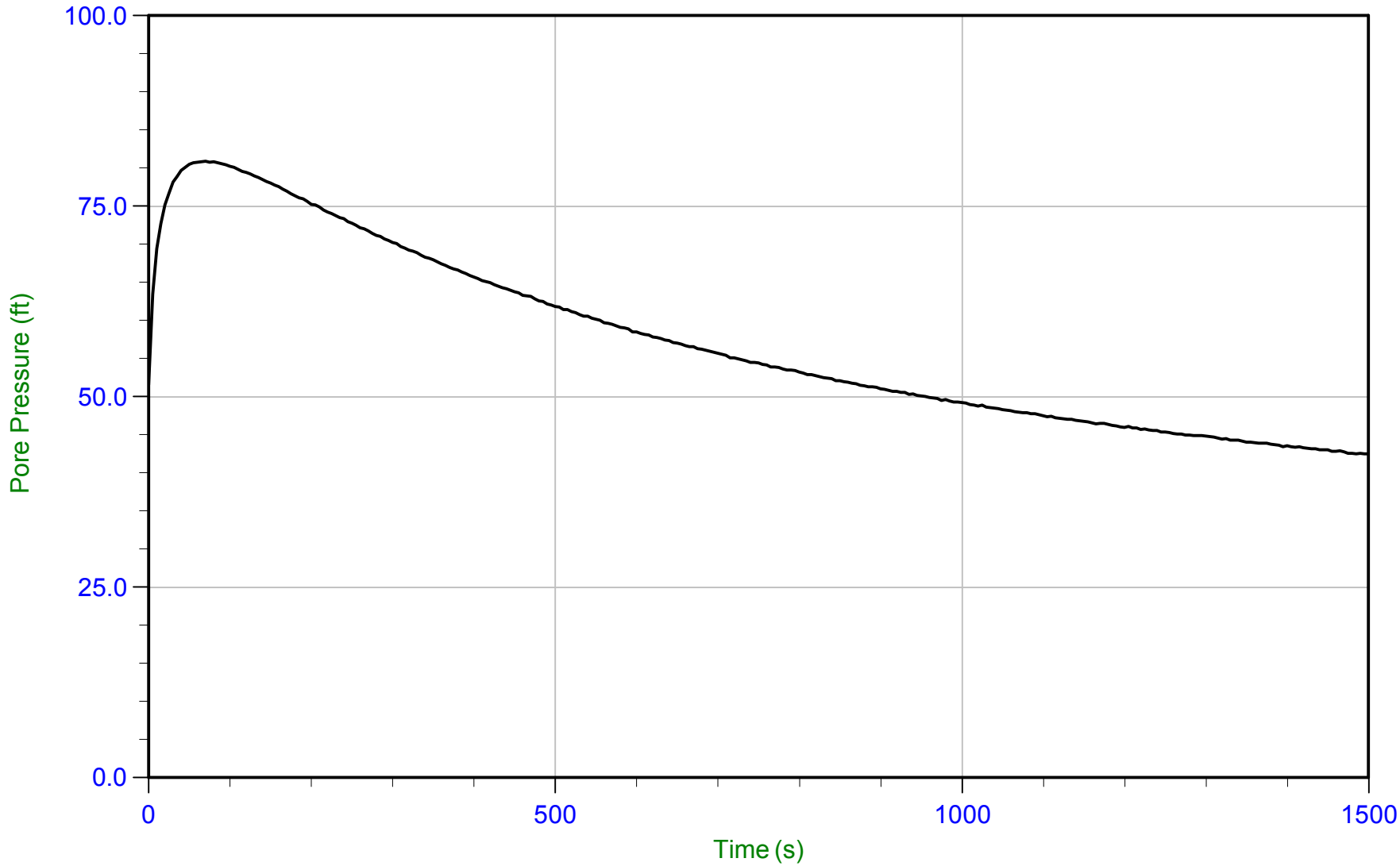
T(50): 60.7 s
Ir: 100
Ch: 11.6 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 10:43:28
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C019
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP19.PPD
Depth: 6.000 m / 19.685 ft
Duration: 1500.0 s

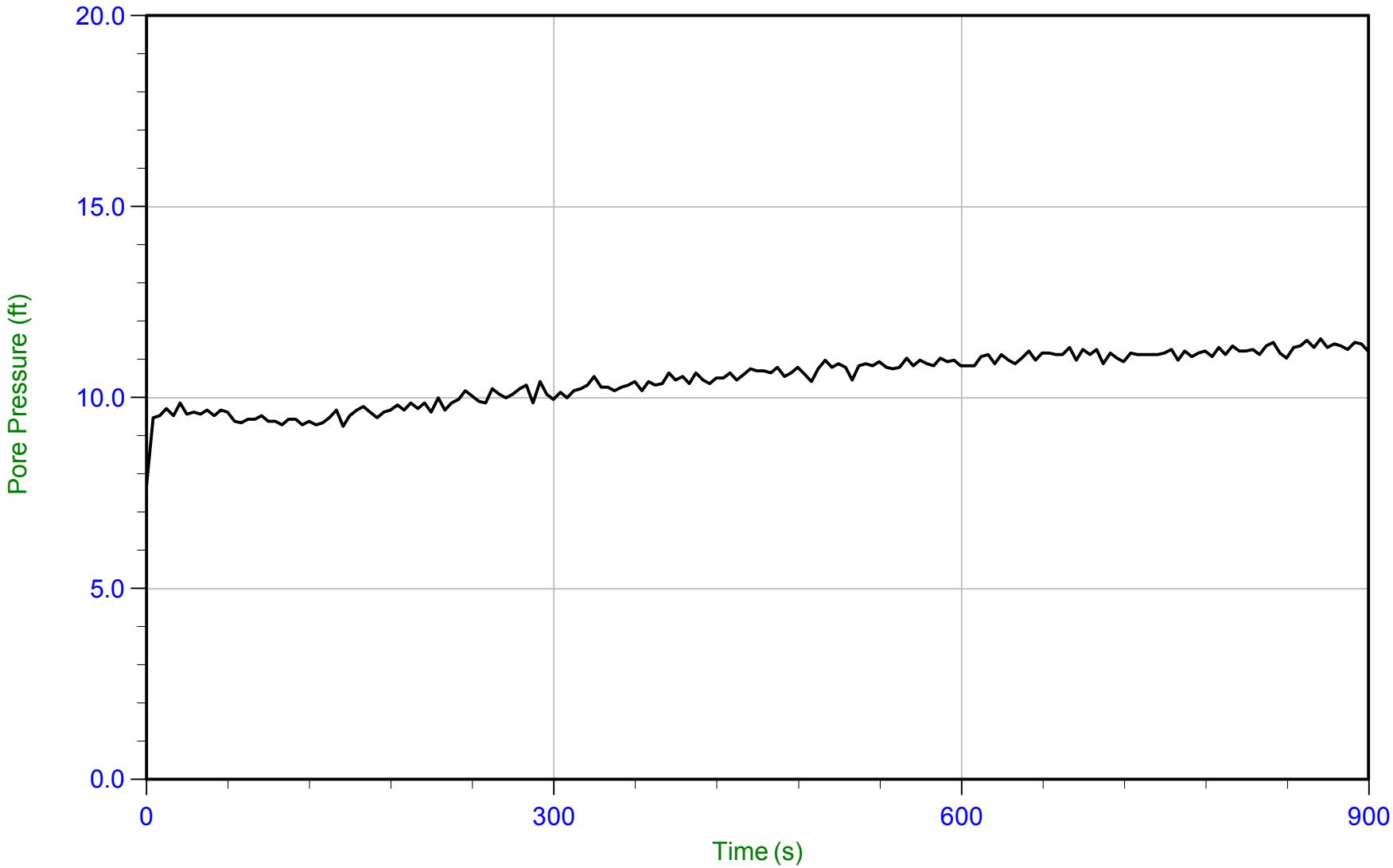
U Min: 42.5 ft
U Max: 80.9 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 08:31:25
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C020
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP20.PPD
Depth: 5.100 m / 16.732 ft
Duration: 900.0 s

U Min: 7.7 ft
U Max: 11.5 ft

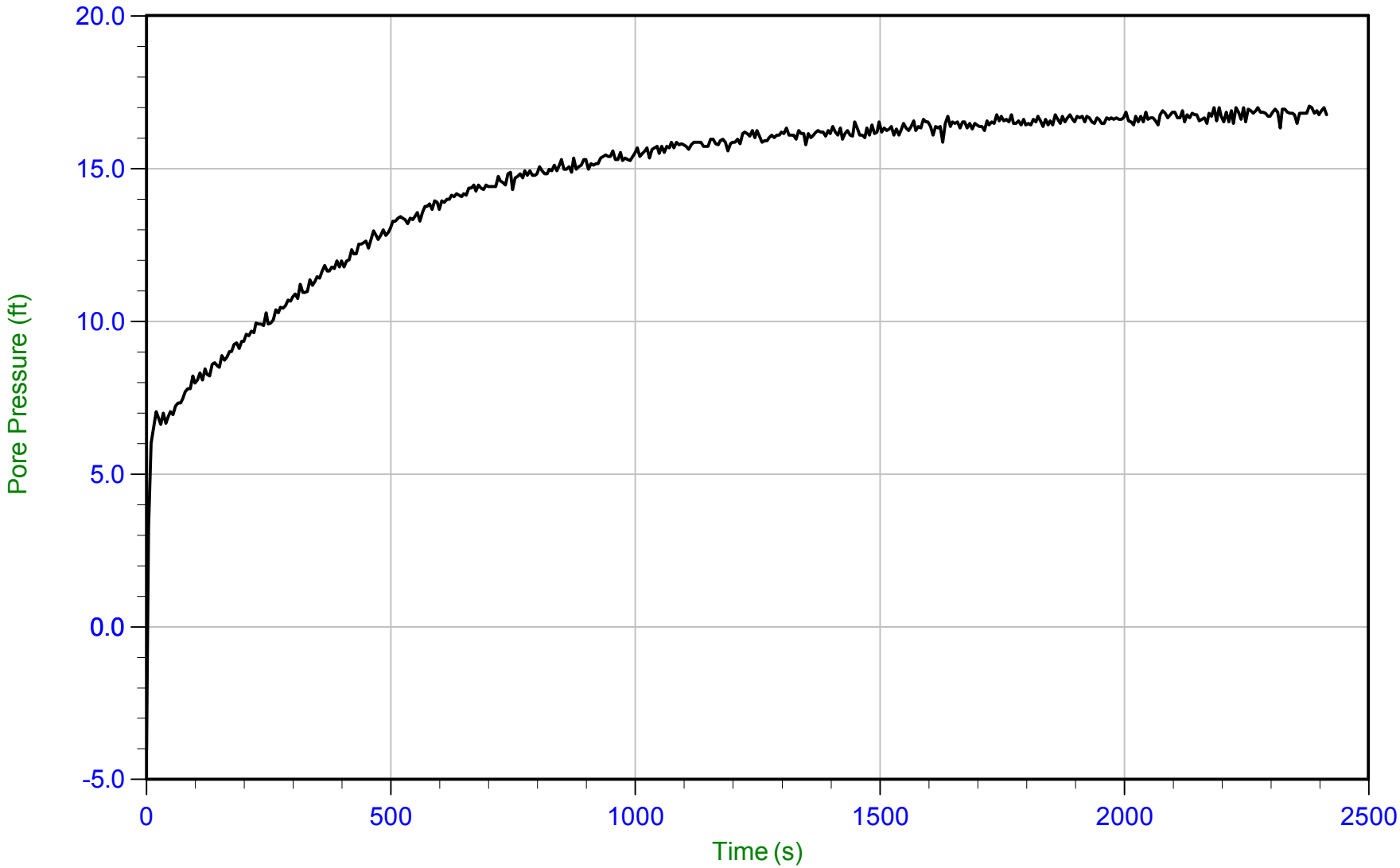
WT: 1.620 m / 5.315 ft
Ueq: 11.4 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 11:10:03
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C021
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP21.PPD
Depth: 6.200 m / 20.341 ft
Duration: 2415.0 s

U Min: -4.0 ft
U Max: 17.0 ft

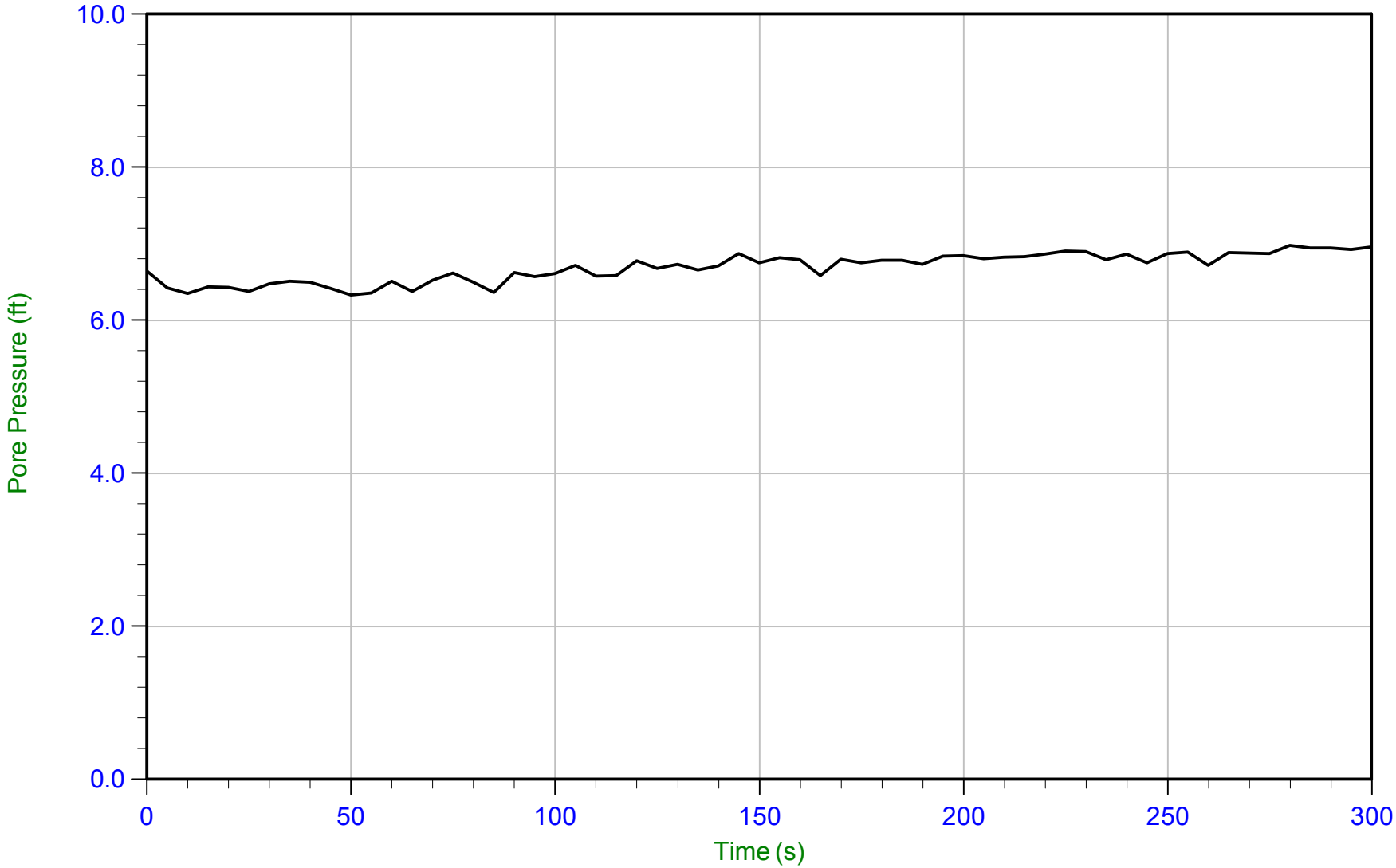
WT: 1.041 m / 3.415 ft
Ueq: 16.9 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 11:53:55
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP22.PPD
Depth: 2.700 m / 8.858 ft
Duration: 300.0 s

U Min: 6.3 ft
U Max: 7.0 ft

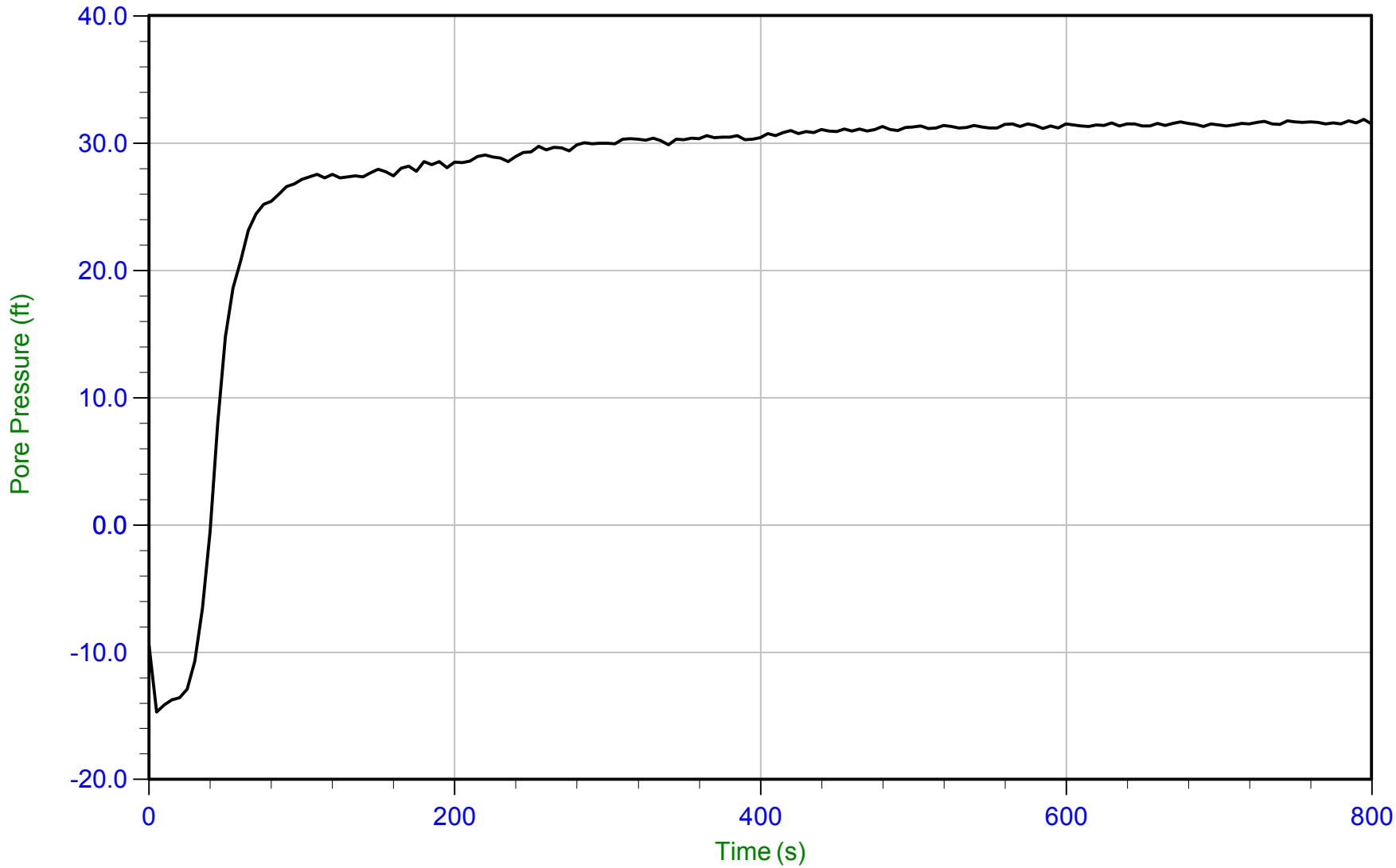
WT: 0.588 m / 1.929 ft
Ueq: 6.9 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 11:53:55
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C022
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP22.PPD
Depth: 10.350 m / 33.956 ft
Duration: 800.0 s

U Min: -14.7 ft
U Max: 31.8 ft

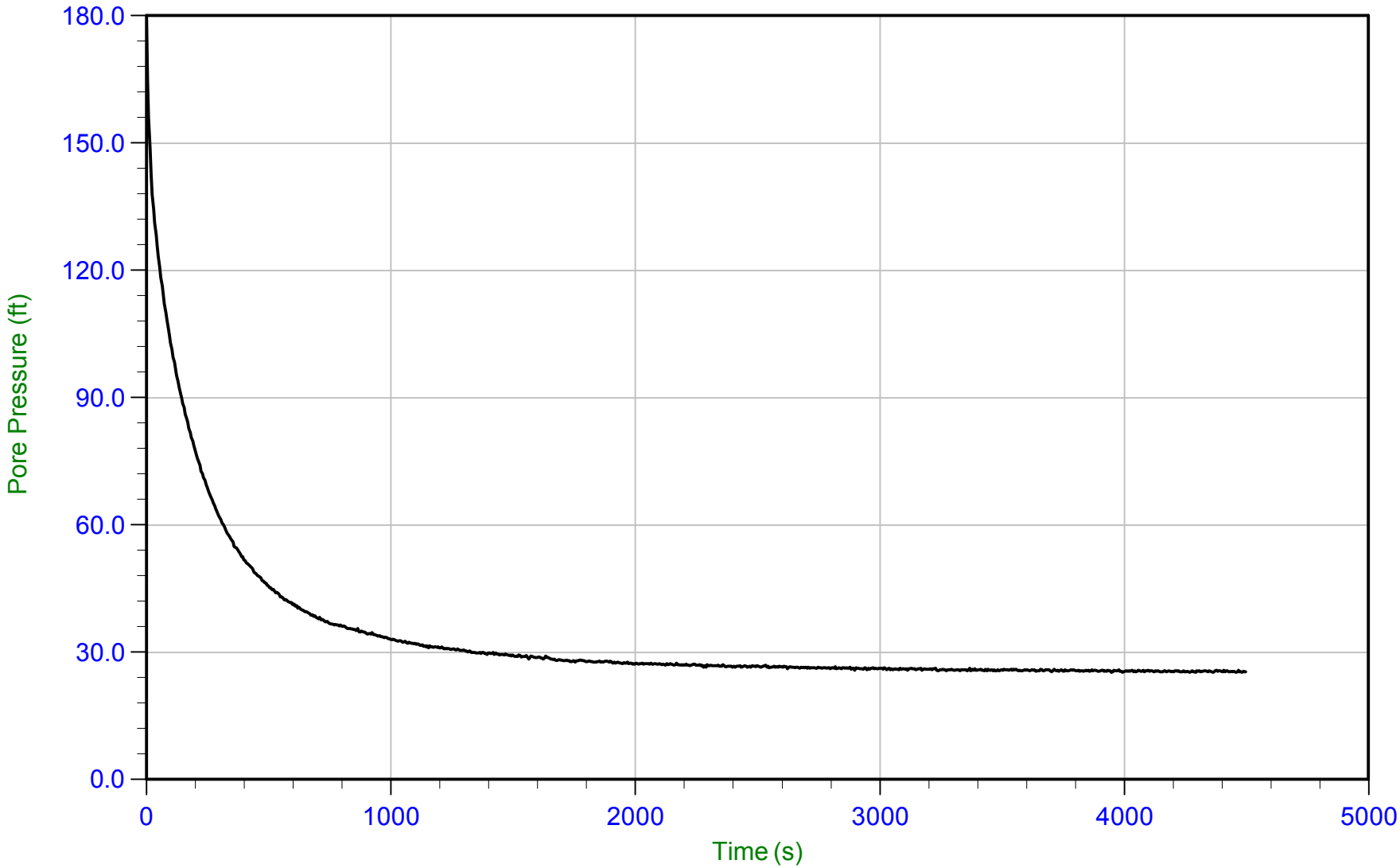
WT: 0.750 m / 2.461 ft
Ueq: 31.5 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 14:39:37
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP23.PPD
Depth: 12.000 m / 39.370 ft
Duration: 4500.0 s

U Min: 25.2 ft
U Max: 179.3 ft

WT: 4.355 m / 14.288 ft
Ueq: 25.1 ft
U(50): 102.20 ft

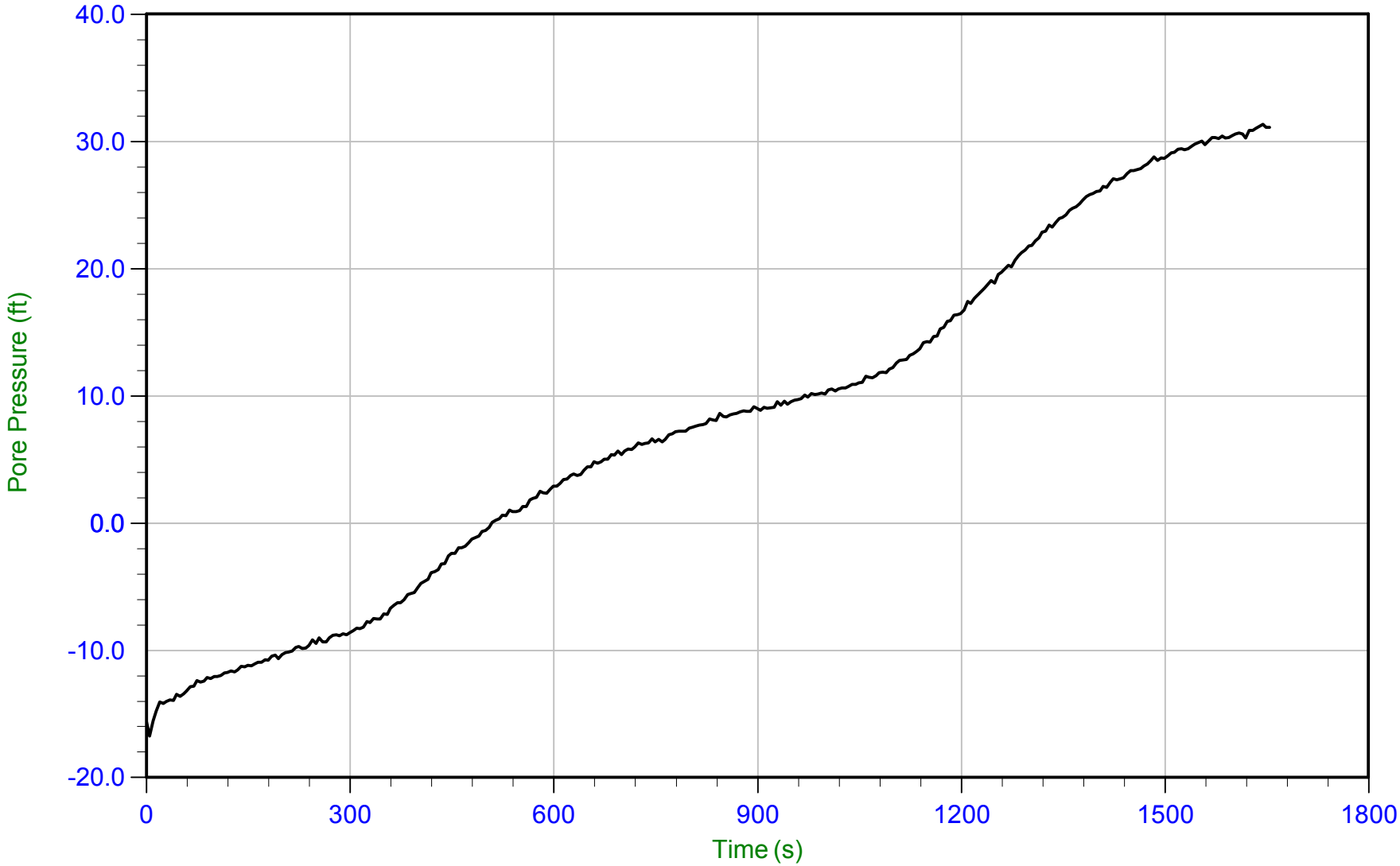
T(50): 102.2 s
Ir: 100
Ch: 6.9 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 14:39:37
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP23.PPD
Depth: 12.600 m / 41.338 ft
Duration: 1655.0 s

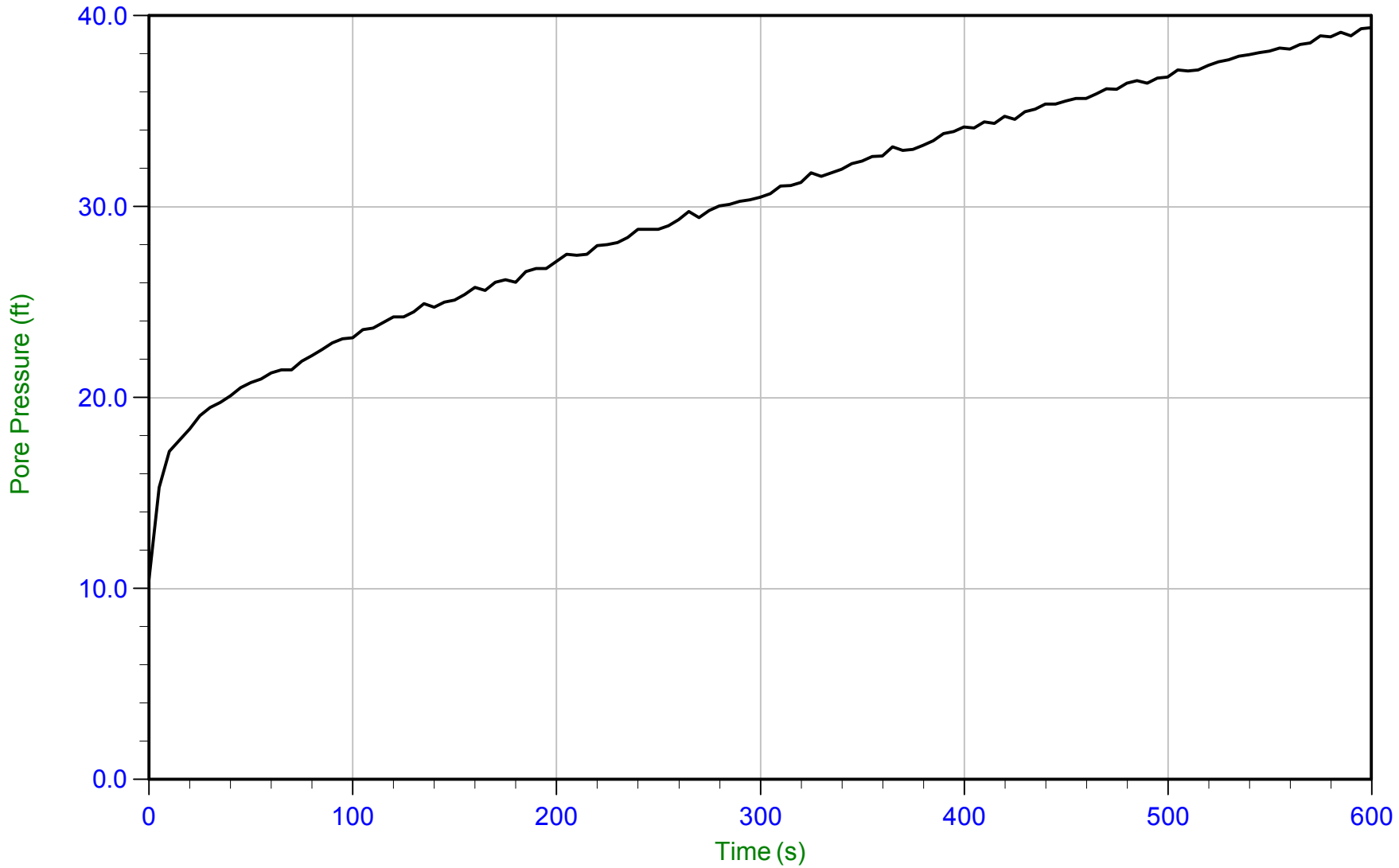
U Min: -16.8 ft
U Max: 31.3 ft

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 07:57:52
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_CP23A.PPD
Depth: 7.800 m / 25.590 ft
Duration: 600.0 s

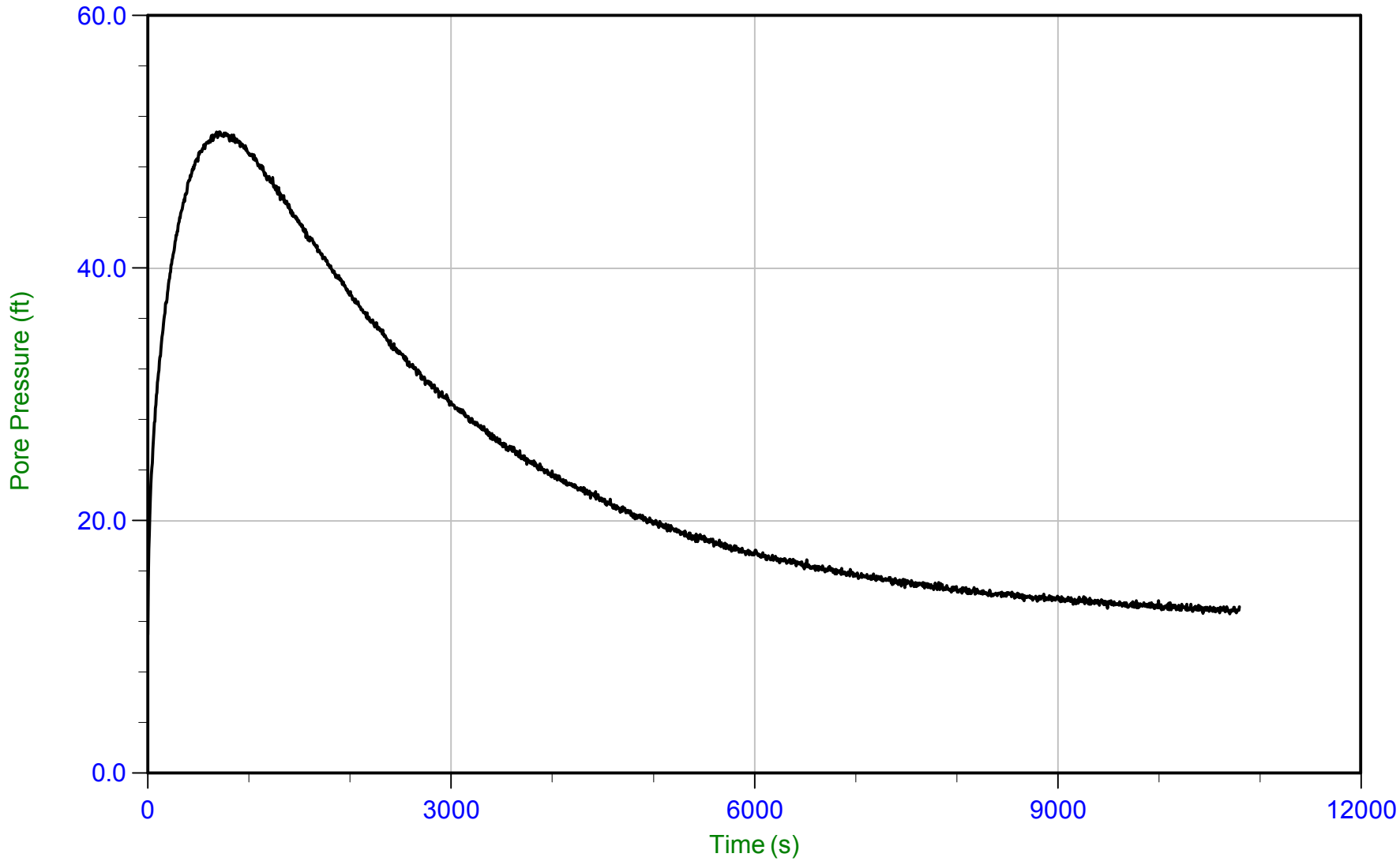
U Min: 10.5 ft
U Max: 39.4 ft

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 07:57:52
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_CP23A.PPD
Depth: 7.900 m / 25.918 ft
Duration: 10800.0 s

U Min: 11.0 ft
U Max: 50.8 ft

WT: 4.688 m / 15.380 ft
Ueq: 10.5 ft
U(50): 30.66 ft

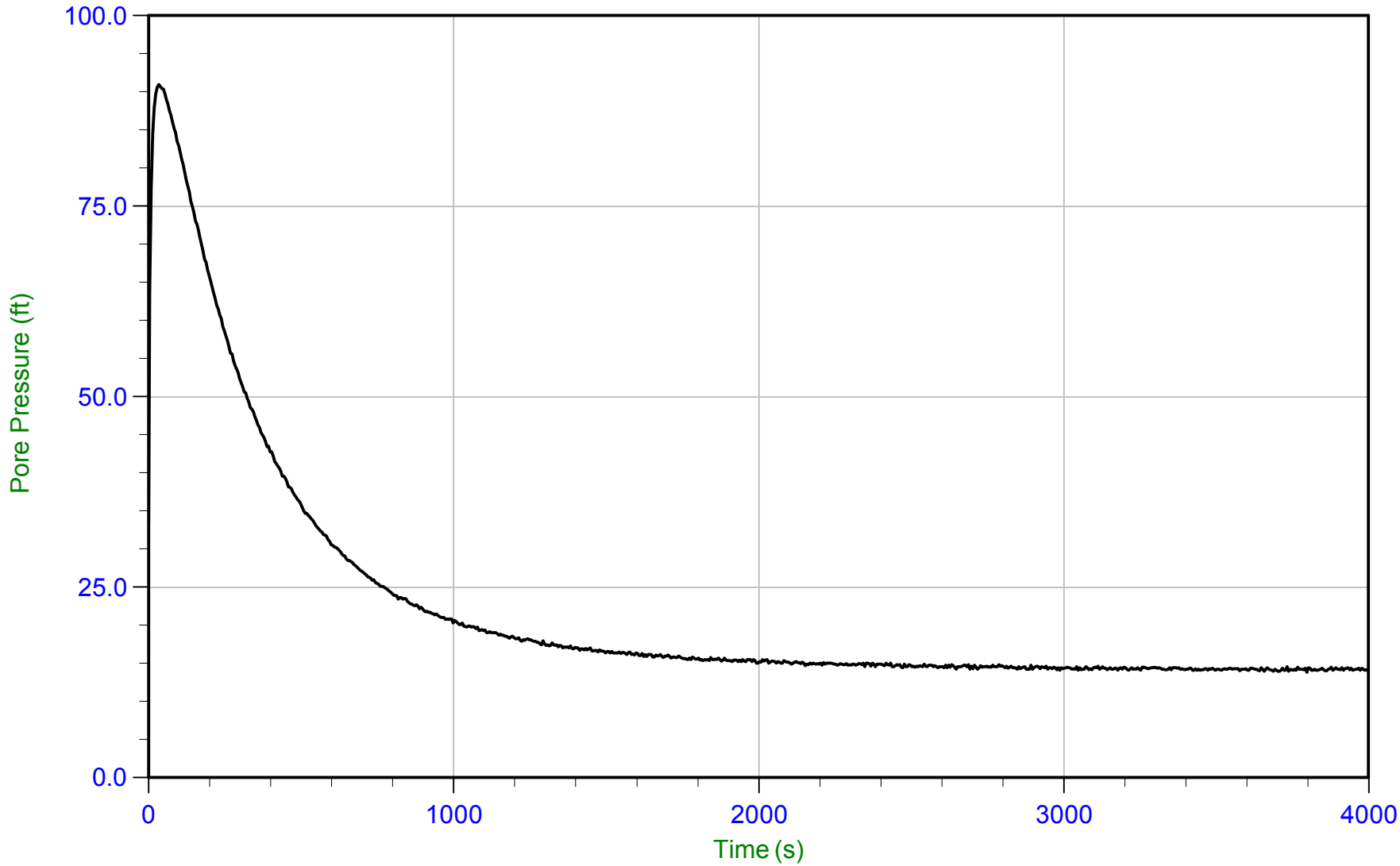
T(50): 2124.8 s
Ir: 100
Ch: 0.3 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 07:57:52
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_CP23A.PPD
Depth: 8.800 m / 28.871 ft
Duration: 4000.0 s

U Min: 13.8 ft
U Max: 90.9 ft

WT: 4.688 m / 15.380 ft
Ueq: 13.5 ft
U(50): 52.22 ft

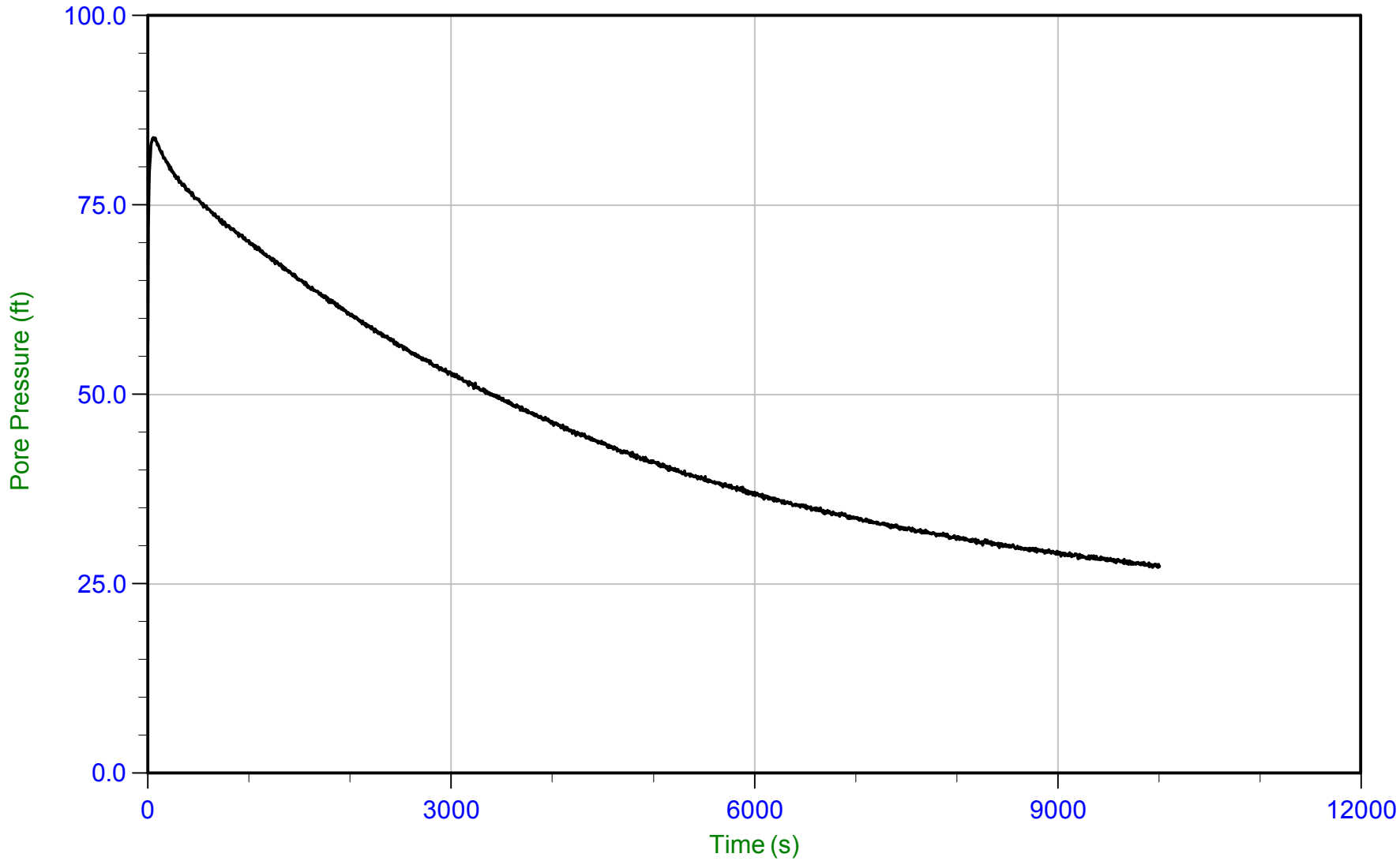
T(50): 266.5 s
Ir: 100
Ch: 2.6 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 15-Aug-2015 07:57:52
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C023A
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_CP23A.PPD
Depth: 10.400 m / 34.120 ft
Duration: 10010.0 s

U Min: 27.2 ft
U Max: 83.9 ft

WT: 4.688 m / 15.380 ft
Ueq: 18.7 ft
U(50): 51.32 ft

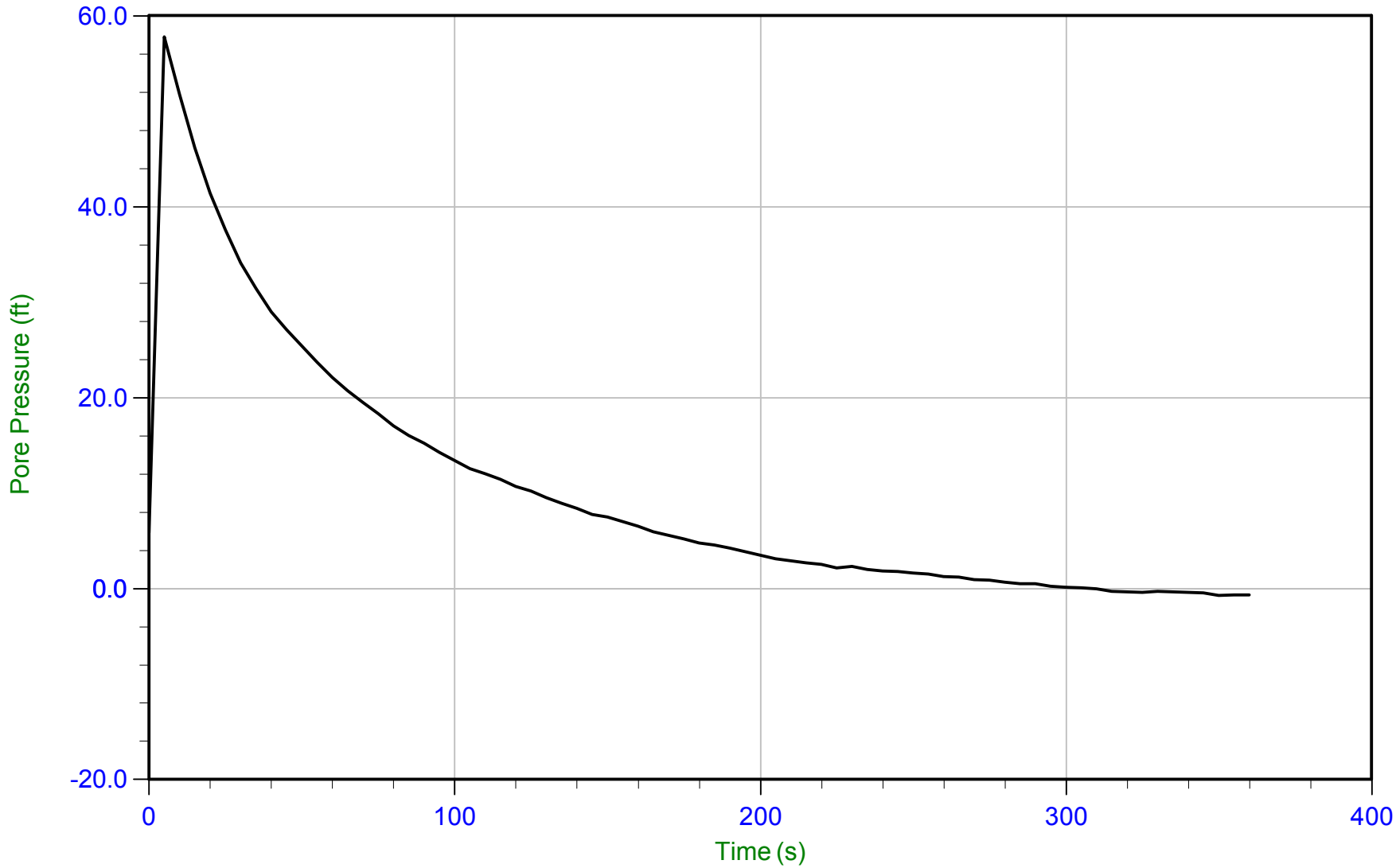
T(50): 3117.3 s
Ir: 100
Ch: 0.2 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 14:36:12
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C024
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP24.PPD
Depth: 1.950 m / 6.398 ft
Duration: 360.0 s

U Min: -0.7 ft
U Max: 57.8 ft

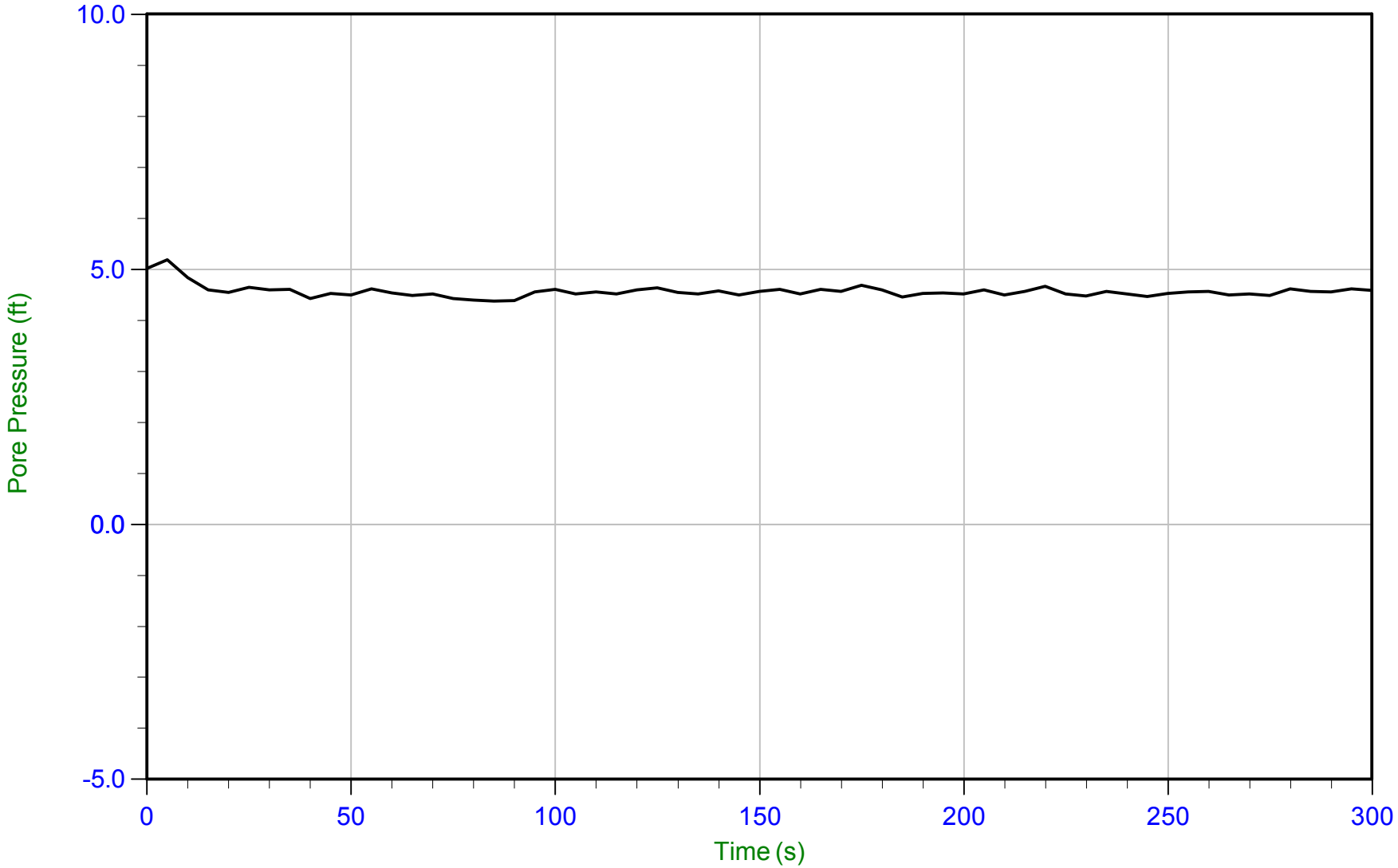
WT: 0.000 m / 0.000 ft
Ueq: 0.0 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 11:22:19
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP25.PPD
Depth: 5.800 m / 19.029 ft
Duration: 300.0 s

U Min: 4.4 ft
U Max: 5.2 ft

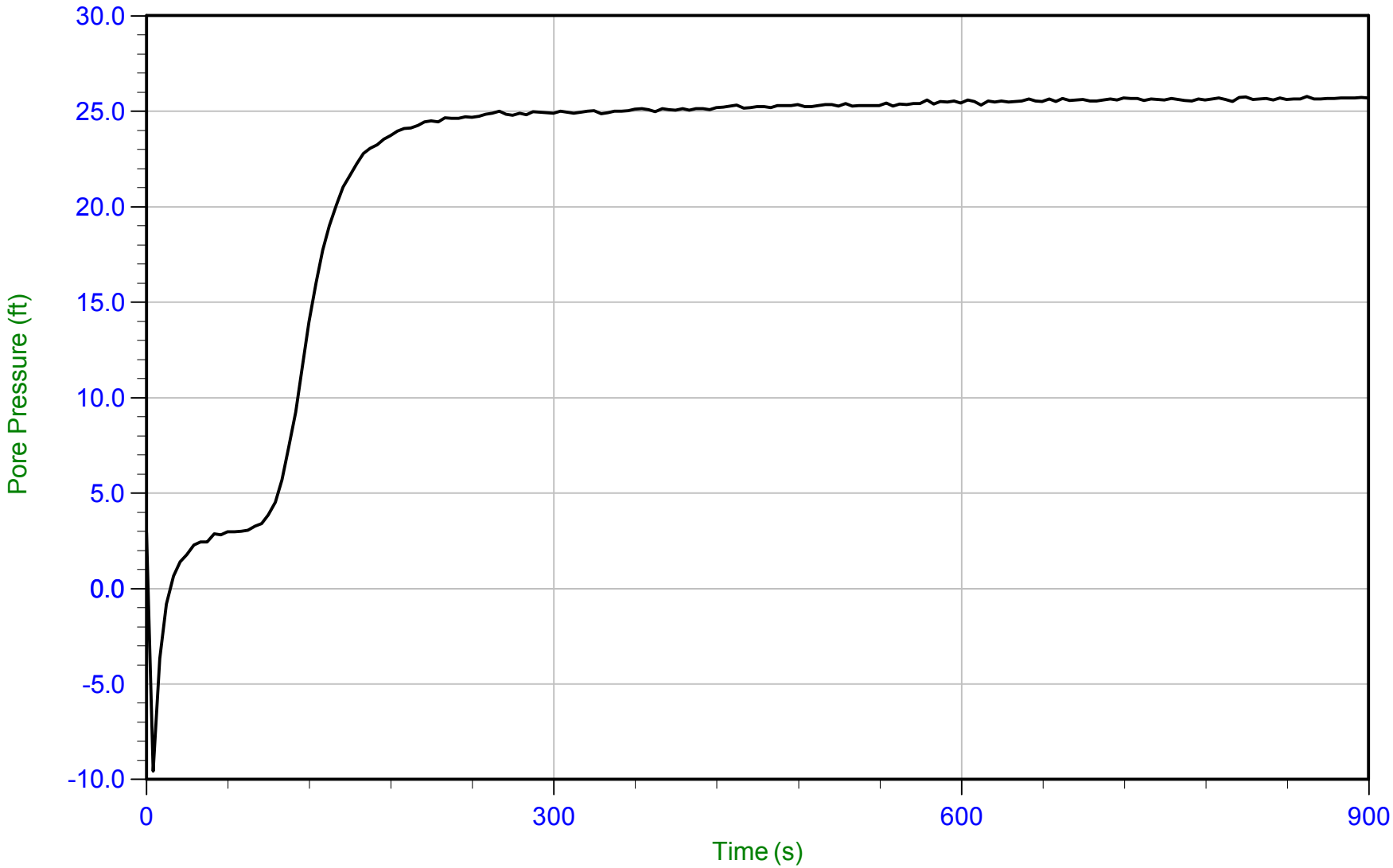
WT: 4.413 m / 14.478 ft
Ueq: 4.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 11:22:19
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C025
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP25.PPD
Depth: 12.700 m / 41.666 ft
Duration: 900.0 s

U Min: -9.6 ft
U Max: 25.8 ft

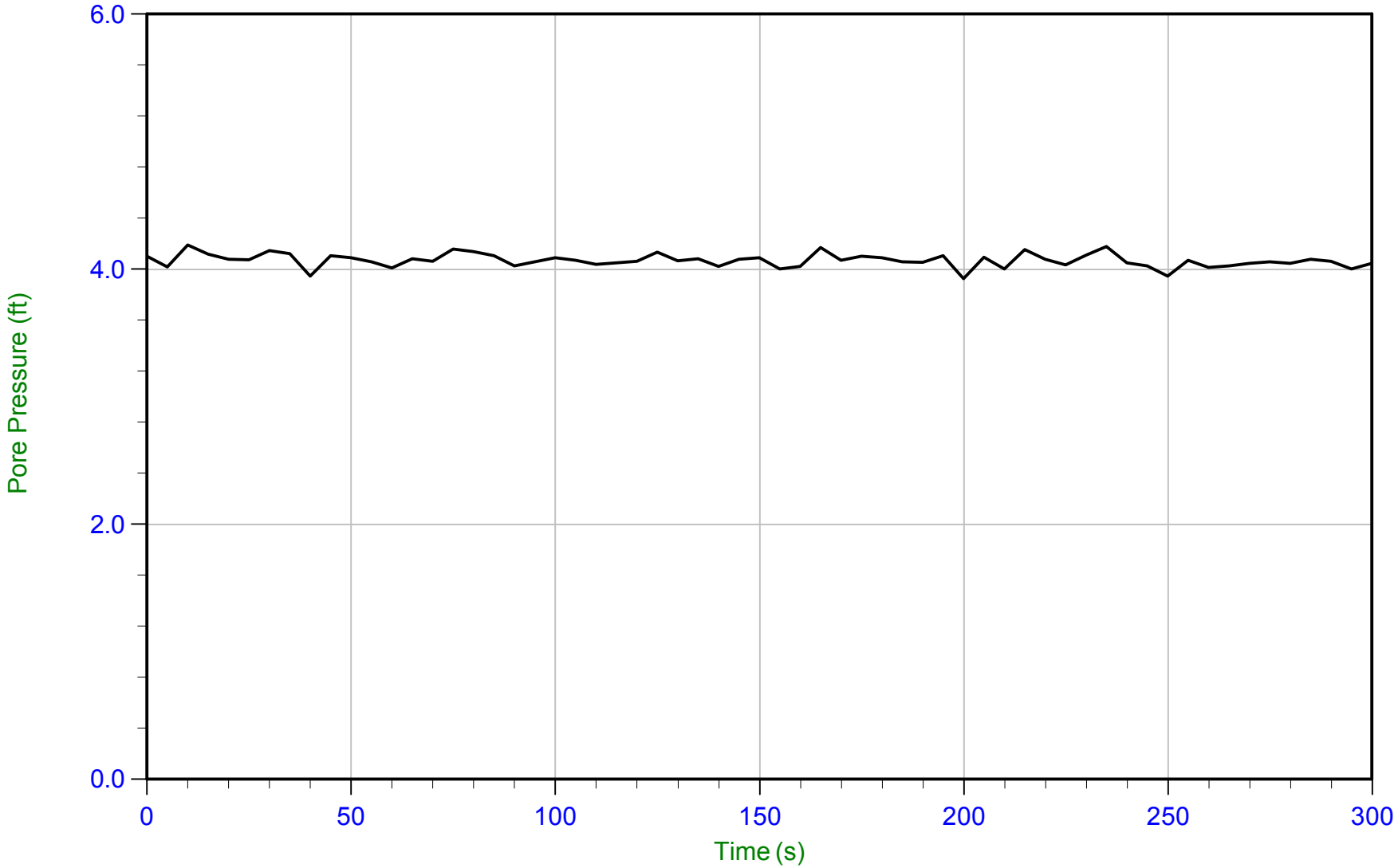
WT: 4.843 m / 15.889 ft
Ueq: 25.8 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 11:17:51
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP26.PPD
Depth: 1.800 m / 5.905 ft
Duration: 300.0 s

U Min: 3.9 ft
U Max: 4.2 ft

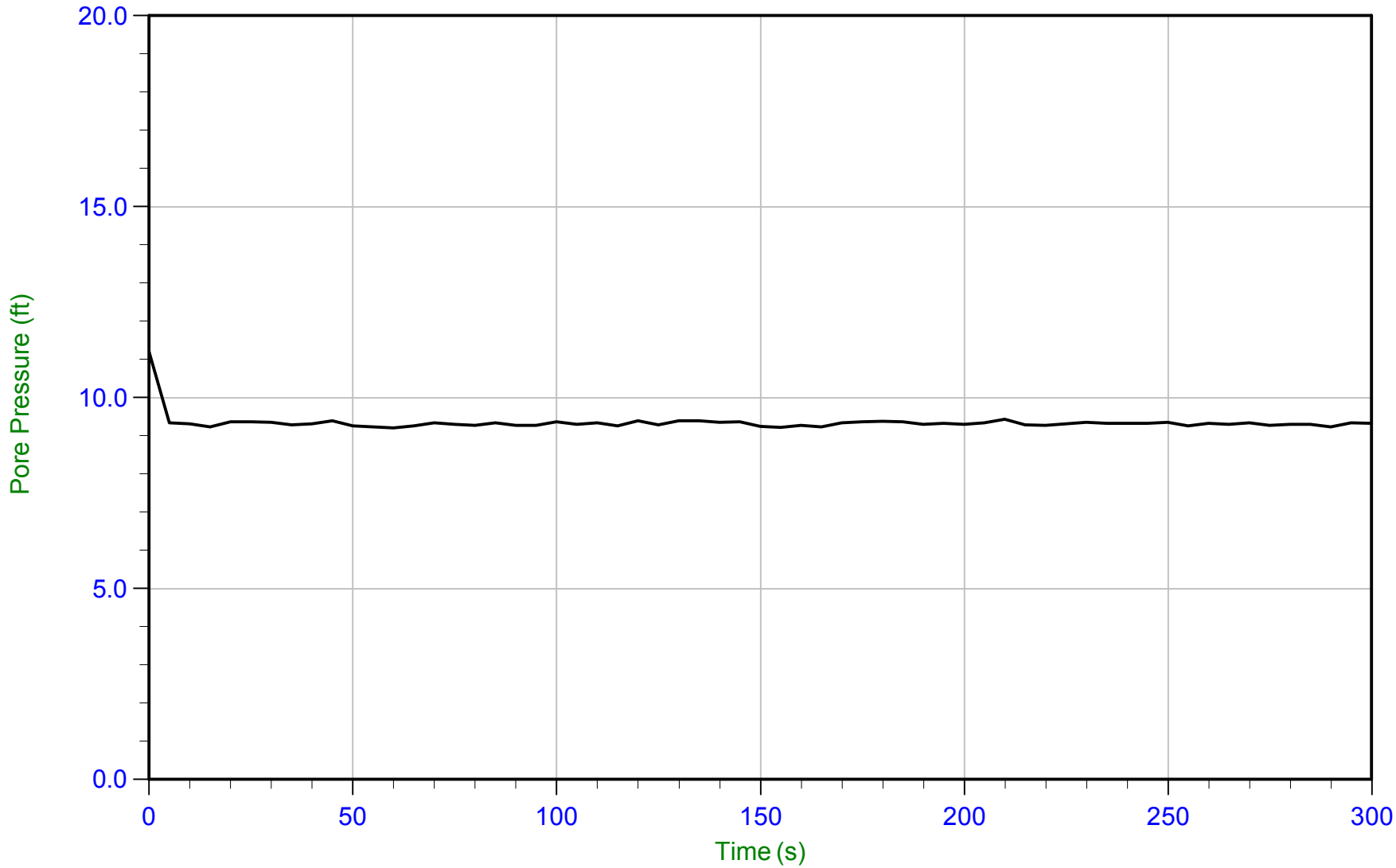
WT: 0.566 m / 1.857 ft
Ueq: 4.0 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 11:17:51
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP26.PPD
Depth: 3.400 m / 11.155 ft
Duration: 300.0 s

U Min: 9.2 ft
U Max: 11.2 ft

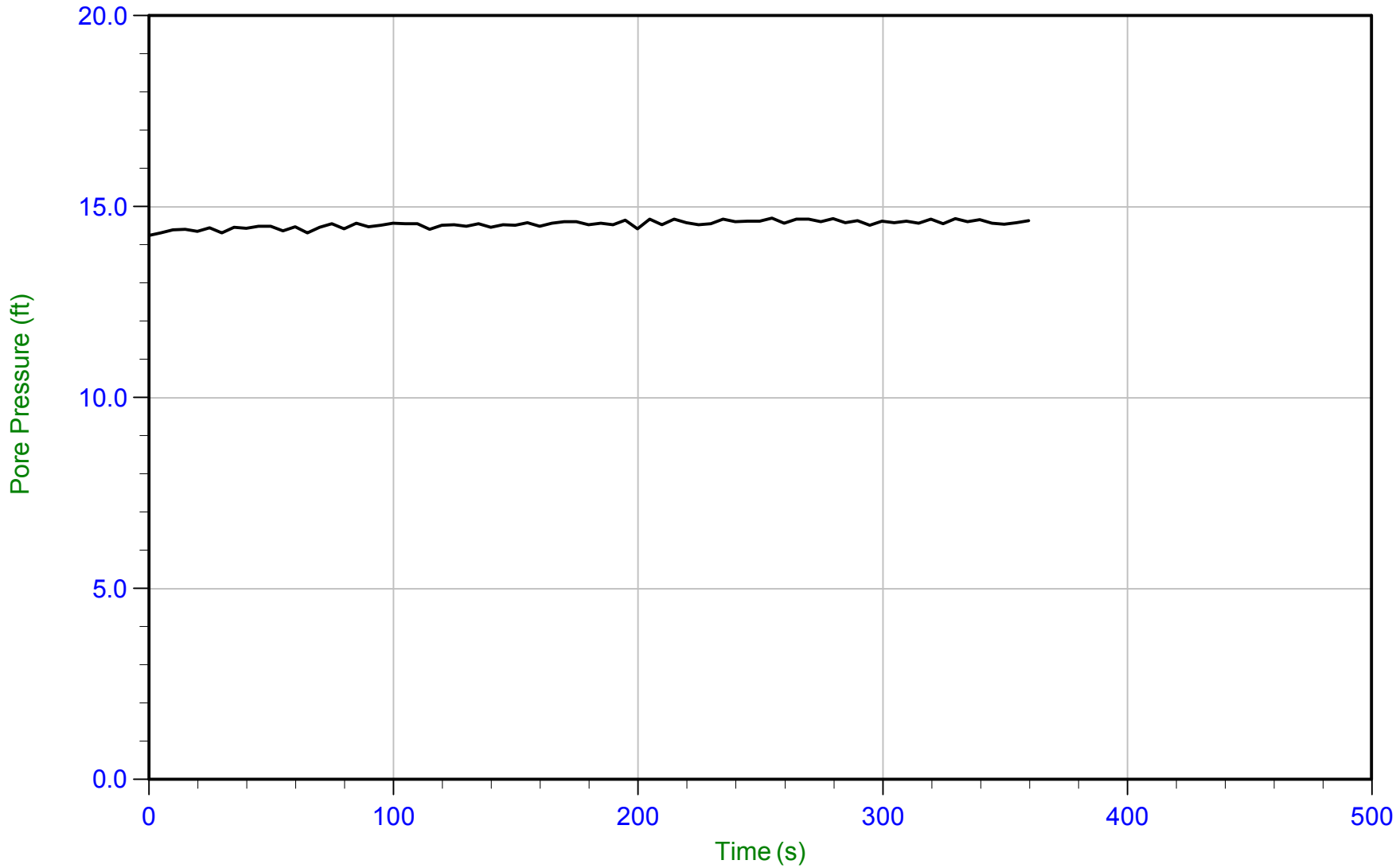
WT: 0.570 m / 1.870 ft
Ueq: 9.3 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 11:17:51
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP26.PPD
Depth: 5.000 m / 16.404 ft
Duration: 360.0 s

U Min: 14.2 ft
U Max: 14.7 ft

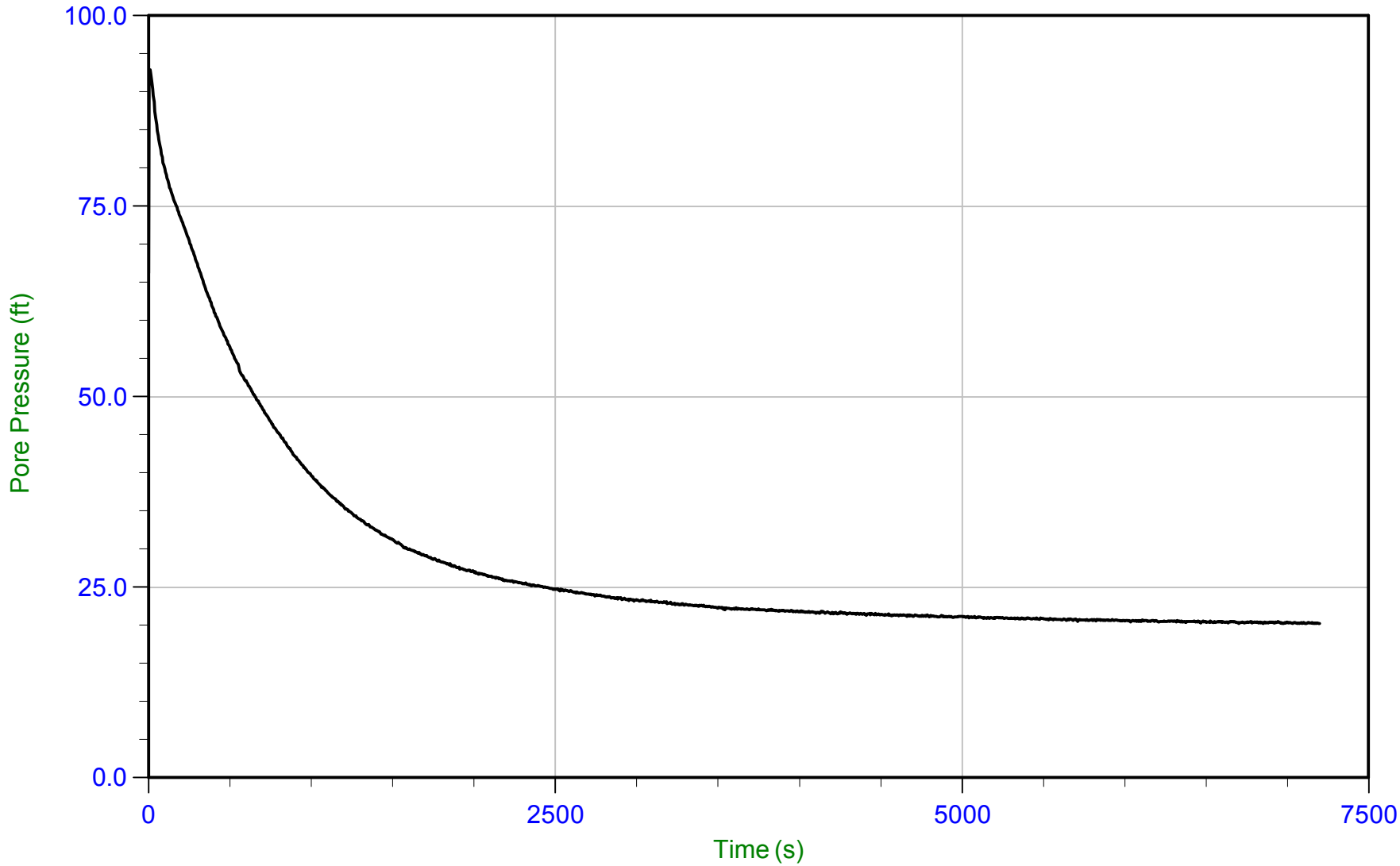
WT: 0.573 m / 1.880 ft
Ueq: 14.5 ft

CONETEC

AECOM

Job No: 15-53070
Date: 17-Aug-2015 11:17:51
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C026
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP26.PPD
Depth: 6.400 m / 20.997 ft
Duration: 7200.0 s

U Min: 20.2 ft
U Max: 92.9 ft

WT: 0.570 m / 1.870 ft
Ueq: 19.1 ft
U(50): 56.02 ft

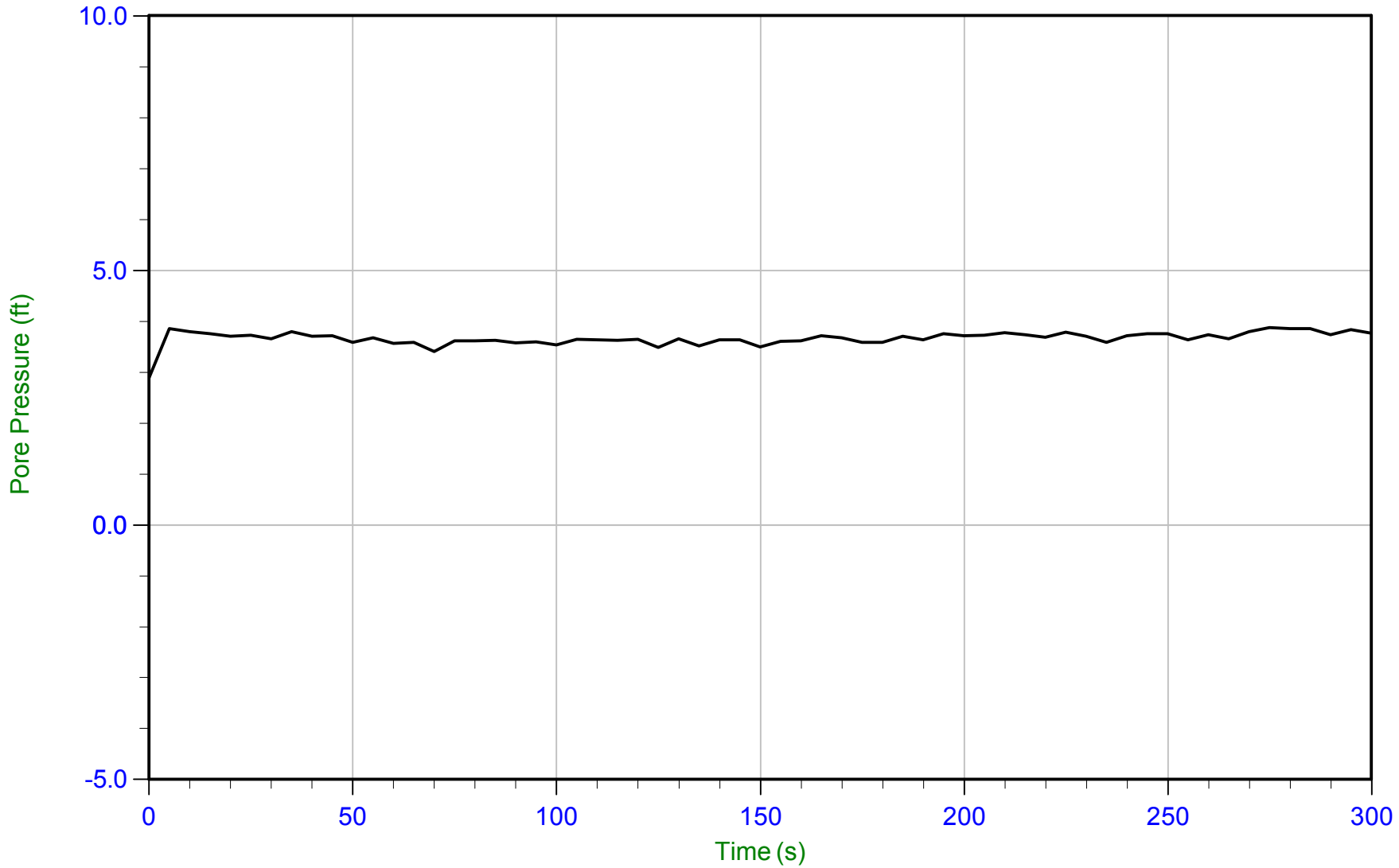
T(50): 501.0 s
Ir: 100
Ch: 1.4 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 12:53:53
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP27.PPD
Depth: 2.500 m / 8.202 ft
Duration: 300.0 s

U Min: 2.9 ft
U Max: 3.9 ft

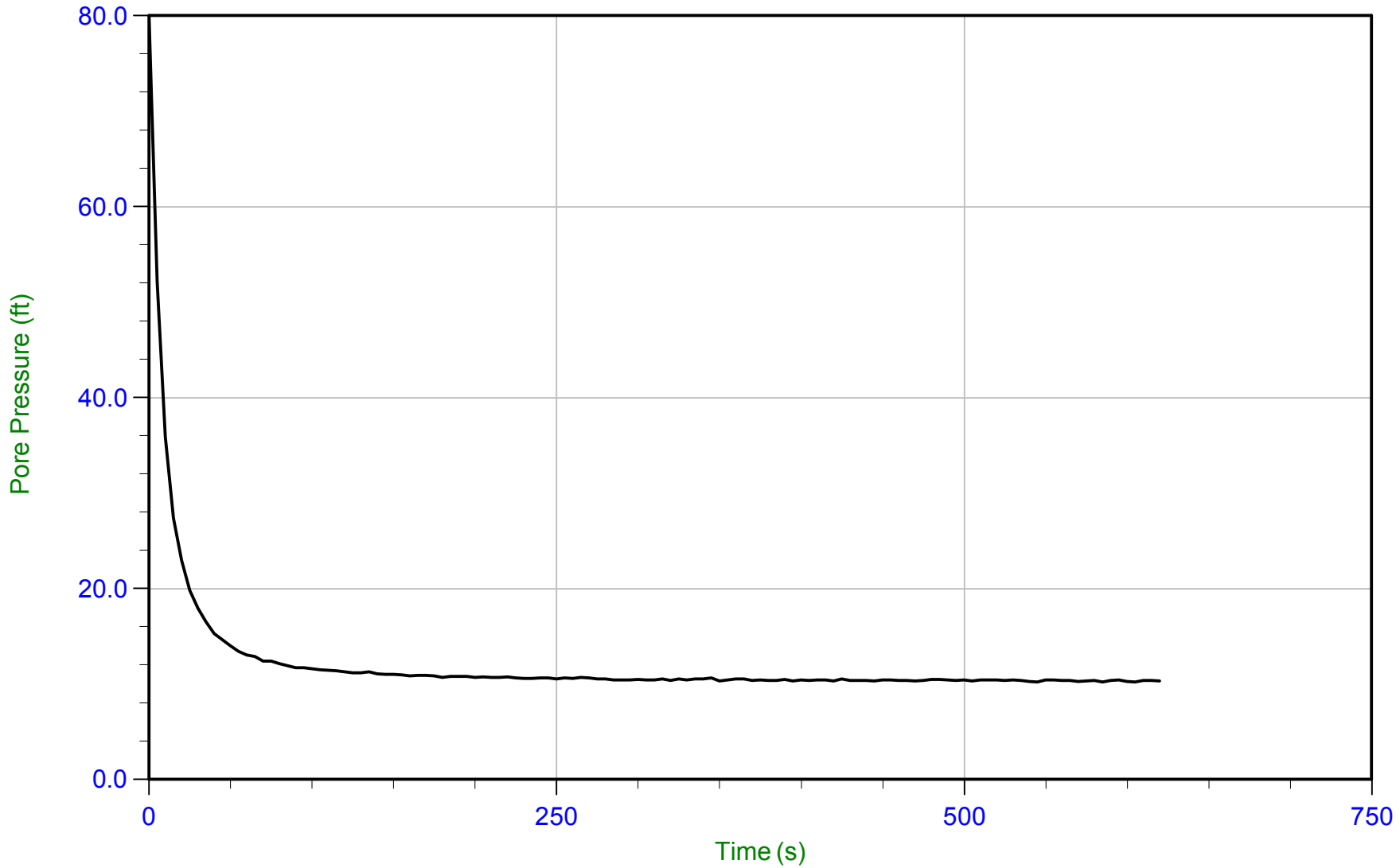
WT: 1.363 m / 4.472 ft
Ueq: 3.7 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 12:53:53
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C027
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP27.PPD
Depth: 4.400 m / 14.436 ft
Duration: 620.0 s

U Min: 10.2 ft
U Max: 80.1 ft

WT: 1.302 m / 4.272 ft
Ueq: 10.2 ft
U(50): 45.12 ft

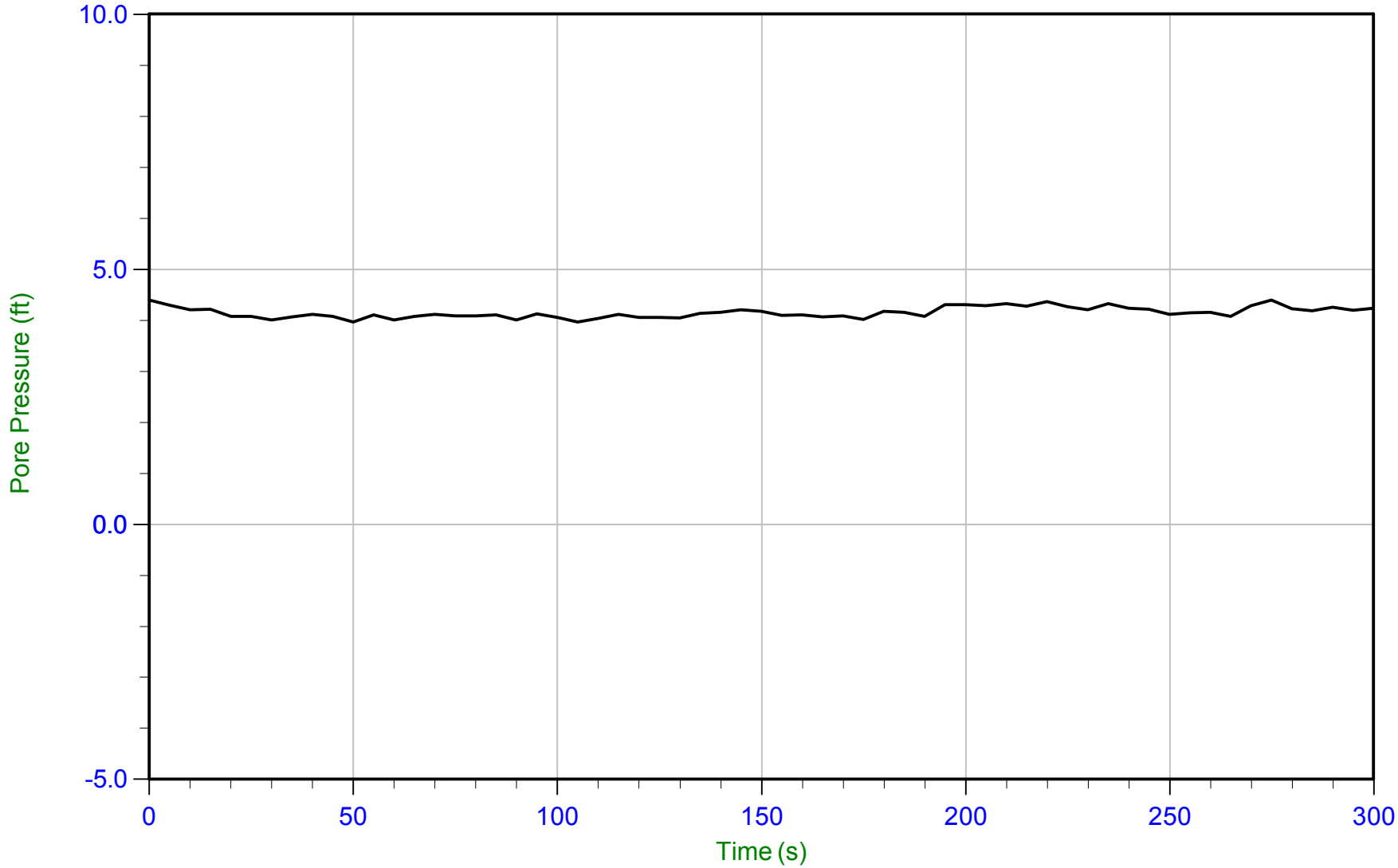
T(50): 7.2 s
Ir: 100
Ch: 98.0 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 08:30:48
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C028
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP28.PPD
Depth: 5.500 m / 18.044 ft
Duration: 300.0 s

U Min: 4.0 ft
U Max: 4.4 ft

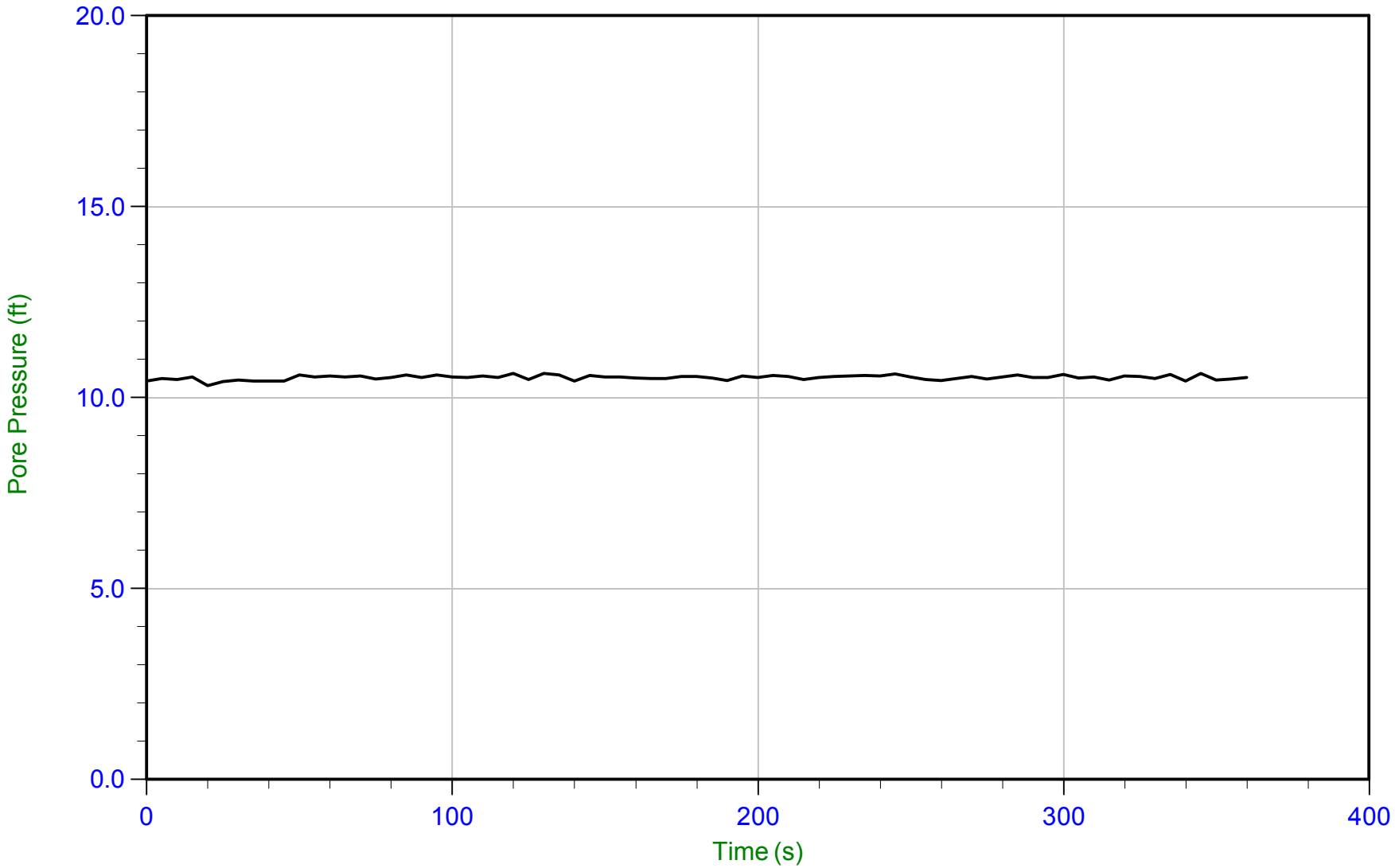
WT: 4.212 m / 13.819 ft
Ueq: 4.2 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 08:30:48
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C028
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP28.PPD
Depth: 7.350 m / 24.114 ft
Duration: 360.0 s

U Min: 10.3 ft
U Max: 10.6 ft

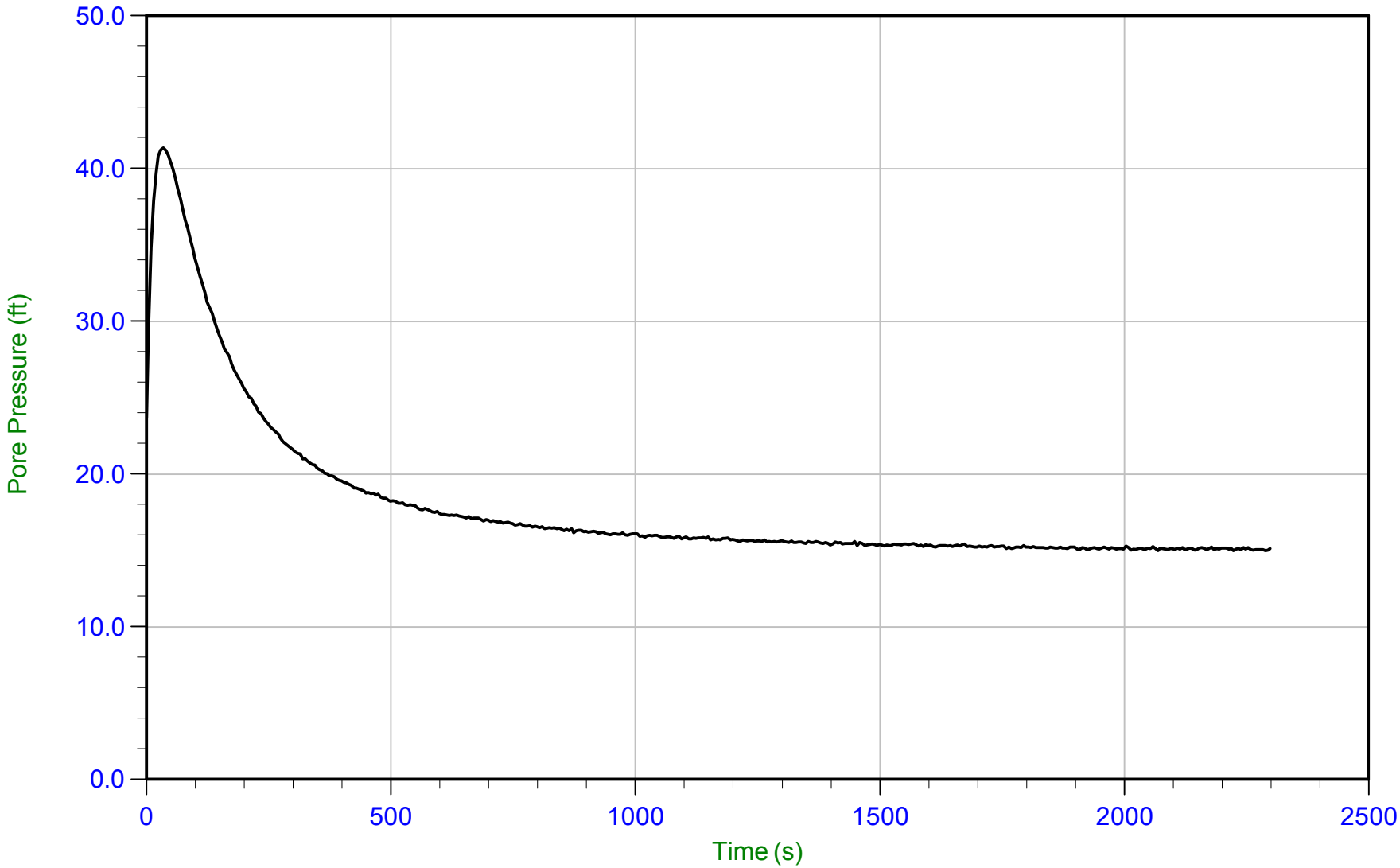
WT: 4.157 m / 13.638 ft
Ueq: 10.5 ft

CONETEC

AECOM

Job No: 15-53070
Date: 18-Aug-2015 08:30:48
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C028
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP28.PPD
Depth: 9.000 m / 29.527 ft
Duration: 2300.0 s

U Min: 15.0 ft
U Max: 41.4 ft

WT: 4.157 m / 13.638 ft
Ueq: 15.9 ft
U(50): 28.63 ft

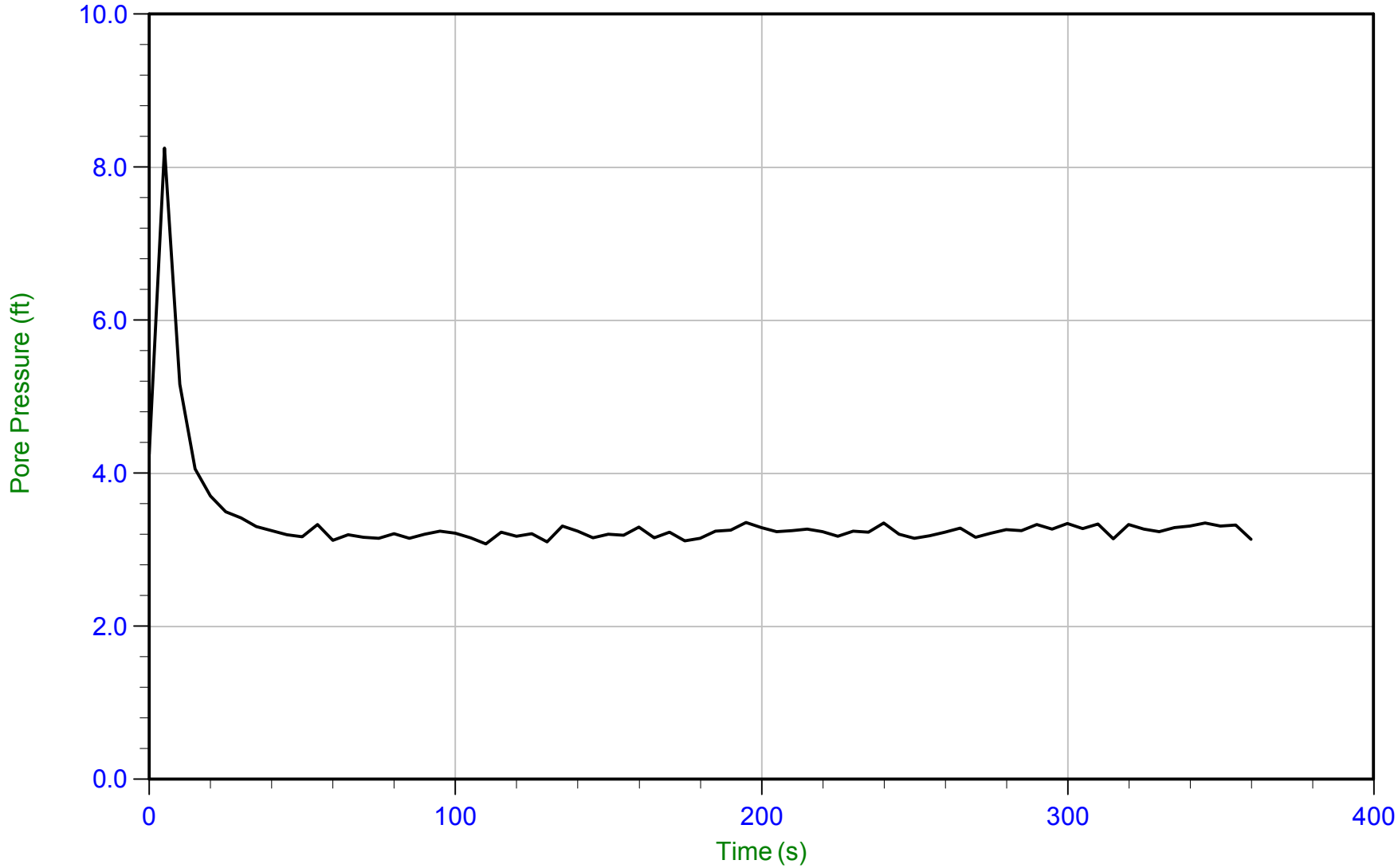
T(50): 120.6 s
Ir: 100
Ch: 5.8 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 14:10:00
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C029
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP29.PPD
Depth: 1.600 m / 5.249 ft
Duration: 360.0 s

U Min: 3.1 ft
U Max: 8.2 ft

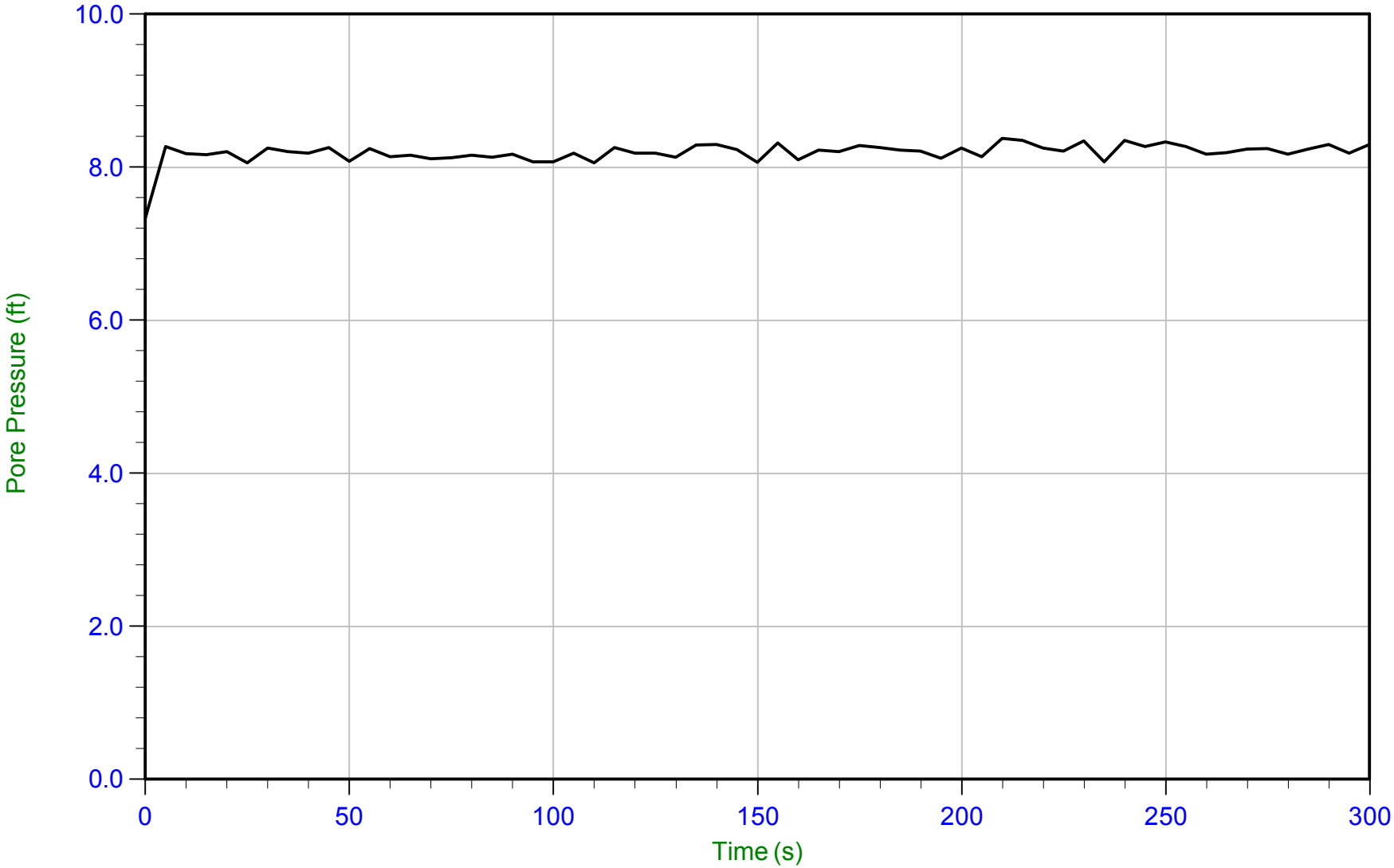
WT: 0.613 m / 2.011 ft
Ueq: 3.2 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 14:10:00
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C029
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP29.PPD
Depth: 3.150 m / 10.335 ft
Duration: 300.0 s

U Min: 7.3 ft
U Max: 8.4 ft

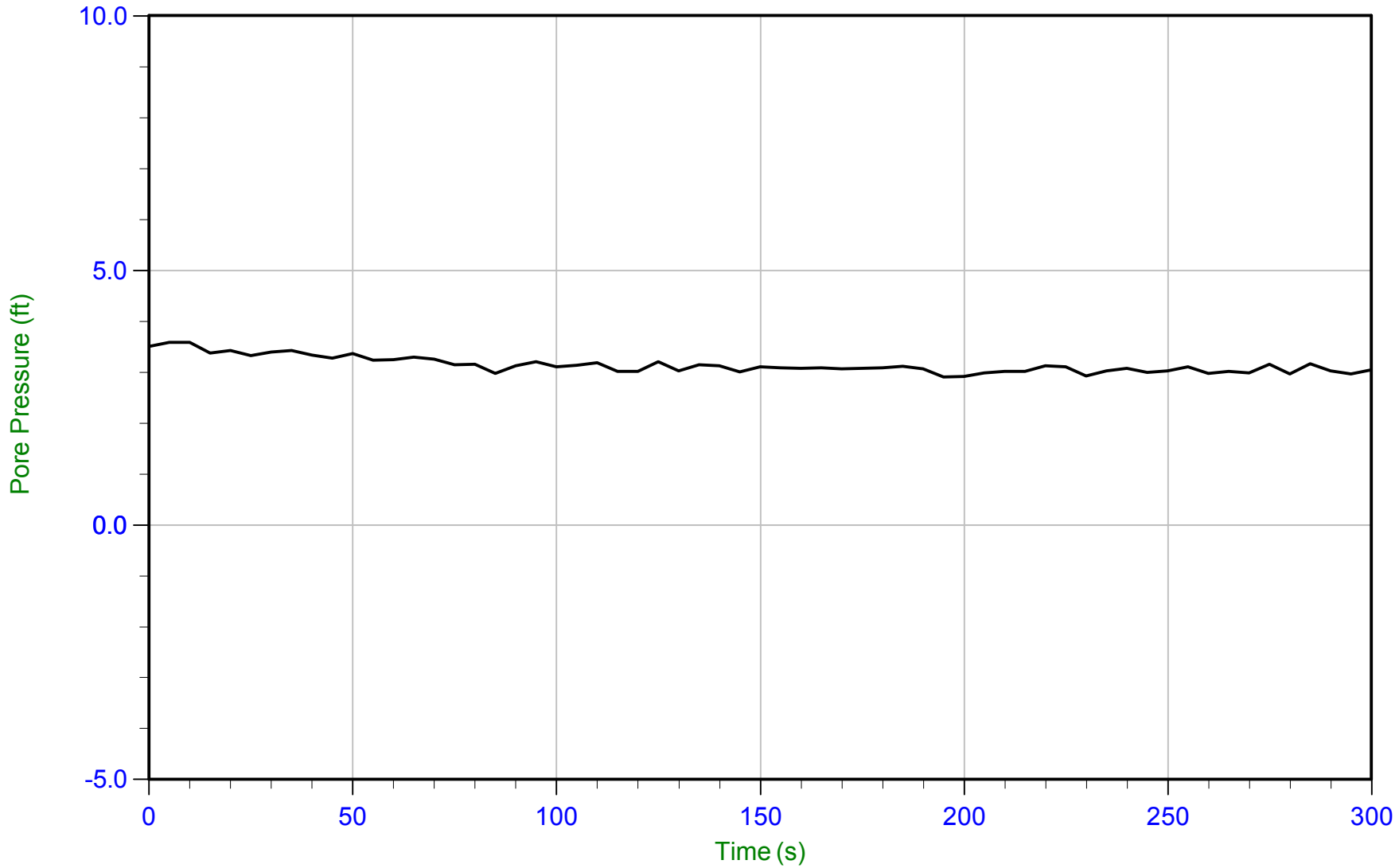
WT: 0.639 m / 2.096 ft
Ueq: 8.2 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 14:42:02
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C030
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP30.PPD
Depth: 1.350 m / 4.429 ft
Duration: 300.0 s

U Min: 2.9 ft
U Max: 3.6 ft

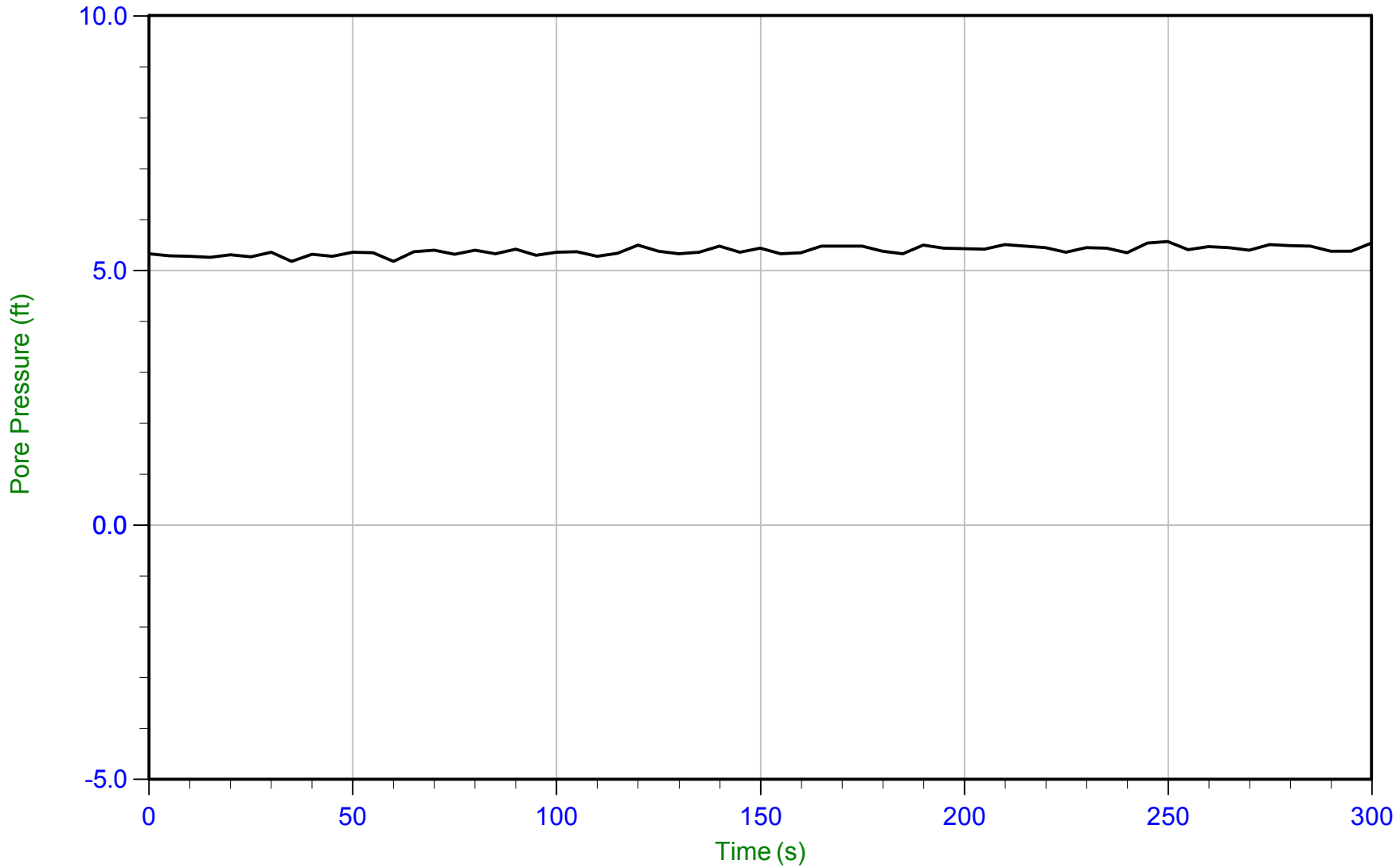
WT: 0.409 m / 1.342 ft
Ueq: 3.1 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 14:42:02
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C030
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP30.PPD
Depth: 2.000 m / 6.562 ft
Duration: 300.0 s

U Min: 5.2 ft
U Max: 5.6 ft

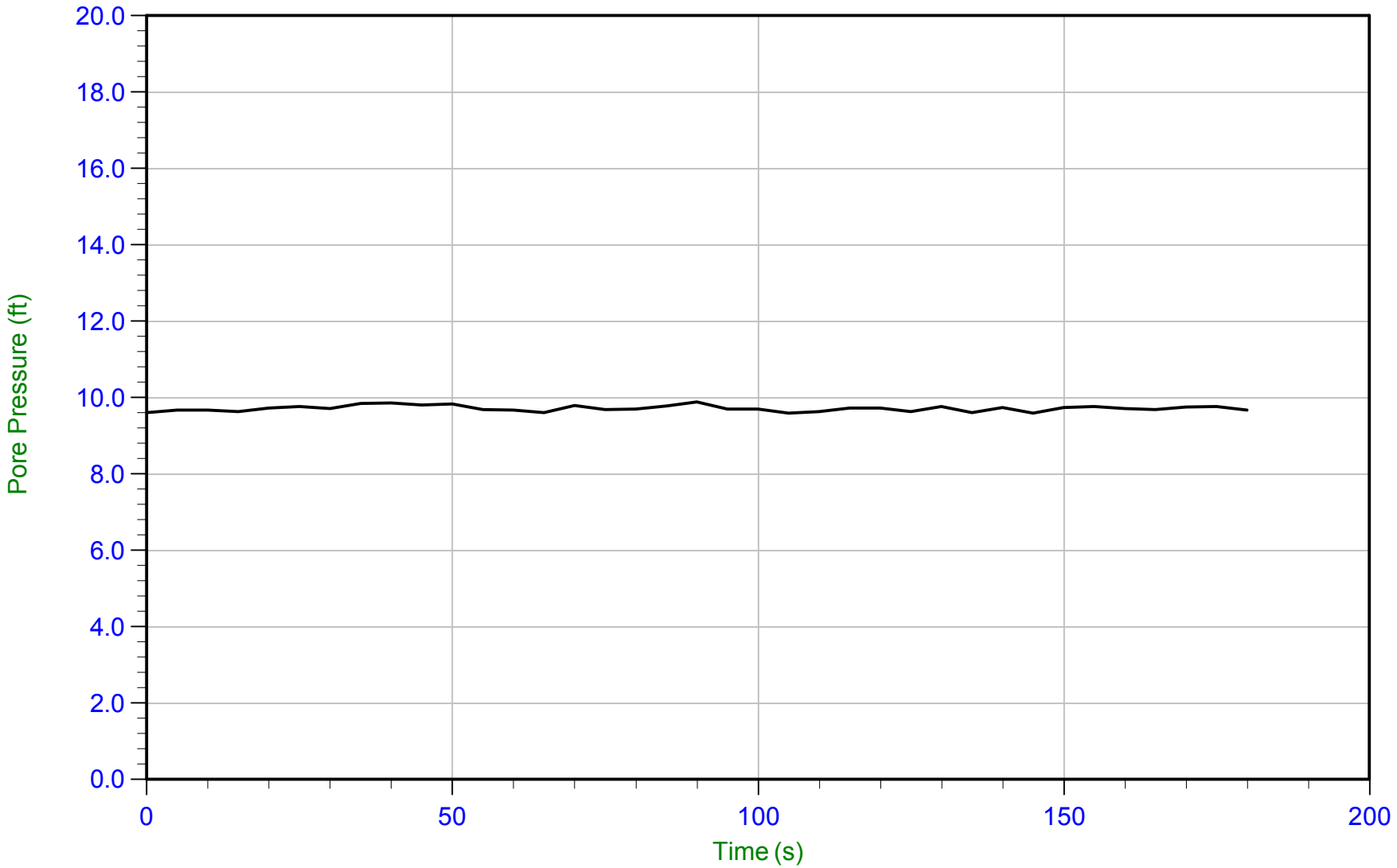
WT: 0.337 m / 1.106 ft
Ueq: 5.5 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 14:42:02
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C030
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP30.PPD
Depth: 3.350 m / 10.991 ft
Duration: 180.0 s

U Min: 9.6 ft
U Max: 9.9 ft

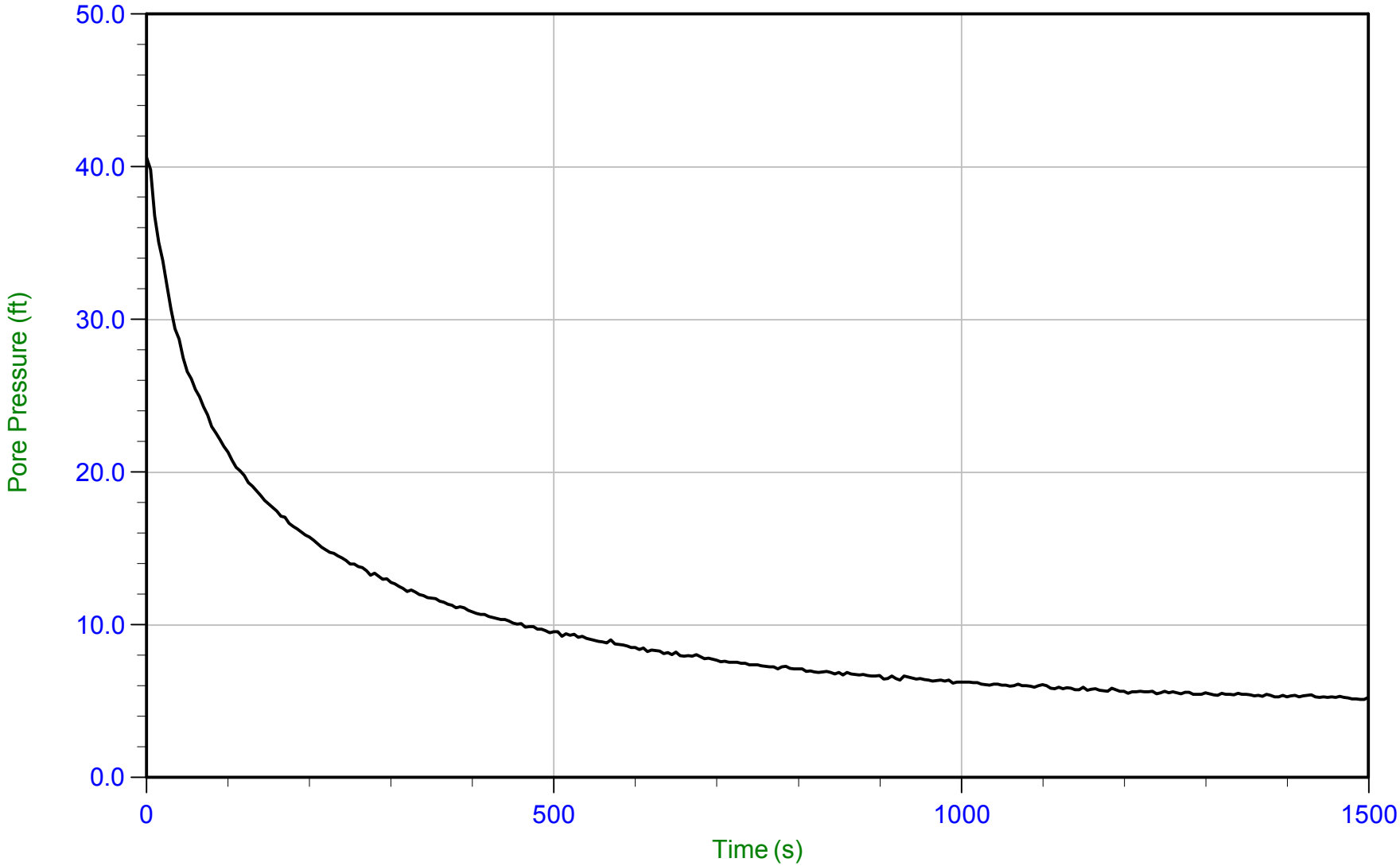
WT: 0.386 m / 1.266 ft
Ueq: 9.7 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 13:13:28
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C031
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP31.PPD
Depth: 2.600 m / 8.530 ft
Duration: 1500.0 s

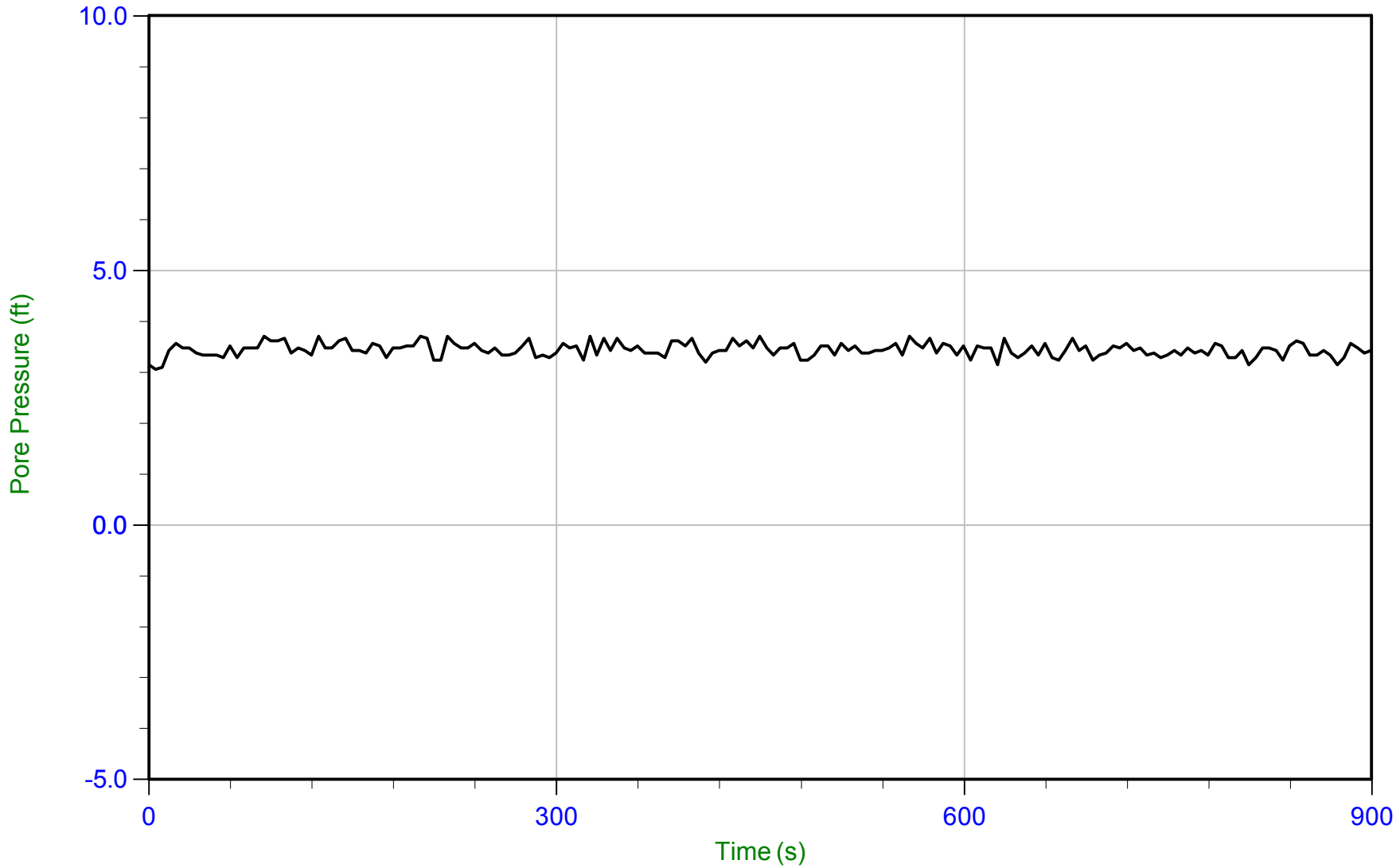
U Min: 5.1 ft
U Max: 40.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 13:32:08
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C032
Cone: 335
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP32.PPD
Depth: 6.150 m / 20.177 ft
Duration: 900.0 s

U Min: 3.0 ft
U Max: 3.7 ft

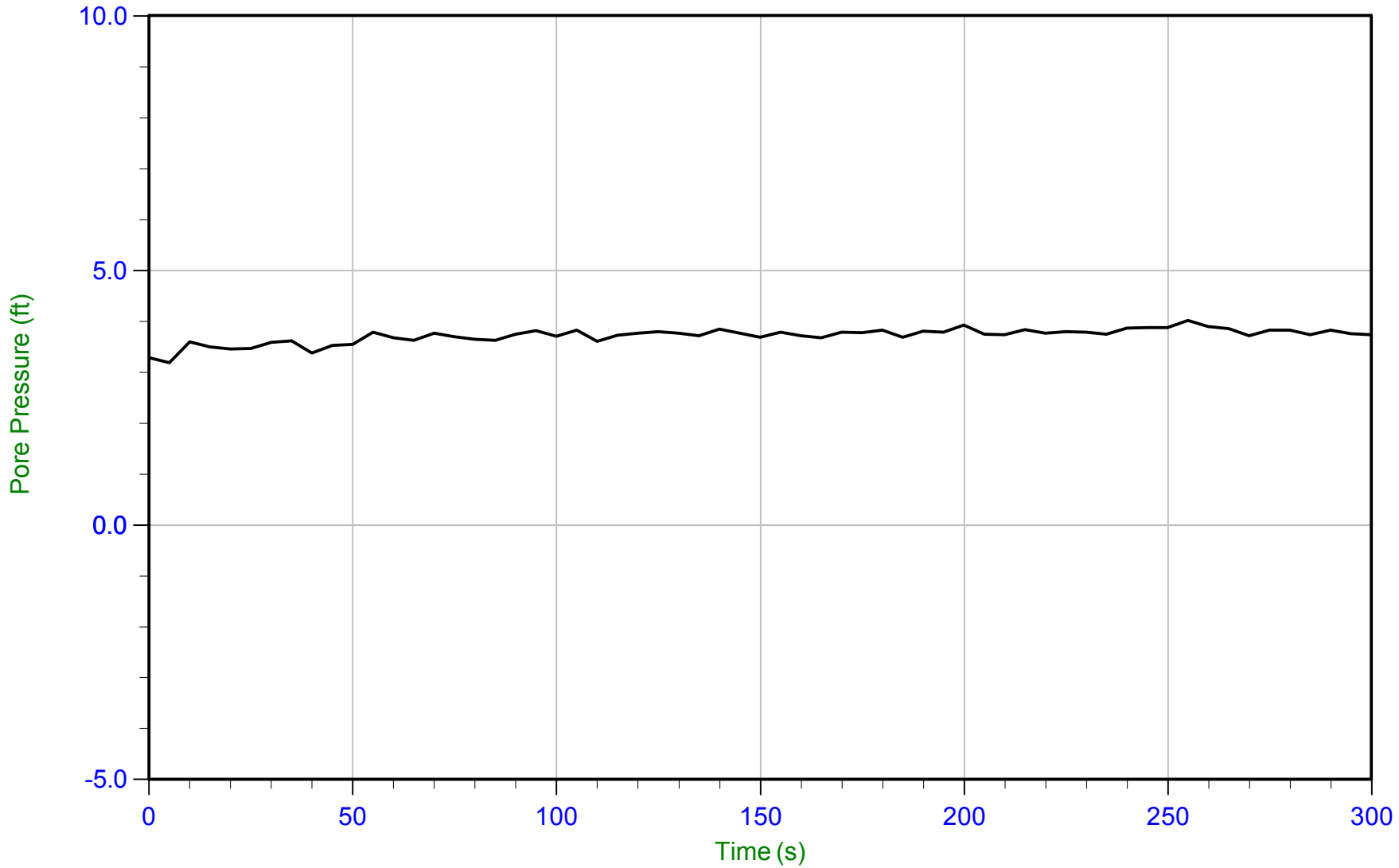
WT: 5.107 m / 16.755 ft
Ueq: 3.4 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 10:29:47
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C033
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP33.PPD
Depth: 8.250 m / 27.067 ft
Duration: 300.0 s

U Min: 3.2 ft
U Max: 4.0 ft

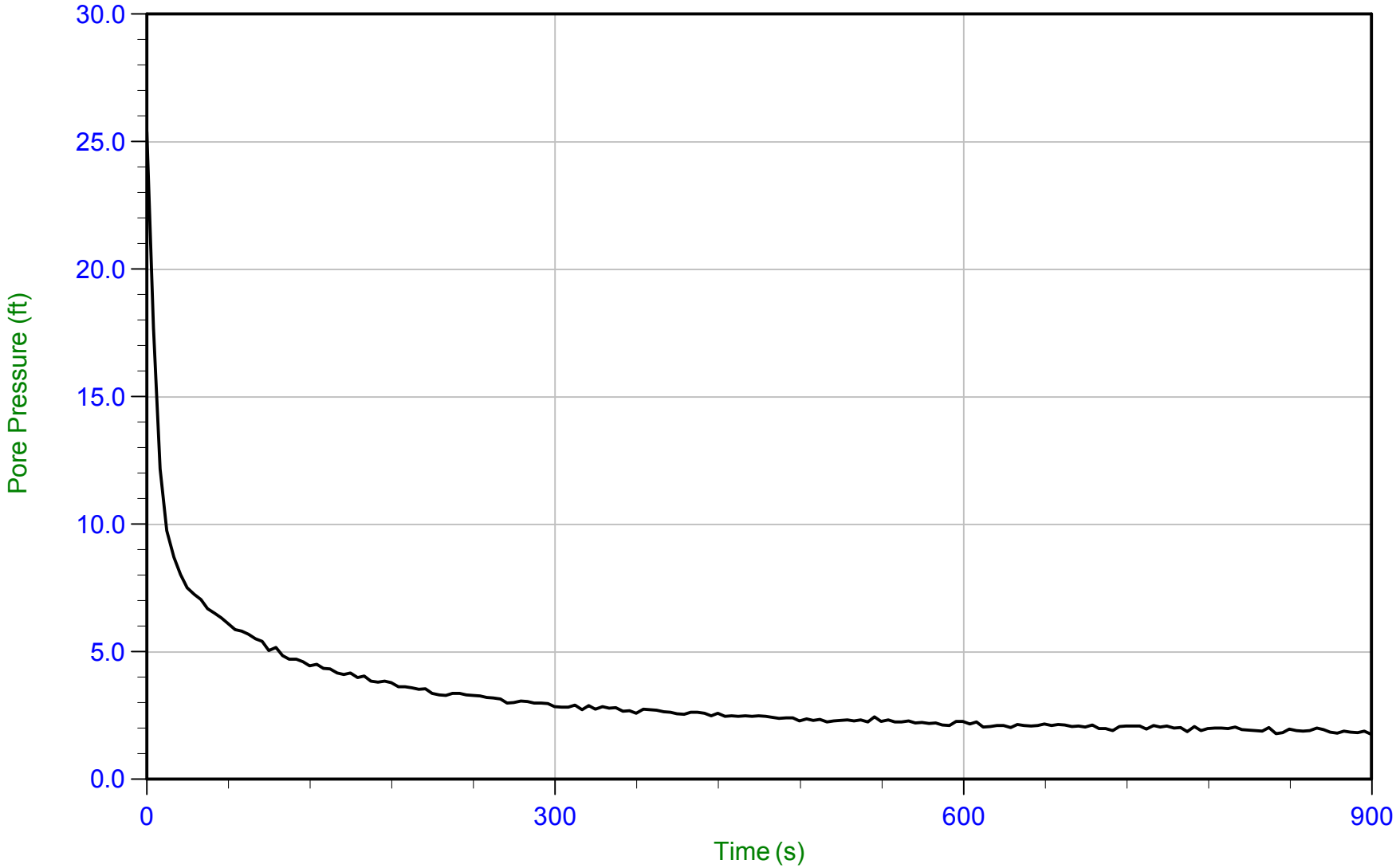
WT: 7.086 m / 23.248 ft
Ueq: 3.8 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 15:46:49
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C034
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP34.PPD
Depth: 1.500 m / 4.921 ft
Duration: 900.0 s

U Min: 1.8 ft
U Max: 25.4 ft

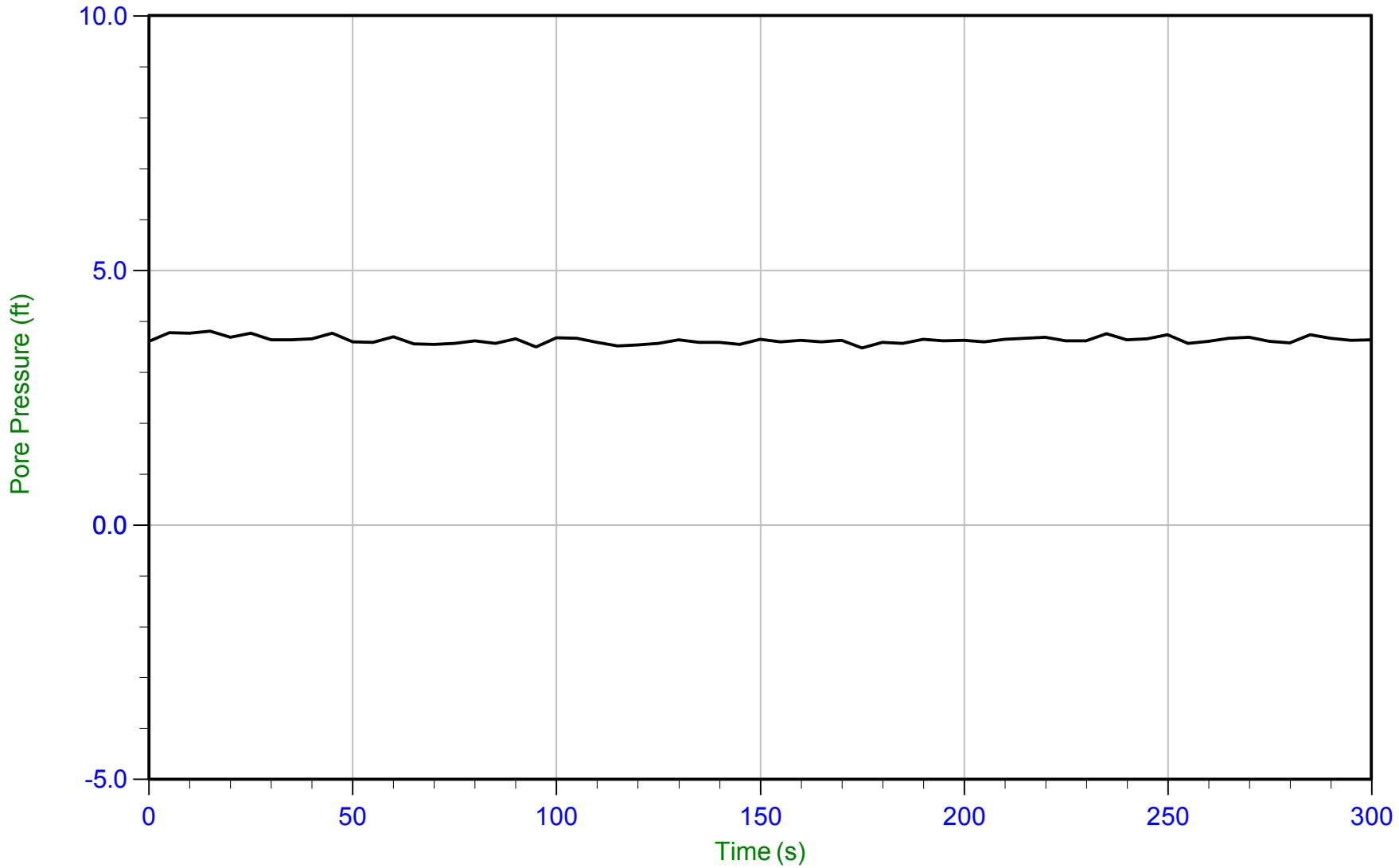
WT: 0.996 m / 3.268 ft
Ueq: 1.7 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 15:46:49
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C034
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP34.PPD
Depth: 7.300 m / 23.950 ft
Duration: 300.0 s

U Min: 3.5 ft
U Max: 3.8 ft

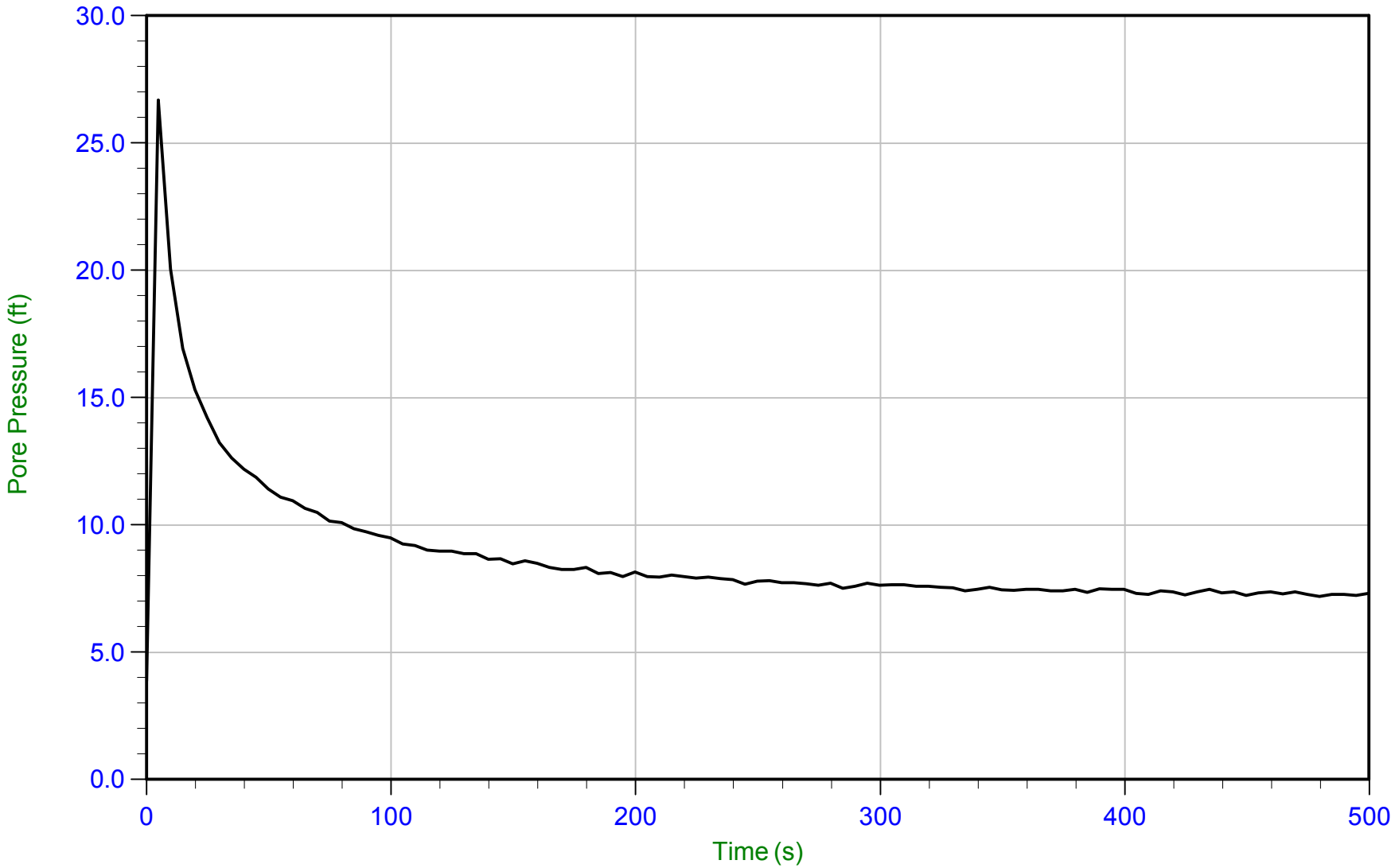
WT: 6.196 m / 20.328 ft
Ueq: 3.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 15:46:49
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C034
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP34.PPD
Depth: 8.350 m / 27.395 ft
Duration: 500.0 s

U Min: 3.9 ft
U Max: 26.7 ft

WT: 6.190 m / 20.308 ft
Ueq: 7.1 ft
U(50): 16.89 ft

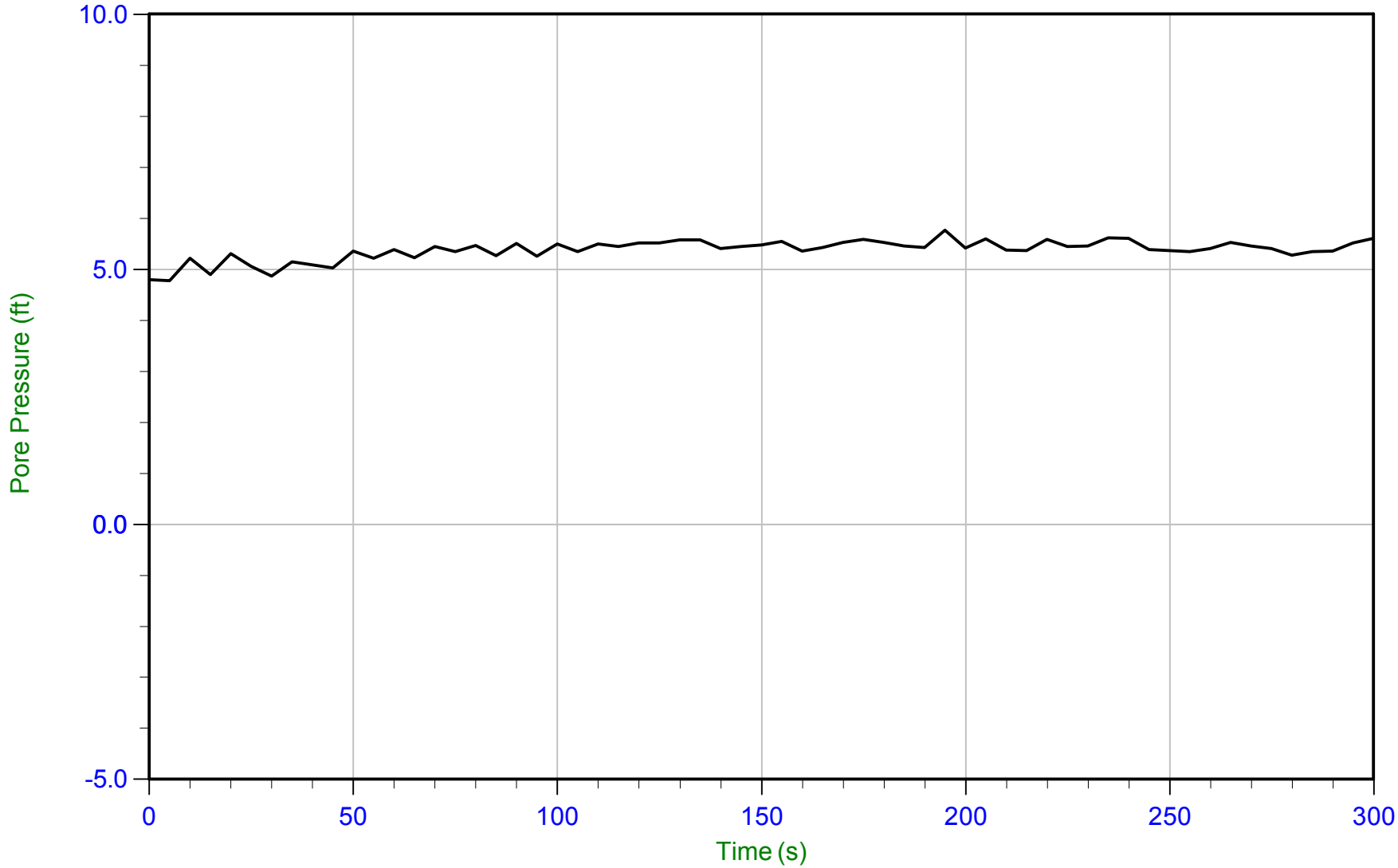
T(50): 10.1 s
Ir: 100
Ch: 69.3 sq cm/min

CONETEC

AECOM

Job No: 15-53070
Date: 13-Aug-2015 09:18:33
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C035
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP35.PPD
Depth: 8.000 m / 26.246 ft
Duration: 300.0 s

U Min: 4.8 ft
U Max: 5.8 ft

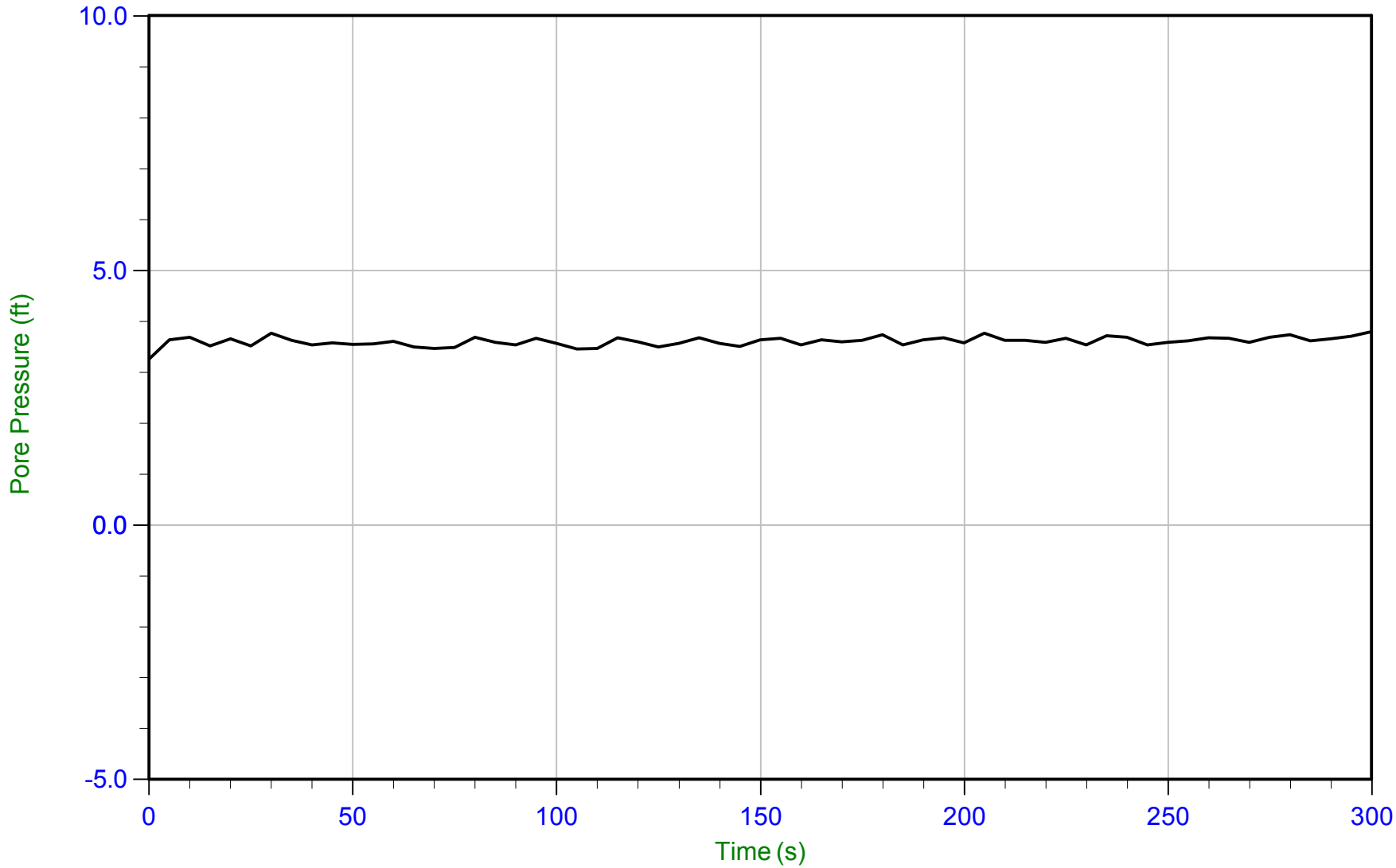
WT: 6.332 m / 20.774 ft
Ueq: 5.5 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 15:30:45
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C036
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP36.PPD
Depth: 1.350 m / 4.429 ft
Duration: 300.0 s

U Min: 3.3 ft
U Max: 3.8 ft

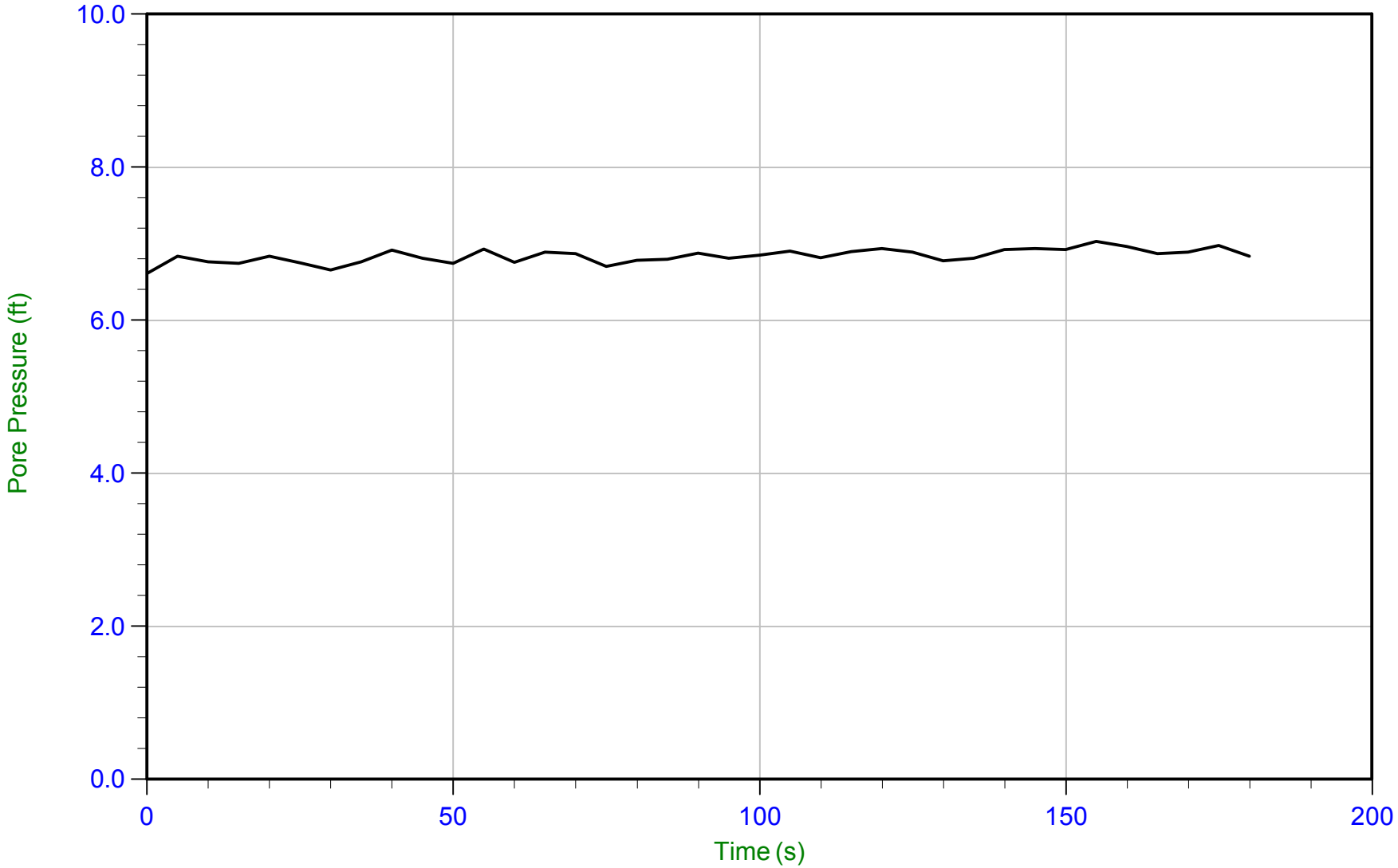
WT: 0.251 m / 0.823 ft
Ueq: 3.6 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 15:30:45
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C036
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP36.PPD
Depth: 2.350 m / 7.710 ft
Duration: 180.0 s

U Min: 6.6 ft
U Max: 7.0 ft

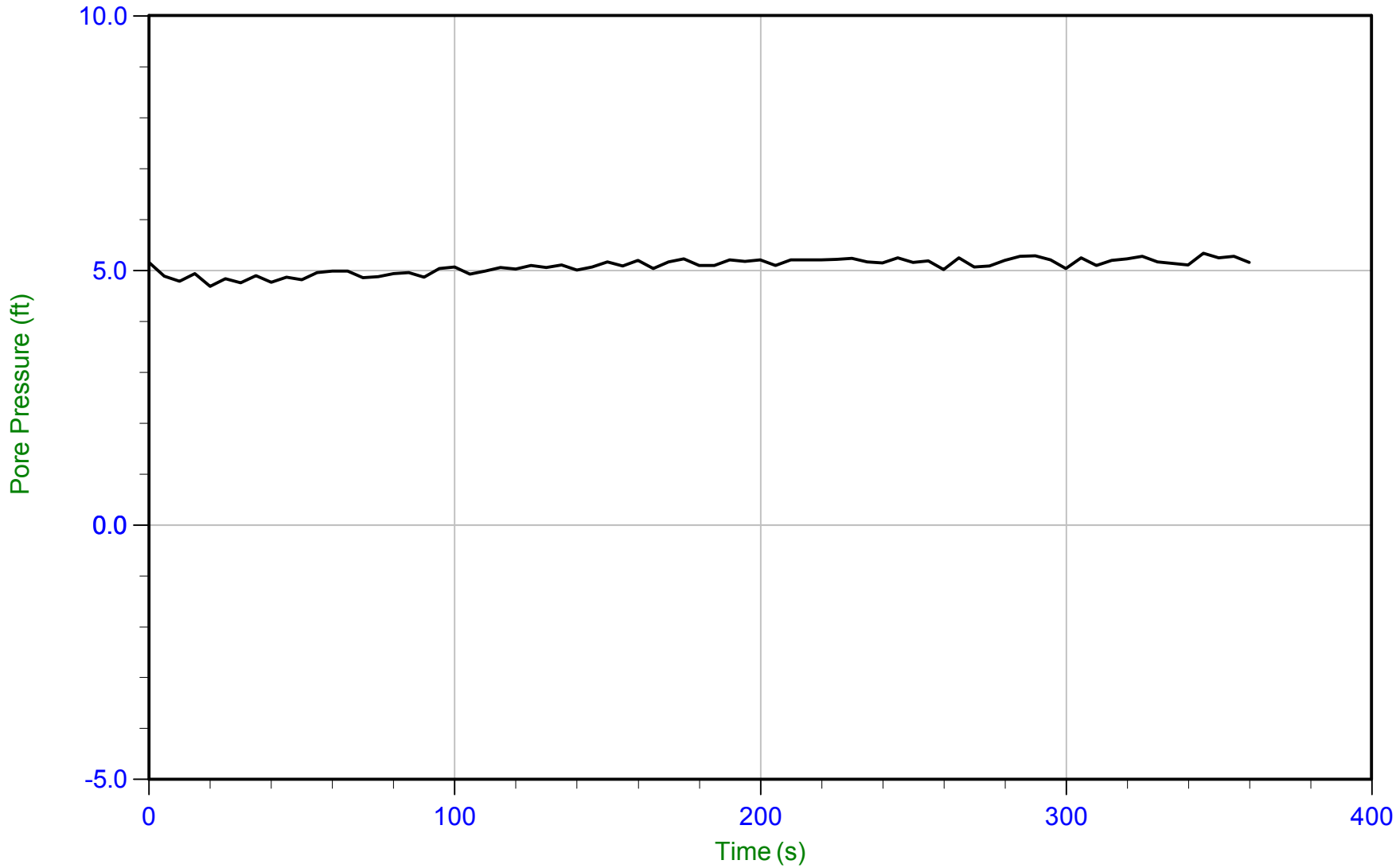
WT: 0.251 m / 0.823 ft
Ueq: 6.9 ft

CONETEC

AECOM

Job No: 15-53070
Date: 14-Aug-2015 16:42:24
Site: Kincaid Power Station, Kincaid, IL

Sounding: KIN-C037
Cone: 374
Cone Area: 15 sq cm



Trace Summary:

Filename: 15-53070_SP37.PPD
Depth: 2.000 m / 6.562 ft
Duration: 360.0 s

U Min: 4.7 ft
U Max: 5.3 ft

WT: 0.414 m / 1.358 ft
Ueq: 5.2 ft

Vibrating Wire Piezometer Installation Summary

CONETEC

Job No: 15-53070
Client: AECOM
Project: Kincaid Power Station
Date: August 13 to 18, 2015
Coordinate Collection Method: TC-7 GPS Receiver (Handheld)
Coordinate Datum: NAD83

Where: P = CF (Li-Lc)

RST VIBRATING WIRE PIEZOMETER INSTALLATION SUMMARY

Location ID	Adjacent CPT	Installation Depth (ft)	Deployment Date	Deployment Time (hr)	Piezometer Serial No.	Cable Length (m)	Piezometer Baseline (Li)	Piezometer After Deployment (Lc)	Calibration Factor (CF)	Calculated Piezometric Surface (P; kPa)	Comments
KIN-P011	KIN-C014	17.01	15-Aug-15	13:00	VW33846	19	8869.0	8741.9	0.11617	14.77	0.9m W. of CPT
KIN-P012	KIN-C015	19.96	15-Aug-15	15:05	VW33850	22	8777.5	8567.0	0.11737	24.71	2.9m S. of CPT
KIN-P004	KIN-C005	18.99	17-Aug-15	16:35	VW33852	22	8810.8	8681.8	0.11468	14.79	1.6m N. of CPT

Attachment E. Lab Test Data

Terracon Laboratory

Test Results

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test Grade NOTE*	USCS Symbol
KIN-B001	S1	1.0	2.5	11.8														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S2	3.5	5.0															
	Color		NO RECOVERY							**Visual Classification**								
	S3	6.0	7.5	20.8		39	23	23	Note*									ML
	Color		Brown							**Visual Classification**			FILL: Silt with sand					
	S4	8.5	10.0															
	Color		NO RECOVERY							**Visual Classification**								
	S5	12.0	14.0															
	Color		No testing assigned							**Visual Classification**								
	S6	14.0	16.0															
	Color		POOR RECOVERY - no testing assigned							**Visual Classification**								
	S7	16.0	18.0															
	Color		No testing assigned							**Visual Classification**								
	S8	18.5	20.0	8.9		23	15	8	**sieve		2.750							CL-ML
	Color		Brown and gray							**Visual Classification**			Sandy silty clay, trace fine gravel					
	S9	23.5	25.0	8.9														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S10	28.5	30.0	10.8														
	Color		Gray							**Visual Classification**			Sandy lean clay					

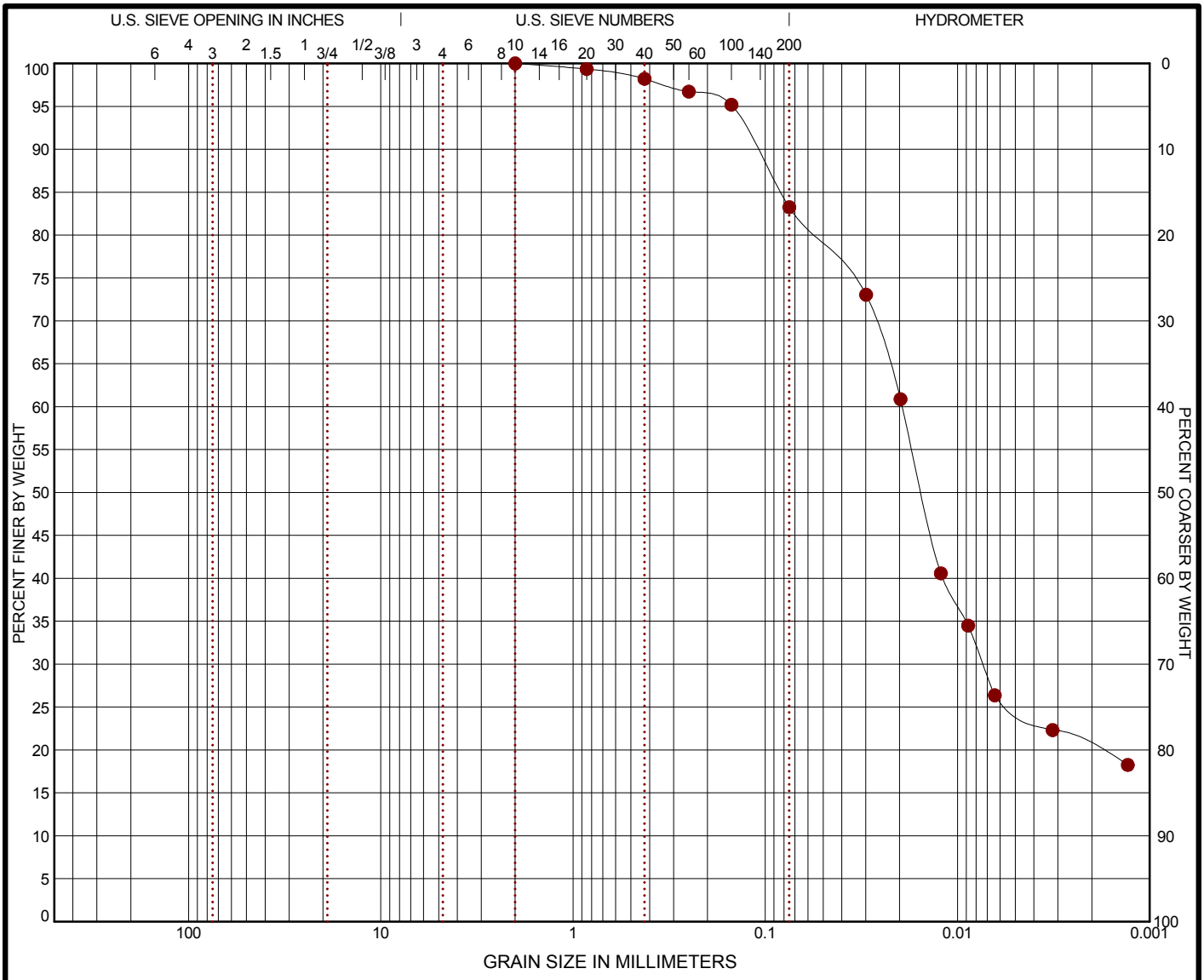
TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B001**	**6**	**0.0**	**0.0**	**16.8**	**58.3**		**24.9**	**ML**

	GRAIN SIZE
	●
D_{60}	**0.019**
D_{30}	**0.007**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	
#10	**100.0**
#20	**99.35**
#40	**98.2**
#60	**96.71**
#100	**95.18**
#200	**83.24**

SOIL DESCRIPTION
● SILT with SAND(ML)

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

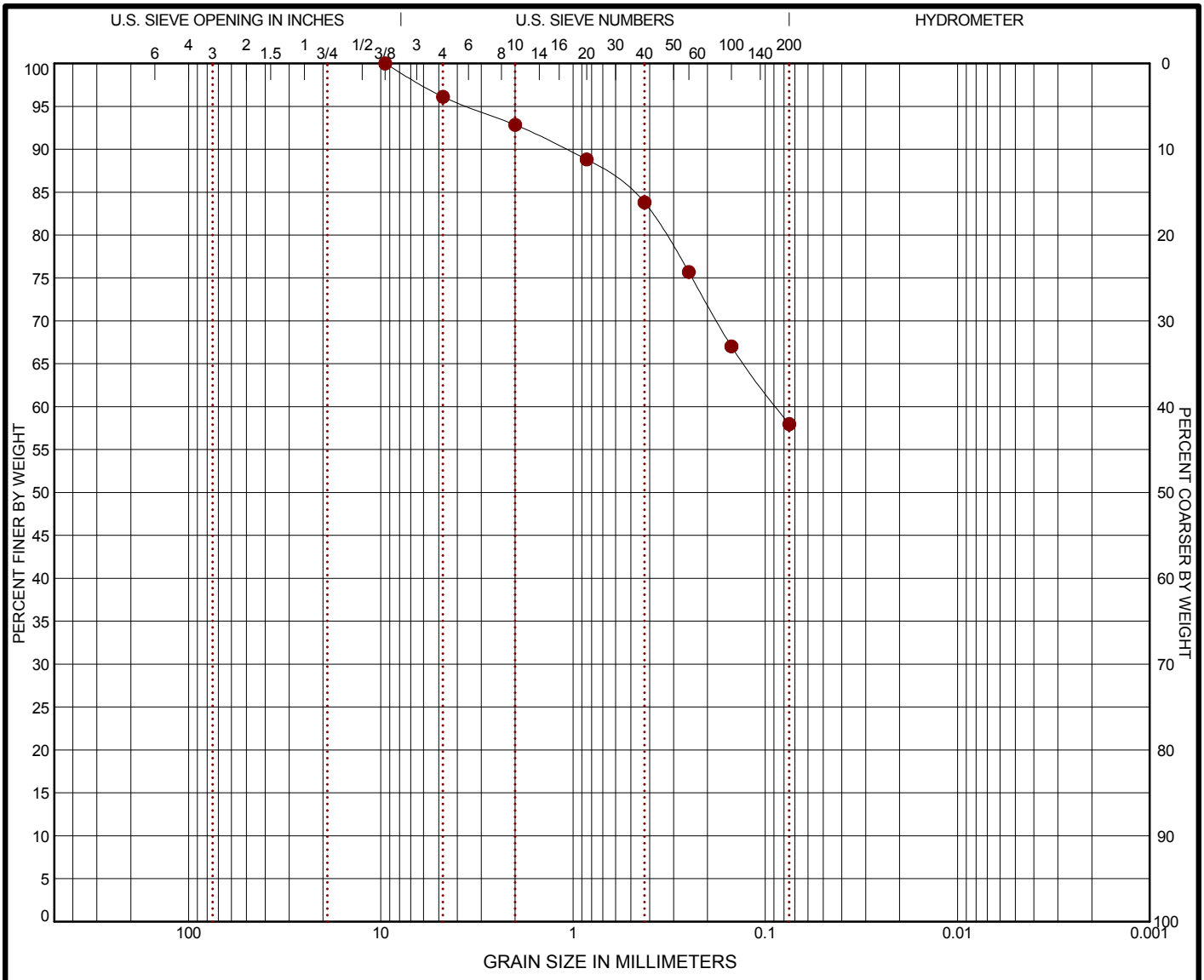
PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B001**	**18.5**	**0.0**	**3.9**	**38.1**		**58.0**		**CL-ML**

	GRAIN SIZE
	●
D_{60}	**0.088**
D_{30}	
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●		
1 1/2"			
1"			
3/4"			
1/2"			
3/8"	**100.0**		
#4	**96.1**		
#10	**92.84**		
#20	**88.82**		
#40	**83.81**		
#60	**75.69**		
#100	**67.03**		
#200	**57.97**		

SOIL DESCRIPTION
● SANDY SILTY CLAY(CL-ML)

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/25/15

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-BOO2	S1	1.0	2.5	18.1														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.0	5.0	19.0	109.8	38	17	21		Note*						Note*	Note*	
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay, trace sand and gravel					
	S3	6.0	7.5	13.9														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.5	28.4		48	22	26										
	Color		Dark gray (ORGANIC CONTENT = 5.9%)							**Visual Classification**			Lean clay					
	S5	13.5	15.0	26.2	NA													
	Color		Brown and gray							**Visual Classification**			Lean clay					
	S6	15.0	17.0	27.5	95.2	41	17	24		Note*			Note*		Note*	Note*	Note*	
	Color		Gray and yellowish brown, trace dark gray							**Visual Classification**			Lean clay, trace sand and gravel					
	S7	18.5	20.0	27.1														
	Color		Brown and gray							**Visual Classification**			Lean clay, trace fine sand					
	S8	23.5	25.0	12.6	135.9	22	14	8										
	Color		Brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S9	28.5	30.0	8.4					** Sieve									
	Color		Gray							**Visual Classification**			Sandy lean clay					
	S10	33.5	35.0	8.9														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S11	38.5	40.0	8.8														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S12	43.5	45.0	11.9					** Sieve									
	Color		Brown and gray							**Visual Classification**			Sandy lean clay					

TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-BOO2	S13	48.5	50.0															
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					

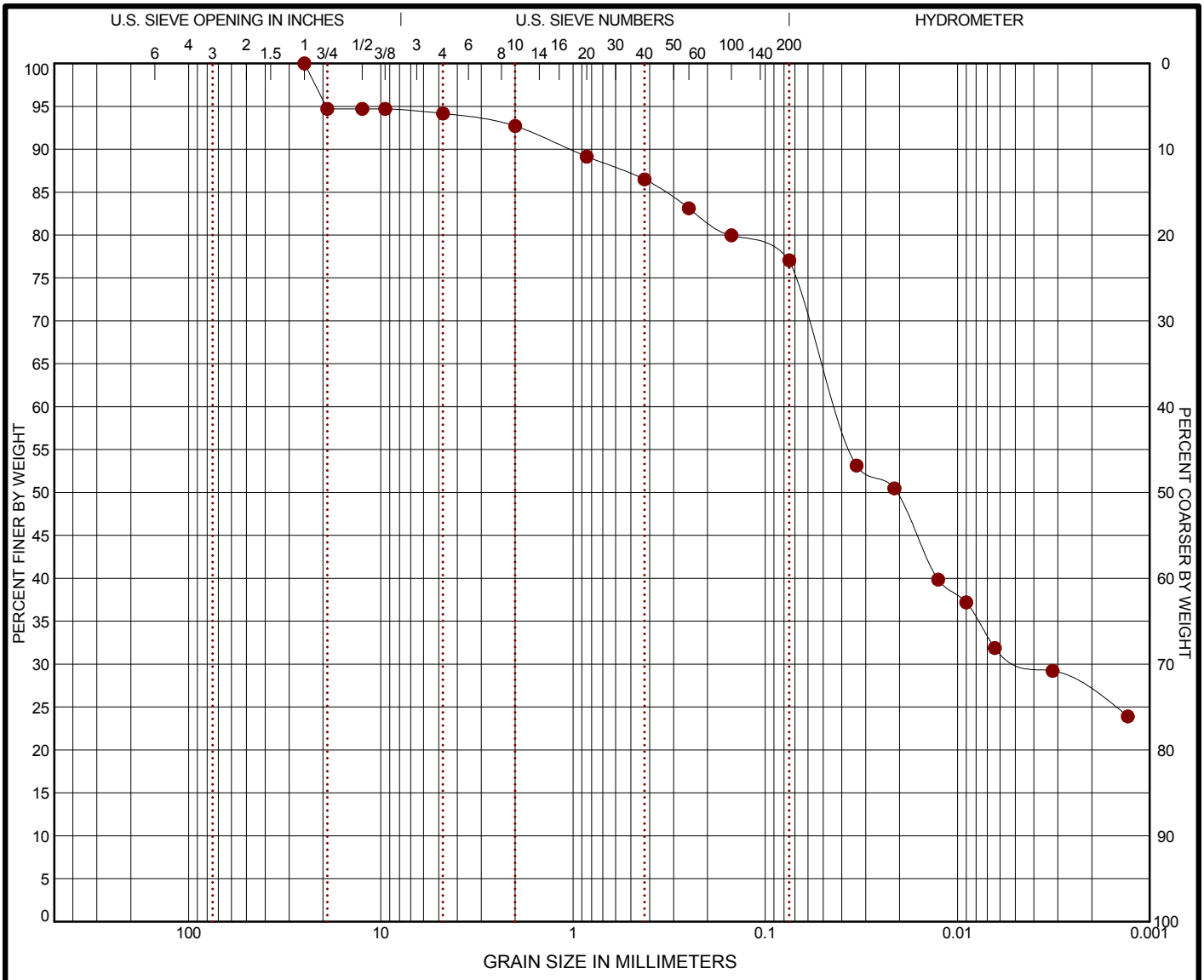
TESTED BY: _____
APPROVED BY: _____

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B002**	**3**	**0.0**	**5.8**	**17.1**	**46.1**		**30.9**	

	GRAIN SIZE
●	
D_{60}	**0.042**
D_{30}	**0.004**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	**100.0**
3/4"	**94.7**
1/2"	**94.7**
3/8"	**94.7**
#4	**94.17**
#10	**92.71**
#20	**89.14**
#40	**86.49**
#60	**83.12**
#100	**79.97**
#200	**77.06**

SOIL DESCRIPTION
●

REMARKS
● Dispersion: 7.3%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

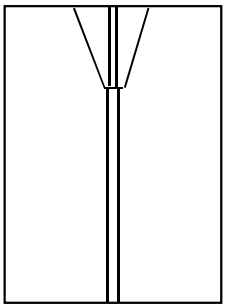
CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B002, S2, 3.0-5.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 21.1%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Grayish Brown Clay

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	7.0	15	0.47						X	X	
2	2	8.0	15	0.53						X	X	
3	2	8.0	15	0.53						X	X	
4	2	8.0	15	0.53						X	X	
5	2	8.5	15	0.57						X	X	
6	2	8.5	15	0.57						X	X	
7	2	9.0	15	0.60						X	X	
8	2	9.0	15	0.60						X	X	
9	2	9.0	15	0.60						X	X	
10	2	9.0	15	0.60						X	X	
1	7	15.0	15	1.00						X	X	
2	7	15.5	15	1.03						X	X	
3	7	16.0	15	1.07						X	X	
4	7	16.0	15	1.07						X	X	
5	7	16.5	15	1.10						X	X	
1	15	20.0	15	1.33						X	X	
2	15	21.0	15	1.40						X	X	
3	15	21.0	15	1.40						X	X	
4	15	21.0	15	1.40						X	X	
5	15	21.0	15	1.40						X	X	
1	40	62.0	30	2.07						X	X	
2	40	60.0	30	2.00						X	X	
3	40	61.0	30	2.03						X	X	
4	40	61.0	30	2.03						X	X	
5	40	61.0	30	2.03						X	X	

CLASSIFICATION = **ND1**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B002 S2 3.0-5.0 feet

2 MIN

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive

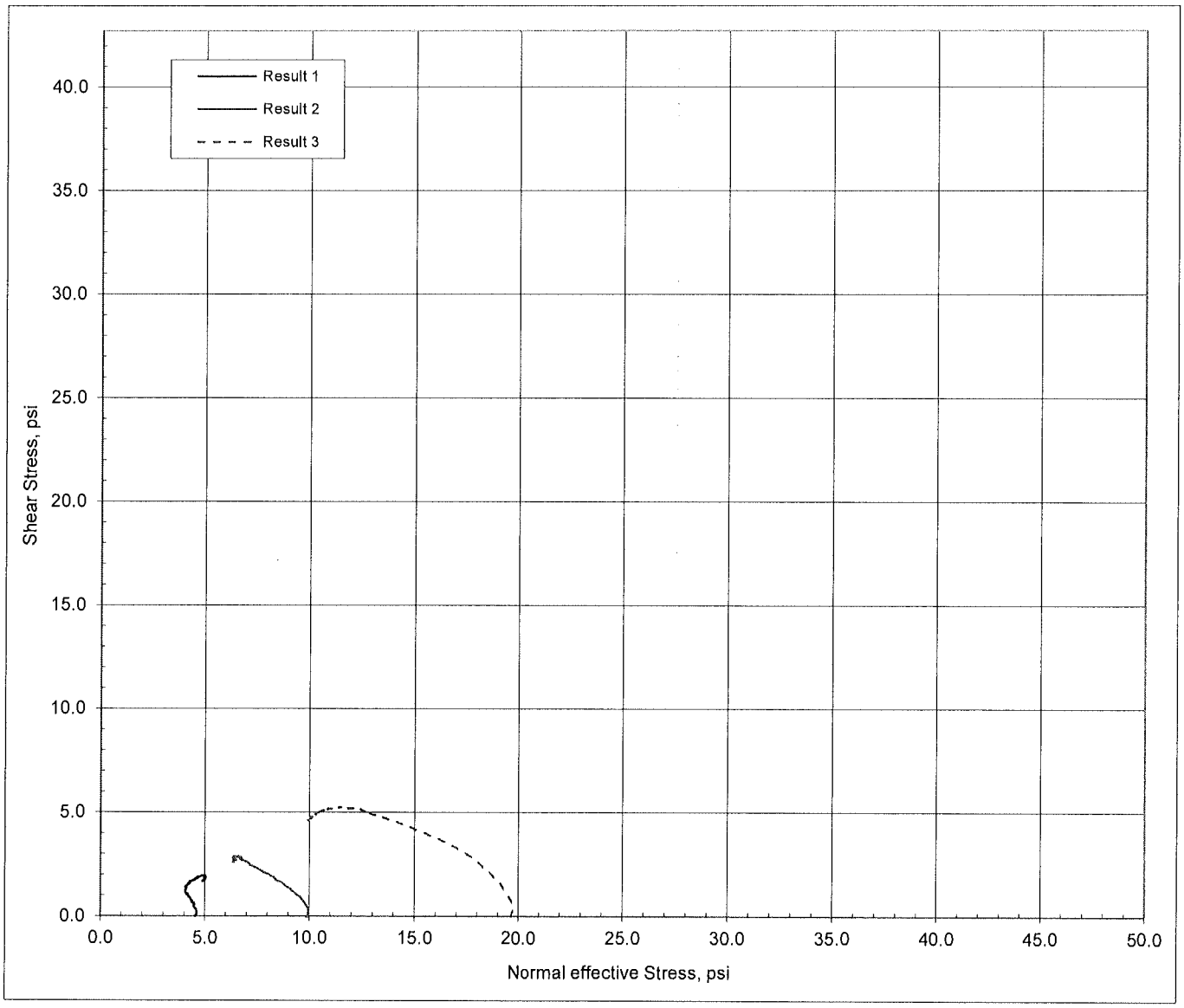
Grade 2 - Intermediate

Grade 3 - Dispersive

Grade 4 - Highly Dispersive

Terracon

CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TESTING OF COHESIVE SOILS
ASTM D6528



	RESULT 1	RESULT 2	RESULT 3		RESULT 1	RESULT 2	RESULT 3
INITIAL DATA				NORMAL EFF. STRESS, psi	4.5	9.9	19.7
AREA, inch2	5.383	5.387	5.383	PRESHEAR MOISTURE, %	27.1	28.3	26.7
HEIGHT, inch	0.704	0.703	0.704	PRESHEAR VOID RATIO	0.69	0.70	0.64
MOISTURE, %	27.5	27.6	27.4	FINAL MOISTURE, %	27.1	28.3	26.8
DRY DENSITY, pcf	95.8	95.1	94.7	FINAL VOID RATIO	0.71	0.72	0.68
SATURATION, %	98	96	95	SHEAR STRAIN RATE, %/min	0.088	0.089	0.092
VOID RATIO	0.76	0.77	0.78	t95 @ MAX STESS, min	1.22	2.09	2.09
LIQUID LIMIT	41		PLASTIC LIMIT	17	PLASTICITY INDEX		24
SAMPLE TYPE	UNDISTURBED			SPECIFIC GRAVITY	2.7 ESTIMATED		
SAMPLE DESCRIPTION	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY						

PROJECT NAME: DYNEGY

LOCATION: KINCAID, ILLINOIS

JOB NO.: 15151122

DATE: 9/24/2015

BORING NO. KIN-B002

SAMPLE NO. S6

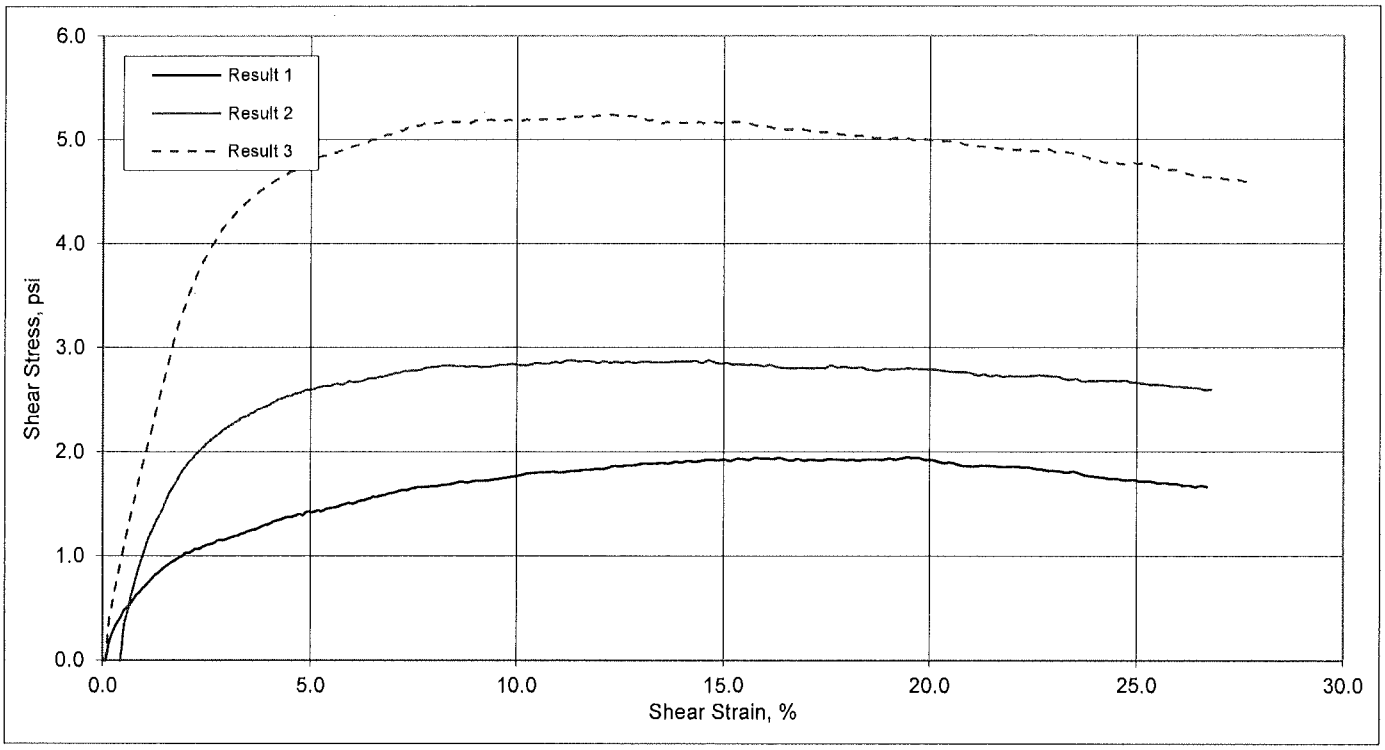
DEPTH, feet 15.0 - 17.0

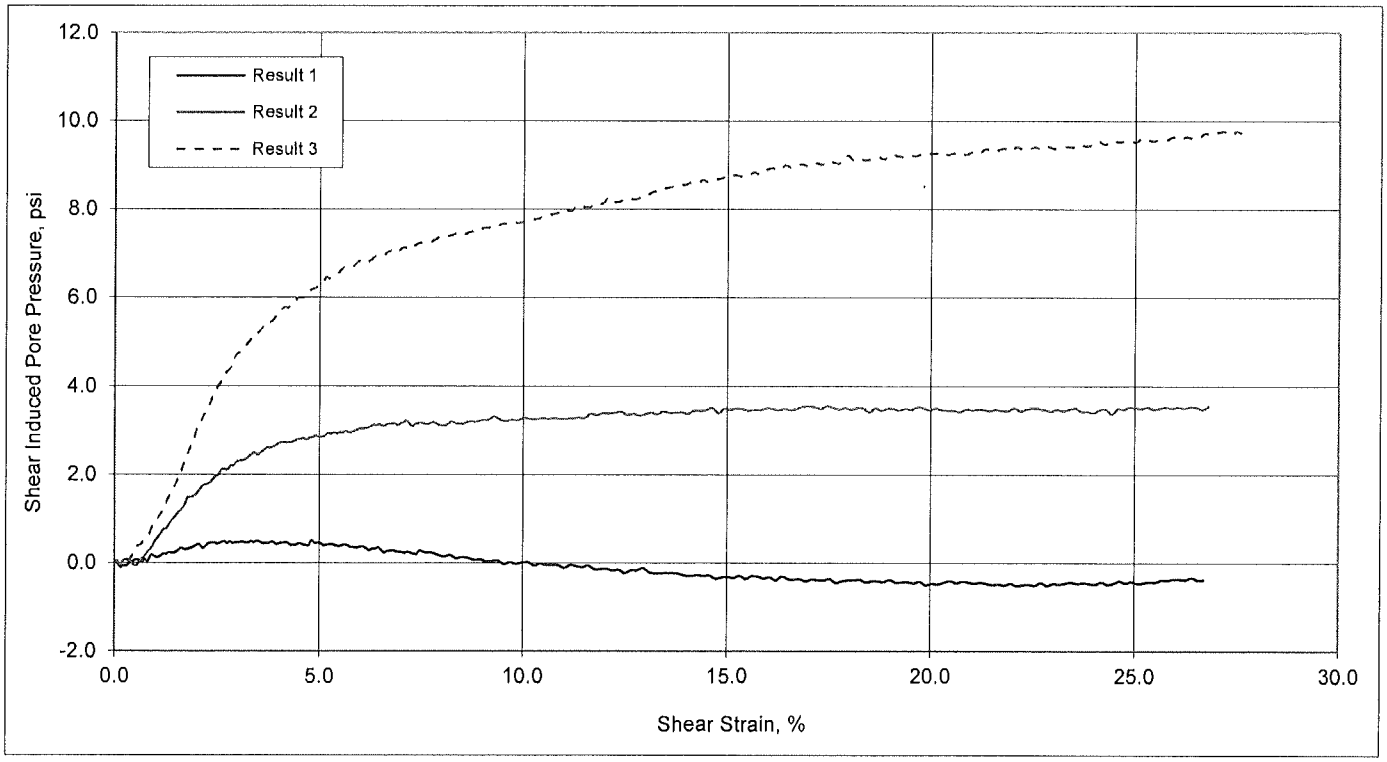
N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 DirectSimpleShear KIN-B0(

Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B002
SAMPLE NO.	S6
DEPTH, feet	15.0 - 17.0

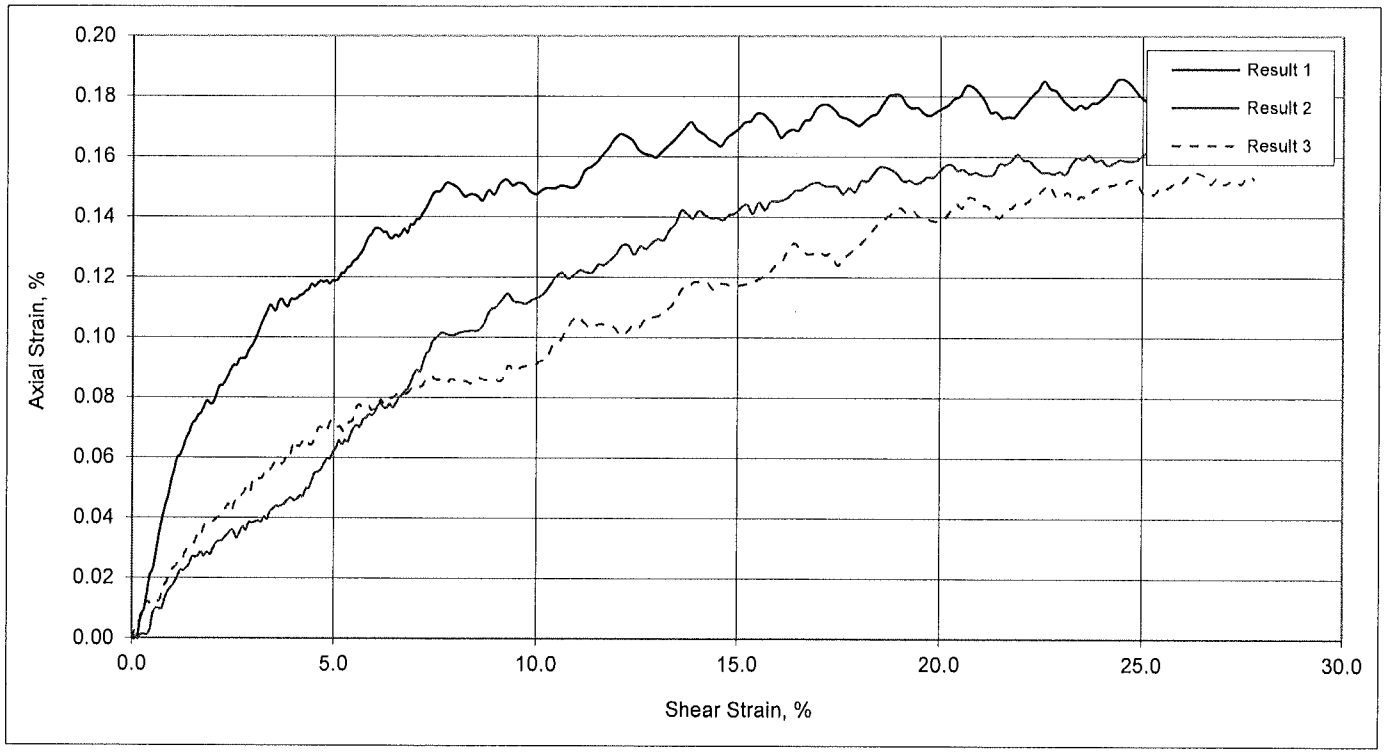


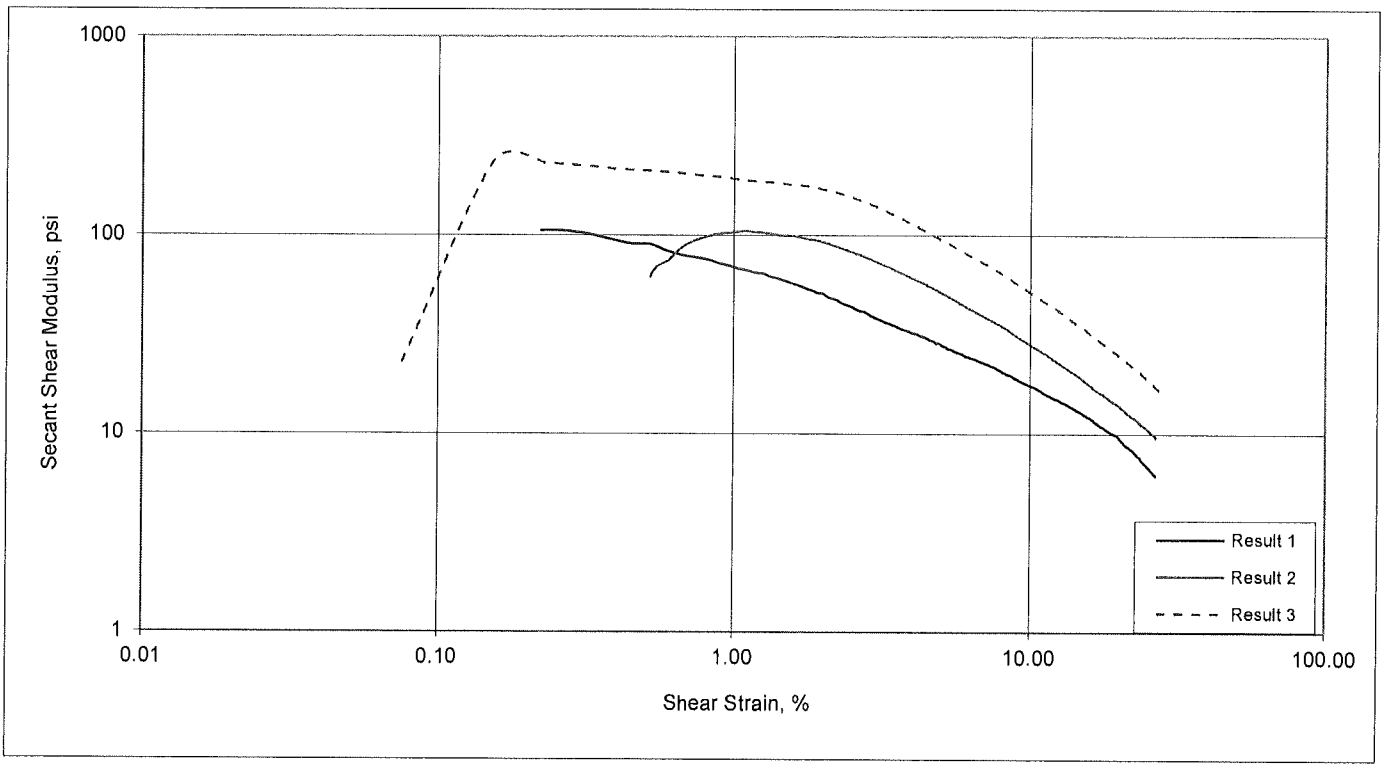


Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B002
SAMPLE NO.	S6
DEPTH, feet	15.0 - 17.0

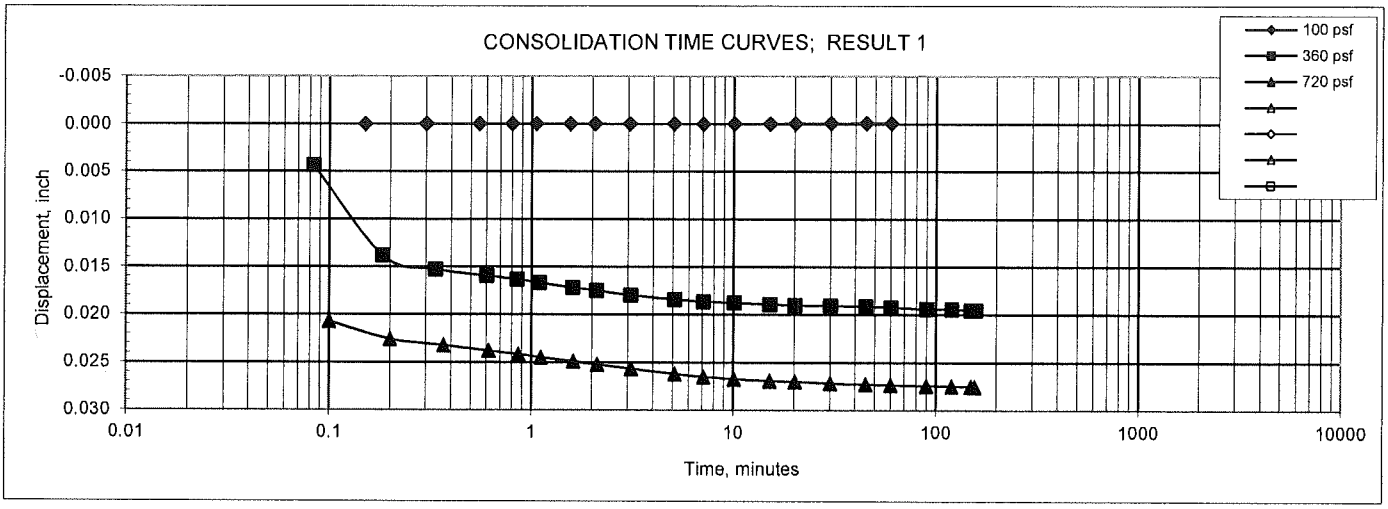


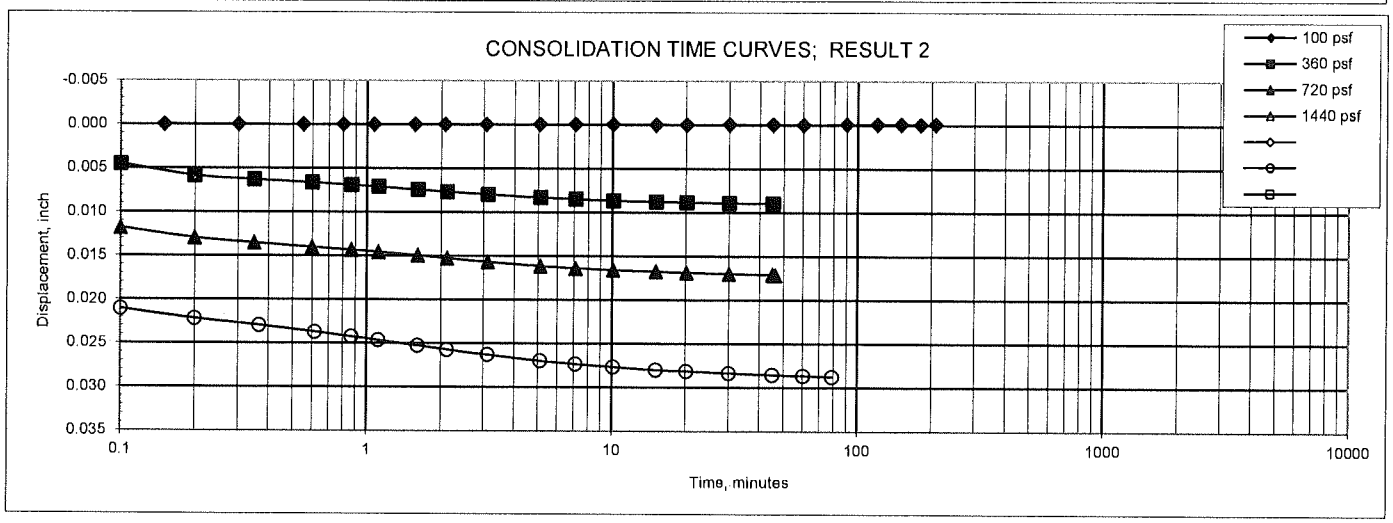


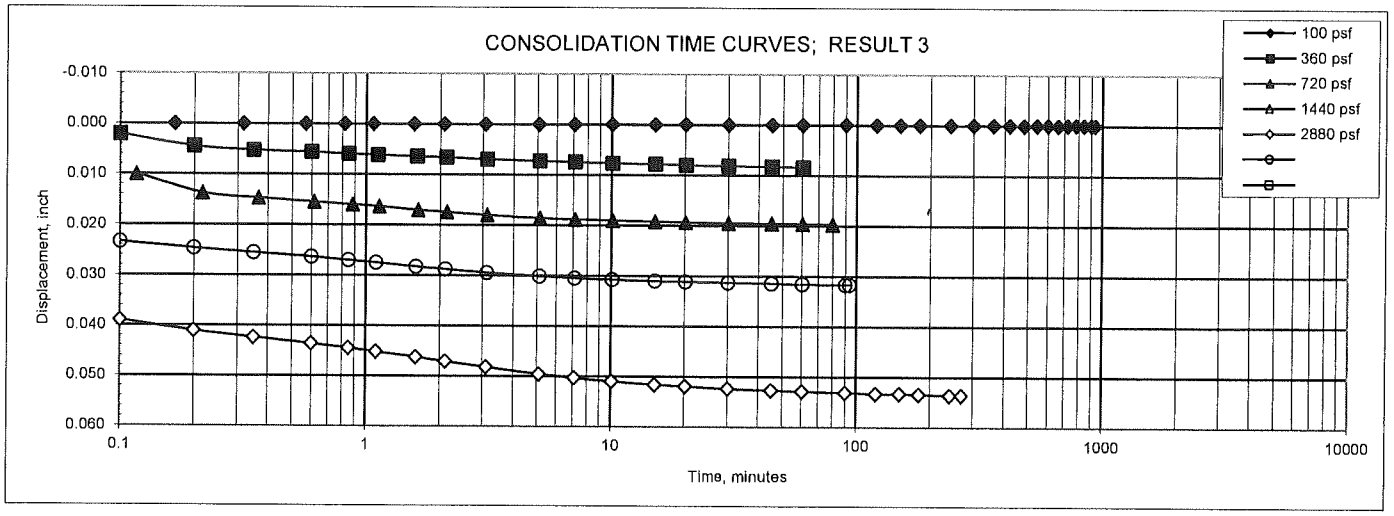
Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

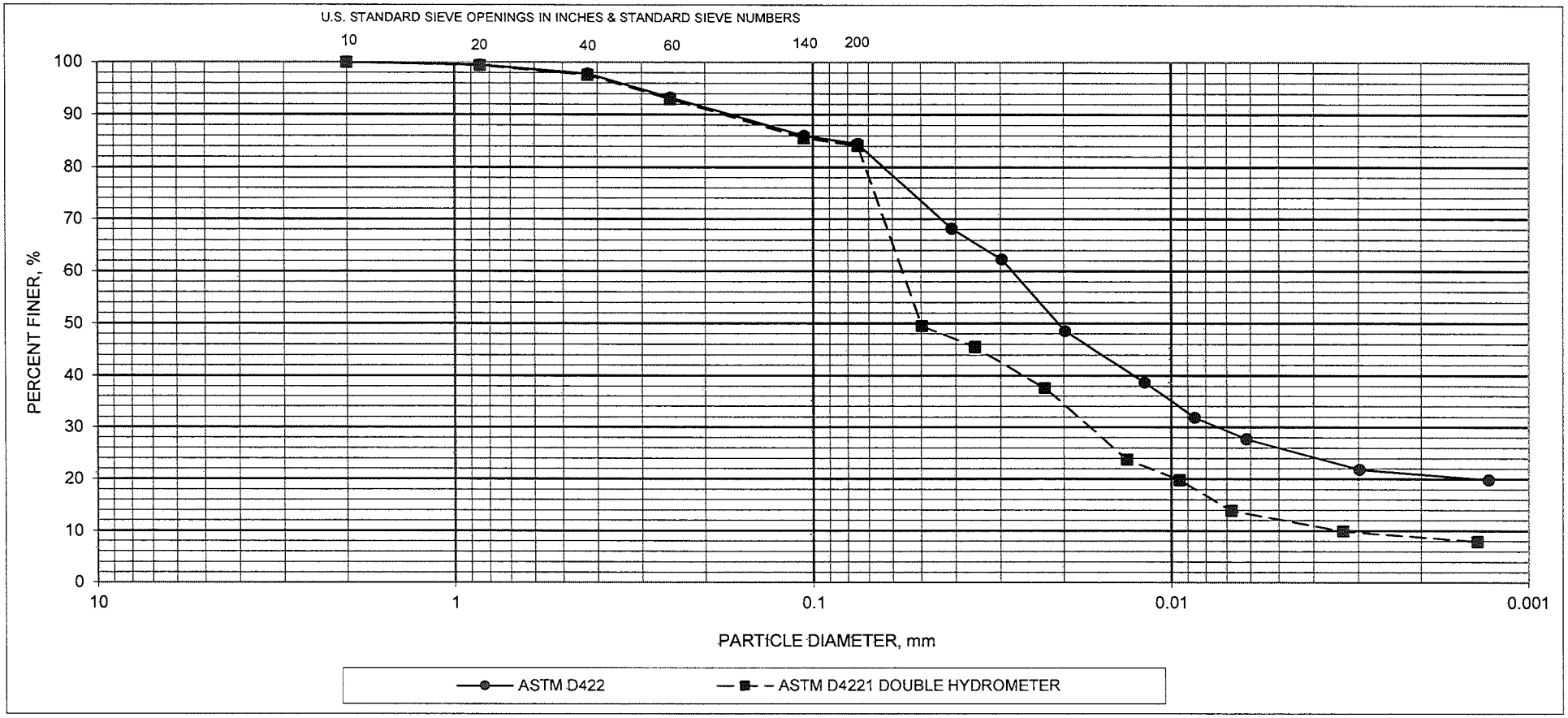
BORING NO.	KIN-B002
SAMPLE NO.	S6
DEPTH, feet	15.0 - 17.0







Terracon



GRAIN SIZE DISTRIBUTION CURVE

ASTM D422, % 0.005 mm	26.0	ASTM D4221 DOUBLE HYDROMETER, % 0.005 mm	12.2	DISPERSION, %	47

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KIN-B002	S6	15.0 - 17.0	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY			41	17	24

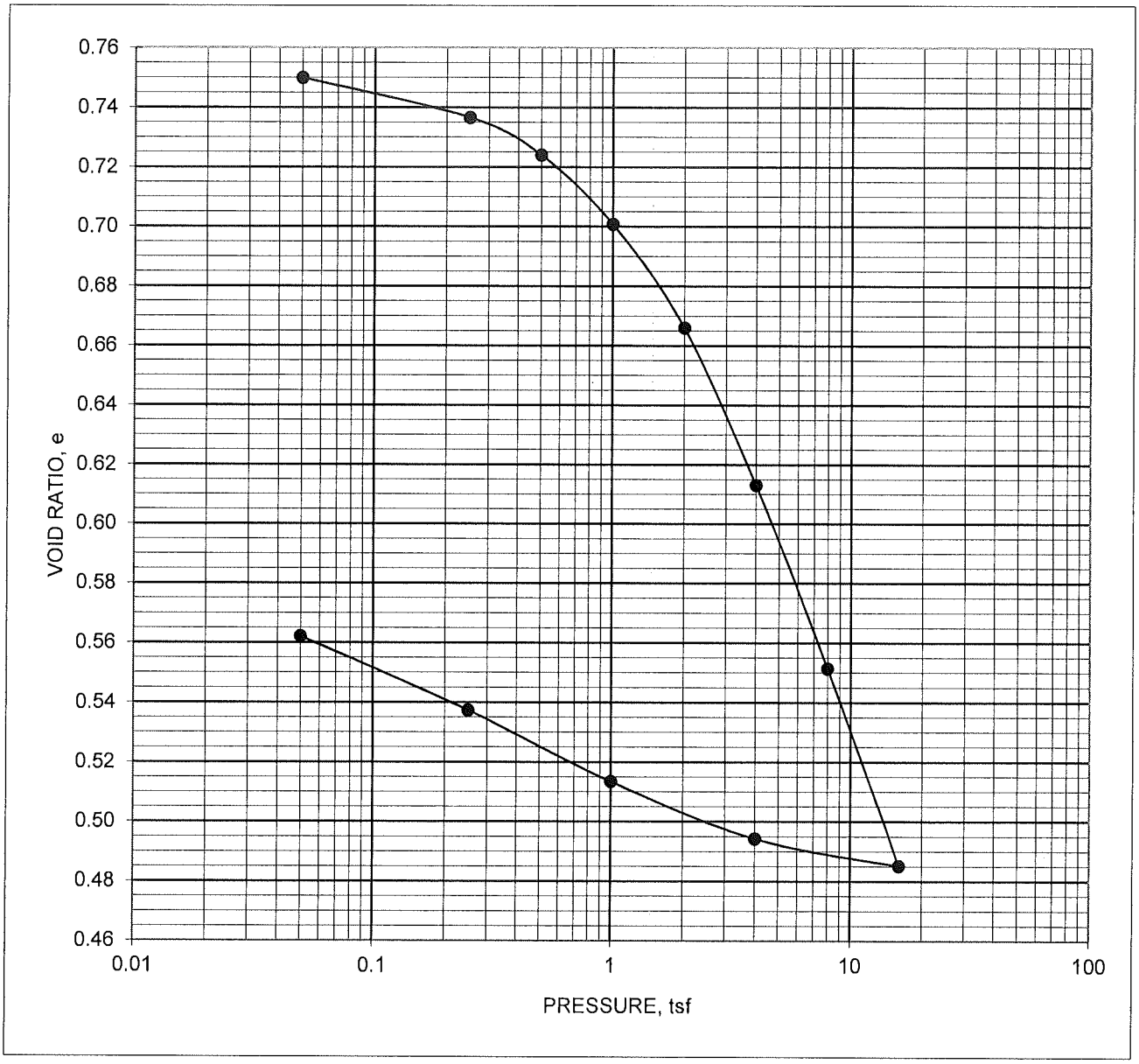
PROJECT DYNEGY

KINCAID, ILLINOIS JOB NO. 15151122 DATE 10/2/2015

N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 HydrometerDoublePlot KINB002-S6-15.0.xls]Hydrometer Data

Terracon

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.53	HEIGHT, mm	25.30	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		0.98		MOISTURE, %		27.2	21.3
PRECONSOL. PRESSURE, tsf		1.32		DRY DENSITY, pcf		96.3	106.9
OVER CONSOLIDATION RATIO		1.3		SATURATION, %		98	101
COMPRESSION INDEX		0.22		VOID RATIO		0.750	0.562
REBOUND INDEX		0.037		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	41	PLASTIC LIMIT	17	PLASTICITY INDEX	24	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY						
BORING NO.	KIN-B002	SAMPLE NO.	S6	DEPTH, feet	15.0 - 17.0		

DYNEGY
KINCAID, ILLINOIS
15151122
10/5/2015

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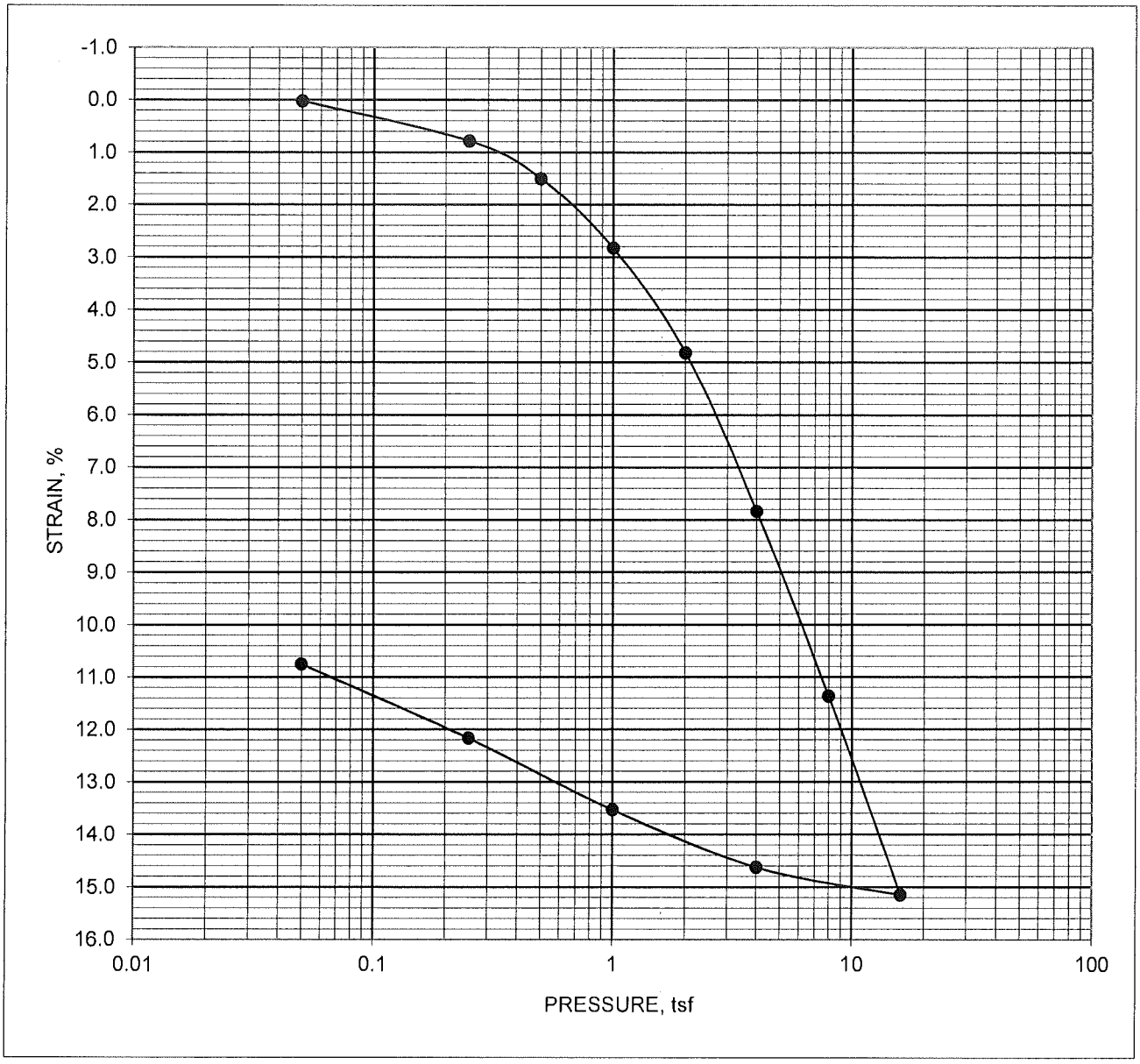
Terracon

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.53	HEIGHT, mm	25.30	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		0.98		MOISTURE, %		27.2	21.3
PRECONSOL. PRESSURE, tsf		1.32		DRY DENSITY, pcf		96.3	106.9
OVER CONSOLIDATION RATIO		1.3		SATURATION, %		98	101
COMPRESSION INDEX		0.22		VOID RATIO		0.750	0.562
REBOUND INDEX		0.037		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	41	PLASTIC LIMIT	17	PLASTICITY INDEX	24	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY						
BORING NO.	KIN-B002	SAMPLE NO.	S6	DEPTH, feet	15.0 - 17.0		

DYNEGY
KINCAID, ILLINOIS
15151122
10/5/2015

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Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
10/5/2015

ADDITIONAL CONSOLIDATION DATA

KIN-B002
S6
15.0 - 17.0

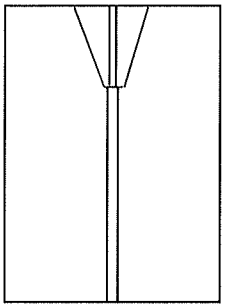
PRESSURE, tsf	Cv50, cm2/sec	Cv90, cm2/sec	Av, cm2/g	Mv, cm2/g	k, cm/sec
0					
0.05			7.18E-06	4.10E-06	
0.25	6.43E-04	6.47E-04	6.82E-05	3.90E-05	2.51E-08
0.5	9.16E-04	9.22E-04	5.17E-05	2.98E-05	2.73E-08
1	6.88E-04	6.92E-04	4.74E-05	2.75E-05	1.89E-08
2	3.46E-04	3.48E-04	3.55E-05	2.09E-05	7.24E-09
4	2.00E-04	2.01E-04	2.70E-05	1.62E-05	3.24E-09
8	1.78E-04	1.79E-04	1.58E-05	9.77E-06	1.74E-09
16	1.64E-04	1.65E-04	8.46E-06	5.45E-06	8.92E-10
AVERAGE	4.48E-04	4.51E-04	3.27E-05	1.91E-05	1.21E-08

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A
10/2/2015

PROJECT DYNEGY COFFEEN & KINCAID POWER STATIONS
JOB NO. 15151122
SAMPLE ID KIN B002; S6; 15.0 - 17.0
COMPACTION CHARACTERISTICS UNDISTURBED
WATER CONTENT 25.8%
DISTILLED WATER ADDED _____ **YES** X **NO**
CURE TIME NATURAL
BY JOHN MARTIN
SAMPLE DESC. LEAN CLAY, DARK GRAY

FLOW STARTED ON 2nd

FINAL HOLE
1.0 mm



TIME, min	HEAD, inch	FLOW, ml	FLOW, sec	FLOW RATE, ml/sec	TURBIDITY FROM SIDE: VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR	CLEAR FROM TOP	REMARKS
1	2	12.8	60	0.21						X	X	
2	2	12.0	60	0.20						X	X	
3	2	12.5	60	0.21						X	X	
4	2	12.5	60	0.21						X	X	
5	2	12.5	60	0.21						X	X	
6	2	12.5	60	0.21						X	X	
7	2	12.5	60	0.21						X	X	
8	2	12.5	60	0.21						X	X	
9	2	12.5	60	0.21						X	X	
10	2	12.5	60	0.21						X	X	
1	7	33.0	60	0.55						X	X	
2	7	33.0	60	0.55						X	X	
3	7	33.0	60	0.55						X	X	
4	7	33.0	60	0.55						X	X	
5	7	33.0	60	0.55						X	X	
1	15	56.0	60	0.93						X		BARELY VISIBLE
2	15	56.0	60	0.93						X		BARELY VISIBLE
3	15	55.5	60	0.93						X		BARELY VISIBLE
4	15	56.5	60	0.94						X	X	
5	15	56.0	60	0.93						X		BARELY VISIBLE
1	40	120.0	60	2.00					X			SLIGHT DARK
2	40	125.0	60	2.08						X		BARELY VISIBLE
3	40	126.0	60	2.10						X		BARELY VISIBLE
4	40	130.0	60	2.17						X		BARELY VISIBLE
5	40	136.0	60	2.27						X		BARELY VISIBLE

CLASSIFICATION = ND1

Terracon

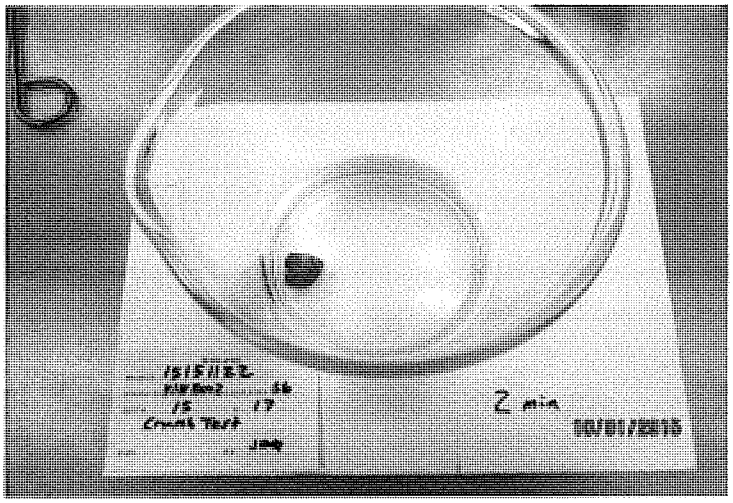
CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

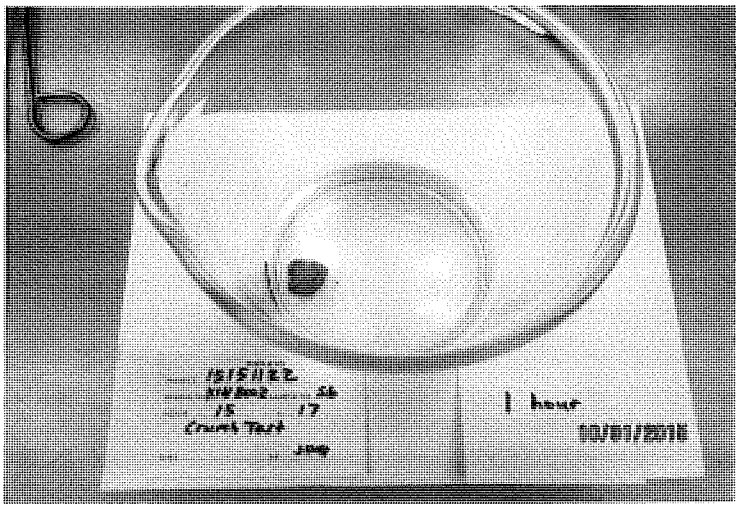
KIN-B002 S6 15.0 - 17.0 feet



2 MIN

GRADE: 1

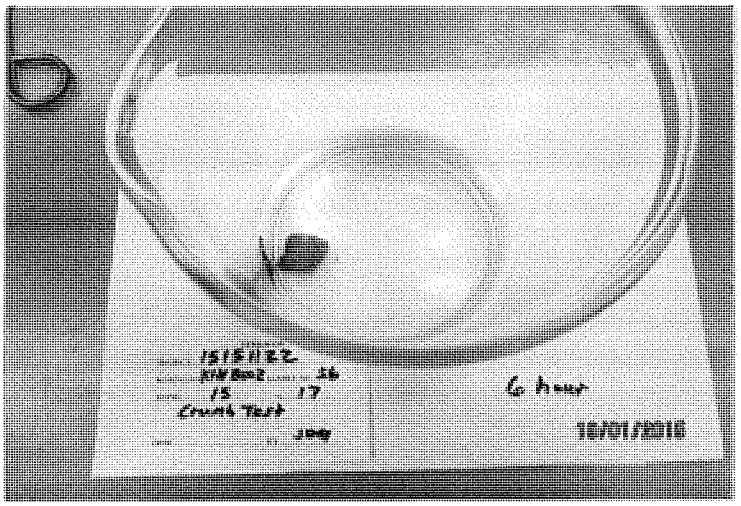
DISPERSIVE CALSSIFICATION: NONDISPERSIVE



1 HOUR

GRADE: 1

DISPERSIVE CALSSIFICATION: NONDISPERSIVE



6 HOUR

GRADE: 1

DISPERSIVE CALSSIFICATION: NONDISPERSIVE

Grade 1 - Nondispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Highly Dispersive

Terracon

CRUMB TEST (ASTM D6572)

Project No.: 15151122 Project Name: Dynegy Location:

Boring No.: KIN B002 Sample No.: S6 Depth: 15-17 [X] ft [ ] m

Visual Classification: LNCL Color: Dark Gray

Moisture Content of Sample:	[X] as-received	[ ] in situ	[ ] air-dried

Tare Number	Wet Mass + Tare (g)	Dry Mass+ Tare (g)	Tare Mass (g)	Water Content (%)
1013	89.81	76.85	28.40	26.7

Specimen Identification:	KIN B002 ; S6 15-17	Specimen Identification:	Specimen Identification:
Spec. Container Identification:	5	Spec. Container Identification:	Spec. Container Identification:
Method: [X] A (Natural) [ ] B (Remolded)		Method: [ ] A (Natural) [ ] B (Remolded)	Method: [ ] A (Natural) [ ] B (Remolded)
Water Type: [X] Distilled [ ] Type IV		Water Type: [ ] Distilled [ ] Type IV	Water Type: [ ] Distilled [ ] Type IV
Initial Water Temp. (°C): 20.4		Initial Water Temp. (°C):	Initial Water Temp. (°C):
Start Time (hh:mm:ss): 7:11:00		Start Time (hh:mm:ss):	Start Time (hh:mm:ss):

Target Reading	Time Taken	Grade	Temp. (°C)
2 min ± 15 s	7:13:00	1	20.0
1 h ± 8 min	8:11:10	1	19.7
6 h ± 45 min	1:15:50	1	20.2

Target Reading	Time Taken	Grade	Temp. (°C)
2 min ± 15 s			
1 h ± 8 min			
6 h ± 45 min			

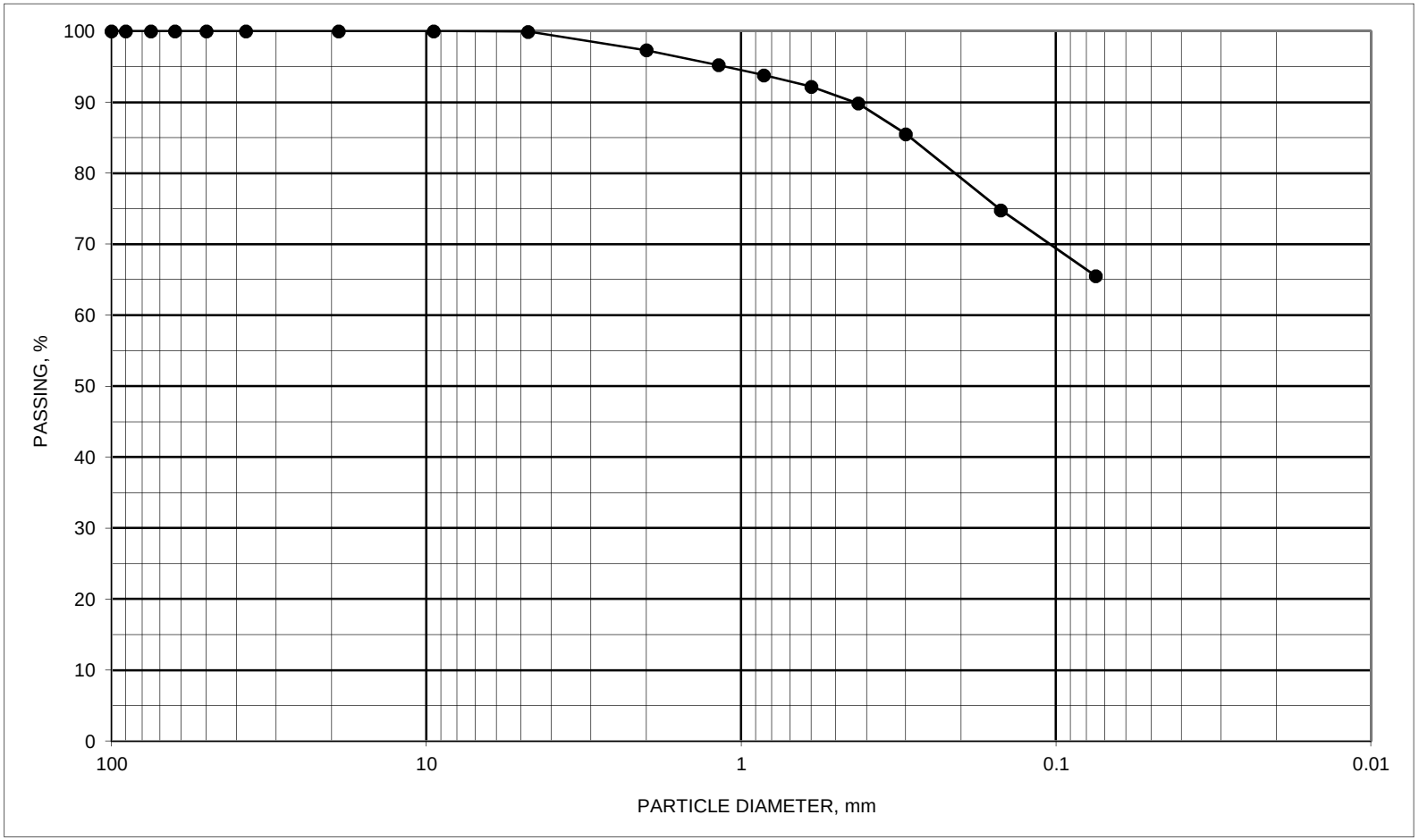
Target Reading	Time Taken	Grade	Temp. (°C)
2 min ± 15 s			
1 h ± 8 min			
6 h ± 45 min			

Dispersive Classification:	Nondispersive	Dispersive Classification:
Additional water added to remold the specimen (Method B): [ ] Y [ ] N		Additional water added to remold the specimen (Method B): [ ] Y [ ] N
		Dispersive Classification:
		Additional water added to remold the specimen (Method B): [ ] Y [ ] N

Remarks:

Prepared By: _____ Date: _____ Tested By: _____ Date: _____ Input By: _____ Date: _____ Reviewed By: _____ Date: _____

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	97
#16	1.18	95
#20	0.85	94
#30	0.600	92
#40	0.425	90
#50	0.300	86
#100	0.150	75
#200	0.075	65.5



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB002	S-9	28.5 TO 30	Sandy lean clay Gray	#VALUE!				

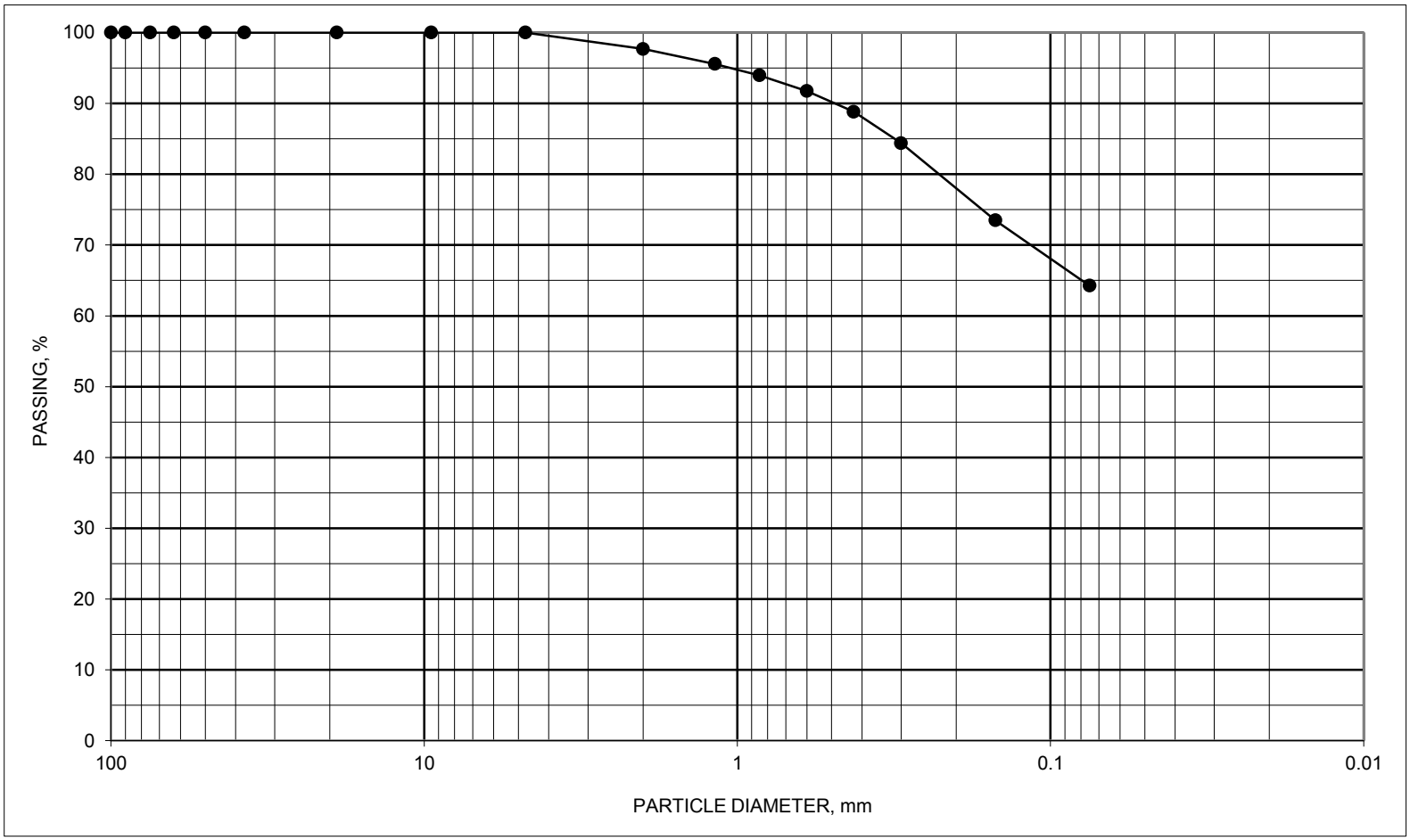
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B002 S-9.xlsx]REPORT

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	98
#16	1.18	96
#20	0.85	94
#30	0.600	92
#40	0.425	89
#50	0.300	84
#100	0.150	73
#200	0.075	64.3



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB002	S-12	43.5 TO 45	Sandy lean clay Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/30/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B002 S-12.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B003	S1	1.0	2.5	11.6														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay with fine to coarse sand, trace fine gravel					
	S2	3.5	5.0	15.5														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S3	6.0	7.5	16.4														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S4	8.5	10.0	9.5														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay clay, trace fine gravel					
	S5	13.5	15.5	18.0														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay, trace fine to medium sand					
	S6	18.5	20.0	23.9	116.4	54	20	34										
	Color		Brown and gray							**Visual Classification**			FILL: Fat clay, trace fine to medium sand					
	S7	22.0	24.0	21.4	103.5	47	20	27					Note*		Note*			
	Color		Dark grayish brown with gray and olive, trace yellowish brown							**USCS Classification**			FILL: Lean clay with sand					
	S8	24.0	26.0	18.4	109.7	31	16	15		Note*				Note*		Note*	Note*	CL
	Color		Grayish green							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S9	28.5	30.0	29.7														
	Color		Brown and gray							**Visual Classification**			Lean to fat clay					
	S10	33.5	35.0	25.2	NA	36	19	17										
	Color		Brown and gray							**Visual Classification**			Lean clay, trace fine sand					
	S11	35.0	37.0		X	X	X	X				X			X			
	Color		Tube sent to Fugro							**Visual Classification**								
	S12	38.5	40.0	26.0		41	18	23										
	Color		Brown and gray							**Visual Classification**			Sandy lean clay					

TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

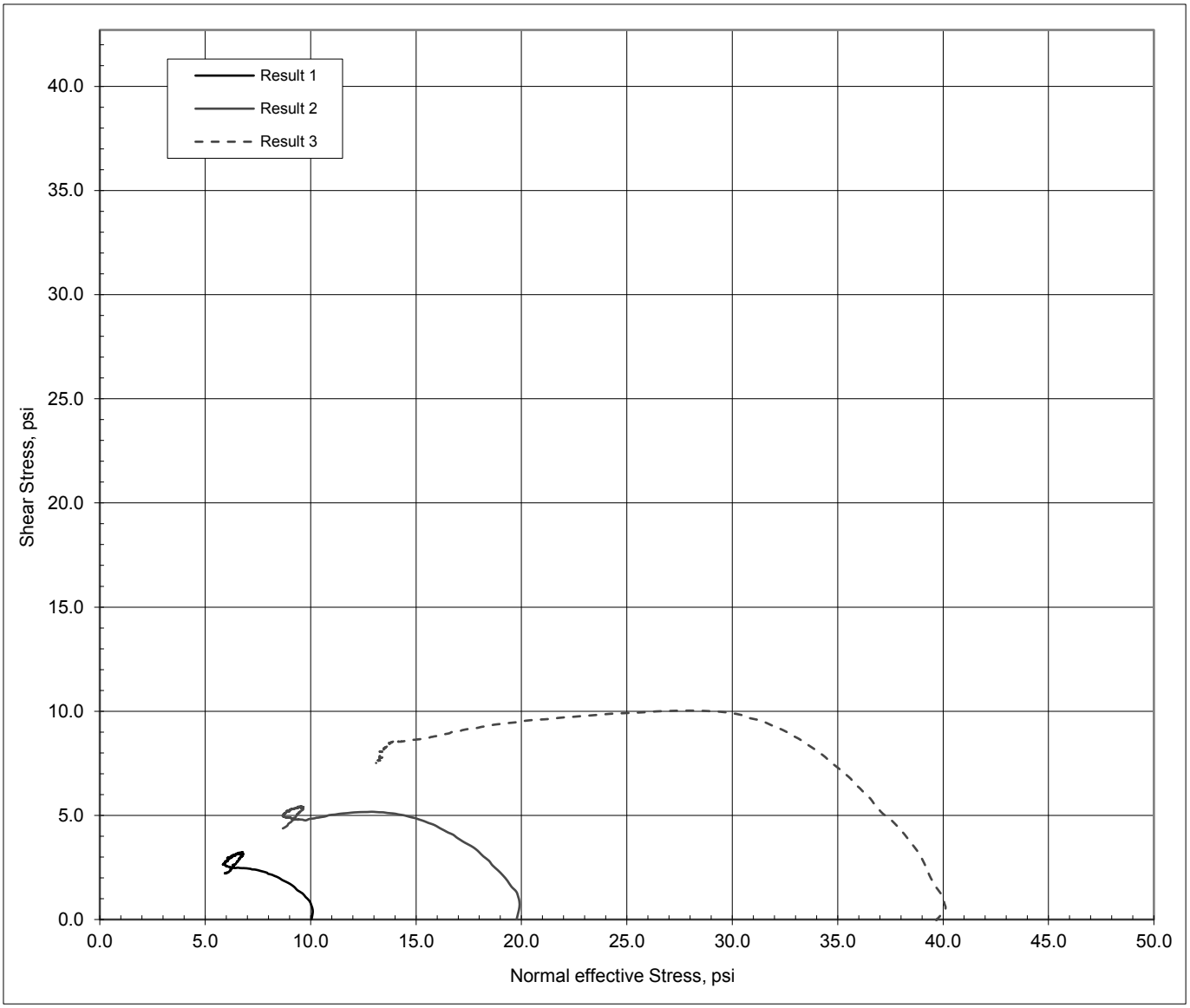
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B003	S13	43.5	45.0	9.2														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S14	48.5	50.0	17.3														
	Color		Brown and gray							**Visual Classification**			Silty fine to medium sand, trace clay and fine gravel					

TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TESTING OF COHESIVE SOILS
ASTM D6528



	RESULT 1	RESULT 2	RESULT 3		RESULT 1	RESULT 2	RESULT 3
INITIAL DATA				NORMAL EFF. STRESS, psi	10.0	19.8	39.8
AREA, inch2	5.387	5.391	5.371	PRESHEAR MOISTURE, %	18.7	21.5	22.9
HEIGHT, inch	0.706	0.706	0.701	PRESHEAR VOID RATIO	0.50	0.56	0.54
MOISTURE, %	17.9	19.4	20.5	FINAL MOISTURE, %	18.7	21.6	22.9
DRY DENSITY, pcf	110.5	104.0	104.9	FINAL VOID RATIO	0.51	0.58	0.55
SATURATION, %	92	85	91	SHEAR STRAIN RATE, %/min	0.086	0.088	0.087
VOID RATIO	0.53	0.62	0.61	t95 @ MAX STESS, min	0.29	2.09	2.47
LIQUID LIMIT	47		PLASTIC LIMIT	20	PLASTICITY INDEX		27
SAMPLE TYPE	UNDISTURBED		SPECIFIC GRAVITY		2.7 ESTIMATED		
SAMPLE DESCRIPTION	FILL; LEAN CLAY WITH SAND DARK GRAYISH BROWN WITH GRAY & OLIVE TRACE YELLOWISH BROWN						

PROJECT NAME: DYNEGY
BORING NO. KIN-B003

LOCATION: KINCAID, ILLINOIS
SAMPLE NO. S7

JOB NO.: 15151122
DEPTH, feet 22.0 - 24.0

DATE: 9/24/2015

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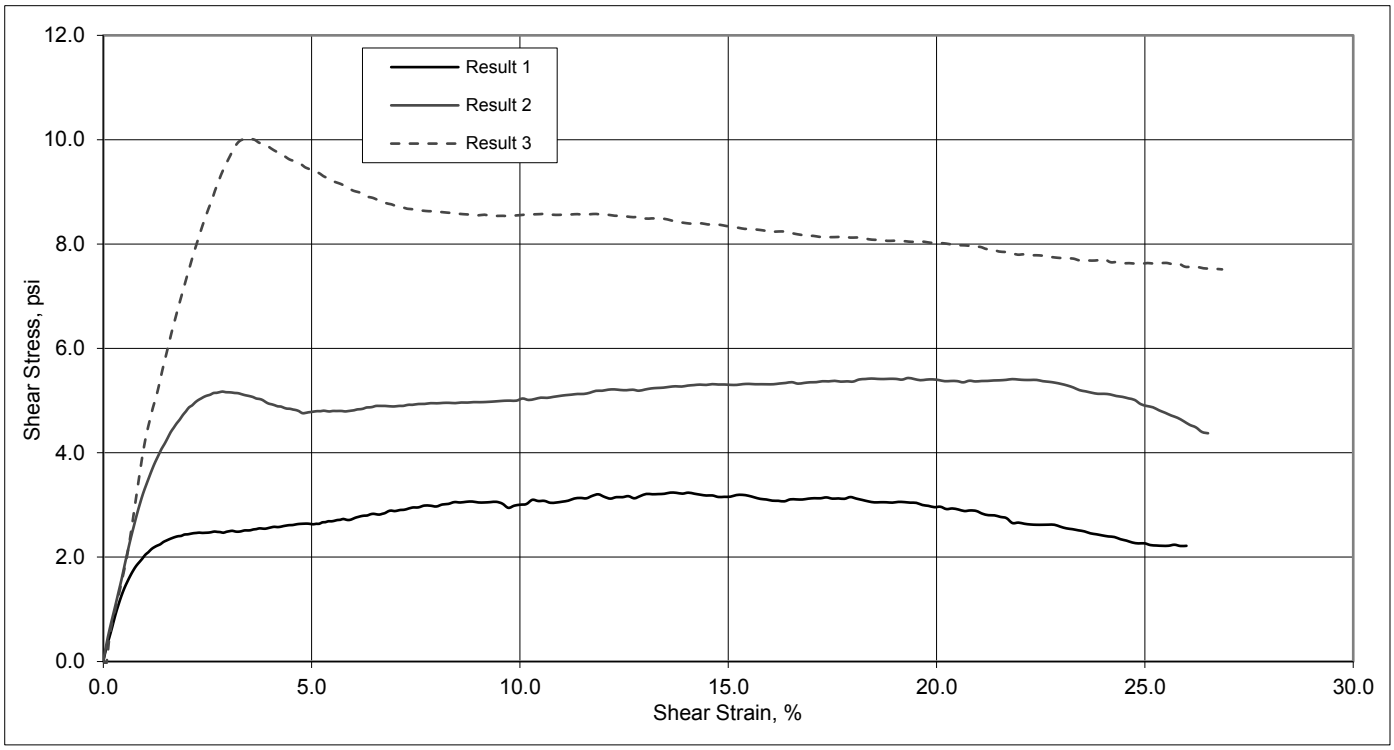
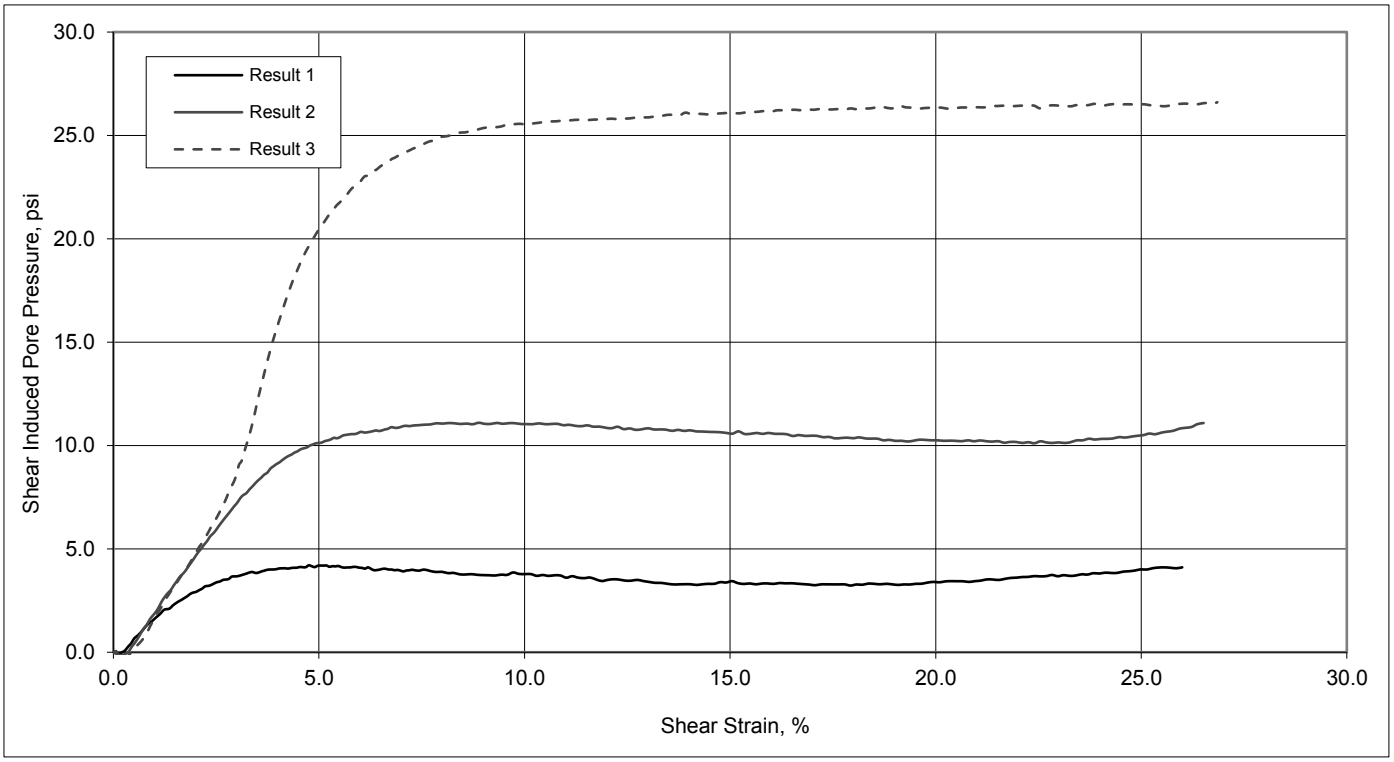
Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

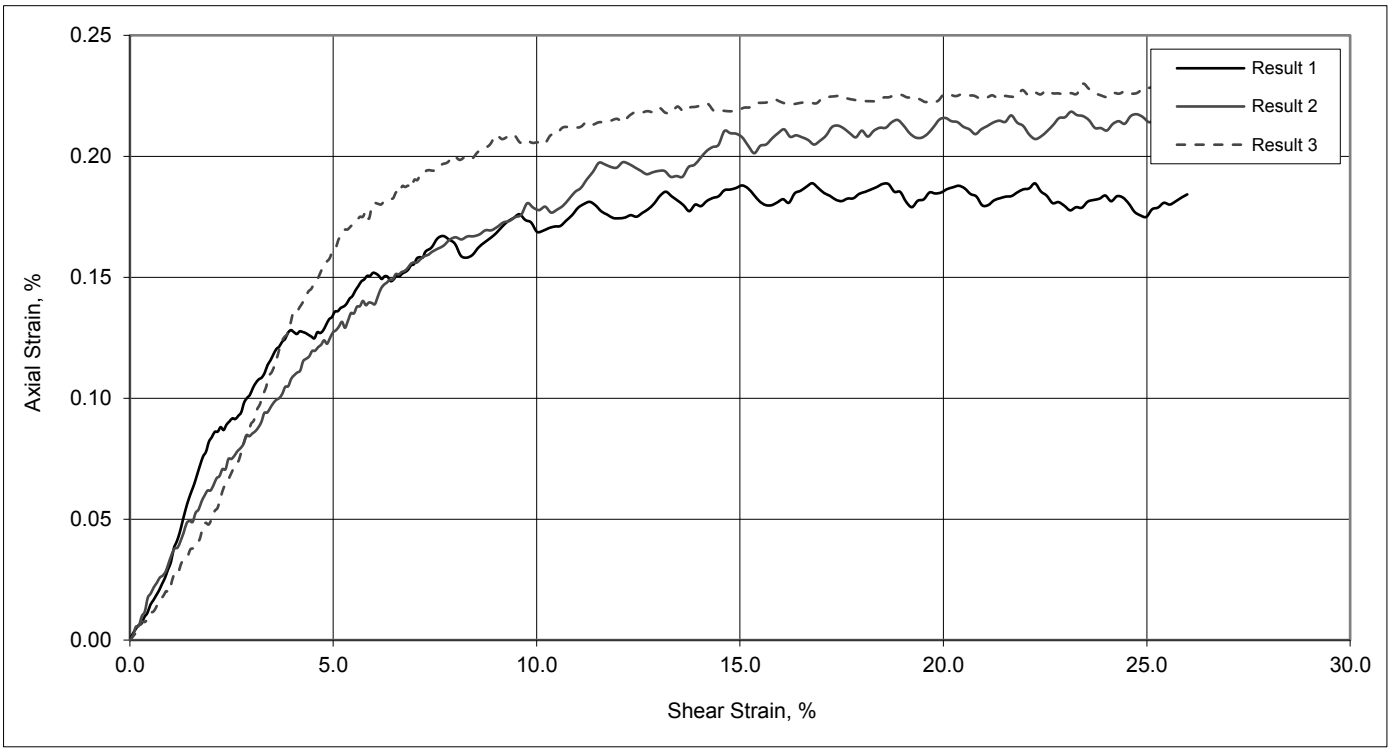
BORING NO.	KIN-B003
SAMPLE NO.	S7
DEPTH, feet	22.0 - 24.0

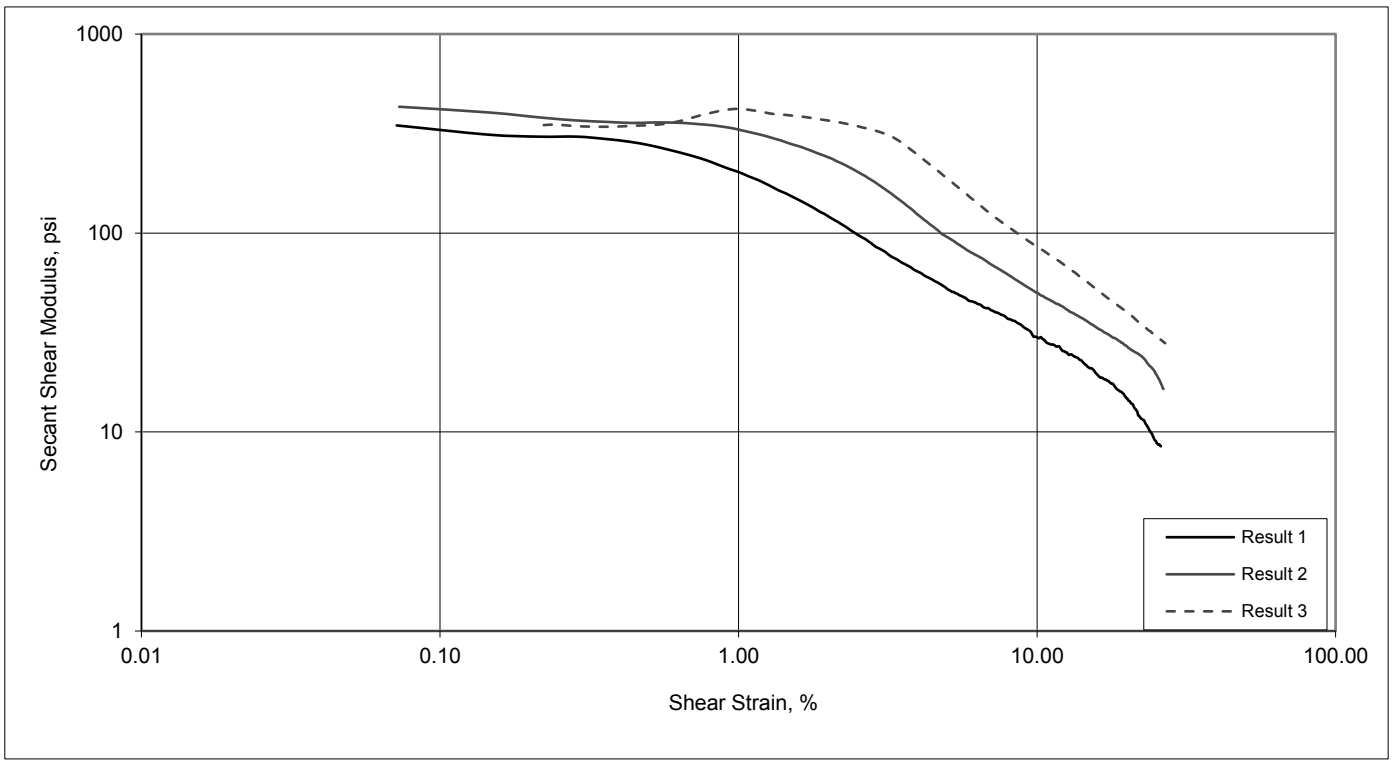




DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B003
SAMPLE NO.	S7
DEPTH, feet	22.0 - 24.0

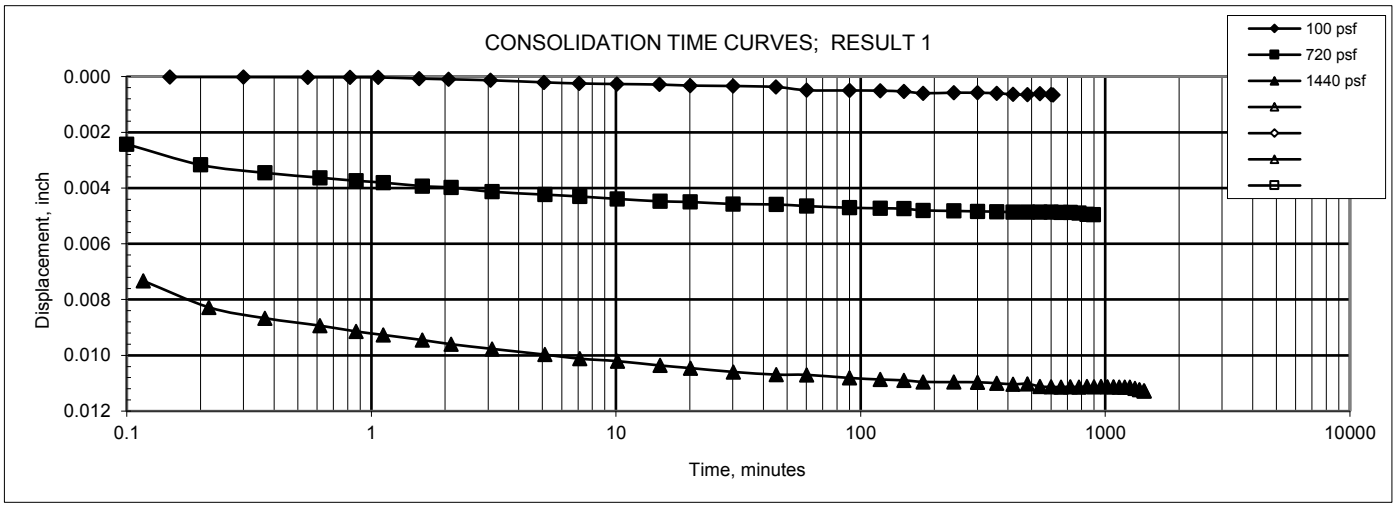


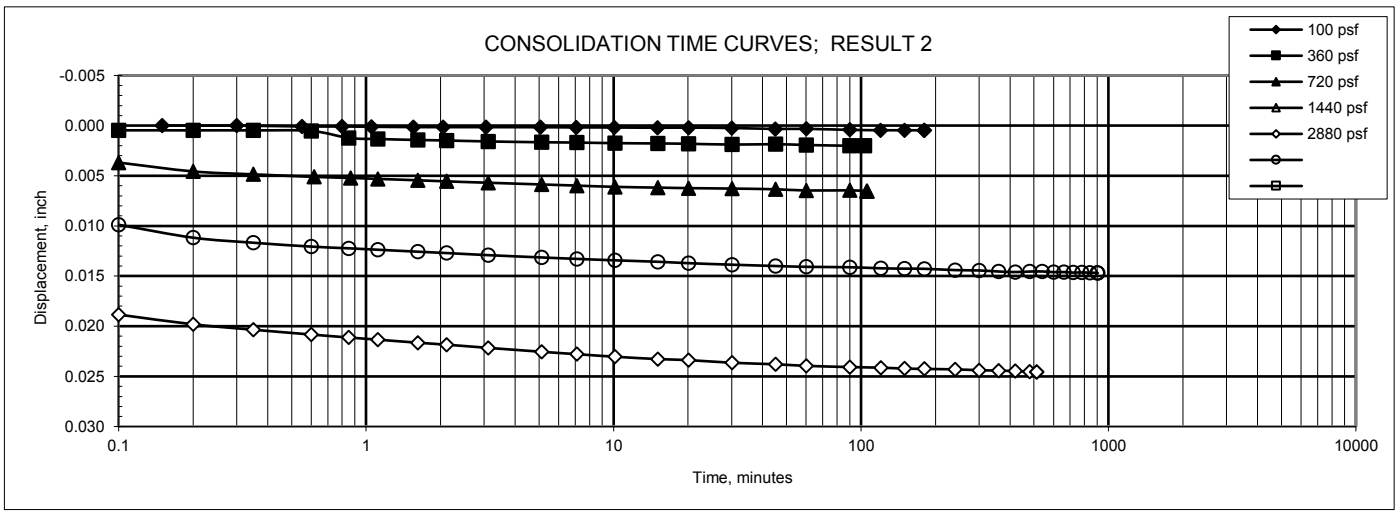


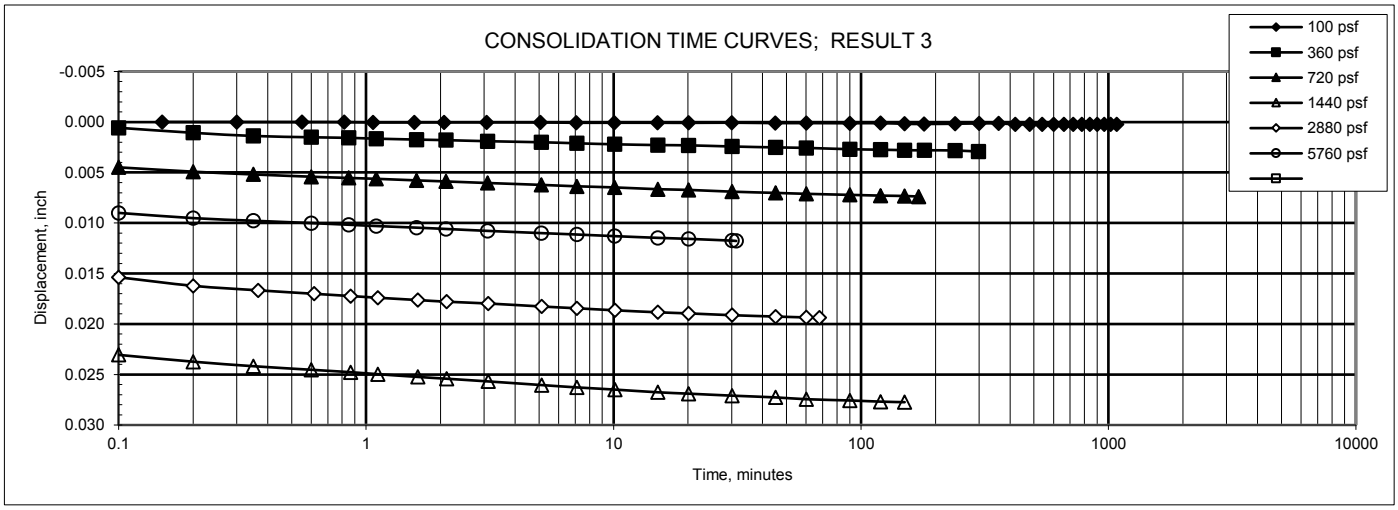
Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

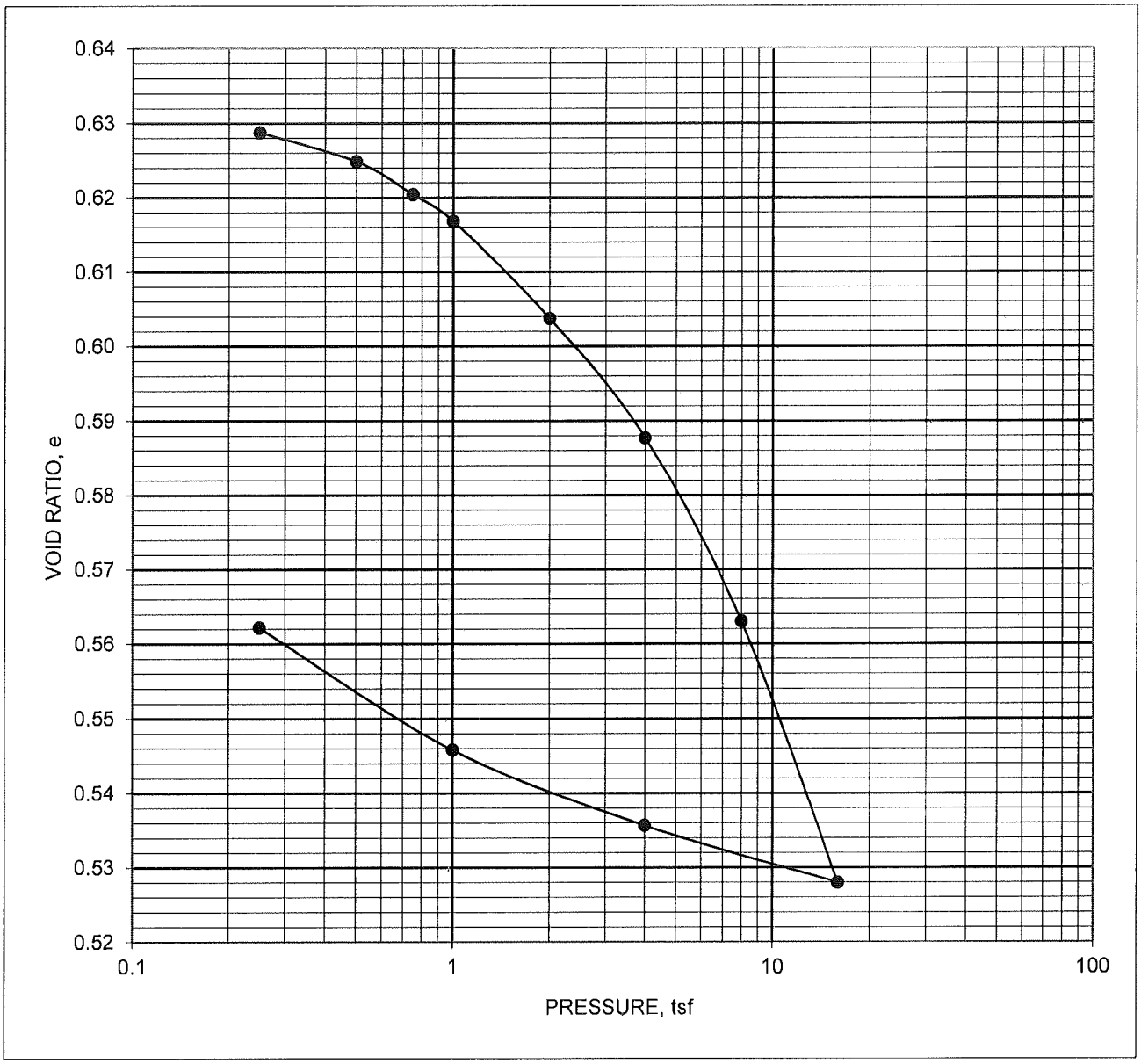
BORING NO.	KIN-B003
SAMPLE NO.	S7
DEPTH, feet	22.0 - 24.0







ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.58	HEIGHT, mm	25.29	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		1.45		MOISTURE, %		21.4	20.8
PRECONSOL. PRESSURE, tsf		3.11		DRY DENSITY, pcf		103.5	107.9
OVER CONSOLIDATION RATIO		2.2		SATURATION, %		92	100
COMPRESSION INDEX		0.11		VOID RATIO		0.629	0.562
REBOUND INDEX		0.022		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	47	PLASTIC LIMIT	20	PLASTICITY INDEX	27	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	FILL: LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH GRAY & OLIVE TRACE YELLOWISH BROWN						
BORING NO.	KIN-B003	SAMPLE NO.	S7	DEPTH, feet	22.0 - 24.0		

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

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Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

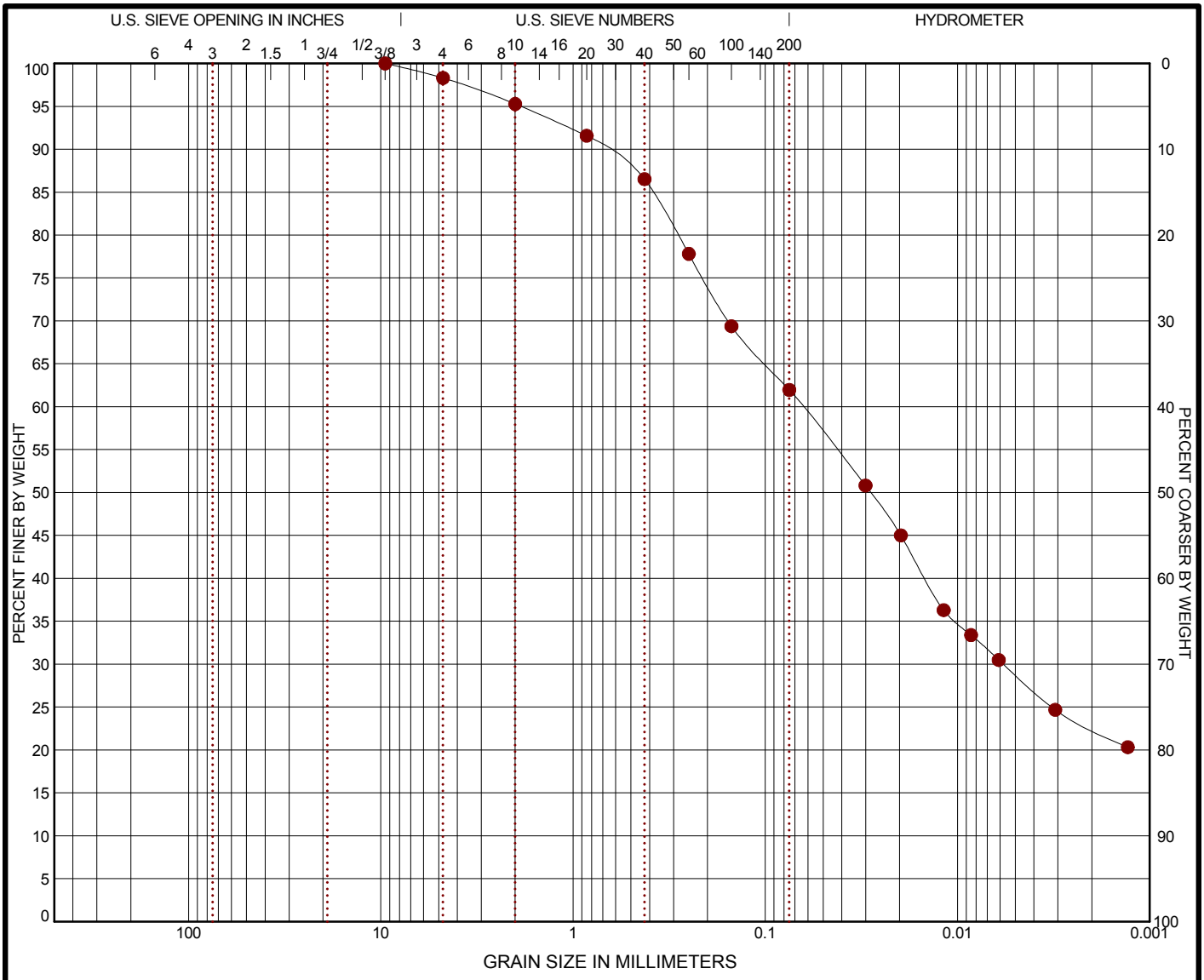
ADDITIONAL CONSOLIDATION DATA

KIN-B003
S7
22.0 - 24.0

PRESSURE, tsf	Cv50, cm2/sec	Cv90, cm2/sec	Av, cm2/g	Mv, cm2/g	k, cm/sec
0					
0.25			6.69E-07	4.11E-07	
0.5	7.17E-04	7.21E-04	1.60E-05	9.85E-06	7.06E-09
0.75	2.48E-04	2.49E-04	1.81E-05	1.11E-05	2.75E-09
1	2.16E-04	2.17E-04	1.47E-05	9.08E-06	1.96E-09
2	1.25E-03	1.26E-03	1.34E-05	8.27E-06	1.03E-08
4	5.02E-04	5.05E-04	8.19E-06	5.11E-06	2.56E-09
8	2.87E-04	2.89E-04	6.31E-06	3.97E-06	1.14E-09
16	1.96E-04	1.97E-04	4.47E-06	2.86E-06	5.60E-10
AVERAGE	4.88E-04	4.91E-04	1.02E-05	6.33E-06	3.77E-09

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B003**	**24**	**0.0**	**1.7**	**36.3**	**33.2**		**28.8**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.064**
D_{30}	**0.006**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	**100.0**
#4	**98.31**
#10	**95.27**
#20	**91.57**
#40	**86.51**
#60	**77.81**
#100	**69.38**
#200	**61.96**

SOIL DESCRIPTION
● SANDY LEAN CLAY(CL)

REMARKS
● Dispersion: 6.19%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

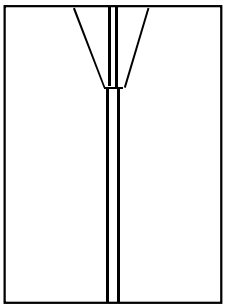
CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B003, S8, 24.0-26.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 14.2%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Sandy Lean Clay

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	45.0	60	0.75						X	X	
2	2	90.0	120	0.75						X	X	
3	2	45.0	60	0.75						X	X	
4	2	90.0	120	0.75						X	X	
5	2	45.0	60	0.75						X	X	
6	2	90.0	120	0.75						X	X	
7	2	45.0	60	0.75						X	X	
8	2	90.0	120	0.75						X	X	
9	2	45.0	60	0.75						X	X	
10	2	90.0	120	0.75						X	X	
1	7	77.0	60	1.28						X	X	
2	7	73.0	60	1.22						X	X	
3	7	73.0	60	1.22						X	X	
4	7	73.0	60	1.22						X	X	
5	7	73.0	60	1.22						X	X	
1	15	86.0	60	1.43						X	X	
2	15	86.0	60	1.43						X	X	
3	15	86.0	60	1.43						X	X	
4	15	86.0	60	1.43						X	X	
5	15	86.0	60	1.43						X	X	
1	40	156.0	60	2.60						X	X	
2	40	156.0	60	2.60						X	X	
3	40	156.0	60	2.60						X	X	
4	40	156.0	60	2.60						X	X	
5	40	156.0	60	2.60						X	X	

CLASSIFICATION = **ND1**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B003 S8 24.0-26.0 feet

2 MIN

GRADE: 2

DISPERSIVE CLASSIFICATION: INTERMEDIATE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive

Grade 2 - Intermediate

Grade 3 - Dispersive

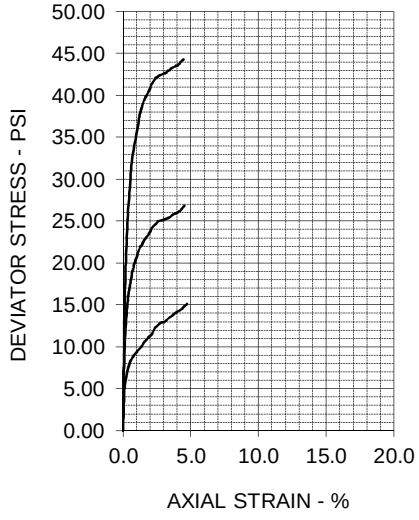
Grade 4 - Highly Dispersive

Terracon

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406

EFFECTIVE STRESS PARAMETERS	ϕ' = 30.7 deg	c' = 0.9 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	18.4	18.4	18.4	
Dry Density - pcf	109.7	109.7	109.7	
Diameter - inches	2.86	2.86	2.86	
Height - inches	5.69	5.69	5.69	
AT TEST				
Final Moisture - %			16.7	
Dry Density - pcf	110.7	112.8	115.3	
Calculated Diameter (in.)	2.86	2.87	2.86	
Height - inches	5.67	5.71	5.69	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.01	23.79	42.12	
Total Pore Pressure - psi	55.8	60.1	71.4	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	2.3	2.0	2.5	
σ_1' Failure - psi	16.19	33.74	60.73	
σ_3' Failure - psi	4.18	9.95	18.61	

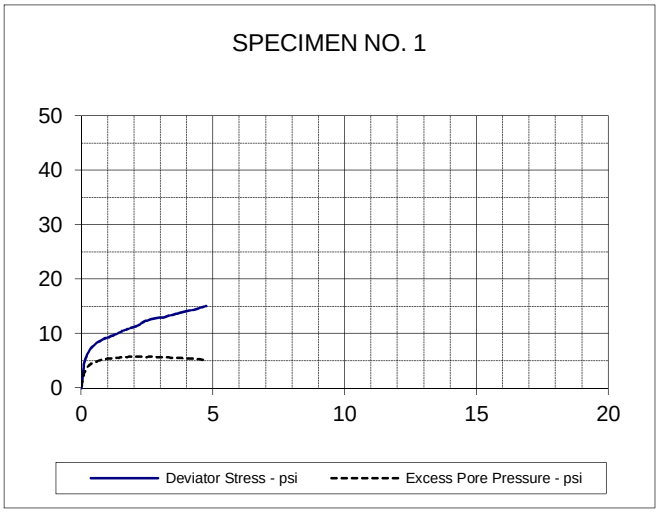
TEST DESCRIPTION

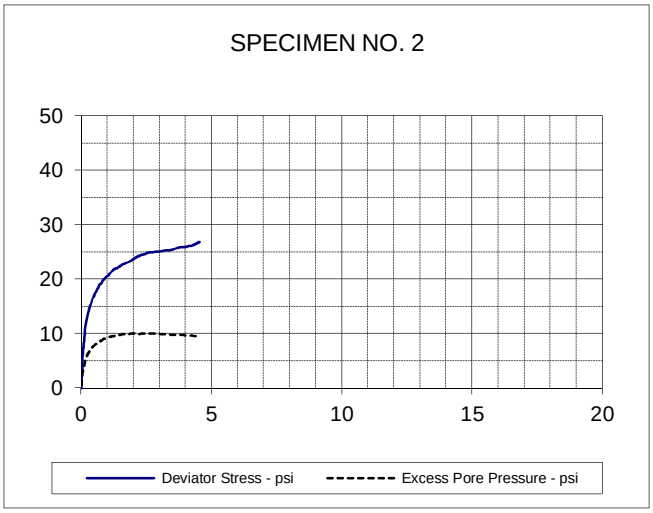
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Sandy Lean Clay (CL)
SAMPLE LOCATION: KIN-B003, S8, 24.0-26.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 31 PL: 16 PI: 15 Percent -200: 62
REMARKS: Multistage Triaxial

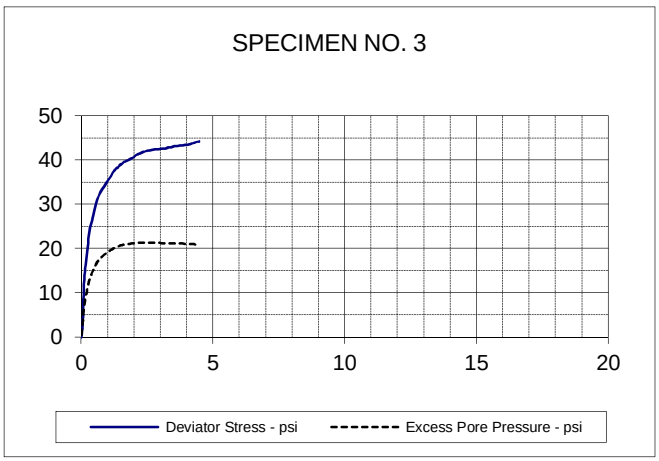
PROJECT INFORMATION

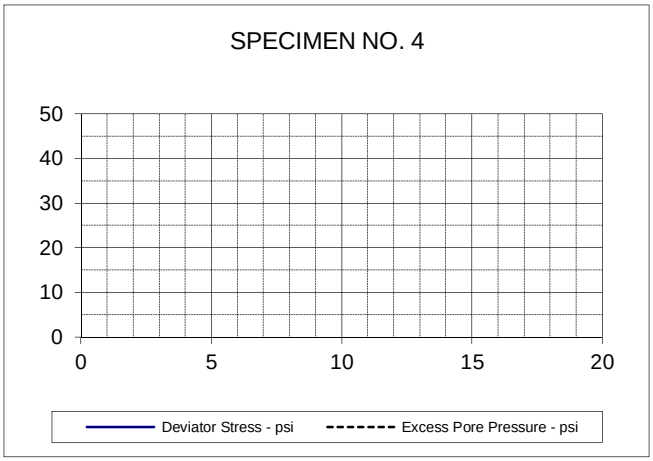
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

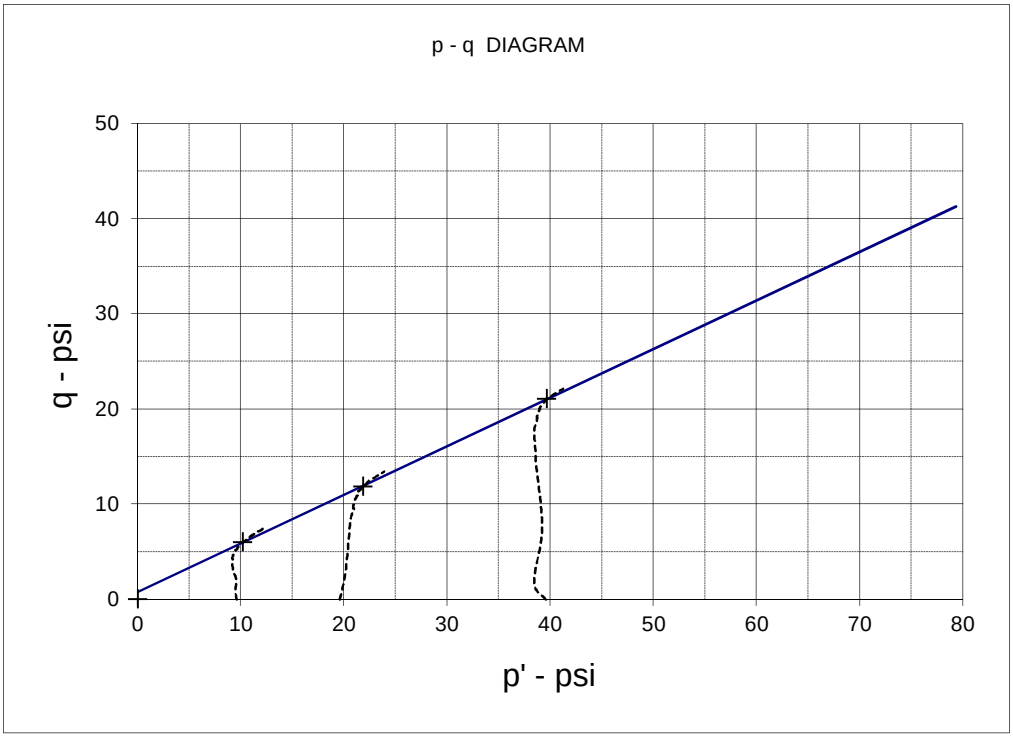
TERRACON







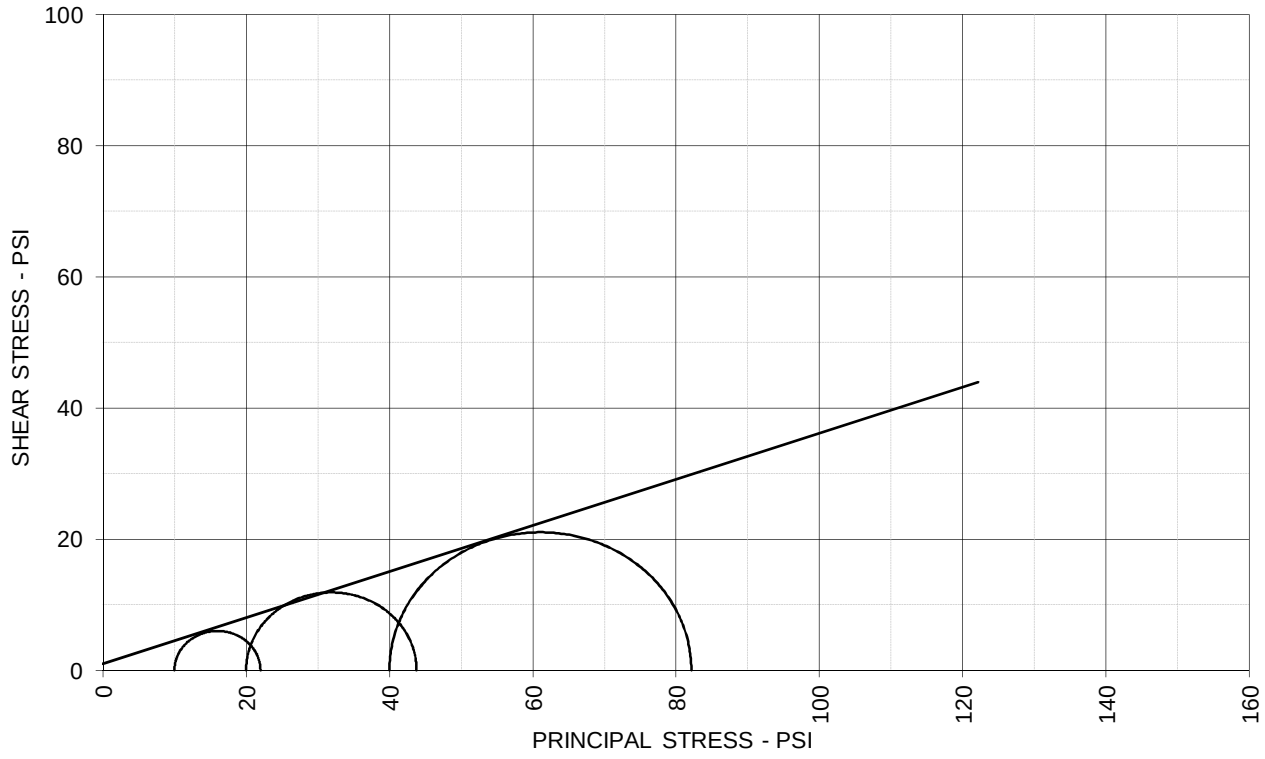




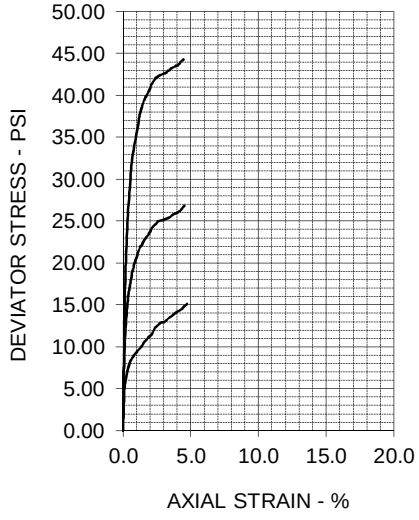
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 27.1	a (psi) = 0.8
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Sandy Lean Clay (CL)			

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 19.4 deg	c = 1.0 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	18.4	18.4	18.4	
Dry Density - pcf	109.7	109.7	109.7	
Diameter - inches	2.86	2.86	2.86	
Height - inches	5.69	5.69	5.69	
AT TEST				
Final Moisture - %			16.7	
Dry Density - pcf	110.7	112.8	115.3	
Calculated Diameter (in.)	2.86	2.87	2.86	
Height - inches	5.67	5.71	5.69	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.01	23.79	42.12	
Total Pore Pressure - psi	55.8	60.1	71.4	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	2.3	2.0	2.5	
σ_1 Failure - psi	22.01	43.79	82.12	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Sandy Lean Clay (CL)
SAMPLE LOCATION: KIN-B003, S8, 24.0-26.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 31 PL: 16 PI: 15 Percent -200: 62
REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B004	S1	1.0	2.5	9.1														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.5	5.0	12.1		31	15	16			2.664							
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S3	6.0	7.5	9.8					** Sieve									
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.0	19.3														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S5																	
	Color		NO Sample							**Visual Classification**								
	S6	13.5	15.0															
	Color		NO RECOVERY							**Visual Classification**								
	S7	17.0	19.0	14.6	117.9	29	15	14				Note*	Note*		NA			
	Color		Dark grayish brown with dark yellowish brown							**Visual Classification**			Lean clay with sand					
	S8	19.0	21.0	21.6	102.9	32	18	14		Note*				Note*		Note*	Note*	CL
	Color		Dark brown and green							**Visual Classification**			Lean clay with sand					
	S9	23.5	25.0	19.0														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S10	28.5	30.0	29.0	NA	55	22	33										
	Color		Brown and dark brown							**Visual Classification**			Fat clay					
	S11	30.0	32.0	25.9	100.1													
	Color		Brown and gray							**USCA Classification**			Lean clay					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

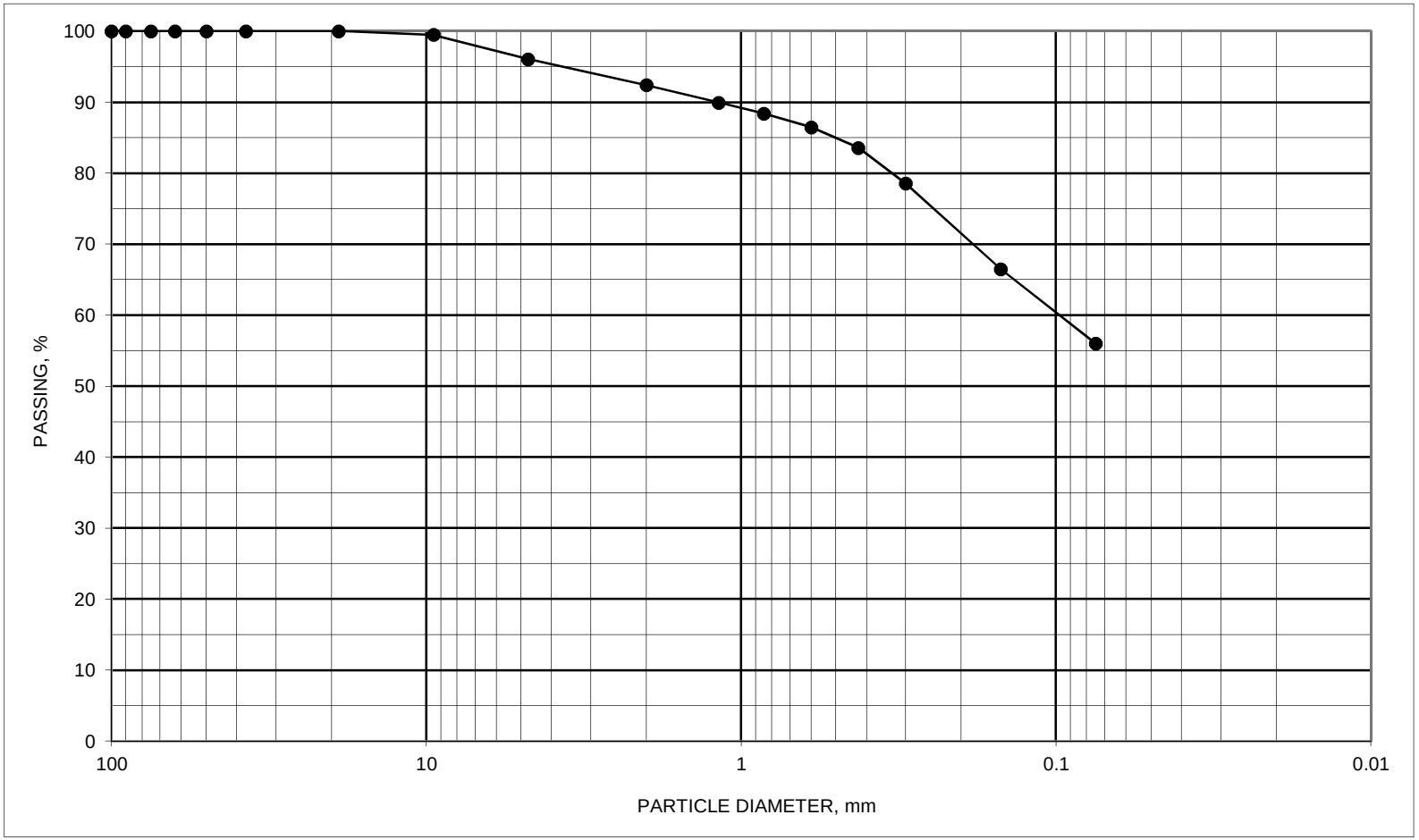
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B004	S12	33.5	35.0	21.2	111.9	42	17	25										
	Color		Brown and gray							**Visual Classification**			Lean clay					
	S13	37.0	39.0	21.2	109.6	43	15	28										
	Color		Brown and gray							**Visual Classification**			Lean clay, trace fine gravel					
	S14	43.5	45.0	9.0														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S15	48.5	50.0	7.7														
	Color		Brownish gray							**Visual Classification**			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	96
#10	2.00	92
#16	1.18	90
#20	0.85	88
#30	0.600	86
#40	0.425	84
#50	0.300	79
#100	0.150	66
#200	0.075	56.0
	D60	0.0976



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB004	S-3	6 TO 7.5	FILL: Sandy lean clay, trace fine gravel Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B004 S-3.xlsx]REPORT

Terracon

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4

PROJECT NAME:	DYNEGY	PROJECT NUMBER:	15151122
LOCATION:	KINCAID, ILLINOIS	DATE:	9/30/2015
		PANEL IDENTIFICATION:	Lenexa Perm Board
SAMPLE ID:	KIN-B004 S7 17.0 - 19.0 feet	BURETTE AREA:	0.312 cm^2
SAMPLE DESCR.:	LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH DARK YELLOWISH BROWN	BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%		DENSITY			
W & T, g	184.86	WET WT, g	519.7		
D & T, g	166.52	DIA, in	2.869	7.29	cm
T, g	34.30	HT, in	2.201	5.59	cm
		AREA		41.71	cm^2
MOIST-		DENSITY:	139.1	PCF WET	
URE, %	**13.9**	DENSITY:	**122.2**	PCF DRY	

ADDITIONAL DATA

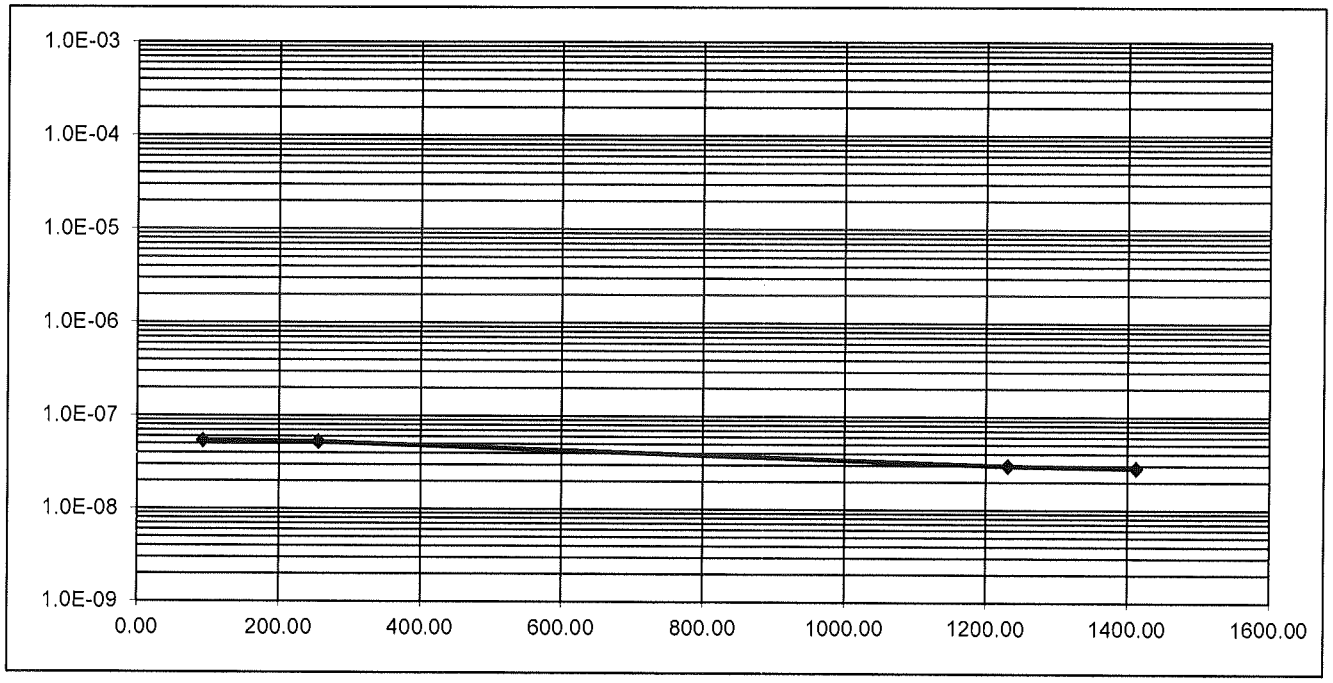
SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	NO
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	27.5	OPTIMUM, %:	NA
SATURATION, %:	98.7	COMPACTION, %:	NA
VOID RATIO:	0.38	OVER OPTIMUM, %:	NA

SATURATION:	LATERAL PRESS.:	104.0	psi	BACK PRESSURE (=UPPER=LOWER):	100.0	psi	
DURING TEST:	LATERAL PRESS.:	104.0	psi	H2: 100.0 psi	H1:	100.0	psi
				BIAS PRESSURE (=H1-H2)		0.0	psi

H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm^3	IN FLOW cm^3	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
8.6	66.9	0.00	58.3									
9.0	66.4	93.00	57.4	0.015558	5.40E-08	0.12	0.16	0.80	10.3	31	23.3	0.925
9.7	65.6	255.00	55.9	0.026480	5.25E-08	0.22	0.25	0.87	10.0	28	23.5	0.920
11.9	63.0	1231.00	51.1	0.089780	2.97E-08	0.69	0.81	0.85	9.1	28	23.2	0.927
12.3	62.6	1412.00	50.3	0.015779	2.82E-08	0.12	0.12	1.00	9.0	31	23.2	0.927

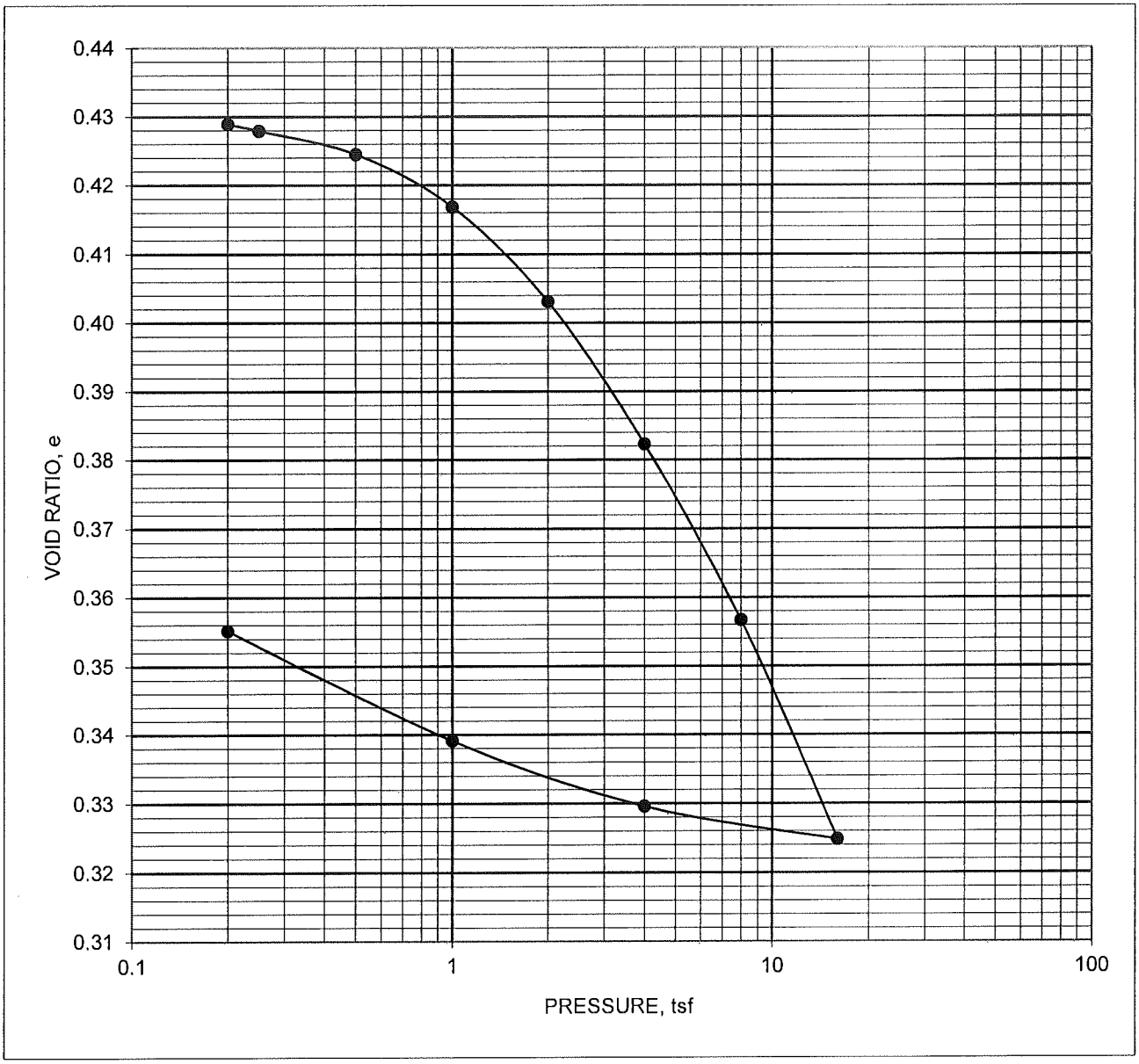
HYDRAULIC CONDUCTIVITY (k_{20}) = **AVERAGE 4.1E-08 cm/sec**

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
GRADIENT	1.0E-05 TO 1.0E-06	10	<1.25	HYDRAULIC	OR
	1.0E-06 TO 1.0E-07	20		GRADIENT	% < 50 AT
	less than 1.0E-07	30		ALLOWED	< 1.0E-8



Terracon

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



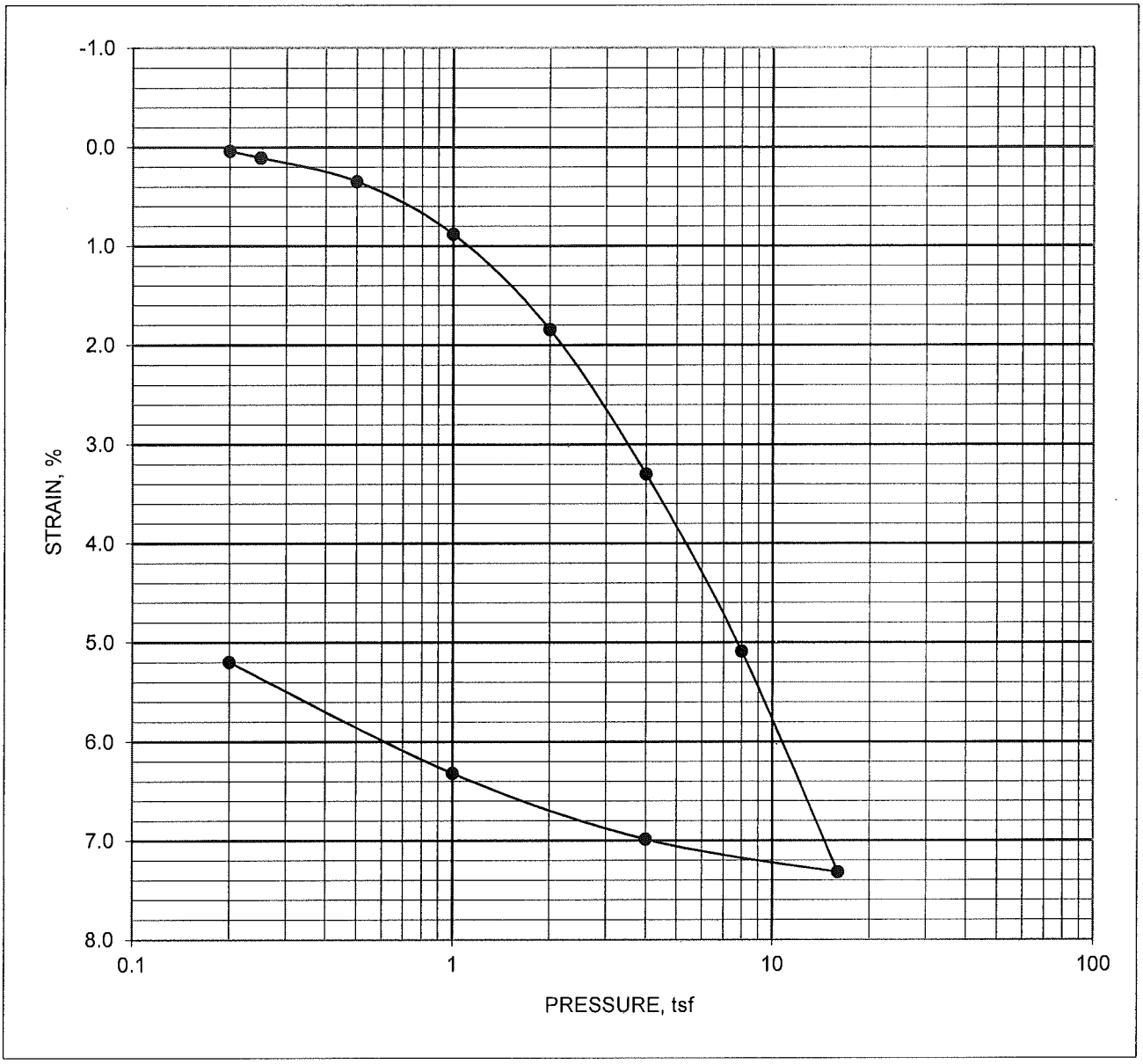
DIAMETER, mm	63.57	HEIGHT, mm	19.01	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		1.22		MOISTURE, %		14.6	13.5
PRECONSOL. PRESSURE, tsf		2.29		DRY DENSITY, pcf		117.9	123.7
OVER CONSOLIDATION RATIO		1.9		SATURATION, %		92	102
COMPRESSION INDEX		0.11		VOID RATIO		0.429	0.355
REBOUND INDEX		0.020		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	29	PLASTIC LIMIT	15	PLASTICITY INDEX	14	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH DARK YELLOWISH BROWN						
BORING NO.	KIN-B004	SAMPLE NO.	S7	DEPTH, feet	17.0 - 19.0		

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 Consolidation KIN-B004-S7-17.0.xl

Terracon

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.57	HEIGHT, mm	19.01	PROPERTY	BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		1.22		MOISTURE, %	14.6	13.5
PRECONSOL. PRESSURE, tsf		2.29		DRY DENSITY, pcf	117.9	123.7
OVER CONSOLIDATION RATIO		1.9		SATURATION, %	92	102
COMPRESSION INDEX		0.11		VOID RATIO	0.429	0.355
REBOUND INDEX		0.020		SAMPLE TYPE	UNDISTURBED	

LIQUID LIMIT	29	PLASTIC LIMIT	15	PLASTICITY INDEX	14	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH DARK YELLOWISH BROWN						
BORING NO	KIN-B004	SAMPLE NO.	S7	DEPTH, feet	17.0 - 19.0		

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 Consolidation KIN-B004-S7-17.0.]

Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

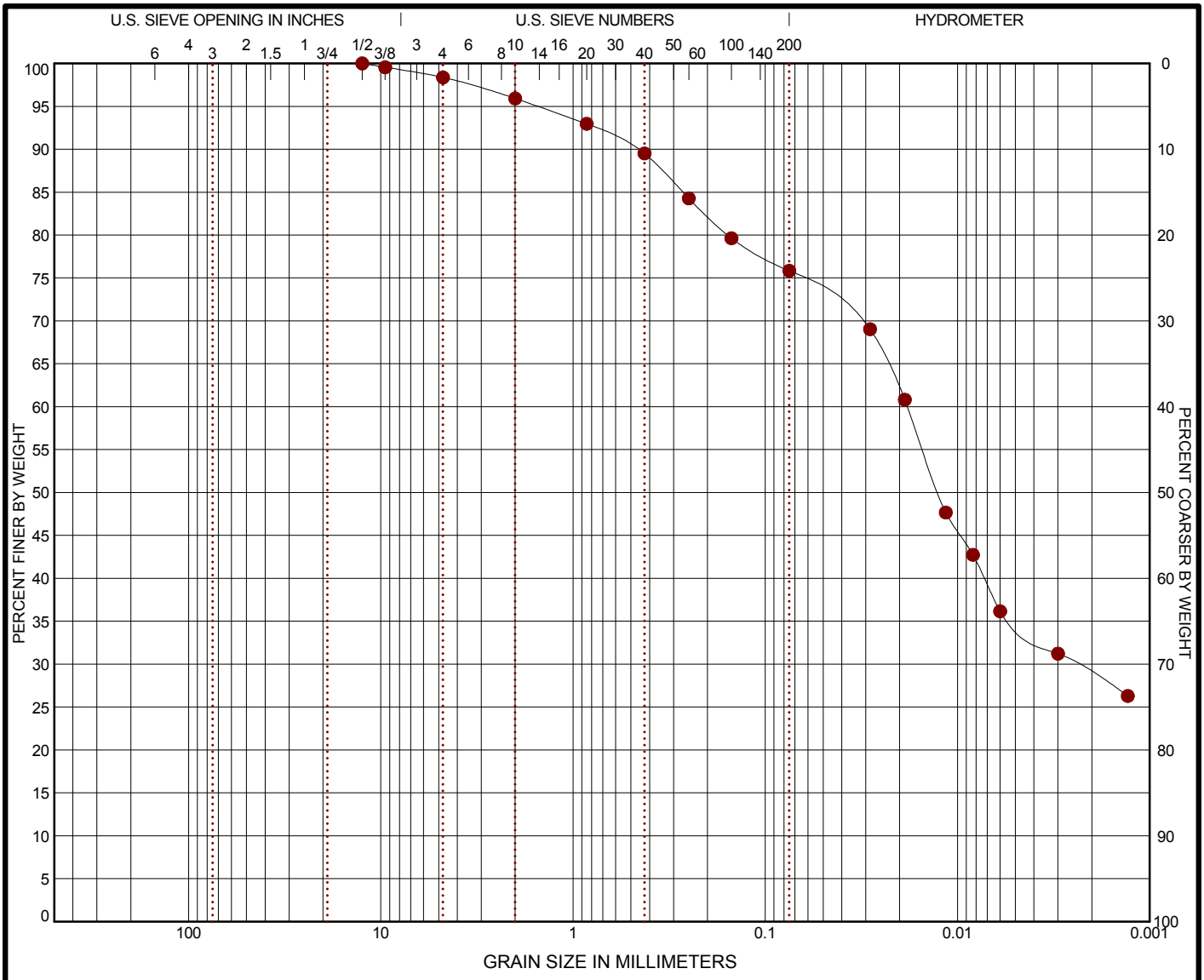
ADDITIONAL CONSOLIDATION DATA

KIN-B004
S7
17.0 - 19.0

PRESSURE, tsf	Cv50, cm2/sec	Cv90, cm2/sec	Av, cm2/g	Mv, cm2/g	k, cm/sec
0					
0.2			2.93E-06	2.05E-06	
0.25	1.23E-04	1.24E-04	1.95E-05	1.37E-05	1.69E-09
0.5	1.34E-03	1.35E-03	1.40E-05	9.84E-06	1.32E-08
1	9.44E-04	9.50E-04	1.56E-05	1.10E-05	1.03E-08
2	1.03E-03	1.03E-03	1.40E-05	9.91E-06	1.02E-08
4	1.04E-03	1.04E-03	1.06E-05	7.58E-06	7.87E-09
8	1.18E-03	1.18E-03	6.54E-06	4.73E-06	5.57E-09
16	8.93E-04	8.98E-04	4.07E-06	3.00E-06	2.68E-09
AVERAGE	9.35E-04	9.41E-04	1.09E-05	7.72E-06	7.36E-09

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B004**	**19**	**0.0**	**1.6**	**22.5**	**41.0**		**34.9**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.018**
D_{30}	**0.002**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	**100.0**
3/8"	**99.55**
#4	**98.37**
#10	**95.91**
#20	**92.96**
#40	**89.51**
#60	**84.28**
#100	**79.62**
#200	**75.84**

SOIL DESCRIPTION

● LEAN CLAY with SAND(CL)

REMARKS

● Dispersion: 5.22%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon

51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

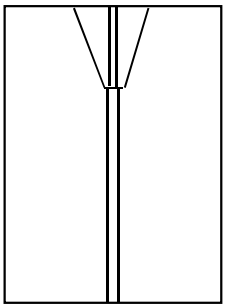
CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B004, S8, 19.0-21.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 22.7%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Lean Clay with Sand

FINAL HOLE
1.5 mm



TIME,	HEAD,	FLOW,		FLOW	TURBIDITY FROM SIDE						CLEAR	REMARKS
				RATE,	VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR	FROM TOP	
min	inch	ml	sec	ml/sec								
1	2	12.0	15	0.80						X	X	
2	2	11.0	15	0.73						X	X	
3	2	11.0	15	0.73						X	X	
4	2	11.0	15	0.73						X	X	
5	2	11.0	15	0.73						X	X	
6	2	11.0	15	0.73						X	X	
7	2	11.0	15	0.73						X	X	
8	2	11.0	15	0.73						X	X	
9	2	11.0	15	0.73						X	X	
10	2	11.0	15	0.73						X	X	
1	7	20.0	15	1.33						X	X	
2	7	21.0	15	1.40						X	X	
3	7	21.0	15	1.40						X	X	
4	7	20.0	15	1.33						X	X	
5	7	20.0	15	1.33						X	X	
1	15	43.0	15	2.87					X		X	
2	15	44.0	15	2.93					X		X	
3	15	45.0	15	3.00					X		X	
4	15	45.0	15	3.00					X		X	
5	15	45.0	15	3.00					X		X	
1	40											
2	40											
3	40											
4	40											
5	40											

CLASSIFICATION = **ND3**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B004 S8 19.0-21.0 feet

2 MIN

GRADE: 3

DISPERSIVE CLASSIFICATION: DISPERSIVE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive

Grade 2 - Intermediate

Grade 3 - Dispersive

Grade 4 - Highly Dispersive

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TRIAXIAL SHEAR TEST REPORT

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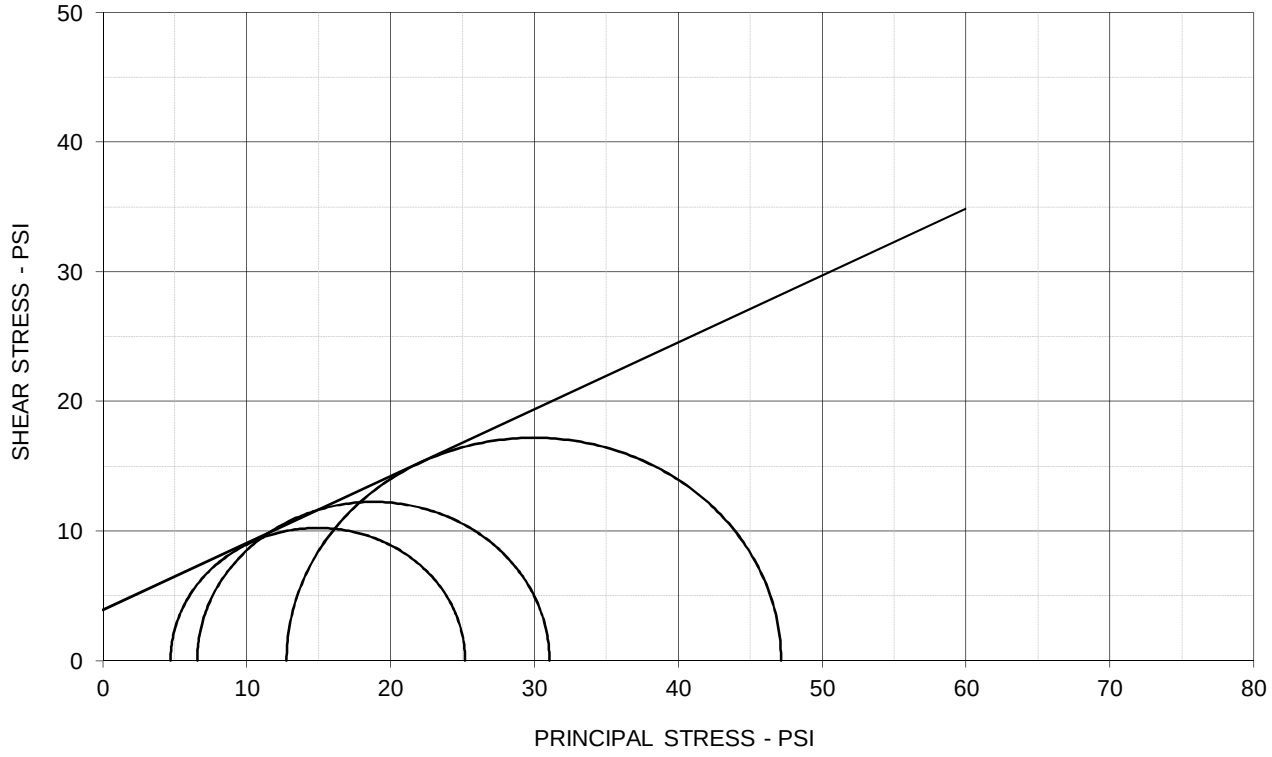
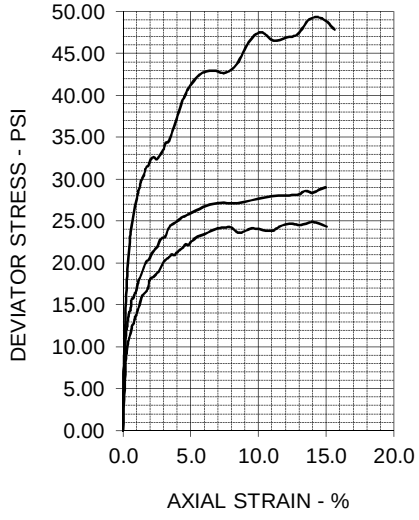
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS	ϕ ' = 27.3 deg	c' = 3.9 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	24.7	20.1	19.9	
Dry Density - pcf	97.2	104.0	107.6	
Diameter - inches	1.38	1.38	1.37	
Height - inches	2.80	2.80	2.79	
AT TEST				
Final Moisture - %	26.4	21.5	18.9	
Dry Density - pcf	97.6	105.7	110.9	
Calculated Diameter (in.)	1.36	1.37	1.36	
Height - inches	2.73	2.76	2.75	
Effect. Cell Pressure - psi	8.0	16.0	32.0	
Failure Stress - psi	20.47	24.48	34.37	
Total Pore Pressure - psi	53.3	59.4	69.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.2	3.5	3.2	
σ_1' Failure - psi	25.19	31.05	47.15	
σ_3' Failure - psi	4.72	6.57	12.78	

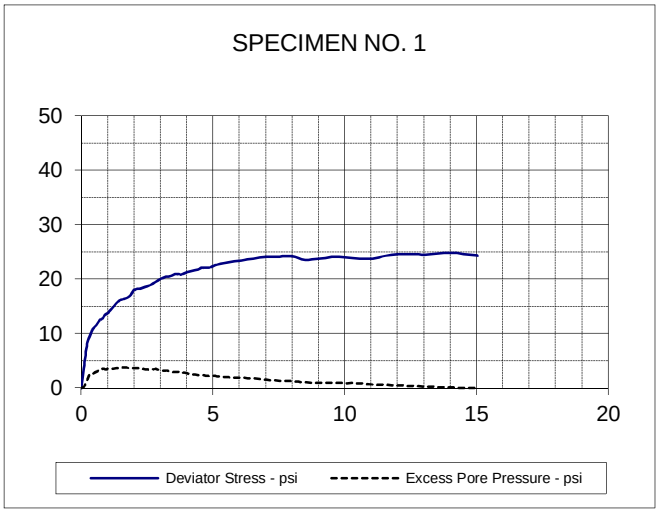
TEST DESCRIPTION

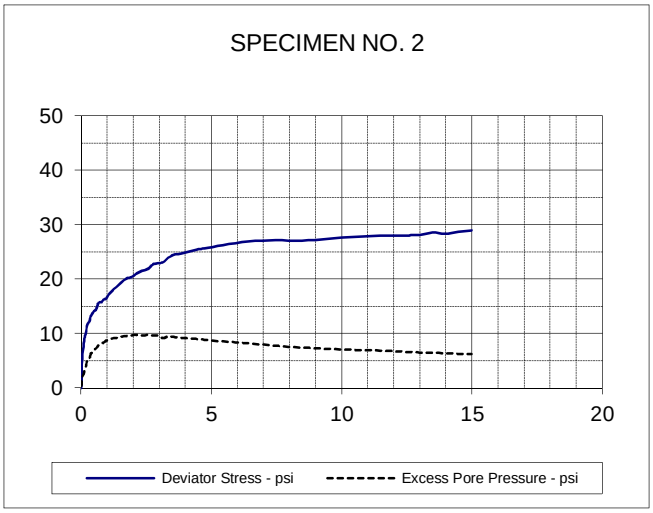
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B004, S8, 19.0-21.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 32 PL: 18 PI: 14 Percent -200: 76
REMARKS: Specimens trimmed to 1.4" diameter.

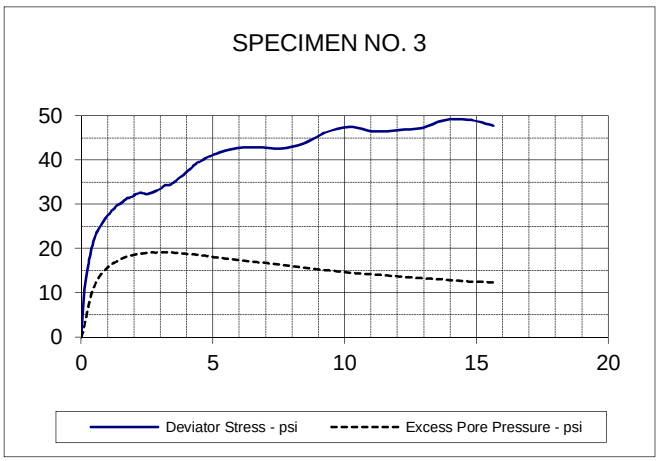
PROJECT INFORMATION

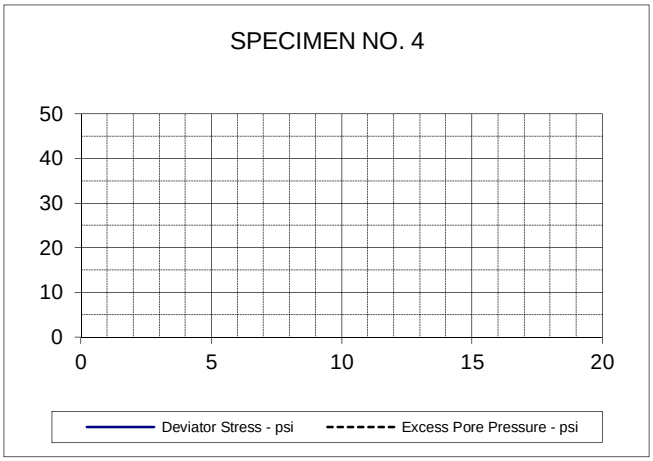
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

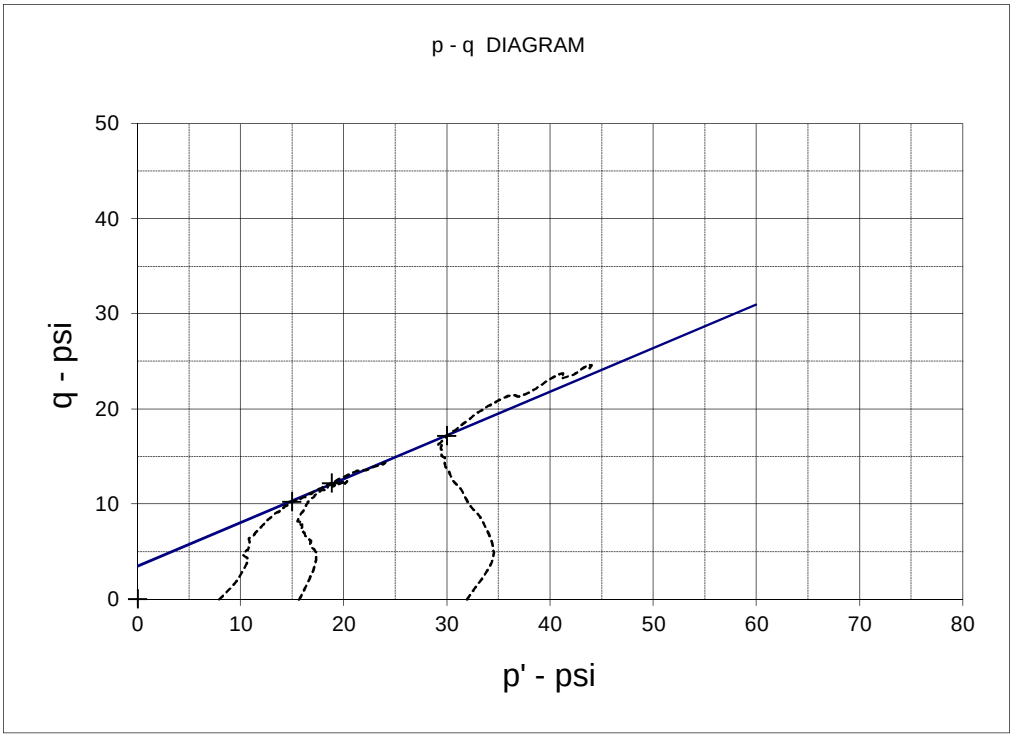
TERRACON







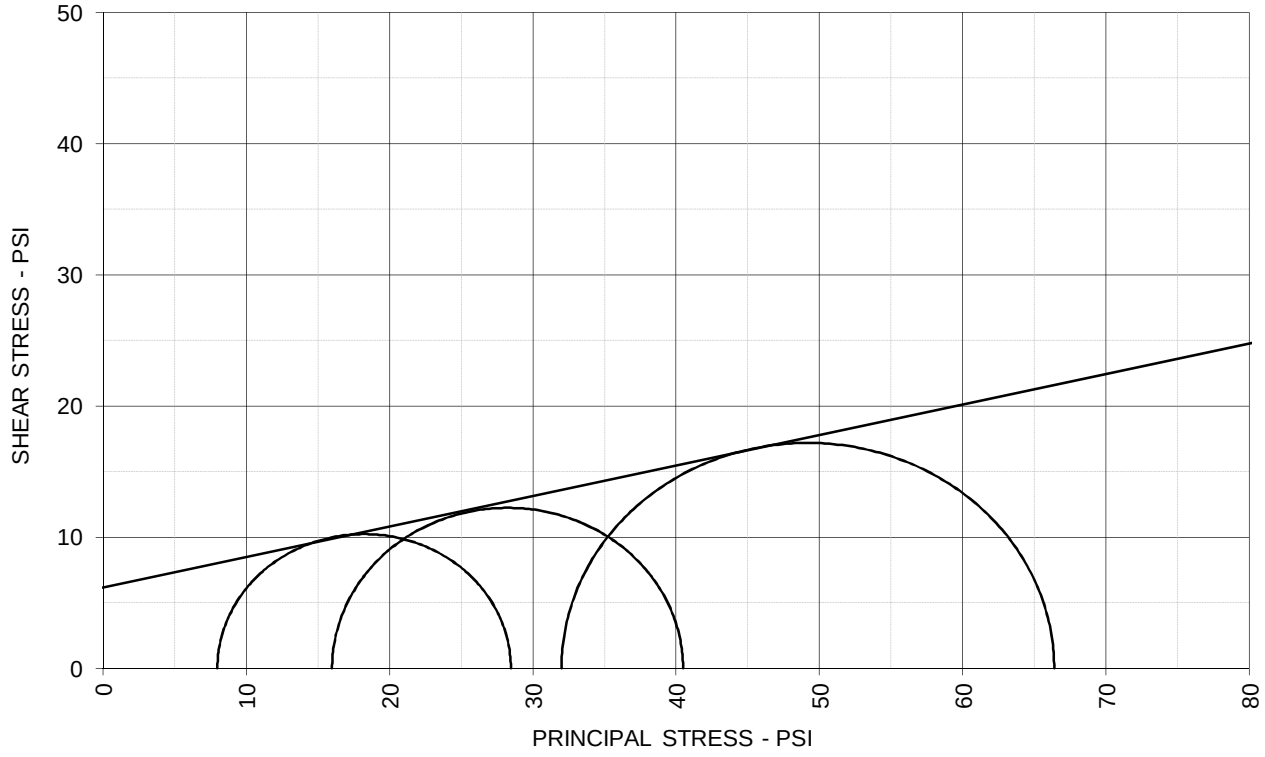




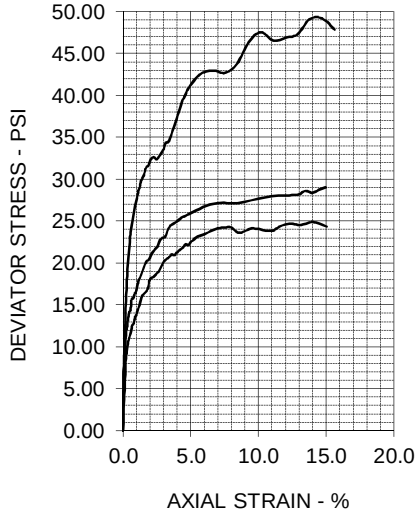
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 24.6	a (psi) = 3.5
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Lean Clay with Sand (CL)			

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 13.1 deg	c = 6.2 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	24.7	20.1	19.9	
Dry Density - pcf	97.2	104.0	107.6	
Diameter - inches	1.38	1.38	1.37	
Height - inches	2.80	2.80	2.79	
AT TEST				
Final Moisture - %	26.4	21.5	18.9	
Dry Density - pcf	97.6	105.7	110.9	
Calculated Diameter (in.)	1.36	1.37	1.36	
Height - inches	2.73	2.76	2.75	
Effect. Cell Pressure - psi	8.0	16.0	32.0	
Failure Stress - psi	20.47	24.48	34.37	
Total Pore Pressure - psi	53.3	59.4	69.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.2	3.5	3.2	
σ_1 Failure - psi	28.47	40.48	66.37	
σ_3 Failure - psi	8.00	16.00	32.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B004, S8, 19.0-21.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 32 PL: 18 PI: 14 Percent -200: 76
REMARKS: Specimens trimmed to 1.4" diameter.

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B005	S1	1.0	2.5	9.8														
	Color		Brown and gray with dark brown							**Visual Classification**			FILL: Lean clay with fine to coarse sand					
	S2	3.5	5.0	29.2														
	Color		Brown and gray							**Visual Classification**			Fat clay					
	S3	6.0	8.0	23.9	102.5	35	23	12		Note*		Note*				Note*	Note*	CL
	Color		Grayish brown							**Visual Classification**			Lean clay, trace sand					
	S4	8.0	10.0	24.2	101.9	38	22	16						Note*				
	Color		Grayish brown							**Visual Classification**			Lean clay with sand					
	S5	13.5	15.0	21.9														
	Color		Brown and gray							**Visual Classification**			Lean clay with fine to medium sand, trace fine gravel					
	S6	16.0	18.0	13.8	122.4	22	14	8	** Sieve									
	Color		Brown and gray							**Visual Classification**			Clayey sand, trace fine gravel					
	S7	18.5	20.0	10.2														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S8	23.5	25.0	6.7		20	13	7										
	Color		Brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S9	28.5	30.0	27.7														
	Color		Brownish gray							**Visual Classification**			Lean to fat shaley clay, trace silt seams					
	S10	33.5	35.0	7.7														
	Color		Brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S11	38.5	40.0	7.8														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S12	43.5	45.0	9.5														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S12A	42.0	43.5	8.2														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B005	S13	52.0	53.5	17.5	110.3	36	18	18										
	Color		Brown							**Visual Classification**		Lean clay, trace fine sand						
	S14	62.0	63.5	16.6					** Sieve		2.748							
	Color		Brown and gray							**Visual Classification**		Sandy lean clay						
	S15A	72.0	72.5	15.2														
	Color		Gray							**Visual Classification**		Shaley lean clay, trace fine gravel						
	S15B	72.5	73.0	8.4														
	Color		Gray							**Visual Classification**		Sandy shaley lean clay, trace fine gravel						
												Rock Unconf. Comp.						
	RUN #1	75.9	76.5	1.0	162.0							6503 psi						
	Color		Gray							**Visual Classification**		Limestone						
	RUN #1	78.0	79.6															
	Color									**Visual Classification**								
	RUN #2	80.8	81.6															
	Color									**Visual Classification**								
	RUN #2	83.0	83.6	8.4	107.3							NA						
	Color		Dark gray							**Visual Classification**		Shale						

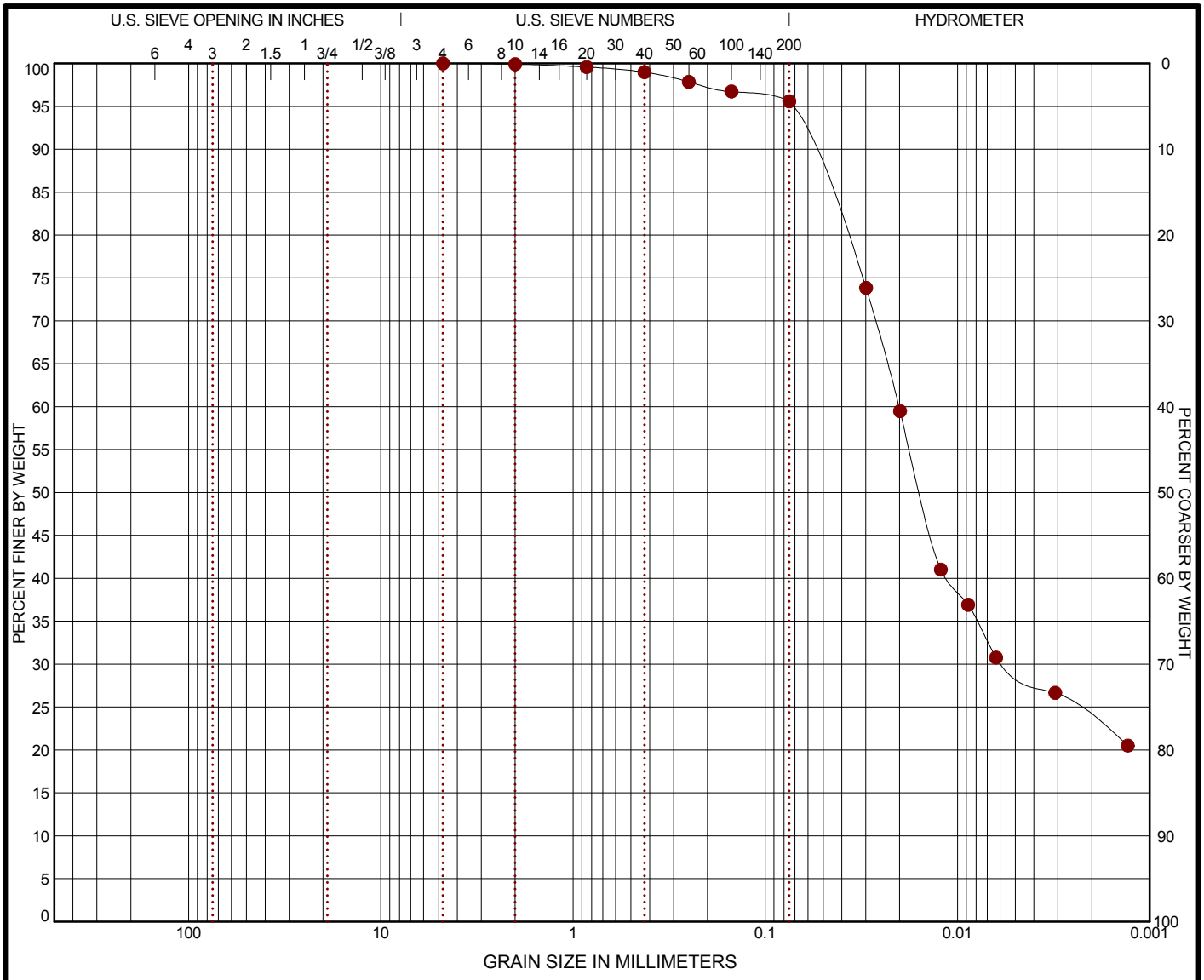
TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B005**	**6**	**0.0**	**0.0**	**4.4**	**66.2**		**29.4**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.02**
D_{30}	**0.006**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●		
1 1/2"			
1"			
3/4"			
1/2"			
3/8"			
#4	**100.0**		
#10	**99.91**		
#20	**99.57**		
#40	**98.97**		
#60	**97.84**		
#100	**96.73**		
#200	**95.59**		

SOIL DESCRIPTION
● LEAN CLAY(CL)

REMARKS
● Dispersion: 18.39%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 10/2/15

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project :	Dynegy-Kincaid							
Date:	9/30/2015			Panel Number :	P-1			
Project No. :	15151122					Permometer Data		
Boring No.:	B005	a_p =	0.031416	cm^2	Set Mercury to Pipet Rp at beginning	Equilibrium	1.6	cm^3
Sample:	S3	a_a =	0.767120	cm^2		Pipet **Rp**	**16.1**	cm^3
Depth (ft):	6.0-8.0	M_1 =	0.030180	C = 0.0004023		Annulus **Ra**	1.0	cm^3
Other Location:	Tube	M_2 =	1.040953	T = 0.0689682				
Material Description :	Grayish Brown Silty Clay							

SAMPLE DATA

					Before Test		After Test	
Wet Wt. sample + ring or tare :			559.64	g				
Tare or ring Wt. :			0.0	g				
Wet Wt: of Sample :			559.64	g	Tare No.:	328	Tare No.:	299
Diameter :	2.83	in	7.18	cm^2	Wet Wt.+tare:	118.39	Wet Wt.+tare:	101.15
Length :	2.67	in	6.79	cm	Dry Wt.+tare:	99.39	Dry Wt.+tare:	85.82
Area:	6.27	in^2	40.44	cm^2	Tare Wt:	20.23	Tare Wt:	21.16
Volume :	16.76	in^3	274.66	cm^3	Dry Wt.:	79.16	Dry Wt.:	64.66
Unit Wt.(wet):	**127.15**	pcf	**2.04**	$g/cm^{\wedge 3}$	Water Wt.:	19	Water Wt.:	15.33
Unit Wt.(dry):	**102.54**	pcf	**1.64**	$g/cm^{\wedge 3}$	% moist.:	**24.0**	% moist.:	**23.7**

Assumed Specific Gravity:	**2.70**	Max Dry Density(pcf) =		OMC =	
		% of max =		+/- OMC =	
Calculated % saturation:	99.41	Void ratio (e) =	**0.64**	Porosity (n)=	**0.39**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.1 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)	Reset = *
9/28/2015	60	14.7	1.399446	21	0.977	6.65E-07	1.88E-03	
9/28/2015	120	13.8	2.299446	21	0.977	5.65E-07	1.60E-03	
9/28/2015	180	13	3.099446	21	0.977	5.25E-07	1.49E-03	
9/28/2015	240	12.3	3.799446	21	0.977	4.98E-07	1.41E-03	

SUMMARY

k_a =	5.63E-07	cm/sec		Acceptance criteria =	50 %
ki			Vm		
k1 =	6.65E-07	cm/sec	18.0	%	Vm = $\frac{\lvert ka-ki \rvert}{ka}$ x 100
k2 =	5.65E-07	cm/sec	0.4	%	
k3 =	5.25E-07	cm/sec	6.8	%	
k4 =	4.98E-07	cm/sec	11.7	%	

Hydraulic conductivity	k =	**5.63E-07**	cm/sec	**1.60E-03**	ft/day
Void Ratio	e =	**0.64**			
Porosity	n =	**0.39**			
Bulk Density	γ =	**2.04**	g/cm^3	**127.1**	pcf
Water Content	W =	**0.40**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**5.77E-12**	cm^2	(at 20 deg C)	

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B005 S3 6.0-8.0 feet

2 MIN

GRADE: 2

DISPERSIVE CLASSIFICATION: INTERMEDIATE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive

Grade 2 - Intermediate

Grade 3 - Dispersive

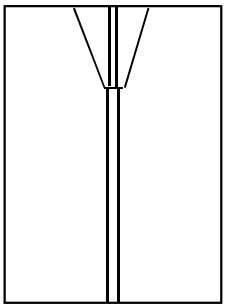
Grade 4 - Highly Dispersive

Terracon

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B005, S3, 6.0-8.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 24.0%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Grayish Brown Silty Clay

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	8.0	15	0.53						X	X	
2	2	8.5	15	0.57						X	X	
3	2	8.0	15	0.53						X	X	
4	2	9.0	15	0.60						X	X	
5	2	8.0	15	0.53						X	X	
6	2	8.0	15	0.53						X	X	
7	2	9.0	15	0.60						X	X	
8	2	9.5	15	0.63						X	X	
9	2	9.5	15	0.63						X	X	
10	2	9.5	15	0.63						X	X	
1	7	18.0	15	1.20						X	X	
2	7	18.5	15	1.23						X	X	
3	7	19.0	15	1.27						X	X	
4	7	19.0	15	1.27						X	X	
5	7	19.0	15	1.27						X	X	
1	15	27.0	15	1.80						X	X	
2	15	26.0	15	1.73						X	X	
3	15	26.0	15	1.73						X	X	
4	15	26.0	15	1.73						X	X	
5	15	26.0	15	1.73						X	X	
1	40	115.0	30	3.83					X			
2	40	118.0	30	3.93					X			
3	40	120.0	30	4.00					X			
4	40	120.0	30	4.00					X			
5	40	120.0	30	4.00					X			

CLASSIFICATION = **ND2**

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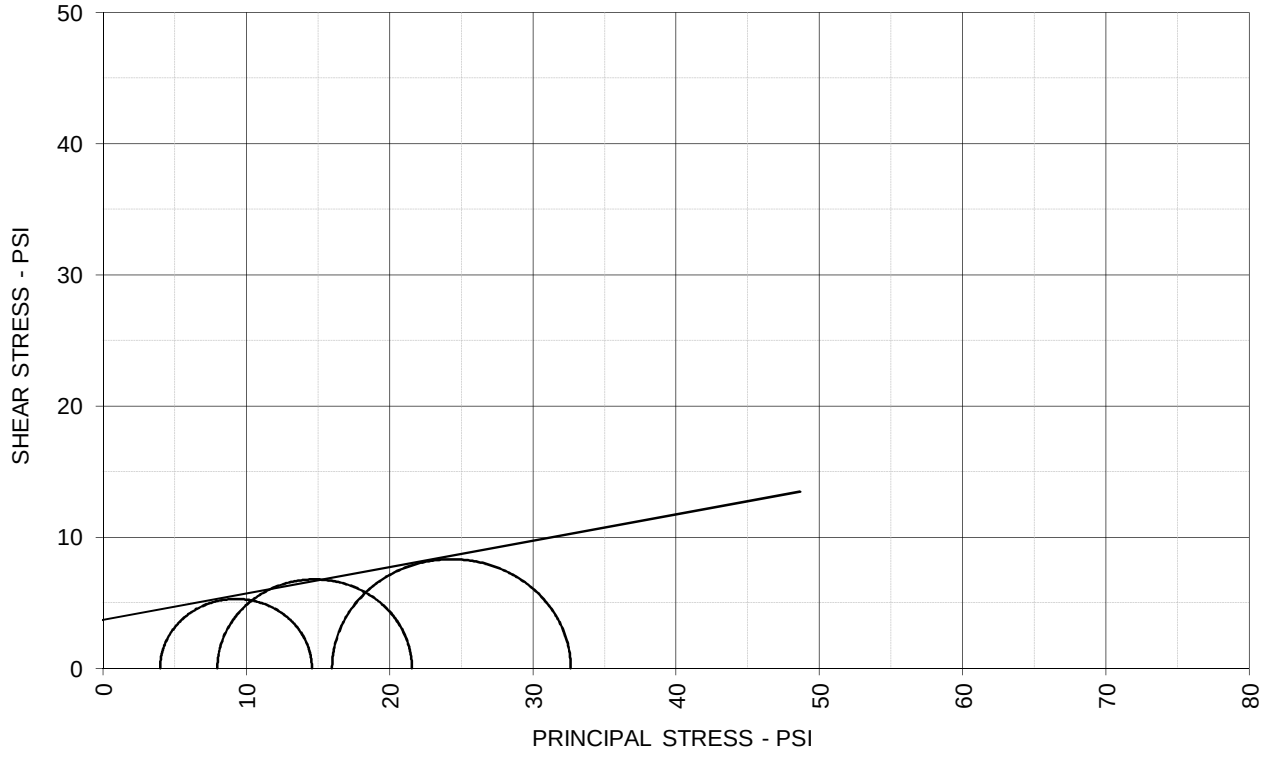
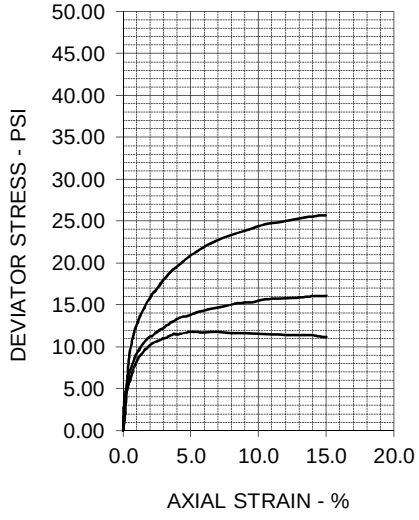
TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 11.4 deg	c = 3.7 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	25.3	23.9	23.4	
Dry Density - pcf	100.1	101.8	104.0	
Diameter - inches	1.99	1.99	1.98	
Height - inches	4.00	3.99	4.00	
AT TEST				
Final Moisture - %	24.7	23.7	21.7	
Dry Density - pcf	100.1	102.0	105.5	
Calculated Diameter (in.)	1.97	1.98	1.96	
Height - inches	3.96	3.96	3.96	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	10.59	13.57	16.65	
Total Pore Pressure - psi	51.1	52.8	59.6	
Strain Rate - inches/min.	0.00040	0.00040	0.00040	
Failure Strain - %	2.4	4.4	2.4	
σ_1 Failure - psi	14.59	21.57	32.65	
σ_3 Failure - psi	4.00	8.00	16.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Clay with Sand
SAMPLE LOCATION: KIN-B005, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 38 PL: 22 PI: 16 Percent -200: X
REMARKS: Specimens trimmed to 2.0" diameter.

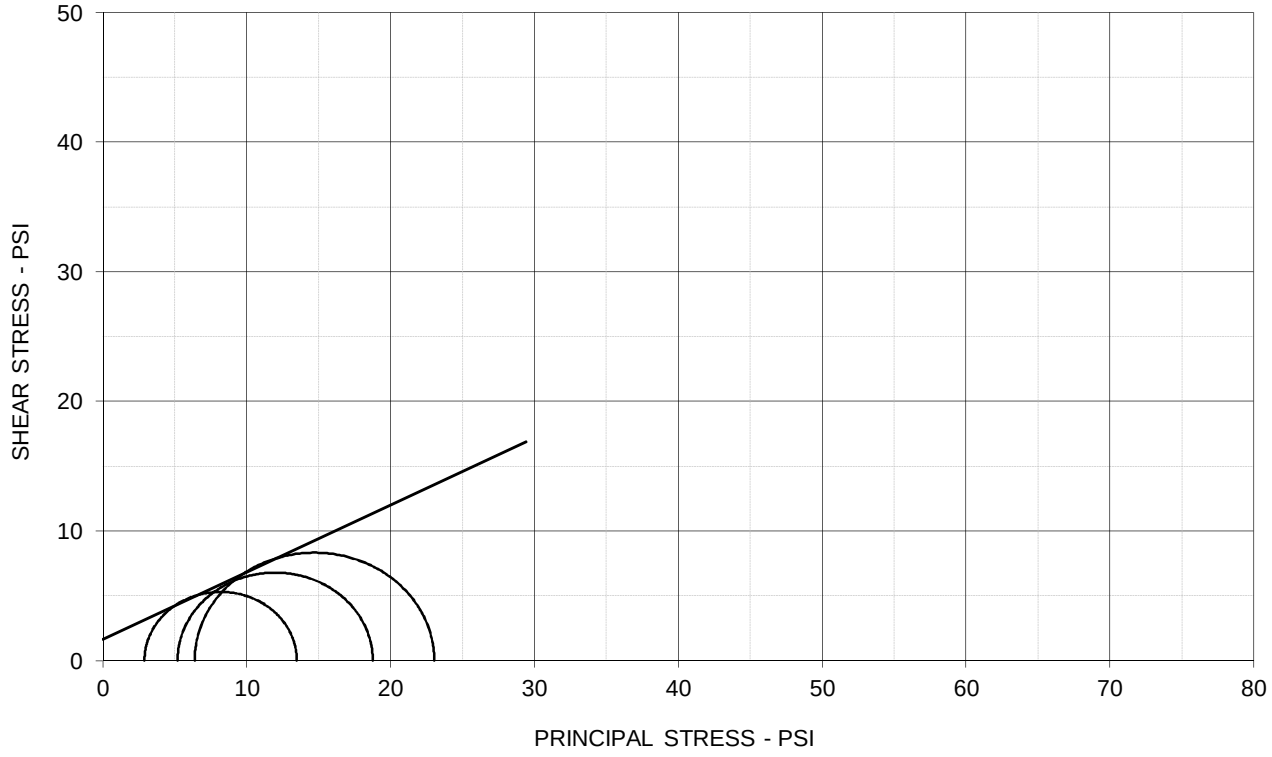
PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

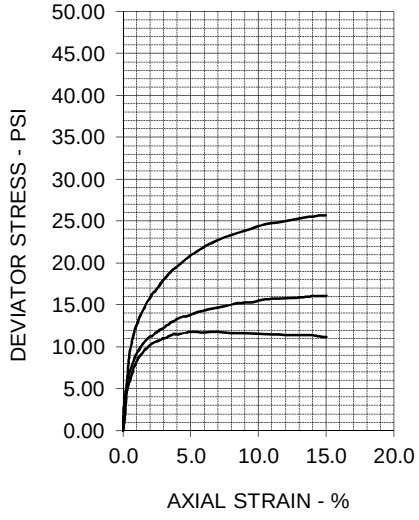
TERRACON

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS	ϕ' = 27.4 deg	c' = 1.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	25.3	23.9	23.4	
Dry Density - pcf	100.1	101.8	104.0	
Diameter - inches	1.99	1.99	1.98	
Height - inches	4.00	3.99	4.00	
AT TEST				
Final Moisture - %	24.7	23.7	21.7	
Dry Density - pcf	100.1	102.0	105.5	
Calculated Diameter (in.)	1.97	1.98	1.96	
Height - inches	3.96	3.96	3.96	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	10.59	13.57	16.65	
Total Pore Pressure - psi	51.1	52.8	59.6	
Strain Rate - inches/min.	0.00040	0.00040	0.00040	
Failure Strain - %	2.4	4.4	2.4	
σ_1' Failure - psi	13.49	18.77	23.04	
σ_3' Failure - psi	2.90	5.20	6.39	

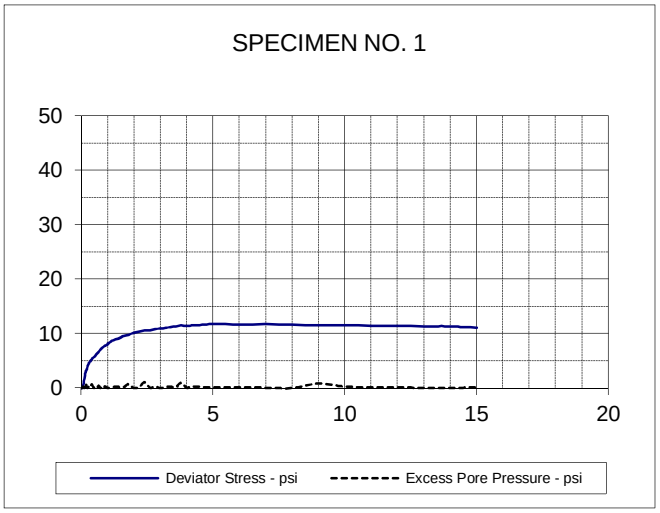
TEST DESCRIPTION

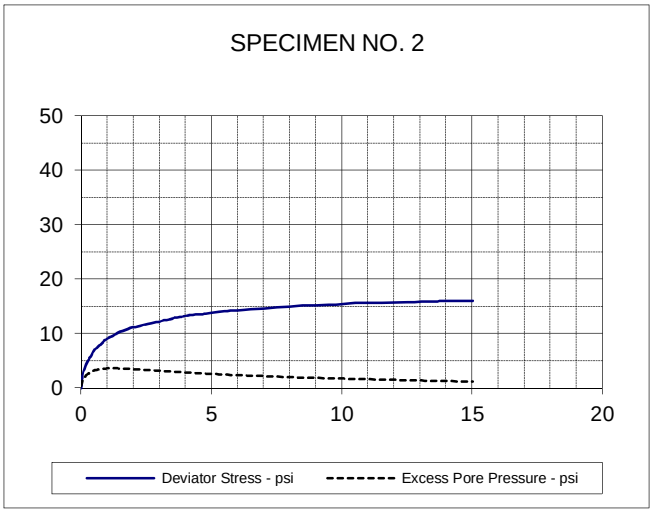
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Clay with Sand
SAMPLE LOCATION: KIN-B005, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 38 PL: 22 PI: 16 Percent -200: X
REMARKS: Specimens trimmed to 2.0" diameter.

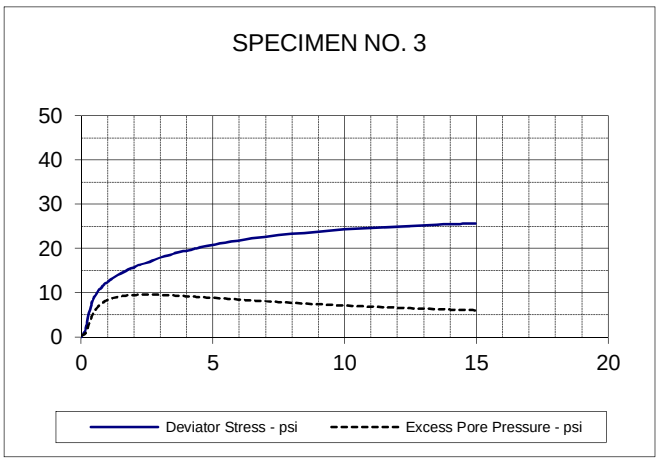
PROJECT INFORMATION

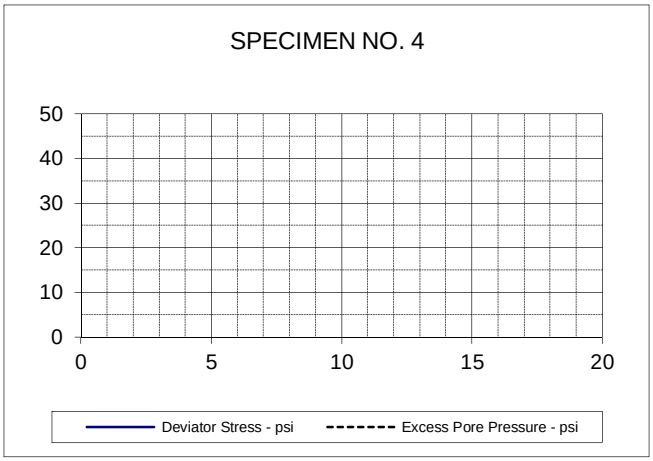
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

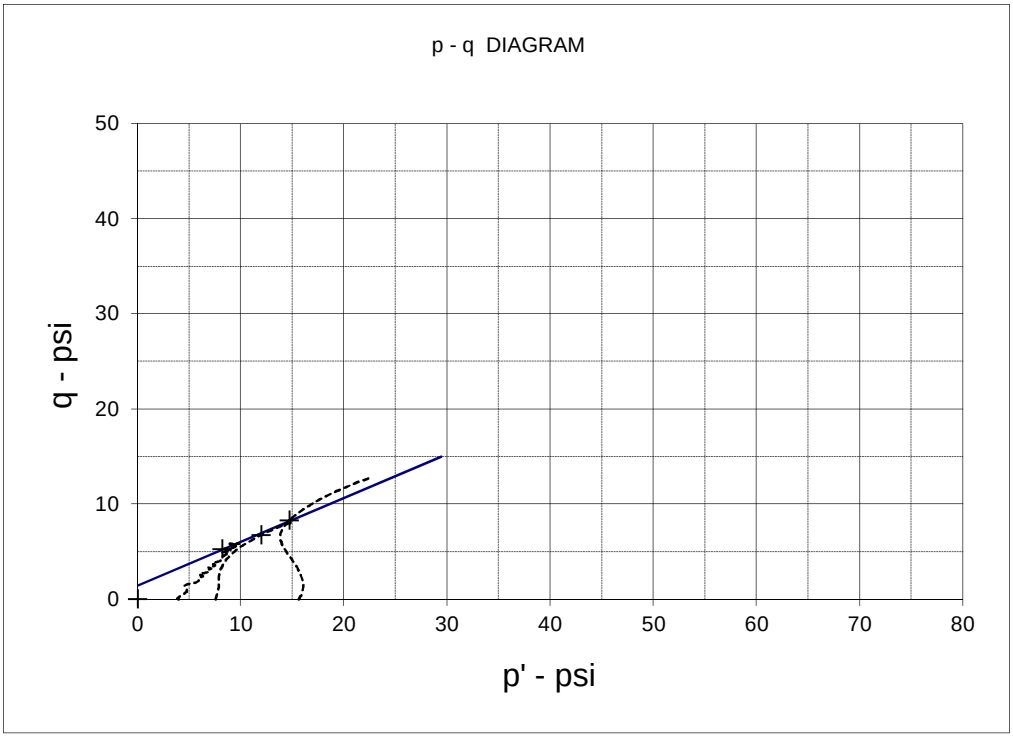
TERRACON





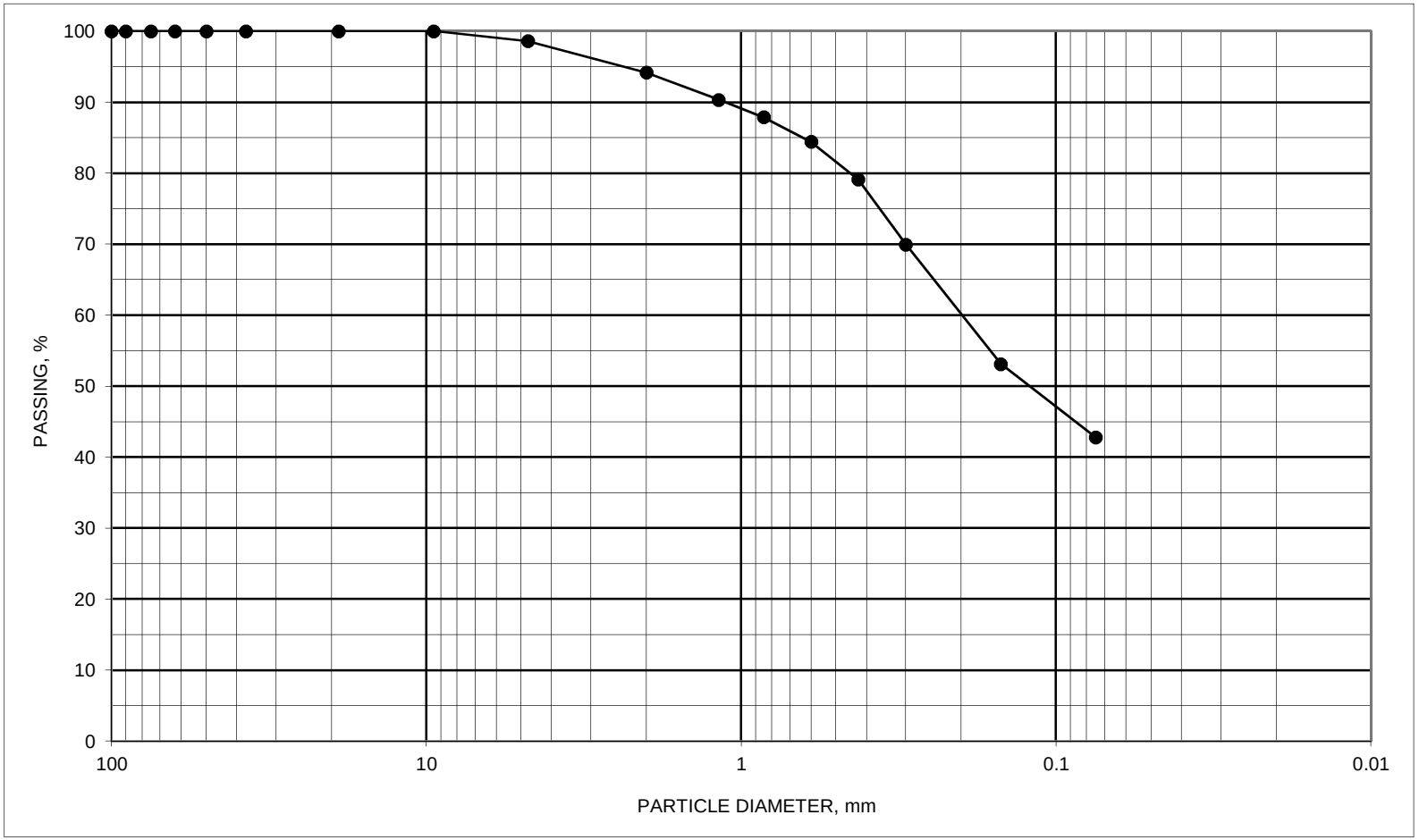






EFFECTIVE STRESS PARAMETERS	R^2 = 0.99	α (deg) = 24.7	a (psi) = 1.4
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Grayish Brown Clay with Sand			

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	99
#10	2.00	94
#16	1.18	90
#20	0.85	88
#30	0.600	84
#40	0.425	79
#50	0.300	70
#100	0.150	53
#200	0.075	42.8
	D60	0.1989



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB005	S-6	16 TO 18	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

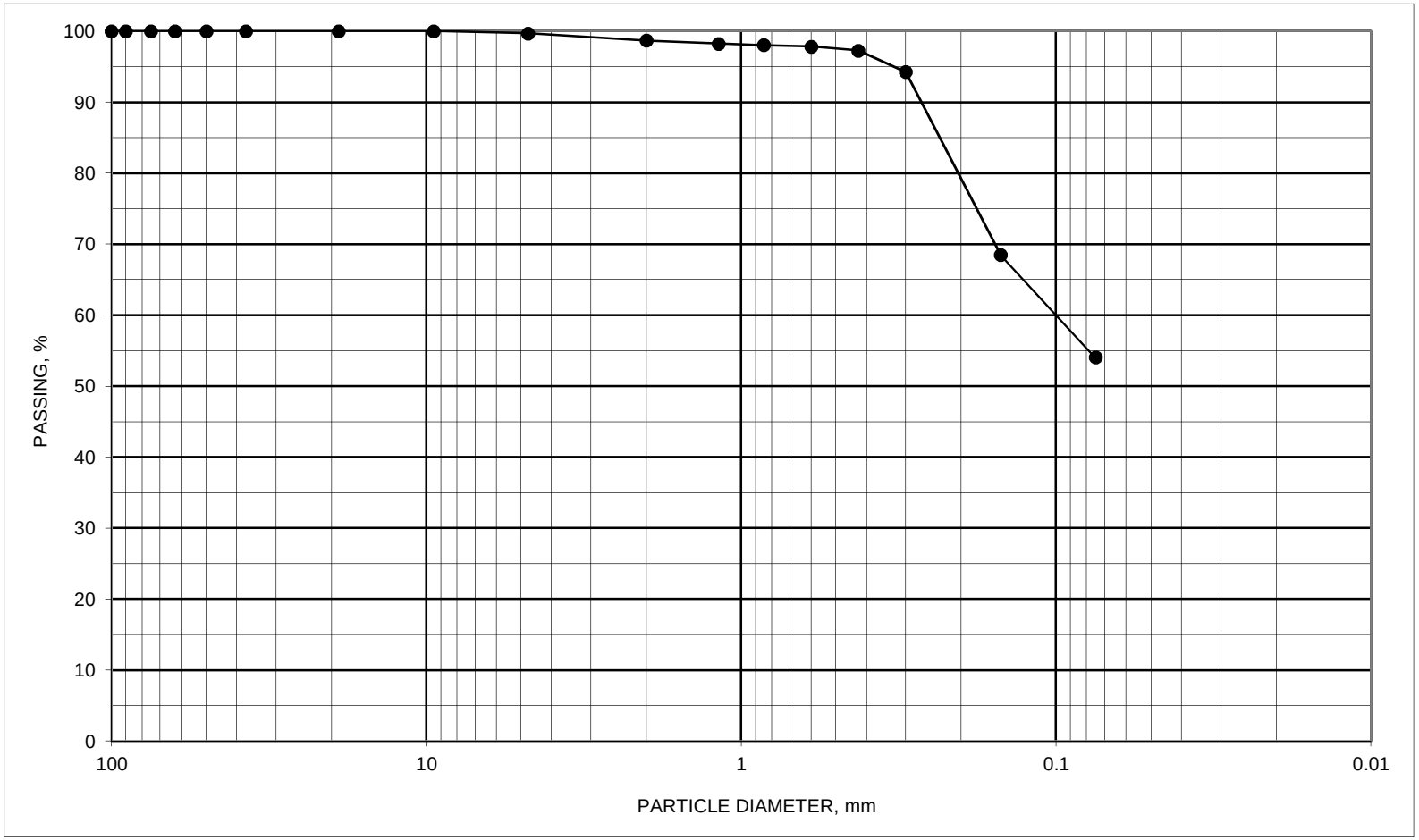
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B005 S-6.xlsx]REPORT

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	99
#16	1.18	98
#20	0.85	98
#30	0.600	98
#40	0.425	97
#50	0.300	94
#100	0.150	68
#200	0.075	54.1
	D60	0.0998



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB005	S-14	62 TO 63.5	Sandy lean clay Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B005 S-14.xlsx]REPORT

Terracon

DYNEGY - KINCAID, ILLINOIS

15151122

10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B006	S1	1.0	2.5	34.2					** Sieve		2.653							
	Color		Brown and black							**Visual Classification**			FILL: Cinders with clayey silt					
	S2	3.5	5.0	71.4														
	Color		Brown with black							**Visual Classification**			FILL: Lean clay with cinders					
	S3			NO RECOVERY														
	Color									**Visual Classification**								
	S4	8.0	10.5															
	Color		No testing assigned							**Visual Classification**			PISTON SAMPLE: ASH					
	S5	12.0	13.5	48.0					** Sieve									
	Color		Dark brown and gray							**Visual Classification**			FILL: Sandy lean clay with organics					
	S6	13.5	16.0															
	Color		No testing assigned							**Visual Classification**			PISTON SAMPLE: ASH					
	S7	17.0	18.5	38.5					** Sieve									
	Color		Dark brown							**Visual Classification**			FILL: Cinders with organics and clay					
	S8	20.0	22.0	NO RECOVERY														
	Color									**Visual Classification**			PISTON SAMPLE - NO RECOVERY					
	S9	22.0	24.5															
	Color		Not at lab - No testing assigned							**Visual Classification**			PISTONE SAMPLE: ASH					
	S10	28.5	30.0	30.4		36	21	15			2.742							
	Color		Brown and gray							**Visual Classification**			Lean clay, trace fine sand					
	S11	33.5	35.0	28.2														
	Color		Brown and gray							**Visual Classification**			Fat clay					
	S12	37.0	39.0															
	Color		No testing assigned							**Visual Classification**								

TESTED BY: JLB, RR, SS

APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

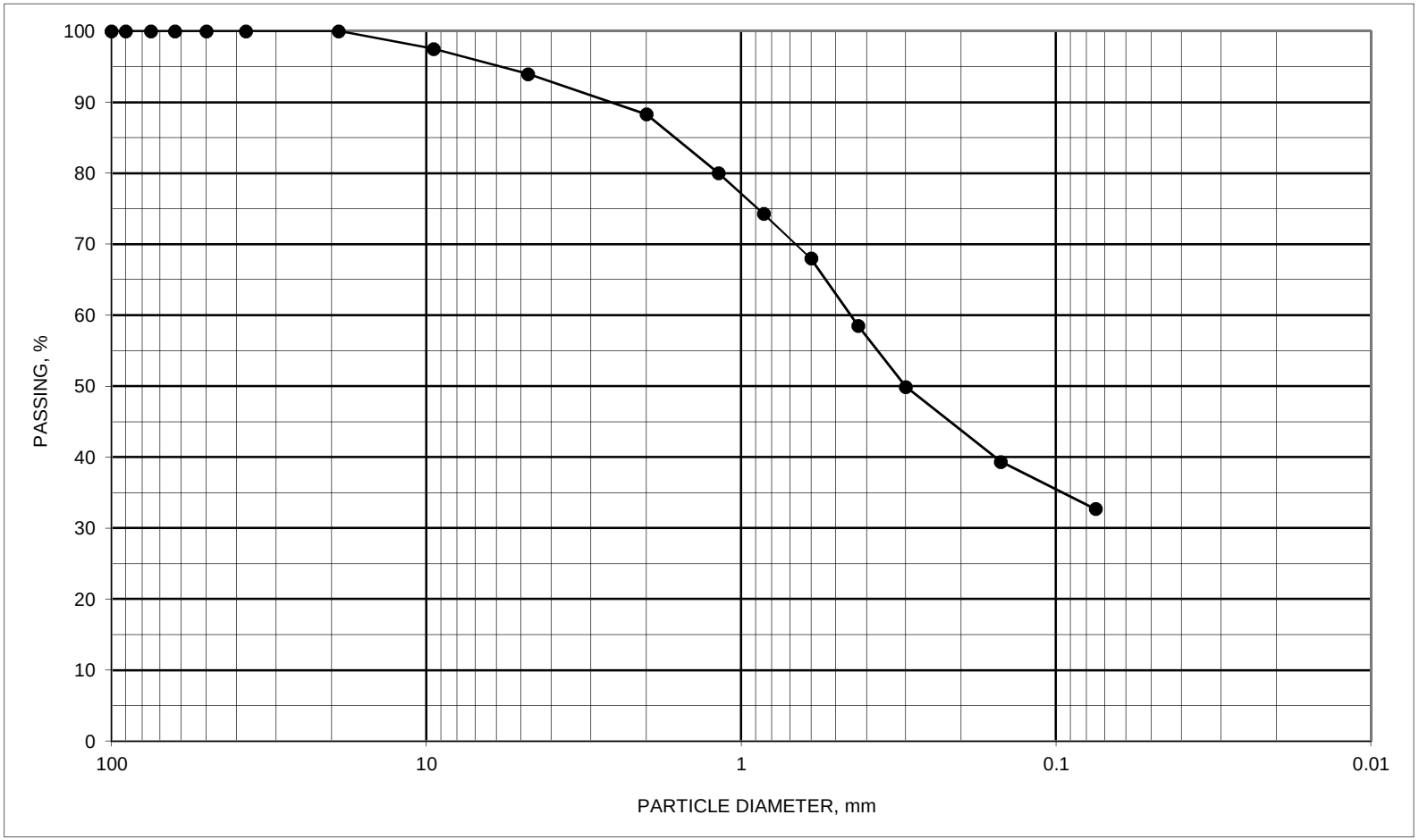
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B006	S13	39.0	41.0															
	Color		No testing assigned							Visual Classification								

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	98
#4	4.8	94
#10	2.00	88
#16	1.18	80
#20	0.85	74
#30	0.600	68
#40	0.425	58
#50	0.300	50
#100	0.150	39
#200	0.075	32.7
	D60	0.4490



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB006	S-1	1 TO 2.5	Cinders with clayey silt Brown and black	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

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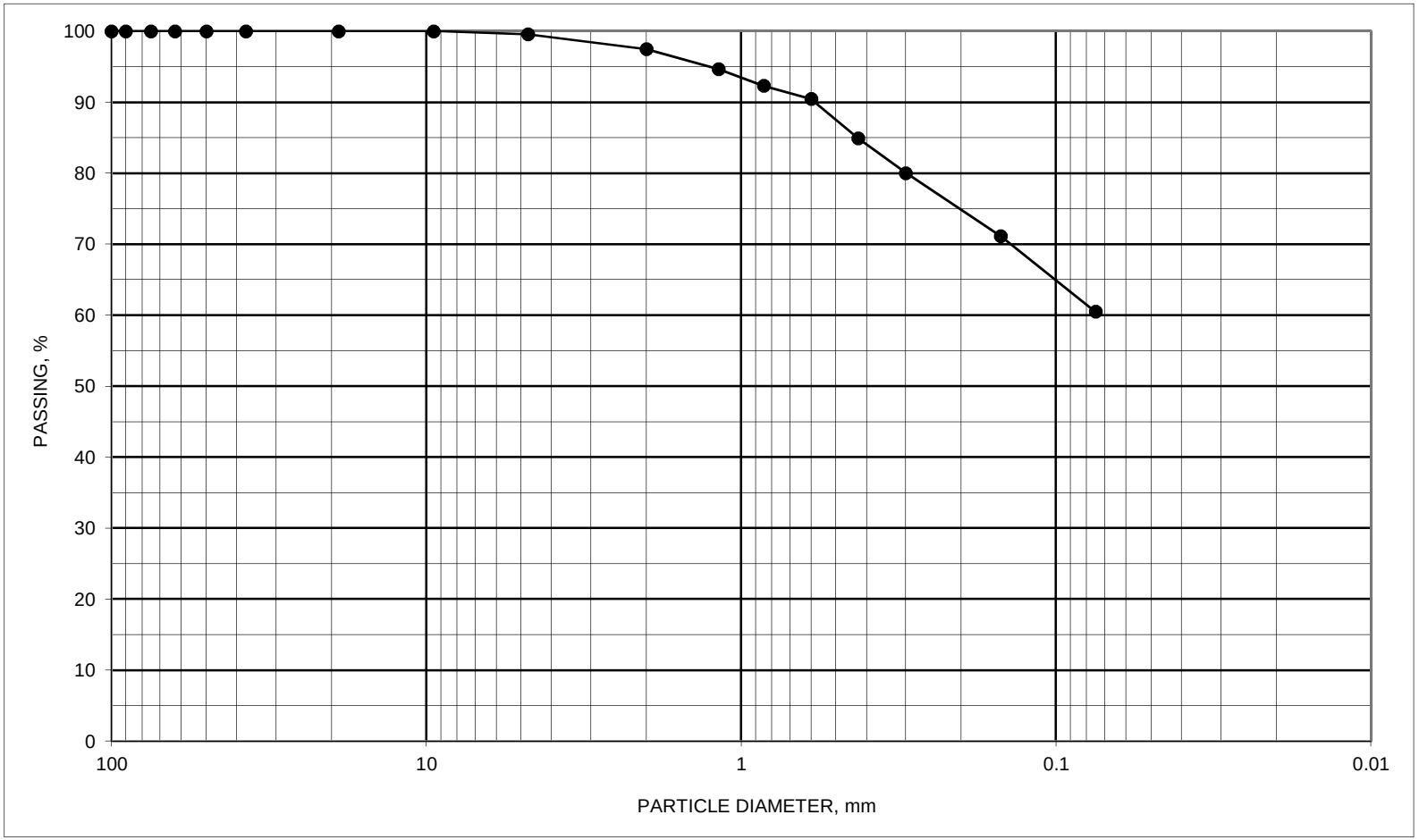
Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	97
#16	1.18	95
#20	0.85	92
#30	0.600	90
#40	0.425	85
#50	0.300	80
#100	0.150	71
#200	0.075	60.5



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB006	S-5	12 TO 13.5	FILL: Sandy lean clay with organics Dark brown and gray	#VALUE!				

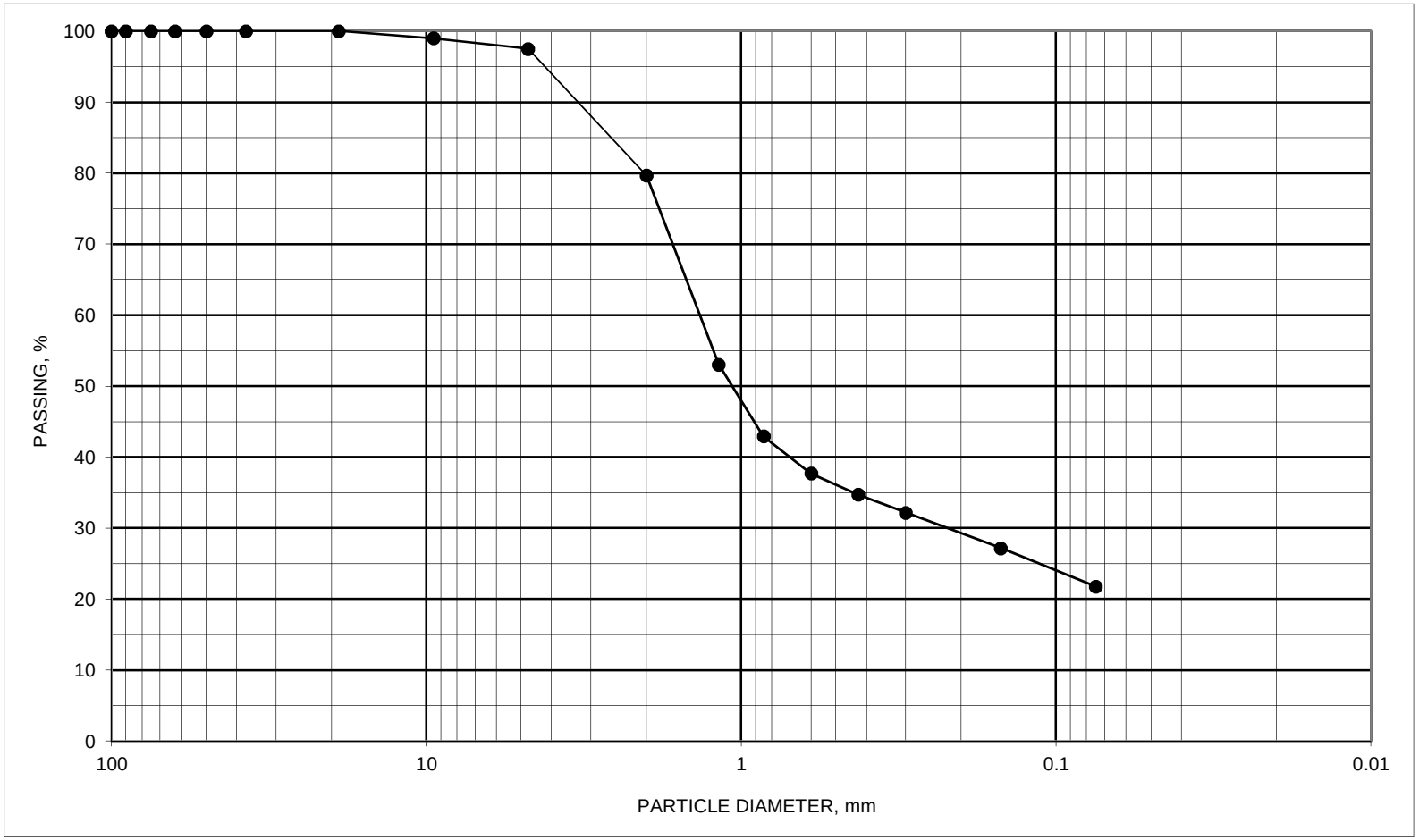
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B006 S-5.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	98
#10	2.00	80
#16	1.18	53
#20	0.85	43
#30	0.600	38
#40	0.425	35
#50	0.300	32
#100	0.150	27
#200	0.075	21.8
	D60	1.3539
	D30	0.2218



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB006	S-7	17 TO 18.5	FILL: Cinders with organics and clay Dark brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B006 S-7.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS

15151122

10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B007	S1	1.0	2.5	5.5														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.5	5.0	8.0														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S3	6.0	7.5	20.8														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.0	6.2														
	Color		Brown and dark brown (ORGANIC CONTENT = 3.9%)							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S5	13.5	15.0	15.0														
	Color		Brown and dark brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S6	16.0	18.0			35	20	15				Note*		Note*				
	Color		Green, brown, and gray							**Visual Classification**			Lean clay with sand					
	S7	18.5	20.0	10.3														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S8	23.5	25.0	24.9														
	Color		Brown and gray with dark gray							**Visual Classification**			FILL: lean to fat clay with fine to medium sand, trace fine gravel					
	S9	25.0	27.0											Note*				
	Color		Grayish brown							**Visual Classification**			Silty clay					
	S10	27.0	29.0	10.8														
	Color		TUBE TO FUGRO							**Visual Classification**								
	S11	33.0	35.0															
	Color		TUBE TO FUGRO							**Visual Classification**								
	S12	35.0	37.0	X	X	X	X	X	**Sieve	X					X	X	X	
	Color		ON HOLD							**Visual Classification**								

TESTED BY: JLB, RR, SS

APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B007	S13	38.5	40.0	13.8														
	Color		Brown							**Visual Classification**			Clayey sand, trace fine gravel					
	S14	43.5	45.0	11.2		27	14	13	**Sieve									
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S15	48.5	50.0	7.7														
	Color		Brownish gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	Color									**Visual Classification**								

TESTED BY: _____
APPROVED BY: _____

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

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HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project :	Dynegy-Kincaid							
Date:	9/30/2015			Panel Number :	P-1			
Project No. :	15151122					Permometer Data		
Boring No.:	B007	a_p =	0.031416 cm^2		Set Mercury to Pipet Rp at beginning	Equilibrium	1.6	cm^3
Sample:	S6	a_a =	0.767120 cm^2			Pipet **Rp**	**16.8**	cm^3
Depth (ft):	16.0-18.0	M_1 =	0.030180	C =	0.0017006	Annulus **Ra**	1.0	cm^3
Other Location:	Tube	M_2 =	1.040953	T =	0.0658646			

Material Description : Greenish Gray and Brown Clay with Sand

SAMPLE DATA

					Before Test		After Test	
Wet Wt. sample + ring or tare :			144.80	g				
Tare or ring Wt. :			0.0	g				
Wet Wt: of Sample :			144.80	g	Tare No.:	215	Tare No.:	123
Diameter :	1.41	in	3.57	cm^2	Wet Wt.+tare:	93.56	Wet Wt.+tare:	102.39
Length :	2.80	in	7.11	cm	Dry Wt.+tare:	81.86	Dry Wt.+tare:	89.97
Area:	1.55	in^2	10.02	cm^2	Tare Wt:	21.00	Tare Wt:	31.26
Volume :	4.35	in^3	71.24	cm^3	Dry Wt.:	60.86	Dry Wt.:	58.71
Unit Wt.(wet):	**126.83**	pcf	**2.03**	g/cm^3	Water Wt.:	11.7	Water Wt.:	12.42
Unit Wt.(dry):	**106.38**	pcf	**1.70**	g/cm^3	% moist.:	**19.2**	% moist.:	**21.2**

Assumed Specific Gravity: **2.70** Max Dry Density(pcf) = OMC =
% of max = +/- OMC =
Calculated % saturation: 97.72 Void ratio (e) = **0.58** Porosity (n)= **0.37**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.8 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)	Reset = *
9/28/2015	120	13.8	2.982666	21	0.977	3.03E-06	8.58E-03	
9/28/2015	240	11.9	4.882666	21	0.977	2.69E-06	7.61E-03	
9/28/2015	360	10.6	6.182666	21	0.977	2.41E-06	6.84E-03	
9/28/2015	480	9.7	7.082666	21	0.977	2.17E-06	6.16E-03	

SUMMARY

k_a =	2.58E-06	cm/sec		Acceptance criteria =	50 %
ki			Vm		
k1 =	3.03E-06	cm/sec	17.6	%	Vm = $\frac{\lvert k_a - k_i \rvert}{k_a} \times 100$
k2 =	2.69E-06	cm/sec	4.3	%	
k3 =	2.41E-06	cm/sec	6.3	%	
k4 =	2.17E-06	cm/sec	15.6	%	

Hydraulic conductivity	k =	**2.58E-06**	cm/sec	**7.30E-03**	ft/day
Void Ratio	e =	**0.58**			
Porosity	n =	**0.37**			
Bulk Density	γ =	**2.03**	g/cm^3	**126.8**	pcf
Water Content	W =	**0.33**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**2.64E-11**	cm^2	(at 20 deg C)	

TRIAXIAL SHEAR TEST REPORT

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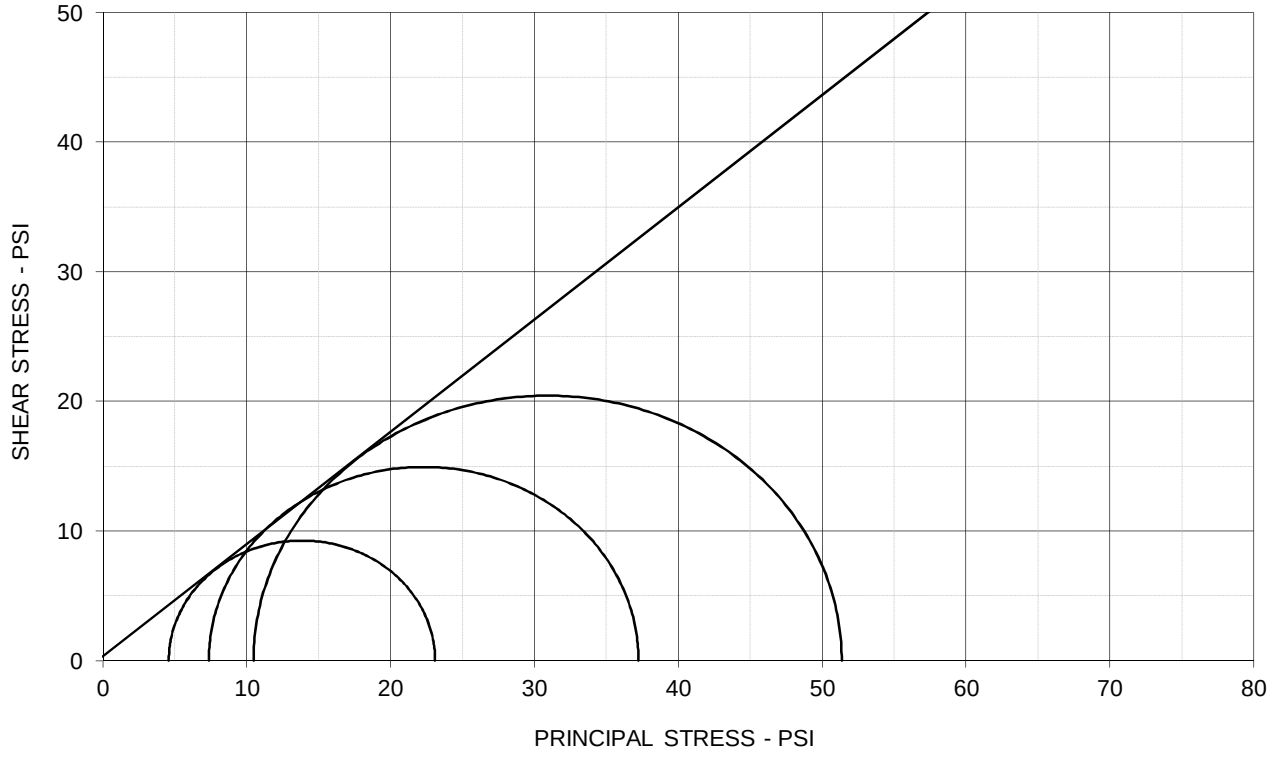
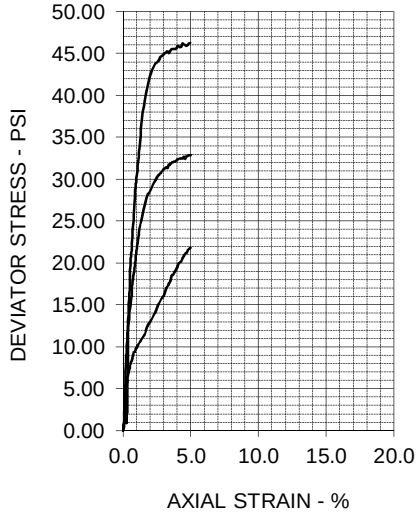


EFFECTIVE STRESS PARAMETERS	ϕ ' = 40.9 deg	c' = 0.3 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	19.2	19.2	19.2	
Dry Density - pcf	106.2	106.2	106.2	
Diameter - inches	1.41	1.41	1.41	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %			11.8	
Dry Density - pcf	107.6	112.0	126.8	
Calculated Diameter (in.)	1.40	1.41	1.41	
Height - inches	2.78	2.80	2.81	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	18.51	29.87	40.88	
Total Pore Pressure - psi	52.9	57.6	69.5	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.6	2.4	1.8	
σ_1' Failure - psi	23.10	37.24	51.36	
σ_3' Failure - psi	4.59	7.37	10.48	

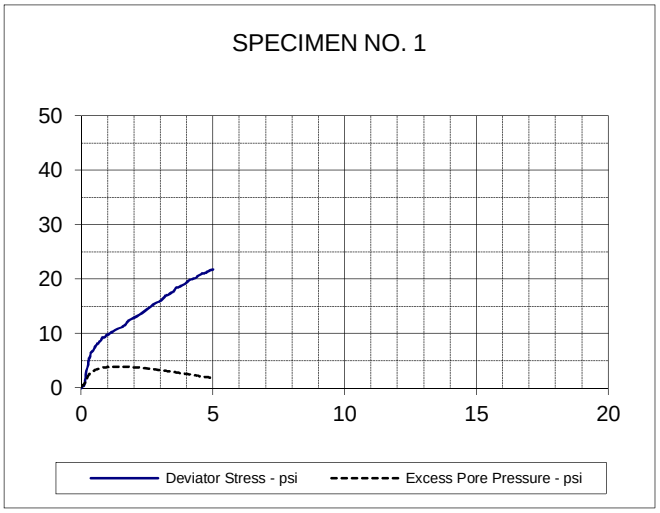
TEST DESCRIPTION

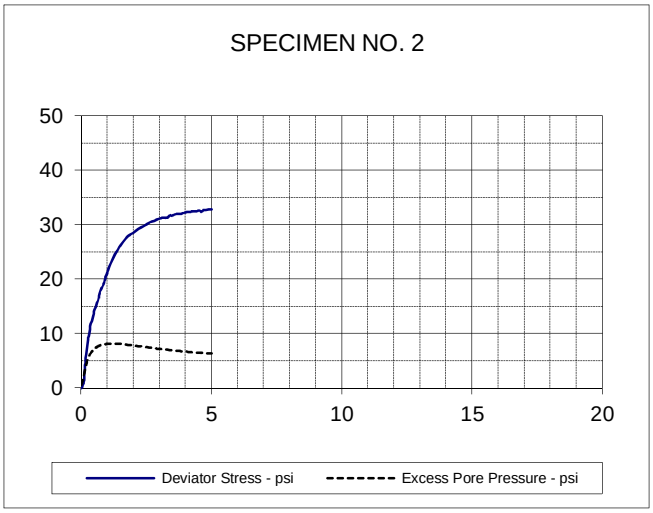
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Green, Brown, Gray Clay with Sand
SAMPLE LOCATION: KIN-B007, S6, 16.0-18.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 35 PL: 20 PI: 15 Percent -200: X
REMARKS: Multistage Triaxial

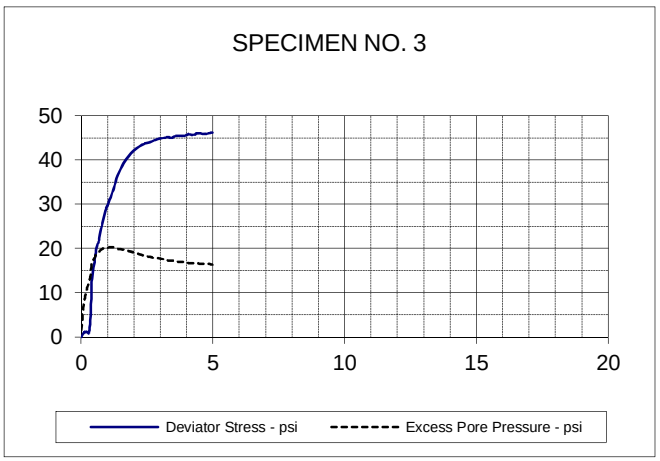
PROJECT INFORMATION

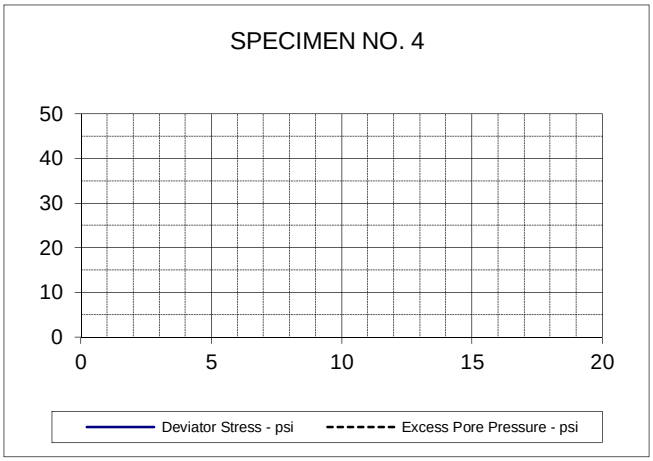
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

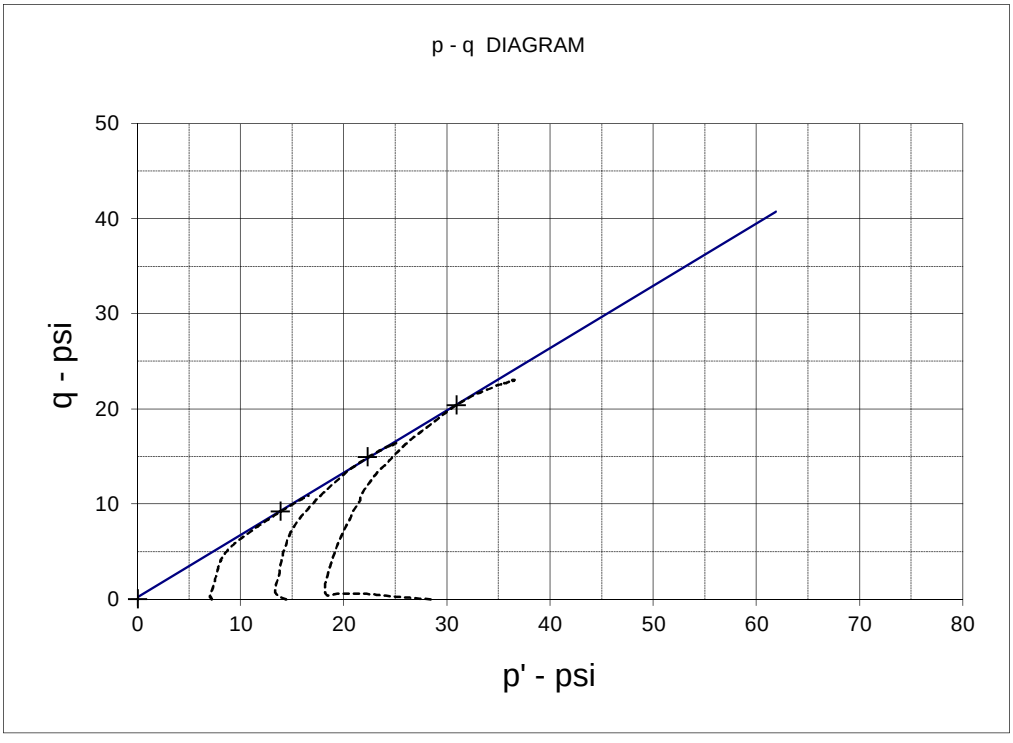
TERRACON











EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 33.2	a (psi) = 0.2
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Green, Brown, Gray Clay with Sand			

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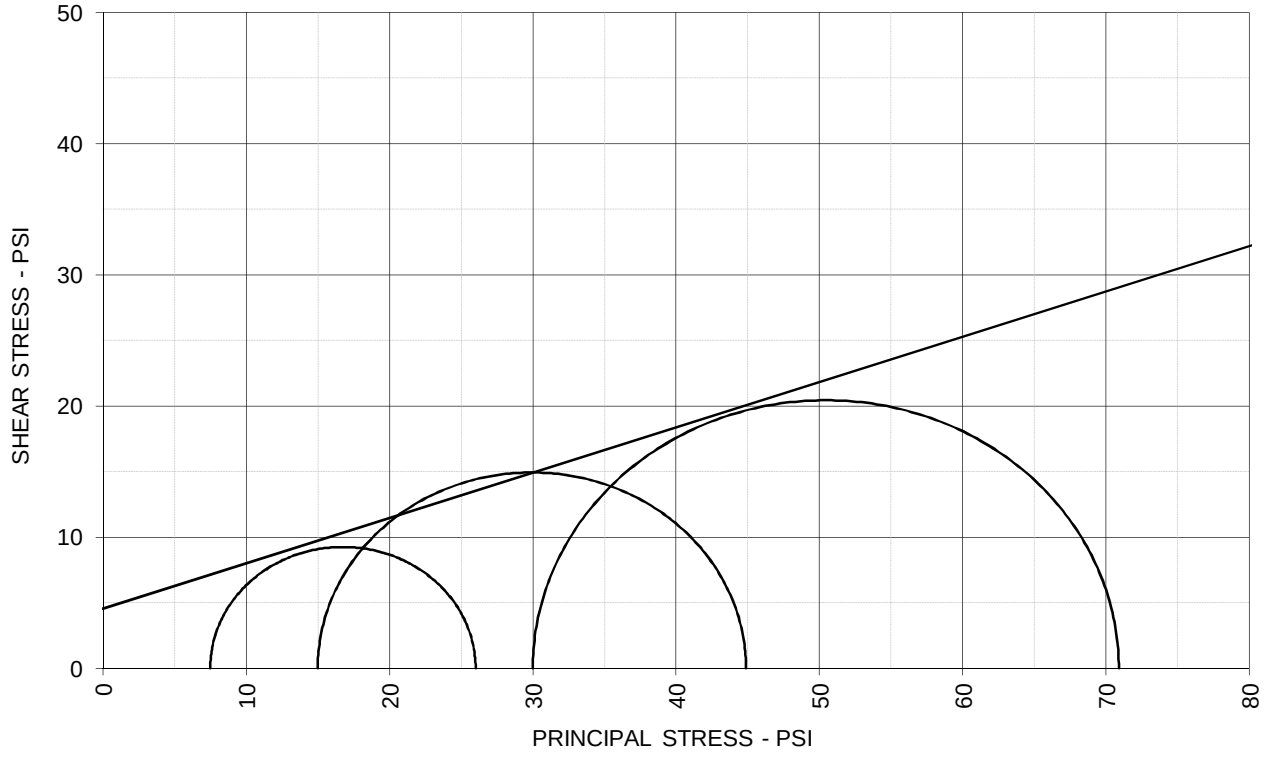
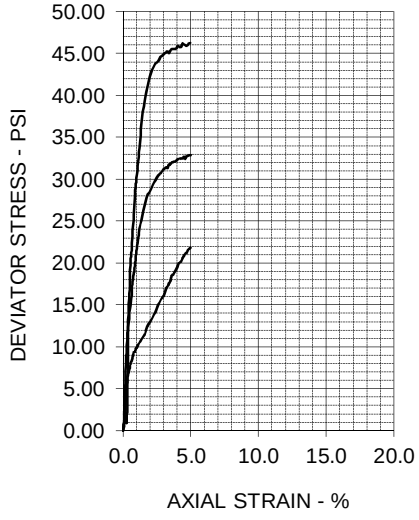


TOTAL STRESS PARAMETERS	ϕ = 19.1 deg	c = 4.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	19.2	19.2	19.2	
Dry Density - pcf	106.2	106.2	106.2	
Diameter - inches	1.41	1.41	1.41	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %			11.8	
Dry Density - pcf	107.6	112.0	126.8	
Calculated Diameter (in.)	1.40	1.41	1.41	
Height - inches	2.78	2.80	2.81	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	18.51	29.87	40.88	
Total Pore Pressure - psi	52.9	57.6	69.5	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.6	2.4	1.8	
σ_1 Failure - psi	26.01	44.87	70.88	
σ_3 Failure - psi	7.50	15.00	30.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Green, Brown, Gray Clay with Sand
SAMPLE LOCATION: KIN-B007, S6, 16.0-18.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 35 PL: 20 PI: 15 Percent -200: X
REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

TRIAXIAL SHEAR TEST REPORT

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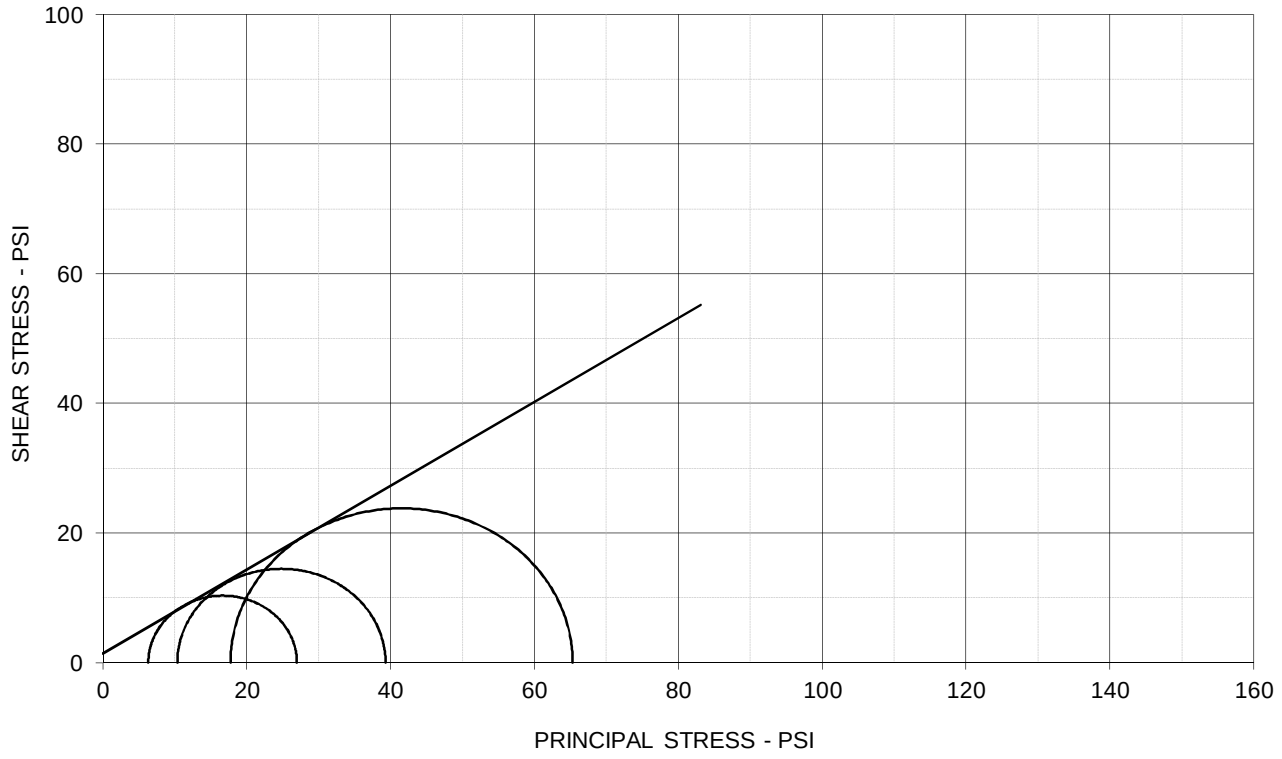
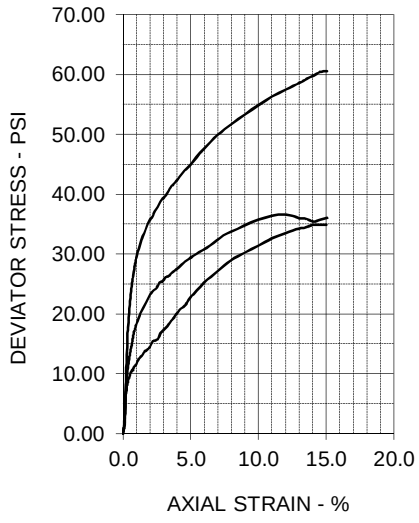


EFFECTIVE STRESS PARAMETERS	ϕ' = 32.9 deg	c' = 1.4 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.5	22.4	22.0	
Dry Density - pcf	102.1	103.2	102.3	
Diameter - inches	1.40	1.40	1.41	
Height - inches	2.80	2.79	2.80	
AT TEST				
Final Moisture - %	23.5	22.0	21.7	
Dry Density - pcf	102.4	104.7	105.5	
Calculated Diameter (in.)	1.39	1.39	1.40	
Height - inches	2.78	2.77	2.76	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	20.65	28.94	47.57	
Total Pore Pressure - psi	53.7	59.6	72.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	4.2	4.7	6.0	
σ_1' Failure - psi	26.99	39.31	65.33	
σ_3' Failure - psi	6.34	10.37	17.76	

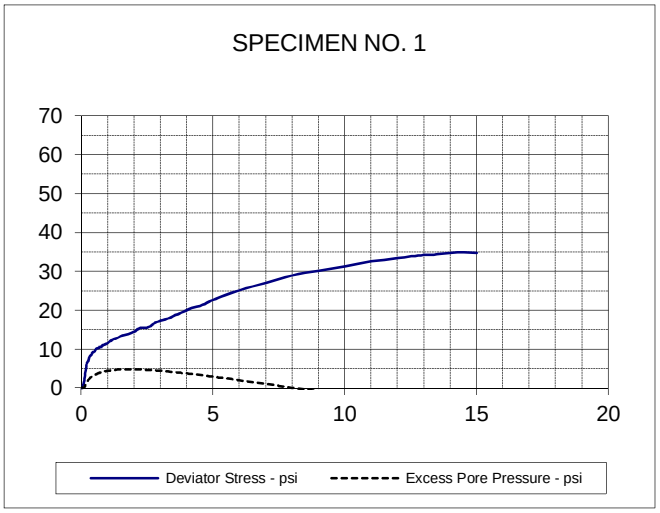
TEST DESCRIPTION

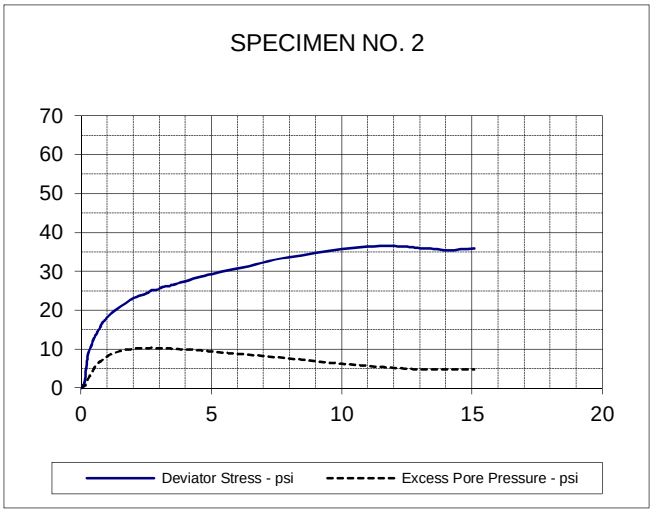
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Silty Clay
SAMPLE LOCATION: KIN-B007, S9, 25.0-27.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: X PL: X PI: X Percent -200: X
REMARKS: Specimens trimmed to 1.4" diameter.

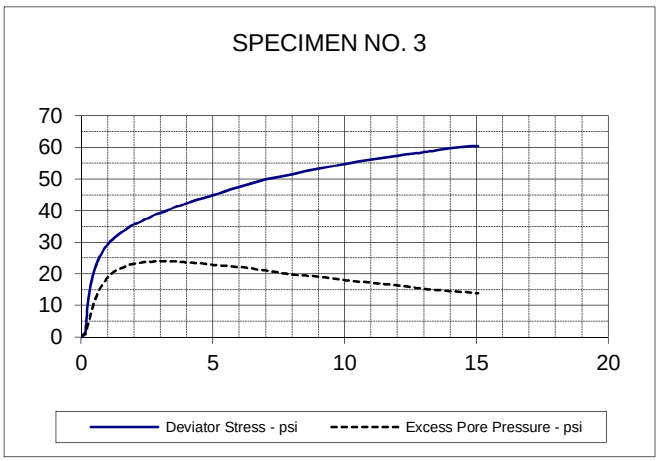
PROJECT INFORMATION

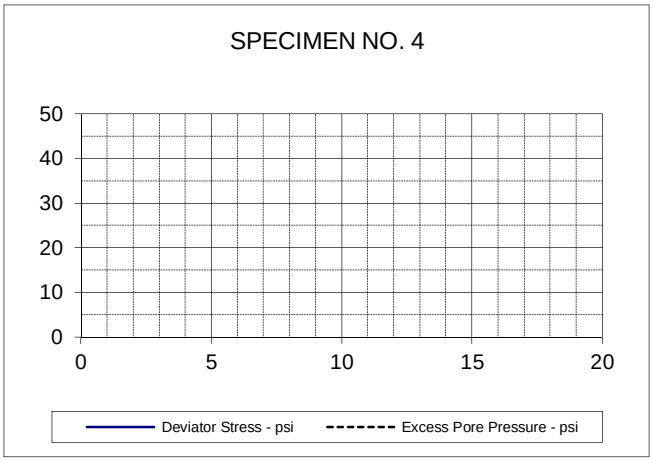
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/13/15

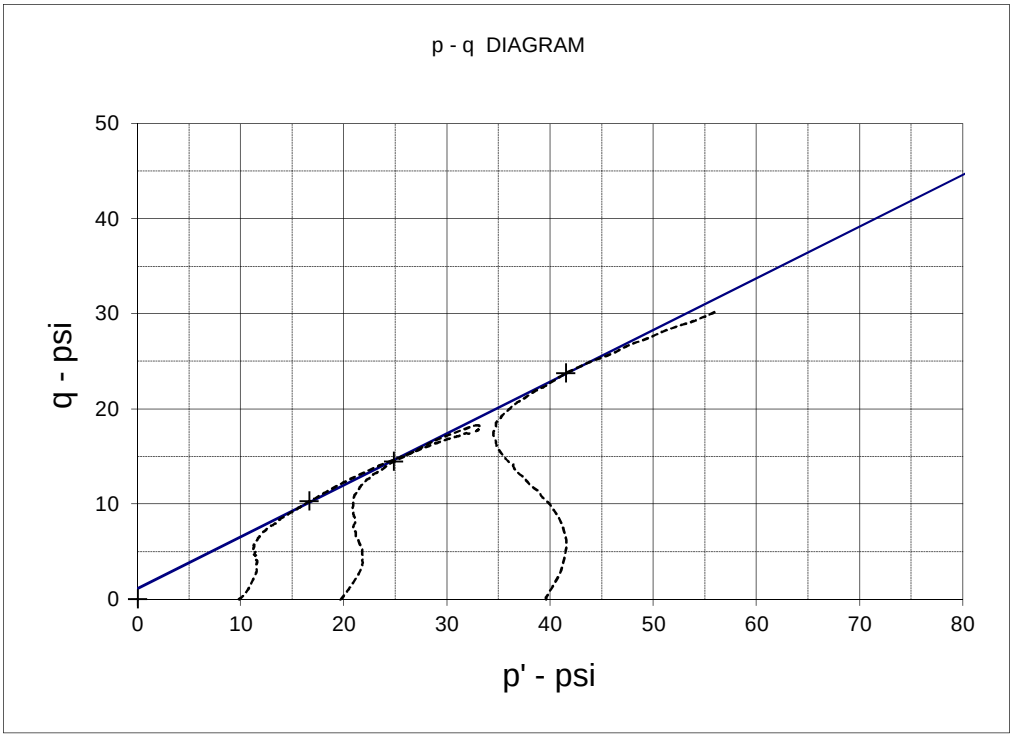
TERRACON











EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 28.5	a (psi) = 1.1
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Grayish Brown Silty Clay			

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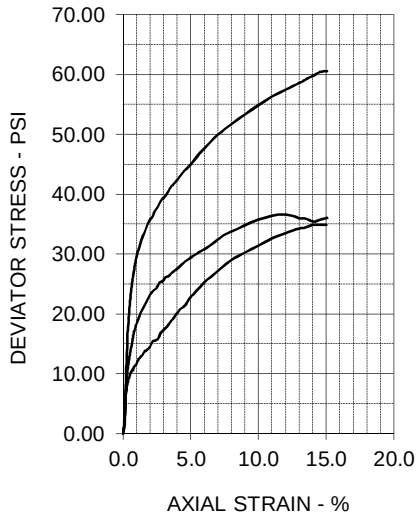
TOTAL STRESS PARAMETERS	ϕ = 18.1 deg	c = 4.1 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.5	22.4	22.0	
Dry Density - pcf	102.1	103.2	102.3	
Diameter - inches	1.40	1.40	1.41	
Height - inches	2.80	2.79	2.80	
AT TEST				
Final Moisture - %	23.5	22.0	21.7	
Dry Density - pcf	102.4	104.7	105.5	
Calculated Diameter (in.)	1.39	1.39	1.40	
Height - inches	2.78	2.77	2.76	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	20.65	28.94	47.57	
Total Pore Pressure - psi	53.7	59.6	72.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	4.2	4.7	6.0	
σ_1 Failure - psi	30.65	48.94	87.57	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

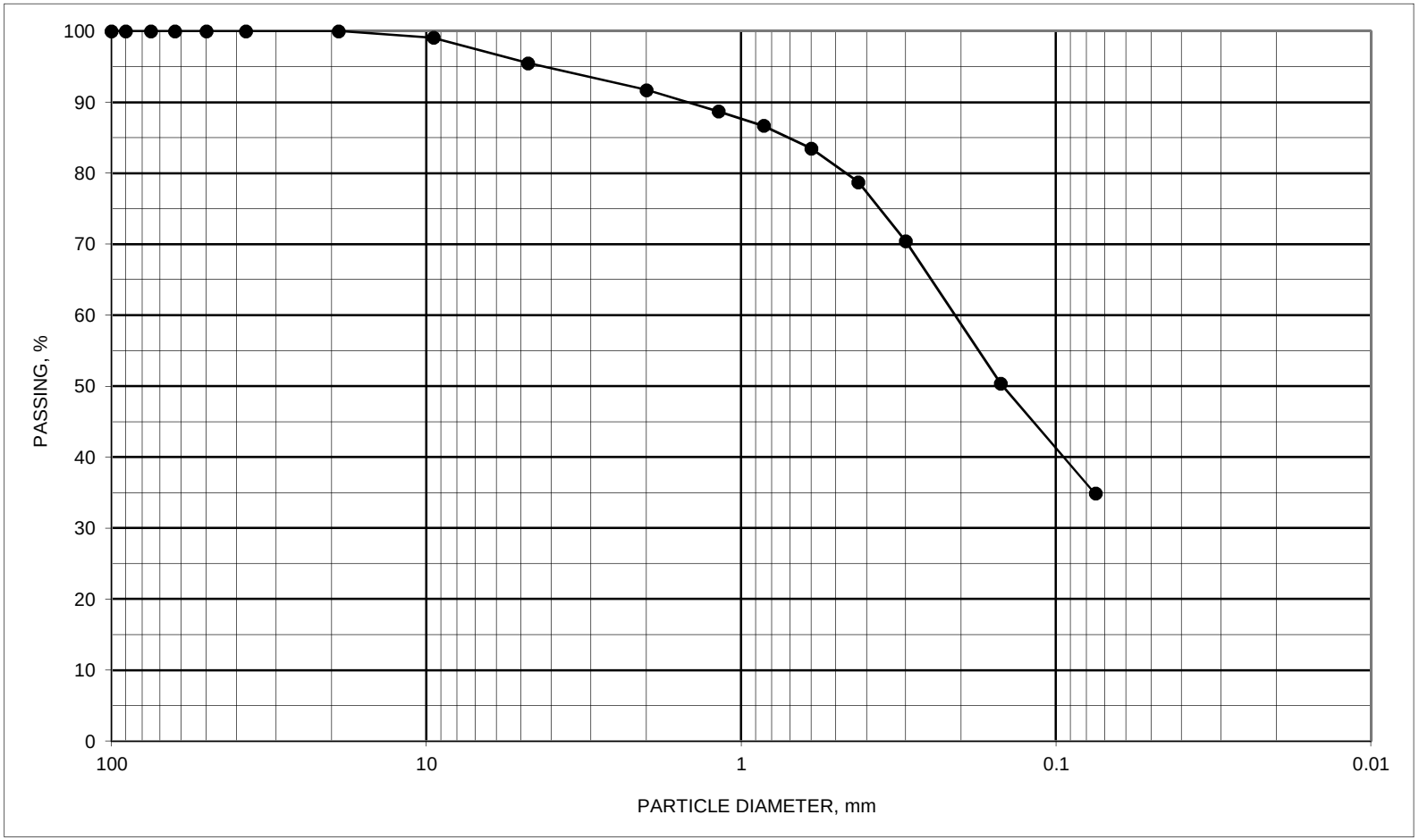
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Silty Clay
SAMPLE LOCATION: KIN-B007, S9, 25.0-27.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: X PL: X PI: X Percent -200: X
REMARKS: Specimens trimmed to 1.4" diameter.

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/13/15

TERRACON

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	96
#10	2.00	92
#16	1.18	89
#20	0.85	87
#30	0.600	84
#40	0.425	79
#50	0.300	70
#100	0.150	50
#200	0.075	34.9
	D60	0.2095



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB007	S-13	38.5 TO 40	Clayey sand, trace fine gravel Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B007 S-13.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B008	S1	1.0	2.5	NO RECOVERY														
	Color									**Visual Classification**								
	S2	3.5	5.0	25.4														
	Color			Brown and gray						**USCS Classification**			FILL: Sandy lean clay					
	S3	6.0	7.5	22.8														
	Color			Brown						**Visual Classification**			Sandy lean clay					
	S4	8.0	10.0	11.4	125.7	19	12	7						Note*				
	Color									**Visual Classification**								
	S5	13.5	15.0	13.3		25	14	11	** Sieve									
	Color			Brown and gray						**Visual Classification**			Sandy lean clay, trace fine to coarse gravel					
	S6	18.5	20.0	10.7	130.8													
	Color			Gray						**Visual Classification**			Sandy lean clay, trace fine gravel					
	S7	23.5	25.0	7.6														
	Color			Brownish gray						**Visual Classification**			Sandy lean clay, trace fine gravel					
	S8	28.5	30.0	7.1														
	Color			Brownish gray						**Visual Classification**			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

TRIAXIAL SHEAR TEST REPORT

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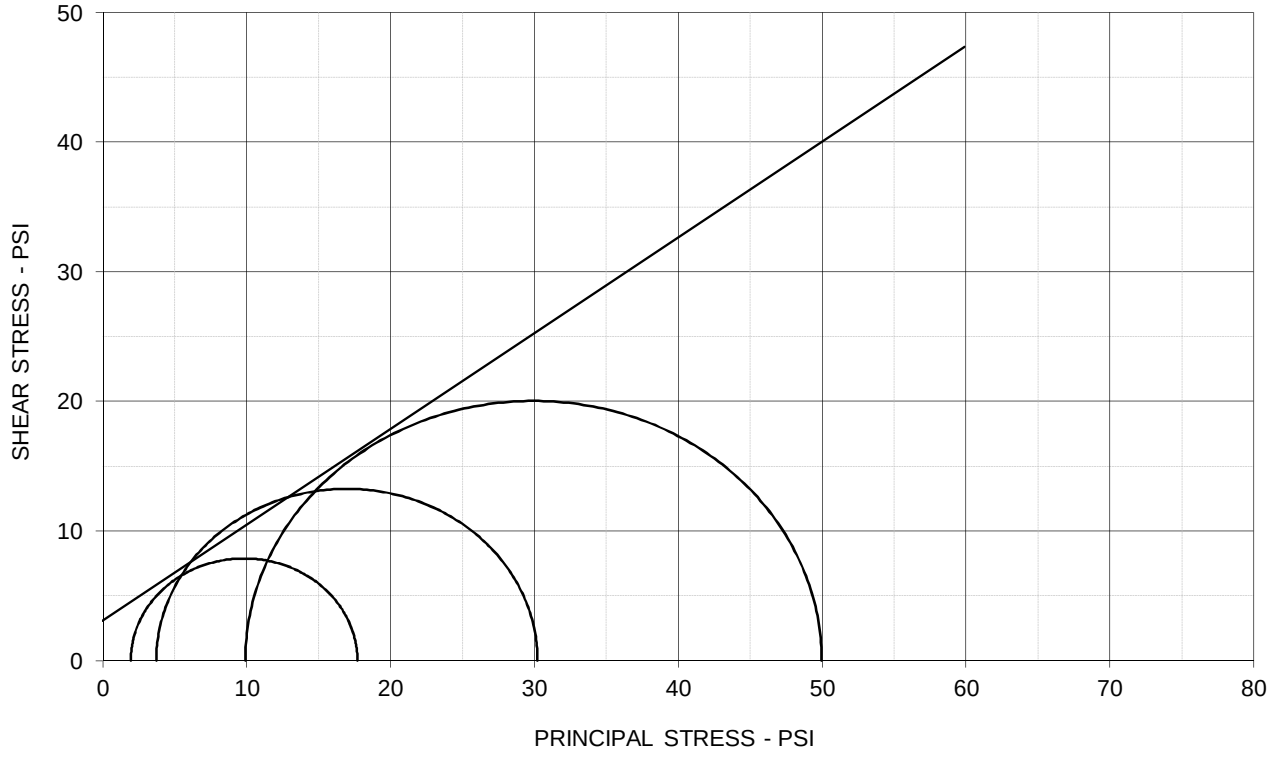
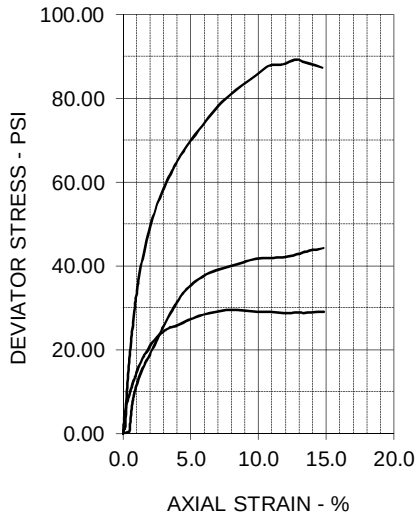


EFFECTIVE STRESS PARAMETERS	ϕ' = 36.5 deg	c' = 3.1 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	13.1	11.8	9.3	
Dry Density - pcf	122.3	122.6	132.2	
Diameter - inches	2.86	2.88	2.87	
Height - inches	5.68	5.68	5.69	
AT TEST				
Final Moisture - %	13.8	13.4	9.8	
Dry Density - pcf	122.3	122.7	132.9	
Calculated Diameter (in.)	2.84	2.85	2.86	
Height - inches	5.64	5.60	5.64	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	15.75	26.50	40.06	
Total Pore Pressure - psi	52.1	54.3	56.1	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	1.2	3.2	1.3	
σ_1' Failure - psi	17.70	30.22	49.97	
σ_3' Failure - psi	1.95	3.72	9.91	

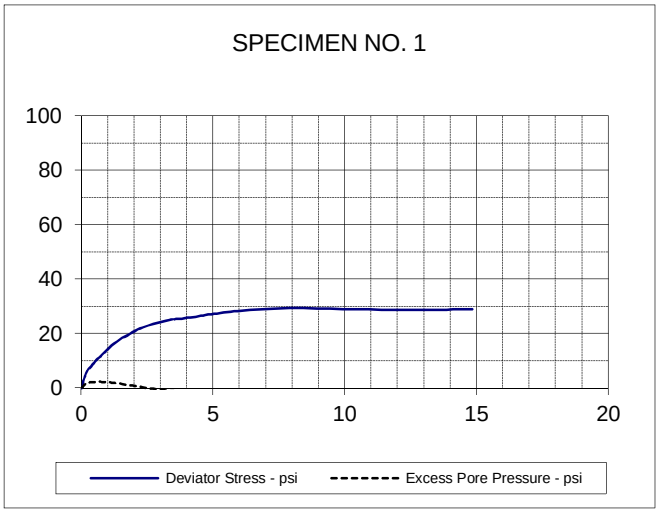
TEST DESCRIPTION

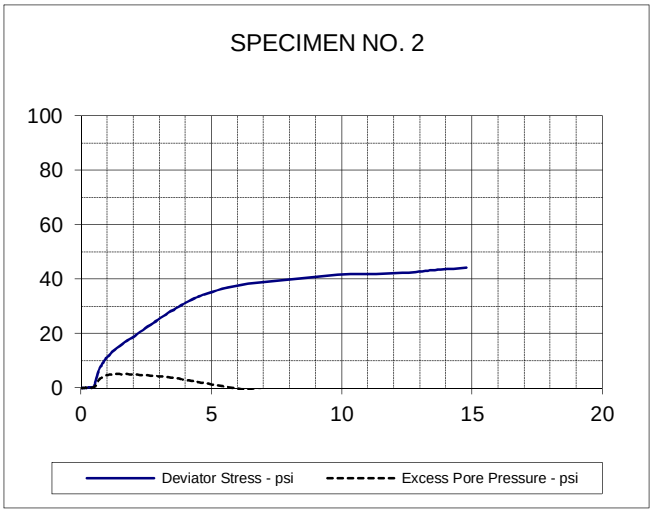
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Sandy Clay
SAMPLE LOCATION: KIN-B008, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 19 PL: 12 PI: 7 Percent -200: X
REMARKS: Three specimen series.

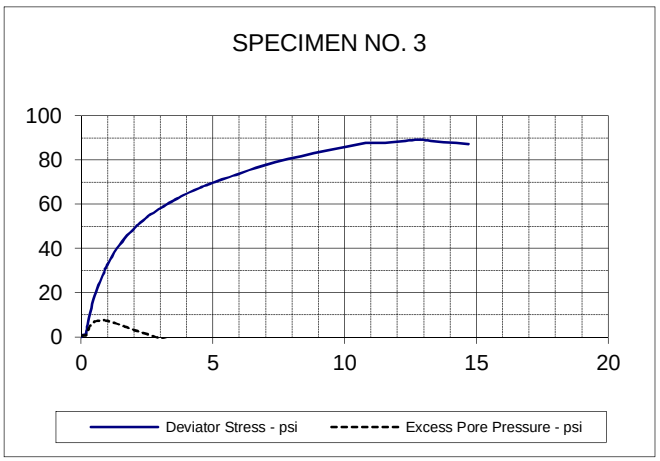
PROJECT INFORMATION

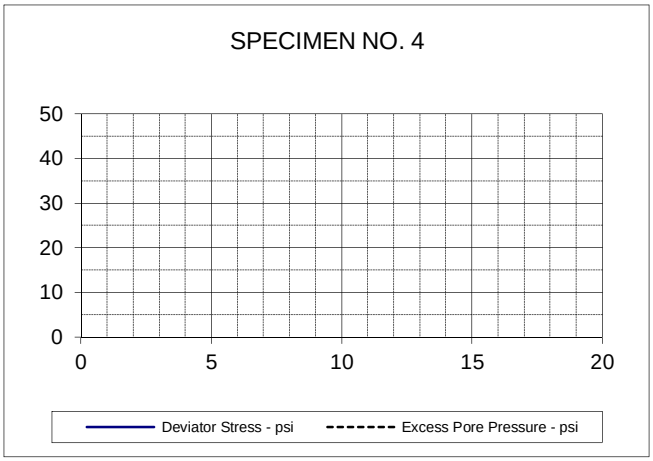
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

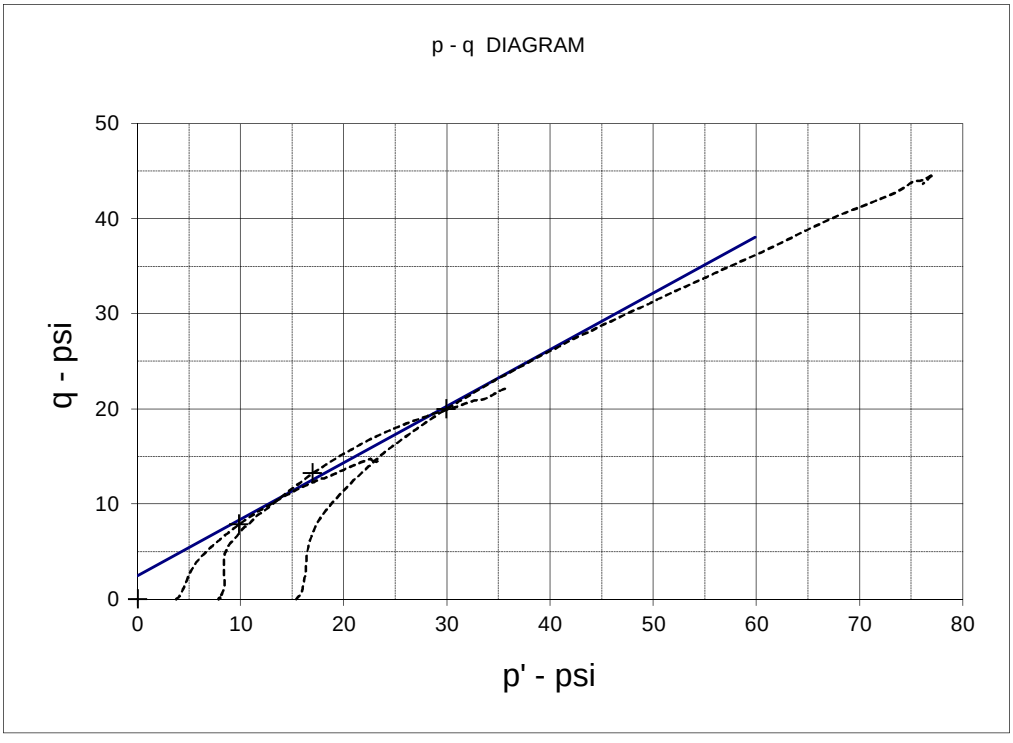
TERRACON











EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 30.7	a (psi) = 2.5
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Grayish Brown Sandy Clay			

TRIAXIAL SHEAR TEST REPORT

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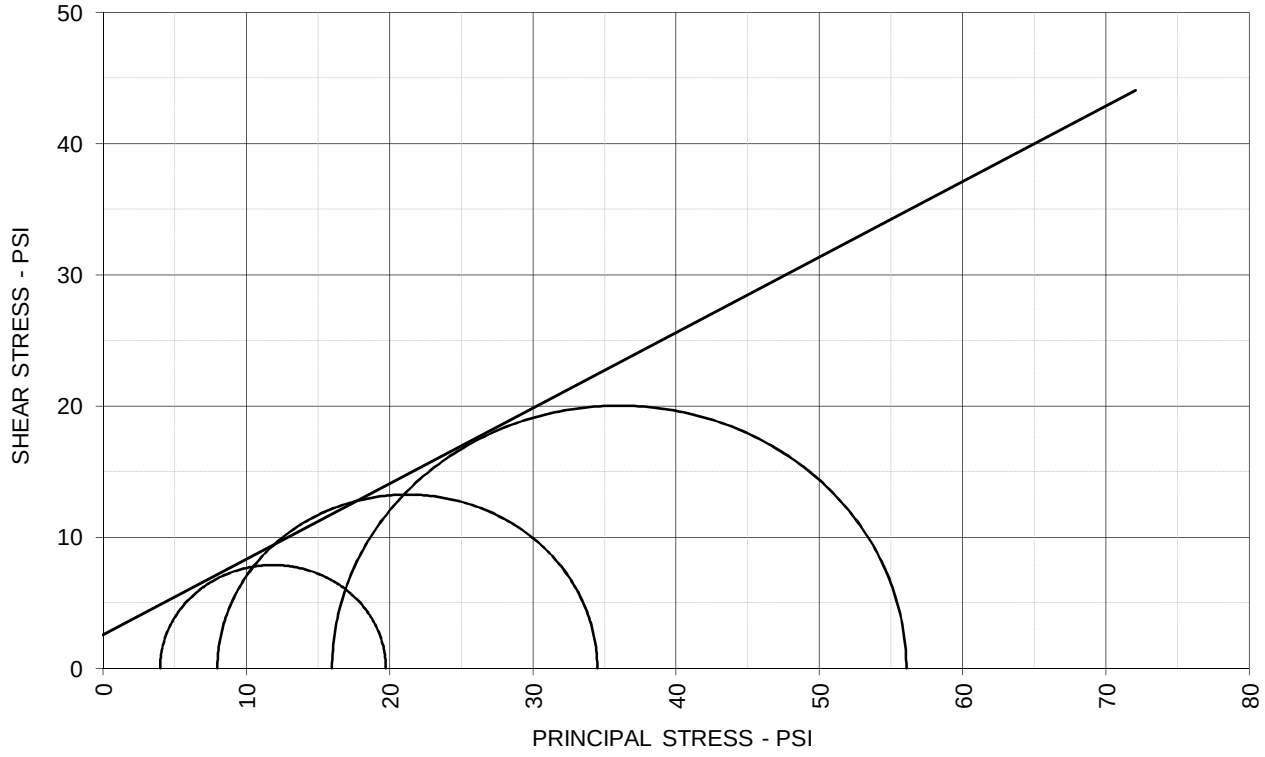
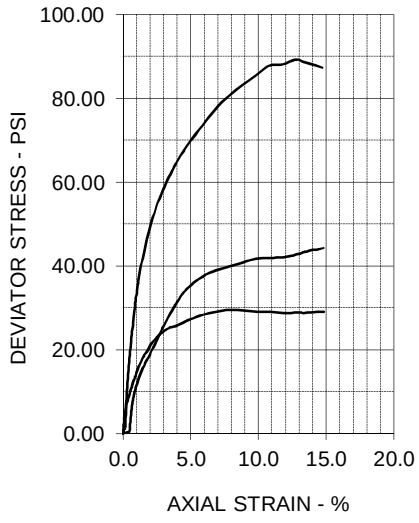


TOTAL STRESS PARAMETERS	ϕ = 29.9 deg	c = 2.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	13.1	11.8	9.3	
Dry Density - pcf	122.3	122.6	132.2	
Diameter - inches	2.86	2.88	2.87	
Height - inches	5.68	5.68	5.69	
AT TEST				
Final Moisture - %	13.8	13.4	9.8	
Dry Density - pcf	122.3	122.7	132.9	
Calculated Diameter (in.)	2.84	2.85	2.86	
Height - inches	5.64	5.60	5.64	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	15.75	26.50	40.06	
Total Pore Pressure - psi	52.1	54.3	56.1	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	1.2	3.2	1.3	
σ_1 Failure - psi	19.75	34.50	56.06	
σ_3 Failure - psi	4.00	8.00	16.00	

TEST DESCRIPTION

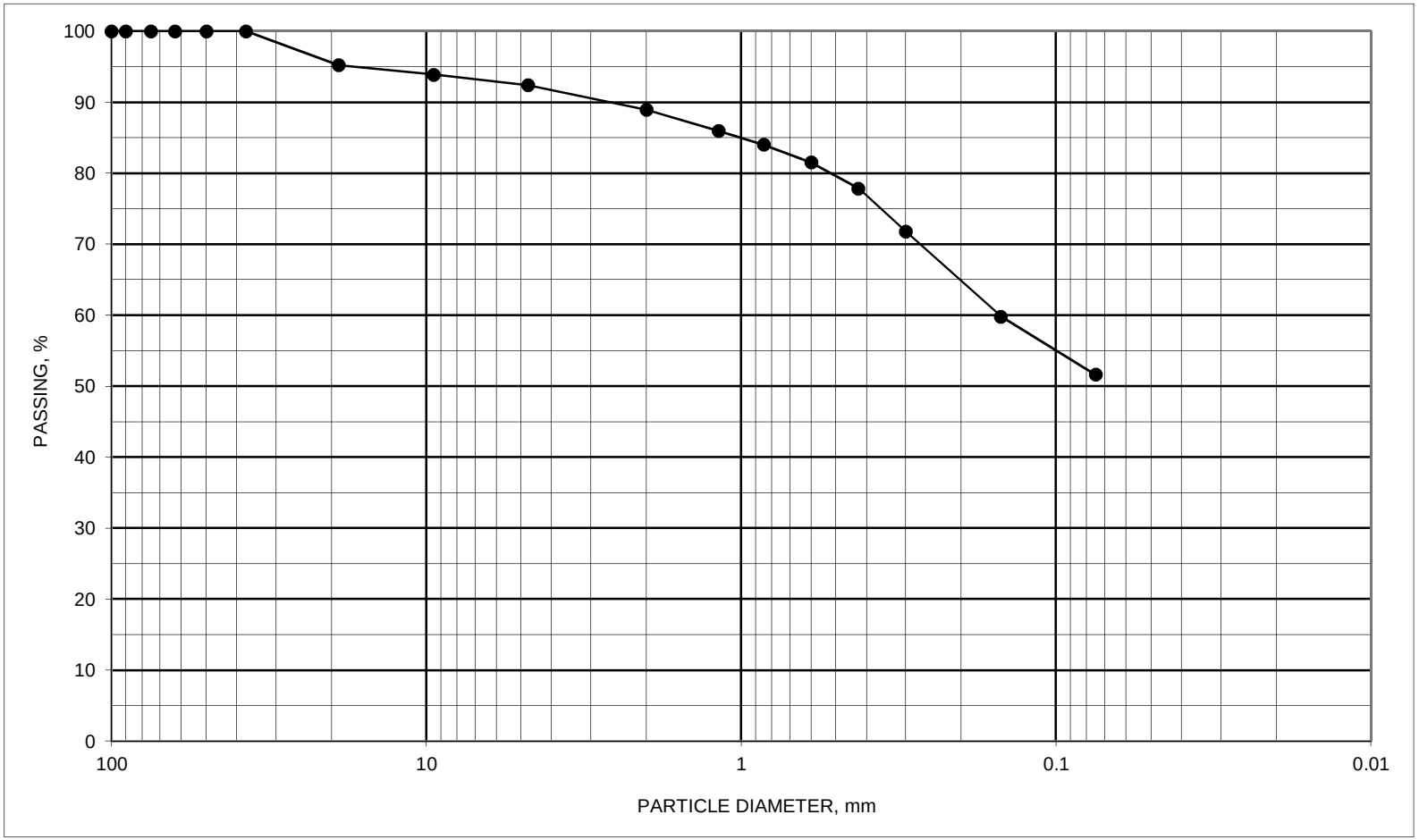
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Sandy Clay
SAMPLE LOCATION: KIN-B008, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 19 PL: 12 PI: 7 Percent -200: X
REMARKS: Three specimen series.

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	95
3/8"	9.5	94
#4	4.8	92
#10	2.00	89
#16	1.18	86
#20	0.85	84
#30	0.600	82
#40	0.425	78
#50	0.300	72
#100	0.150	60
#200	0.075	51.7
	D60	0.1515



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB008	S-5	13.5 TO 15	Sandy lean clay, trace fine to coarse gravel Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B008 S-5.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

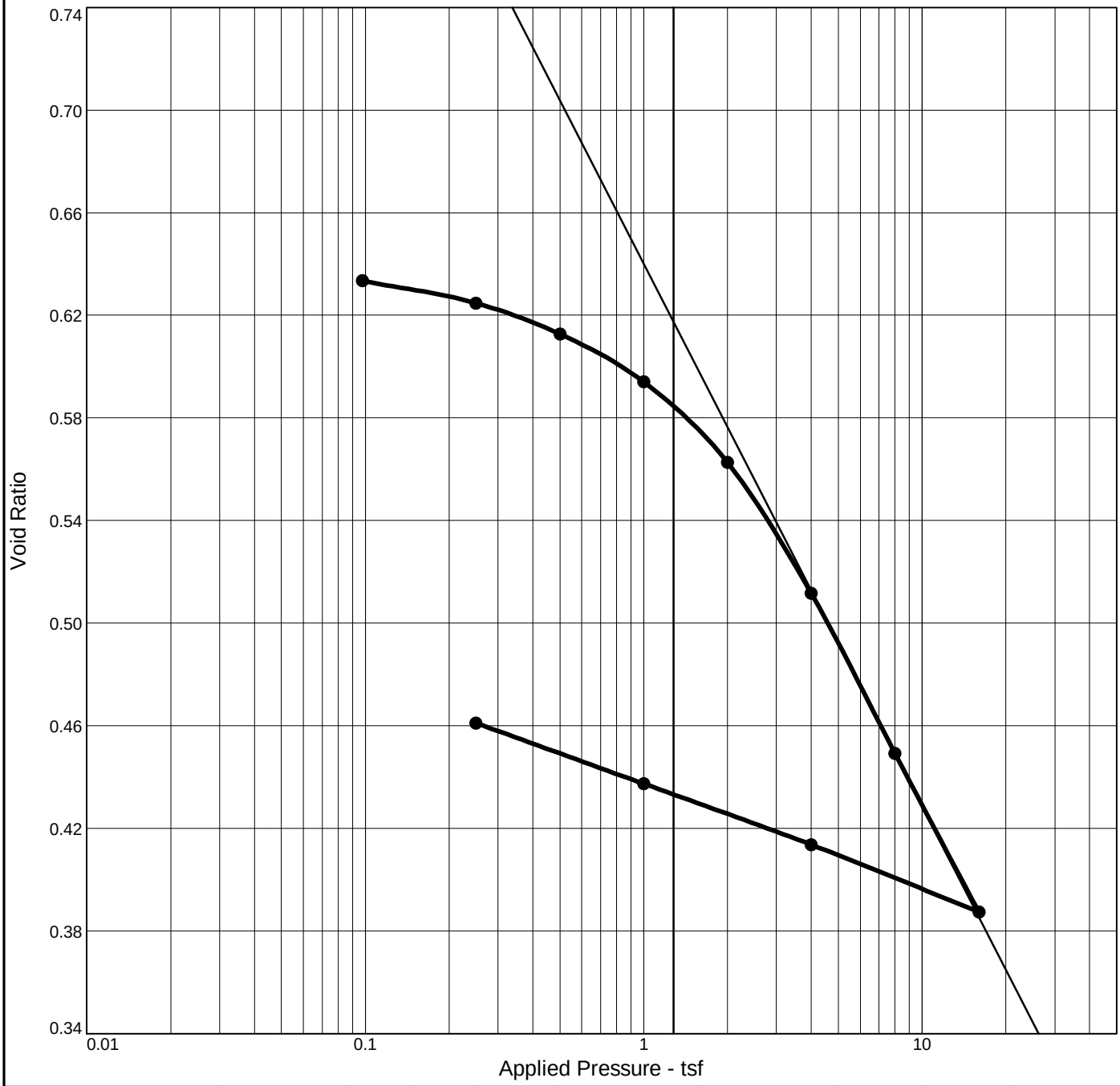
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B009	S1	1.0	2.5	20.3														
	Color		Dark brown							**Visual Classification**			FILL: Lean clay with fine sand					
	S2	3.5	5.0	23.8		42	19	23										
	Color		Dark brown							**Visual Classification**			FILL: Lean clay with fine sand					
	S3	6.0	7.5	21.3														
	Color		Brown and gray							**USCS Classification**			FILL: Fat clay with fine to medium sand					
	S4	7.5	9.5	19.9	103.2	28	15	13					Note*					
	Color		Grayish brown							**Visual Classification**			Sandy lean clay with pebbles					
	S5	13.5	15.0	10.3	103.0													
	Color		Brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S6	18.5	20.0	7.5														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S7	23.5	25.0	11.5		19	14	5										
	Color		Gray							**Visual Classification**			Sandy silty lean clay, trace fine gravel					
	S8	28.5	30.0	9.2	96.5													
	Color		Brownish gray							**Visual Classification**			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
84.6 %	19.9 %	103.2	28	13	2.7	0.49	2.02	0.21	0.04	0.634

MATERIAL DESCRIPTION	USCS	AASHTO
Grayish Brown Sandy Clay with Pebbles	X	X

Project No. 15151122 **Client:** AECOM

Project: Dynegy-Kincaid

Source of Sample: KIN-B009 **Depth:** 7.5-9.5 ft **Sample Number:** S4

Terracon Consultants, Inc.

Chattanooga, TN

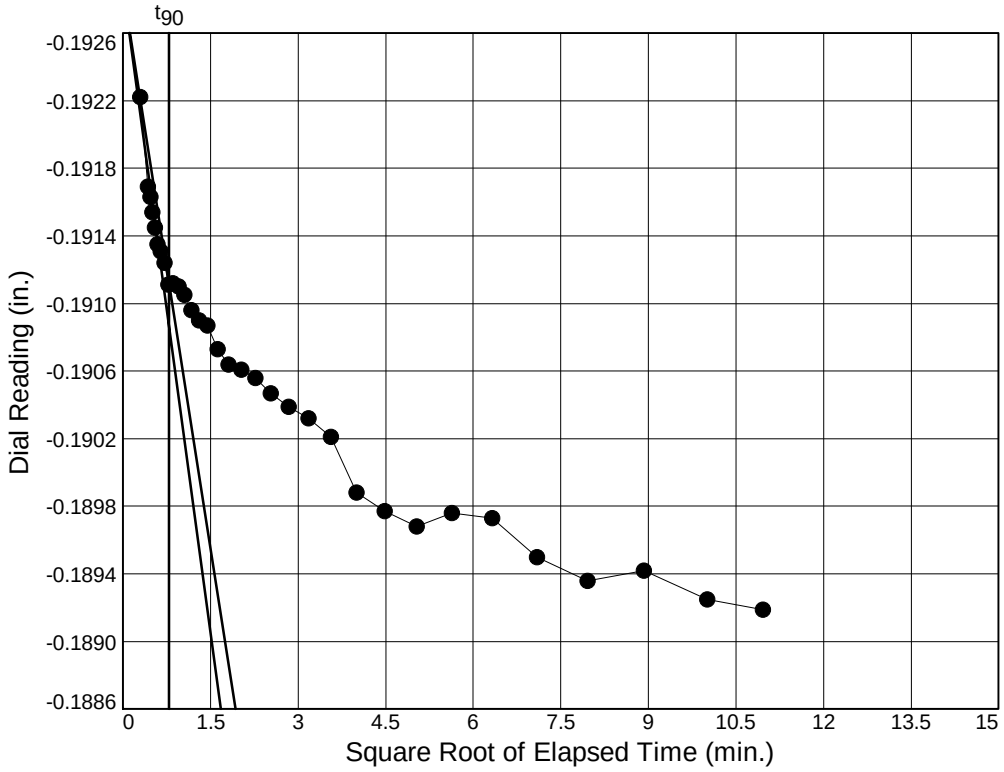
Remarks:

Swell pressure of 195 psf.

Dial Reading vs. Time

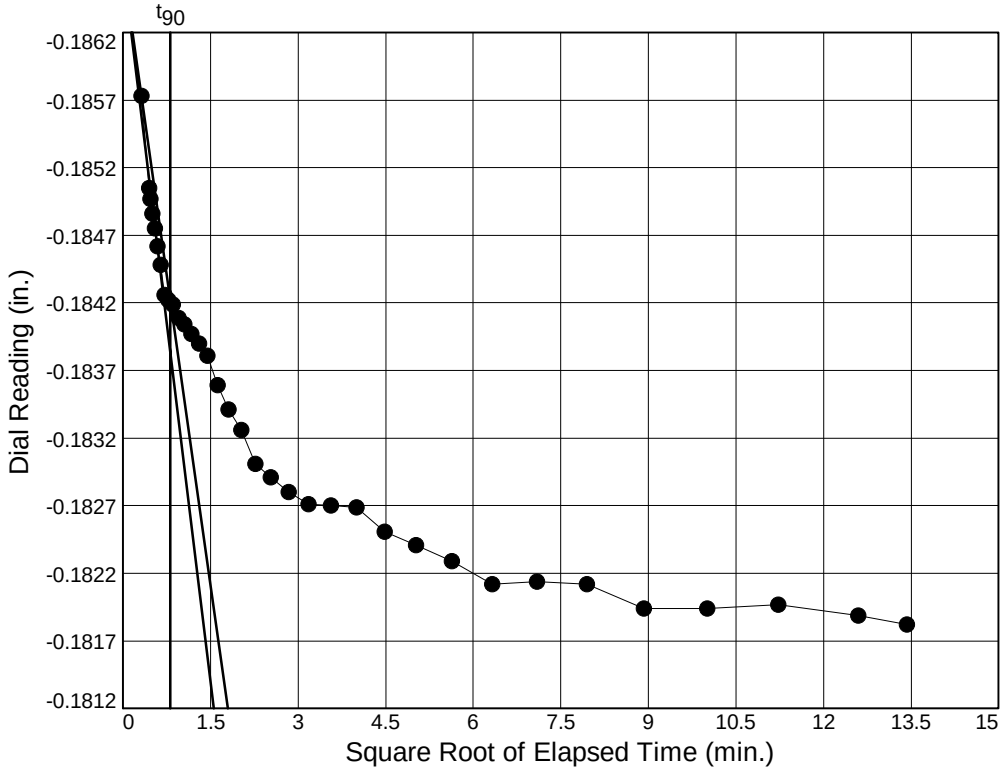
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 2
Load= 0.25 tsf
D_0 = -0.1929
D_{90} = -0.1911
D_{100} = -0.1909
T_{90} = 0.62 min.

C_v @ T_{90}
0.0364 $cm.^2/sec.$



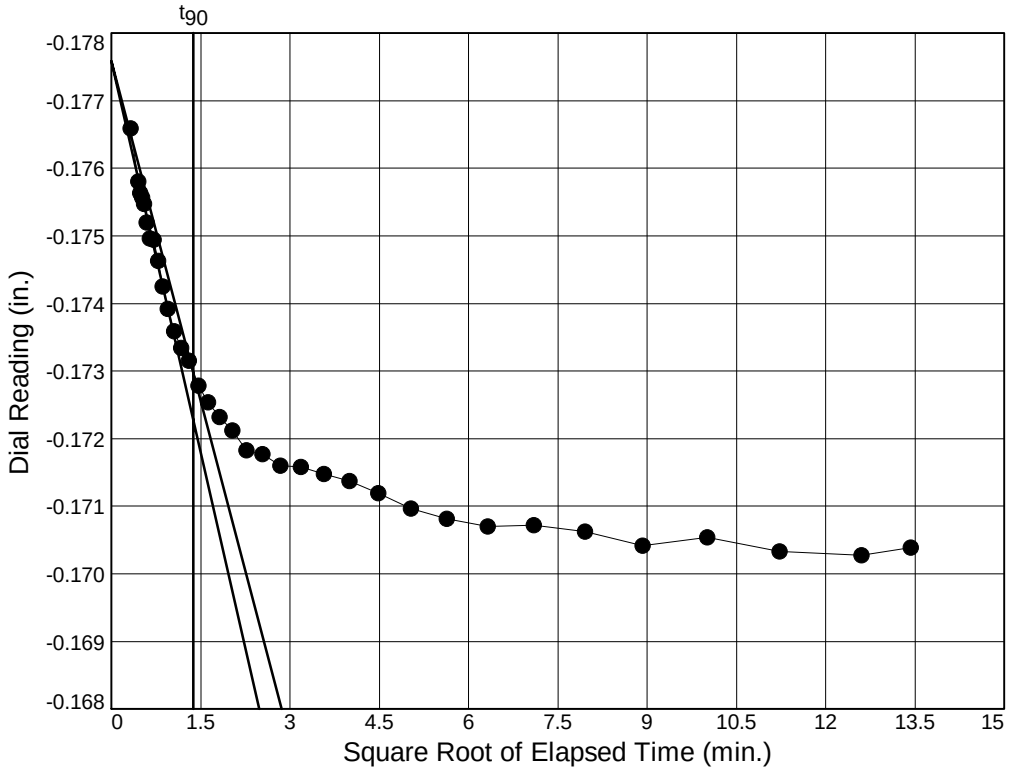
Load No.= 3
Load= 0.50 tsf
D_0 = -0.1867
D_{90} = -0.1842
D_{100} = -0.1839
T_{90} = 0.66 min.

C_v @ T_{90}
0.0339 $cm.^2/sec.$

Dial Reading vs. Time

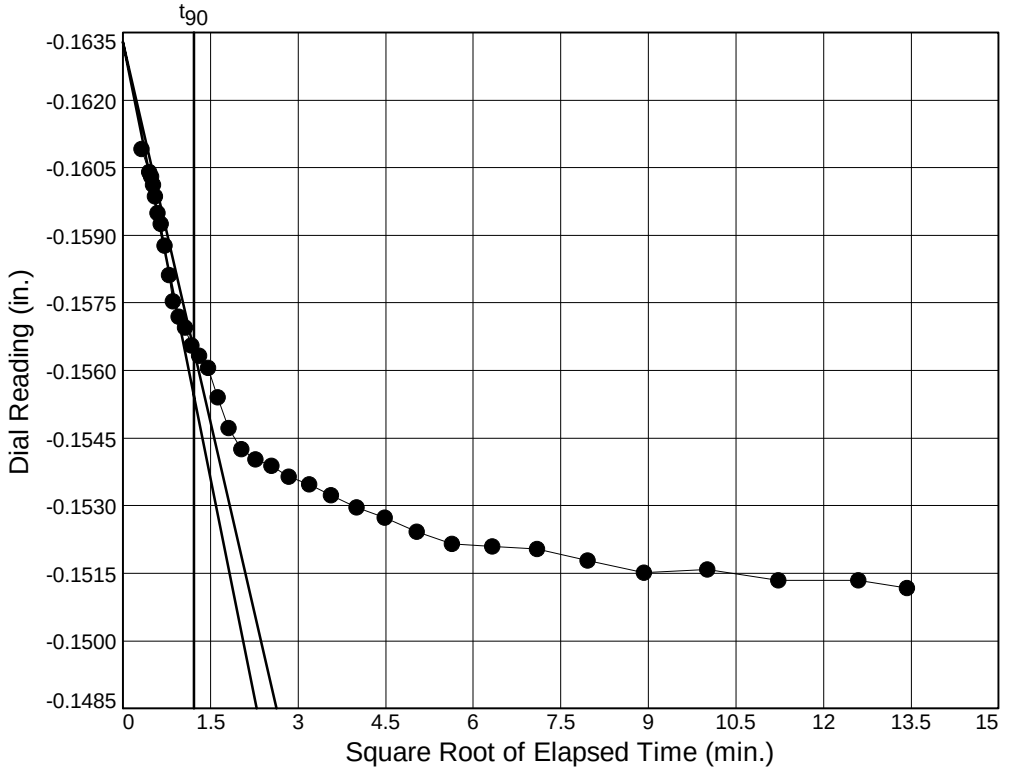
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 4
Load= 1.00 tsf
D_0 = -0.1776
D_{90} = -0.1730
D_{100} = -0.1725
T_{90} = 1.89 min.

C_v @ T_{90}
0.0116 $cm.^2/sec.$



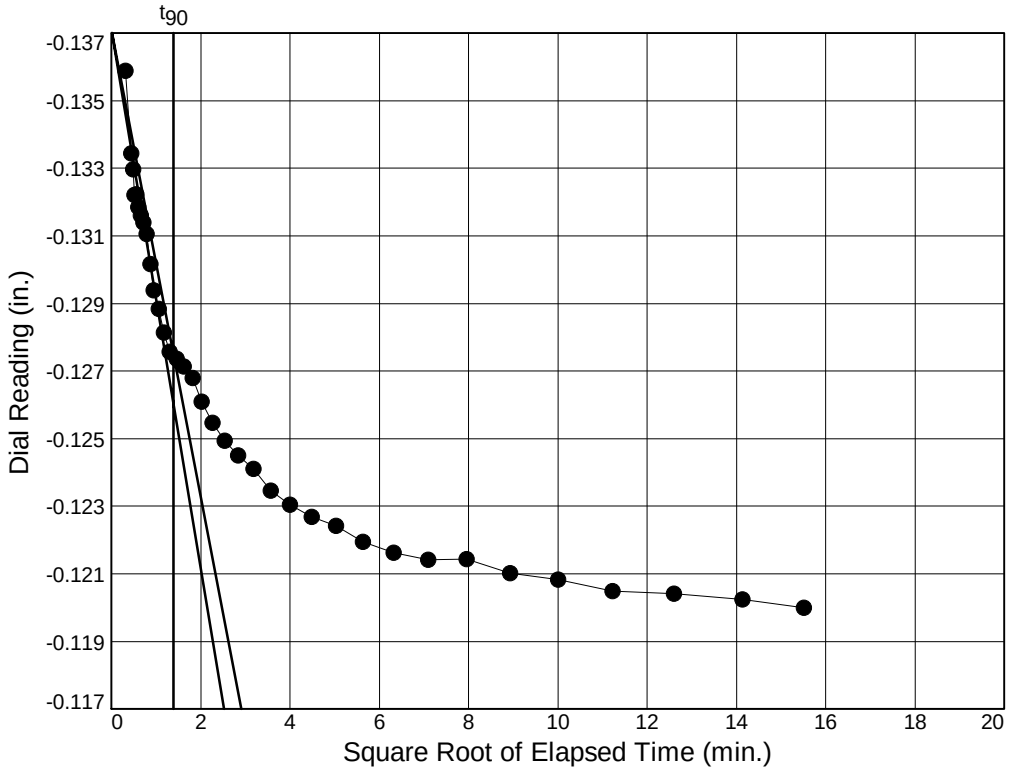
Load No.= 5
Load= 2.00 tsf
D_0 = -0.1633
D_{90} = -0.1565
D_{100} = -0.1557
T_{90} = 1.47 min.

C_v @ T_{90}
0.0145 $cm.^2/sec.$

Dial Reading vs. Time

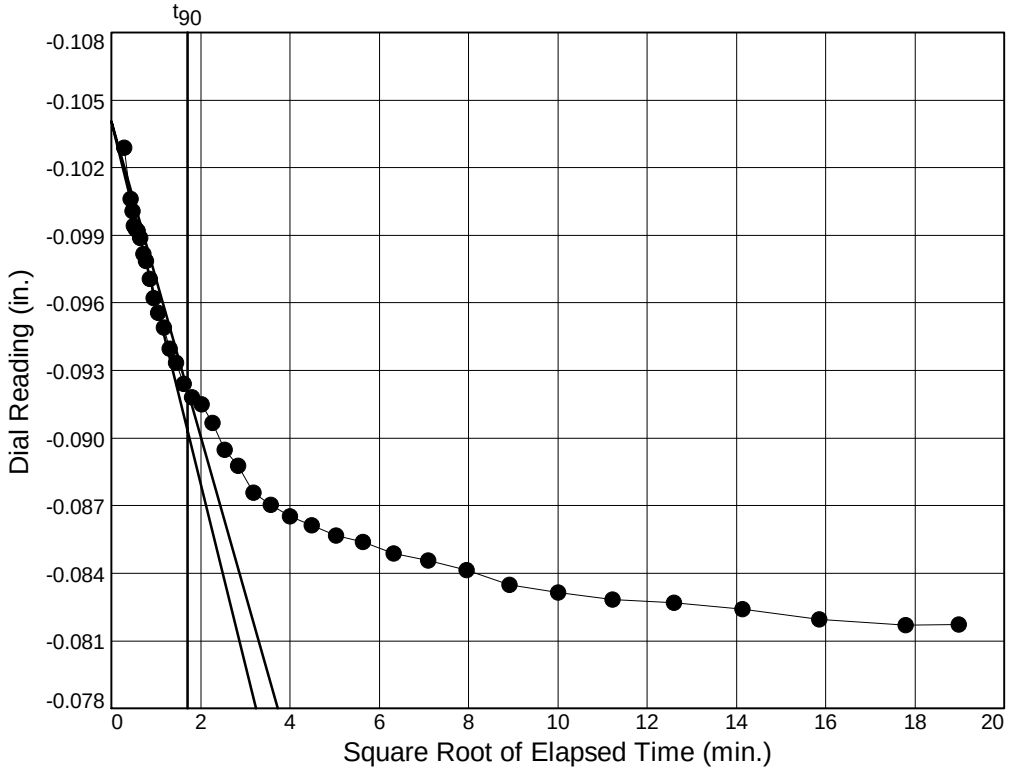
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 6
Load= 4.00 tsf
D_0 = -0.1370
D_{90} = -0.1274
D_{100} = -0.1264
T_{90} = 1.94 min.

C_v @ T_{90}
0.0104 $cm.^2/sec.$



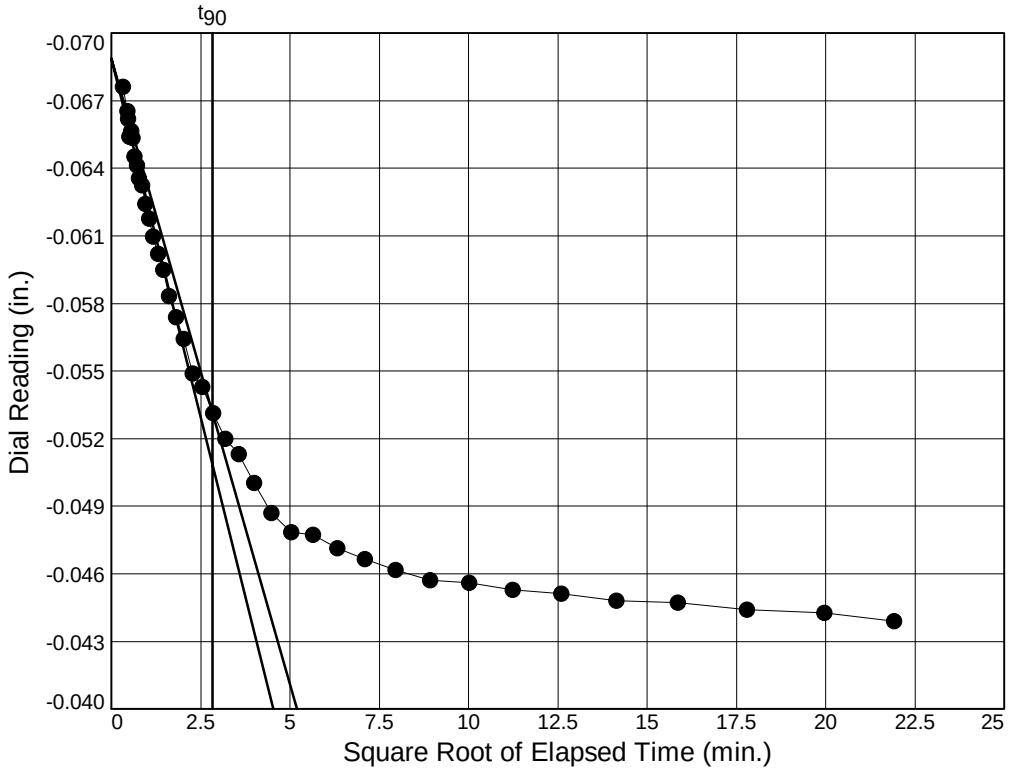
Load No.= 7
Load= 8.00 tsf
D_0 = -0.1040
D_{90} = -0.0922
D_{100} = -0.0908
T_{90} = 2.89 min.

C_v @ T_{90}
0.0065 $cm.^2/sec.$

Dial Reading vs. Time

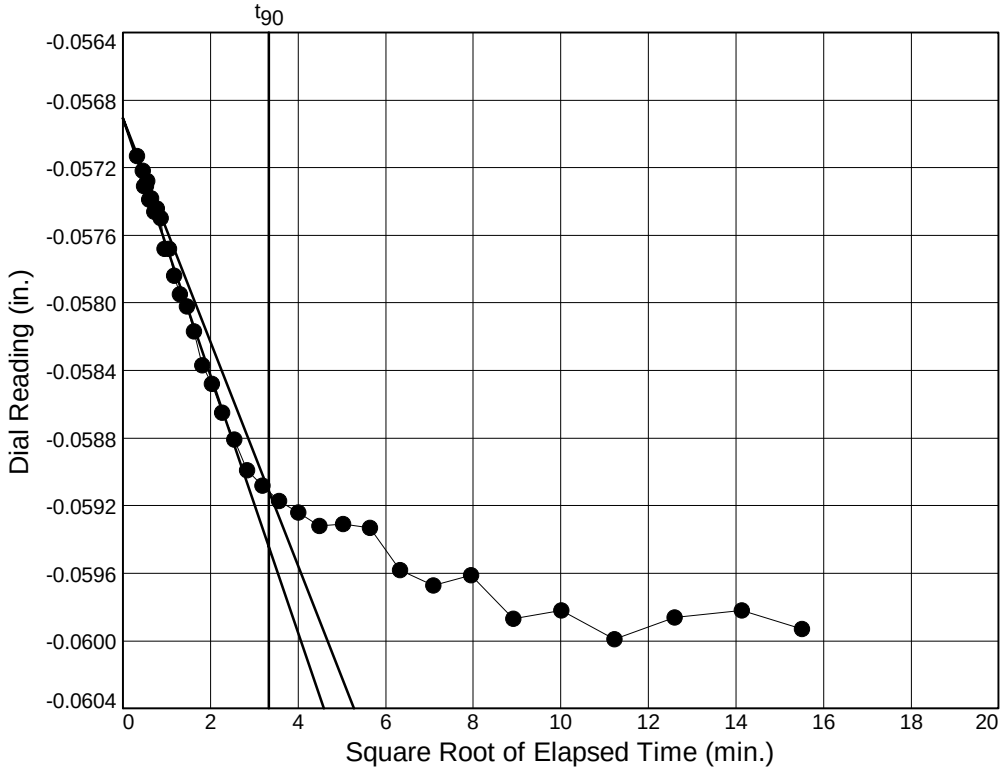
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 8
Load= 16.00 tsf
D_0 = -0.0689
D_{90} = -0.0532
D_{100} = -0.0515
T_{90} = 7.97 min.

C_v @ T_{90}
0.0022 $cm.^2/sec.$



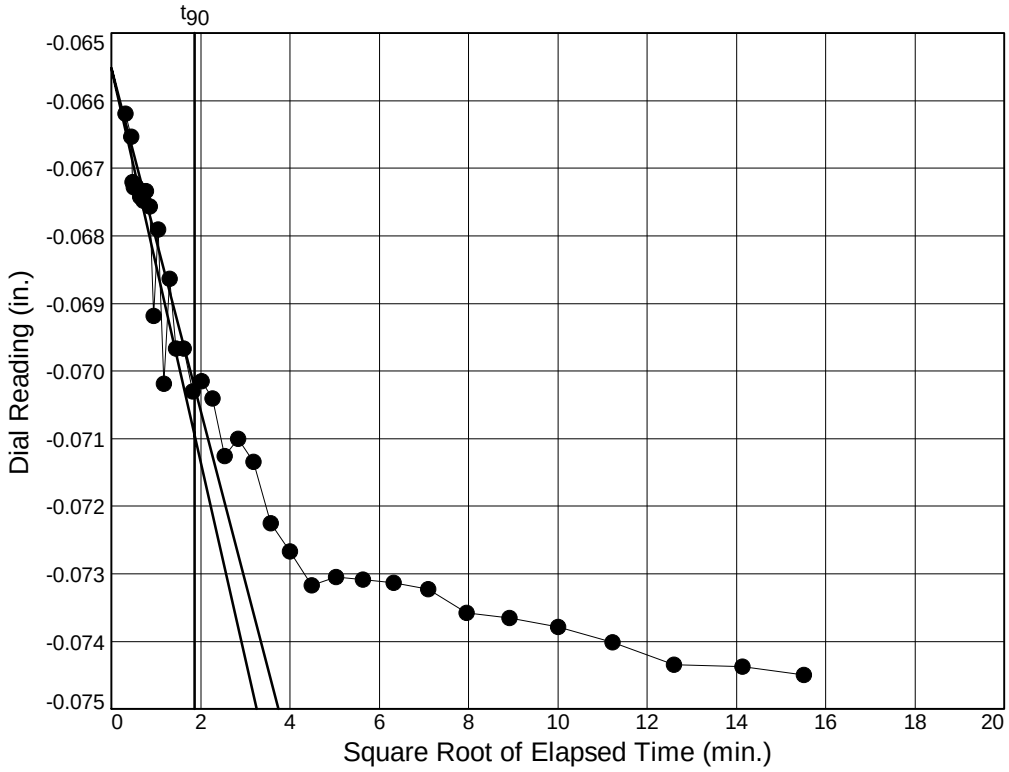
Load No.= 9
Load= 4.00 tsf
D_0 = -0.0569
D_{90} = -0.0591
D_{100} = -0.0594
T_{90} = 11.12 min.

C_v @ T_{90}
0.0015 $cm.^2/sec.$

Dial Reading vs. Time

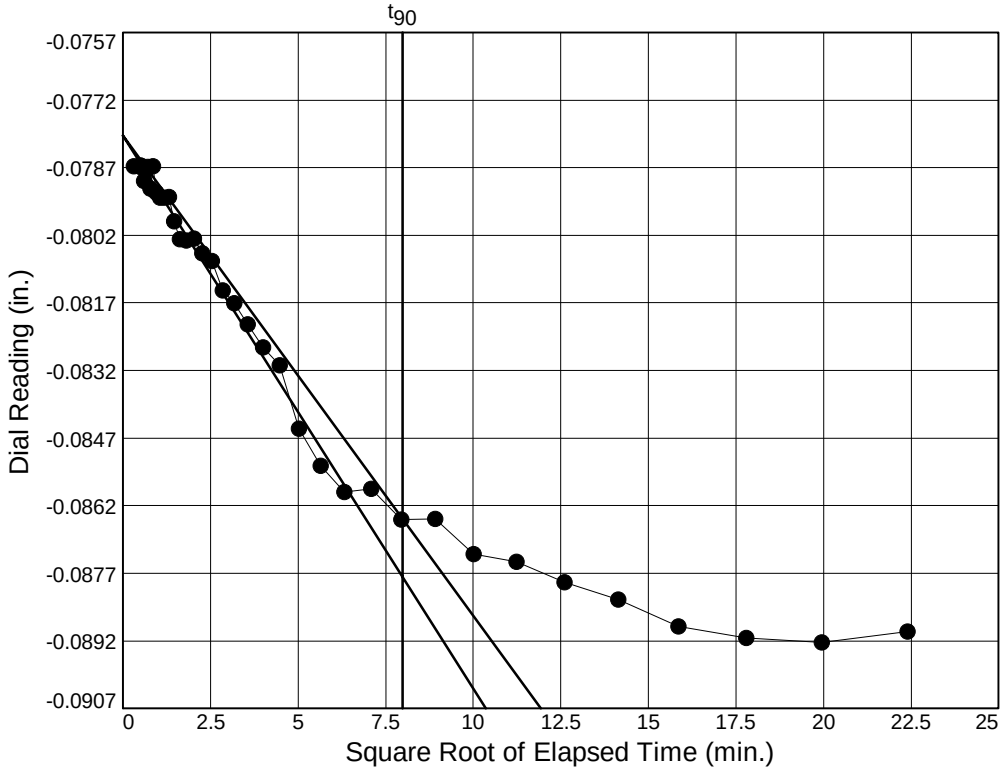
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 10
Load= 1.00 tsf
D_0 = -0.0655
D_{90} = -0.0703
D_{100} = -0.0708
T_{90} = 3.49 min.

C_v @ T_{90}
0.0050 cm.^{2}/sec.



Load No.= 11
Load= 0.25 tsf
D_0 = -0.0780
D_{90} = -0.0865
D_{100} = -0.0874
T_{90} = 63.68 min.

C_v @ T_{90}
0.0003 cm.^{2}/sec.

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B010	S1	1.0	2.5	4.9														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.5	5.0	8.9														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S3	6.0	7.5	9.5		23	14	9	** Sieve									
	Color		Brown							**USCS Classification**			FILL: Sandy lean clay, trace fine to coarse gravel					
	S4	8.5	10.0	11.8	121.5													
	Color		Brown and dark brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S5	13.5	15.0	19.5														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S6	18.5	20.5	21.1	105.8	33	14	19		Note*				Note*		Note*	Note*	CL
	Color									**Visual Classification**			Lean clay with sand					
	S7	20.5	22.5	11.8	123.2	31	15	16										
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S8	23.5	24.4	23.3	110.7													
	Color		Brown and gray with dark brown							**Visual Classification**			FILL: Fat clay with fine to medium sand					
	S8A	29.4	25.0	17.6														
	Color		Brown and gray with dark brown							**Visual Classification**			FILL: Fat clay with fine to medium sand					
	S9	28.5	30.0	28.9	NA	40	20	20										
	Color		Dark brown (ORGANIC CONTENT = 5.3%)							**Visual Classification**			Lean clay					
	S10	32.0	34.0															
	Color		TUBE TO FRUGO							**Visual Classification**								
	S11	33.5	35.0	20.9					Note*									
	Color		Brown and gray							**Visual Classification**			Sandy lean to fat clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

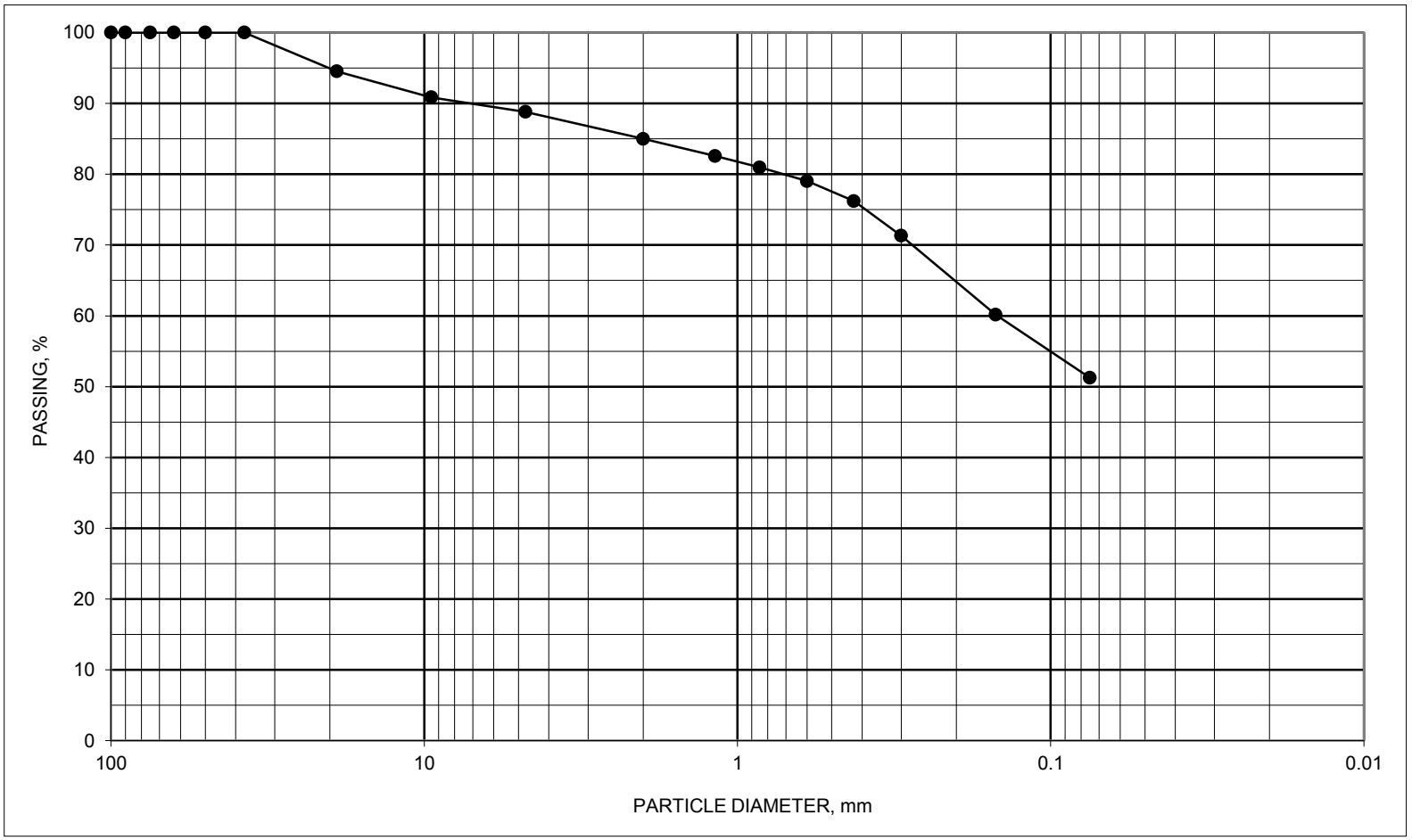
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
	S12	38.5	40.0	9.8					** Sieve									
	Color		Brown and gray							**Visual Classification**			Clayey sand, trace fine gravel					
KIN-B010	S13	43.5	45.0	10.7														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S14	48.5	50.0	9.9	135.9	23	14	9										
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S15	58.5	60.0	9.5														
	Color		Gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S16	68.5	70.0	17.0														
	Color		Greenish gray and brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
												Rock Unconf. Comp.						
	RUN #1	70.6	71.2	0.3	165.3							11377 psi						
	RUN #1	71.5	72.5															
	Color		Gray							**Visual Classification**			Limestone					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	95
3/8"	9.5	91
#4	4.8	89
#10	2.00	85
#16	1.18	83
#20	0.85	81
#30	0.600	79
#40	0.425	76
#50	0.300	71
#100	0.150	60
#200	0.075	51.3
	D60	0.1481



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB010	S-3	6 TO 7.5	Sandy lean clay, trace fine to coarse gravel Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/30/2015

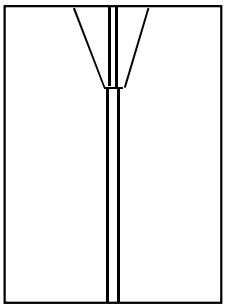
N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B010 S-3.xlsx]GRADATION

Terracon

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B010, S6, 18.5-20.5 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 22.7%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Lean Clay with Sand

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	10.0	15	0.67						X	X	
2	2	10.5	15	0.70						X	X	
3	2	10.5	15	0.70						X	X	
4	2	11.0	15	0.73						X	X	
5	2	11.5	15	0.77						X	X	
6	2	12.0	15	0.80						X	X	
7	2	11.0	15	0.73						X	X	
8	2	11.5	15	0.77						X	X	
9	2	11.5	15	0.77						X	X	
10	2	11.0	15	0.73						X	X	
1	7	17.5	15	1.17						X	X	
2	7	17.5	15	1.17						X	X	
3	7	18.0	15	1.20						X	X	
4	7	18.0	15	1.20						X	X	
5	7	18.0	15	1.20						X	X	
1	15	25.5	15	1.70						X	X	
2	15	25.5	15	1.70						X	X	
3	15	25.0	15	1.67						X	X	
4	15	26.0	15	1.73						X	X	
5	15	25.0	15	1.67						X	X	
1	40	81.0	30	2.70						X	X	
2	40	81.0	30	2.70						X	X	
3	40	78.0	30	2.60						X	X	
4	40	79.0	30	2.63						X	X	
5	40	80.0	30	2.67						X	X	

CLASSIFICATION = **ND1**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B010 S6 18.5-20.5 feet

2 MIN

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive

Grade 2 - Intermediate

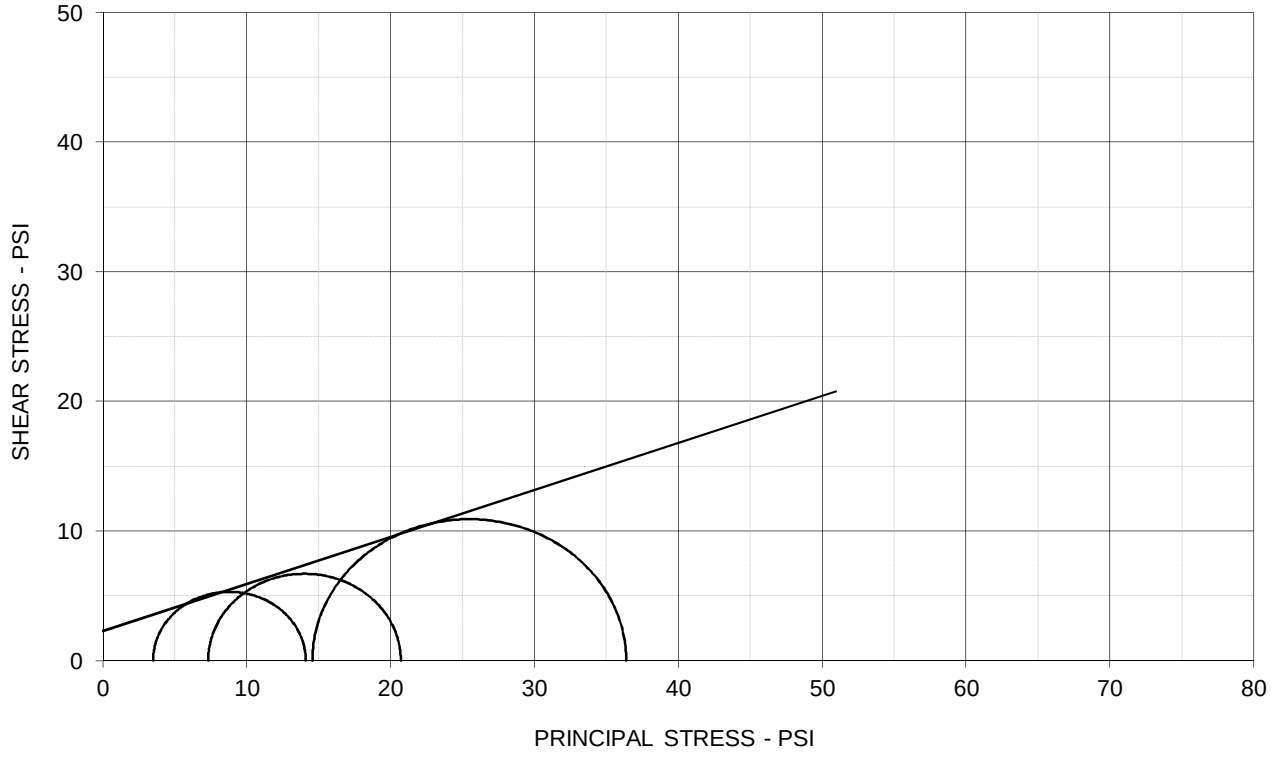
Grade 3 - Dispersive

Grade 4 - Highly Dispersive

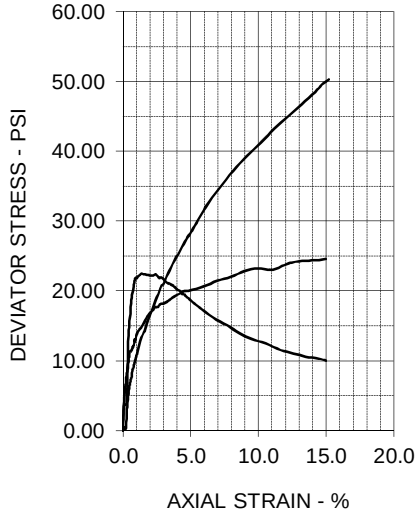
Terracon

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS	ϕ' = 19.9 deg	c' = 2.3 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.7	20.5	20.2	
Dry Density - pcf	103.4	105.9	108.1	
Diameter - inches	1.39	1.40	1.39	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %	23.1	20.0	17.7	
Dry Density - pcf	103.4	108.4	113.3	
Calculated Diameter (in.)	1.38	1.39	1.38	
Height - inches	2.75	2.78	2.77	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	10.61	13.39	21.81	
Total Pore Pressure - psi	54.0	57.7	65.4	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	1.0	1.0	1.0	
σ_1' Failure - psi	14.11	20.72	36.38	
σ_3' Failure - psi	3.50	7.33	14.57	

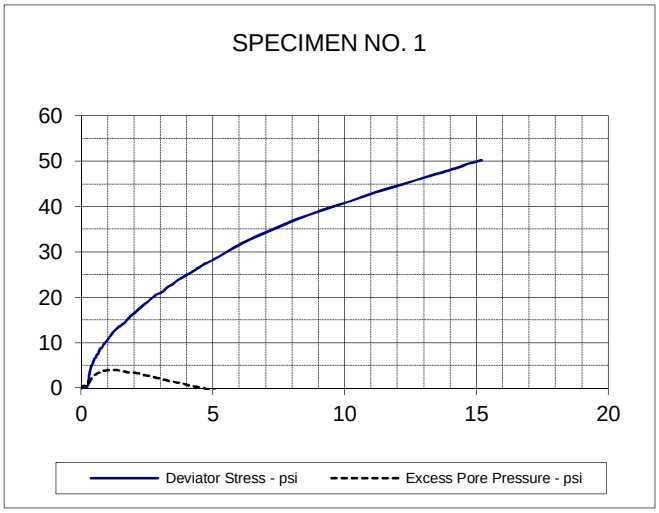
TEST DESCRIPTION

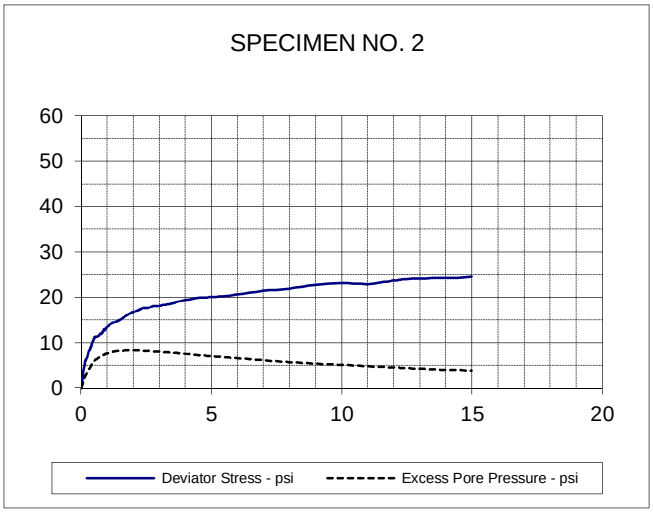
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B010, S6, 18.5-20.5 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 33 PL: 14 PI: 19 Percent -200: 84
REMARKS: Specimens trimmed to 1.4" diameter.

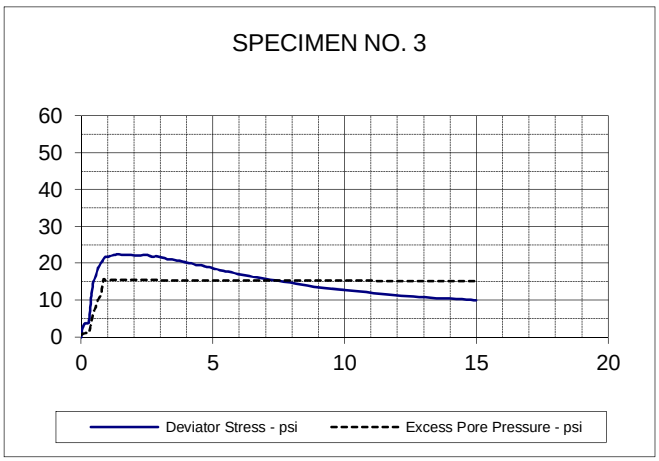
PROJECT INFORMATION

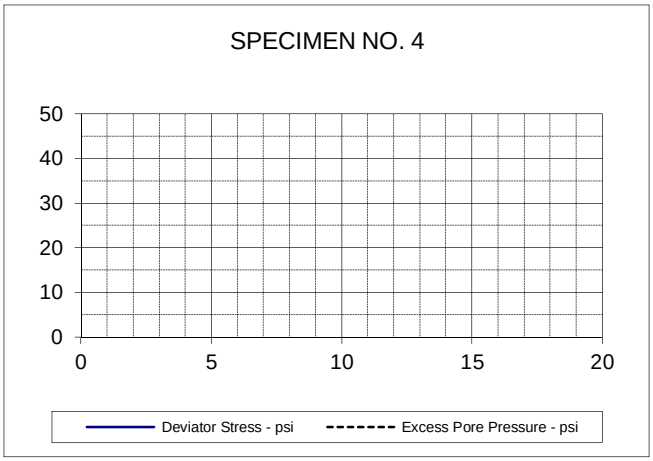
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

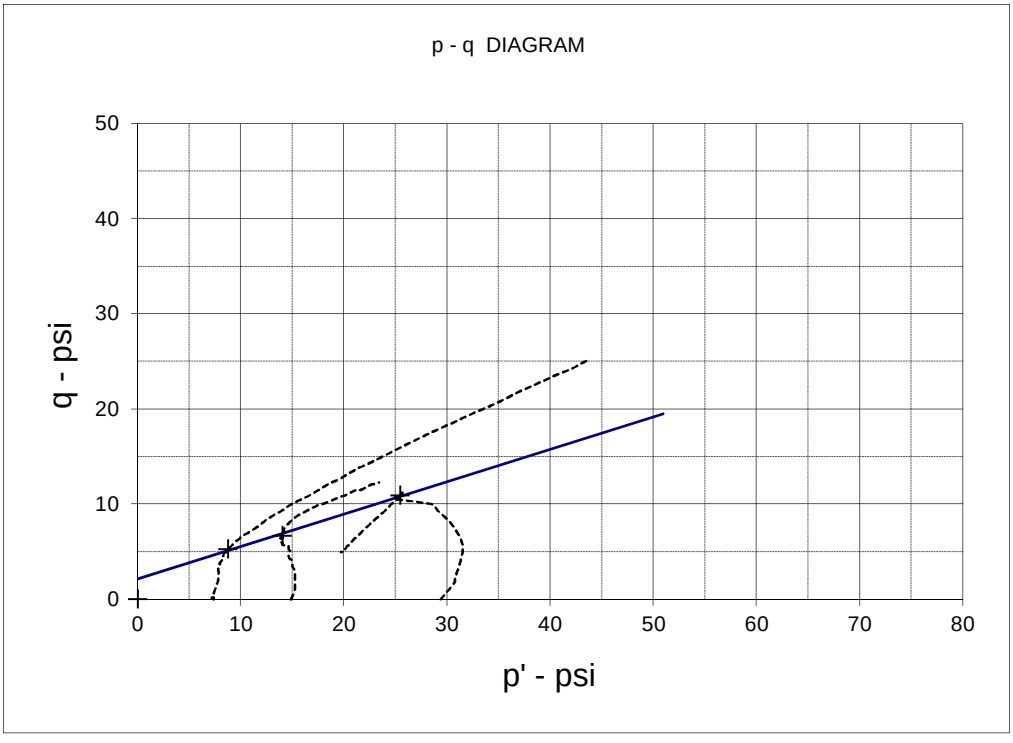
TERRACON







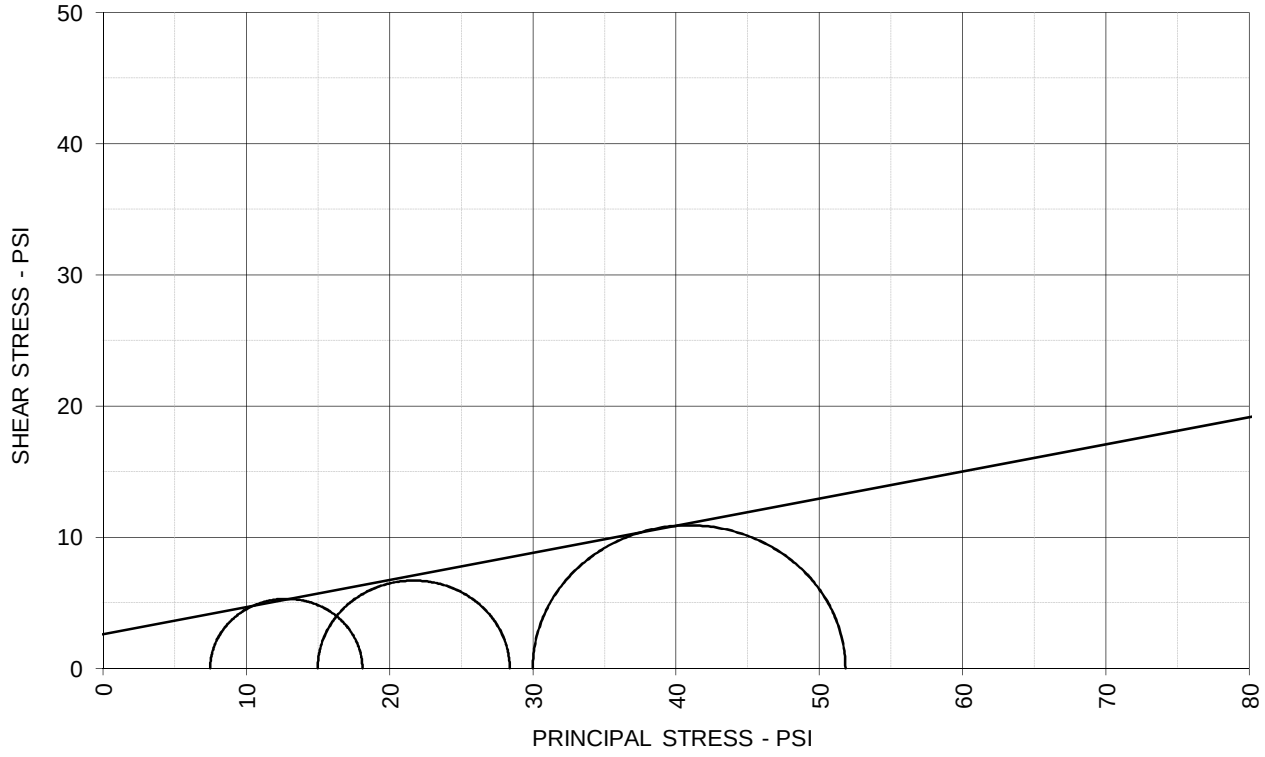




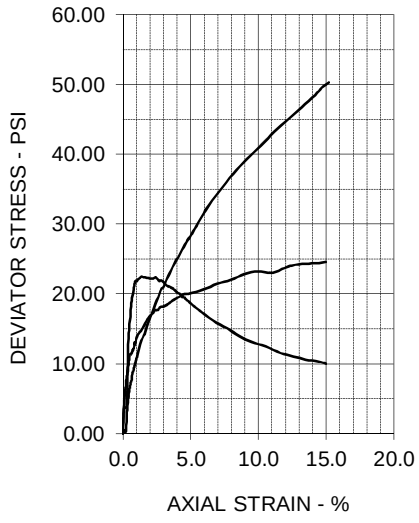
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 18.8	a (psi) = 2.1
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Lean Clay with Sand (CL)			

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 11.7 deg	c = 2.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.7	20.5	20.2	
Dry Density - pcf	103.4	105.9	108.1	
Diameter - inches	1.39	1.40	1.39	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %	23.1	20.0	17.7	
Dry Density - pcf	103.4	108.4	113.3	
Calculated Diameter (in.)	1.38	1.39	1.38	
Height - inches	2.75	2.78	2.77	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	10.61	13.39	21.81	
Total Pore Pressure - psi	54.0	57.7	65.4	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	1.0	1.0	1.0	
σ_1 Failure - psi	18.11	28.39	51.81	
σ_3 Failure - psi	7.50	15.00	30.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B010, S6, 18.5-20.5 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 33 PL: 14 PI: 19 Percent -200: 84
REMARKS: Specimens trimmed to 1.4" diameter.

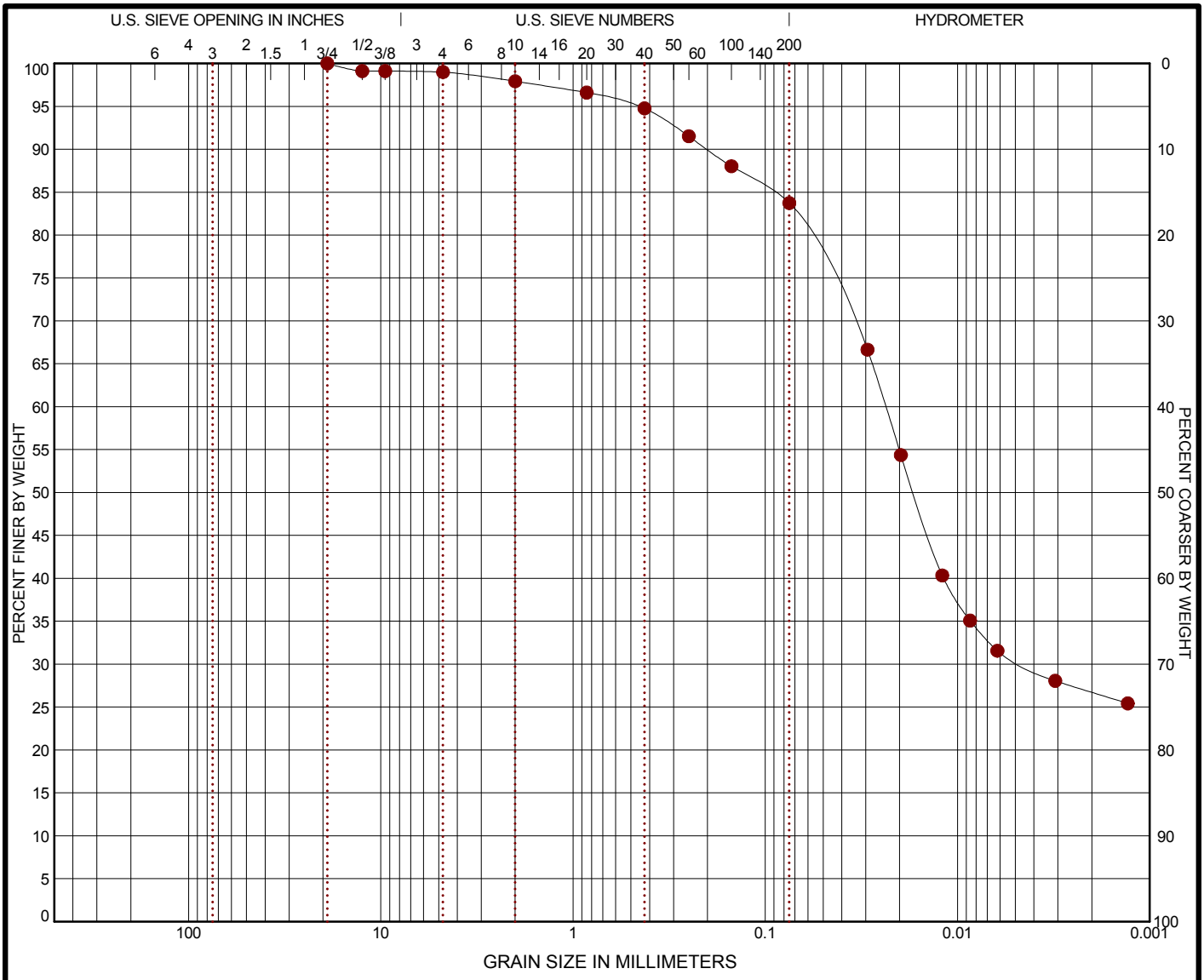
PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B010**	**18.5**	**0.0**	**1.0**	**15.3**	**53.3**		**30.5**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.024**
D_{30}	**0.005**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	**100.0**
1/2"	**99.11**
3/8"	**99.11**
#4	**98.99**
#10	**97.92**
#20	**96.61**
#40	**94.77**
#60	**91.52**
#100	**88.02**
#200	**83.73**

SOIL DESCRIPTION
● LEAN CLAY with SAND(CL)

REMARKS
● Dispersion: 18.42%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

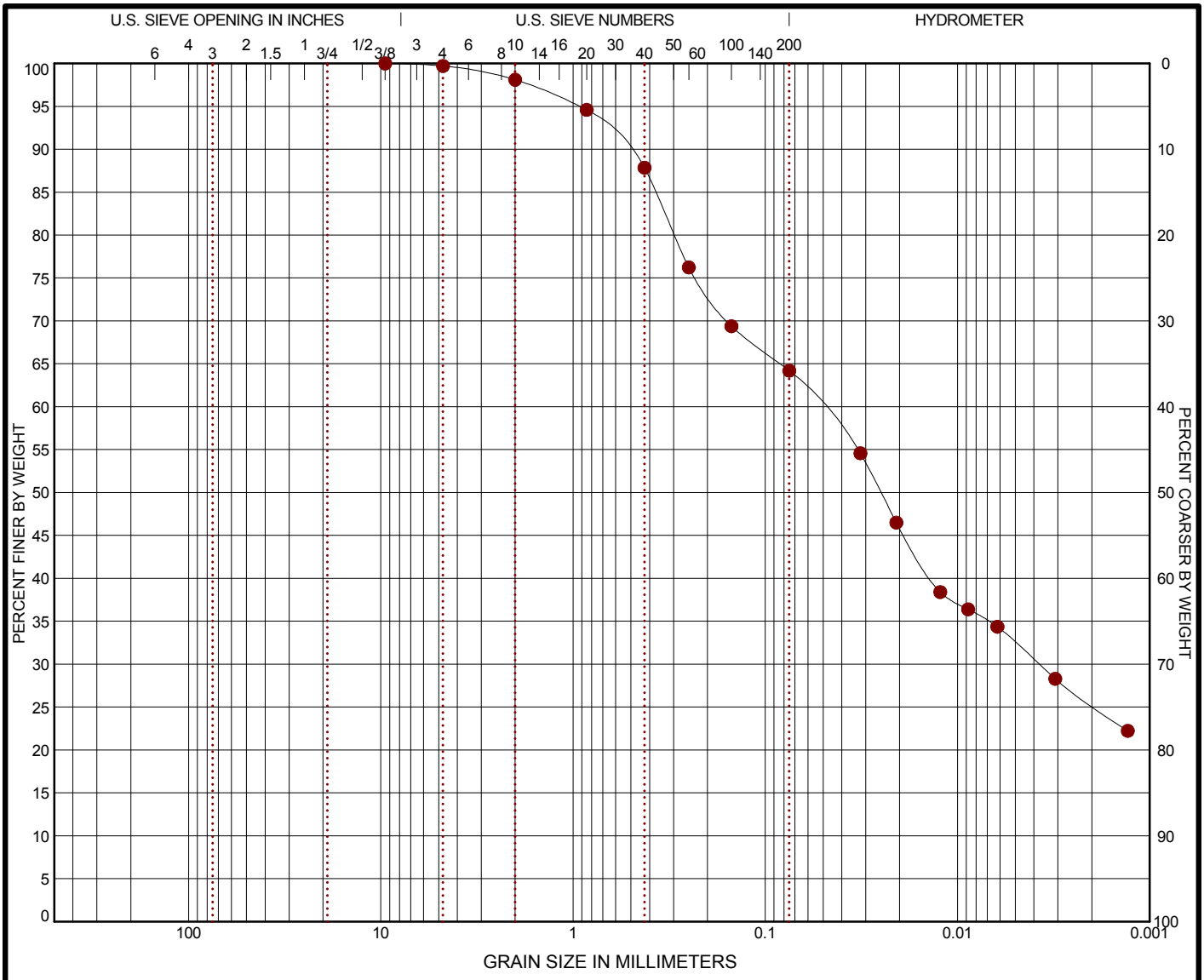
PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B010**	**33.5**	**0.0**	**0.3**	**35.5**	**31.7**		**32.5**	

	GRAIN SIZE
	●
D_{60}	**0.052**
D_{30}	**0.004**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●		
1 1/2"			
1"			
3/4"			
1/2"			
3/8"	**100.0**		
#4	**99.71**		
#10	**98.09**		
#20	**94.59**		
#40	**87.85**		
#60	**76.23**		
#100	**69.37**		
#200	**64.2**		

SOIL DESCRIPTION
●

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

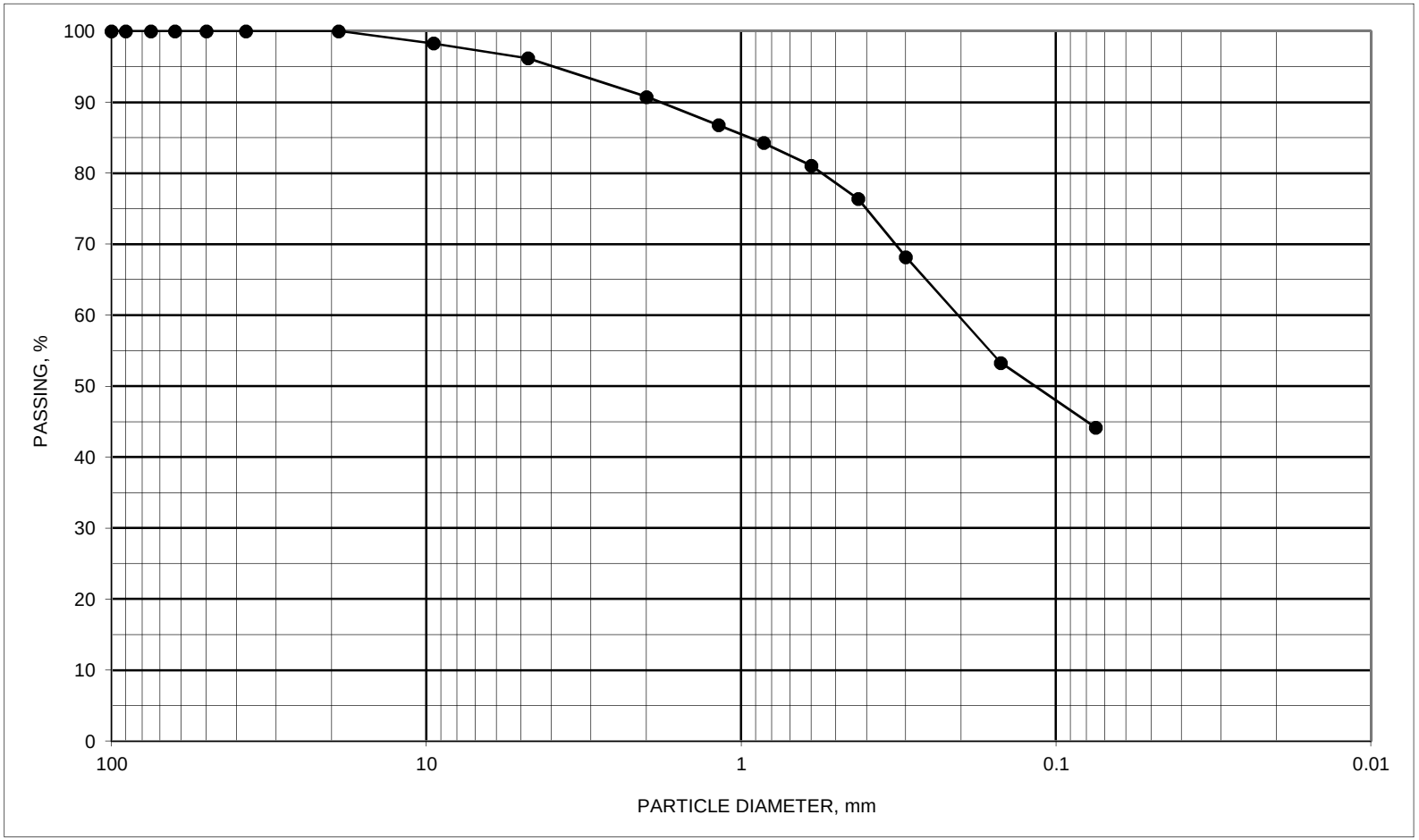
Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/25/15

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	98
#4	4.8	96
#10	2.00	91
#16	1.18	87
#20	0.85	84
#30	0.600	81
#40	0.425	76
#50	0.300	68
#100	0.150	53
#200	0.075	44.2
	D60	0.2049



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB010	S-12	38.5 TO 40	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B010 S-12.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B011	S1	1.0	2.5	16.6														
	Color		Brown							**Visual Classification**			FILL: Lean clay with fine sand					
	S2	3.5	5.0	18.6		38	20	18										
	Color		Brown and dark brown (ORGANIC CONTENT = 2.9%)							**Visual Classification**			FILL: Lean clay with fine sand, trace fine gravel					
	S3	6.0	7.5	17.2	NA	44	18	26										
	Color		Brown and dark brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.0	20.4														
	Color		Brown and gray							**Visual Classification**			FILL: Lean to fat clay, trace fine sand					
	S5	13.5	15.5	22.9	96.0	58	21	37										
	Color		Dark brown (ORGANIC CONTENT = 2.5%)							**Visual Classification**			FILL: Fat clay					
	S6	18.5	20.0	27.7	110.2	49	20	29										
	Color		Brown and gray							**Visual Classification**			FILL: Lean to fat clay, trace fine sand					
	S7	23.5	25.0	26.8					Note*									
	Color		Brown and gray							**Visual Classification**			Lean clay, trace fine sand					
	S8	25.5	27..5	TUBE TO FUGRO														
	Color									**Visual Classification**								
	S9	28.5	30.0	26.5		40	19	21										
	Color		Brown and gray							**Visual Classification**			Lean clay, trace fine sand					
	S10	33.5	35.0	25.0		33	16	17										
	Color		Brown and gray							**Visual Classification**			Sandy lean clay					
	S11	38.5	40.0	8.2		23	14	9	** Sieve									
	Color		Brown and gray							**Visual Classification**			Clayey sand, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.
*** Testing Not Possible

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B011	S12	43.5	45.0	9.0					** Sieve									
	Color		Brownish gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S13	48.5	50.0	9.6														
	Color		Brownish gray							**Visual Classification**			Sandy lean clay, trace fine gravel					

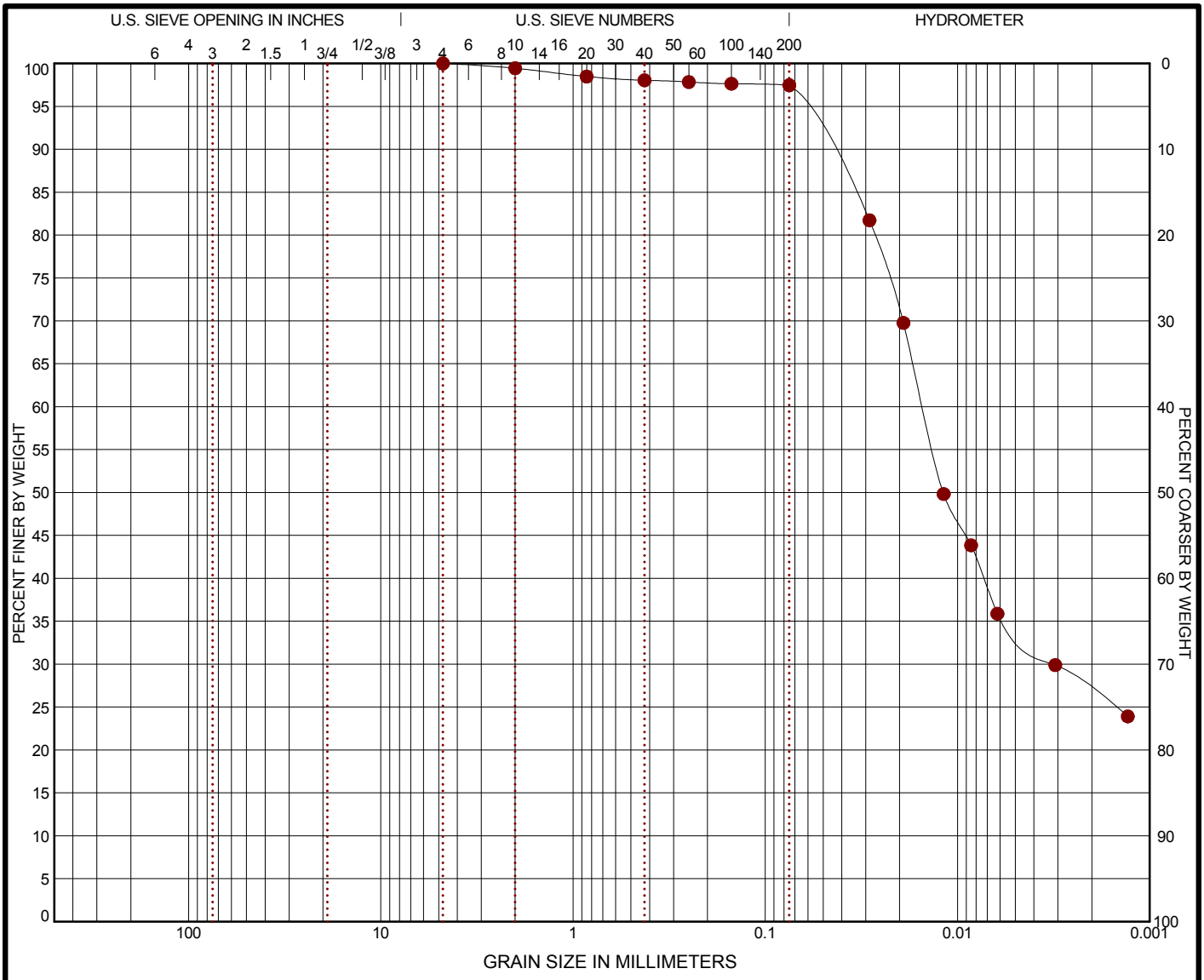
TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.
*** Testing Not Possible

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B011**	**23.5**	**0.0**	**0.0**	**2.5**	**63.4**		**34.0**	

	GRAIN SIZE
●	
D_{60}	**0.015**
D_{30}	**0.003**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●		
1 1/2"			
1"			
3/4"			
1/2"			
3/8"			
#4	**100.0**		
#10	**99.44**		
#20	**98.47**		
#40	**98.03**		
#60	**97.83**		
#100	**97.63**		
#200	**97.46**		

SOIL DESCRIPTION
●

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

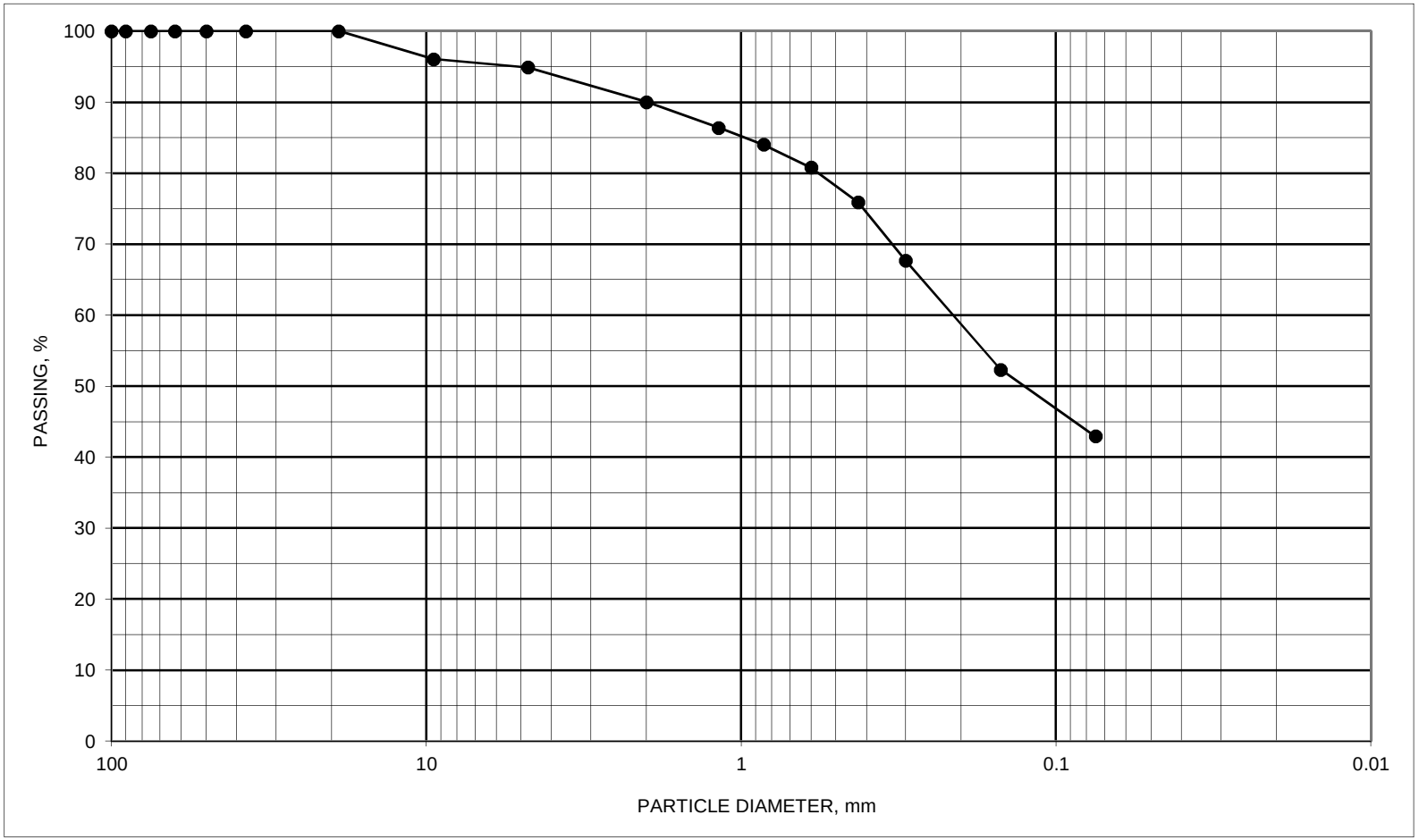
Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/25/15

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	96
#4	4.8	95
#10	2.00	90
#16	1.18	86
#20	0.85	84
#30	0.600	81
#40	0.425	76
#50	0.300	68
#100	0.150	52
#200	0.075	42.9
	D60	0.2122



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB011	S-11	38.5 TO 40	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

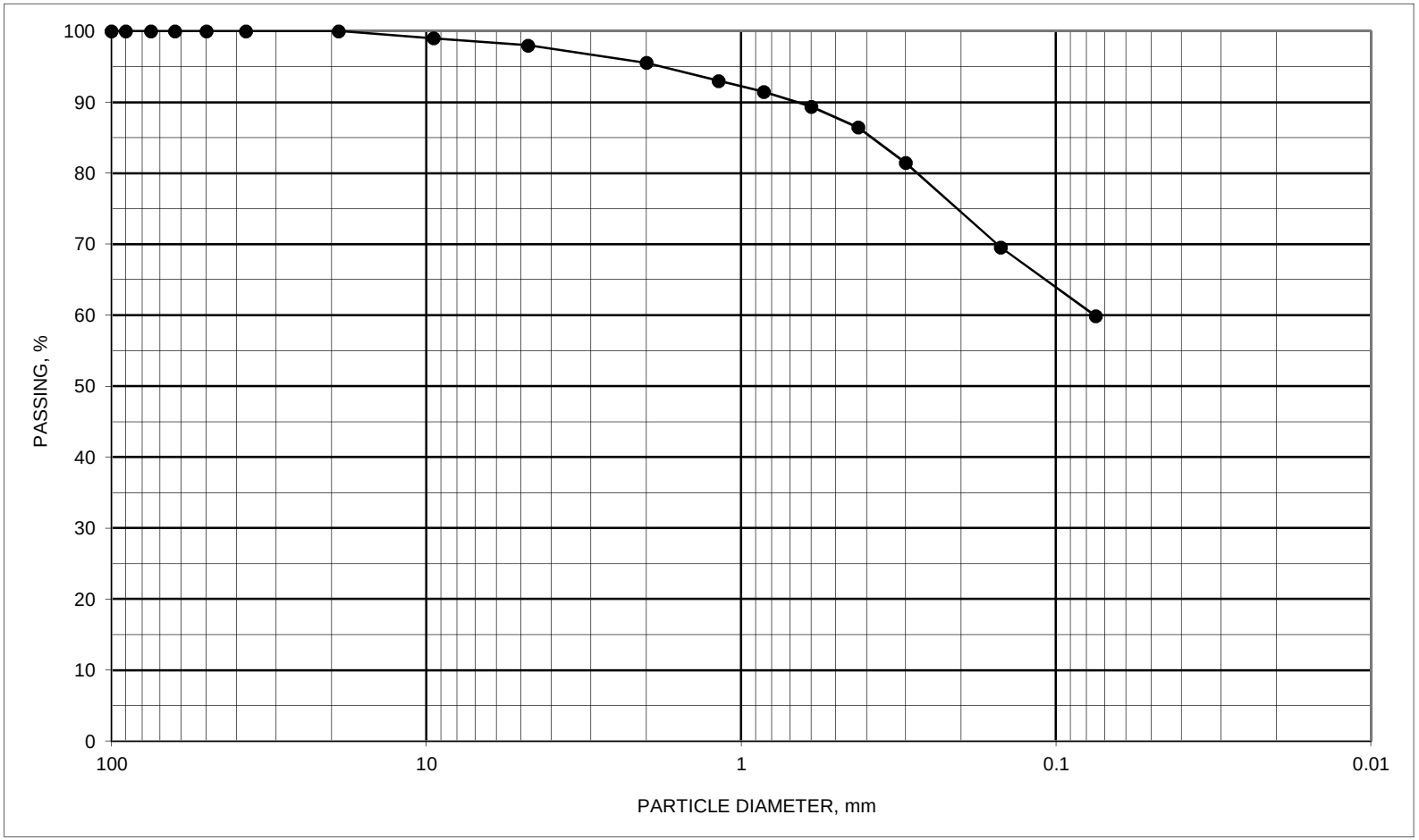
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B011 S-11.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	98
#10	2.00	96
#16	1.18	93
#20	0.85	91
#30	0.600	89
#40	0.425	86
#50	0.300	81
#100	0.150	70
#200	0.075	59.9
	D60	0.0755



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB011	S-12	43.5 TO 45	Sandy lean clay, trace fine gravel Brownish gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B011 S-12.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B012	S1	1.0	2.5	11.2					** Sieve									
	Color		Black							**Visual Classification**			FILL: Cinders					
	S2	3.5	5.0	12.0					** Sieve		2.829							
	Color		Black							**Visual Classification**			FILL: Cinders					
	S3	7.0	9.0	X														
	Color		Piston sample - no recovery							**Visual Classification**								
	S4	8.5	10.0	19.4														
	Color		Black							**Visual Classification**			FILL: Cinders					
	S5	13.0	15.5	X														
	Color		PISTON SAMPLE - ASH OVERLAY							**Visual Classification**								
	S6	15.5	17.5															
	Color		No testing assigned							**Visual Classification**								
	S7	18.5	20.5	X	X	X	X	X			X		X		X			
	Color		ON HOLD							**Visual Classification**								
	S8	23.5	25.0															
	Color		No testing assigned							**Visual Classification**								
	S9	28.5	30.0	8.4	NA	19	13	6										
	Color		Brown and gray							**Visual Classification**			Sandy Silty lean clay, trace fine gravel					
	S10	33.5	35.0	7.1														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S11	38.5	40.0	14.9					** Sieve									
	Color		Brown and gray							**Visual Classification**			Clayey sand, trace fine gravel					

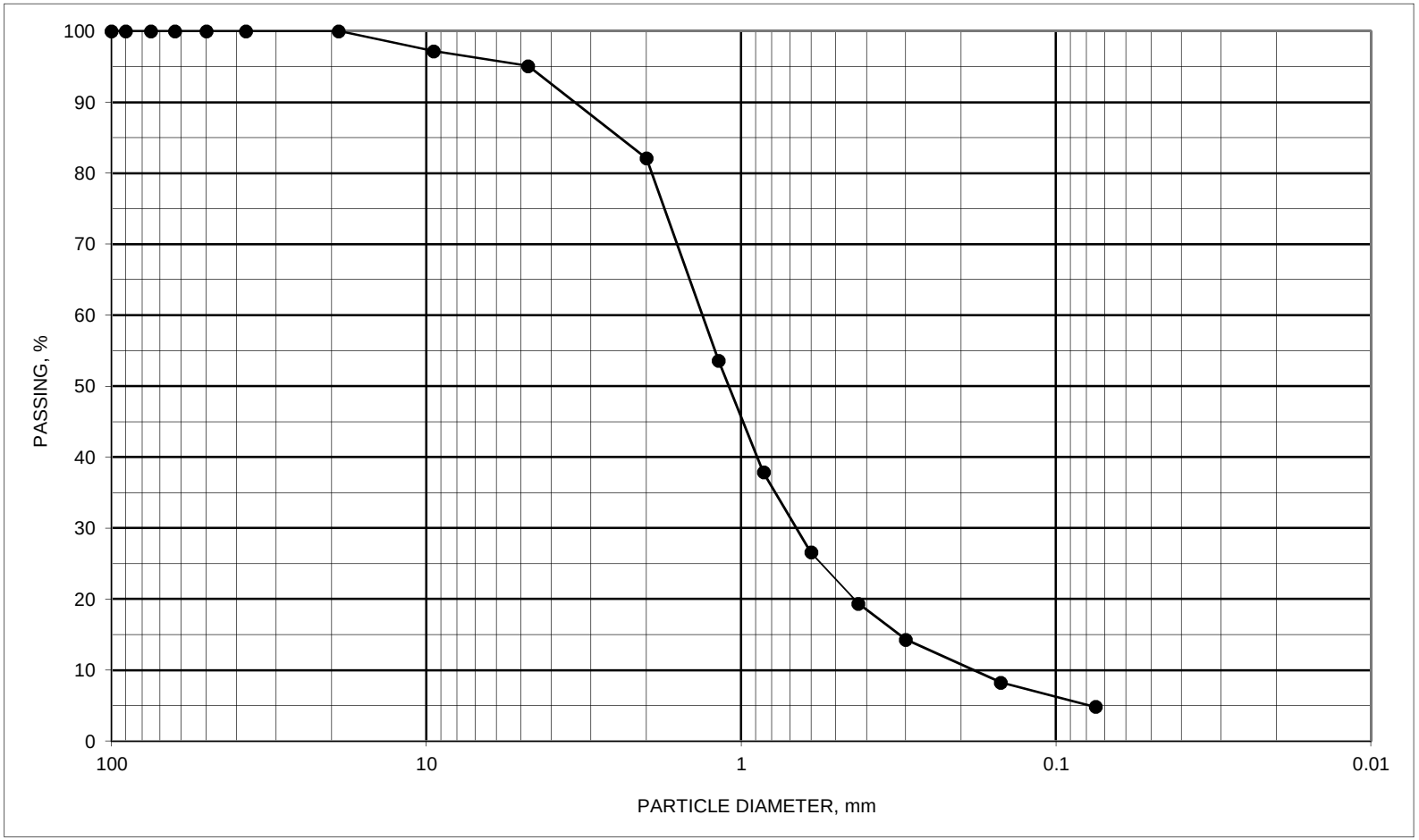
TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.
*** Testing Not Possible

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	97
#4	4.8	95
#10	2.00	82
#16	1.18	54
#20	0.85	38
#30	0.600	27
#40	0.425	19
#50	0.300	14
#100	0.150	8
#200	0.075	4.8

D60	1.3289
D30	0.6670
D10	0.1833
Cu	7.2
Cc	1.8



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB012	S-1	1 TO 2.5	FILL: Cinders Black	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

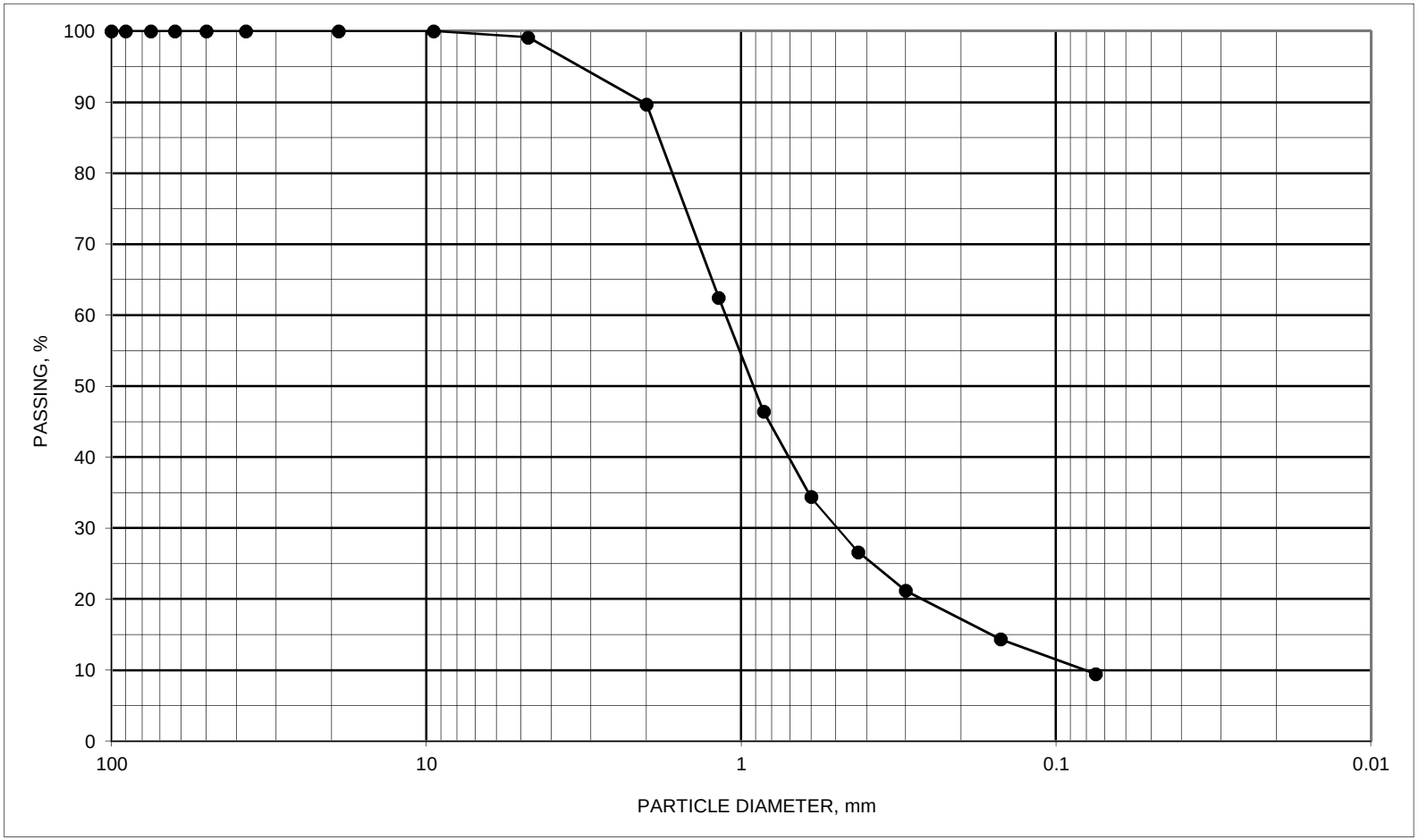
JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B012 S-1.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	99
#10	2.00	90
#16	1.18	62
#20	0.85	46
#30	0.600	34
#40	0.425	27
#50	0.300	21
#100	0.150	14
#200	0.075	9.4

D60	1.1222
D30	0.4940
D10	0.0812
Cu	13.8
Cc	2.7



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB012	S-2	3.5 TO 5	FILL: Cinders Black	#VALUE!				

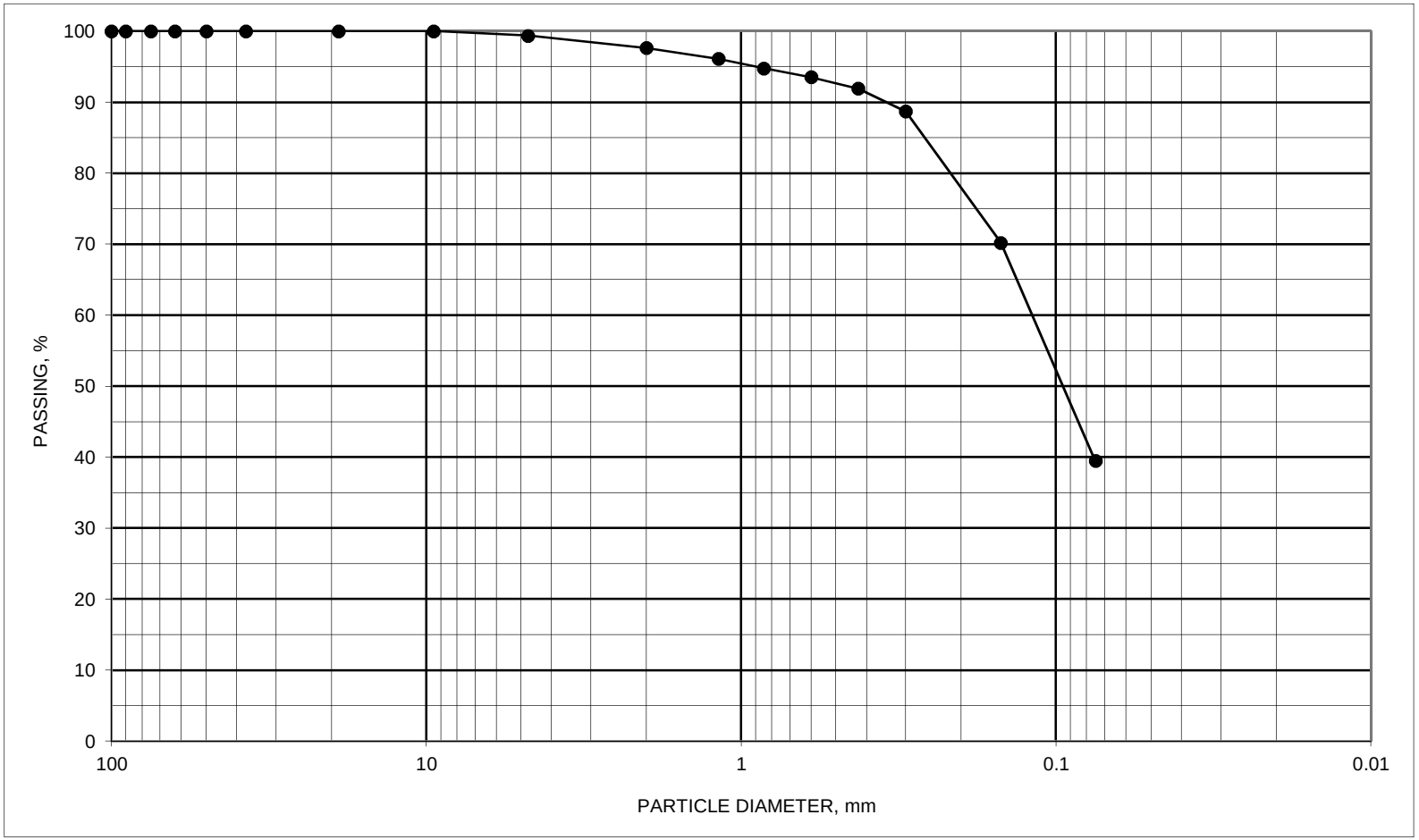
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B012 S-2.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	99
#10	2.00	98
#16	1.18	96
#20	0.85	95
#30	0.600	94
#40	0.425	92
#50	0.300	89
#100	0.150	70
#200	0.075	39.5
	D60	0.1192



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB012	S-11	38.5 TO 40	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B012 S-11.xlsx]GRADATION

Terracon

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	1.7	2.9	4.5	49.4	40.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2	100.0		
3/8	99.5		
#4	98.6		
#8	97.2		
#10	96.9		
#16	95.9		
#30	94.8		
#40	94.0		
#50	93.1		
#80	91.6		
#100	91.0		
#200	89.5		

* (no specification provided)

Material Description

Gray Lean Clay, Little Sand, Trace Gravel

Atterberg Limits

PL= 25 LL= 46 PI= 21

Coefficients

D_{90}= 0.0810 D_{85}= 0.0524 D_{60}= 0.0103
D_{50}= 0.0069 D_{30}= 0.0032 D_{15}= 0.0015
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(21)

Remarks

Natural Moisture = 15.5%

Sample Number: B-12 **Depth:** 48-50'

Date: 9/14/15

CGC, Inc.

Client: Natural Resource Technology, Inc.
Project: Dynegy - Kincaid (NRT# 2285/3.2)
Project No: C15385-1 **Figure**

Tested By: DRW **Checked By:** DAS

TRC Environmental Corporation

Falling Head, Rising Tailwater Permeability Test (ASTM D5084, Method C)

QC: JPH

QA: JPH

Project Name:	Dynegy - Kincaid	Cell #:	8
Project #:	C15385-1	USCS Description:	Gray Lean Clay, Little Sand, Trace Gravel
Sample Name:	B-12, 48-50'	USCS Classification:	CL
Visual Descript:	Gray Lean Clay, Little Sand, Trace Gravel	Average Kv =	4.3E-08 cm/s

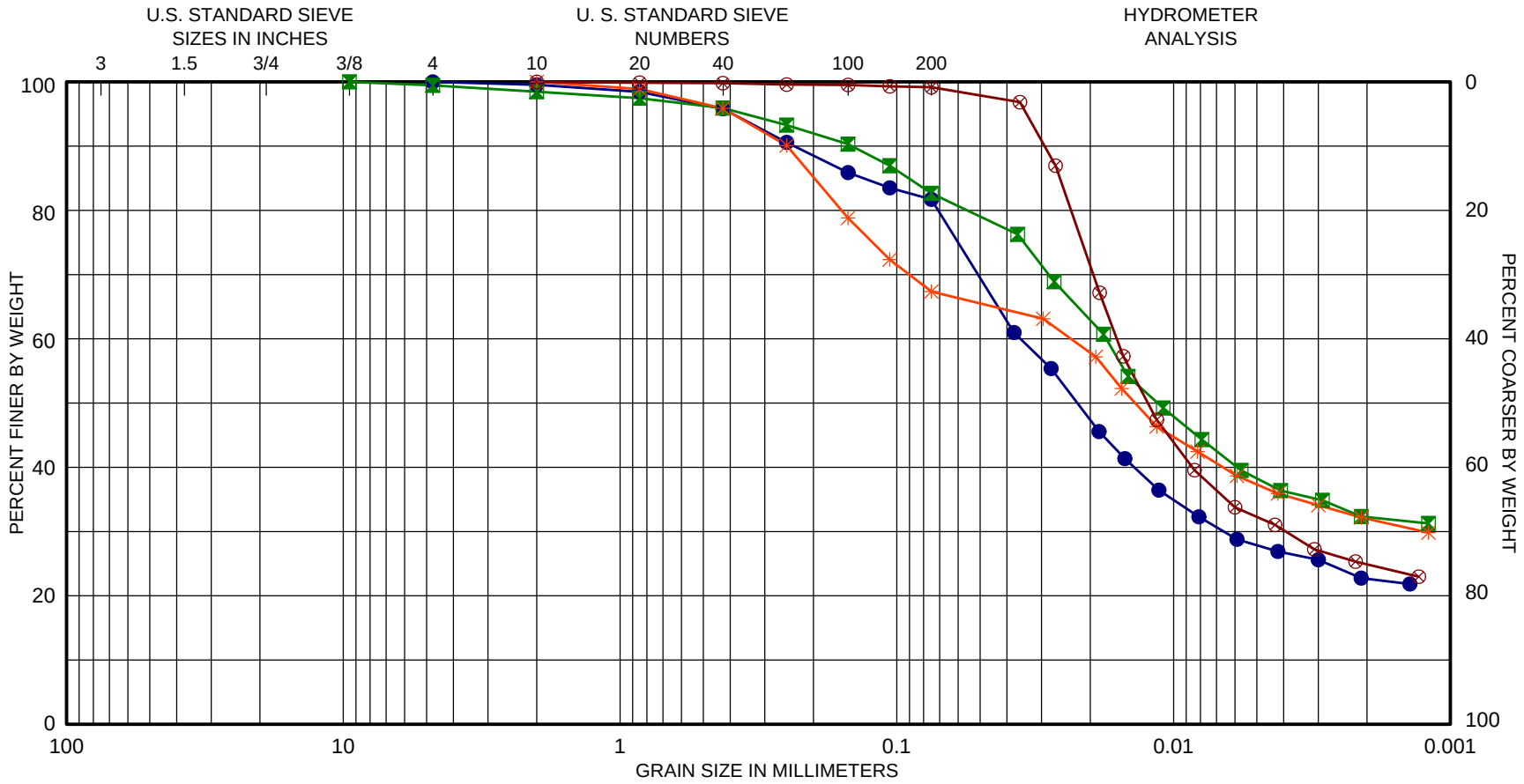
Sample Type:	Undisturbed	Initial Values	Final Values			
Sample Dia. (in)		2.86	2.86	Permeant:	Water	
Sample Ht. (in)		2.65	2.65	Permeant Specific Gravity:	1.00	
Tare & Wet (g)		606.70	886.70	Sample Specific Gravity:	2.85	Est.
Tare & Dry (g)		525.45	792.50	Confining Pressure (psi):	100.0	
Tare (g)		0.00	267.05	Burette Diameter (in):	0.250	
Sample Wt. (g)		606.70	619.65	Burette Zero (cm):	100.0	
Moisture (%)		15.5	17.9	Maximum Gradient:	7.5	
Wet Density (pcf)		135.9	138.8	Average Gradient:	7.1	
Dry Density (pcf)		117.7	117.7	Max. Effect. Stress (psi):	6.1	
Saturation (%)		86.3	100.0	Min. Effect. Stress (psi):	4.7	
				Ave. Effect. Stress (psi):	5.2	

	Date			Time		Run	Temp	Pressure (psi)		Cham	Cham.	Bot	Bot.	Top	Top	Flow	Kv ***	Ave.*
	Yr.	Mo.	Day	Hr.	Min.	Time (s)	C°**	Bot	Top	(cm)	Dif.(cm)	(cm)	Dif.(cm)	(cm)	Dif.(cm)	Dif.(%)	cm/s	0,1
1	2015	8	27	13	53.00		0.0	95	95	24.50		2.85		102.05				
2	2015	8	27	15	1.00	4080	21.0	95	95	24.90	0.40	3.75	0.90	101.35	0.70	12.5	1.0E-07	
3	2015	8	28	5	29.00	52080	21.0	95	95	28.60	3.70	9.30	5.55	97.35	4.00	16.2	5.0E-08	
4	2015	8	28	7	32.00	7380	21.0	95	95	29.30	0.70	9.95	0.65	96.65	0.70	-3.7	5.2E-08	
5	2015	8	28	10	45.00	11580	22.0	95	95	29.70	0.40	11.00	1.05	95.36	1.30	-10.4	5.8E-08	
6	2015	8	28	13	21.00	9360	22.0	95	95	30.20	0.50	11.80	0.80	94.75	0.61	13.9	4.4E-08	
7	2015	8	30	16	21.00	183600	22.0	95	95	34.50	4.30	24.45	12.65	83.35	11.40	5.2	4.6E-08	
8	2015	8	31	4	19.00	43080	21.0	95	95	34.00	-0.50	26.70	2.25	81.25	2.10	3.4	4.5E-08	
9	2015	8	31	6	42.00	8580	22.0	95	95	34.30	0.30	27.15	0.45	80.90	0.35	12.5	4.2E-08	
10	2015	8	31	9	9.00	8820	22.0	95	95	34.40	0.10	27.55	0.40	80.50	0.40	0.0	4.2E-08	
11	2015	8	31	11	24.00	8100	22.0	95	95	34.75	0.35	28.00	0.45	80.15	0.35	12.5	4.6E-08	
12	2015	8	31	14	51.00	12420	21.0	95	95	34.85	0.10	28.45	0.45	79.65	0.50	-5.3	3.7E-08	
13	2015	8	31	17	39.00	10080	21.0	95	95	35.40	0.55	29.05	0.60	79.30	0.35	26.3	4.7E-08	
14	2015	8	31	20	38.00	10740	21.0	95	95	35.60	0.20	29.50	0.45	78.90	0.40	5.9	4.0E-08	1
15	2015	9	1	5	21.00	31380	21.0	95	95	35.60	0.00	30.85	1.35	77.55	1.35	0.0	4.5E-08	1
16	2015	9	1	7	15.00	6840	21.0	95	95	35.85	0.25	31.15	0.30	77.30	0.25	9.1	4.3E-08	1
17	2015	9	1	9	42.00	8820	21.0	95	95	35.85	0.00	31.50	0.35	76.95	0.35	0.0	4.3E-08	1
18																		
19																		
20																		
21																		
22																		
23																		
24																		
25																		
26																		

**A zero in this column starts a series of measurements. *Average Kv for those rows with a 1 in the Ave. column. 4.3E-08 cm/s

(Termination determined by stable Kv and low flow differential.) ***Kv adjusted for temperature.

Fugro Laboratory Test Results



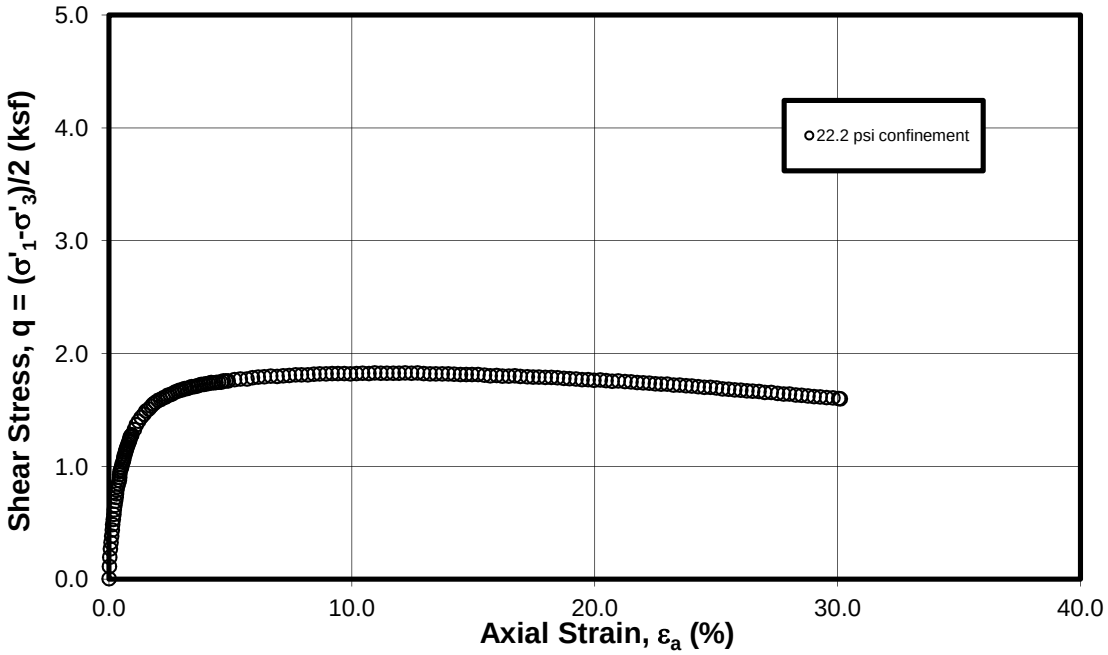
GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

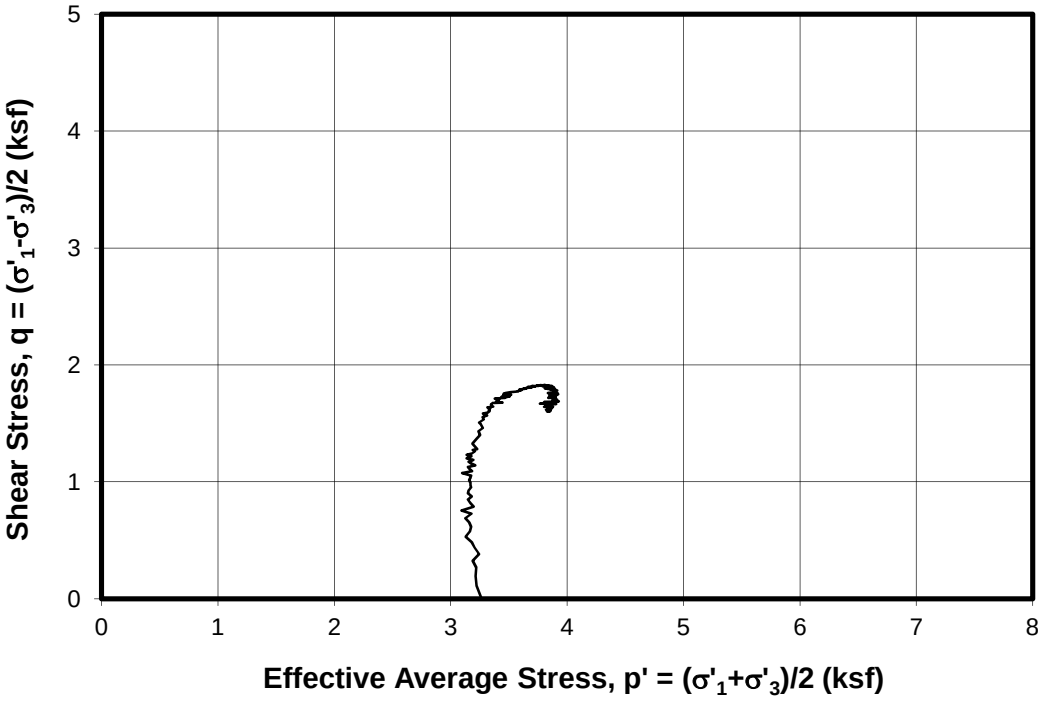
SYMBOL	BORING	DEPTH, FT	C_c	C_u	D_{50}	D_{90}	CLASSIFICATION
●	KIN-B003	36.9			0.02	0.23	Clay, brown and gray, with carbonate nodules and sand pockets
⧓	KIN-B007	34.9			0.01	0.15	Clay, brown, with carbonate nodules, sand, and ferrous stains
✳	KIN-B010	33.45			0.01	0.25	Clay, brown, with carbonate nodules and sand pockets
⊗	KIN-B011	26.5			0.01	0.03	Silty Clay, brown, with ferrous stains

GRAIN SIZE CURVE

Exploration Number	Sample Depth (ft)	LL	PL	PI	Specific Gravity
KIN-B011	26.50	38	19	19	2.68
KIN-B010	33.45	54	14	40	2.697
KIN-B007	34.90	50	15	35	2.699
KIN-B003	36.90	54	15	39	2.705

INDEX TESTS



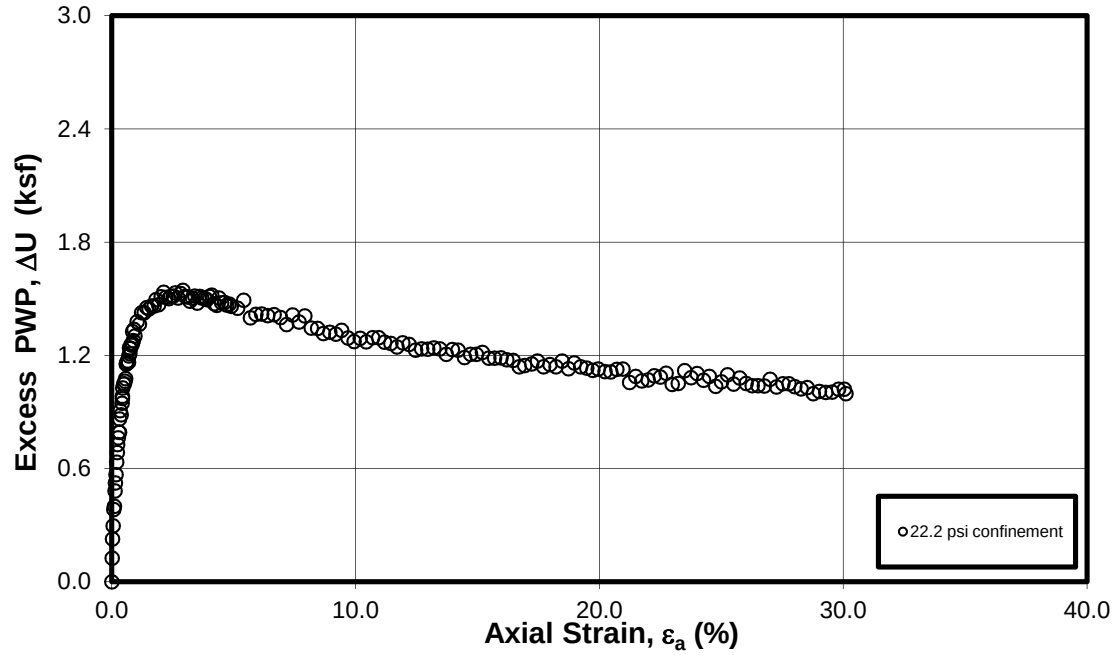


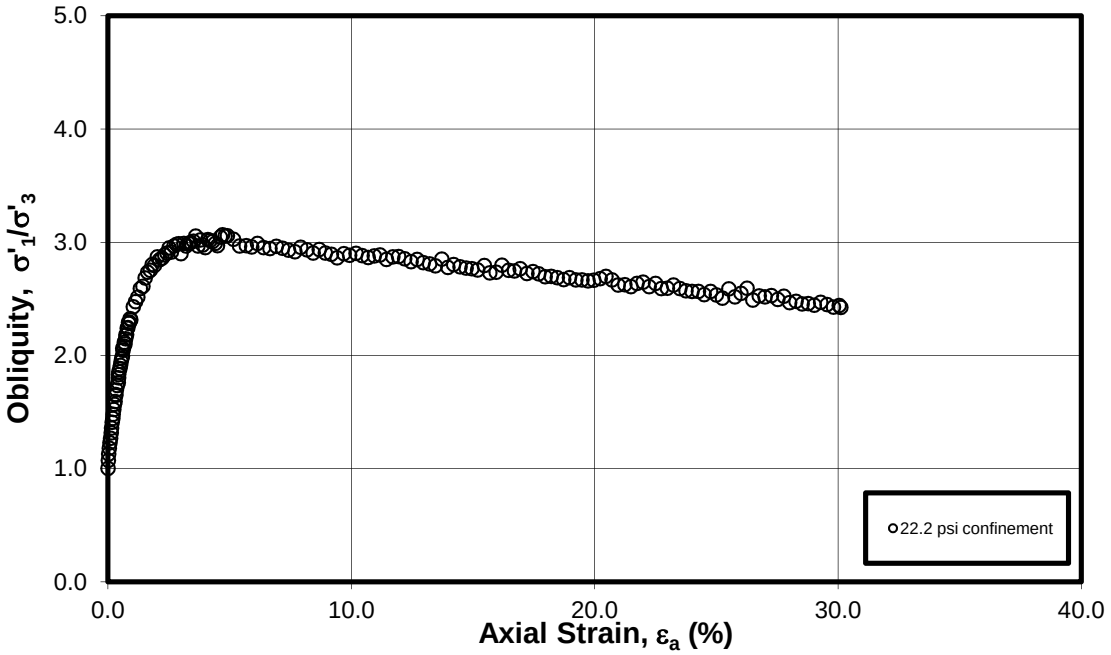
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-11c - Depth: 36.90 ft

Boring KIN-B003



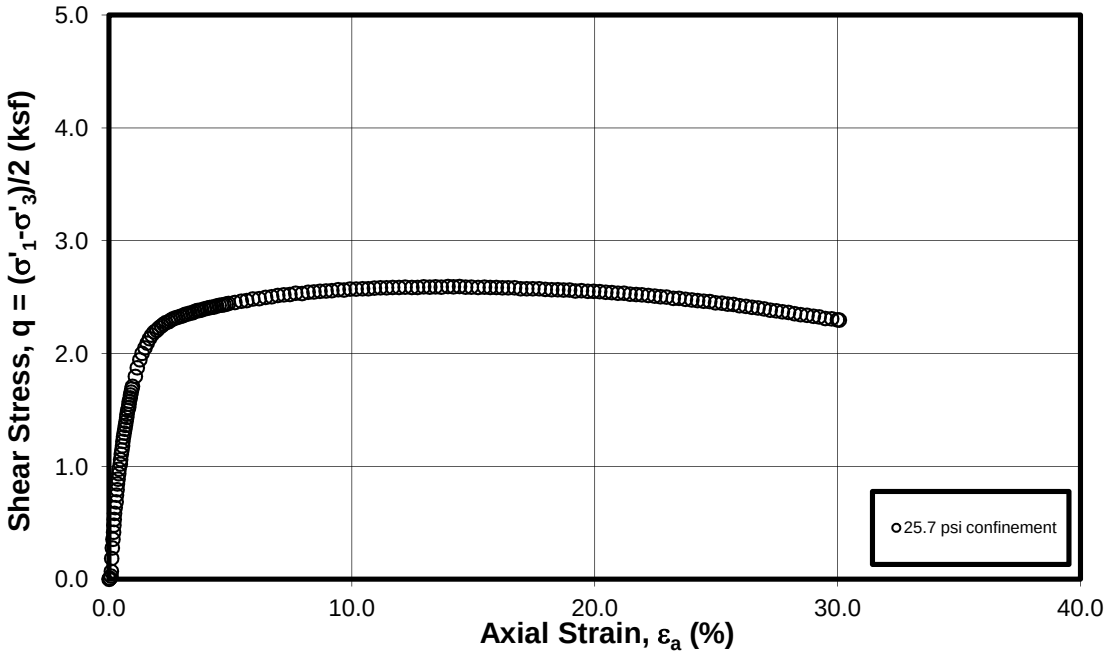


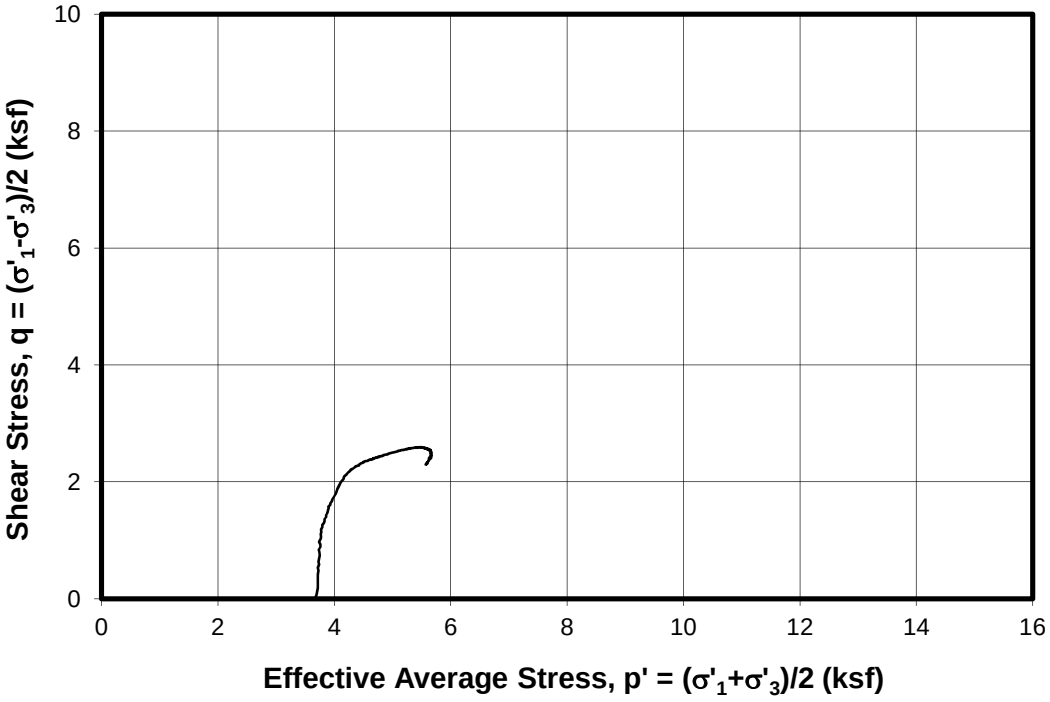
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-11c - Depth: 36.90 ft

Boring KIN-B003



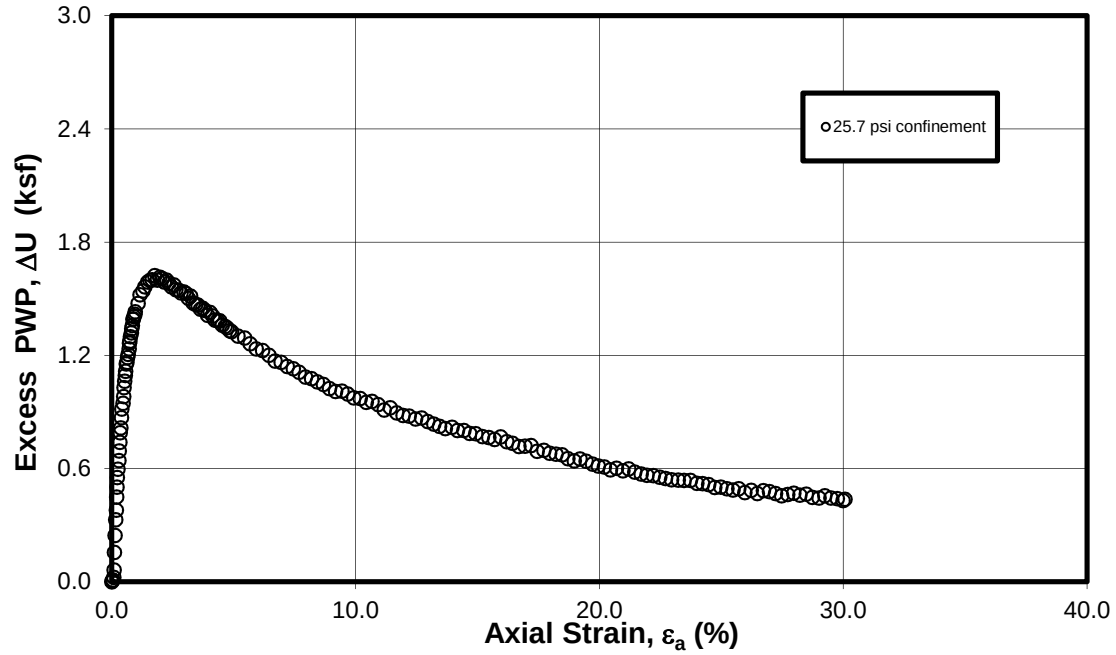


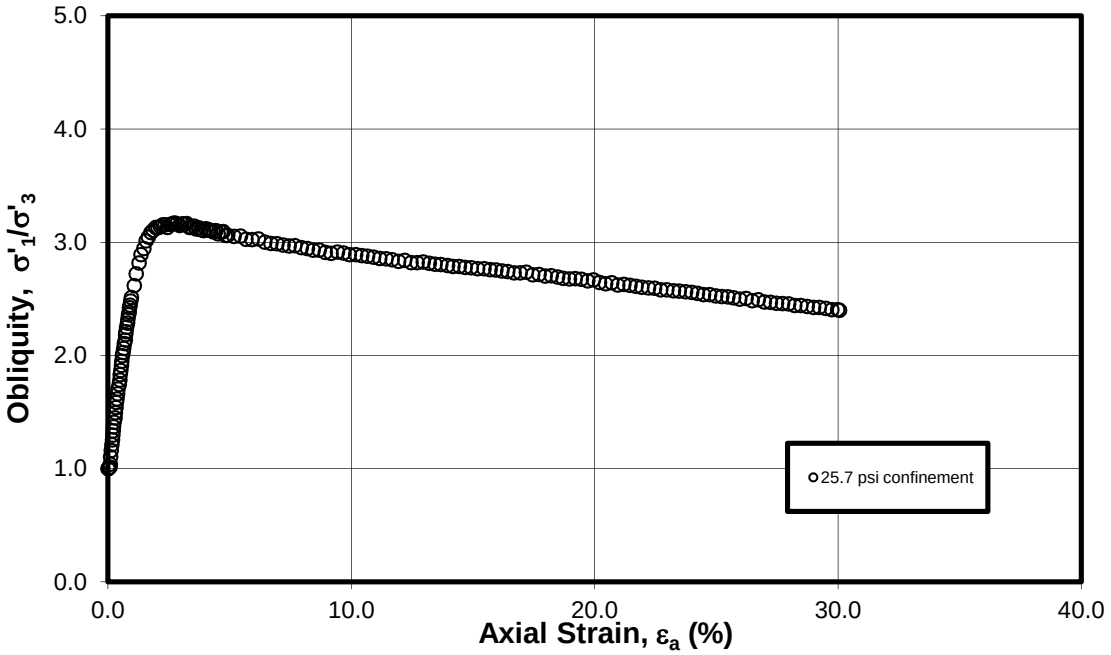
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-11c - Depth: 34.90 ft

Boring KIN-B007



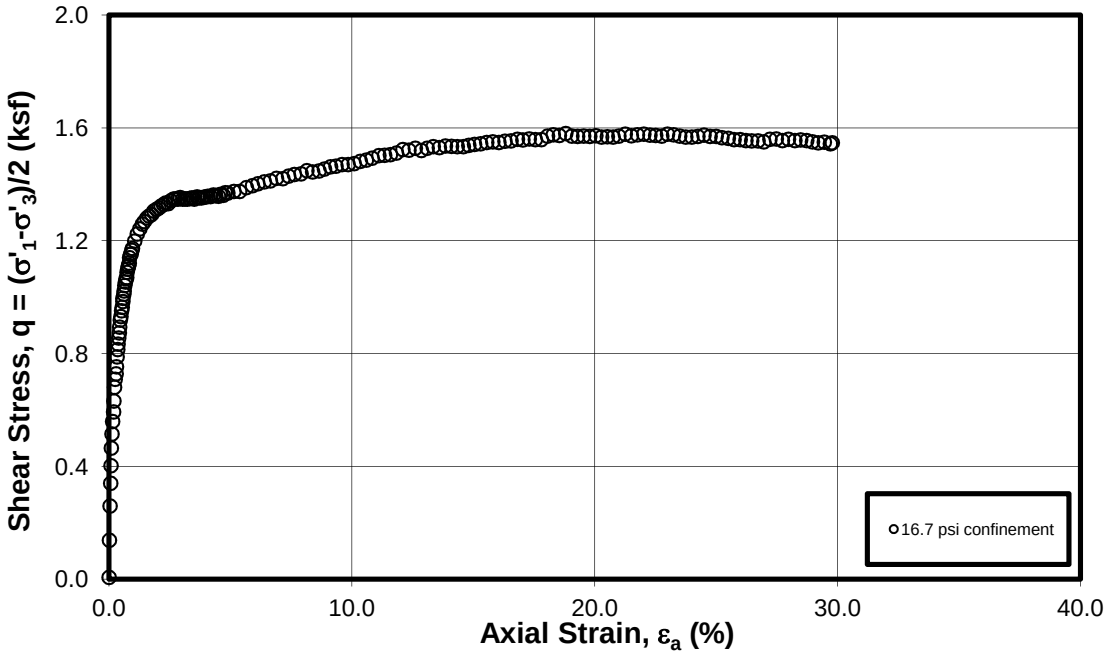


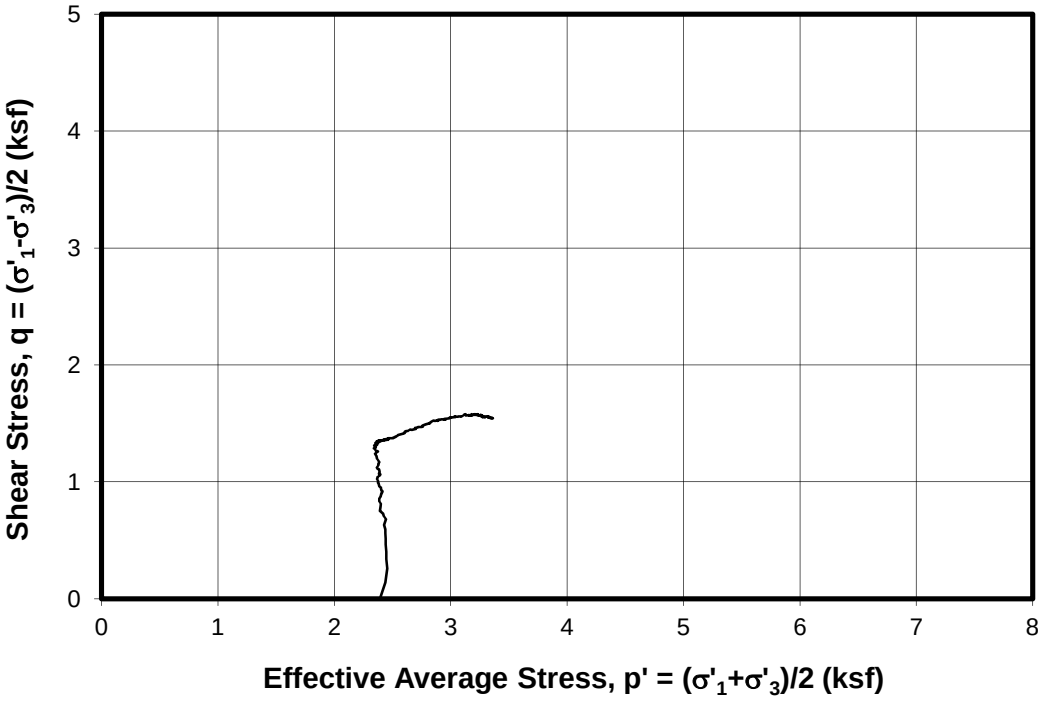
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-11c - Depth: 34.90 ft

Boring KIN-B007



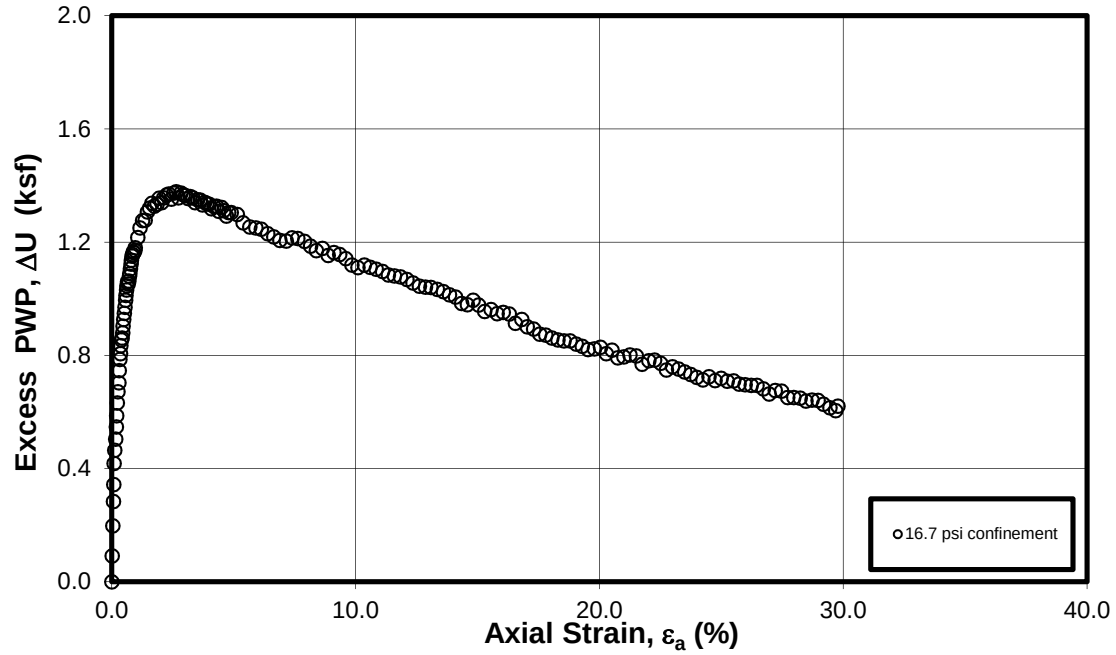


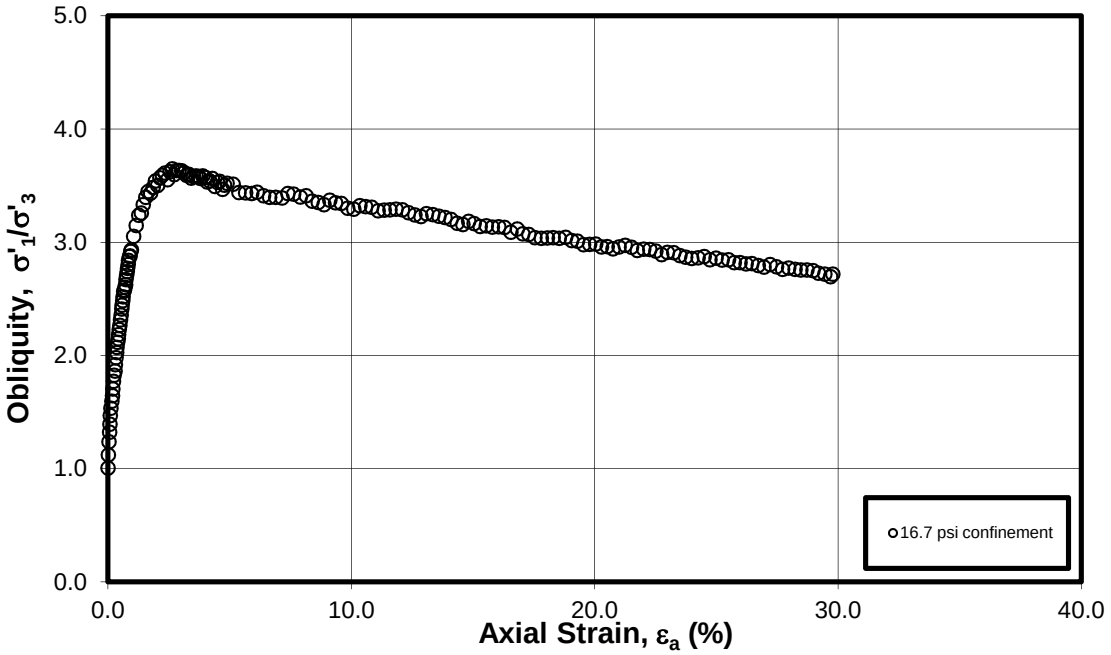
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-10d - Depth: 33.45 ft

Boring KIN-B010



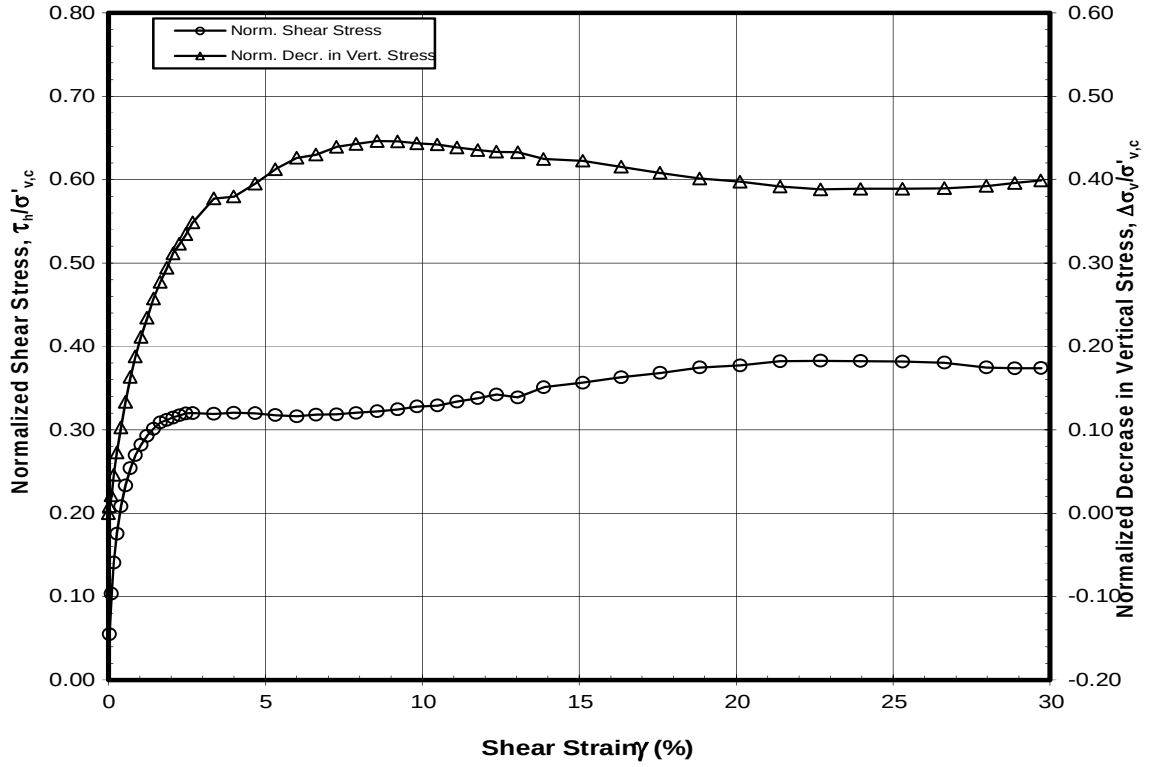


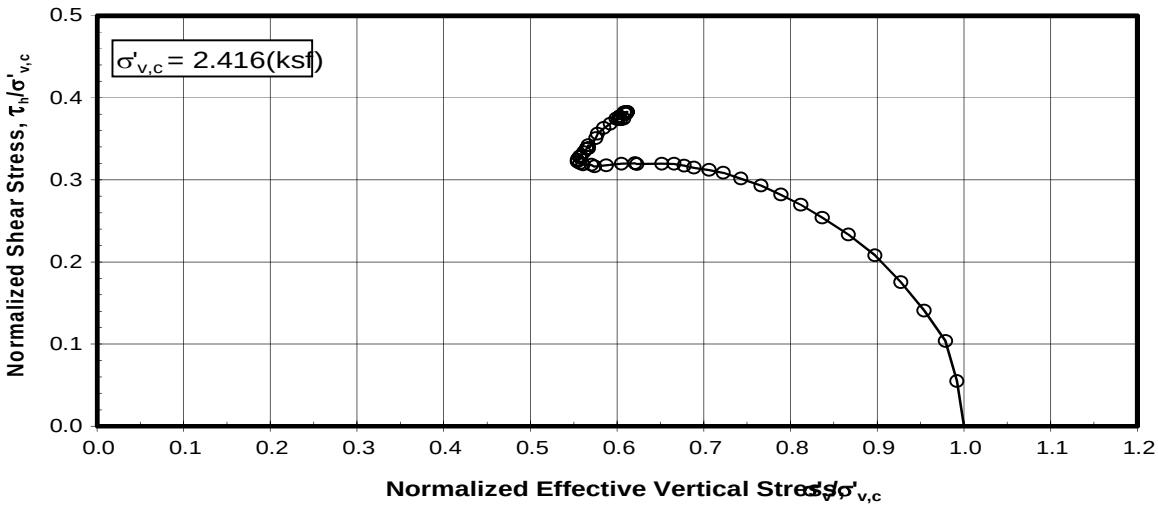
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-10d - Depth: 33.45 ft

Boring KIN-B010



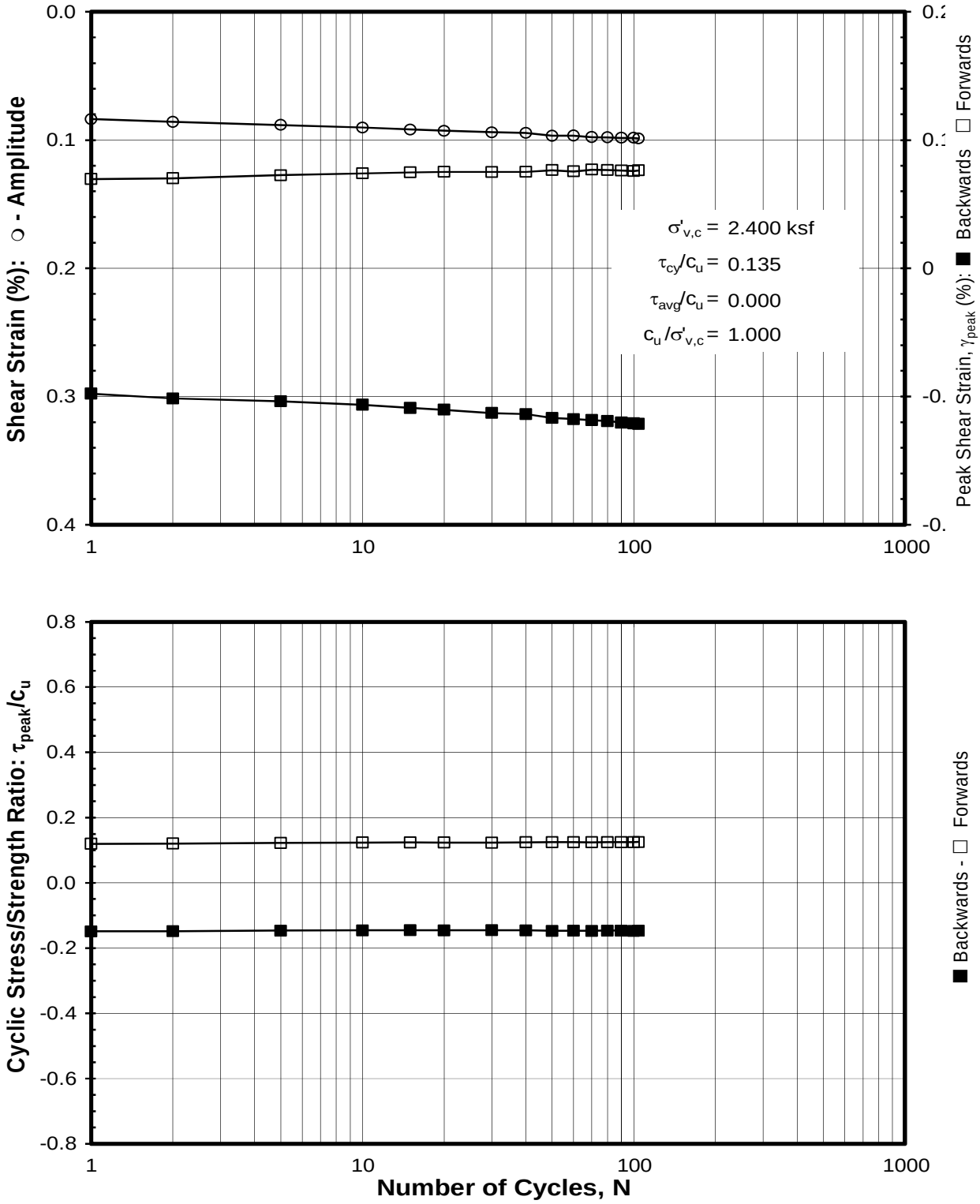


STATIC DSS TEST

K_o Consolidation - OCR = 1

Sample: 10e - Depth: 33.05 ft

Boring KIN-B010



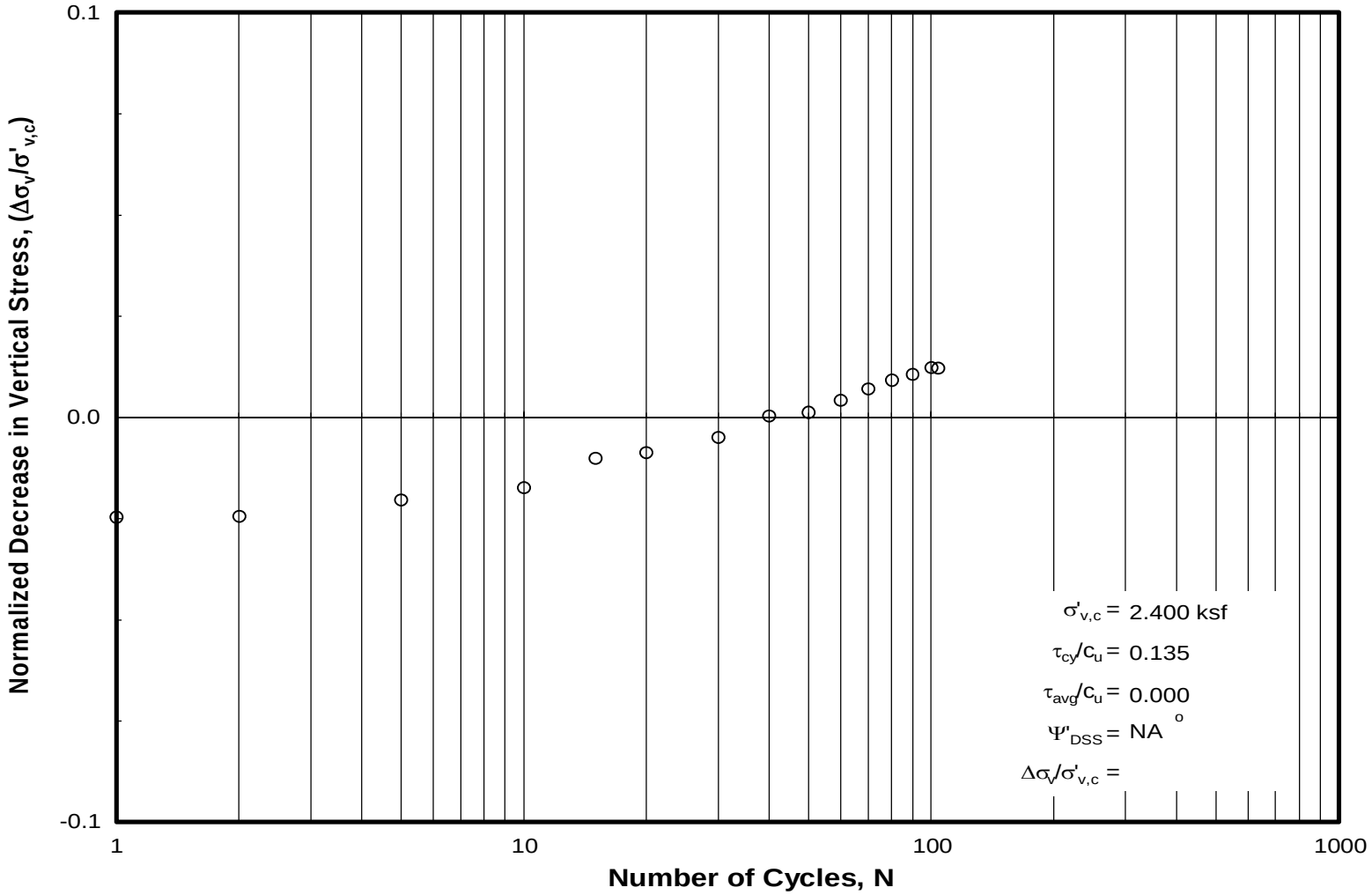
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



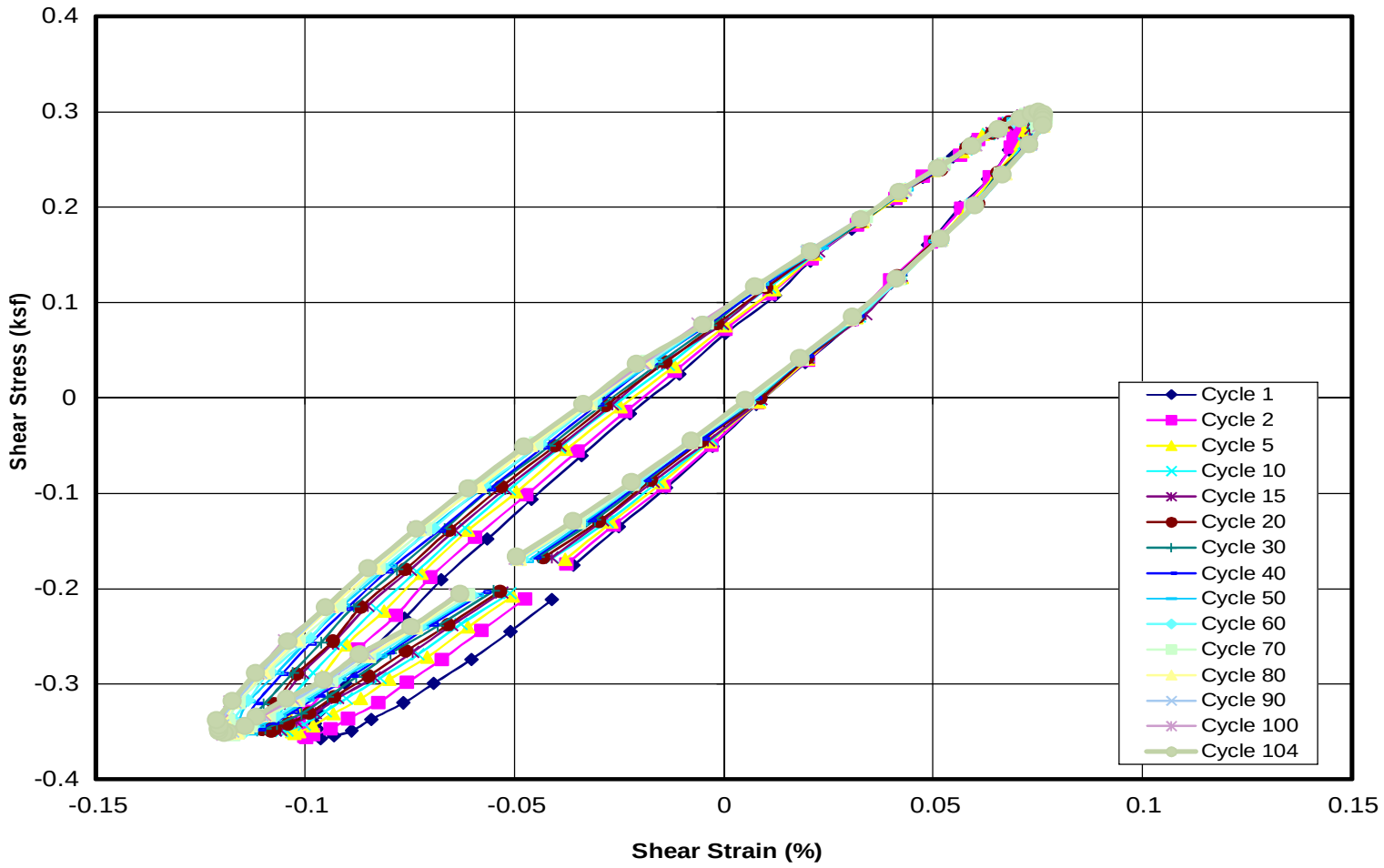
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



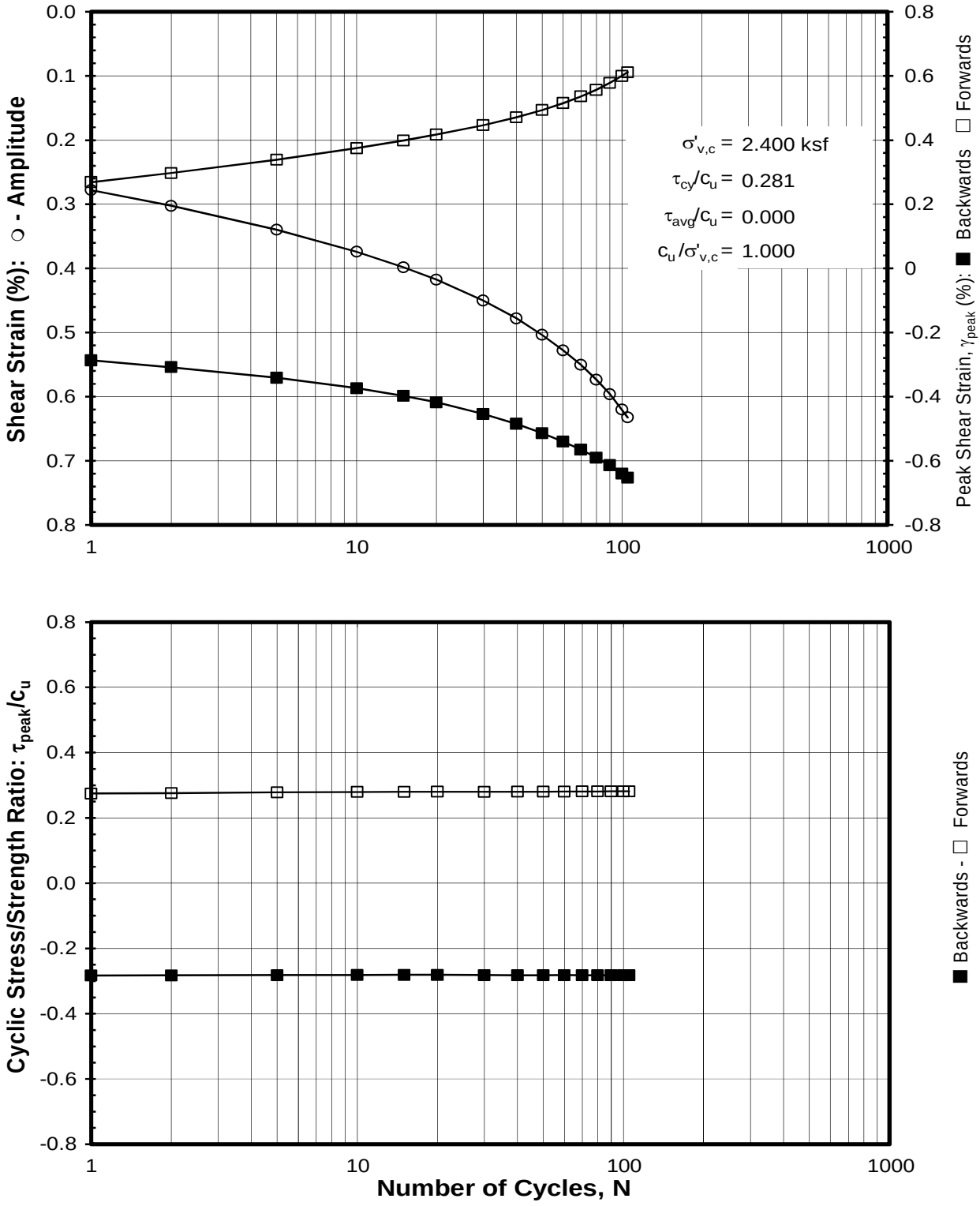
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



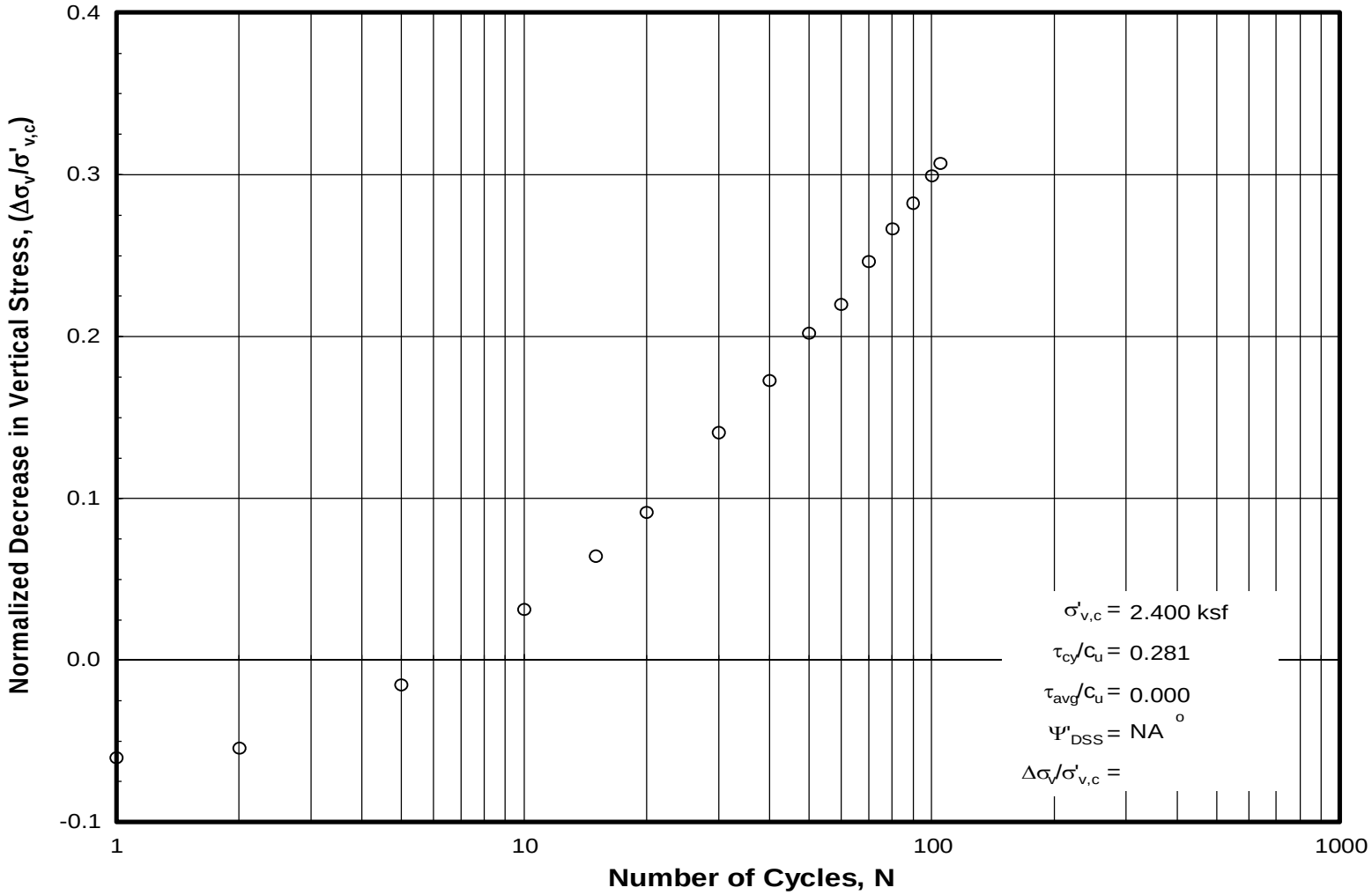
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



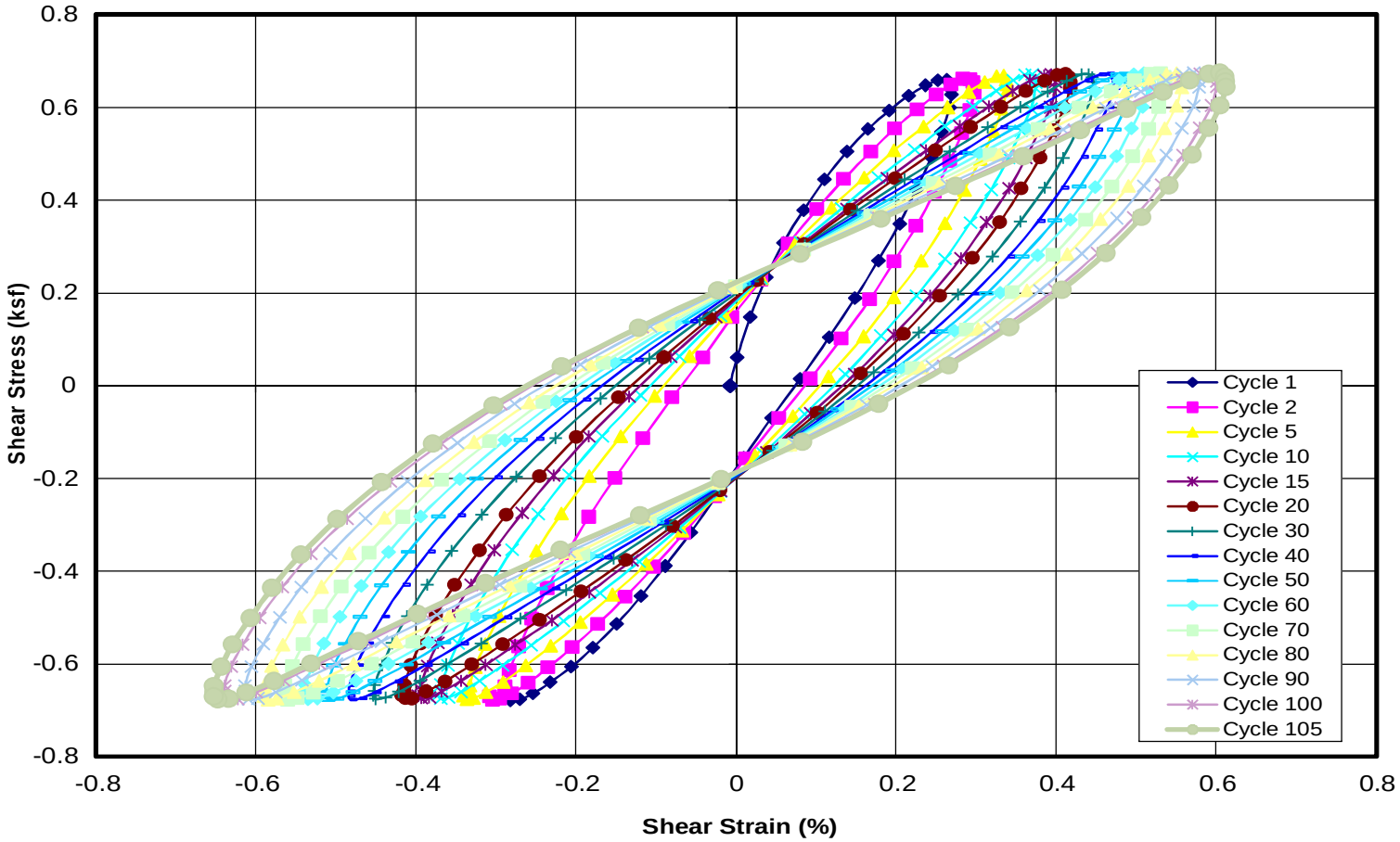
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



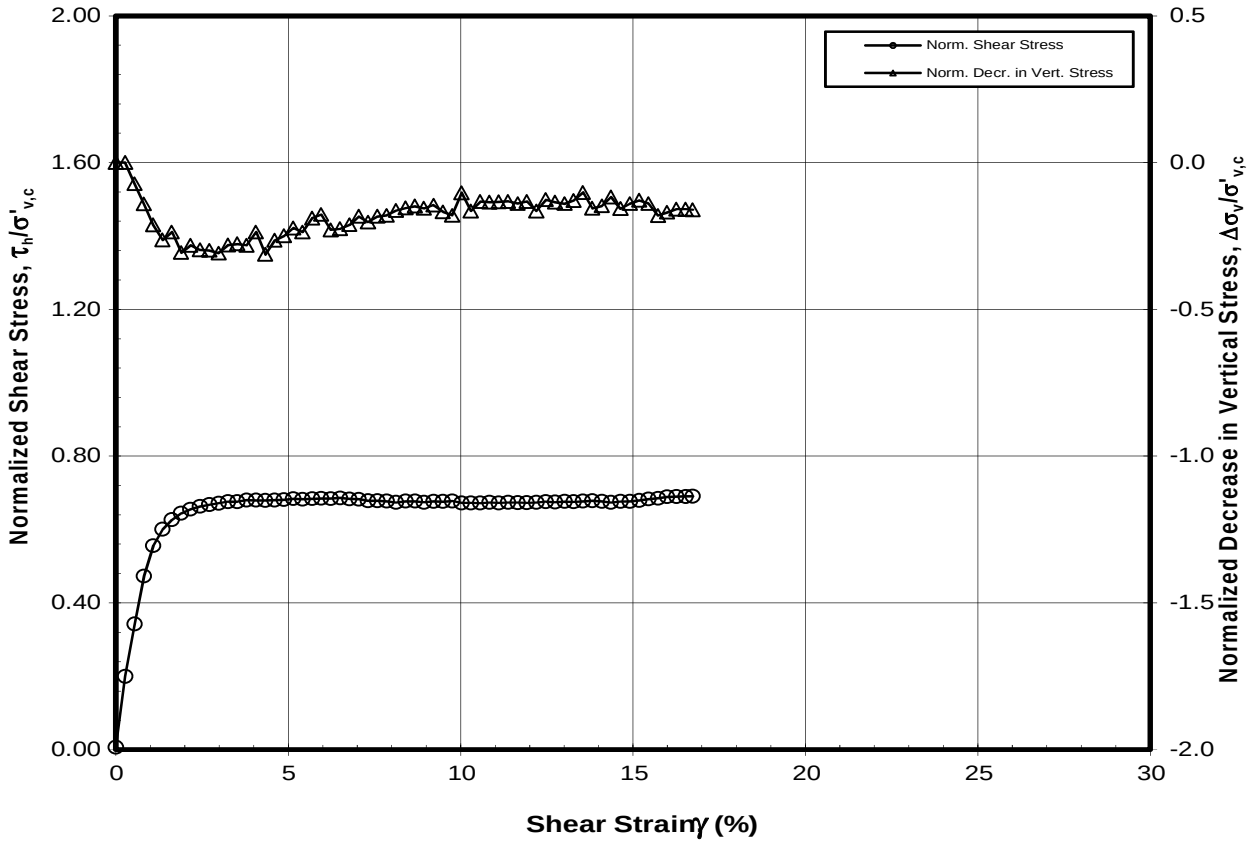
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

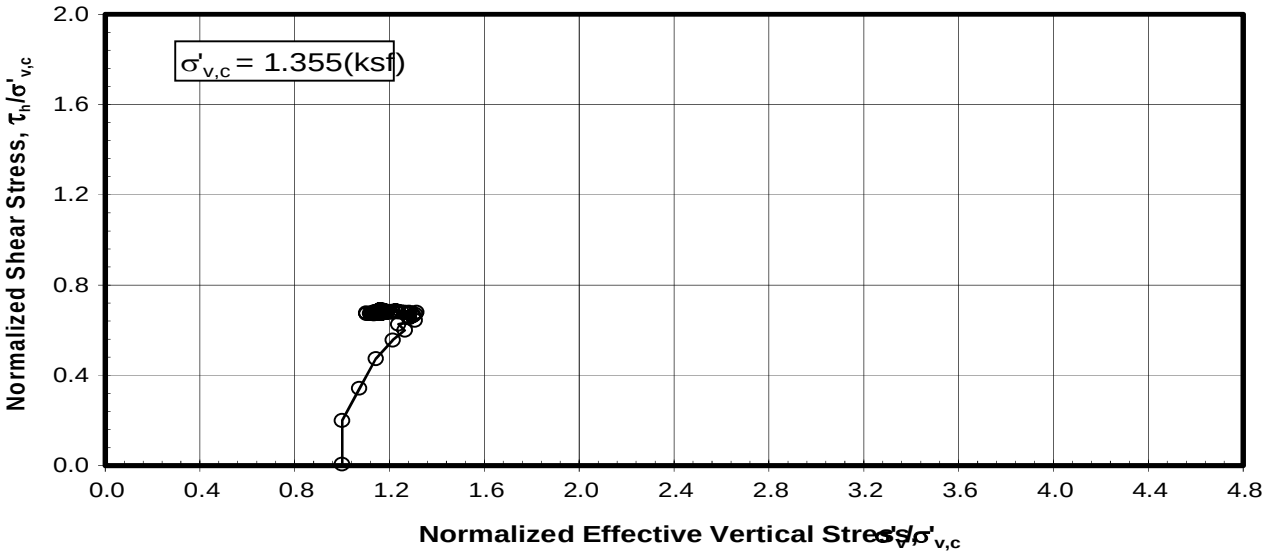
OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



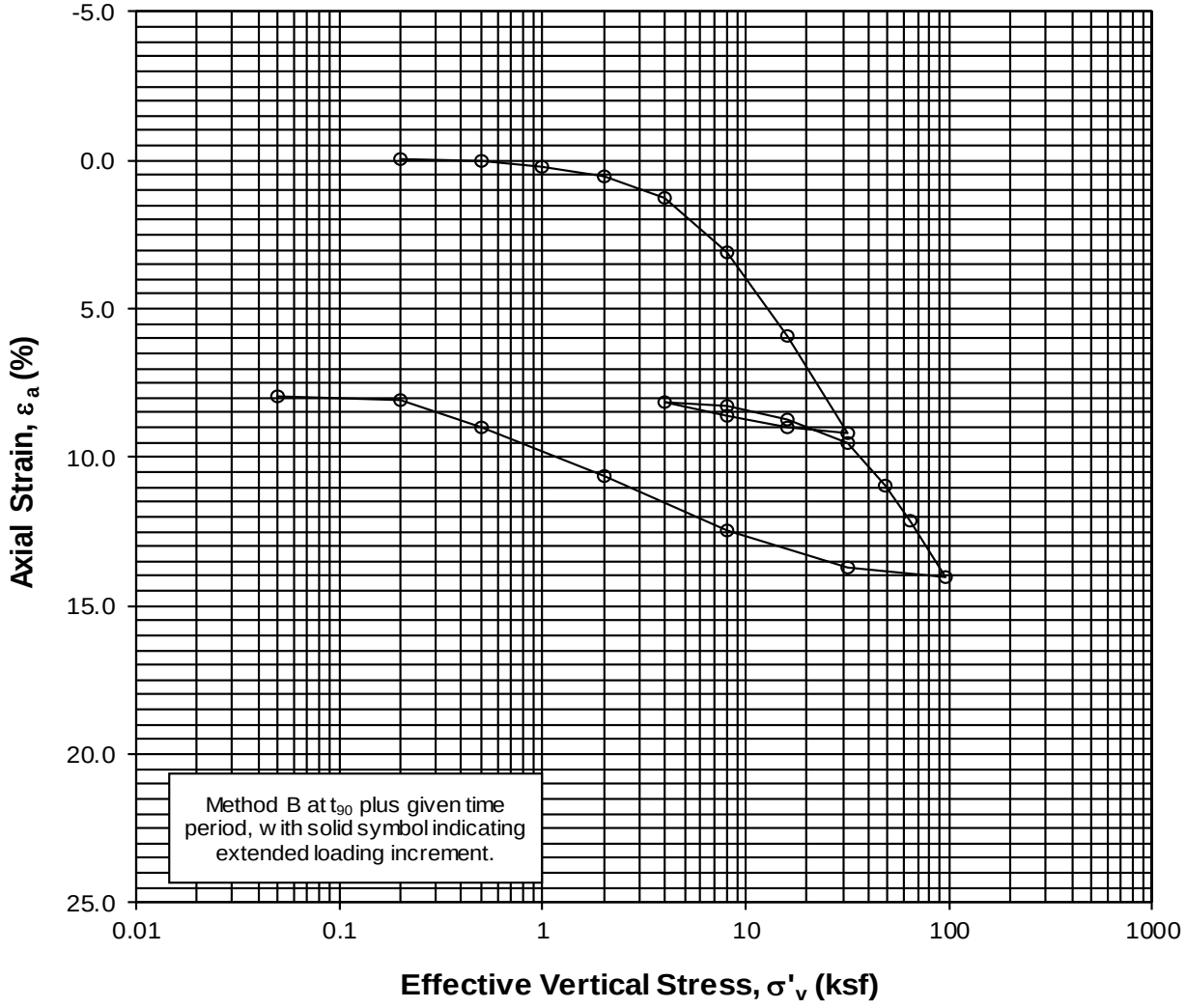


POST CYCLIC STATIC DSS TEST

K_0 Consolidation - OCR = 1 - Strain Rate = 5 %/hr

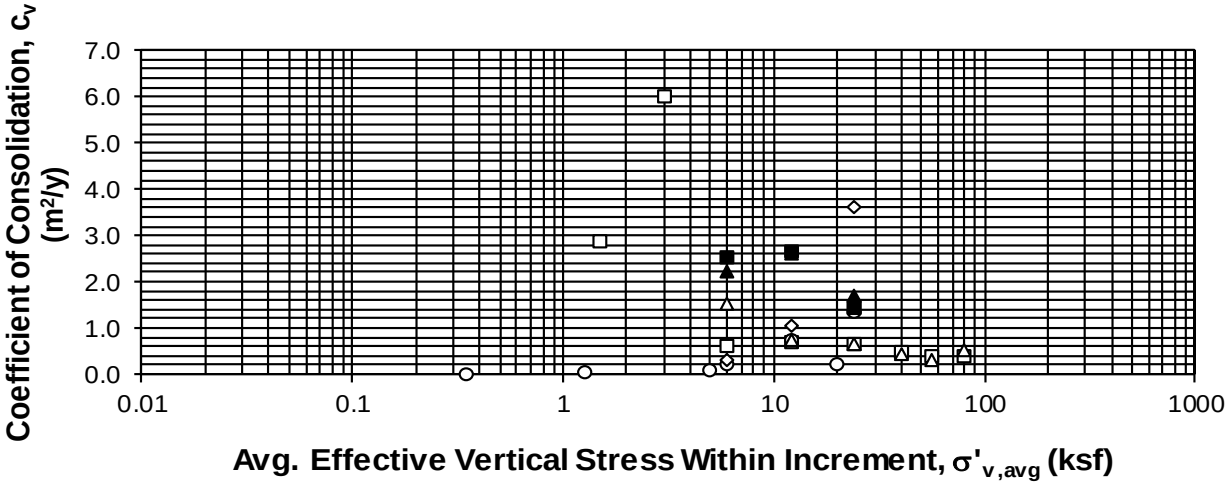
Sample: S-10c - Depth: 33.75 ft.

Boring KIN-B010



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading

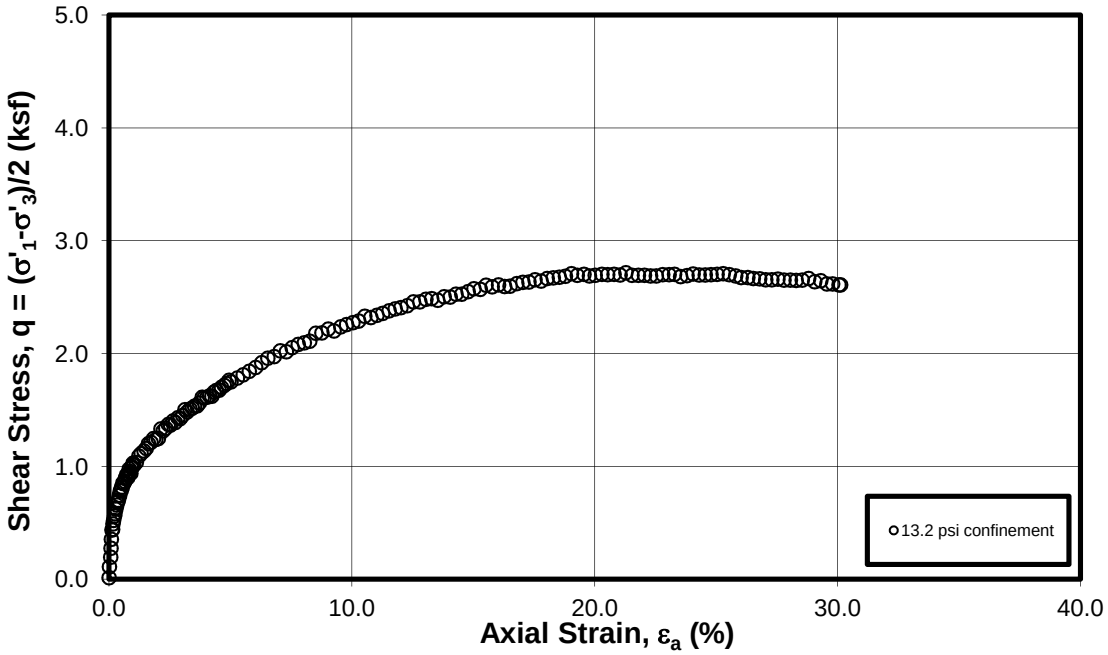
with solid symbols indicating reloading increments

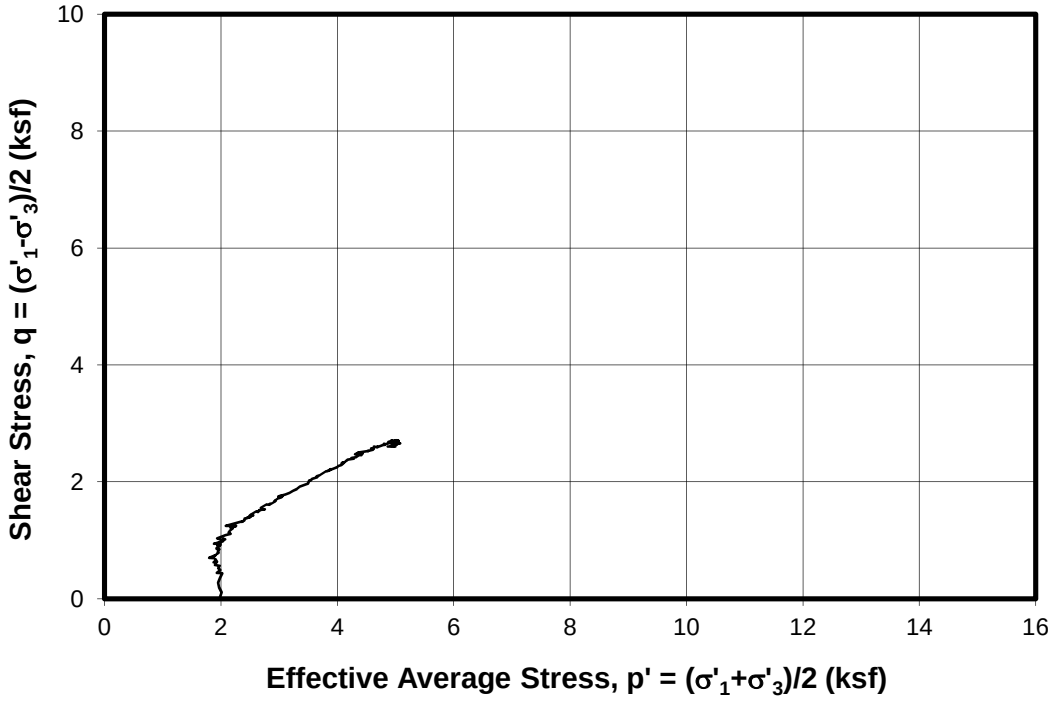


1-D CONSOLIDATION TEST: INC

Sample No. 10a Depth 33.6 ft

Boring KIN-B010



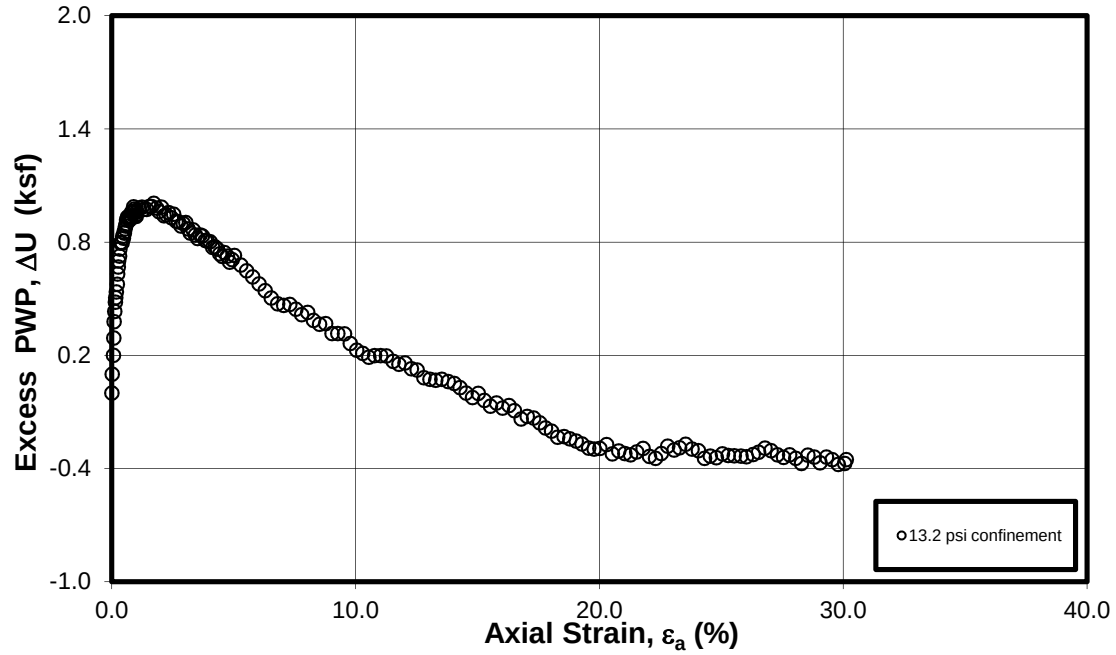


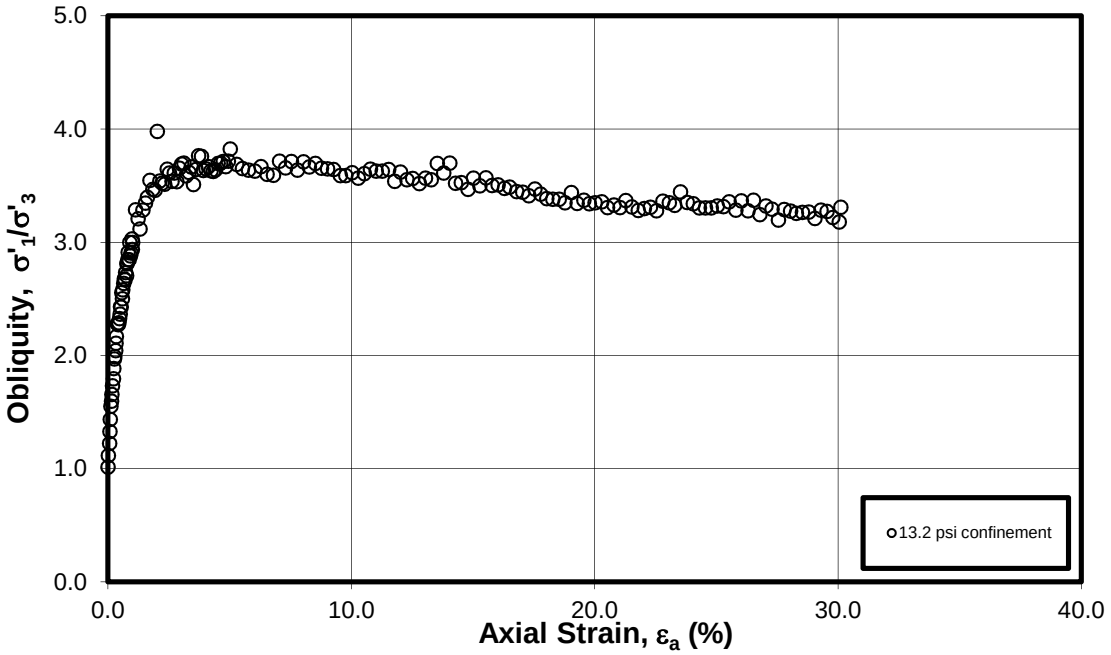
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-08d - Depth: 26.50 ft

Boring KIN-B011



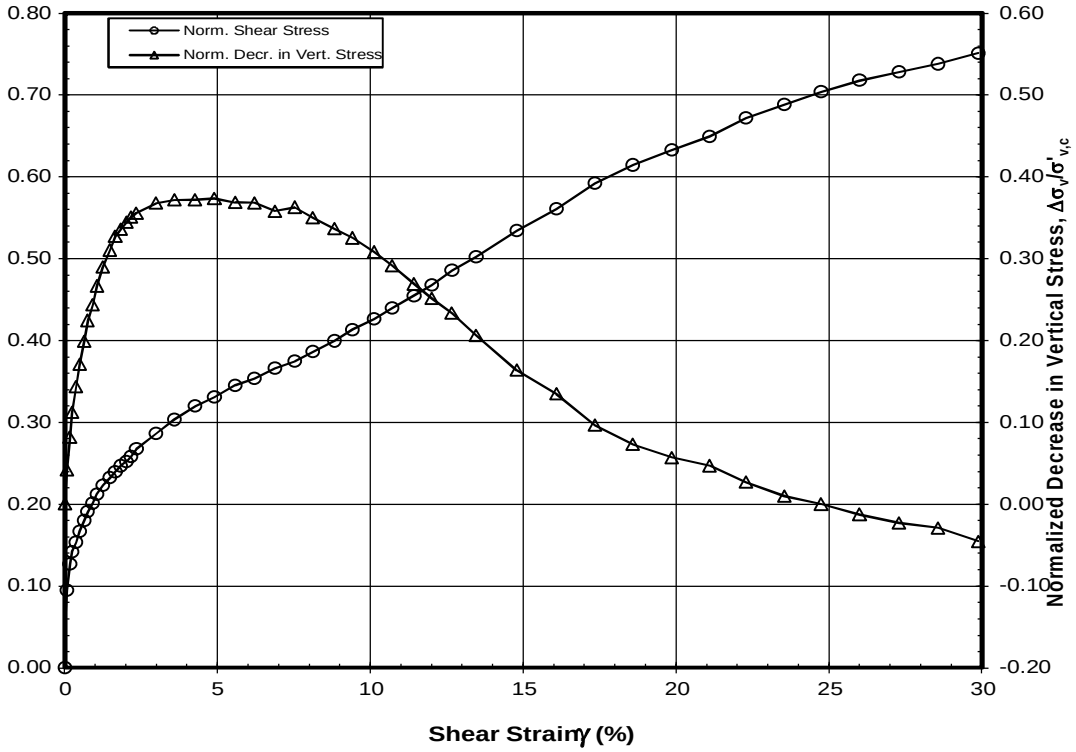


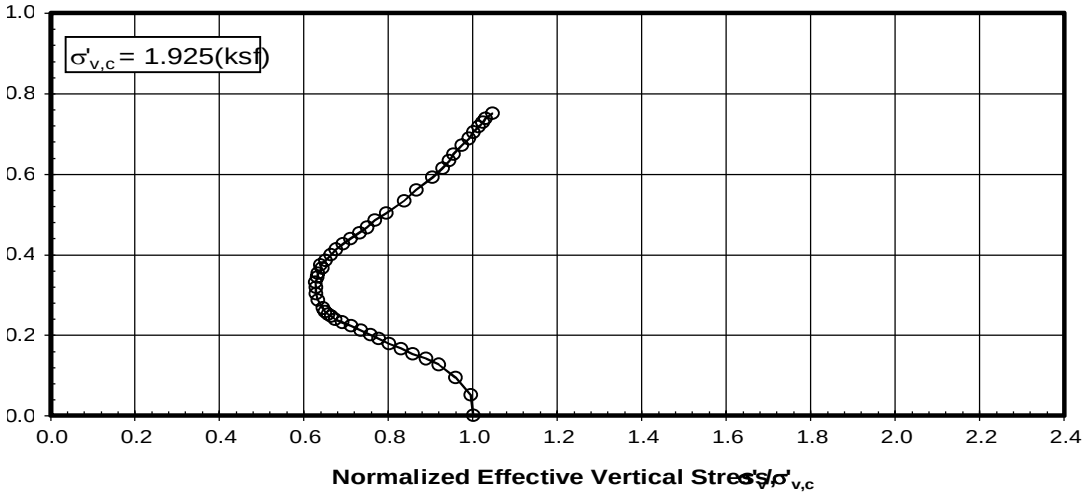
UNDRAINED TRIAXIAL COMPRESSION TEST

Isotropically Consolidated

Sample: S-08d - Depth: 26.50 ft

Boring KIN-B011



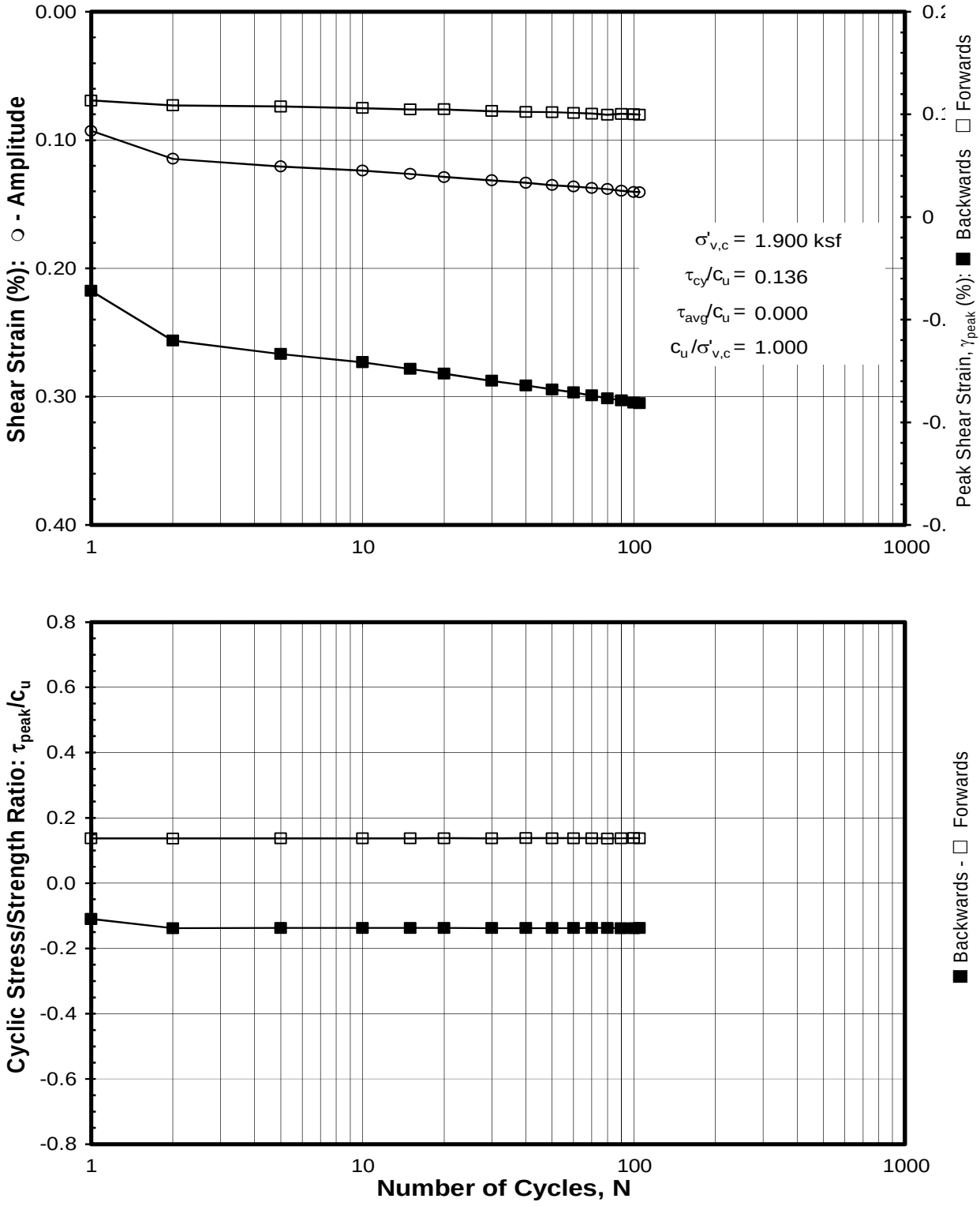


STATIC DSS TEST

K_o Consolidation - OCR = 1

Sample: 8e - Depth: 26.10 ft

Boring KIN-B011



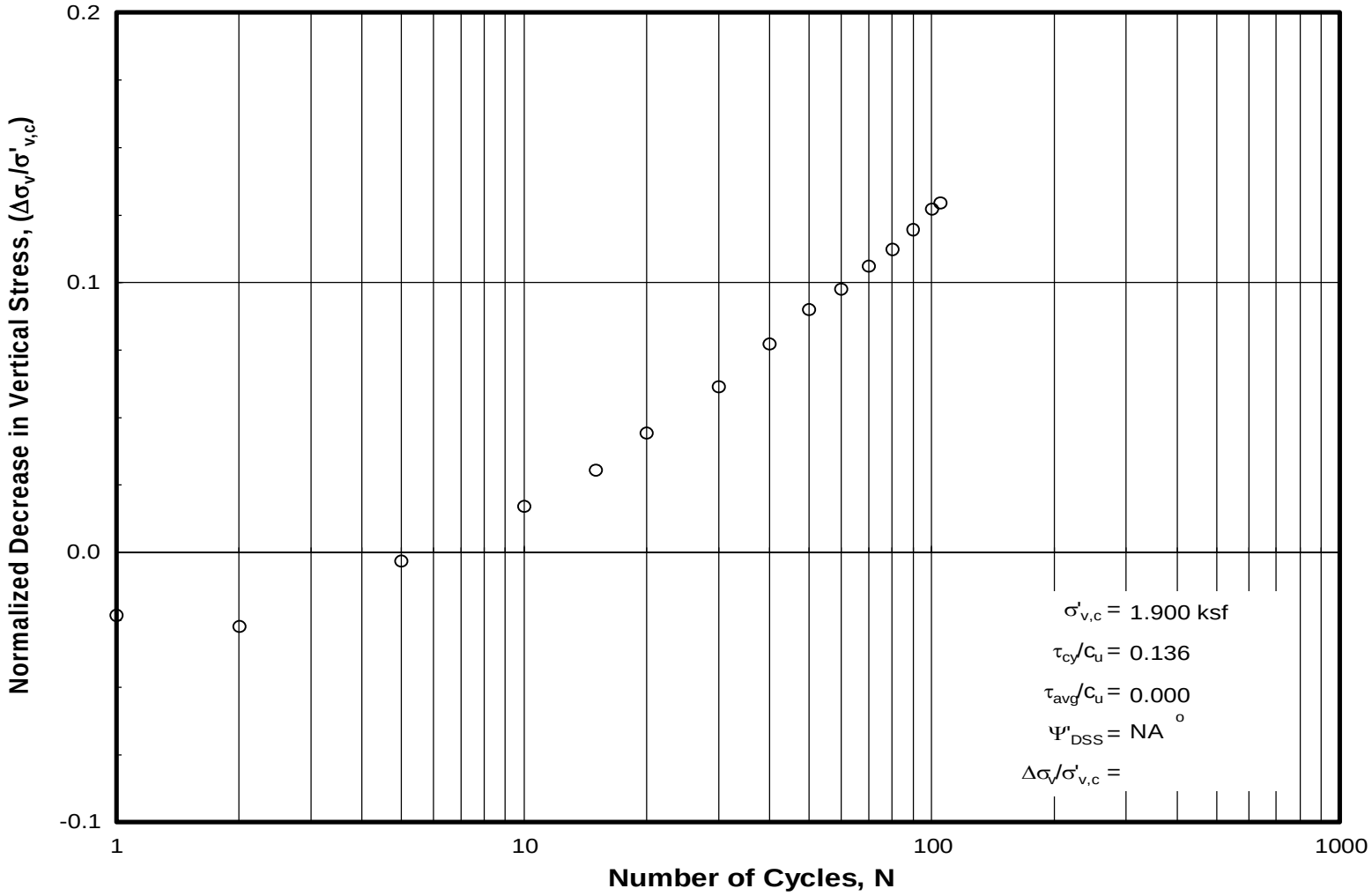
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



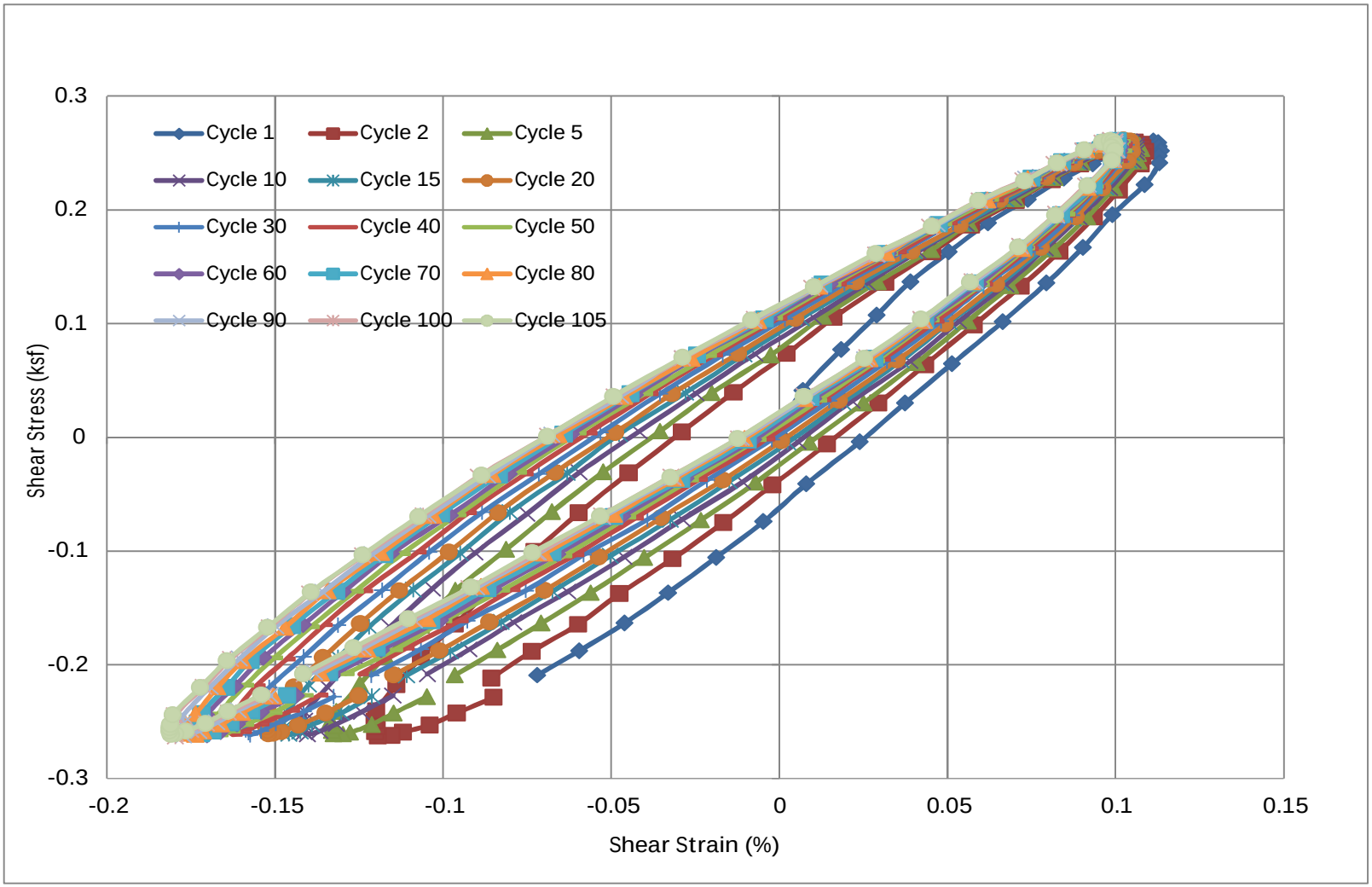
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



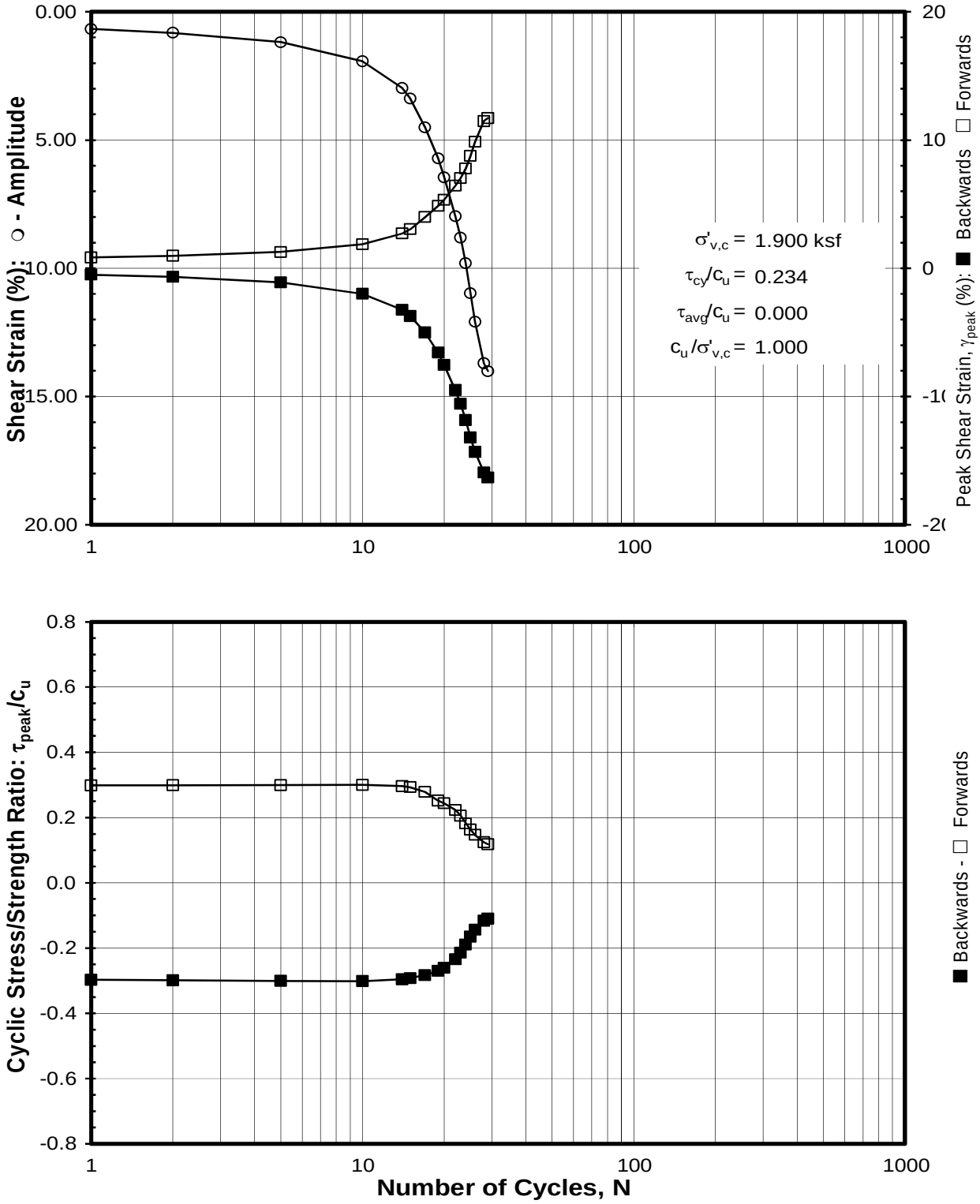
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



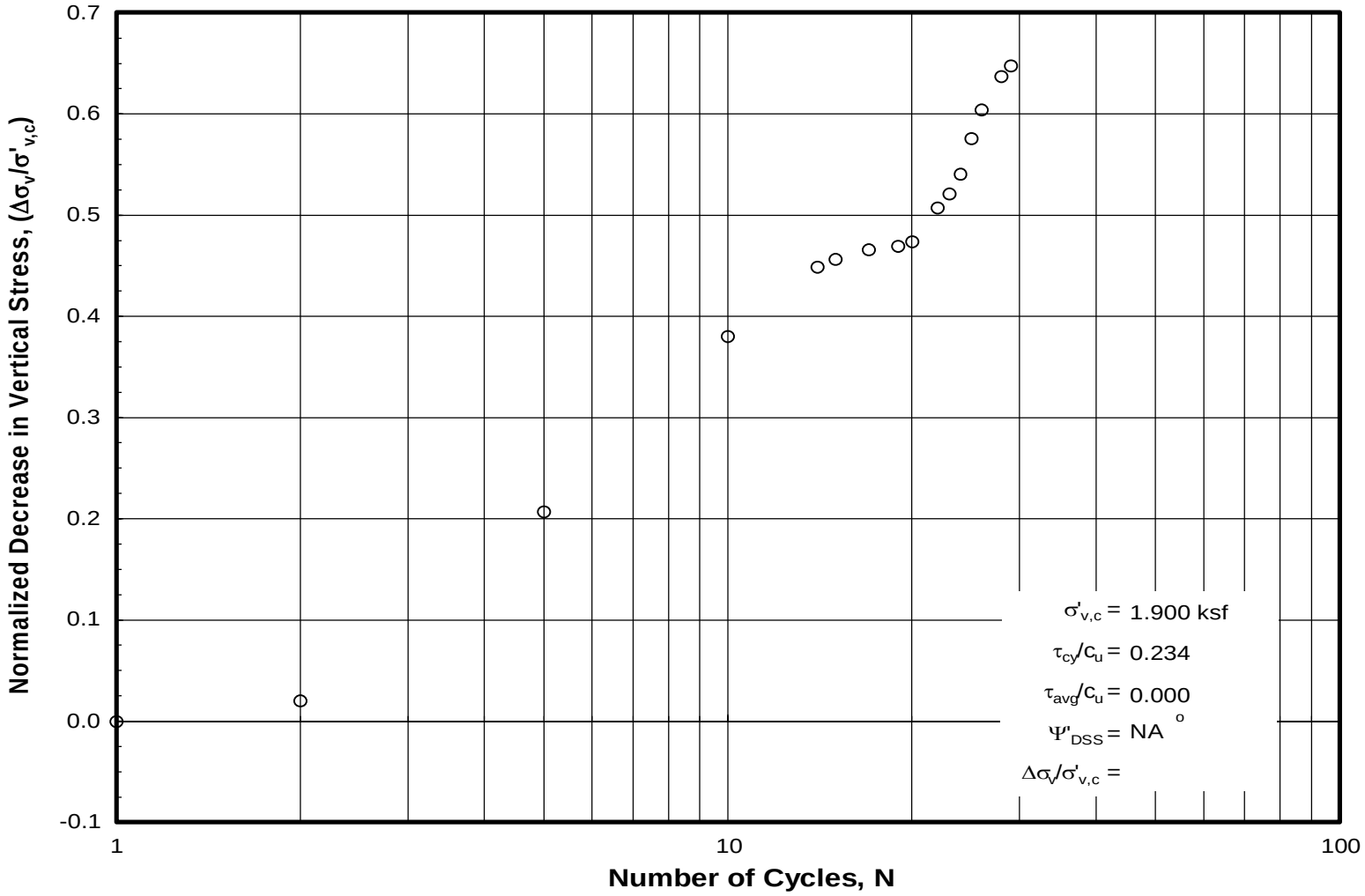
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



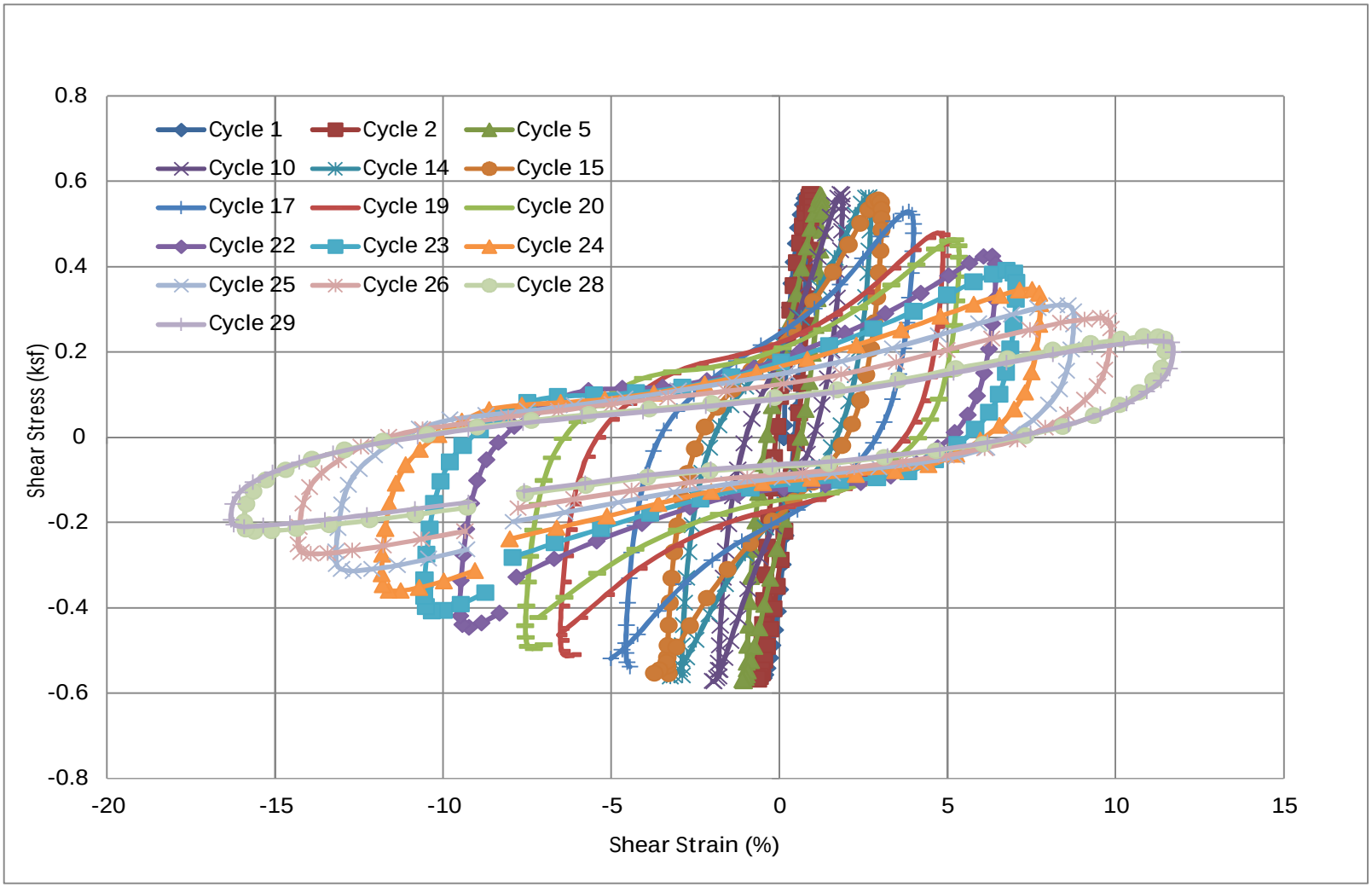
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



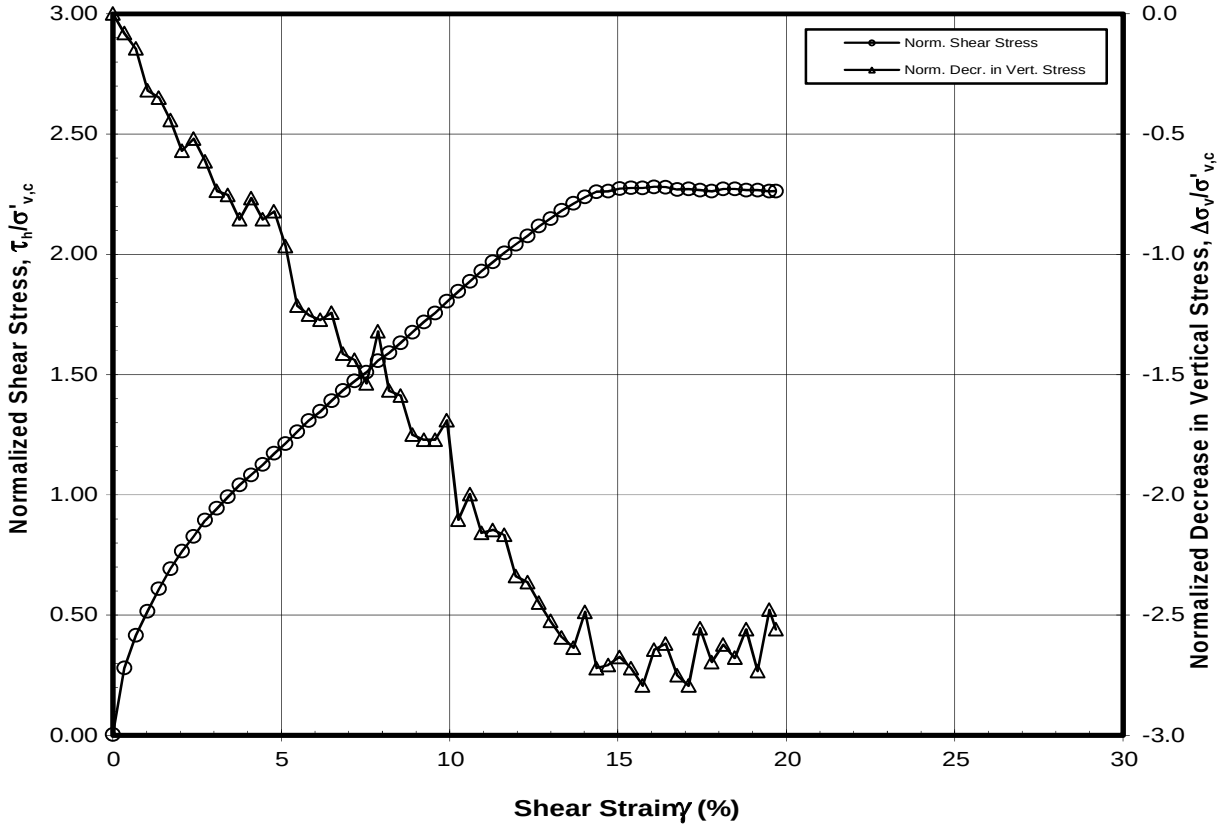
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

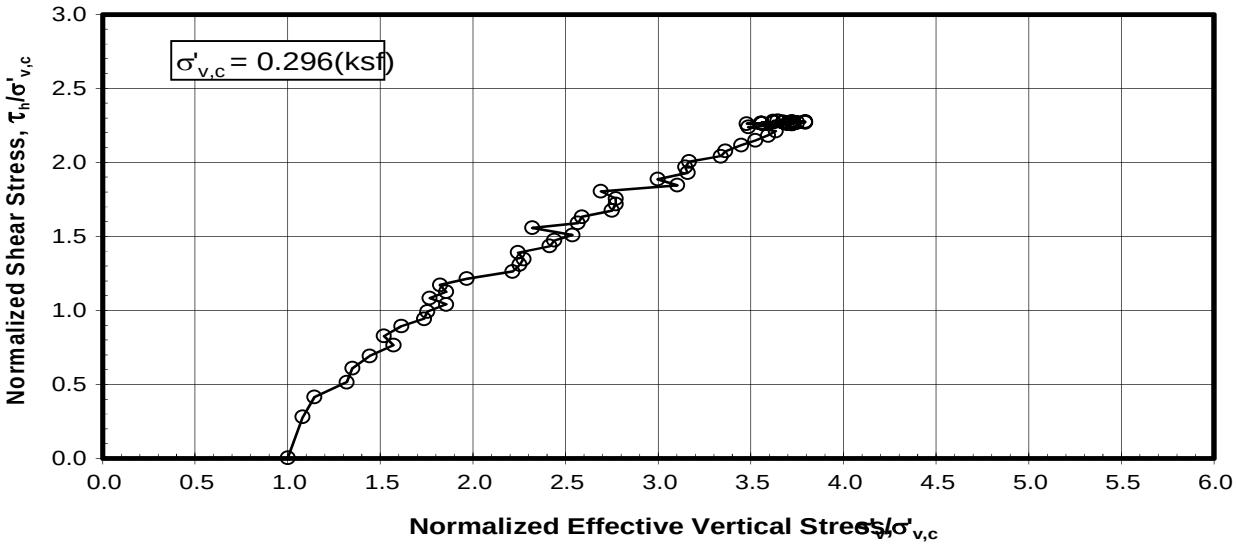
OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



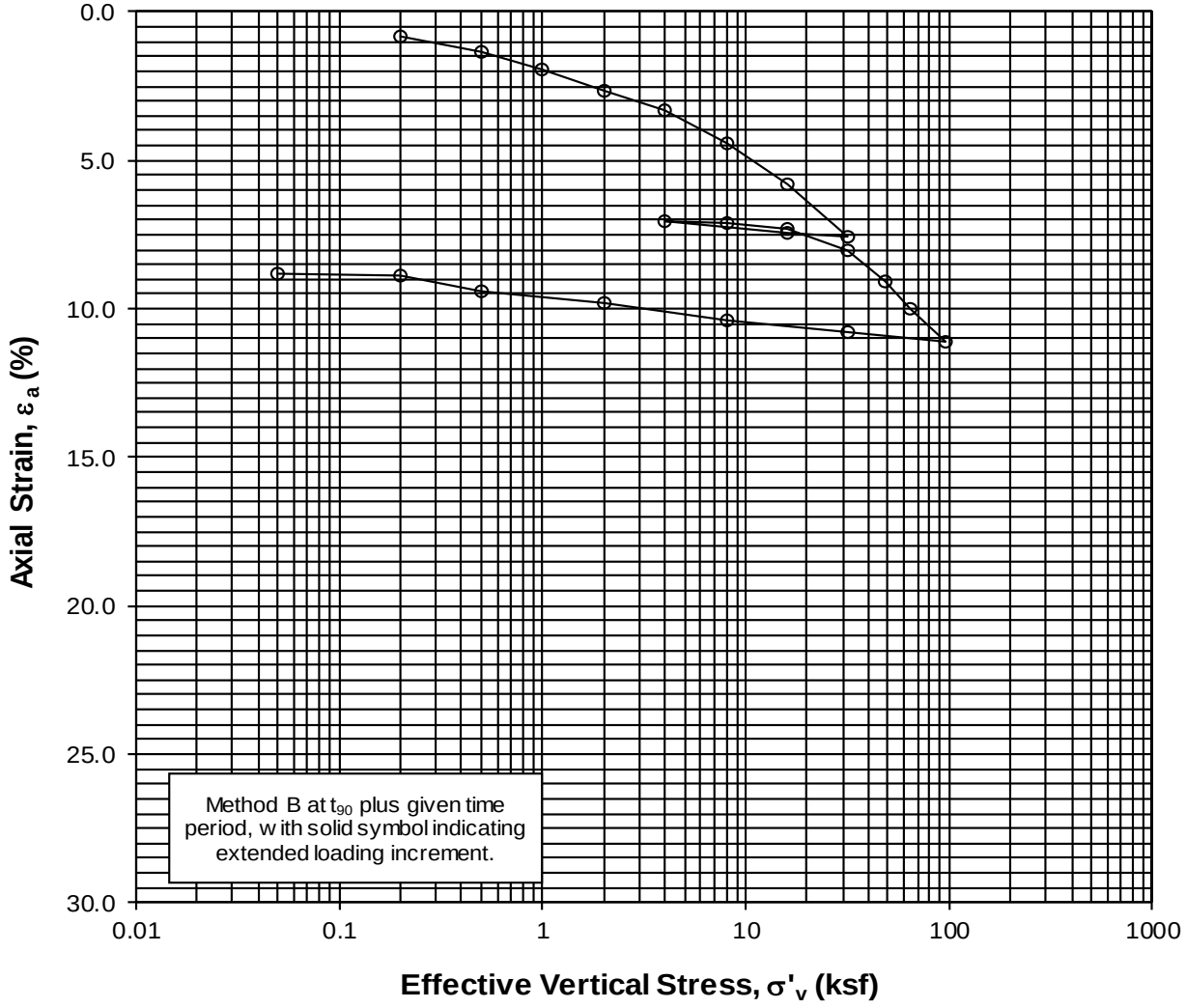


POST CYCLIC STATIC DSS TEST

K_o Consolidation - OCR = 1 - Strain Rate = 5 %/hr

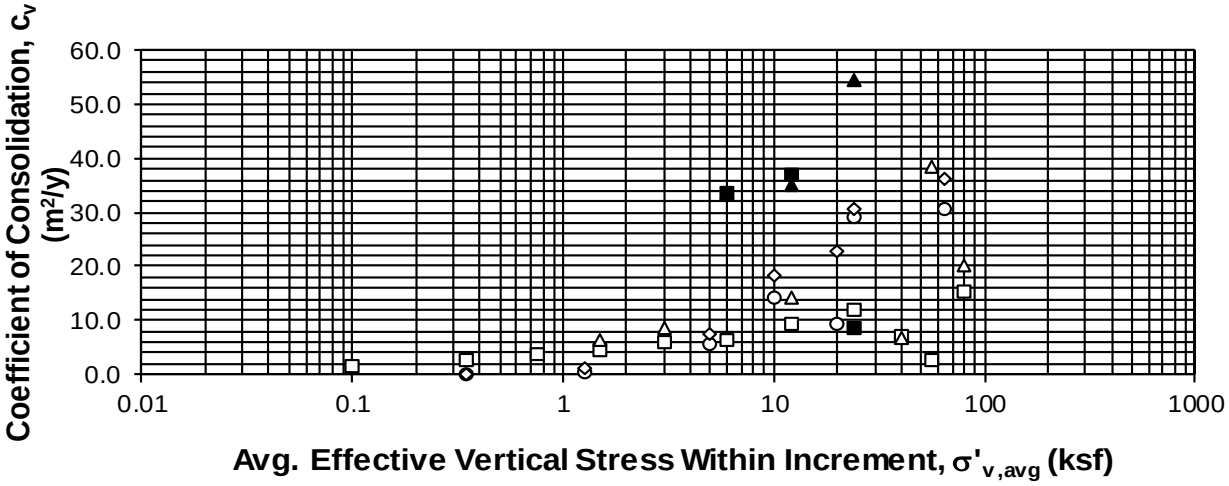
Sample: 8c - Depth: 26.80 ft.

Boring KIN-B011



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading

with solid symbols indicating reloading increments



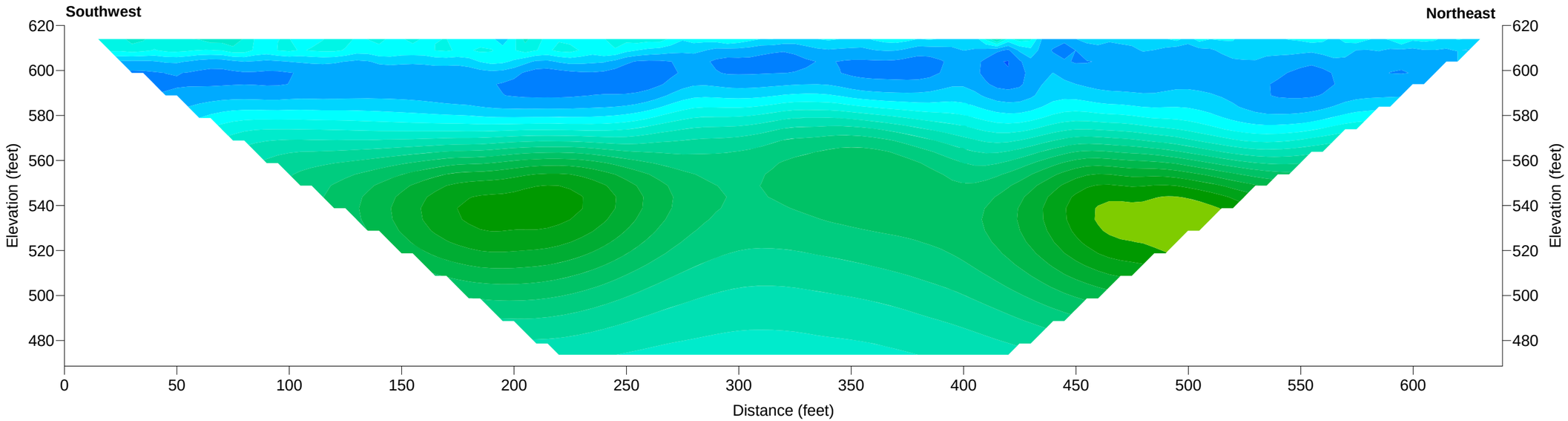
1-D CONSOLIDATION TEST: INC

Sample No. 8a Depth 26.65 ft

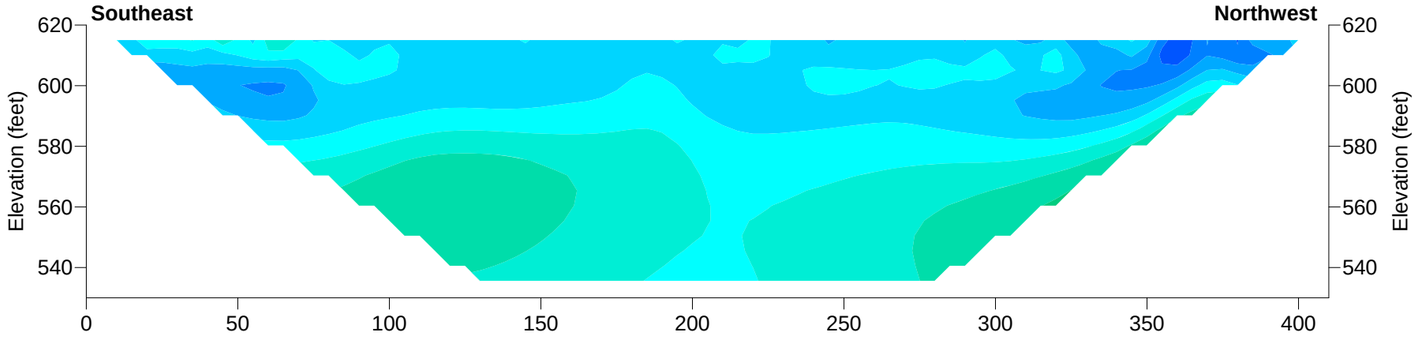
Boring KIN-B011

Attachment F. Geophysical Plots

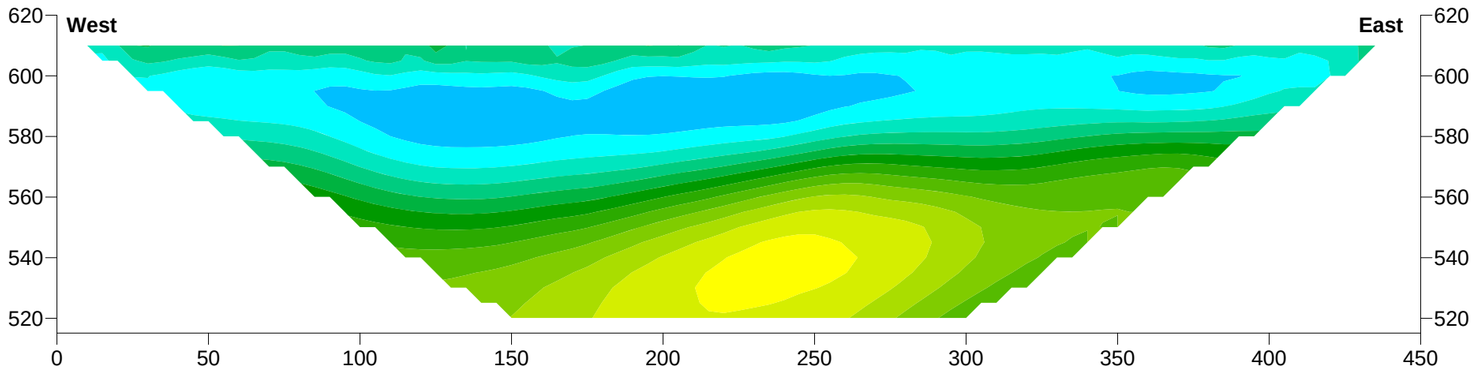
ERI Line 2



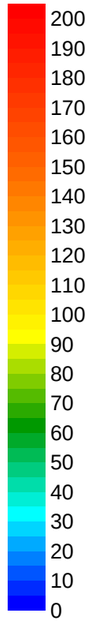
ERI Line 1



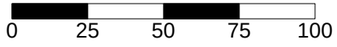
ERI Line 3



Apparent Resistivity (Ohm- meters)



Scale 1 inch = 50 feet



AECOM
Geophysical Services

Electrical Resistivity Imaging Results
ERI Lines 1 to 3
Ash Pond

Kincaid Power Plant

Kincaid, Illinois

DESIGNED BY		DRAWN BY		CHECKED BY		JOB NUMBER
NDB	9/8/15	NDB	9/8/15	TJK	9/8/15	60407913

Attachment G. Analysis Section Development Calculations

AECOM

QMS Form 3-3 (MM)
Rev. 2013 QMS
Date: 28 Feb 2013

IE QMS - Americas | **Detail Check - Calculations**

Project Name	Dynegy CCR Management Program	**Client**	Dynegy, Inc.
Project Location	Kincaid, Christian County, Illinois	**PM**	Eric Glazier
Project Number	60480698	**PIC**	Vic Modeer

IDENTIFYING INFORMATION

(This section is to be completed by the Originator.)

Calculation Medium: *(Select as appropriate)*
☒ Electronic
☒ Hard-copy

File Name: Kincaid Ash Pond Section Development.docx
Unique Identification: N/A
Number of pages *(including cover sheet)*: 5 plus attachments

Discipline:	Geotechnical
Title of Calculation:	Kincaid Ash Pond Section Development
Calculation Originator:	Brian Gomez
Calculation Contributors:	
Calculation Checker:	Meaghan Kenna

DESCRIPTION & PURPOSE

See attached.

BASIS / REFERENCE / ASSUMPTIONS

See attached.

ISSUE / REVISION RECORD

Checker comments, if any, provided on: ☐ hard-copy ☐ electronic file ☐ Form 3-5

No.	Description	P	S	F	Originator Initials	Date	Checker Initials	Date
0	Initial Issue	☐	☐	☑	BWG	1/28/16	MEK	1/28/16
1	Revised elevations	☐	☑	☐	BWG	2/10/16	EJV	2/10/16
2		☐	☐	☐				
3		☐	☐	☐				

For a given Revision, indicate either P (Preliminary), S (Superseding) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

APPROVAL and DISTRIBUTION

☐ The below individuals assert that the Detail Check – Calculations is complete.

Brian Gomez — Originator Signature — 1/28/16 — Date

Meaghan Kenna — Checker Signature — 1/28/16 — Date

Eric J. Slagen — Project Manager (or Designee) Signature — January 29, 2016 — Date

Distribution:

Project Central File – Quality File Folder
Other – Specify: Enter names here.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Section Development | Project Name: Dynegy CCR

By: Brian Gomez | Date: 02/09/2016 | Project No: 60480698

Checked By: Meaghan Kenna | Date: 02/09/2016 | Task No.: 01

OBJECTIVE:

This calculation package presents the slope stability sections analyzed at Kincaid Ash Pond. Geometry revisions were made to the previously analyzed sections using recent boring and Cone Penetration Test (CPT) logs. The approach used to identify the foundation material contacts and phreatic surfaces based on the recent field investigation data is discussed below.

BACKGROUND:

The material characterizations for the stability analyses were completed using CPT and boring logs from a subsurface investigation program completed in August 2015. The investigation included 12 soil borings and 37 CPT soundings. Boring and CPT sounding locations are shown relative to the slope stability analysis sections on the plan view drawing of exploration locations and sections in Appendix A. Field testing included Standard Penetration Tests (SPT), CPT dissipation testing, and shear wave velocity measurements using seismic CPT. Open well and vibrating wire piezometers were installed in select borings and CPTs, respectively. Based on the results of the investigation, four stratigraphic layers were identified at the site:

- **Impounded Ash**: Fine- to coarse-grained SAND (cinders) with clayey silt, organics or clay, very loose to very dense, moist to very wet, and dark brown to black.
- **Embankment Fill**: Low to medium plasticity sandy CLAY or CLAY with sand (CL), or high plasticity clay (CH). The CL and CH soils had occasional occurrences of trace levels of fine gravel, were medium stiff to very stiff with occasional soft zones, moist to very moist, and brown to gray.
- **Foundation Clay**: Native clay of alluvial origin with occasional layers of coarse-grained soil. The fine-grained soils (clays) were generally classified as low to medium plasticity silty CLAY, sandy CLAY, CLAY with sand, or CLAY (CL) with trace amounts of sand or gravel; or high plasticity CLAY (CH). The CL and CH soils were soft to very stiff with a CPT profile indicative of a somewhat over-consolidated crust near the top of the layer, very moist to very wet, and brown to gray with some occurrence of reddish brown silt seams. The coarse-grained soil encountered in the borings was classified as clayey SAND (SC), with a trace amount of gravel, very loose, low plasticity, very wet, and brown to gray.
- **Till**: Predominantly classified as sandy CLAY (CL) with some occurrences of clayey SAND (SC) or silty SAND (SM), usually with a trace amount of fine gravel, generally hard, low to medium plasticity, slightly moist to very wet, and brown to gray.

APPROACH AND ASSUMPTIONS:

Section Development

The ash and embankment surface geometry for each section was developed using the 2013 USGS ortho-imagery. A total of five study sections were developed to represent critical areas of the embankment including the following:

- **Station 18+50**: Area of steepest dike along east side of the Ash Pond.
- **Station 48+50**: Area of tallest and steepest dike along north side of the Ash Pond.
- **Station 63+00**: Area of steepest dike along northwest corner of the Ash Pond, including the slope into the toe lake.
- **Station 71+00**: Area of steepest and tallest dike along the west side of the Ash Pond, outside of the slope into the toe lake.
- **Station 94+50**: Area of tallest and steepest dike along south side of the Ash Pond.

Each section along with a plan view is provided in Appendix A.

STA 18+50

The internal geometry at section STA 18+50 was developed from CPTs KIN-C001, C003, C019, C020 and C021. CPTs C001, C003, and boring B002 were projected perpendicularly from the south east corner to the section. Boring B011 was projected perpendicularly along the east reach from the north. CPTs C019, C020, and C021, were projected perpendicularly and located at the section. The geometry at section STA 18+50 is shown in Figure 1.

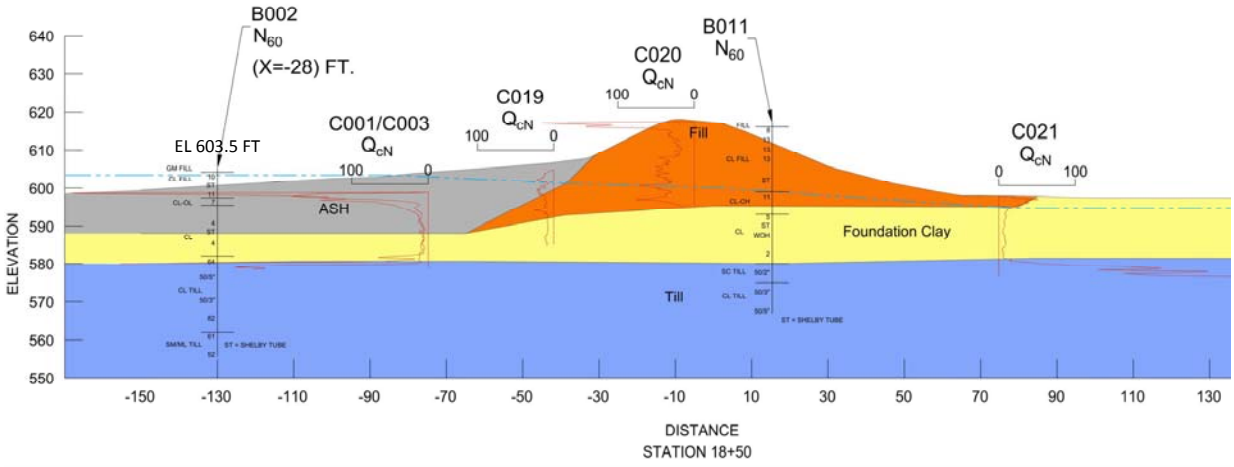


Figure 1: Section STA 18+50

STA 48+50

The internal geometry at section STA 48+50 was developed using CPTs KIN-C013, C014, C015, C016, and C026. CPT C013 and borings B009 and B010 were projected perpendicularly from the west along the north reach. CPTs C014, C015, and C016 were projected perpendicularly to the section from the northeast corner of the impoundment. The geometry at section STA 48+50 is shown in Figure 2.

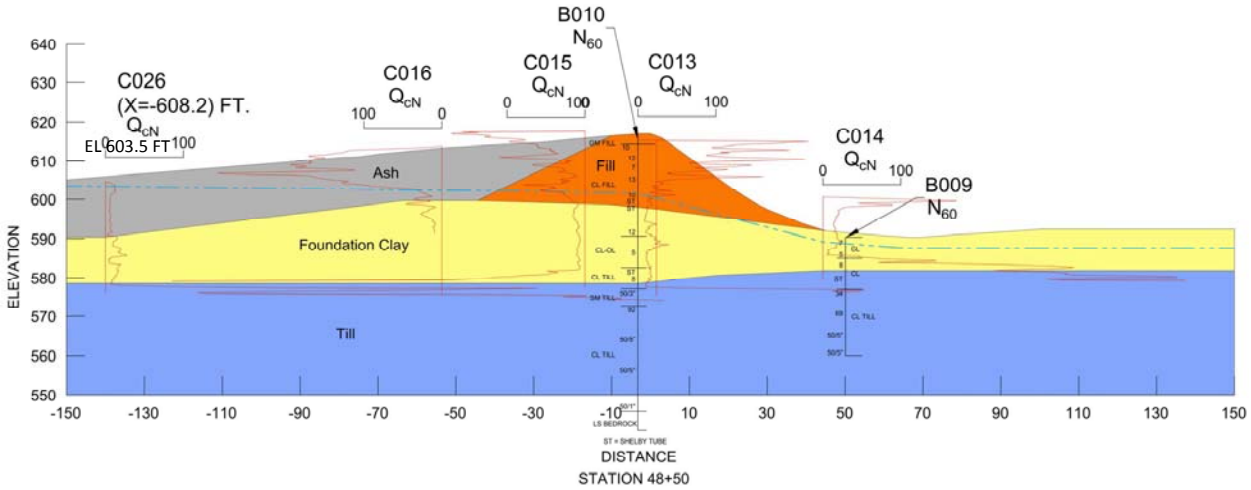


Figure 2: Section STA 48+50

STA 63+00

The internal geometry at section STA 63+00 was developed using CPTs KIN-C011, C012, and C025. The CPTs were projected perpendicularly and located at the section. Borings B007 and B008 were projected perpendicularly from the northeast, along the reach. The geometry at section STA 63+00 is shown in Figure 3.

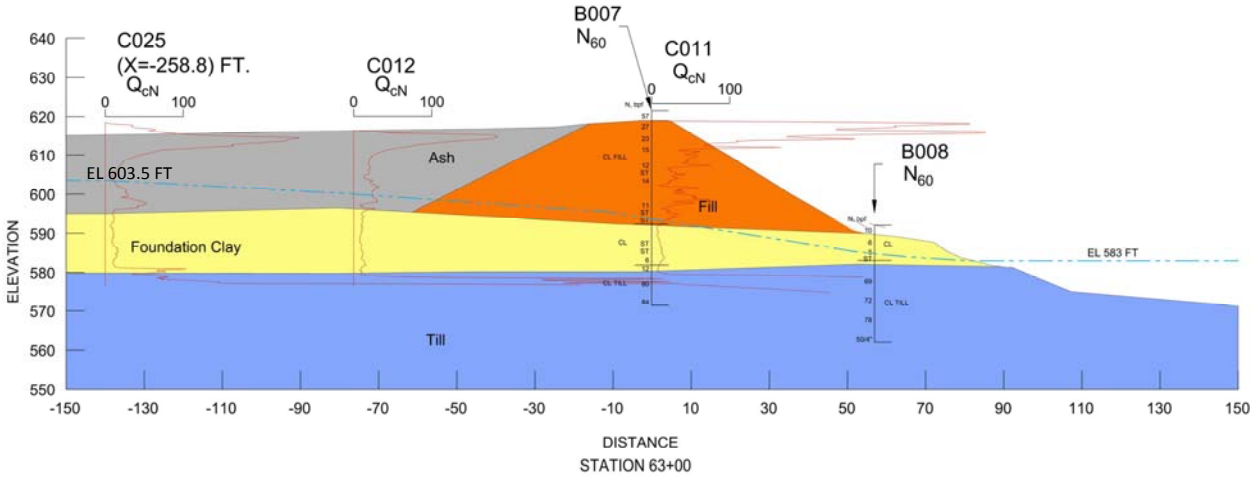


Figure 3: Section STA 63+00

STA 71+00

The internal geometry at section STA 71+00 was developed using CPTs KIN-C009, C010, C023, C024, and C024b. CPTs C024 and C024b are located at the section, within the impoundment, but were not used to develop the stratigraphy since they were solely pushed through ash. CPTs C009, C010, and C023 were projected perpendicularly and are located at the section. The geometry at section STA 71+00 is shown in Figure 4.

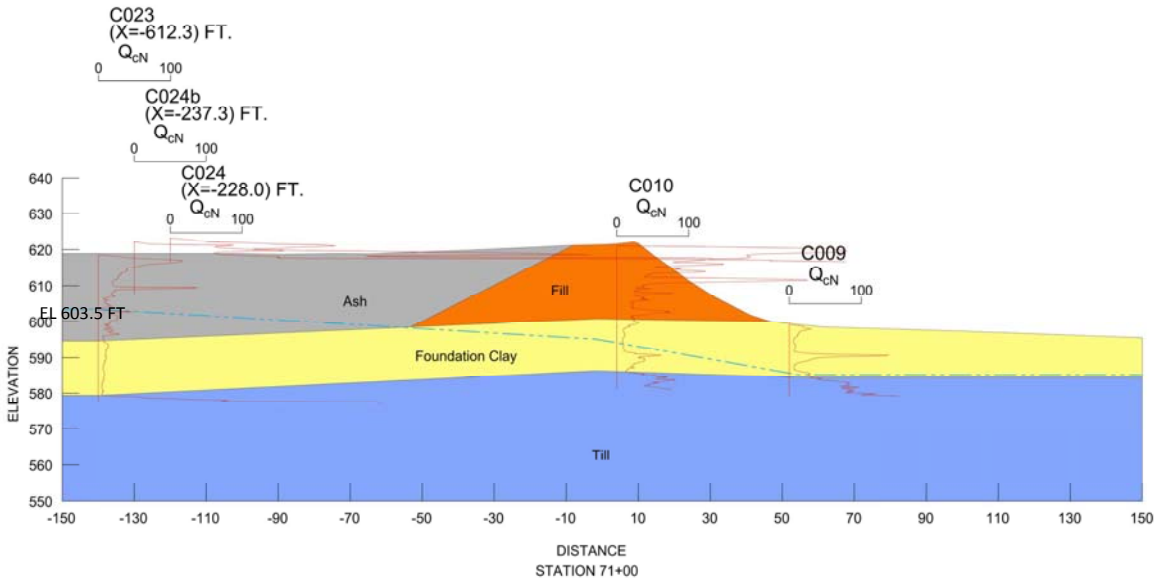


Figure 4: Section STA 71+00

STA 94+50

The internal geometry at section STA 94+50 was developed using CPTs KIN-C004, C005, and C032. All CPTs and boring B003 were projected perpendicularly and located slightly west of the section. The geometry at section STA 94+50 is shown in Figure 5.

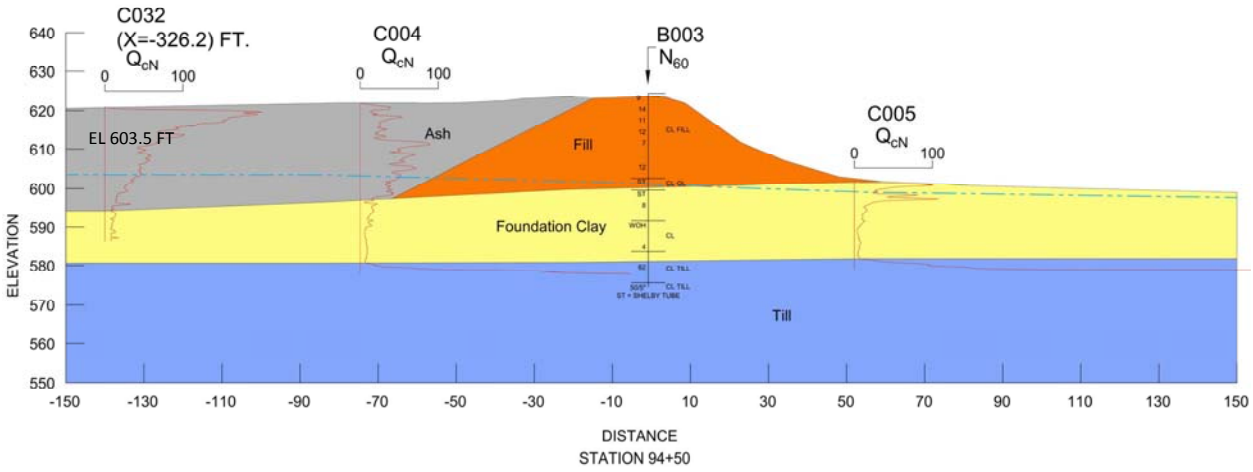


Figure 5: Section STA 94+50

Phreatic Surface

The normal operating pool elevation is at 603.5 feet. A phreatic surface for each section was developed primarily using piezometer water level measurements, and secondarily using static pore pressure profiles interpreted from CPT pore pressure dissipation tests judged to be representative of steady state conditions. The highest piezometer water level readings from five measurement events (8/23/15, 10/7/15, 10/30/15, 11/23/15, and 12/23/15) were conservatively used. Where stability sections are located between piezometers and/or CPTs, water levels were interpolated using a weighted average method and projected as a phreatic surface onto the sections.

APPENDICES:

- Appendix A – Field Exploration Plan and Sections
- Appendix B – CPT Data and Boring Logs

Calculation Notes

Subject: Kincaid Ash Pond Section Development

Project Name: Dynegy CCR

By: Brian Gomez Date: 02/09/2016

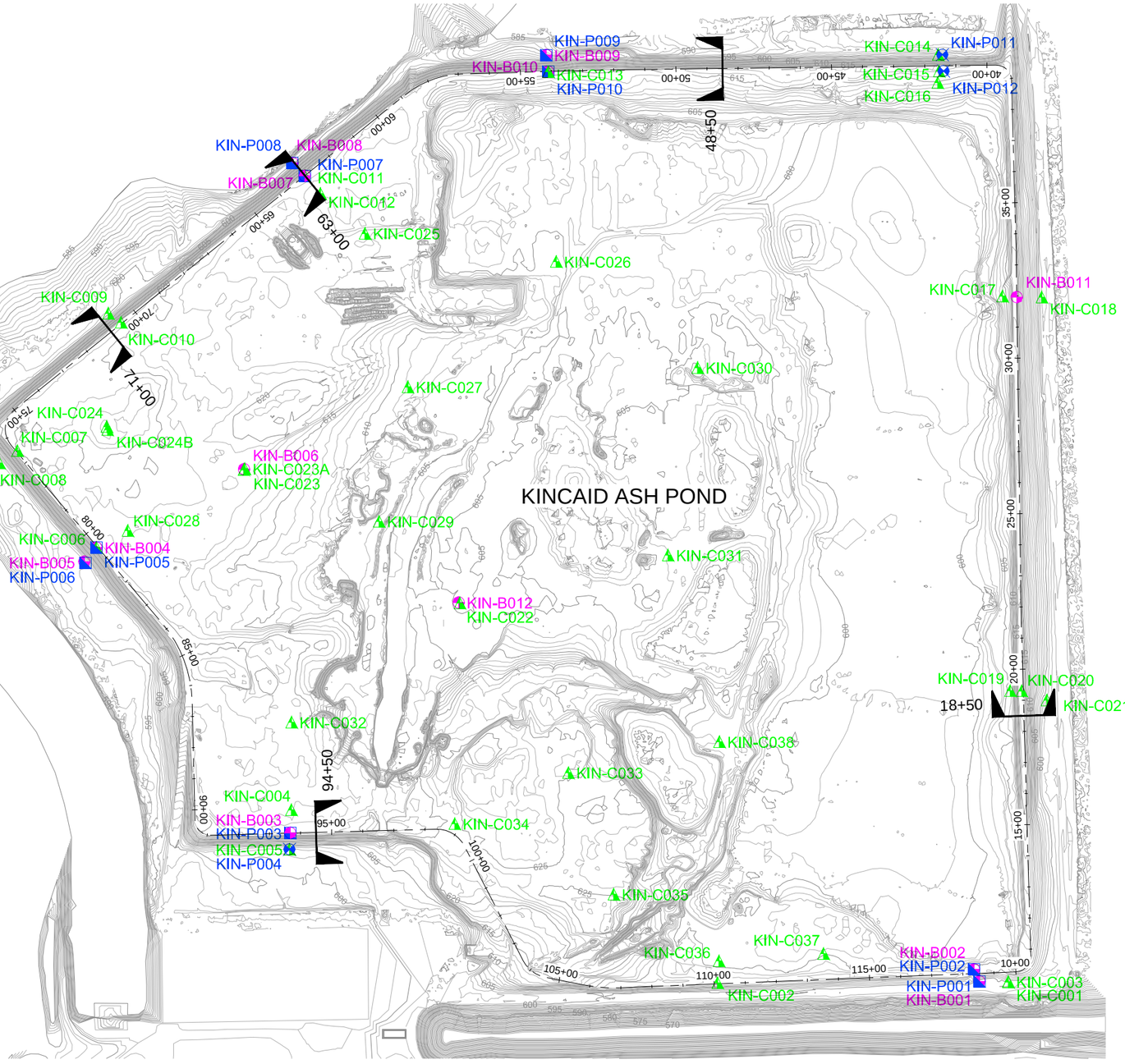
Project No: 60480698

Checked By: Meaghan Kenna Date: 02/09/2016

Task No.: 01

APPENDIX A

Field Exploration Plan and Sections



LEGEND

KIN-B000	AECOM BORING LOCATION
KIN-C000	AECOM CONE PENETROMETER TESTING LOCATION
KIN-P000	AECOM PIEZOMETER LOCATION
KIN-P000	AECOM VIBRATING WIRE PIEZOMETER (VWP) LOCATION
	LOCATION OF GEOPHYSICAL INVESTIGATION
	STUDY SECTION

NOTES:

1. CONTOURS ARE 2 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. GROUND CONTOURS ARE INTERPRETED FROM HISTORIC TOPOGRAPHIC MAPS PROVIDED BY DYNEGY, RECENT GROUND SHOTS BY AECOM, AND FINAL RESULTS OF LIDAR SURVEYING PERFORMED BY SURDEX CORPORATION IN AUGUST 2015.
4. BATHYMETRY CONTOURS ARE BASED ON A BATHYMETRIC SURVEY PERFORMED BY WEAVER CONSULTANTS IN OCTOBER 2015.
5. STATION 10+00 IS THE BEGINNING OF STATIONING.

N

0 200 400 600
SCALE IN FEET

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

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

GEOTECHNICAL REPORT
ASH POND

ISSUED FOR BIDDING	DATE	BY
ISSUED FOR CONSTRUCTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	
DRAWN BY:	GJH
DESIGNED BY:	EJV
CHECKED BY:	MCR
DATE CREATED:	12/23/2015
PLOT DATE:	2/9/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

BORING, CPT, PIEZOMETER AND CROSS SECTION LOCATIONS

SHEET 1 OF 1

SMITH, CURT, 2/9/2016 11:38 AM
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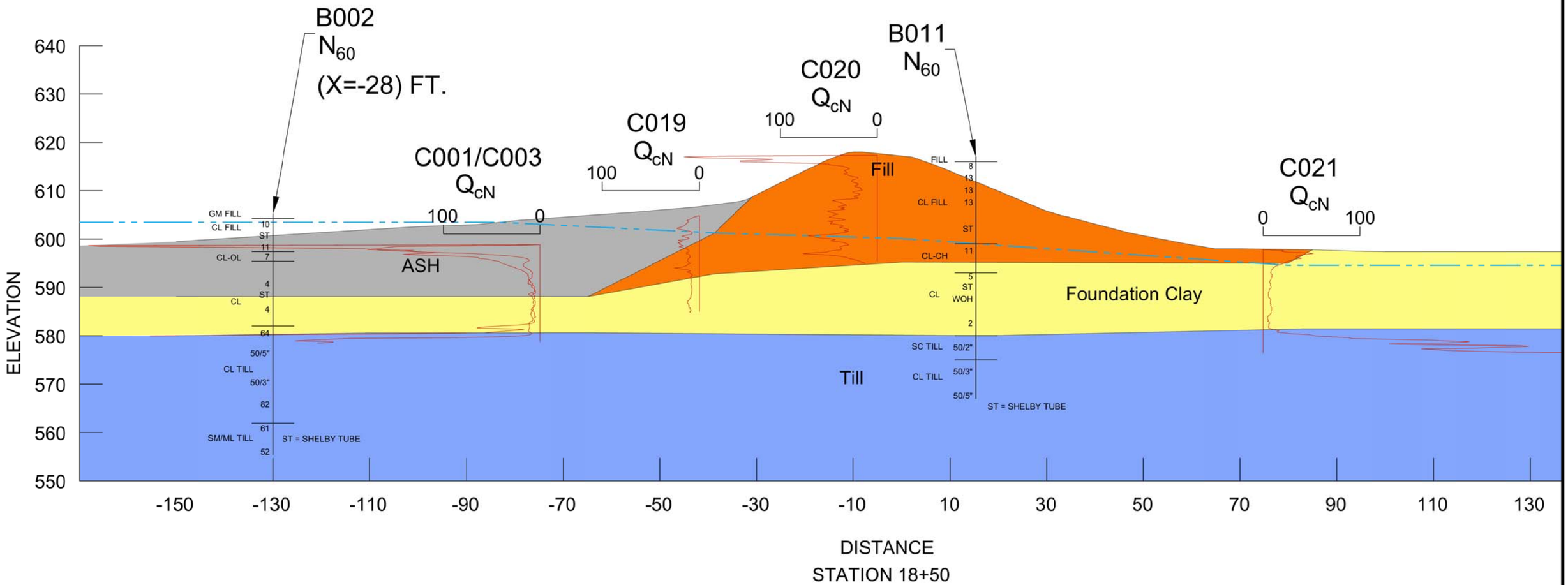

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 18+50	FIGURE 5-1
AECOM			

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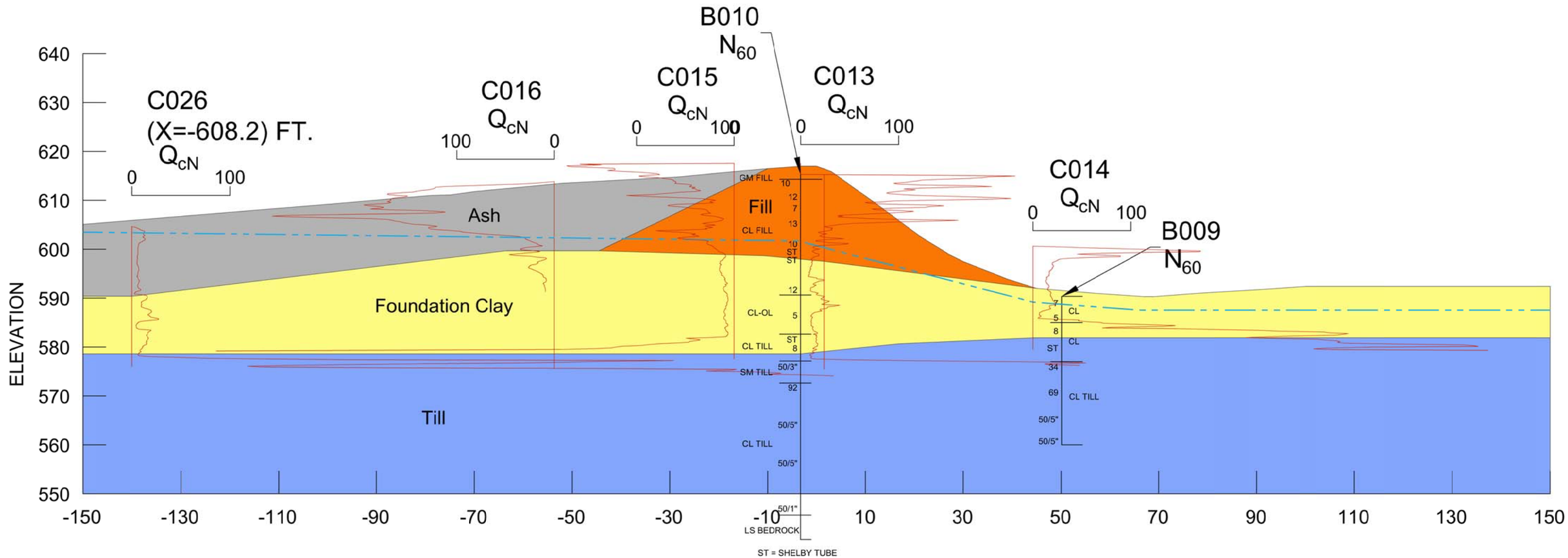

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 48+50	FIGURE 5-2
AECOM			

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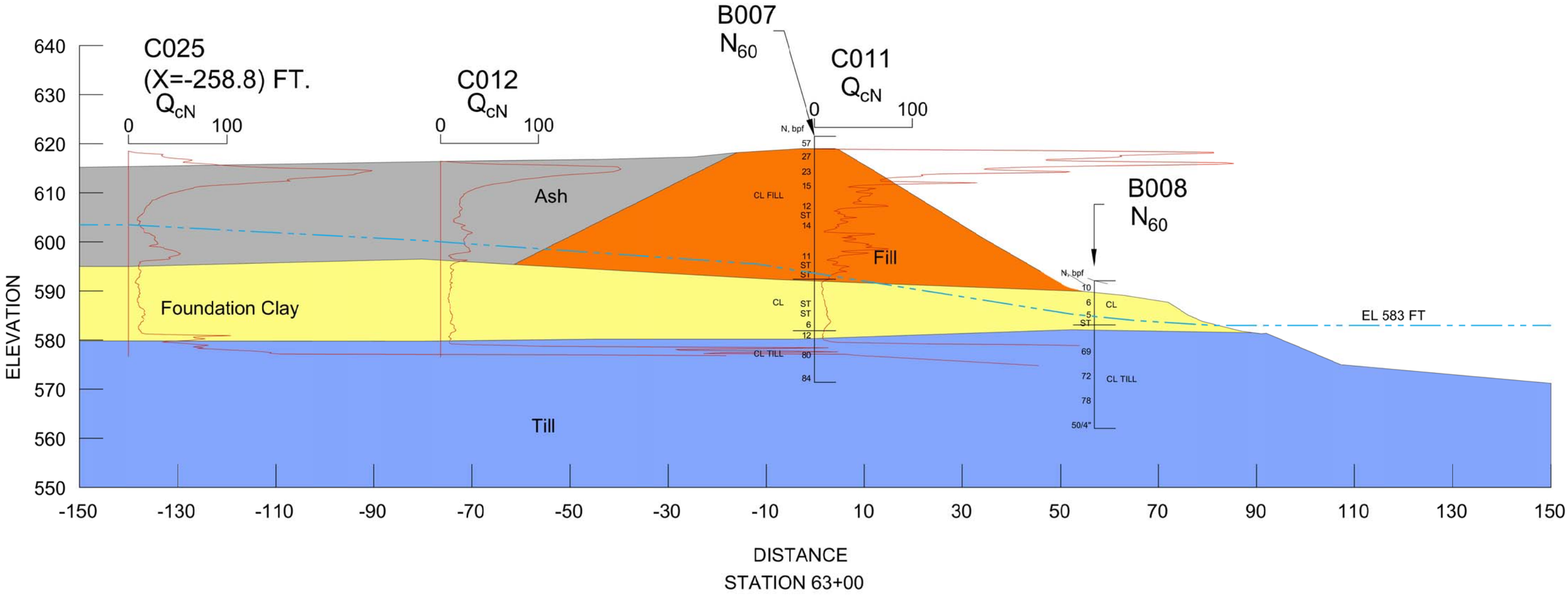

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 63+00	FIGURE 5-3
AECOM			

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C023
(X=-612.3) FT.
Q_{cN}
0 100

C024b
(X=-237.3) FT.
Q_{cN}
0 100

C024
(X=-228.0) FT.
Q_{cN}
0 100

C010
Q_{cN}
0 100

C009
Q_{cN}
0 100

Ash

Fill

Foundation Clay

Till

ELEVATION

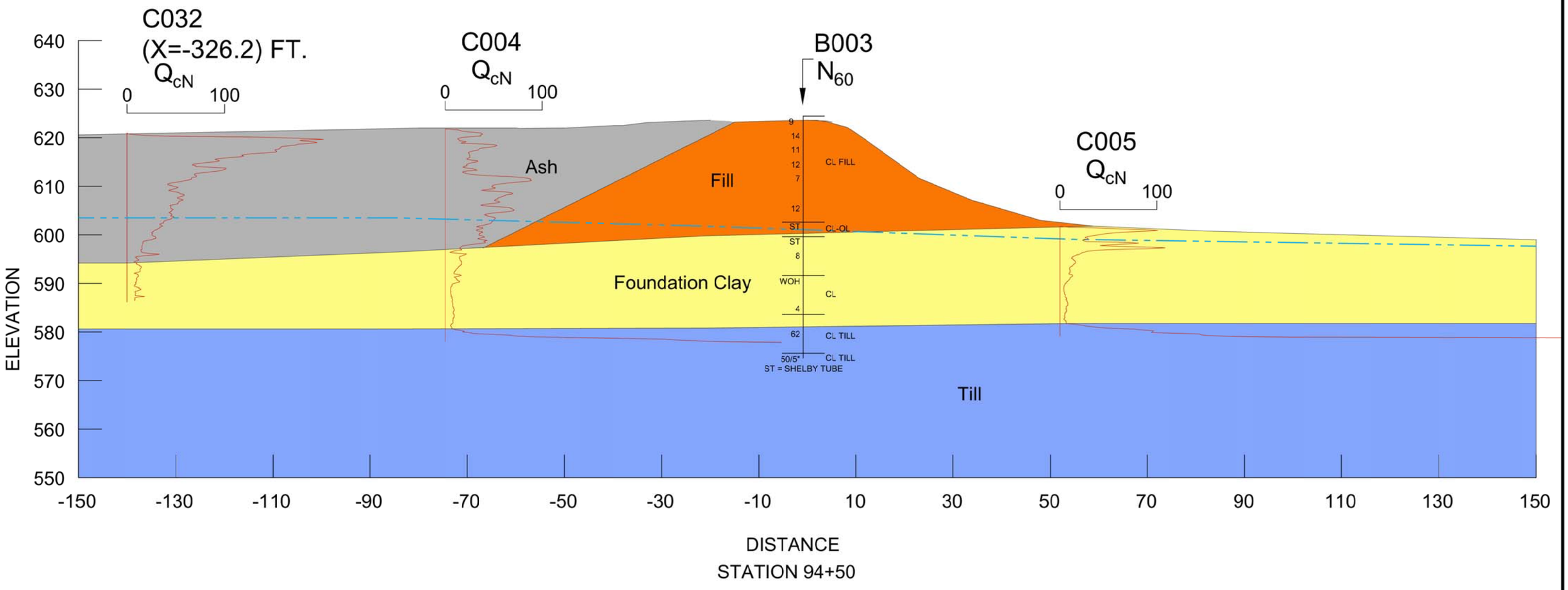
640
630
620
610
600
590
580
570
560
550

-150 -130 -110 -90 -70 -50 -30 -10 10 30 50 70 90 110 130 150

DISTANCE
STATION 71+00

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 71+00	FIGURE 5-4
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\7.0_CAD_GIS\7.05_Working_Files\STABILITY_SECTIONS\KINCAID\KIN-SLOPE-STABILITY-SECTIONS_rev1.dwg



PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 94+50	FIGURE 5-5
	AECOM		

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Calculation Notes

Subject: Kincaid Ash Pond Section Development

Project Name: Dynegy CCR

By: Brian Gomez Date: 02/09/2016

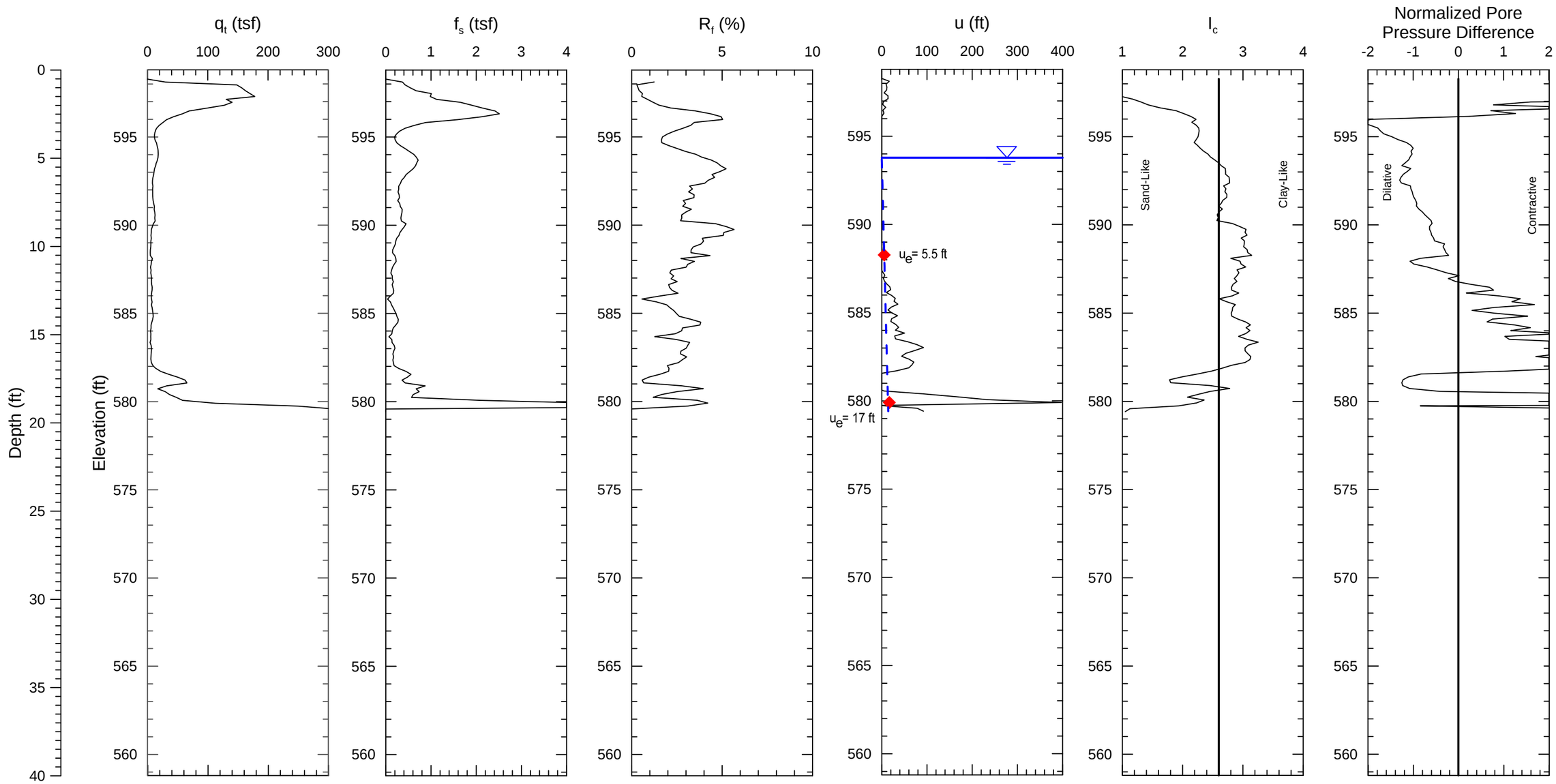
Project No: 60480698

Checked By: Meaghan Kenna Date: 02/09/2016

Task No.: 01

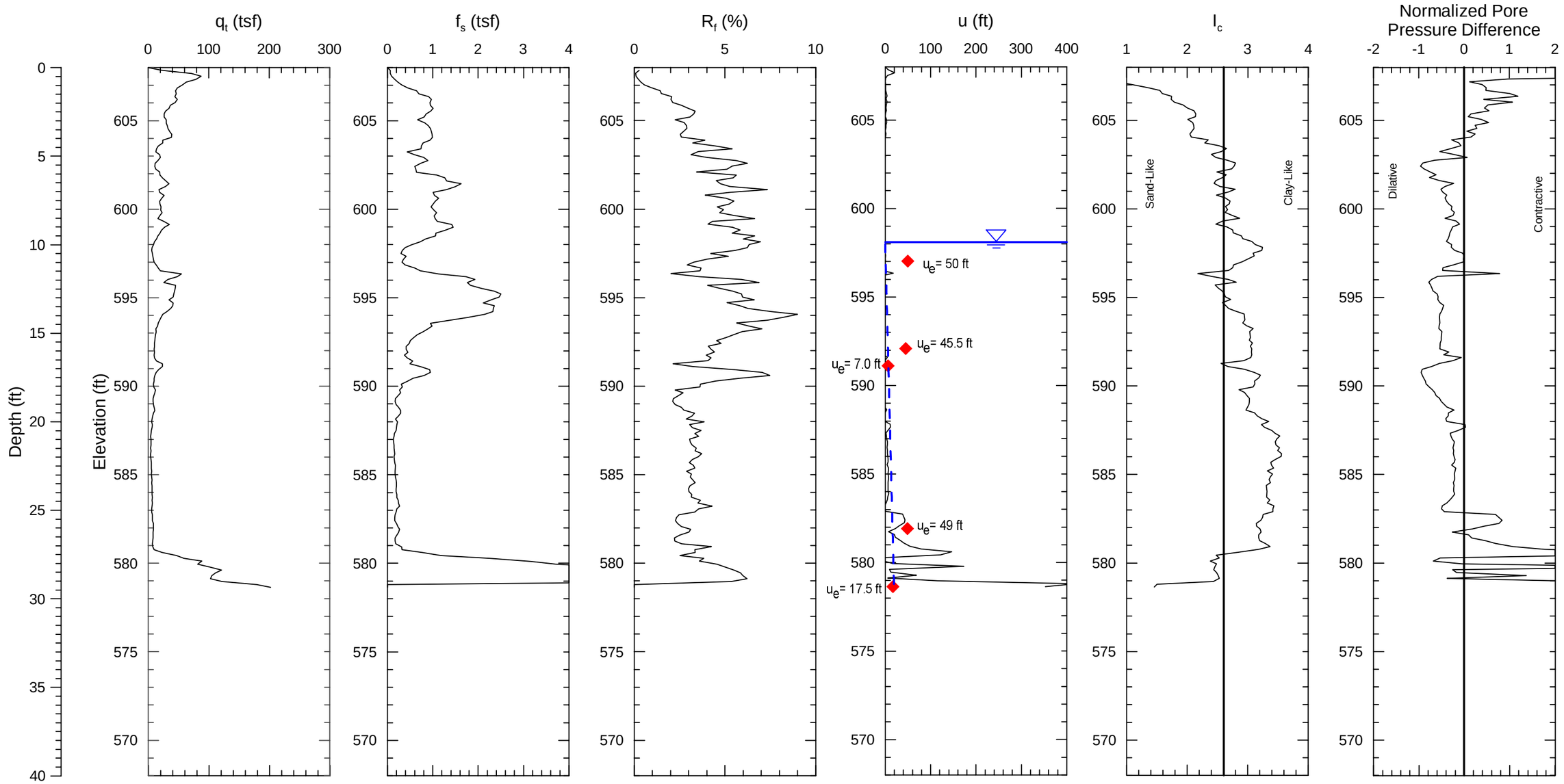
APPENDIX B

CPT Data and Boring Logs



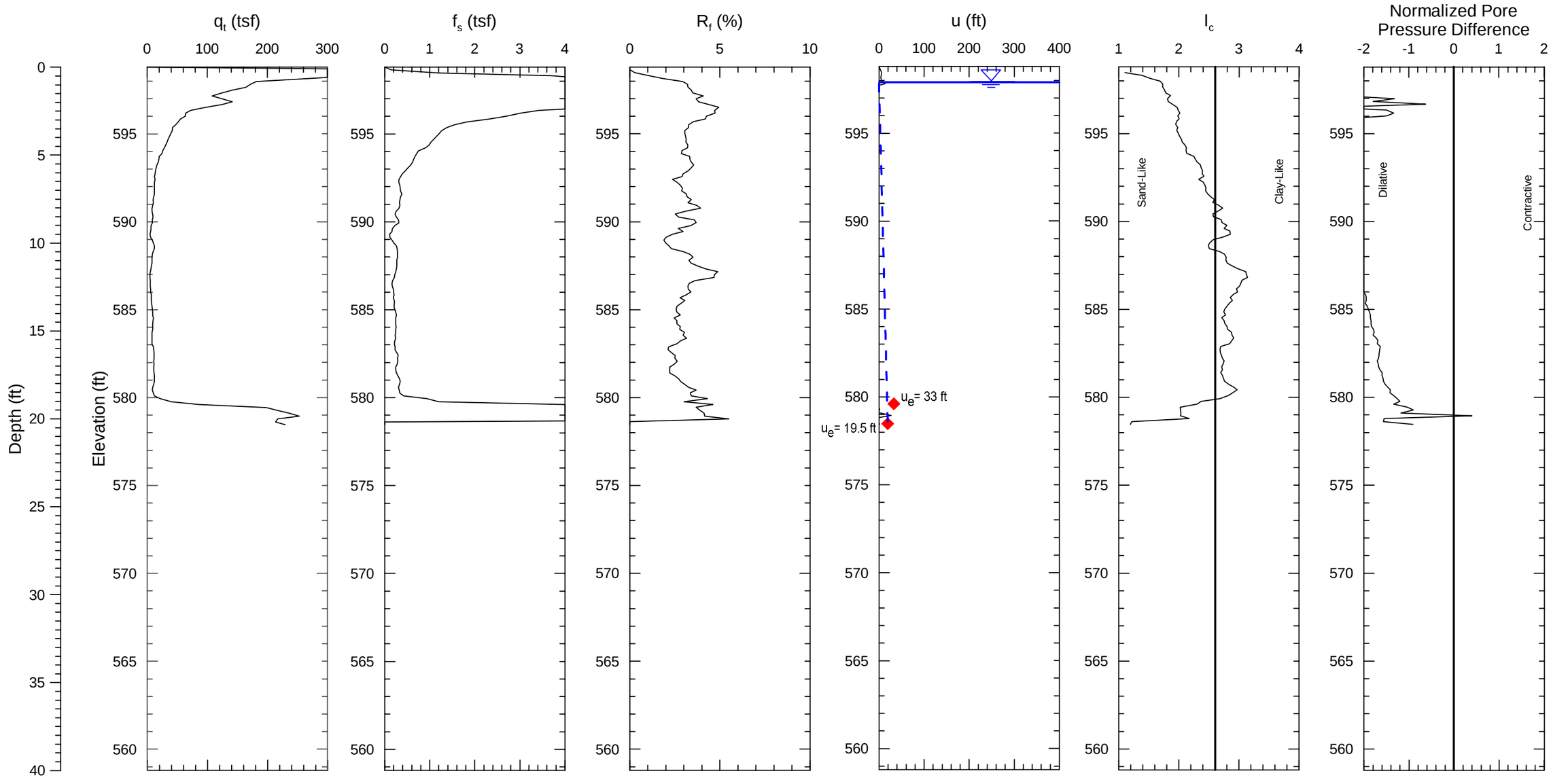
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C001 Kincaid Ash Pond	FIGURE
AECOM			



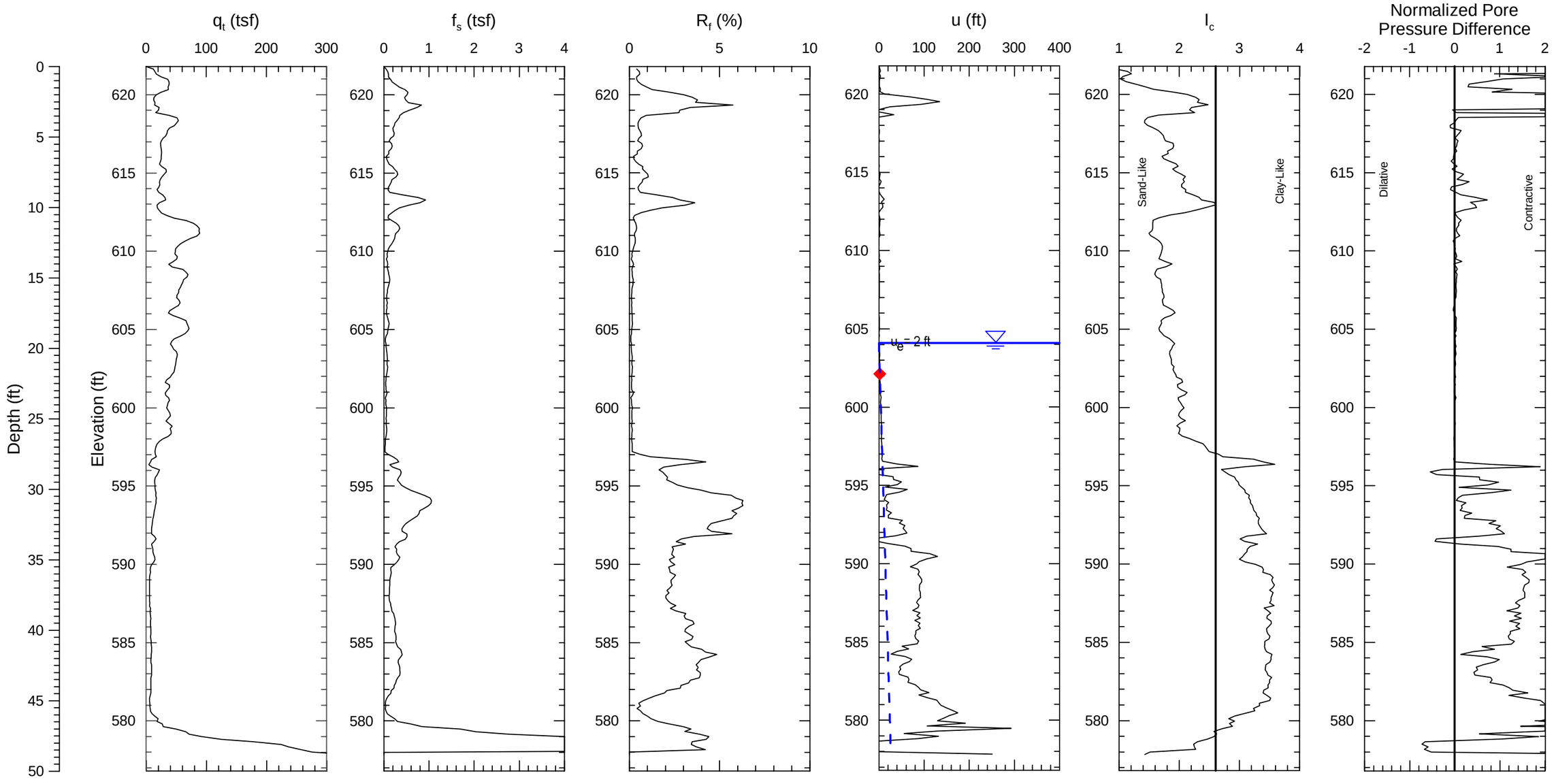
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C002 Kincaid Ash Pond	FIGURE
AECOM			



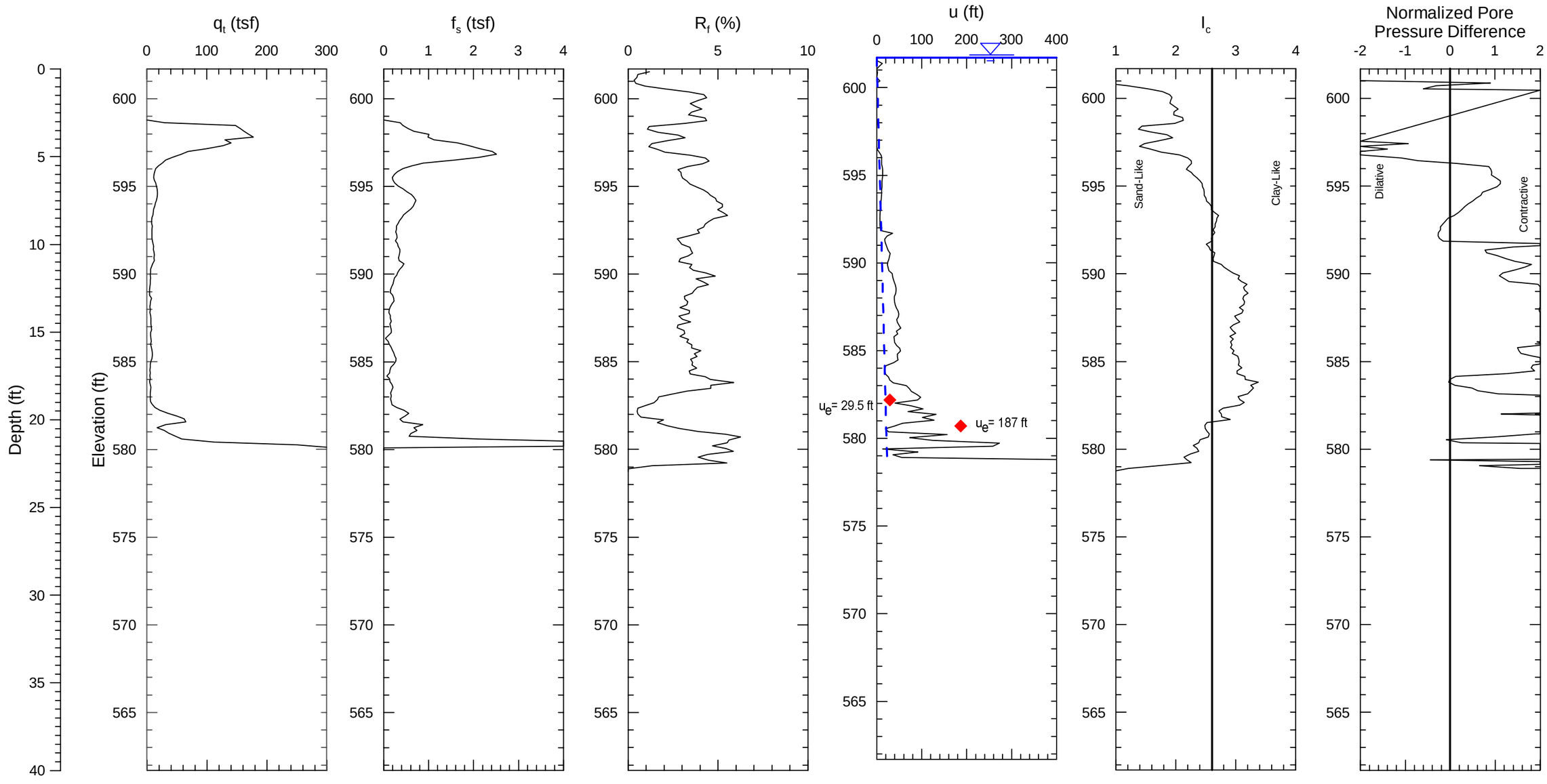
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C003 Kincaid Ash Pond	FIGURE
AECOM			



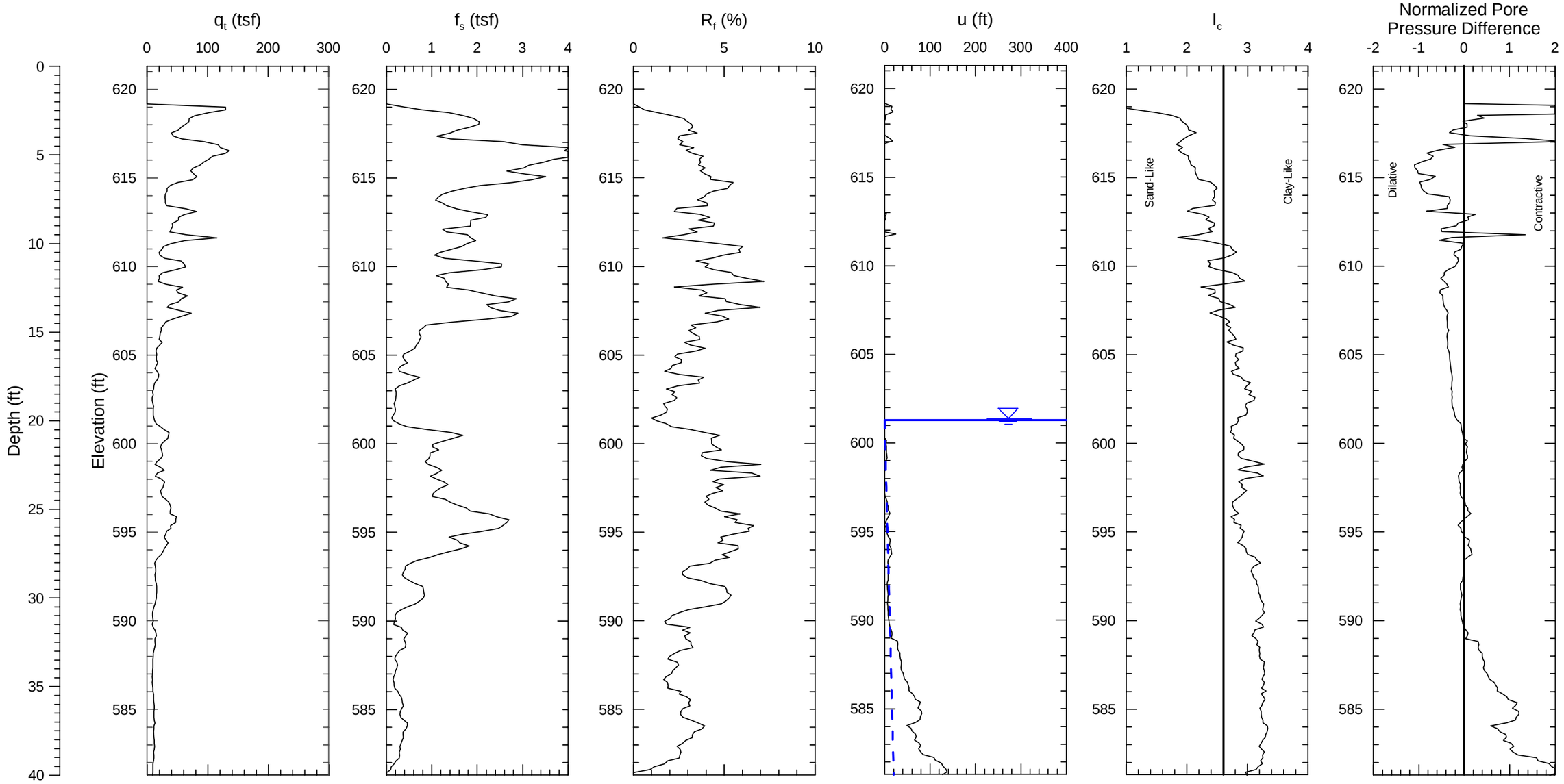
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C004 Kincaid Ash Pond	FIGURE
AECOM			



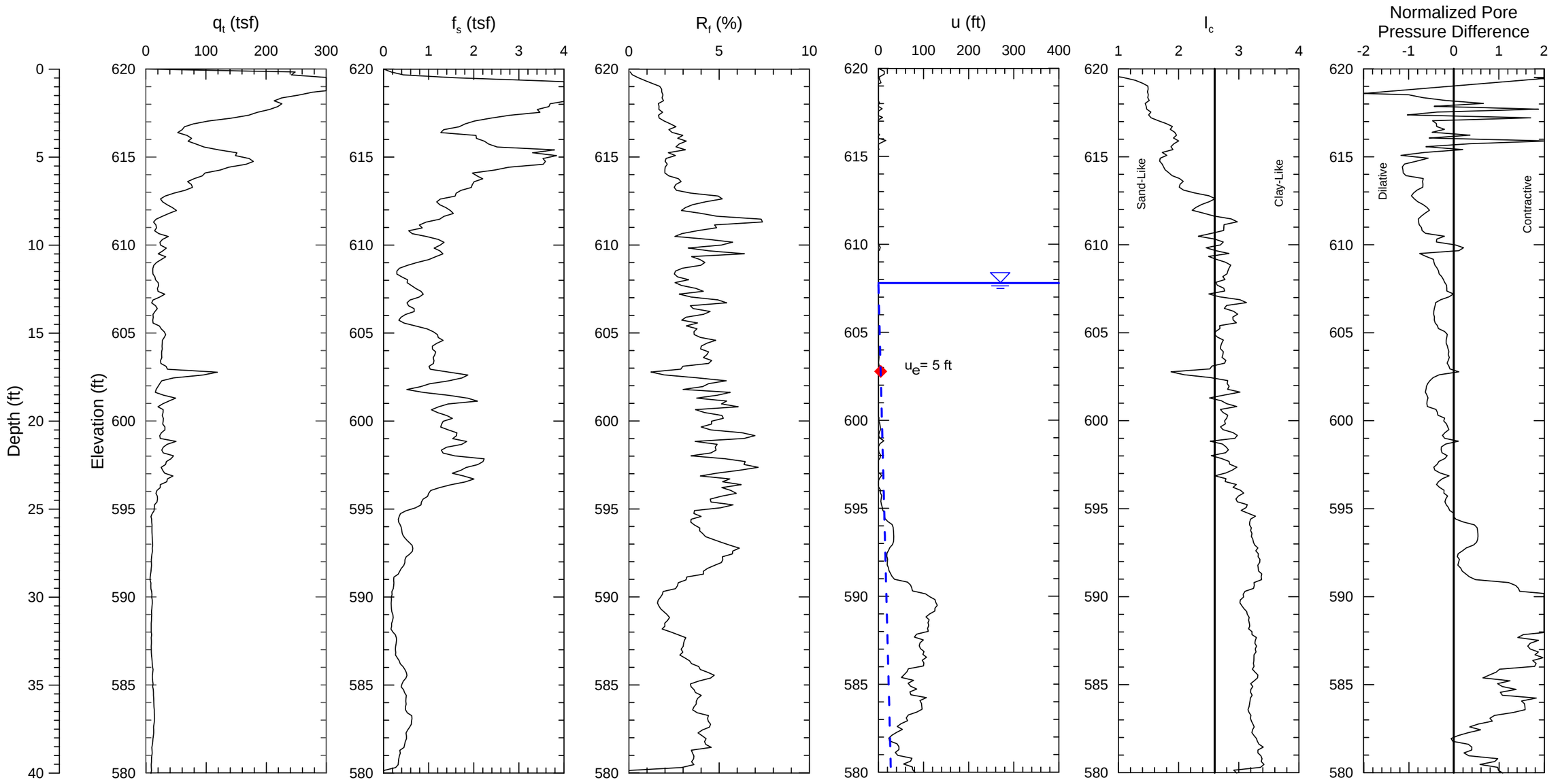
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C005 Kincaid Ash Pond	FIGURE
AECOM			



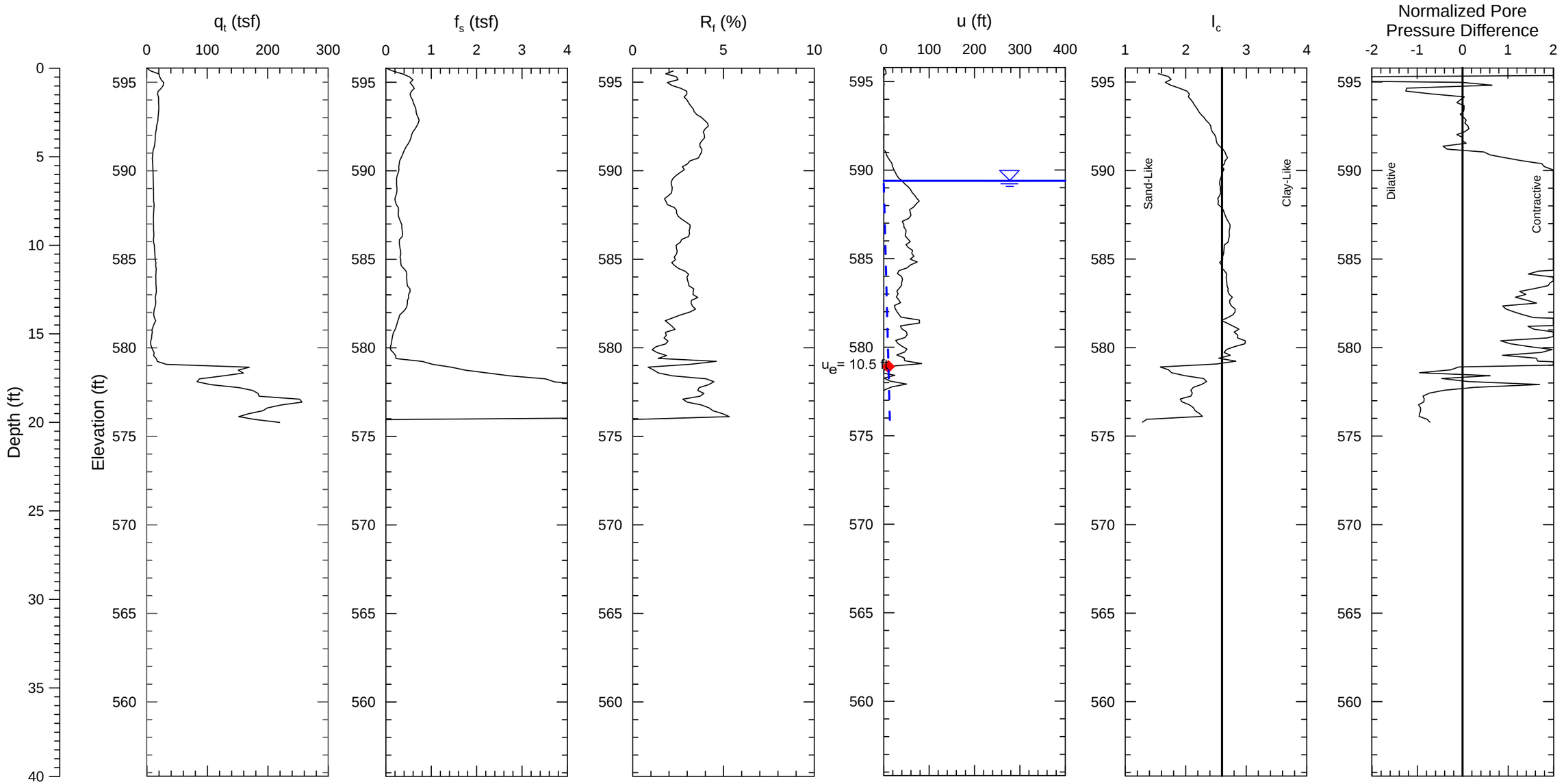
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C006 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C007 Kincaid Ash Pond	FIGURE
AECOM			



◆ Pore Pressure Dissipation Test

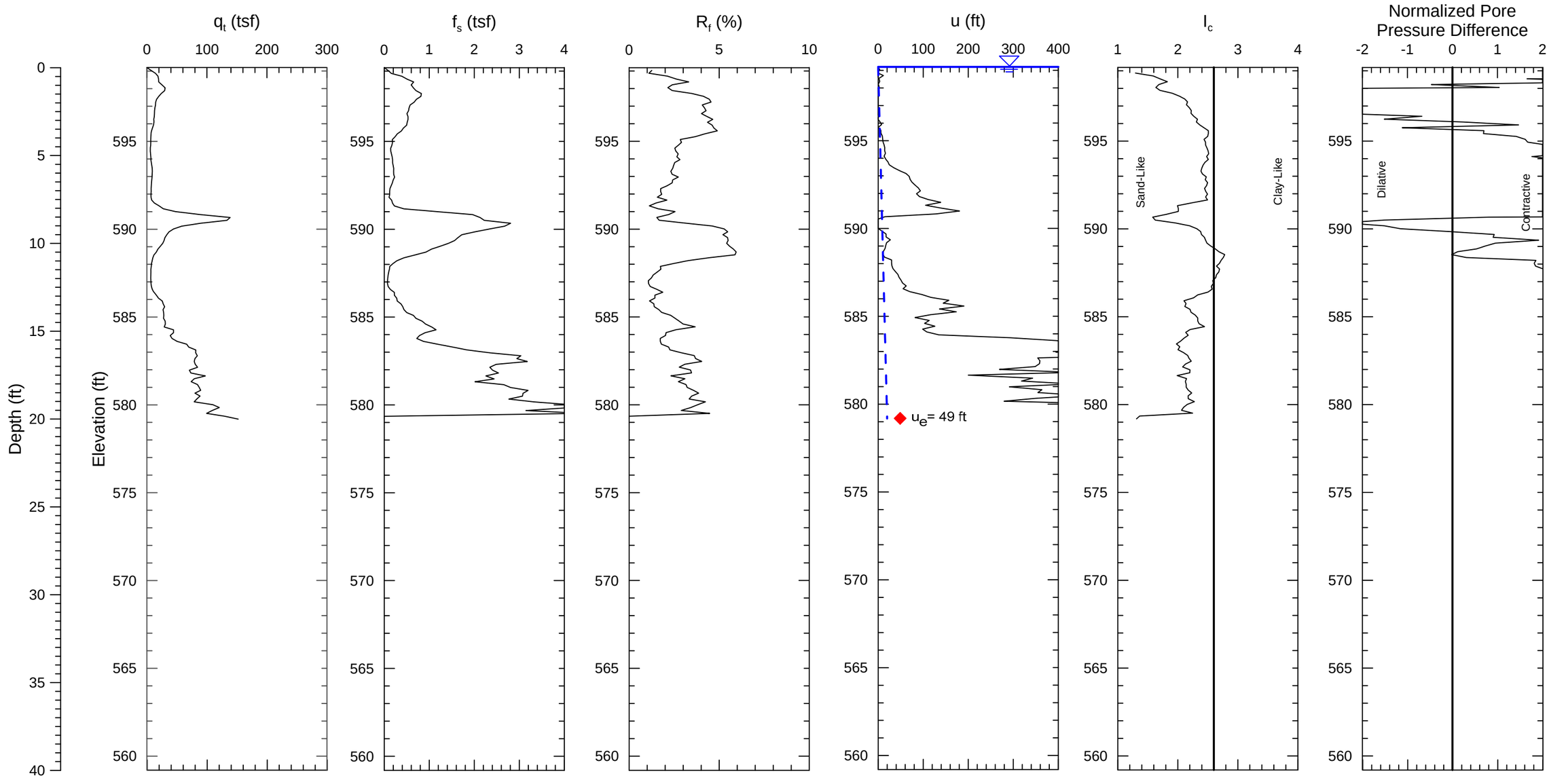
– – – – – 100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C008 Kincaid Ash Pond	FIGURE
AECOM			



Pore Pressure Dissipation Test

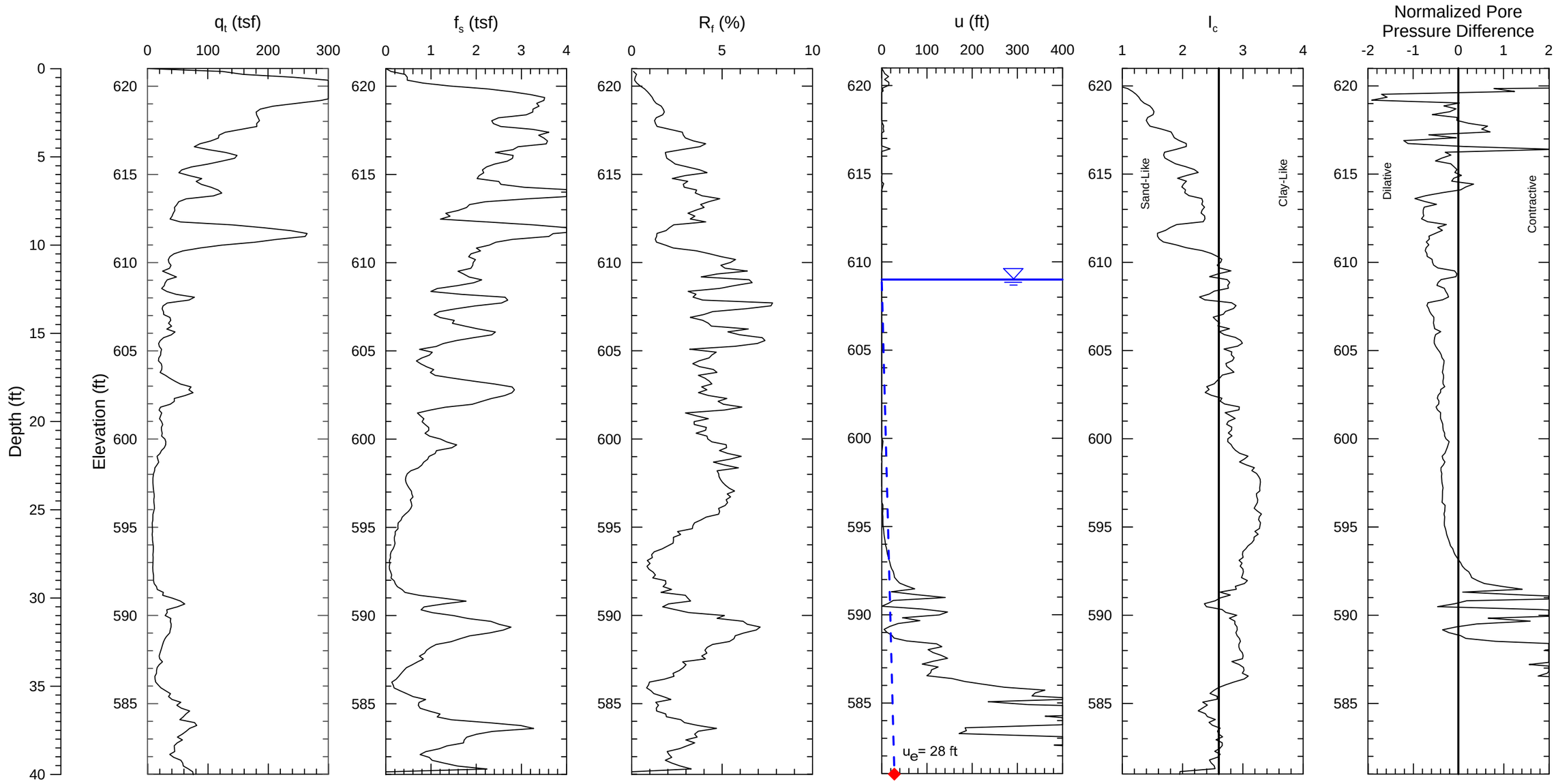
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

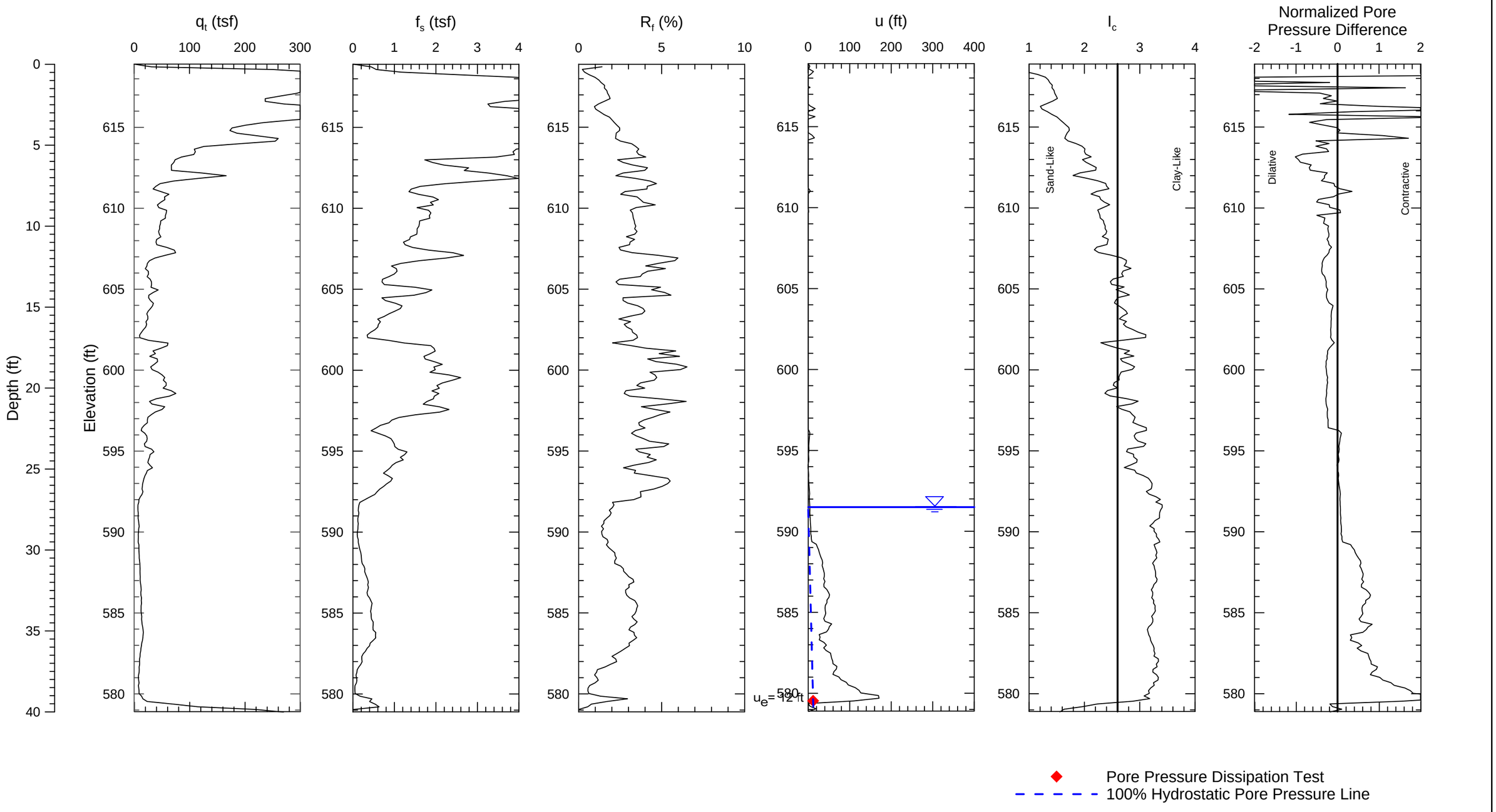
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C009 Kincaid Ash Pond	FIGURE
AECOM			



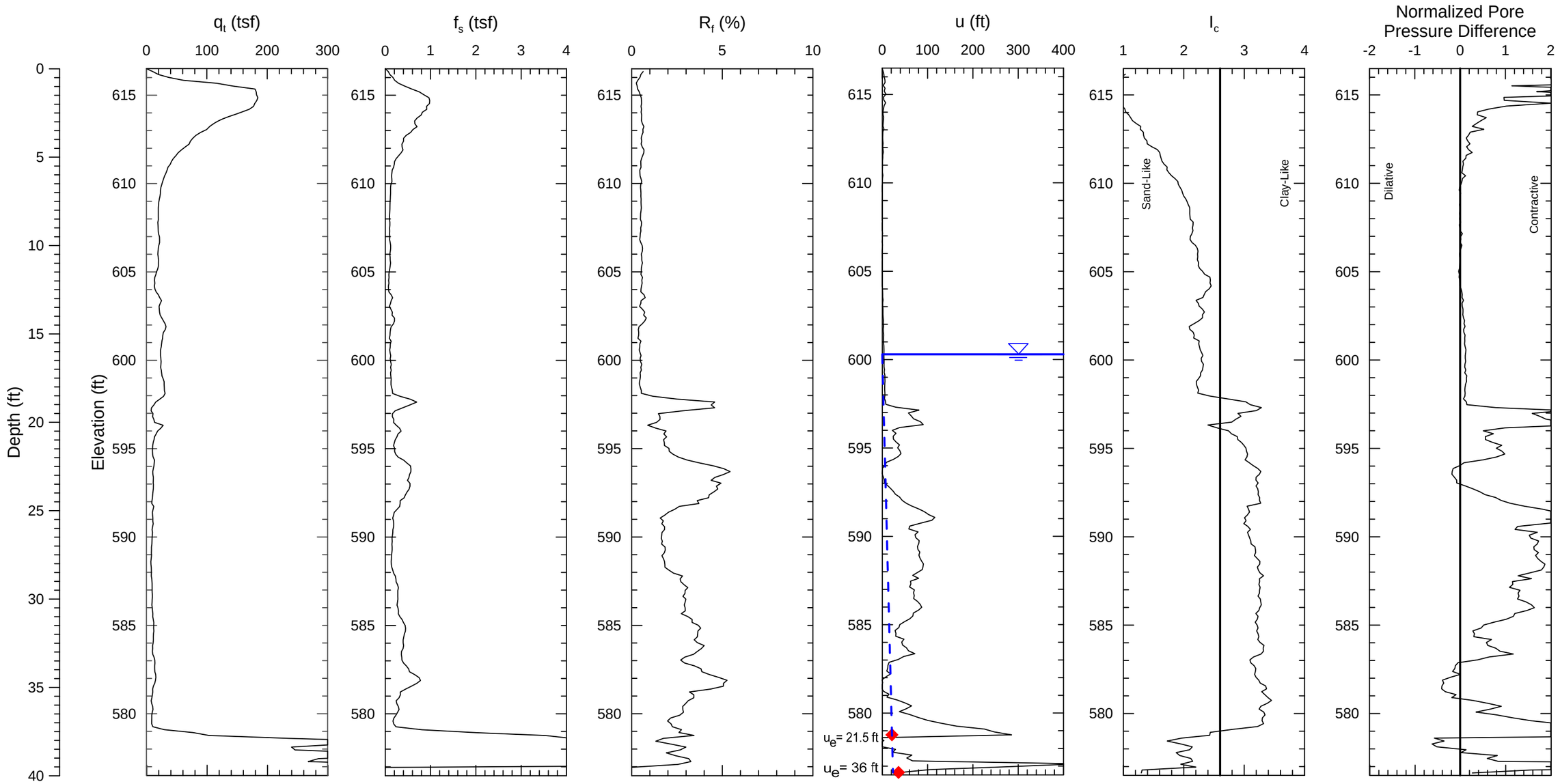
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C010 Kincaid Ash Pond	FIGURE
AECOM			



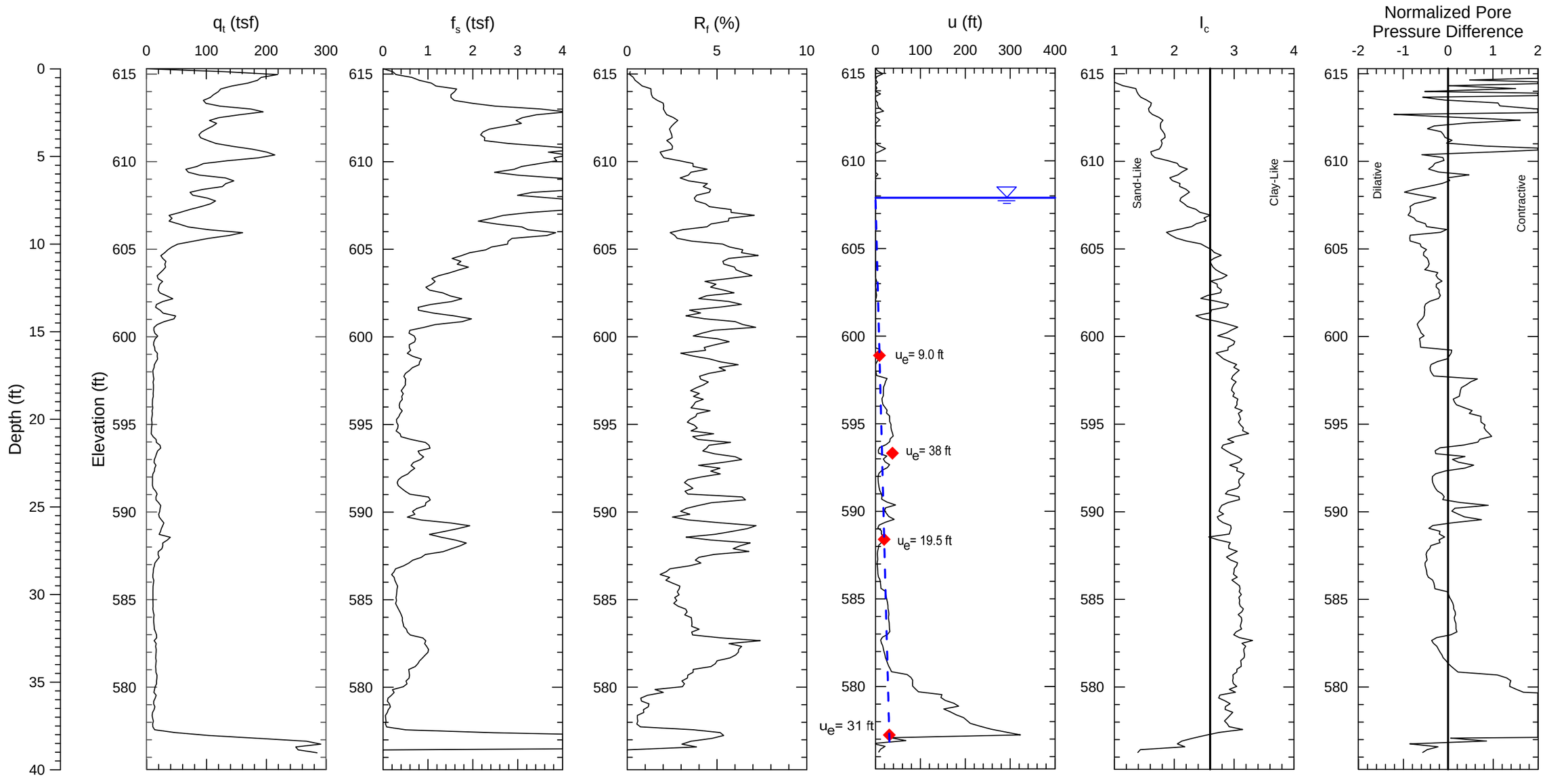
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C011 Kincaid Ash Pond	FIGURE
AECOM			



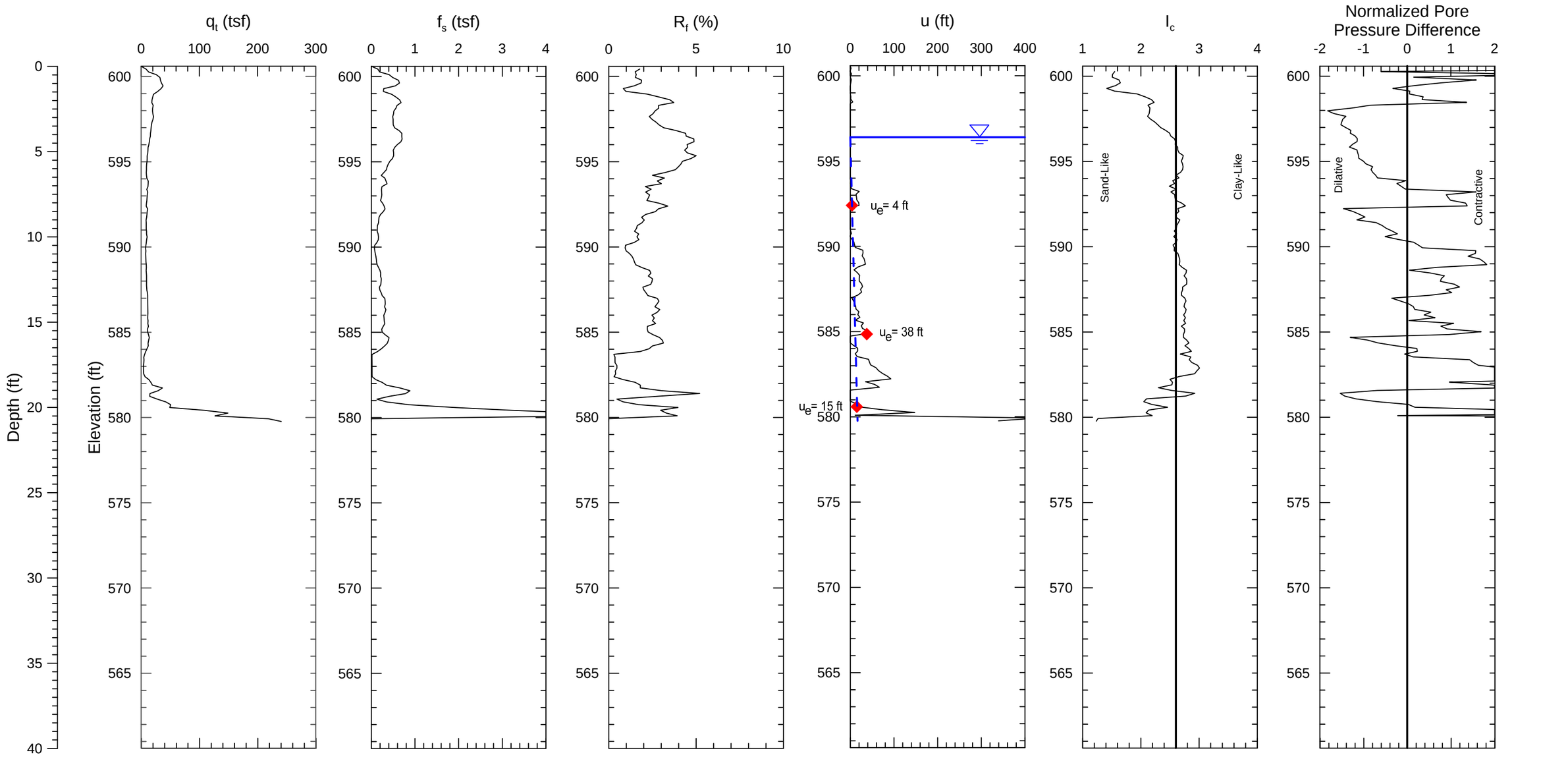
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C012 Kincaid Ash Pond	FIGURE
AECOM			



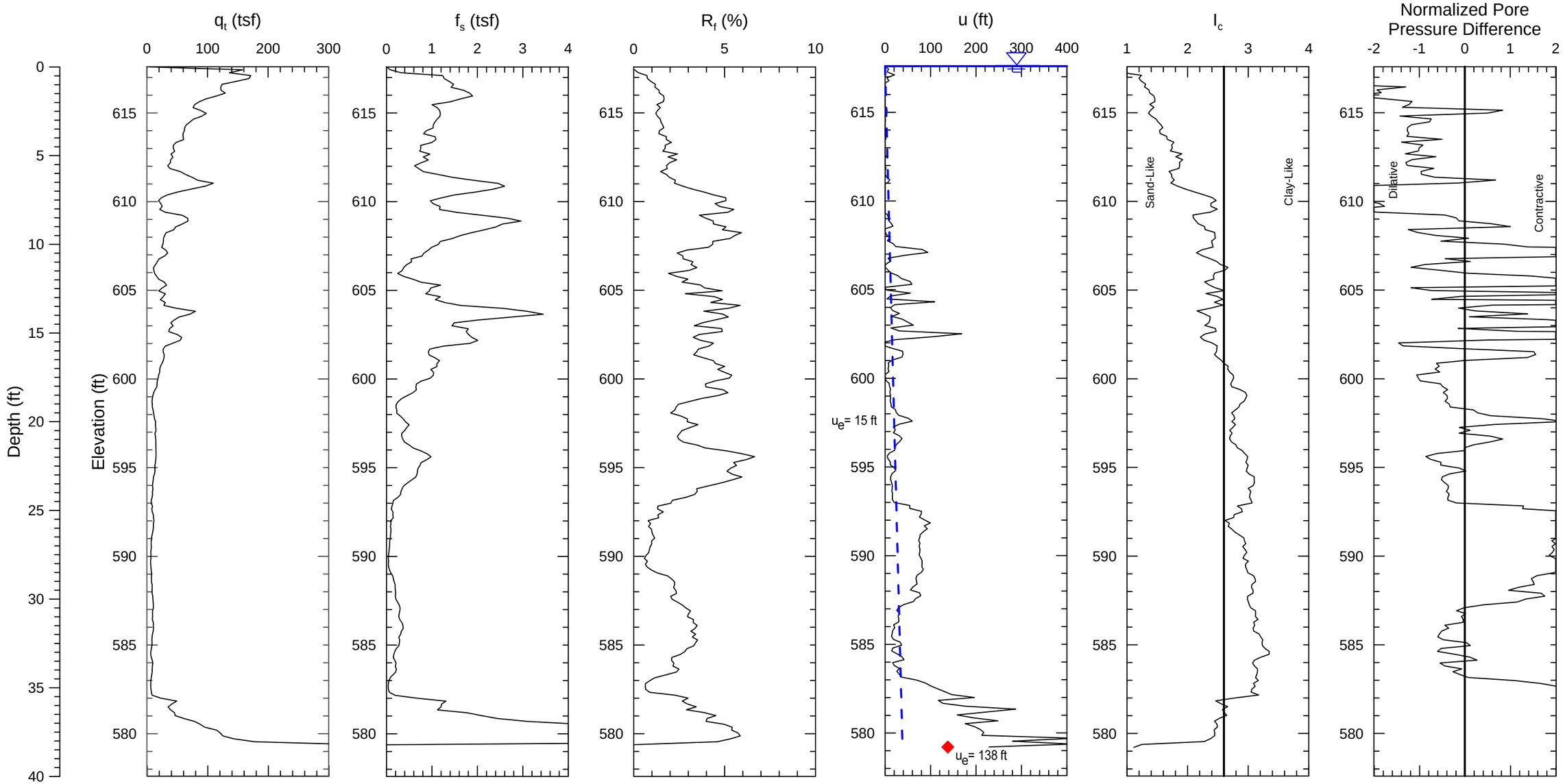
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C013 Kincaid Ash Pond	FIGURE
AECOM			



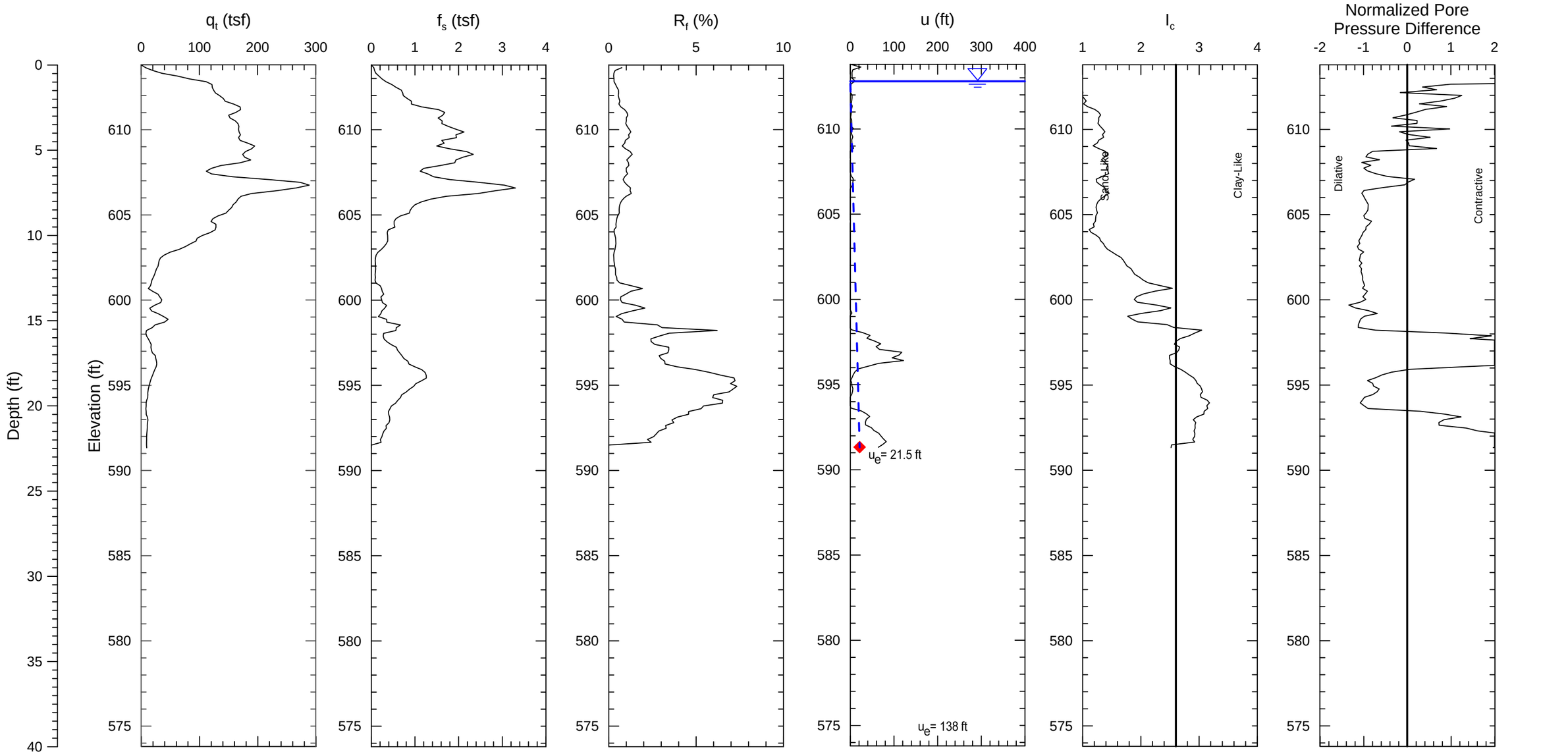
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C014 Kincaid Ash Pond	FIGURE
AECOM			



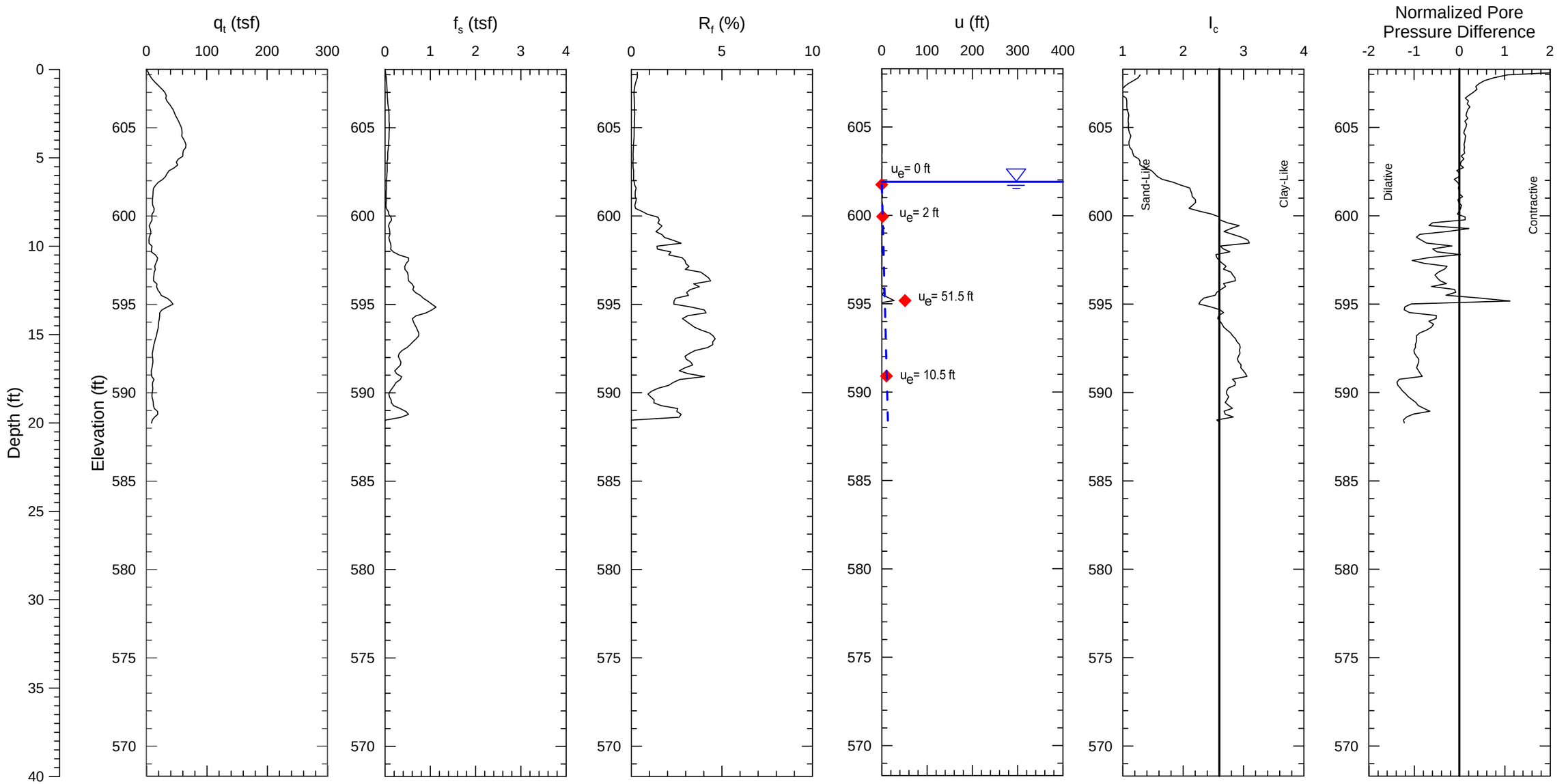
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C015 Kincaid Ash Pond	FIGURE
AECOM			



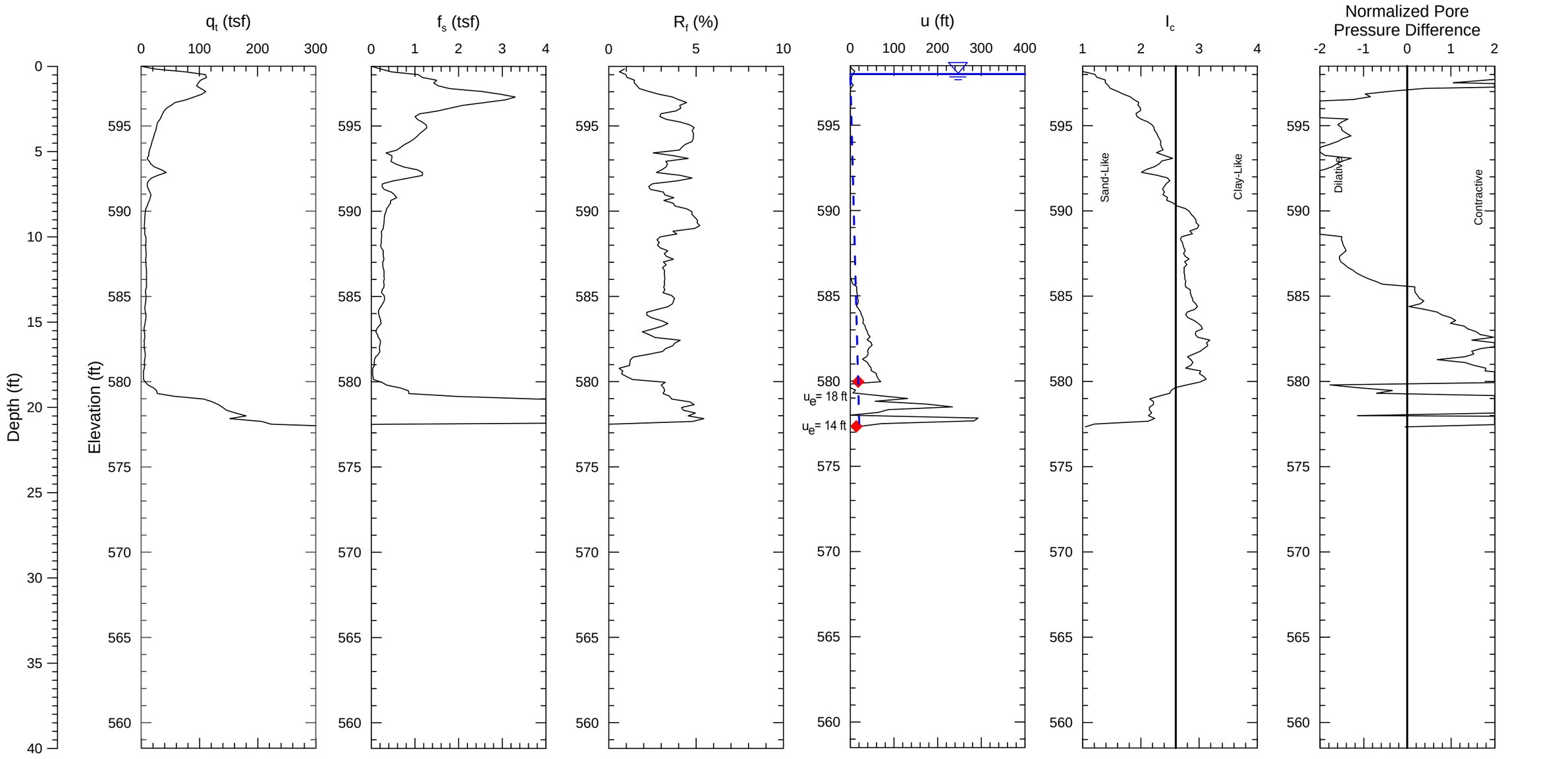
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C016 Kincaid Ash Pond	FIGURE
AECOM			



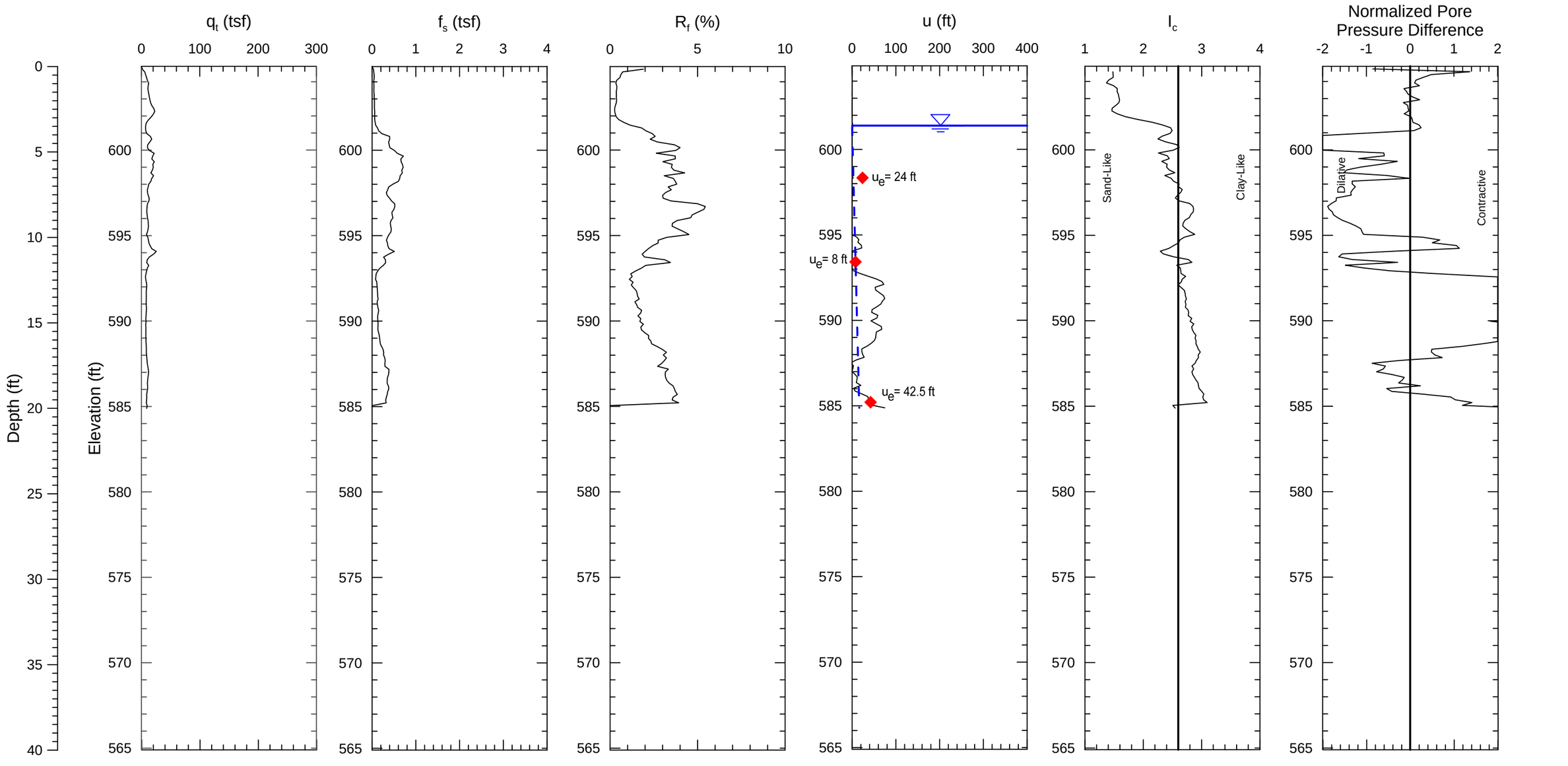
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C017 Kincaid Ash Pond	FIGURE
AECOM			



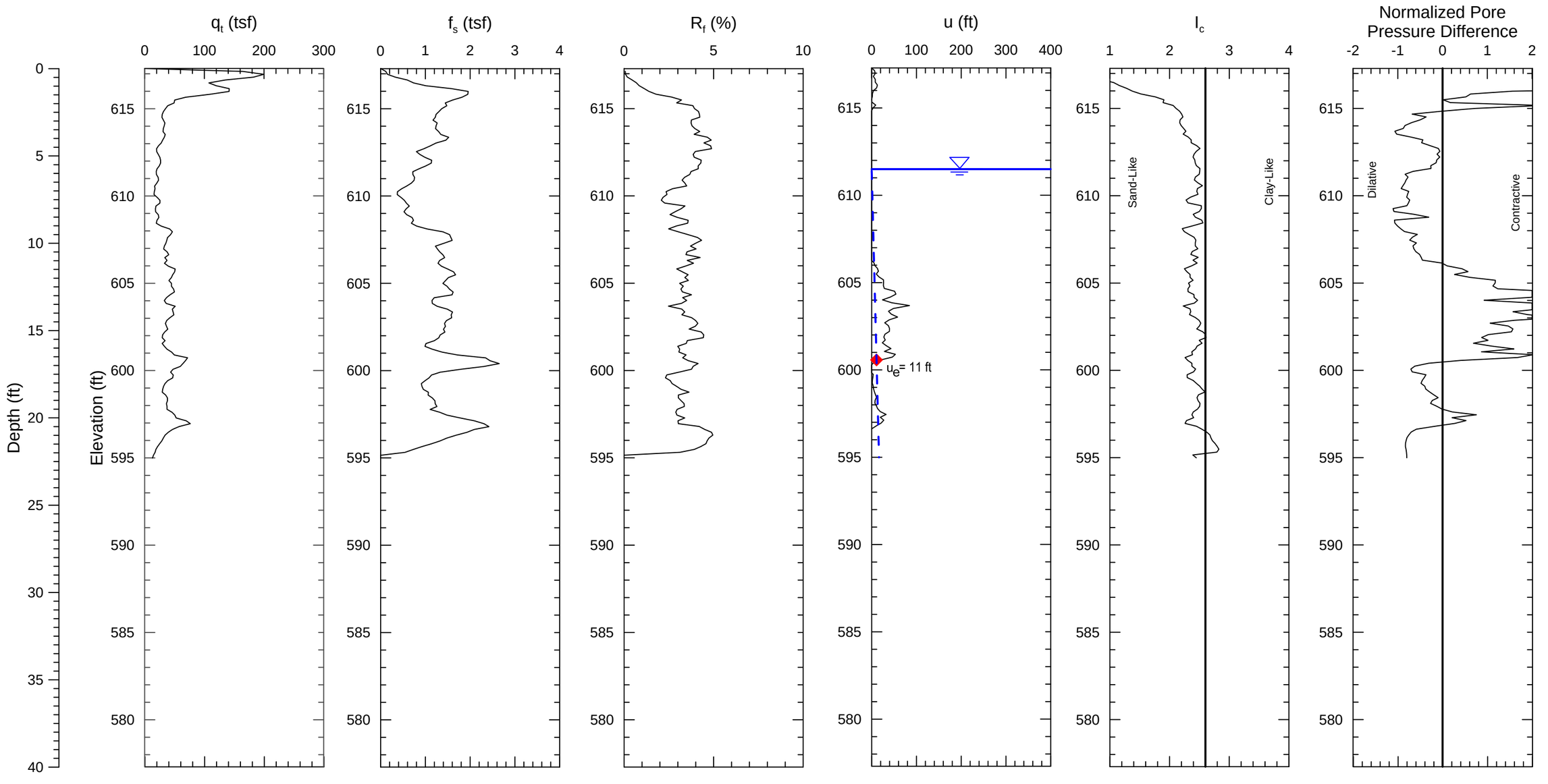
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C018 Kincaid Ash Pond	FIGURE
AECOM			



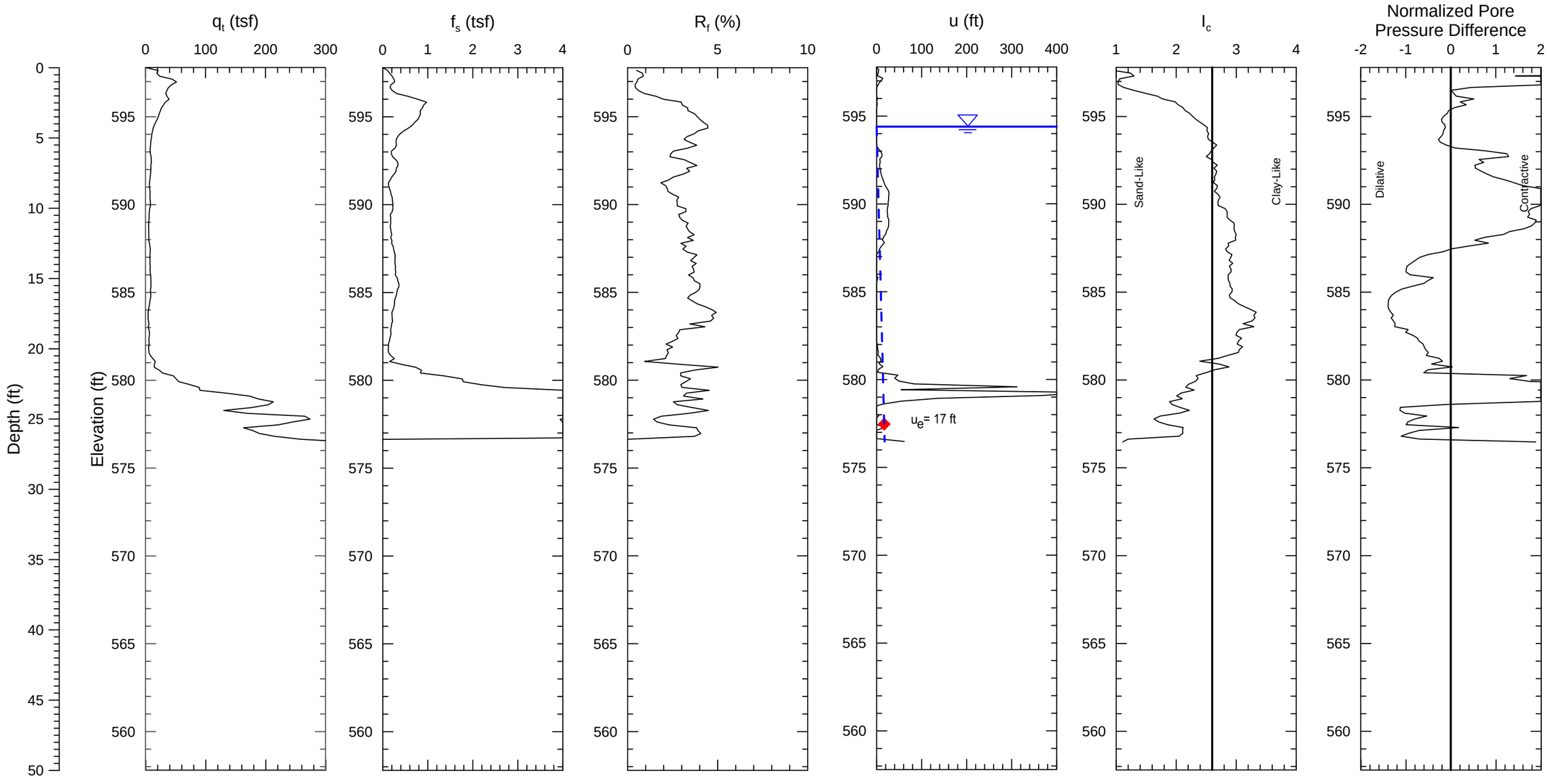
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C019 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C020 Kincaid Ash Pond	FIGURE
AECOM			



Pore Pressure Dissipation Test

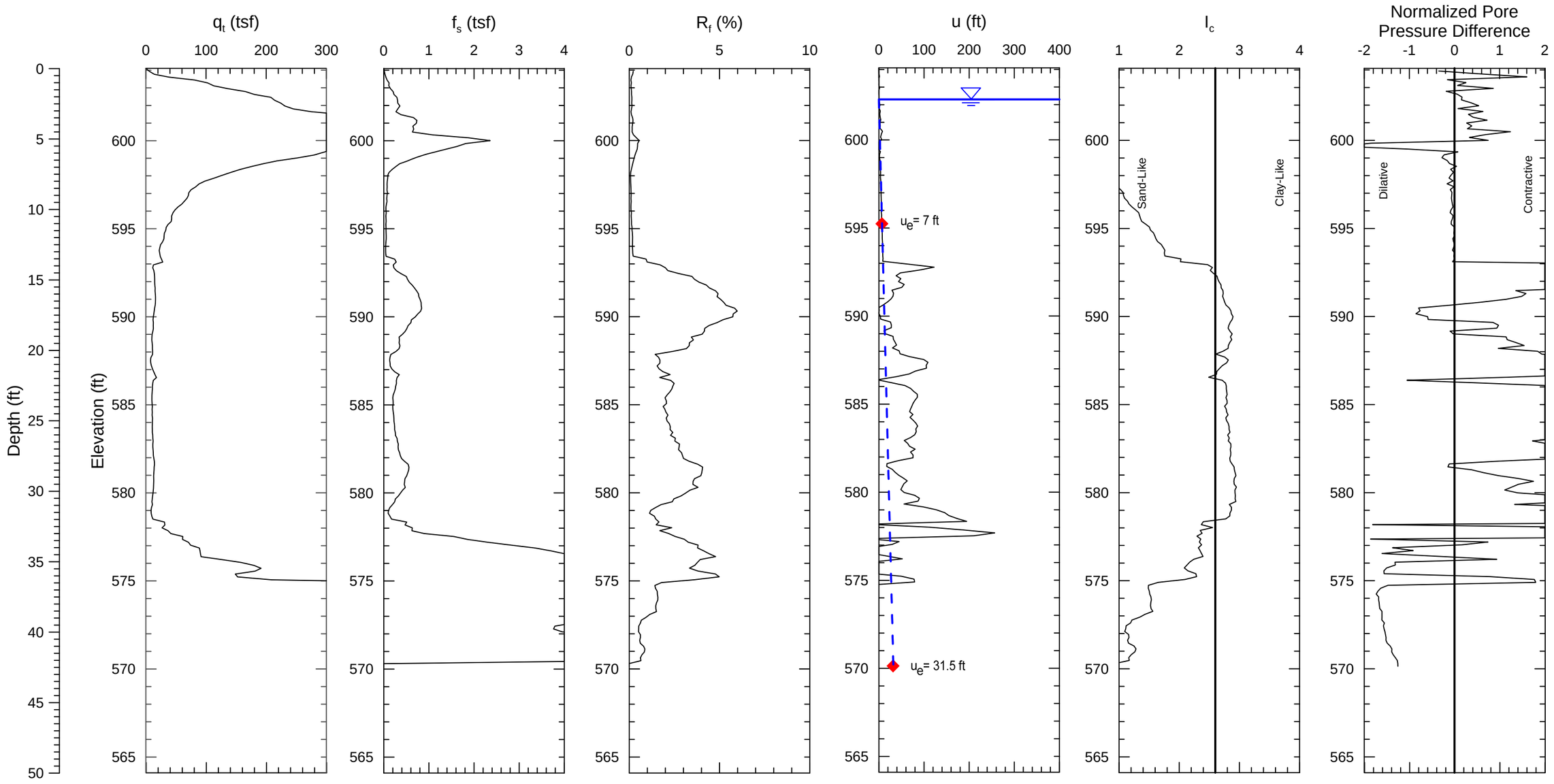
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

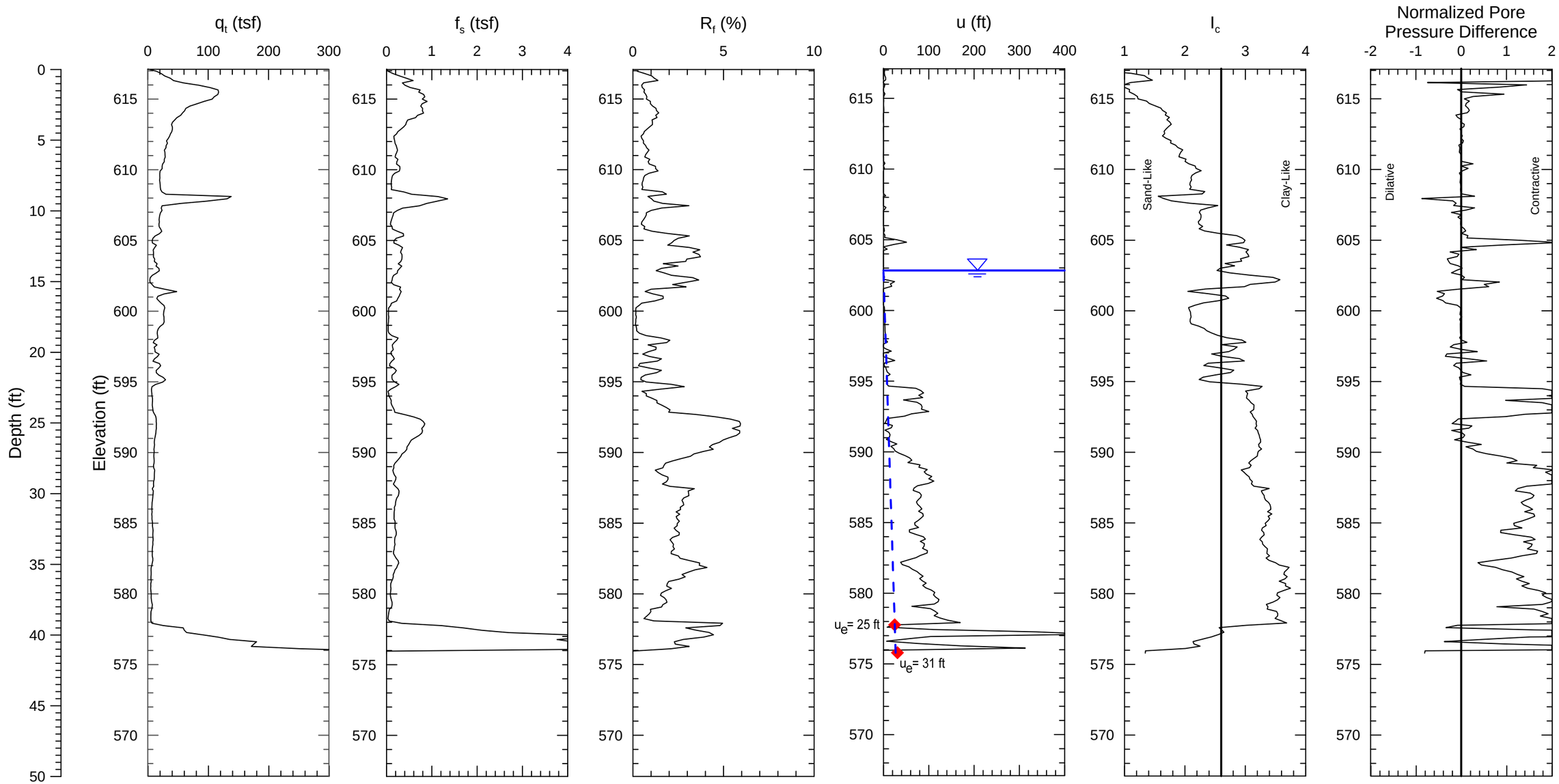
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C021 Kincaid Ash Pond	FIGURE
AECOM			



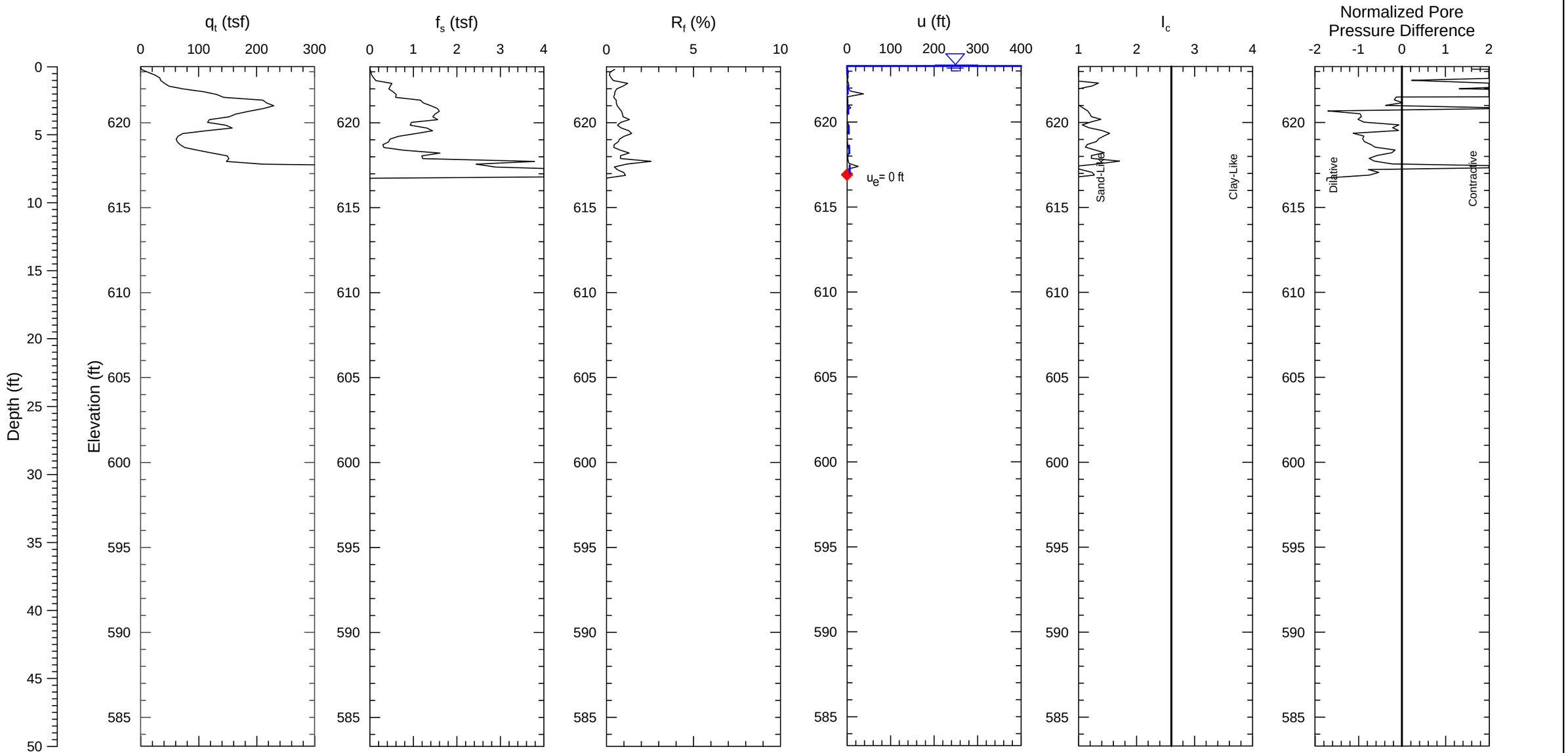
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C022 Kincaid Ash Pond	FIGURE
AECOM			



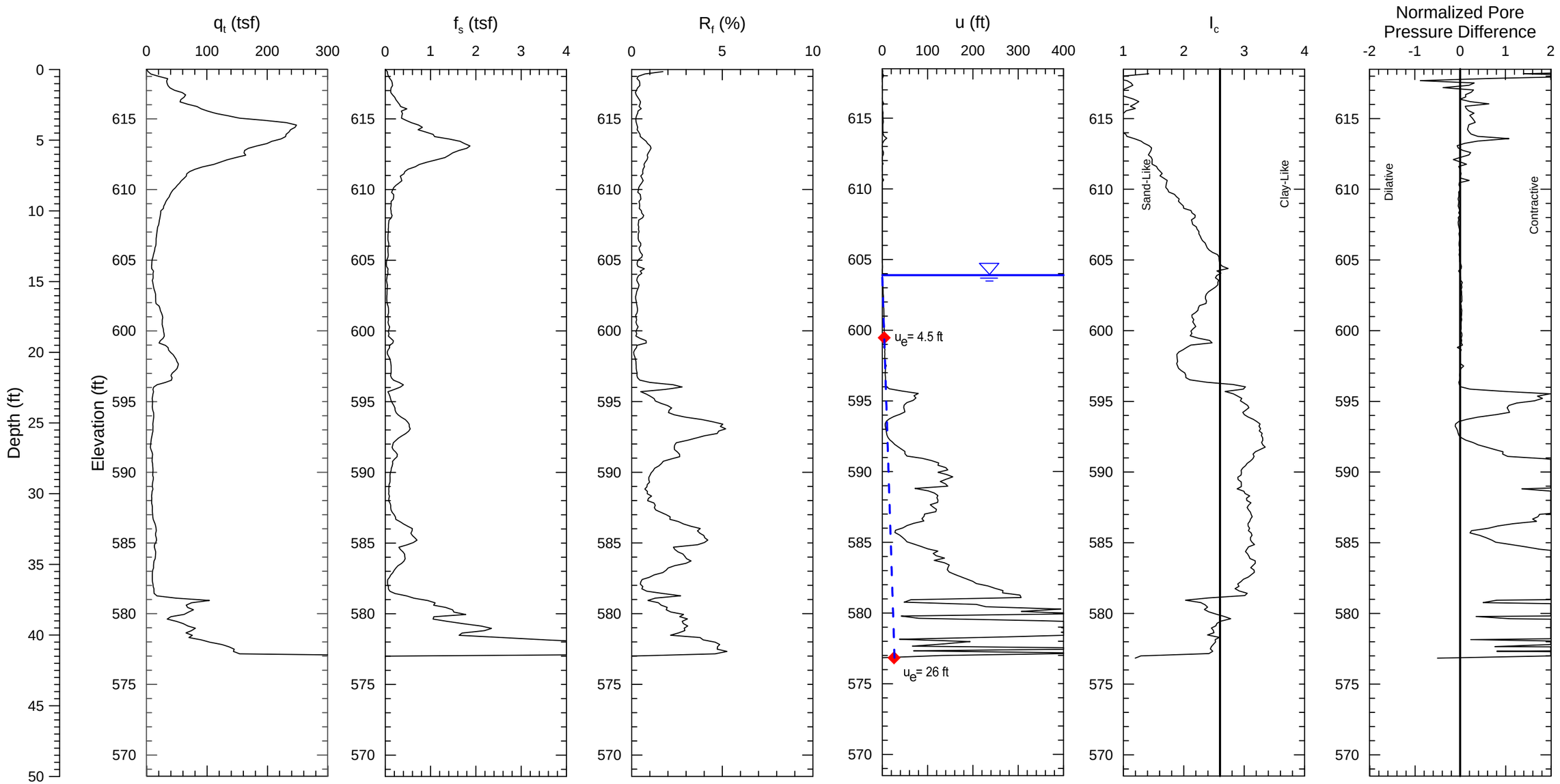
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C023 Kincaid Ash Pond	FIGURE
AECOM			



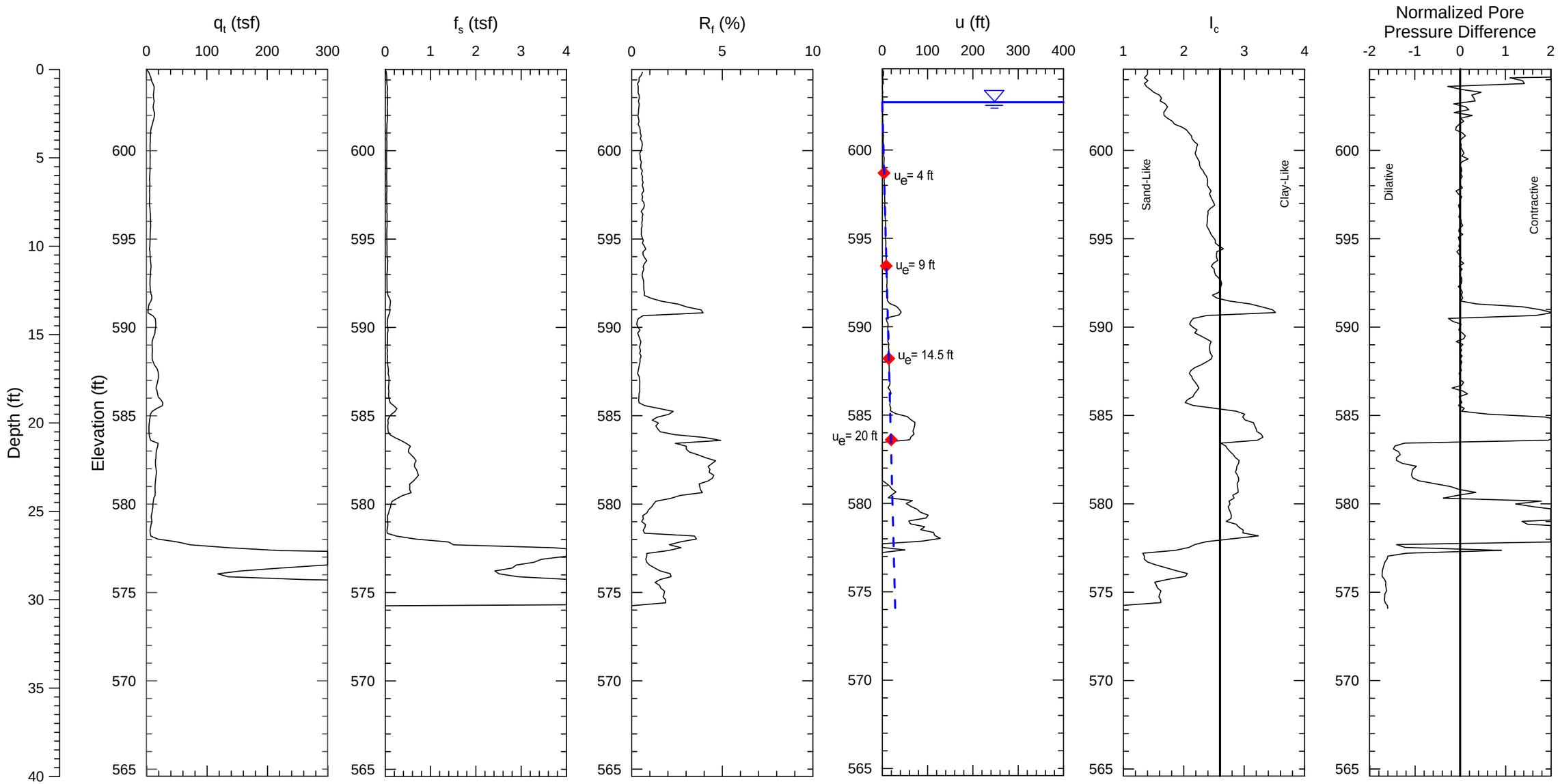
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C024 Kincaid Ash Pond	FIGURE
AECOM			



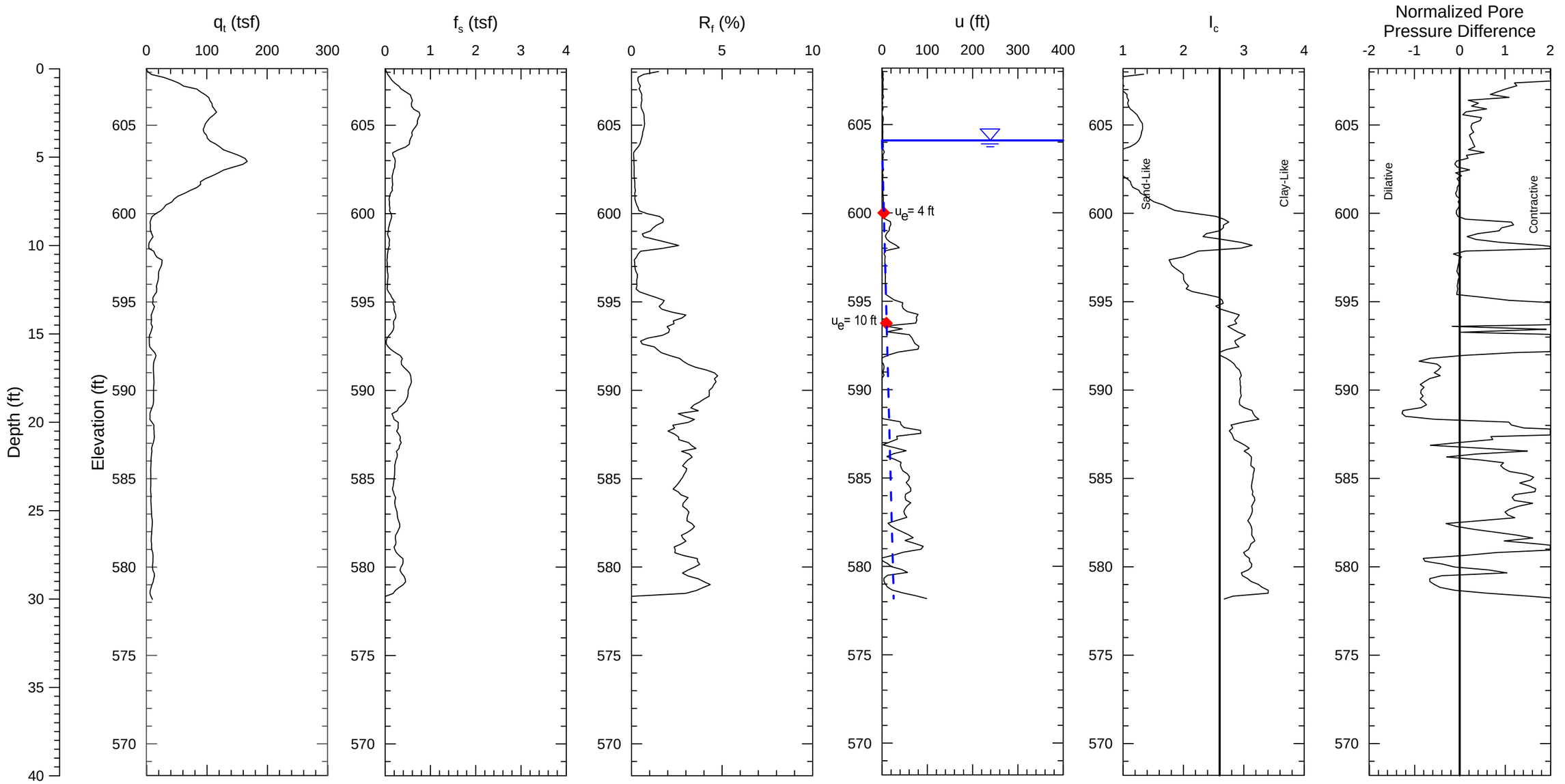
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C025 Kincaid Ash Pond	FIGURE
AECOM			



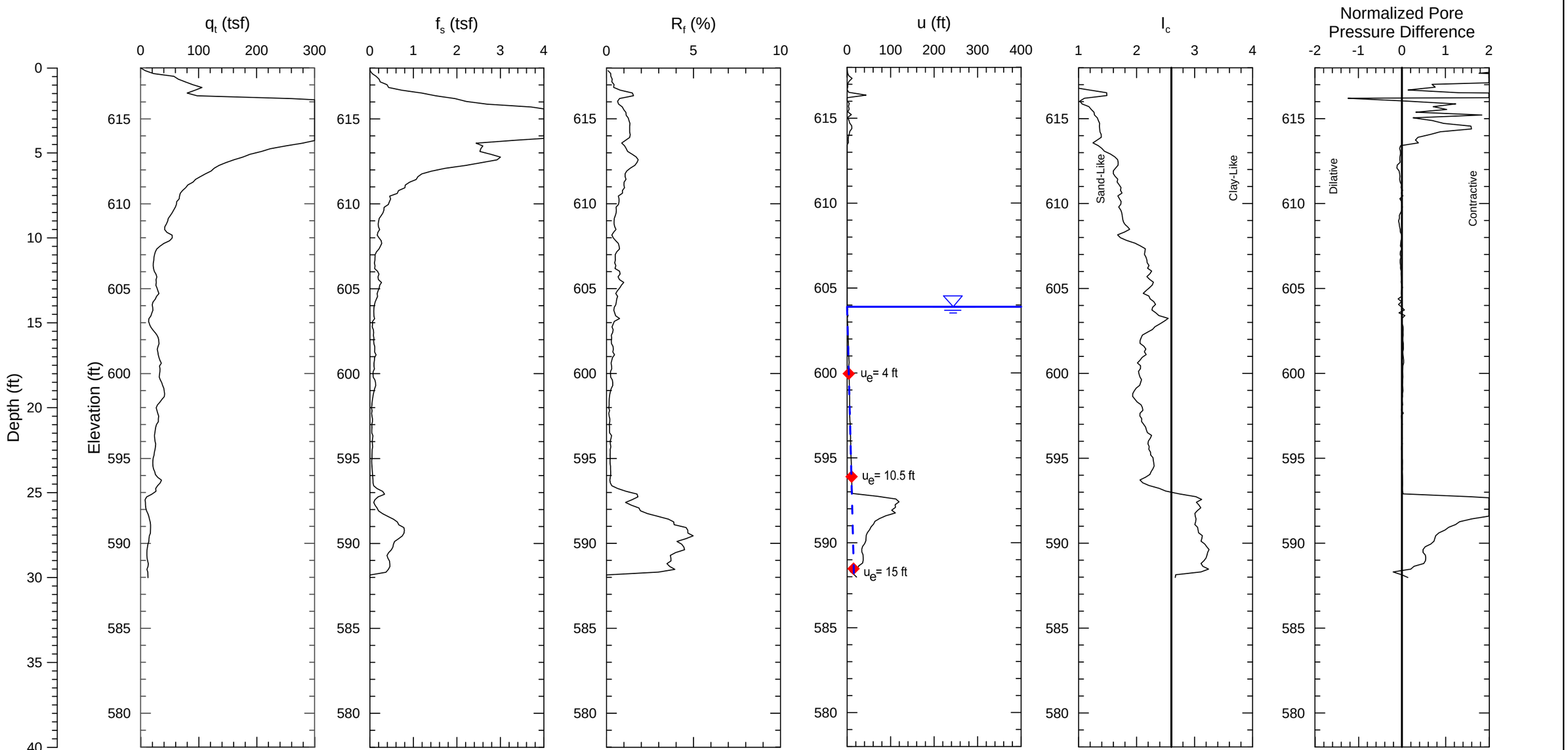
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C026 Kincaid Ash Pond	FIGURE
AECOM			



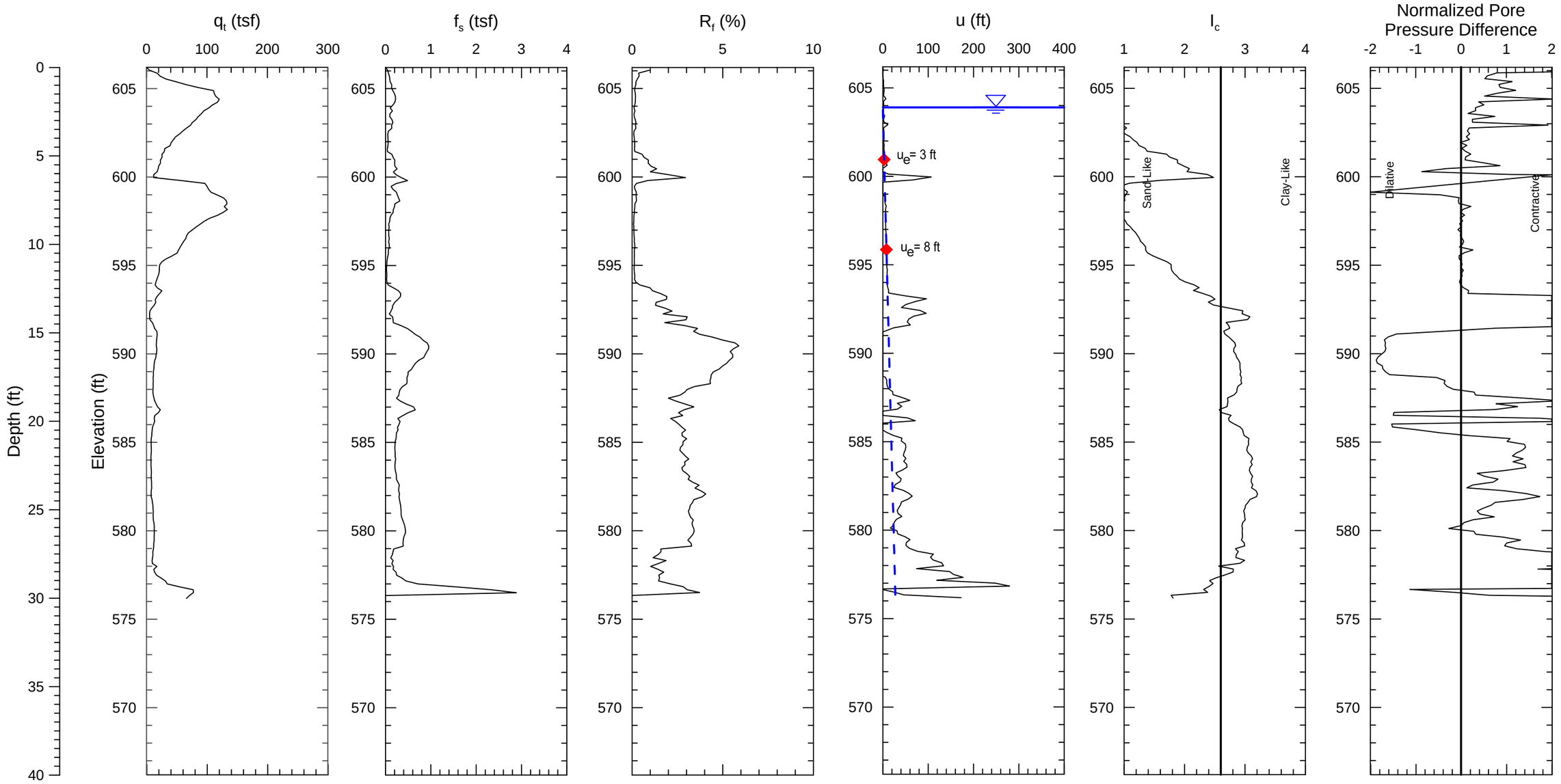
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C027 Kincaid Ash Pond	FIGURE
AECOM			



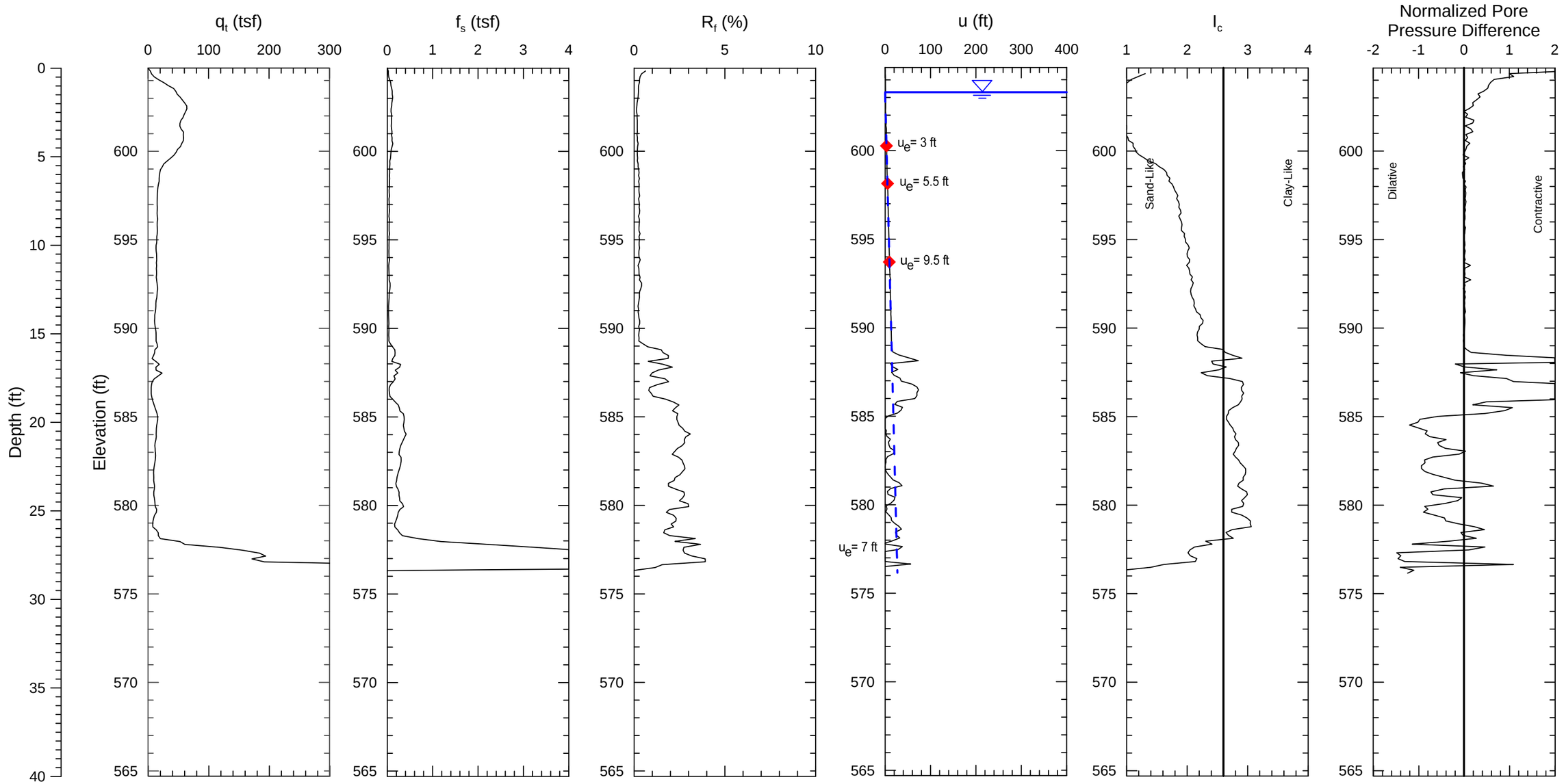
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C028 Kincaid Ash Pond	FIGURE
AECOM			



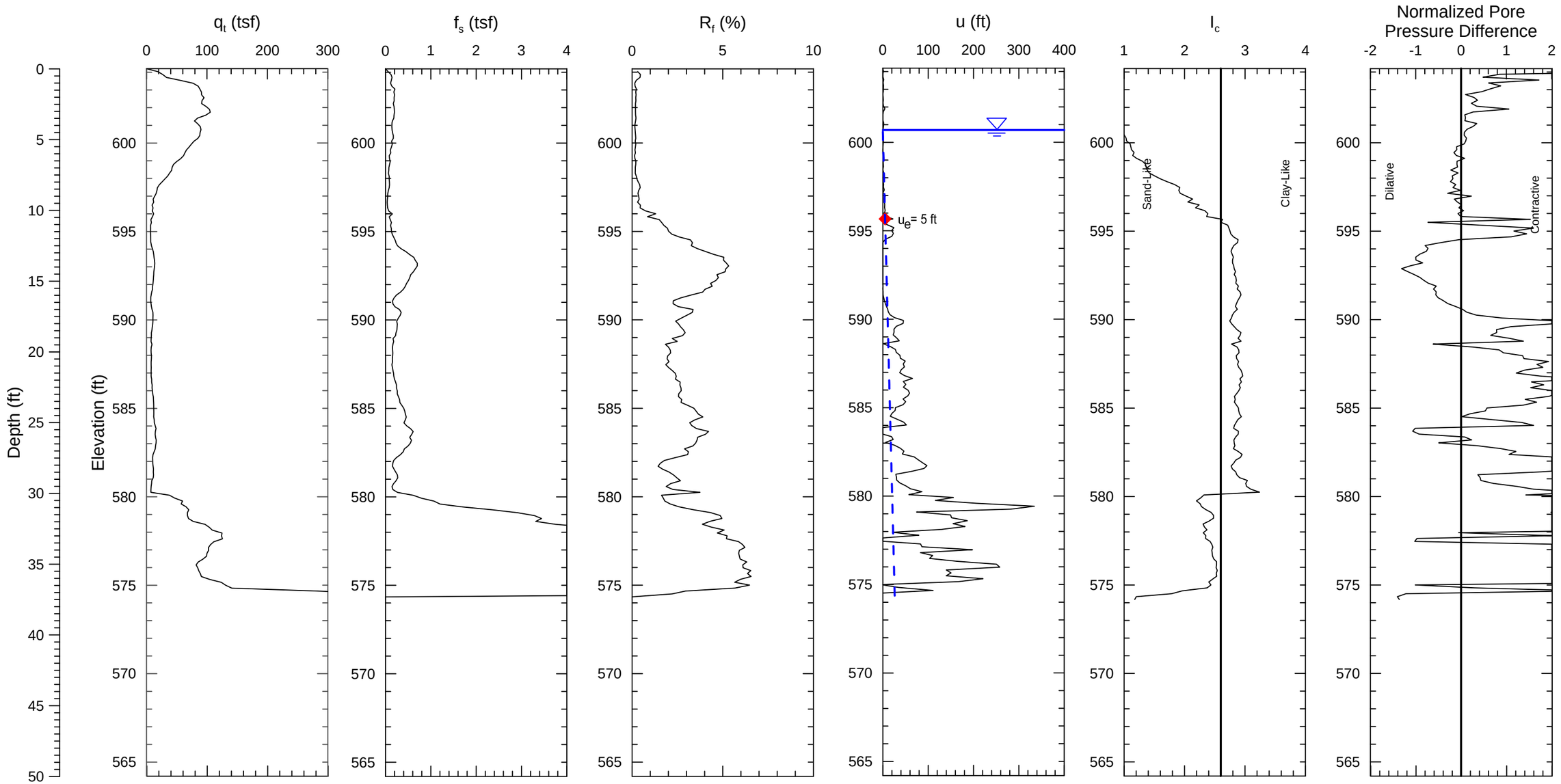
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C029 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C030 Kincaid Ash Pond	FIGURE
AECOM			



Pore Pressure Dissipation Test

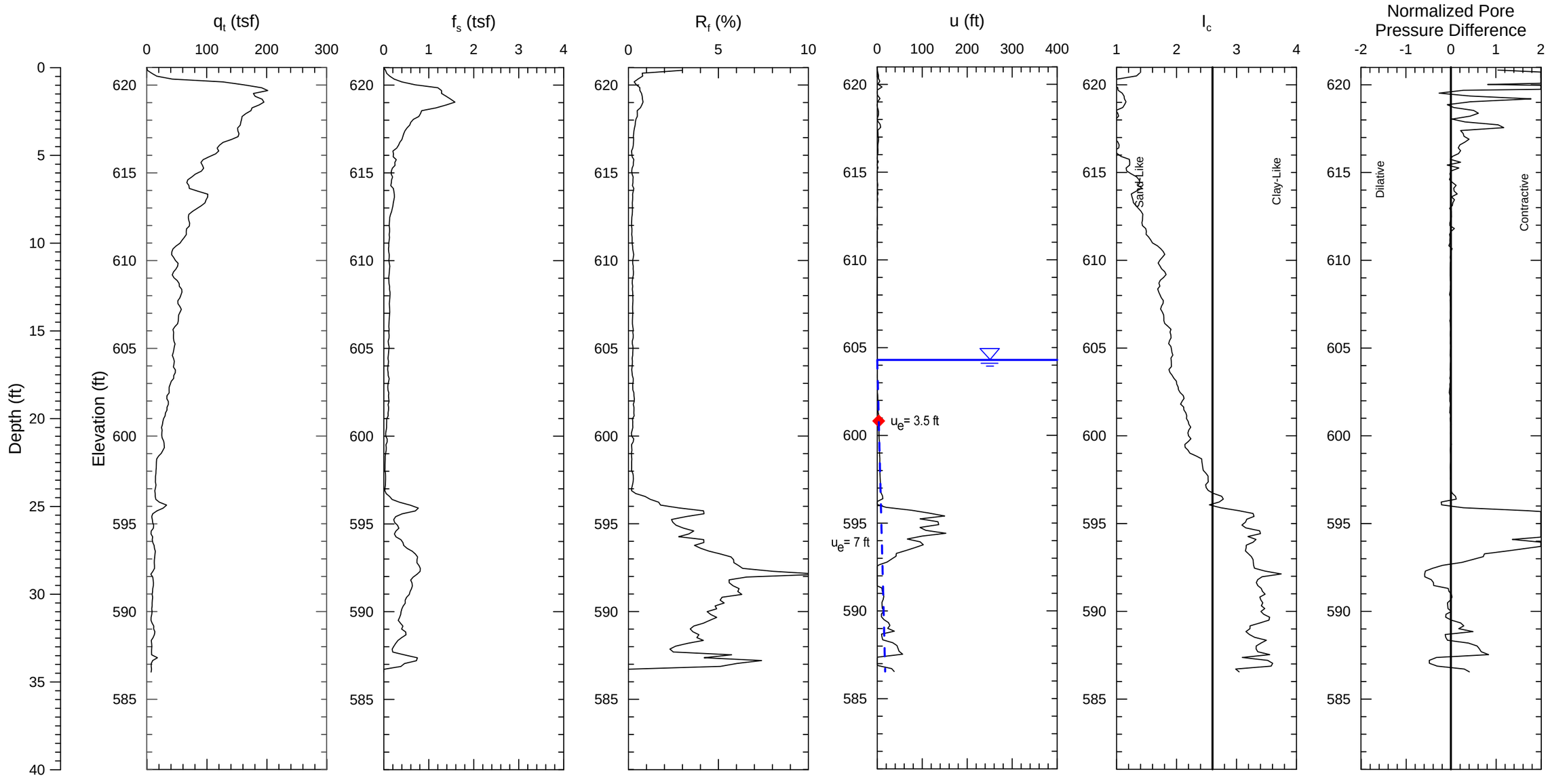
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

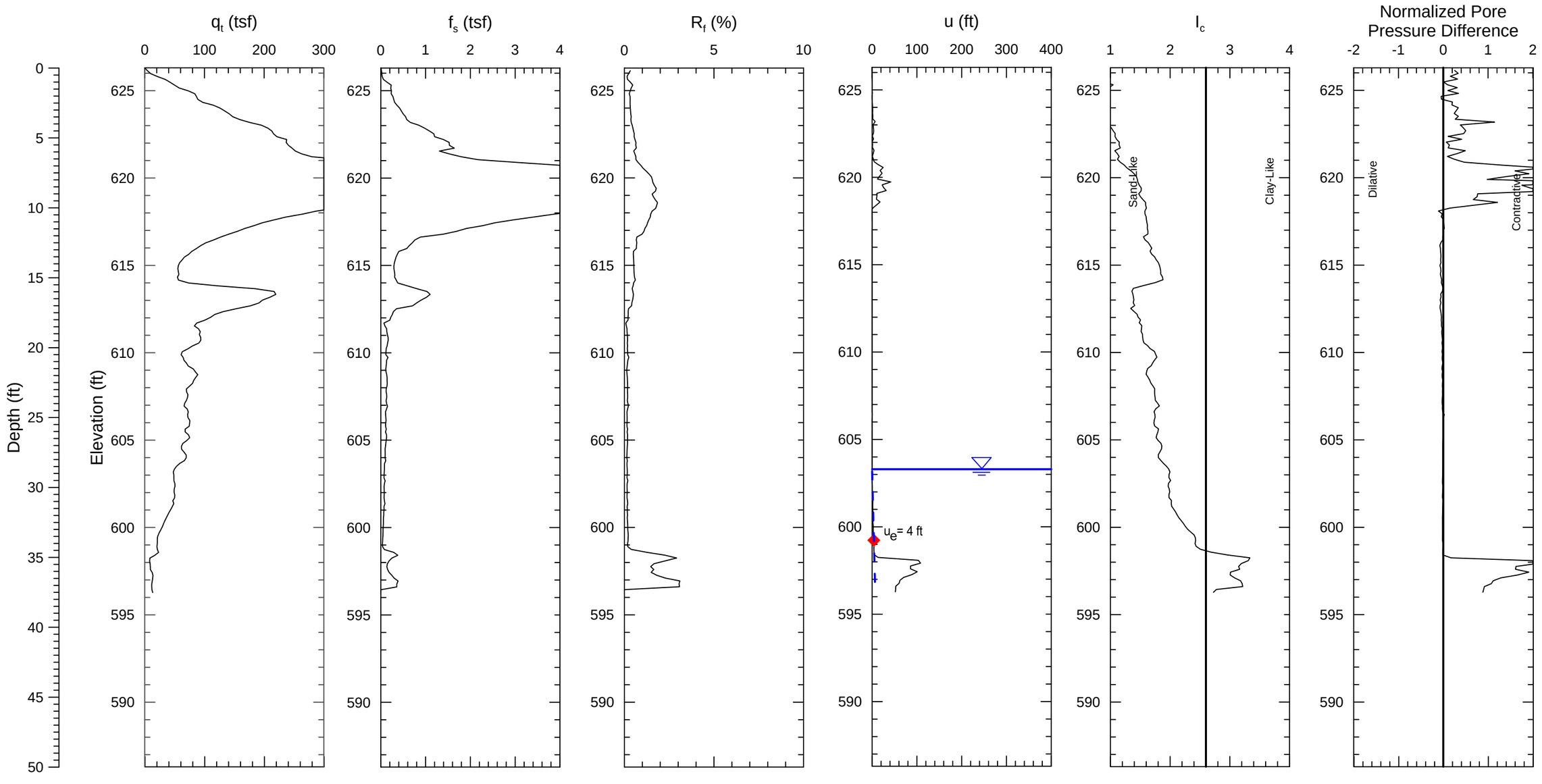
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C031 Kincaid Ash Pond	FIGURE
AECOM			



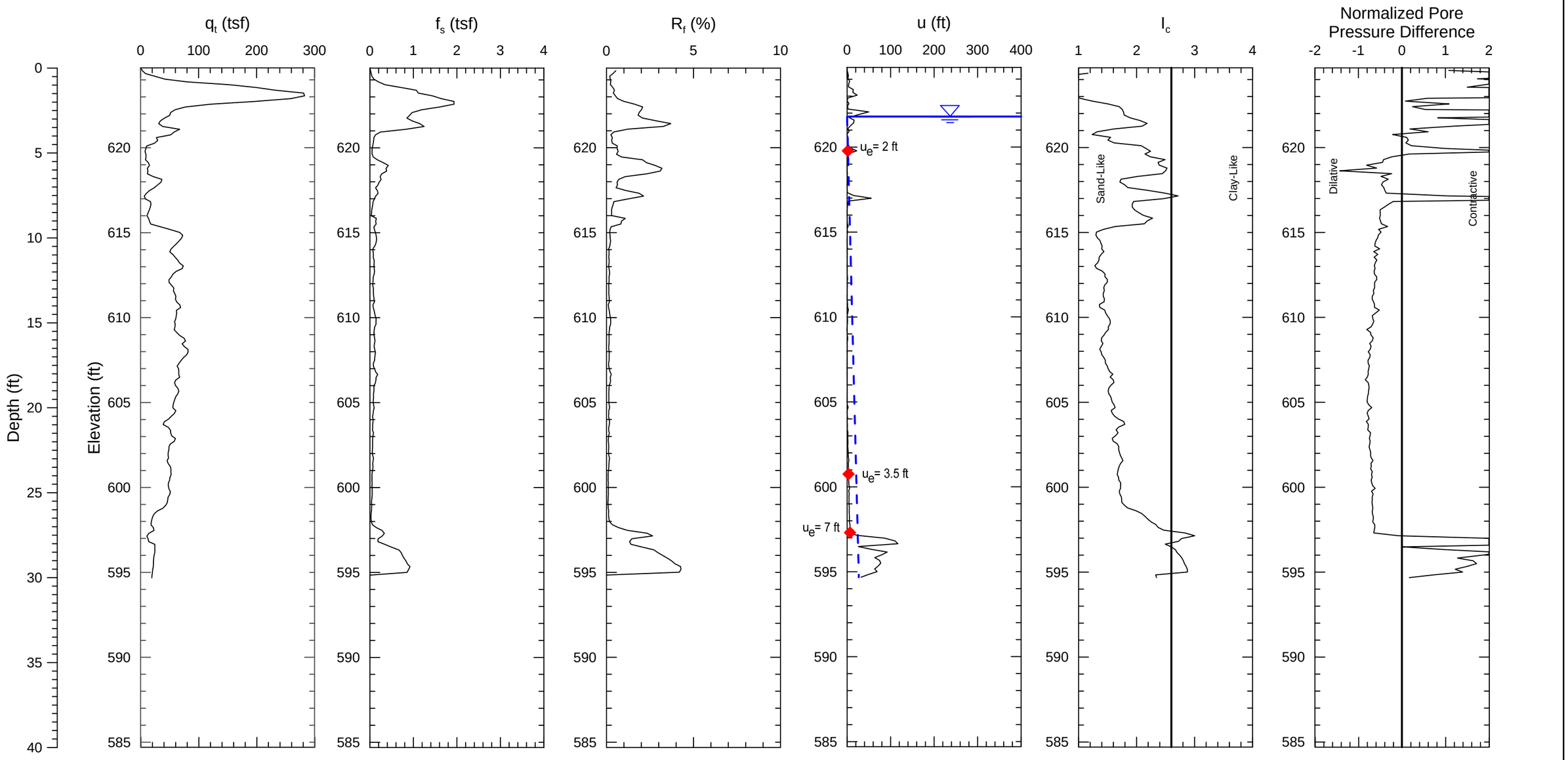
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C032 Kincaid Ash Pond	FIGURE
AECOM			



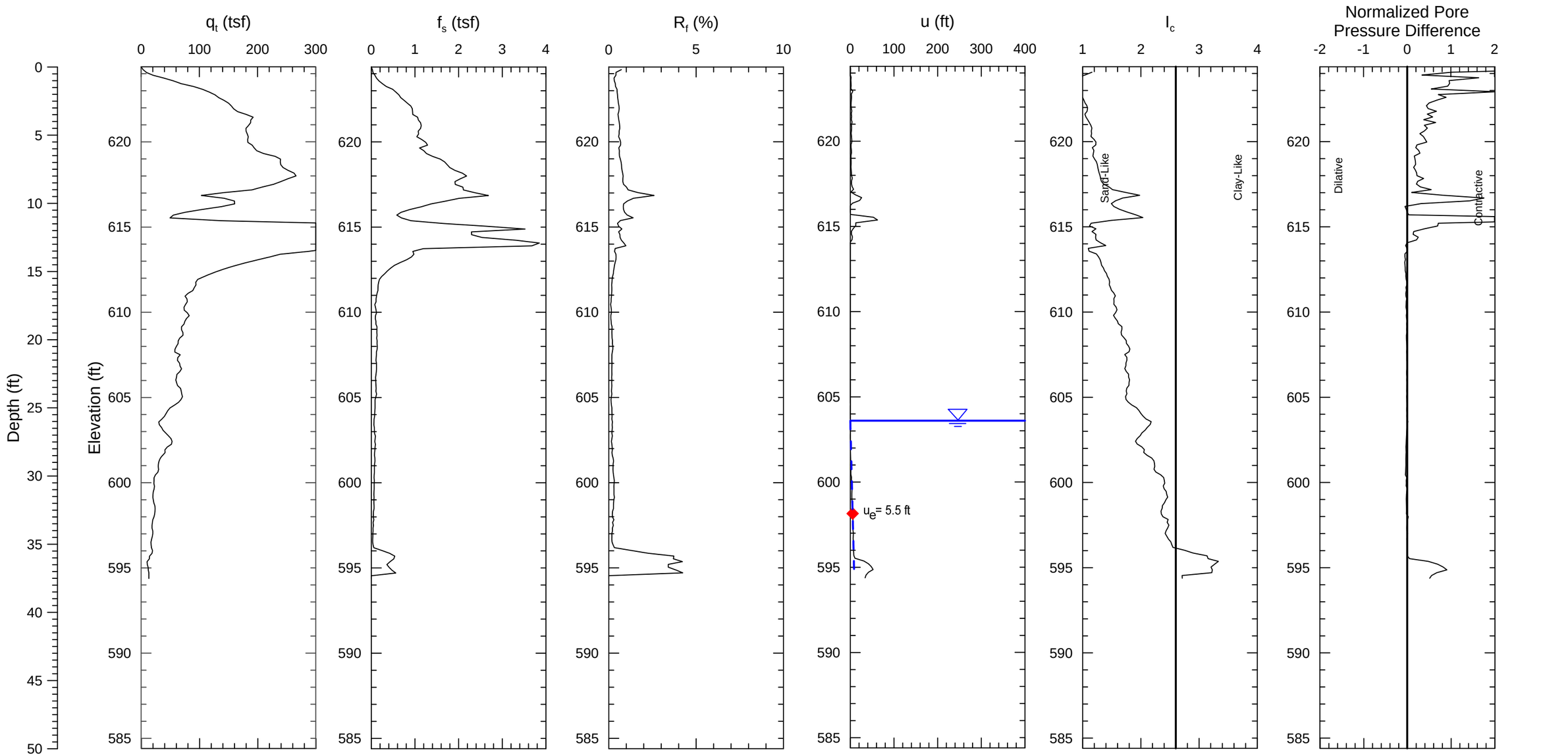
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C033 Kincaid Ash Pond	FIGURE
AECOM			



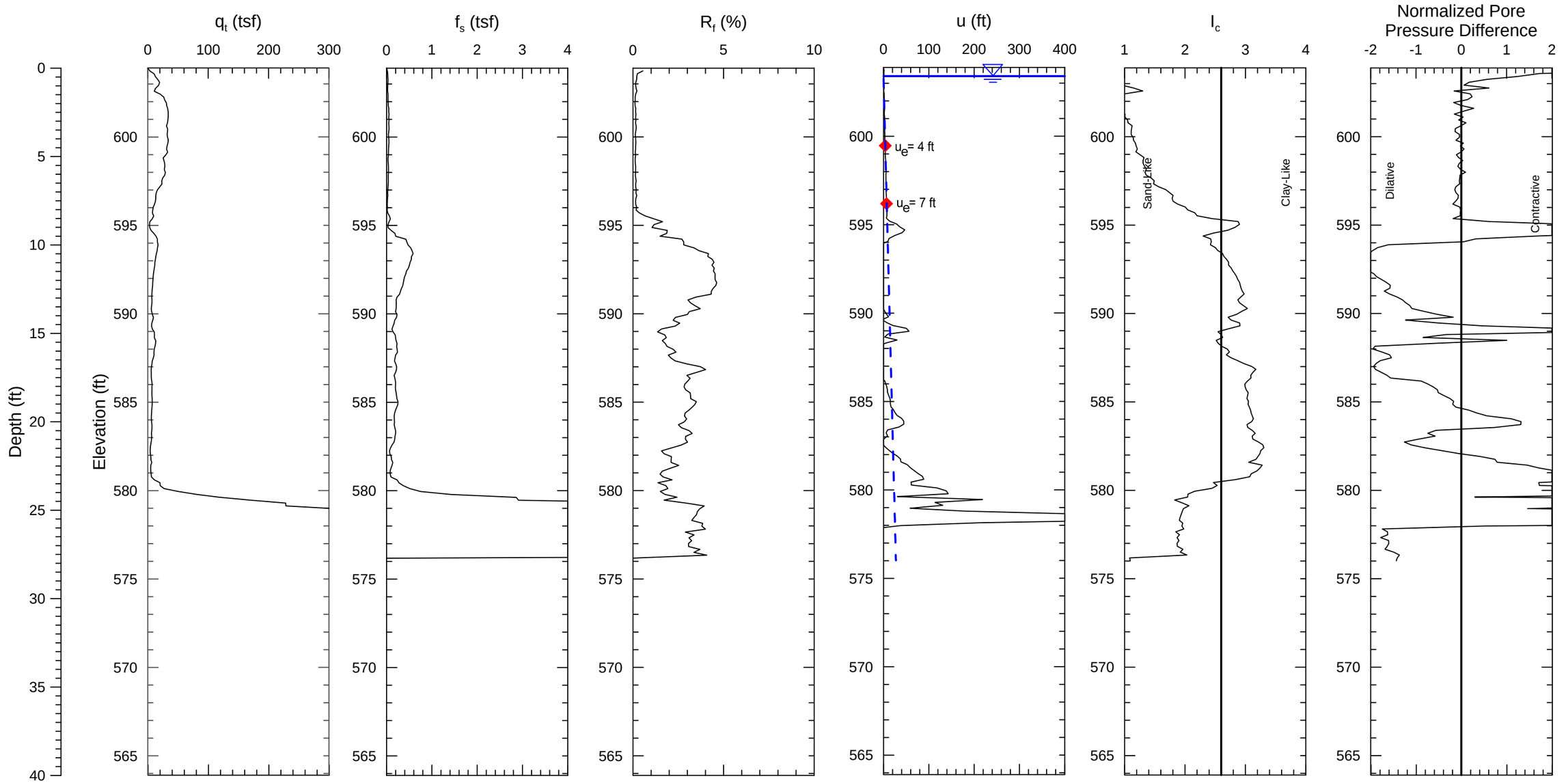
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C034 Kincaid Ash Pond	FIGURE
AECOM			



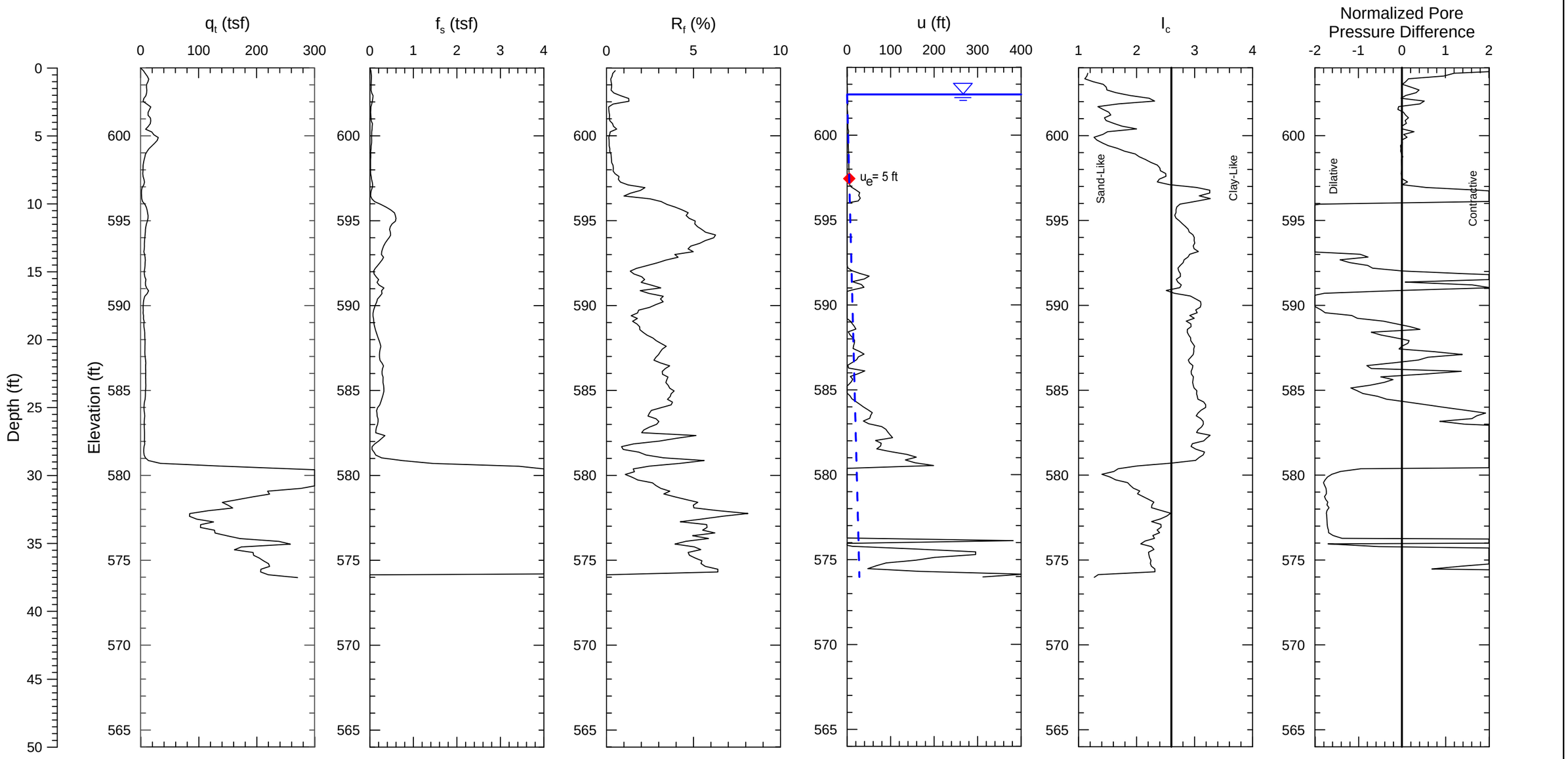
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C035 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C036 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C037 Kincaid Ash Pond	FIGURE
AECOM			

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Date(s) Drilled	08/14/2015 8:20 AM to 08/14/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	599.204 ft NAVD 88
Borehole Backfill	Piezometer KIN-P001	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066425.165 E 2487814.897 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 599.2 / Depth (feet) 0.0								
			S1	6 6 7	100		Medium dense, brown and gray, low plasticity, CLAY with fine to medium sand, trace fine gravel, with topsoil and roots, (CL) (EMBANKMENT FILL)	11.8				3.0			
595			S2	6 6 6	0										*Rock blocked S2.*
	5						593.2 / 6.0								
			S3	4 5 7	83		Stiff, moist, brown, low plasticity, CLAY with sand, with topsoil, (CL) (EMBANKMENT FILL)	20.8		39	16	4.0			
590			S4	2 2 3	0										
	10						587.2 / 12.0								
			S5				Stiff, gray, low plasticity, silty CLAY, (CL) with reddish brown silt seams, trace fine sand								
585			S6		0										
	15		S7												
							581.2 / 18.0								
			S8	12 24 32	100		Hard, very moist, brown and gray, low plasticity, sandy silty CLAY with orange brown silt seams, trace fine gravel, (CL) (TILL)	8.9		23	8	> 4.5			*Shelby tube refusal at 18 ft.*
580	20														
575							Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
	25		S9	26 50 / 5"	67			8.9				> 4.5			
570			S10	27 41 50 / 4 "	59		Hard, wet, gray, low plasticity, sandy CLAY (CL) (TILL)	10.8				4.5			*Installed Piezometer KIN - P001 in boring.*
	30						569.2 / 30.0								

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:26:12 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					End of Boring at 30 ft								
565	35													
560	40													
555	45													
550	50													
545	55													
540	60													
535	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:26:12 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Date(s) Drilled	08/12/2015 9:00 AM to 08/13/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	605.234 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P002 5 ft East of KIN-B002)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066464.224 E 2487797.168 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
605	0						605.2 / 0.0								
							Moist, light gray, sandy GRAVEL, trace silt, (GM) (FILL)								
							604.2 / 1.0								
		S	S1	3 5 5	78		Stiff, moist, brown and gray, low plasticity, CLAY, trace sand and gravel with topsoil and roots, (CL) (EMBANKEMENT FILL)	18.1				3.5			
		S	S2		71			19.0	130.7	38	21				
600	5														
		S	S3	2 5 6	100		Stiff, moist, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	13.9				3.5			
							597.2 / 8.0								
		S	S4	2 3 4	94		Medium stiff, moist, dark gray, medium plasticity, CLAY with topsoil, (CL)	28.4		48	26	0.5			*Organic content 5.9%.*
595	10														
		S	S5	2 2 2	100		Soft, wet, brown and gray, medium plasticity, CLAY, (CL)	26.2				1.5			
590	15														
		S	S6		100		Gray and yellowish brown, trace dark gray, medium plasticity, CLAY, trace sand and gravel, (CL)	27.5	121.4	41	24				
		S	S7	WOH 2 2	100		Soft, very wet, brown and gray, medium plasticity, CLAY, trace fine sand, (CL)	27.1				0.5			
585	20														
							582.2 / 23.0								
		S	S8	12 23 41	78		Hard, very moist to wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	12.6	153.0	22	8	> 4.5			*Shelby tube refusal at 23' bgs. No recovery.*
580	25														
		S	S9	30 41 50 / 5"	94		Hard, wet, gray, low plasticity, sandy CLAY, (CL) (TILL)	8.4				> 4.5			
	30														

AECOM

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:32:24 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
575	30													
														8/12/15
570	35	S10	16 41 50 / 3"	78		Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	8.9				> 4.5			*Rig needs to be repaired at site, work stopped 12 N.*
														8/13/15
		S11	10 32 50	89			8.8				> 4.5			*Work continued on hole at 9:45 a.m.*
565	40													
														Switch to Rotary drilling.
		S12	27 27 34	100		Hard, very wet, brown and gray, low plasticity, sandy CLAY, (CL) (TILL)	11.9				> 4.5			
560	45													
		S13	17 23 29			Hard, wet, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
555	50					555.2 / 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P002 with 5 ft offset to the East. Coordinates shown are for Boring KIN-B002.*
550	55													
545	60													
	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:32:24 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Sheet 1 of 2

Date(s) Drilled	08/14/2015 1:20 PM to 08/15/2015 3:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	624.454 ft NAVD 88
Borehole Backfill	Piezometer KIN-P003	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066902.847 E 2485599.511 (ft NAD83)	Groundwater Level(s)	29 ft on 8/14/2015 1:20:00 PM		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 624.5 / Depth (feet) 0.0								
		S	S1	4 4 5	94		Stiff, brown and gray, low plasticity, CLAY with fine to coarse sand, trace fine gravel with roots and topsoil, (CL) (EMBANKMENT FILL)	11.6				> 4.5			
620	5	S	S2	3 4 10	94		Stiff, brown and gray, low plasticity, CLAY with fine to medium sand, trace fine gravel, (CL) (EMBANKMENT FILL)	15.5				> 4.5			
		S	S3	3 4 7	100			16.4				> 4.5			
615	10	S	S4	3 5 7	72		Stiff, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.5				3.0			
610	15	S	S5	3 4 5	100		Stiff, moist, brown and gray, low plasticity, CLAY, trace fine to medium sand, (CL) (EMBANKMENT FILL)	18.0				1.5			
							Elevation (feet) 606.0 / Depth (feet) 18.5								
605	20	S	S6	3 5 7	100		Stiff, moist, brown and gray, high plasticity, CLAY, trace fine to medium sand, (CH) (EMBANKMENT FILL)	23.9	144.2	54	34	2.0			
							Elevation (feet) 602.5 / Depth (feet) 22.0								
		S	S7		100		Moist, dark grayish brown with gray and olive, trace yellowish brown, medium plasticity, CLAY with sand, with organics (CL)	21.4	125.6	47	27				
600	25	S	S8		92		Stiff to very stiff, moist, grayish green, low plasticity, sandy CLAY, trace fine gravel with reddish brown silt seams (CL)	18.4	129.9	31	15				
							Elevation (feet) 595.5 / Depth (feet) 29.0								
595	30	S	S9	3 4 4			Medium stiff, wet, brown and gray, low plasticity, CLAY, (CL)	29.7							

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					591.5 / 33.0 Very soft, very wet, brown and gray, low plasticity, CLAY, trace fine sand, with reddish brown silt seams, (CL)								
590		S10	WOH WOH 1	100			25.2		36	17	0.5			
	35	S11		96										
585		S12	WOH 1 3	100		Soft, very wet, brown and gray, medium plasticity, sandy CLAY (CL)	26.0		41	23	0.5			
	40					583.5 / 41.0 Hard, gray, medium plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
580		S13	7 16 46	100			9.2				> 4.5			
	45													
575		S14	19 19 50 / 5"			575.5 / 49.0 Very dense, very wet, brown and gray, silty fine to medium SAND, trace clay and fine gravel (SM) (TILL) 574.5 / 50.0	17.3				2.0			
	50					End of Boring at 50 ft								*Installed Piezometer KIN-P003 in boring.*
570														
	55													
565														
	60													
560														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Sheet 1 of 2

Date(s) Drilled	08/18/2015 3:50 PM to 08/19/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.345 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout Piezometer KIN-P005	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067820.182 E 2484976.546 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 621.3 / Depth (feet) 0.0								
620	0	S1		9 9 9	72		Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.1				> 4.5			
	5	S2		4 6 10	100		Very stiff, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	12.1		31	16	> 4.5			
615		S3		4 3 4	61		Medium stiff, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.8							
	10	S4		2 2 3	67		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel with reddish brown silt seams (CL) (EMBANKMENT FILL)	19.3				1.25			
610															*No S5 Sample.*
	15	S6		6 7 7	0										
605		S7			79		Stiff, moist, dark grayish brown with dark yellowish brown, low plasticity, CLAY with sand, with reddish brown silt seams (CL) (EMBANKMENT FILL)	14.6	135.1	29	14				
	20	S8			92		Dark brown and green, low plasticity, CLAY with sand (CL) (EMBANKMENT FILL)	21.6	125.1	32	14				
600							599.3 / 22.0								
		S9		4 9 10	100		Very stiff, moist, brown and gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel, with organics (CL)	19.0				2.5			
	25						596.3 / 25.0 Very stiff, moist, greenish gray, high plasticity, silty CLAY, (CH).								
595															
		S10		2 4 5	100		Stiff, moist, brown and dark brown, high plasticity, CLAY (CH)	29.0		55	33	2.0			
	30						591.3 / 30.0								

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	S11		100		Brown and gray, CLAY (CL)	25.9	126.0						
590														
		S12	WOH 2 3	100		Medium stiff, wet, brown and gray, medium plasticity, CLAY with reddish orange silt seams (CL)	21.2	135.6	42	25	1.0			
	35													
585														
		S13				Brown and gray, medium plasticity, CLAY, trace fine gravel (CL)	21.2	132.8	43	28				
														ST refusal at 39 ft.
	40													
580														
		S14	20 50 / 3"	67		577.3 44.0 Hard, wet, brown and gray, medium plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	9.0				> 4.5			
	45													
575														
		S15	25 30 33			Hard, very moist, brownish gray, medium plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					571.3 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P005 in boring.*
570														
	55													
565														
	60													
560														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Sheet 1 of 3

Date(s) Drilled	08/21/2015 8:00 AM to 08/23/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Mud Rotary / Rock Core	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	85.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	596.38 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P006 5 ft Southeast of KIN-B005)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067774.633 E 2484937.386 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 596.4 / Depth (feet) 0.0								
	0						Stiff, moist, brown and gray with dark brown, low plasticity, CLAY, with fine to coarse sand (CL) (EMBANKMENT FILL)							
595		S1	2 4 6		83			9.8				4.5			
							593.4 / 3.0								
		S2	2 3 4		100		Medium stiff, moist, brown and gray, low plasticity, CLAY with silt seams (CL)	29.2				2.5			
	5						590.4 / 6.0								
590		S3			92		Grayish brown, low plasticity, CLAY, trace sand (CL)	23.9	127.0	35	12	1.5			
		S4			83		Stiff, moist, grayish brown, low plasticity, CLAY with sand, with reddish brown silt seams (CL).	24.2	126.6	38	16	1.25			
	10														
585															
		S5	2 2 2		100		Soft, very moist to wet, brown and gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel, (CL)	21.9				1.0			
	15														
580		S6			100		579.4 / 17.0	13.8	139.3	22	8	> 4.5			
							Brown and gray, low plasticity, clayey SAND, trace fine gravel, with reddish brown silt seams, (SC) 577.9 / 18.5								
		S7	5 6 8		78		Stiff, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL)	10.2				> 4.5			
	20														
575							572.9 / 23.5								
		S8	22 29 35		100		Hard, moist, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	6.7		20	7	2.0			
	25														
570							567.9 / 28.5								
		S9	6 10 14		100		Very stiff, dry, brownish gray, low plasticity, shaley CLAY, trace silt seams (CL)	27.7				3.5			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													
565														
		S10	13 18 23	100		562.4 / 34.0 Hard, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	35													
560														
		S11	16 24 30	100		Hard, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.8				> 4.5			
	40													
555														
		S12A	12 23 36	100			8.2				> 4.5			*Auger head broke at 10 a.m. Restart 8/23/15. Grout hole; offset 8 ft. SE, set 14 ft. HSA as casing, drill mud rotary and start sampling at 42 ft (S 12A).*
		S12	20 23 30	100			9.5				> 4.5			
	45													
550														
	50													
545														
		S13	8 14 21	100		Hard, brown, low plasticity, CLAY, trace fine sand (CL) (TILL)	17.5	129.6	36	18	> 4.5			
	55													
540														
	60													
535														
		S14	10 16 26	94		Hard, very wet, brown and gray, low plasticity, sandy CLAY (CL) (TILL)	16.6				> 4.5			
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
530																
	70															
525							524.9	71.5								
						Hard, gray, low plasticity, shaley CLAY, trace fine gravel (CL) (TILL)	523.9	72.5								
		S15A	23 50 / 5"	72		Very soft, gray, low plasticity, sandy shaley CLAY, trace fine gravel, (CL) (BEDROCK)			15.2 8.4				> 4.5			
	75						521.4	75.0								*Switch to roller bit. Hard drilling 74 - 75'. Rollerbit refusal at 75 ft. Start wireline coring on 8/24/15.*
520						Limestone, hard, medium strong, light to medium gray. qu = 6,500 psi (75.9 - 76.5 ft)			1.0	163.6						
		C1	79	100												
	80						516.8	79.6								
515						SHALE, very soft, laminated, waxy, dark gray SHALE, moderately hard, laminated, black										
		C2	53	91					8.4	116.3						
	85						511.4	85.0								*Installed Piezometer KIN-P006 with 5 ft offset to the Southeast. Coordinates shown are for Boring KIN-B005.*
510						End of Boring at 85 ft										
	90															
505																
	95															
500																
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Date(s) Drilled	08/14/2015 9:30 AM to 08/18/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Cased, Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	41.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	618.622 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1068071.624 E 2485451.262 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					618.6 / 0.0 Dry, black, fine to coarse grained sand (cinders) (ASH)								
		S1	3 3 3	100		Loose, wet, brown and gray, sand (cinders) with clayey silt (ASH)	34.2							
615						615.1 / 3.5								
		S2	WOH 1 WOH	100		Very soft, wet, brown with black, low plasticity, CLAY, with cinders (CL)	71.4				0.5			
	5	S3		0										
610		S4		100		Very wet, dark brown, low plasticity, fine to medium grained sandy CLAY with ash (CL)								*Piston sample.*
	10	S5	WOH	100		Very soft, very wet, dark brown and gray, low plasticity, sandy CLAY, with organics, with ash (CL)	48.0				0.25			
605		S6		47		603.6 / 15.0								*Piston sample. 8/14/15 12:05 work stopped.*
	15					Very loose, wet, coarse grained sand (cinders) (ASH)								
		S7	1 1 1	100		Very loose, very wet, dark brown sand (cinders), with organics and clay (ASH)	38.5							
600														*8/18/15 9:15 work resumed.*
	20	S8		0										*Piston sample.*
		S9		100		Very loose, very wet, black, fine to coarse grained sand (cinders) (ASH)								
595						Very loose, wet, coarse grained sand (cinders) (ASH)								
	25													
590		S10	2 2 3	56		589.6 / 29.0 Medium stiff, very wet, brown and gray, low plasticity, CLAY, trace fine sand, with reddish	30.4		36	15	1.0			
	30													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					brown silt seams (CL)								
						585.1 / 33.5								
585		S11	WOH 2 3	100		Medium stiff, very wet, low plasticity, CLAY, with reddish brown silt seams (CL)	28.2				1.0			
	35													
		S12		100										
580														
	40	S13		46										
						577.6 / 41.0								
						End of Boring at 41 ft								
575														
	45													
570														
	50													
565														
	55													
560														
	60													
555														
	65													

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Sheet 1 of 2

Date(s) Drilled	08/20/2015 11:35 AM to 08/20/2015 2:15 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.499 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P007 adj. to KIN-B007).	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069015.221 E 2485646.034 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
	0						621.5 / 0.0 Hard, dry, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)								
620		S1	21 26 31		78			5.5				> 4.5			
		S2	9 12 15		100		617.5 / 4.0 Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	8.0				> 4.5			
	5														
615		S3	20 15 8		100			20.8				> 4.5			
							613.0 / 8.5								
		S4	4 6 9		100		Stiff, moist, brown to dark brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	6.2				3.0			*Organic content 3.9%.*
	10														
610															
		S5	4 5 7		100			15.0				4.25			
	15														
605		S6			83		Green, brown and gray, low plasticity, CLAY, with sand (CL) (EMBANKMENT FILL)			35	15				
		S7	3 6 8		100		Stiff, very moist, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	10.3				3.0			
	20														
600															
		S8	3 5 6		100		597.5 / 24.0 Stiff, very moist, brown and gray with dark gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel (CL) (EMBANKMENT FILL)	24.9				1.5			
	25						596.5 / 25.0 Soft, grayish brown, silty CLAY (CL)								
		S9			100							0.5			
595		S10			100		Medium stiff, very moist, brown to light brown, low plasticity, sandy CLAY, trace silt, trace fine gravel, with roots (CL)	10.8				1.0			
	30														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 3:00:13 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	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
590	30															
		S11		100				Medium stiff, wet, light brown, low plasticity, sandy CLAY (CL)								
585	35	S12		100												
						583.5	38.0									
		S13	WOH WOH 6	67				Very loose, very wet, brown, low plasticity, clayey SAND, trace fine gravel (SC)	13.8				0.75			
580	40					582.0	39.5	Medium stiff, wet, light brown, low plasticity, sandy CLAY, trace silt (CL) (TILL)								
		S14	24 38 42	100				Hard, very wet, gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	11.2		27	13	> 4.5			
575	45															
		S15	25 34 50					Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					571.5	50.0	End of Boring at 50 ft								*Installed Piezometer KIN-P007 with offset. Coordinates shown are for Boring KIN-B007.*
570																
	55															
565																
	60															
560																
	65															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B008

Sheet 1 of 1

Date(s) Drilled	08/20/2015 7:45 AM to 08/20/2015 11:10 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	592.087 ft NAVD 88
Borehole Backfill	Piezometer KIN-P008	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069056.566 E 2485606.651 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 592.1 / Depth (feet) 0.0 Rockfill (3 - 7 inch), little topsoil.								
							591.1 / 1.0								
590		S1	7 5 5		0		Medium stiff, very moist, brown and gray, low plasticity, sandy CLAY, (CL) (EMBANKMENT FILL)								*Rock lodged in S1.*
		S2	2 2 4		100			25.4				2.25			
	5						Soft to medium stiff, wet, brown, low plasticity, sandy CLAY (CL) (EMBANKMENT FILL)								
585		S3	2 2 3		100			22.8				0.25 1.0			
		S4			100		583.1 / 9.0	11.4	140.0	19	7				
	10						Low plasticity, sandy CLAY (CL) (TILL)								*Till material at the bottom of S4.*
580															
		S5	15 30 39		100		Hard, wet, brown and gray, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (TILL)	13.3		25	11	> 4.5			
	15														
575															
		S6	13 31 41		100		Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	10.7	144.8			> 4.5			
	20														
570															
		S7	20 35 43		100		Hard, slightly moist, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.6				> 4.5			
	25														
565															
		S8	18 32 50 / 4"				562.1 / 30.0	7.1				> 4.5			*Installed Piezometer KIN-P008 in boring.*
	30						End of Boring at 30 ft								

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B009

Sheet 1 of 1

Date(s) Drilled	08/14/2015 1:15 PM to 08/14/2015 2:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	590.387 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P009 adj. to KIN-B009)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069403.056 E 2486422.107 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 590.4 / Depth (feet) 0.0								
590	0	S1		3 3 4	100		Medium stiff, moist, dark brown, medium plasticity, CLAY, with fine sand, with roots (CL) (EMBANKMENT FILL)	20.3				1.75			
		S2		2 2 3	100		586.4 / 4.0 Medium stiff, moist, dark brown, medium plasticity, CLAY, with sand, with roots (CL) 585.4 / 5.0	23.8		42	23	1.5			
585	5	S3		2 3 5	100		Medium stiff, moist, brown and gray, low plasticity, CLAY, with fine to medium sand, with silt seams (CL) 582.9 / 7.5	21.3				1.0			
		S4			100		Grayish brown, low plasticity, sandy CLAY, with pebbles (CL)	19.9	123.7	28	13				
580	10														*S9 and S10 collocated hole.*
							577.4 / 13.0								
		S5		6 15 19	100		Hard, wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	10.3	113.6			> 4.5			*Shelby tube refusal.*
575	15														
		S6		16 29 40	100		Gray	7.5				> 4.5			
570	20														
		S7		18 32 50 / 5"	94		Hard, gray, low plasticity, sandy silty CLAY, trace fine gravel (CL) (TILL)	11.5				> 4.5			
565	25														*Installed Piezometer KIN-P009 in boring.*
		S8		16 33 50 / 5"	94		Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	9.2	105.4			> 4.5			
	30						560.4 / 30.0								

End of Boring at 30 ft

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Sheet 1 of 3

Date(s) Drilled	08/26/2015 8:00 AM to 08/26/2015 5:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary	Drill Bit Size/Type	7.75 in. O.D. HSA / 4 in. Roller Bit	Borehole Depth	75.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	615.29 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-010 12 ft West of KIN-B010)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069349.893 E 2486428.735 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
615	0						615.3 / 0.0 Topsoil and gravel basecourse (fill).								
							614.3 / 1.0								
		S1	4 4 6		78		Stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	4.9				> 4.5			
		S2	4 5 7		89			8.9				4.0			
610	5														
		S3	3 3 4		100		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (EMBANKMENT FILL)	9.5		23	9	1.75 3.0			
		S4	4 6 7		89		Stiff, moist, brown and dark brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	11.8	135.8			> 4.5			
605	10														
		S5	2 5 5		100		Brown and gray	19.5				0.75			
600	15														
		S6			20		Stiff, moist, grayish brown, low plasticity, CLAY, with sand (CL) (EMBANKMENT FILL)	21.1	128.1	33	19	1.5			
595	20						594.3 / 21.0								
		S7			18		Very stiff, low plasticity, CLAY, with sand (CL)	11.8	137.7	31	16	3.5			*ST refusal*
								23.3							
		S8	3 5 7		94		590.9 / 24.4	17.6	136.5			1.25			
590	25						Stiff, very wet, brown and gray with dark brown, low plasticity, CLAY, with fine to medium sand (CL)								
		S9	2 2 3		100		586.3 / 29.0 Medium stiff, dark brown, medium plasticity, CLAY (CL)	28.9		40	20	0.5			*Organic content 5.3%.*
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
585	30													*30 - 32': Duttings appear as topsoil.*
						583.3 / 32.0								
		S10		22		Medium stiff, very wet, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL)					1.75			
		S11	3 4 4	100			20.9				1.75			
580	35													
						577.3 / 38.0								
		S12	13 32 50 / 3"	89		Very dense, very wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)	9.8							*38': Hard augering.*
575	40													*40': Mud rotary*
						572.3 / 43.0								
		S13	23 42 50	89		Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	10.7				> 4.5			
570	45													
		S14	27 50 / 5"	89		Low plasticity	9.9	149.4	23	9	> 4.5			
565	50													
560	55													
		S15	23 35 50 / 5"	100			9.5				> 4.5			
555	60													*61 - 63': Easier drilling.*
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
550																
		S16	13 50 50 / 1"	89		Greenish gray and brown Shale (BEDROCK)	545.8	69.5	17.0				> 4.5			*Roller bit refusal. S17-SPT bouncing. Switch to rock coring.*
545	70					Shale, dark gray, very soft, waxy	545.0	70.3								
		C1	53	95		Run #1 70.3 - 75': Limestone, gray, thinly bedded, strong, moderately hard, qu = 11,380 psi (70.6 - 71.2 ft)			0.3	165.8						
540	75					End of Boring at 75 ft	540.3	75.0								*Installed Piezometer KIN-P010 with 12 ft offset West.*
535	80															
530	85															
525	90															
520	95															
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Date(s) Drilled	08/11/2015 11:30 AM to 08/11/2015 4:30 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6.50 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	617.018 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1068624.963 E 2487934.93 (ft NAD83)	Groundwater Level(s)	26 ft on 8/11/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 617.0 / Depth (feet) 0.0 Sandy gravel fill.								
							616.0 / 1.0								
615		S1	3 4 4		33		Medium stiff, moist, brown, low plasticity, CLAY, with fine sand, (CL) (EMBANKMENT FILL)	16.6							
	5	S2	3 6 7		83		Stiff, moist, brown and dark brown, low plasticity, CLAY, with fine sand, trace fine gravel (CL) (EMBANKMENT FILL)	18.6		38	18				*Organic Content of 2.9%.*
610		S3	3 5 8		100		Stiff, brown and dark brown, medium plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	17.2		44	26				
							608.5 / 8.5								
	10	S4	3 5 8		100		Stiff, brown to gray, medium plasticity, CLAY, trace fine sand (CL) (EMBANKMENT FILL)	20.4							
605															
		S5			96		602.5 / 14.5	22.9	118.0	58	37				*Organic content 2.5%.*
	15						Dark brown, high plasticity, CLAY (CH) (EMBANKMENT FILL) 16 - 18': Possible topsoil								
600							599.0 / 18.0								
	20	S6	3 5 6		100		Stiff, brown and gray, medium plasticity, CLAY, trace fine sand (CL)	27.7	140.7	49	29				
595															
		S7	2 2 3		100		593.0 / 24.0 Medium stiff, moist, brown and gray, medium plasticity, CLAY, trace fine sand, with reddish brown silt seams (CL)	26.8				0.75			
	25						▽								
590		S8			96							0.5			
		S9	WOH		100		Very soft, moist, brown and gray, medium plasticity, CLAY, trace fine sand, with reddish	26.5		40	21	0.3			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30						brown silt seams (CL)								
585		S10		WOH 1 1	100		Very soft, wet, brown and gray, low plasticity, sandy CLAY (CL)	25.0		33	17				
	35						Elevation (feet) 580.0 / Depth (feet) 37.0								
580							Very dense, wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)								
		S11		12 21 50 / 2"	100			8.2		23	9				
	40						Elevation (feet) 575.0 / Depth (feet) 42.0								
575							Hard, wet, brownish gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
		S12		37 50 / 3"	61			9.0				> 4.5			
	45														
570															
		S13		50 / 5"	33			9.6				> 4.5			
	50						Elevation (feet) 567.0 / Depth (feet) 50.0								
							End of Boring at 50 ft								
565															
	55														
560															
	60														
555															
	65														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B012

Date(s) Drilled	08/25/2015 8:00 AM to 08/25/2015 12:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	40.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	605.539 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1067643.467 E 2486141.078 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
605	0						Elevation (feet) 605.5 / Depth (feet) 0.0								
		S1		7 8 12	83		Medium dense, moist, black, fine to coarse grained sand (cinders) (ASH)	11.2							
		S2		12 18 18	100			12.0							
600	5						Very dense, very wet, black, sand (cinders) (ASH)								
		S3			0										*Piston sample 6' to 8': NR. Auger to 8.5'.*
		S4		3 3 4	44		Loose, very wet, black, sand (cinders) (ASH)	19.4							*Ash flowing into auger at 8.5'. Use SPT.*
595	10														
							Elevation (feet) 591.7 / Depth (feet) 13.8								*Piston sampler.*
		S5			60		Very soft, wet, light brown, low plasticity, silty CLAY (CL)					0.25			
590	15	S6			100		Very soft to soft					0.5			
		S7			92		Soft					0.75			
585	20														
		S8			100		Soft, grayish brown, low plasticity, sandy silty CLAY, trace fine gravel (CL)					0.6			
580	25														
							Elevation (feet) 577.5 / Depth (feet) 28.0								
		S9		11 28 43	100		Hard, brown and gray, low plasticity, sandy silty CLAY, trace fine gravel (CL) (TILL)	8.4		19	6	> 4.5			*28' Harder drilling*
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B012

Elevation (feet)	Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
575	30													
		S10	22 47 50 / 3"	89		Hard, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.1							*35' Very hard drilling*
570	35													
						567.5 / 38.0								
		S11	27 38 50 / 4"	89		Very dense, very wet, brown and gray, clayey SAND, trace fine gravel (SC) (TILL)	14.9							
565	40					565.5 / 40.0								
						End of Boring at 40 ft								
560	45													
555	50													
550	55													
545	60													
	65													

Attachment H. Material Characterization Calculations

AECOM

QMS Form 3-3 (MM)
Rev. 2013 QMS
Date: 28 Feb 2013

IE QMS - Americas

Detail Check - Calculations

Project Name	Dynegy CCR Management Program	**Client**	Dynegy, Inc.
Project Location	Kincaid, Christian County, Illinois	**PM**	Eric Glazier
Project Number	60480898	**PIC**	Vic Modeer

IDENTIFYING INFORMATION

(This section is to be completed by the Originator.)

Calculation Medium: *(Select as appropriate)*
☒ Electronic
☒ Hard-copy

File Name: Kincaid Ash Pond Material Characterization.docx
Unique Identification: N/A
Number of pages *(including cover sheet)*: 6 plus attachments

Discipline:	Geotechnical
Title of Calculation:	Kincaid Ash Pond Material Characterization
Calculation Originator:	Julie Heitland
Calculation Contributors:	Meaghan Kenna, Brian Gomez, Kevin Ritter
Calculation Checker:	Amanda Duvigneaud

DESCRIPTION & PURPOSE

See attached.

BASIS / REFERENCE / ASSUMPTIONS

See attached.

ISSUE / REVISION RECORD

Checker comments, if any, provided on: ☐ hard-copy ☐ electronic file ☐ Form 3-5

No.	Description	P	S	F	Originator Initials	Date	Checker Initials	Date
0	Initial Issue	☐	☐	☒	JAH	1/8/16	ALD	1/13/16
1	Revised elevations	☐	☑	☐	JAH	2/10/16	ALD	2/10/16
2		☐	☐	☐				
3		☐	☐	☐				

For a given Revision, indicate either P (Preliminary), S (Superseding) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

APPROVAL and DISTRIBUTION

☑ The below individuals assert that the Detail Check – Calculations is complete.

Julie Heitland — Originator Signature — 1/13/16 — Date

Amanda J Duvigneaud — Checker Signature — 1/13/16 — Date

Eric J Glazier — Project Manager (or Designee) Signature — January 28, 2016 — Date

Distribution:

Project Central File – Quality File Folder
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Calculation Notes AECOM

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

Objective

A material characterization was performed to estimate material properties for the embankment and foundation clay soils at Kincaid Ash Pond. Kincaid Ash Pond is a Coal Combustion Residuals (CCR) unit at Dynegy's Kincaid Station located in Kincaid, Christian County, Illinois. Selected material properties for slope stability analyses are summarized in the following sections.

Subsurface Conditions

A subsurface investigation was conducted at Kincaid Ash Pond in August 2015 by AECOM. Field and laboratory test results were used to evaluate subsurface stratigraphy and material properties. The investigation included 12 soil borings and 37 Cone Penetration Test (CPT) soundings. Borings and CPTs were drilled or pushed through the ash deposit and along the crest and toe of the existing embankment. Boring and CPT locations are shown in Figure 1. Boring logs and CPT soundings are included at the end of this calculation package for reference.

Field testing included Standard Penetration Tests (SPT), CPT dissipation testing, and shear wave velocity measurements using the seismic CPT. Open well and vibrating well piezometers were installed in select borings and CPTs. CPT soundings were used to develop the subsurface stratigraphic profile. Boring logs were also used for comparison and visual confirmation of the CPT data. Based on results of the investigation, four stratigraphic materials were identified at the site:

- **Impounded Ash**: Fine- to coarse-grained SAND (cinders) with clayey silt, organics or clay, very loose to very dense, moist to very wet, and dark brown to black.
- **Embankment Fill**: Low to medium plasticity sandy CLAY or CLAY with sand (CL), or high plasticity clay (CH). The CL and CH soils had occasional occurrences of trace levels of fine gravel, were medium stiff to very stiff with occasional soft zones, moist to very moist, and brown to gray.
- **Foundation Clay**: Native clay of alluvial origin with occasional layers of coarse-grained soil. The fine-grained soils (clays) were generally classified as low to medium plasticity silty CLAY, sandy CLAY, CLAY with sand, or CLAY (CL) with trace amounts of sand or gravel; or high plasticity CLAY (CH). The CL and CH soils were soft to very stiff with a CPT profile indicative of a somewhat over-consolidated crust near the top of the layer, very moist to very wet, and brown to gray with some occurrence of reddish brown silt seams. The coarse-grained soil encountered in the borings was classified as clayey SAND (SC), with a trace amount of gravel, very loose, low plasticity, very wet, and brown to gray.
- **Till**: Predominantly classified as sandy CLAY (CL) with some occurrences of clayey SAND (SC) or silty SAND (SM), usually with a trace amount of fine gravel, generally hard, low to medium plasticity, slightly moist to very wet, and brown to gray.

Representative samples of the embankment and foundation clay were collected at regular intervals from the borings for laboratory testing. Laboratory tests were assigned to characterize the site materials including index (moisture content, unit weight, Atterberg limits, specific gravity, and gradation analysis), permeability, and consolidation testing. Strength testing included isotropically consolidated-undrained triaxial tests with pore pressure measurements (CIU') and static direct simple shear tests (DSS) on the embankment and foundation clay materials. In addition, cyclic and post-cyclic DSS tests were performed on the foundation clay. Laboratory test results are included at the end of this calculation package for reference.

Material Properties

Approach, Analysis, and Assumptions

Material properties for slope stability analyses were developed using both laboratory testing data (index and strength testing) and strength correlations from CPT data. The following is a summary of the specific material properties developed for the impounded ash, embankment, foundation clay, and till:

- Unit Weight
- Drained Shear Strength
- Undrained Shear Strength
- Post-Earthquake Shear Strength

A detailed material characterization was performed for the embankment and foundation clay materials. Material properties for the impounded ash and till were conservatively estimated based on empirical correlations and experience with similar materials.

Unit Weight

Unit weight for the embankment and foundation clay were evaluated using measured results from samples collected within the materials. Measured total unit weights ranged from 118 to 144 pounds per cubic foot (pcf) within the embankment and 105 to 150 pcf within the foundation clay. A total unit weight of 135 pcf was selected for the embankment, and a total unit weight of 125 pcf was selected for the foundation clay. Measured unit weights versus depth, as well as other index properties are presented in Figure A.1 included in Appendix A.

Drained Shear Strength

Peak drained shear strengths for the embankment and foundation clay were evaluated for the normal operating (steady-state) loading condition using results from CIU' and DSS tests. CIU' strength tests were performed on three undisturbed tube samples collected within the embankment and eight undisturbed tube samples collected within the foundation clay. DSS strength tests were performed on four undisturbed tube samples collected within the foundation clay. CIU' stress paths, DSS test paths,

and stress vs strain plots for the various lab tests are shown in figures included in Appendices B and C. CIU' test results were evaluated using peak obliquity (maximum principle stress ratio) failure criteria, and DSS test results were evaluated using 10% strain failure criteria. For each material tested, the shear stress on the failure plane (τ_{ff}) and corresponding effective normal stress on the failure plane (σ'_{ff}) at failure were plotted and a strength envelope was fit to the data.

The peak drained shear strength for the embankment was characterized with a nonlinear strength envelope to assign the shear strength as a function of the effective normal stress on the failure plane. The nonlinear strength envelope is curved below an effective normal stress of 1,440 pounds per square foot (psf) and linear above 1,440 psf, as shown in Figure B.1 in Appendix B. A curved envelope was fit to the data at lower stresses since the compacted embankment material is more overconsolidated within the lower stress range. The linear portion of the envelope is defined by an effective stress friction angle (ϕ') of 40 degrees and zero effective cohesion (c').

The peak drained shear strength for the foundation clay was characterized based on the orientation of the failure plane below the embankment and in the free field (or near the toe of the embankment). The shear strength below the embankment is more representative of a failure plane resulting from CIU' tests, while the shear strength in the free field is more representative of a failure plane resulting from DSS tests. Therefore, a nonlinear strength envelope using CIU' test results was used to characterize the foundation clay below the embankment, and a linear strength envelope using DSS test results was used to characterize the foundation clay in the free field. Similar to the embankment, the nonlinear strength envelope is curved below an effective normal stress of 2,160 psf and linear above 2,160 psf, as shown in Figure C.1 in Appendix C. A curved envelope was fit to the data at lower stresses since the foundation clay below the embankment is generally overconsolidated within the lower stress range and becomes more normally consolidated at higher stresses. The linear portion of the envelope is defined by an effective stress friction angle (ϕ') of 32 degrees and zero effective cohesion (c'). The linear strength envelope using DSS test results is defined by an effective stress friction angle (ϕ') of 30 degrees and zero effective cohesion (c'), as shown in Figure C.1 in Appendix C.

Undrained Shear Strength

Peak undrained shear strengths for the embankment and foundation clay were evaluated for the probable maximum flood (PMF) loading condition using the same CIU' and DSS test results that were used to evaluate the drained shear strength discussed above. For each material tested, the shear stress on the failure plane (τ_{ff}) and corresponding effective confining stress (σ'_{fc}) at failure were plotted and a strength envelope was fit to the data.

The peak undrained shear strength for both the embankment and foundation clay were characterized using a linear strength envelope with a specified minimum undrained shear strength. The linear strength envelope represents the undrained strength ratio (S_u/p'). A minimum undrained shear strength (min S_u) was assigned to better represent the strength at lower stresses. The strength envelope for the embankment is defined by an undrained strength ratio (S_u/p') of 0.68 and minimum undrained shear strength (min S_u) of 575 psf, as shown in Figure B.2 in Appendix B.

Similar to the drained shear strength, the peak undrained shear strength for the foundation clay was characterized using two strength envelopes based on the orientation of the failure plane below the embankment and in the free field (or near the toe of the embankment). Therefore, CIU' test results were used to characterize the foundation clay below the embankment, and DSS test results were used to characterize the foundation clay in the free field. In addition to the lab results, correlated values for peak undrained strength from CPT results were applied to the undrained strength characterization for the foundation clay. The undrained strength evaluated from CPT results was plotted versus depth for both the foundation clay below the embankment and the foundation clay in the free field and compared to the lab results, as shown in Figures D.1 and D.2 in Appendix D. An N_{kt} value of 10 was used to correlate peak undrained shear strength values from the CPT test results, based on calibration of the correlated undrained strength values to the results of laboratory shear strength testing. The strength envelopes for the foundation clay below the embankment and in the free field are defined by undrained strength ratios (S_u/p') of 0.48 and 0.30 and minimum undrained shear strengths (min S_u) of 800 psf and 400 psf, respectively, as shown in Figure C.2 in Appendix C.

Post-Earthquake Shear Strength

Earthquake loading is a rapid loading that may cause excess pore water pressures in saturated, fine-grained materials and strength loss immediately following loading. Therefore, peak undrained shear strengths were assigned to all materials for the pseudo-static loading condition. Shear strengths under the post-earthquake loading condition were evaluated by identifying the relative behavior of the materials and performing a liquefaction triggering analysis on the materials. Results of the lab testing and liquefaction triggering analysis generally indicate no strain softening in the embankment and till materials. Therefore, the embankment was assigned peak undrained shear strengths for the post-earthquake loading condition. Peak undrained shear strengths were applied to the embankment both above and below the phreatic surface since the embankment has a saturation of 80 percent above the phreatic surface and may behave similarly to saturated material below the phreatic surface during earthquake loading.

Correlated values of peak and residual undrained strength from CPT results in the foundation clay indicate a potential for strain softening of this material. As a result, cyclic and post-cyclic DSS strength

tests were performed on two undisturbed tube samples collected within the foundation clay to estimate a residual undrained shear strength for this material under the post-earthquake loading condition. Both samples were subjected to a cyclic stress ratio (CSR) of about 0.14 and did not experience strain softening. The CSR was then increased to 0.28 in one sample and 0.23 in the second sample. The sample tested under a CSR of 0.23 experienced strain softening while the sample tested under a CSR of 0.28 did not experience strain softening. Post-cyclic DSS test paths and stress vs strain plots, as well as cyclic DSS plots for the lab tests are shown in figures included in Appendix C. The post-cyclic DSS test results were evaluated using 10% strain failure criteria. For the samples subjected to a CSR of 0.28 and 0.23, the shear stress on the failure plane (τ_{ff}) and corresponding effective confining stress (σ'_{fc}) at failure were plotted and a strength envelope was fit to the data.

Using results of the post-cyclic DSS tests, the residual strength envelope for the soft foundation clay is defined by an undrained strength ratio (S_u/p') of 0.30 and minimum undrained shear strength (min S_u) of 400 psf, as shown in Figure C.3 in Appendix C. The residual strength envelope was weighted toward the sample that experienced strain softening. Quasi steady state strengths using the static CIU' and DSS test results were also evaluated for comparison, as shown in Figure C.3. The quasi steady state strengths using the static DSS tests generally match well with the sample that experienced strain softening.

Impounded Ash and Till

Material properties for the impounded ash and till were conservatively estimated since preliminary slope stability analyses indicated these materials do not have a significant impact on the stability of the impoundment. A unit weight of 112 pcf was assumed for the impounded ash based on experience with similar manmade materials and deposition methods. The drained shear strength of the impounded ash was characterized using CPT soundings pushed within the impoundment. The ash CPT signature indicates tip resistances greater than 150 tons per square foot (tsf), sleeve frictions of 1 to 4 tsf, and soil behavior type indices between 1 and 1.5, indicating sand-like behavior. The effective stress friction angle for the impounded ash was estimated using the Kulhawy and Mayne (1990) CPT friction angle correlation. The correlation indicates a range of friction angles between 35 and 47 degrees. A conservative effective stress friction angle (ϕ') of 32 degrees was assumed based on preliminary slope stability analyses indicating that as the failure surface moves towards the upstream crest of the embankment, the factor of safety increases. This conservative assumption was made in part due to the indication that the ash material does not affect the stability of the embankment. The coarse nature and pore pressure behavior from the CPT soundings indicate the material will be well-drained, and thus an undrained strength ratio (S_u/p') of 0.40 (equivalent to 22 degrees) was assumed for the undrained shear strength.

For the post-earthquake shear strength, liquefaction triggering analyses were completed on cone penetration soundings advanced within the impounded ash. These cones show ash material underlain by native soils. Based on the simplified liquefaction analyses, the saturated sand-like material indicates factors of safety against liquefaction less than 1.2, and thus the potential for liquefaction. CPT sounding KIN-C022 is a representative sounding of the impounded ash material. The liquefied residual strength for the potentially liquefiable ash was estimated using the residual shear strength correlation to cone penetration provided in "Soil Liquefaction During Earthquakes" by I.M. Idriss and R.W. Boulanger (2008). The residual strength was estimated as the sleeve friction (f_s) value from the CPT sounding. Based on the correlation, the residual strength ranges from 0.05 to 0.15 within the zone of saturated, liquefiable material indicated in the triggering analyses as shown in the residual liquefied strength figure for KIN-C022 in Appendix D. A residual undrained strength ratio of 0.06 was applied to the saturated ash.

The unit weight and drained shear strength for the till were estimated using the Duncan and Buchignani (1976) SPT blow count correlations with dry unit weight and effective stress friction angle. SPT blow counts within the till were generally greater than 50 blows per foot. The correlations indicate unit weights greater than 140 pcf (assuming 10 percent moisture content) and friction angles greater than 38 degrees. A unit weight of 135 pcf and effective stress friction angle (ϕ') of 40 degrees were assumed for the till. An undrained strength ratio of 0.64 (equivalent to 32 degrees) was estimated for the undrained shear strength based on results of CPT correlations with undrained strength ratio. To prohibit failure surfaces from propagating into the stronger till layer below the foundation clay, a minimum undrained shear strength equal to the value selected for the foundation clay (min S_u = 800 psf) was also assigned to the till.

As mentioned previously, results of the liquefaction triggering analysis generally indicate no strain softening in the till. Therefore, the till was assigned peak undrained shear strengths for the post-earthquake loading condition.

Results

The table on the following page summarizes the material properties used for slope stability analyses at Kincaid Ash Pond.

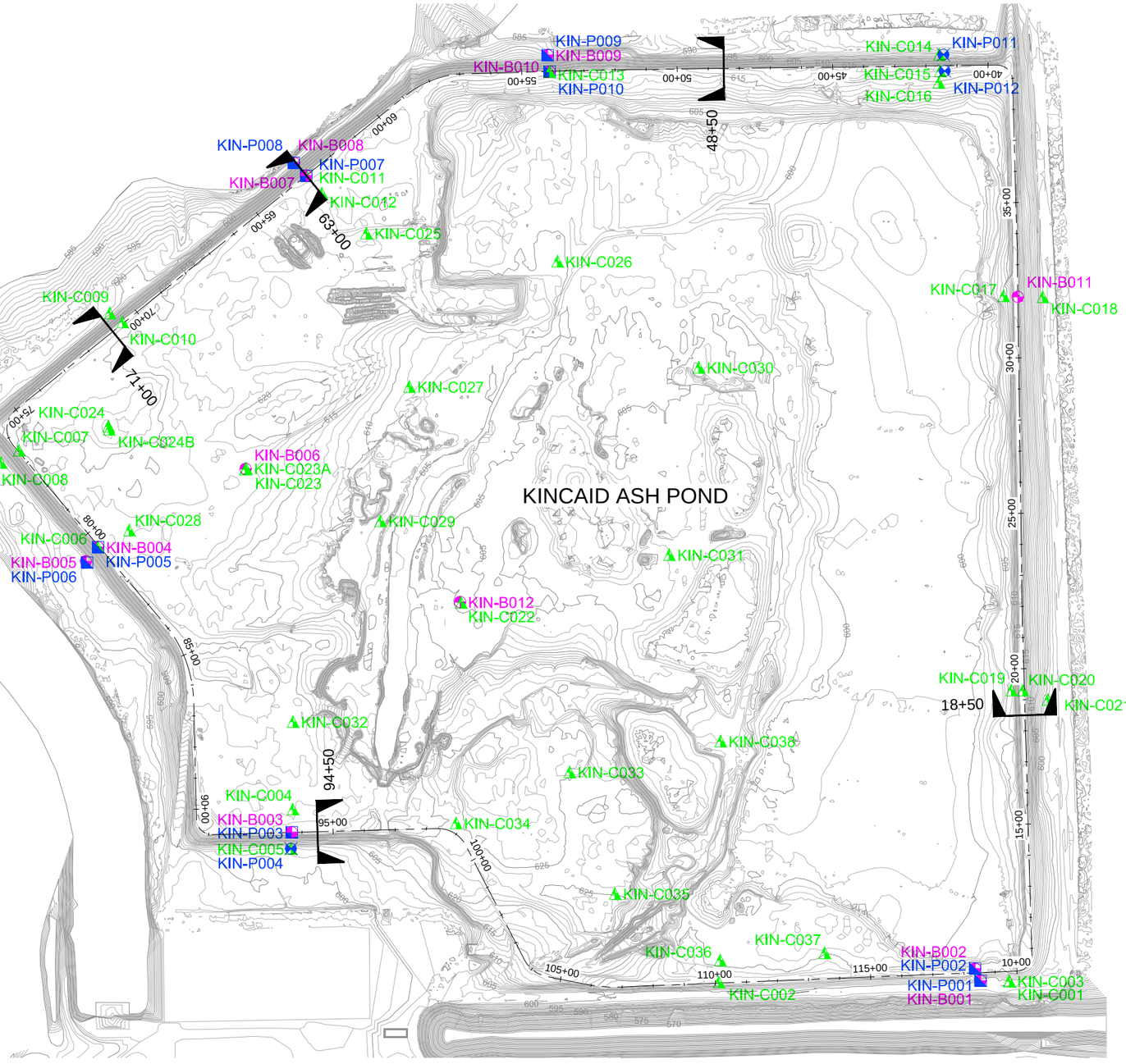
Kincaid Ash Pond Slope Stability Material Properties					
Material	**Unit Weight (pcf)**	**Peak Drained Shear Strength**		**Peak Undrained Shear Strength**	**Post-Earthquake Shear Strength**
		Cohesion, c' (psf)	**Friction Angle, ϕ' (degrees)**	**S_u/p'**	**S_u/p'**
Ash	112	0	32	0.40	0.06
Embankment	135	0	40 *with curved envelope for* σ'_{ff} *< 1440 psf* *(SEE NOTE 1)*	S_u/p' = 0.68, Minimum S_u = 575 psf	Peak Undrained
Foundation Clay	125	0	Below Embankment: ϕ' = 32 *with curved envelope for* σ'_{ff} *< 2160 psf* *(SEE NOTE 2)* Free Field: ϕ' = 30	Below Embankment: S_u/p' = 0.48, Minimum S_u = 800 psf Free Field: S_u/p' = 0.30, Minimum S_u = 400 psf	S_u/p' = 0.30, Minimum S_u = 400 psf
Till	135	0	40	S_u/p' = 0.64, Minimum S_u = 800 psf	Peak Undrained

Notes: 1 - Embankment Nonlinear Drained Shear Strength Envelope

σ'_{ff} (psf)	τ_{ff} (psf)
0	0
432	490
864	850
1440	1208
4320	3625

2 - Foundation Clay **Below Embankment** Nonlinear Drained Shear Strength Envelope

σ'_{ff} (psf)	τ_{ff} (psf)
0	0
432	475
864	763
1440	1080
2160	1350
5760	3599



LEGEND

KIN-B000	AECOM BORING LOCATION
KIN-C000	AECOM CONE PENETROMETER TESTING LOCATION
KIN-P000	AECOM PIEZOMETER LOCATION
KIN-P000	AECOM VIBRATING WIRE PIEZOMETER (VWP) LOCATION
	LOCATION OF GEOPHYSICAL INVESTIGATION
	STUDY SECTION

NOTES:

1. CONTOURS ARE 2 FOOT ELEVATION INTERVALS.
2. SURVEY BENCHMARKS WILL BE PROVIDED BY THE OWNER.
3. GROUND CONTOURS ARE INTERPRETED FROM HISTORIC TOPOGRAPHIC MAPS PROVIDED BY DYNEGY, RECENT GROUND SHOTS BY AECOM, AND FINAL RESULTS OF LIDAR SURVEYING PERFORMED BY SURDEX CORPORATION IN AUGUST 2015.
4. BATHYMETRY CONTOURS ARE BASED ON A BATHYMETRIC SURVEY PERFORMED BY WEAVER CONSULTANTS IN OCTOBER 2015.
5. STATION 10+00 IS THE BEGINNING OF STATIONING.

N

0 200 400 600
SCALE IN FEET

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

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

GEOTECHNICAL REPORT
ASH POND

ISSUED FOR BIDDING	DATE	BY
ISSUED FOR CONSTRUCTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
△		
△		
△		
△		

AECOM PROJECT NO:	
DRAWN BY:	GJH
DESIGNED BY:	EJV
CHECKED BY:	MCR
DATE CREATED:	12/23/2015
PLOT DATE:	2/9/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

BORING, CPT, PIEZOMETER AND CROSS SECTION LOCATIONS

SHEET 1 OF 1

SMITH, CURT, 2/9/2016 11:38 AM
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Calculation Notes AECOM

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

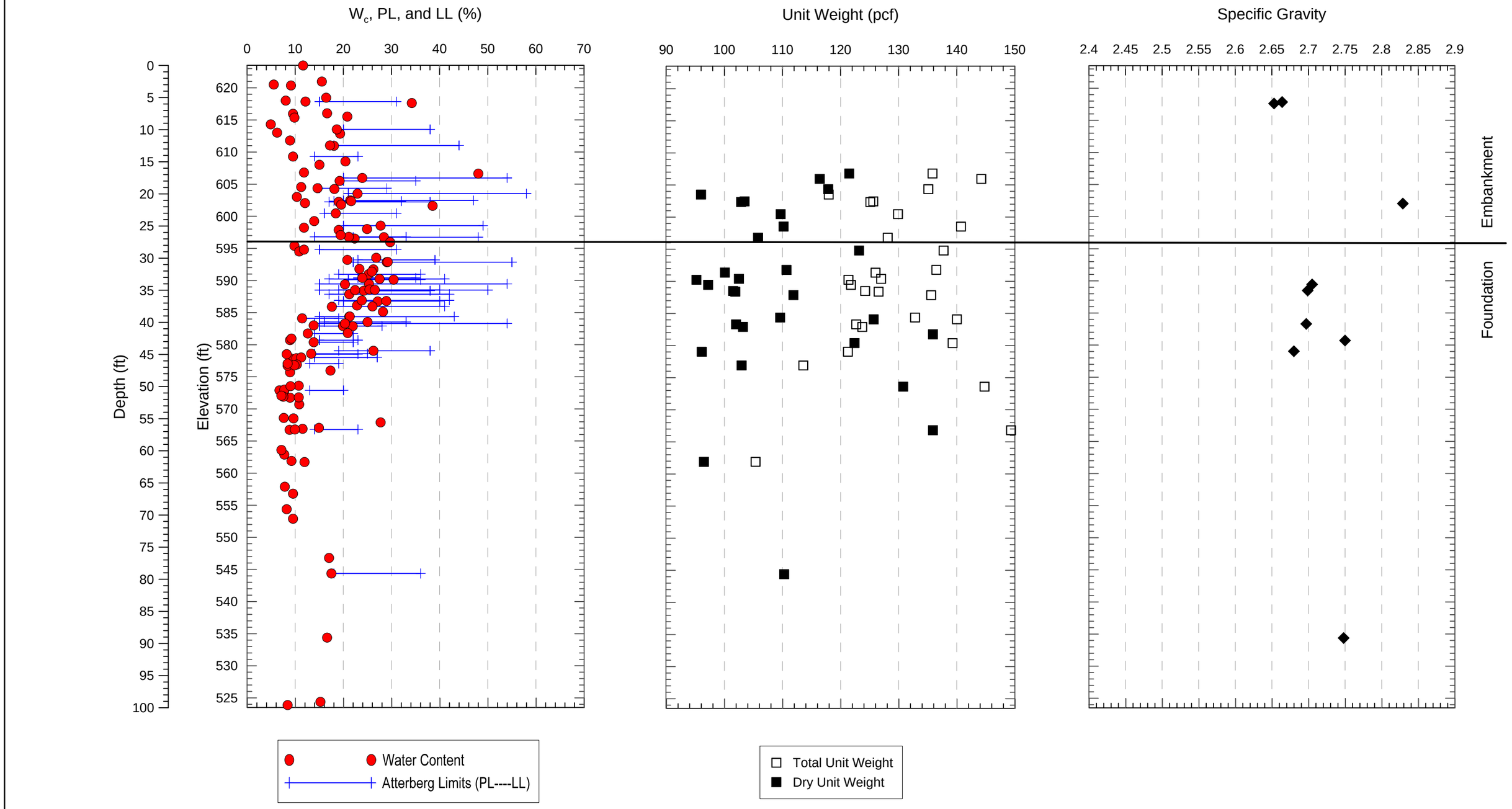
Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

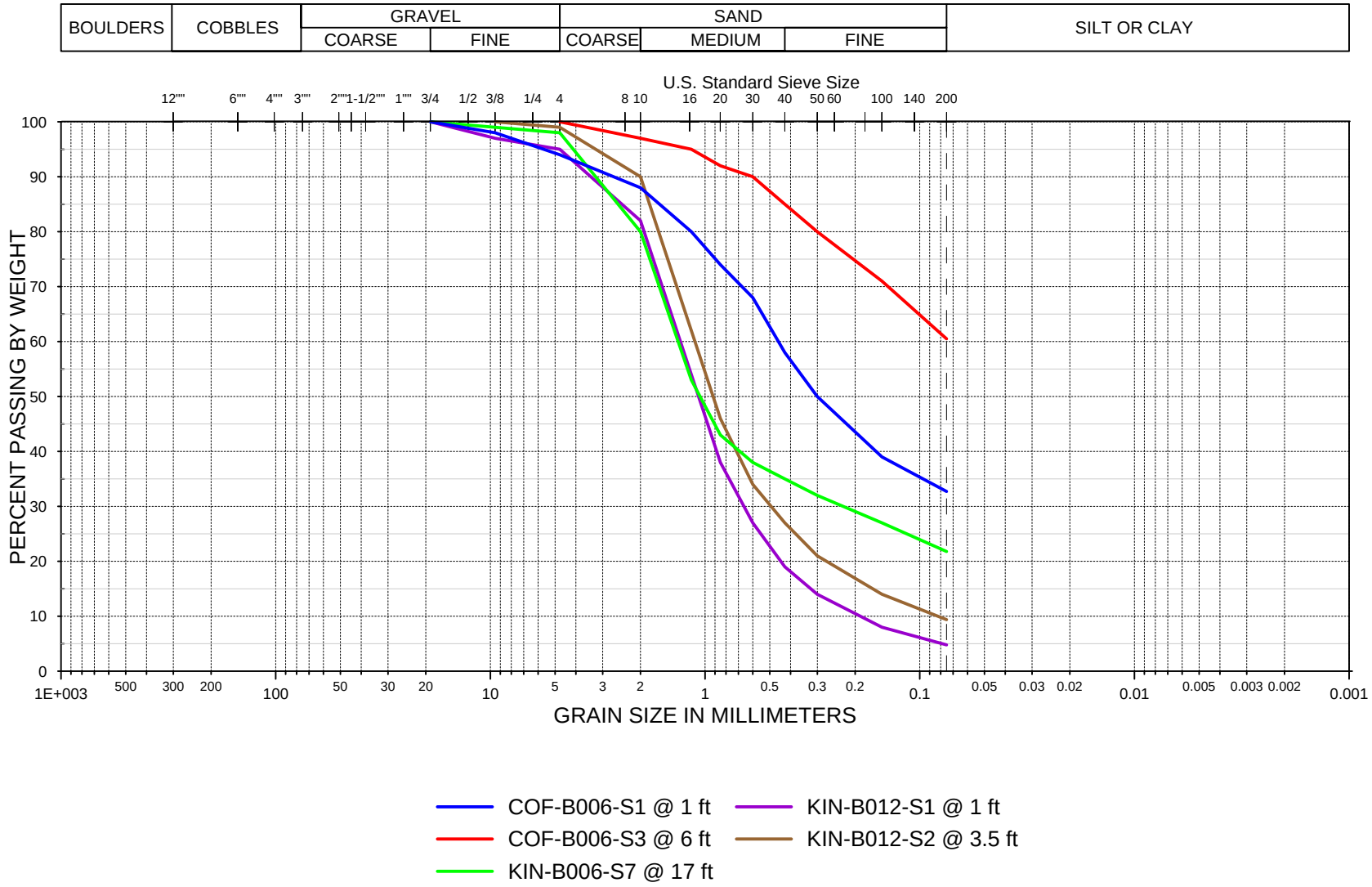
Task No.: 01

APPENDIX A

Index Properties



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond Water Content, Atterberg Limits, Unit Weight, and Specific Gravity	FIGURE
	AECOM		



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Impounded Ash** Gradations	Figure A.2
AECOM			

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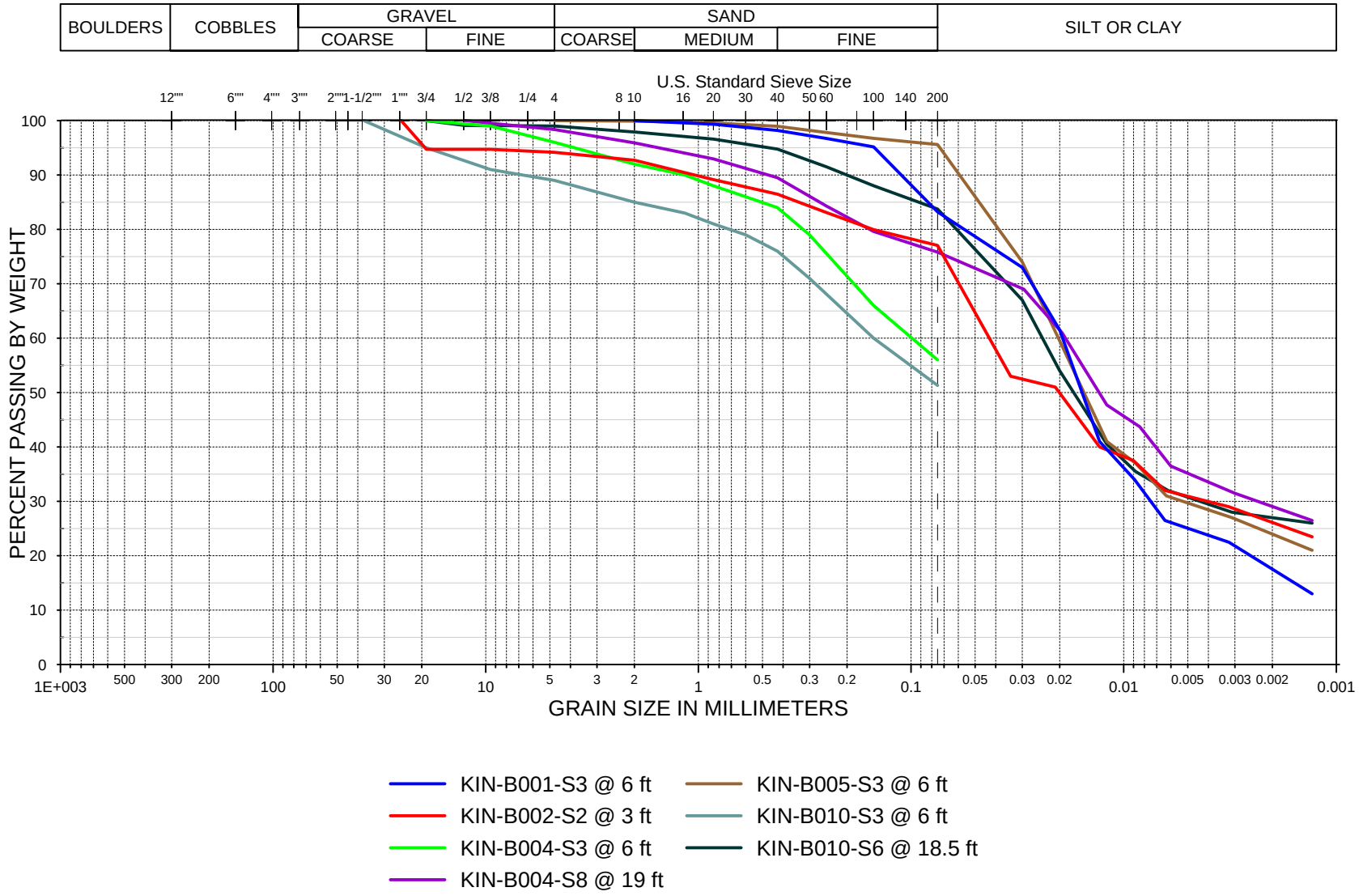

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** Gradations	Figure A.3
AECOM			

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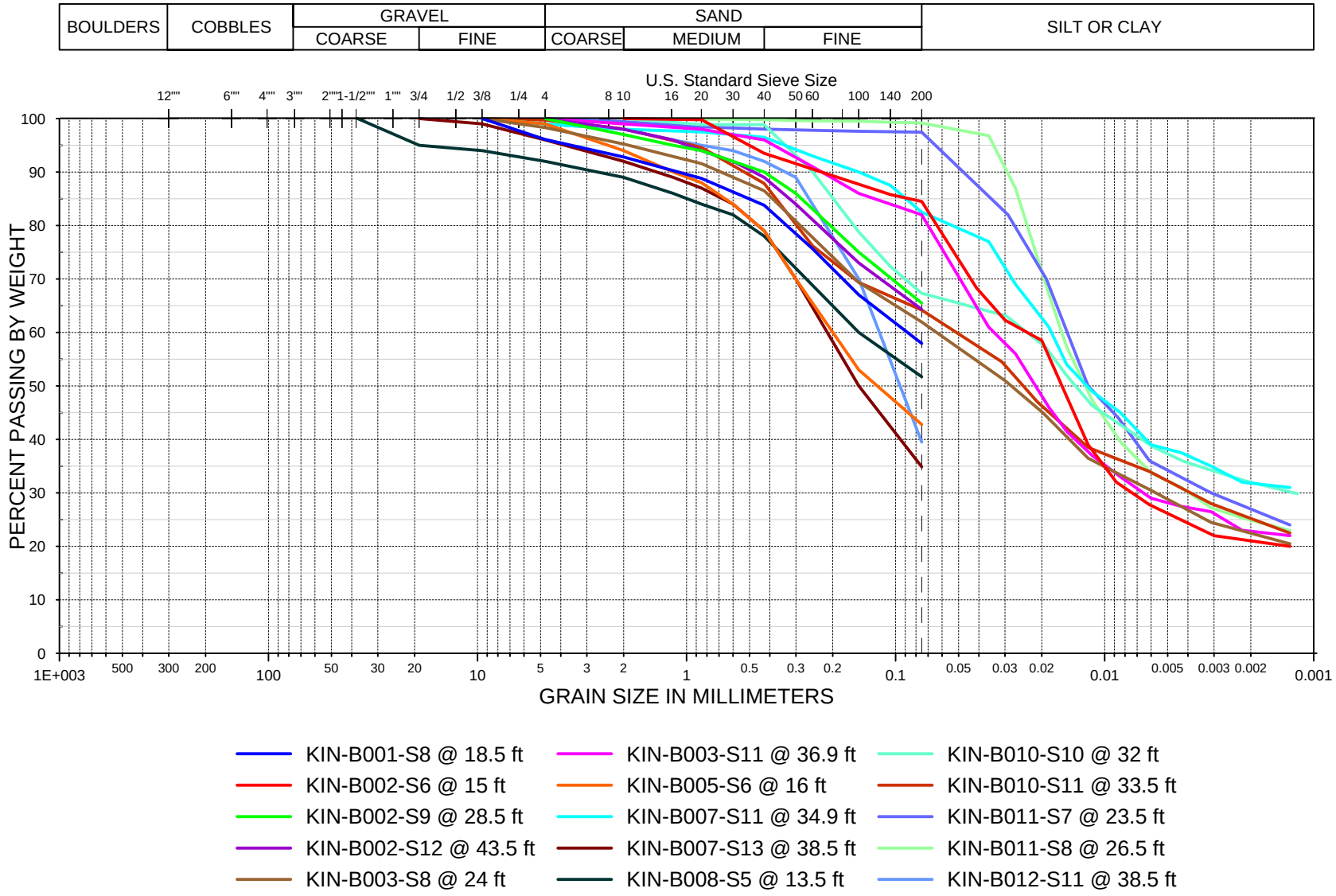

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Gradations	Figure A.4
AECOM			

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Calculation Notes

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

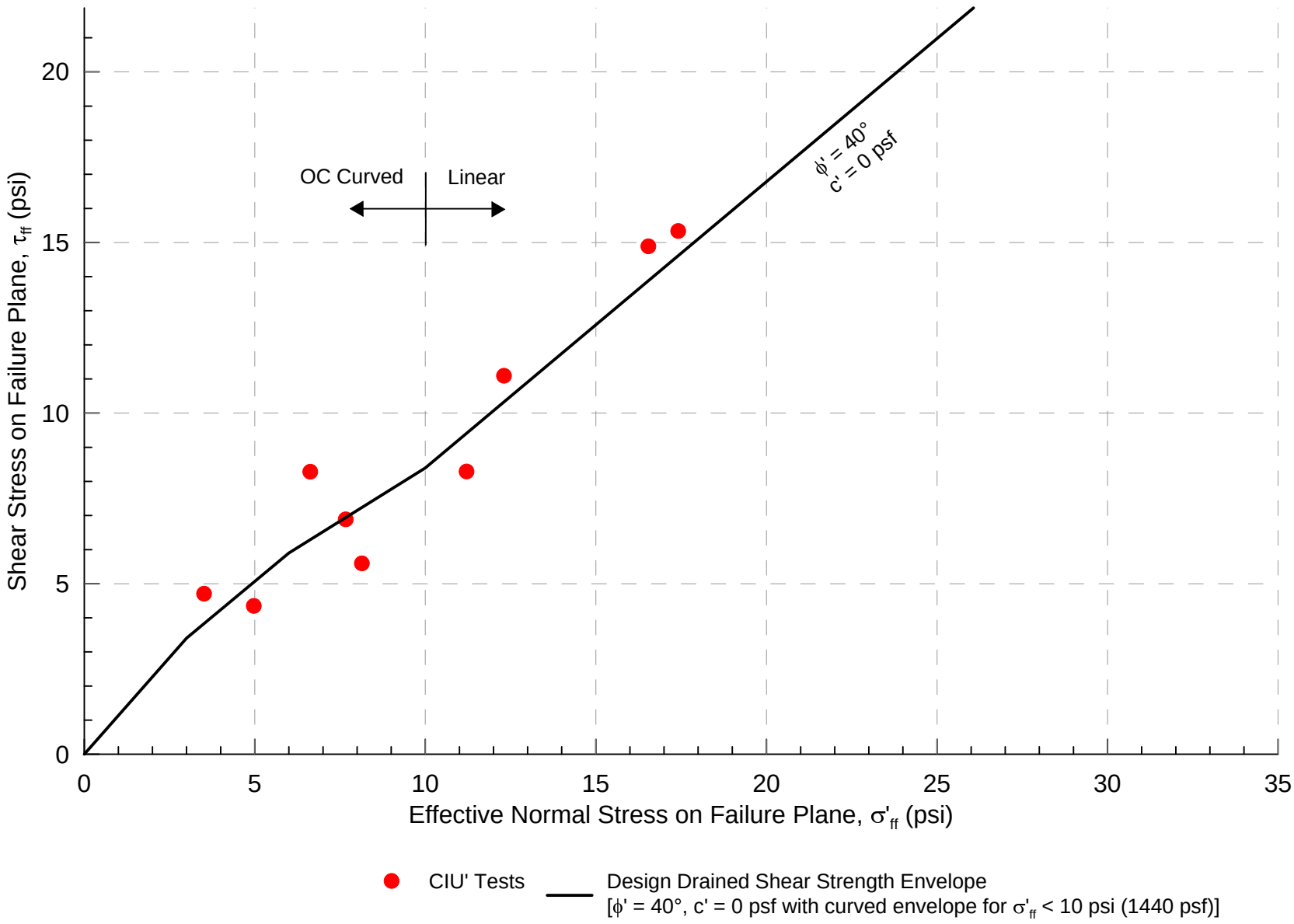
Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

APPENDIX B

Embankment Shear Strength Characterization



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** Drained Shear Strength Characterization	Figure B.1
AECOM			

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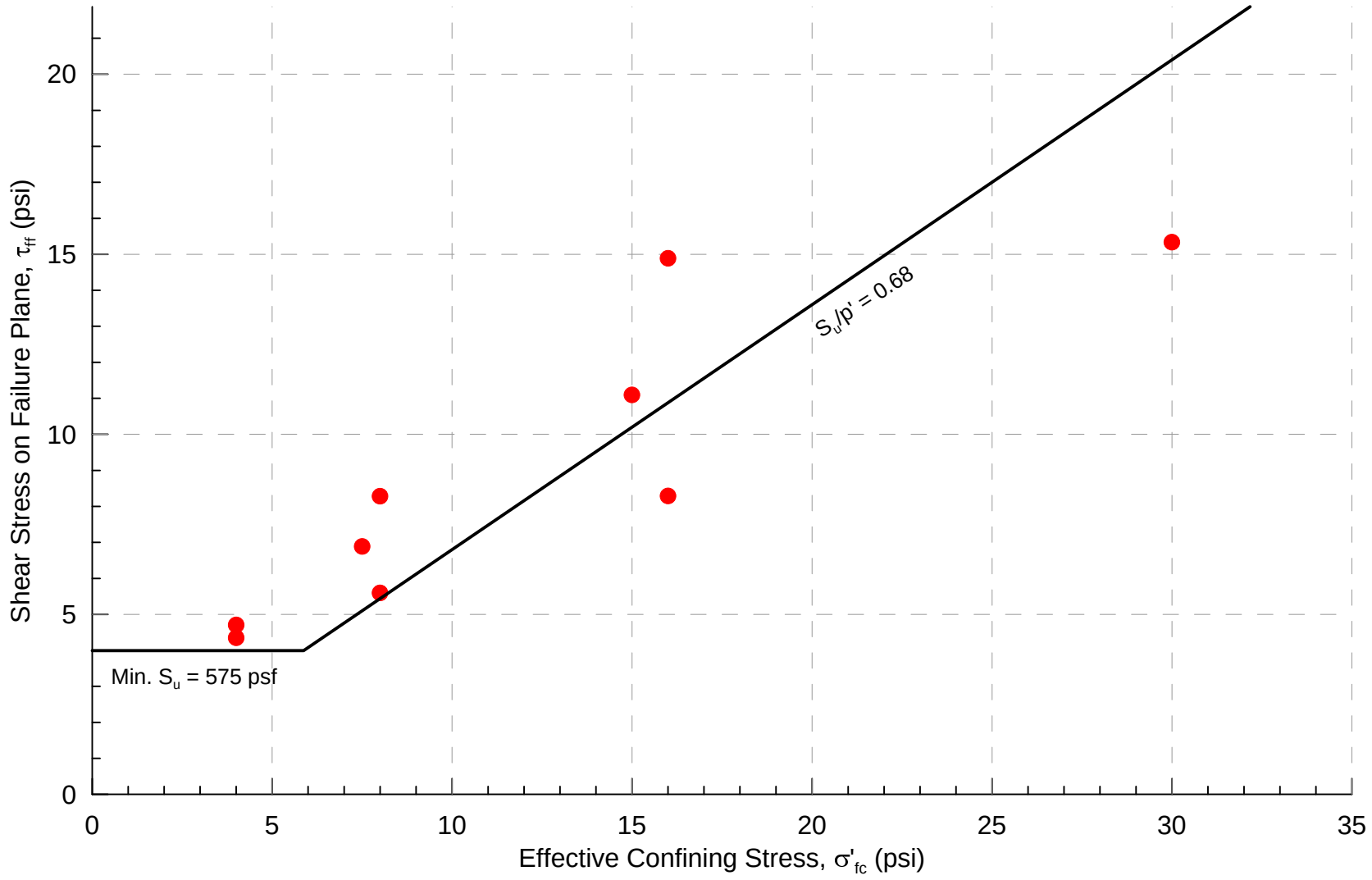

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** Undrained Shear Strength Characterization	Figure B.2
AECOM			

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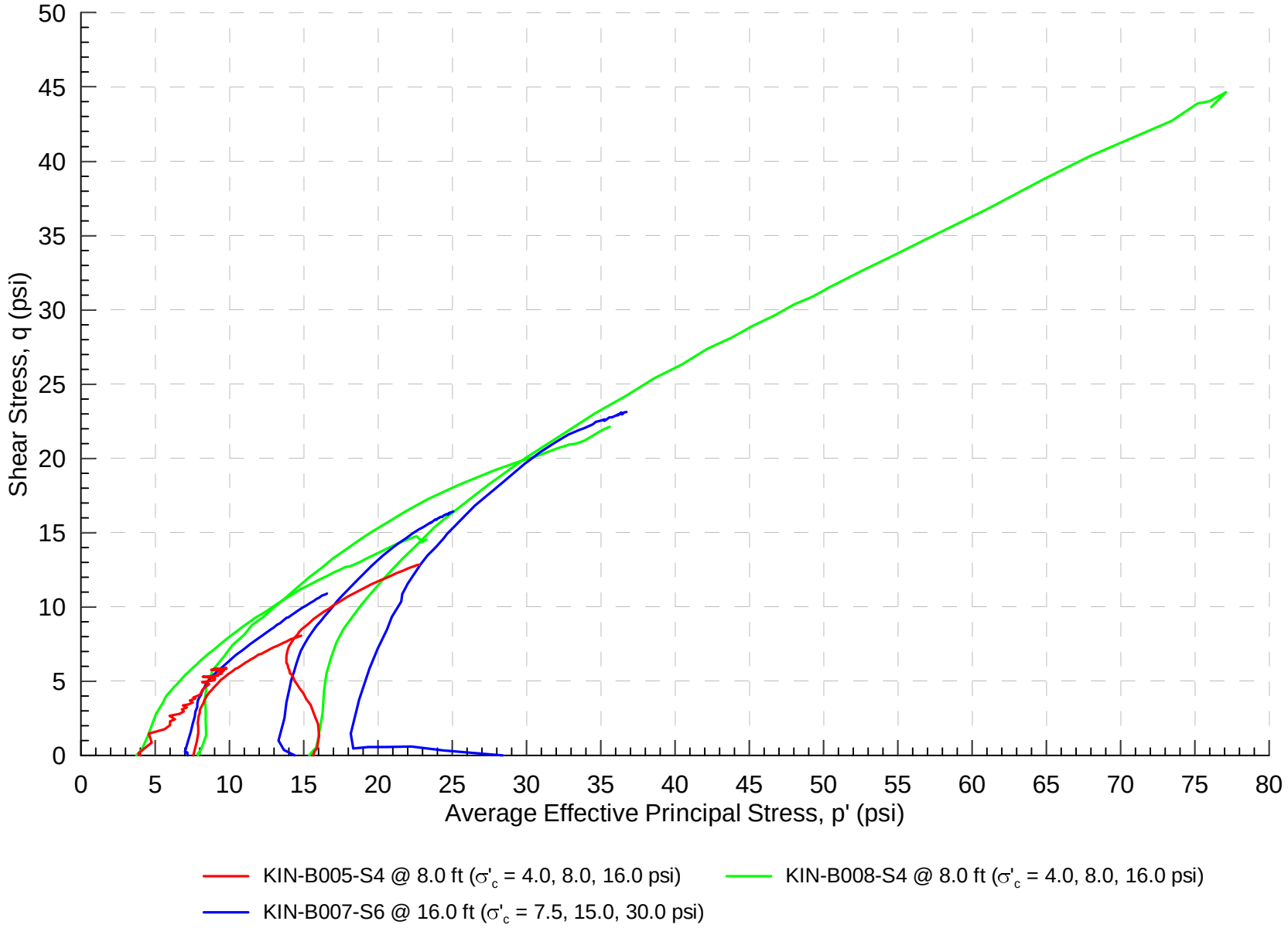

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** CIU' Stress Paths	Figure B.3
AECOM			

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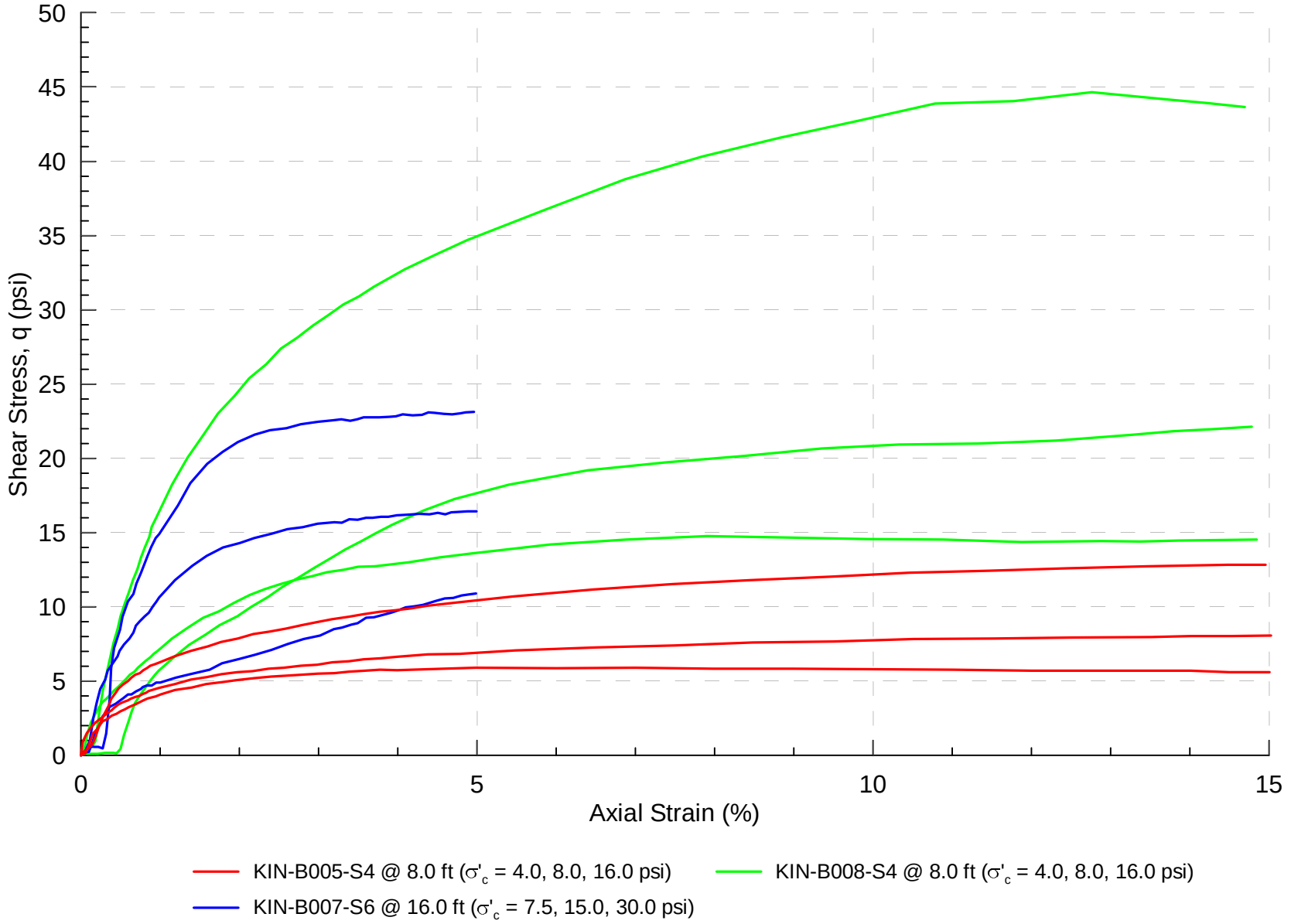

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** CIU' Stress vs Strain	Figure B.4
	AECOM		

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Calculation Notes

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

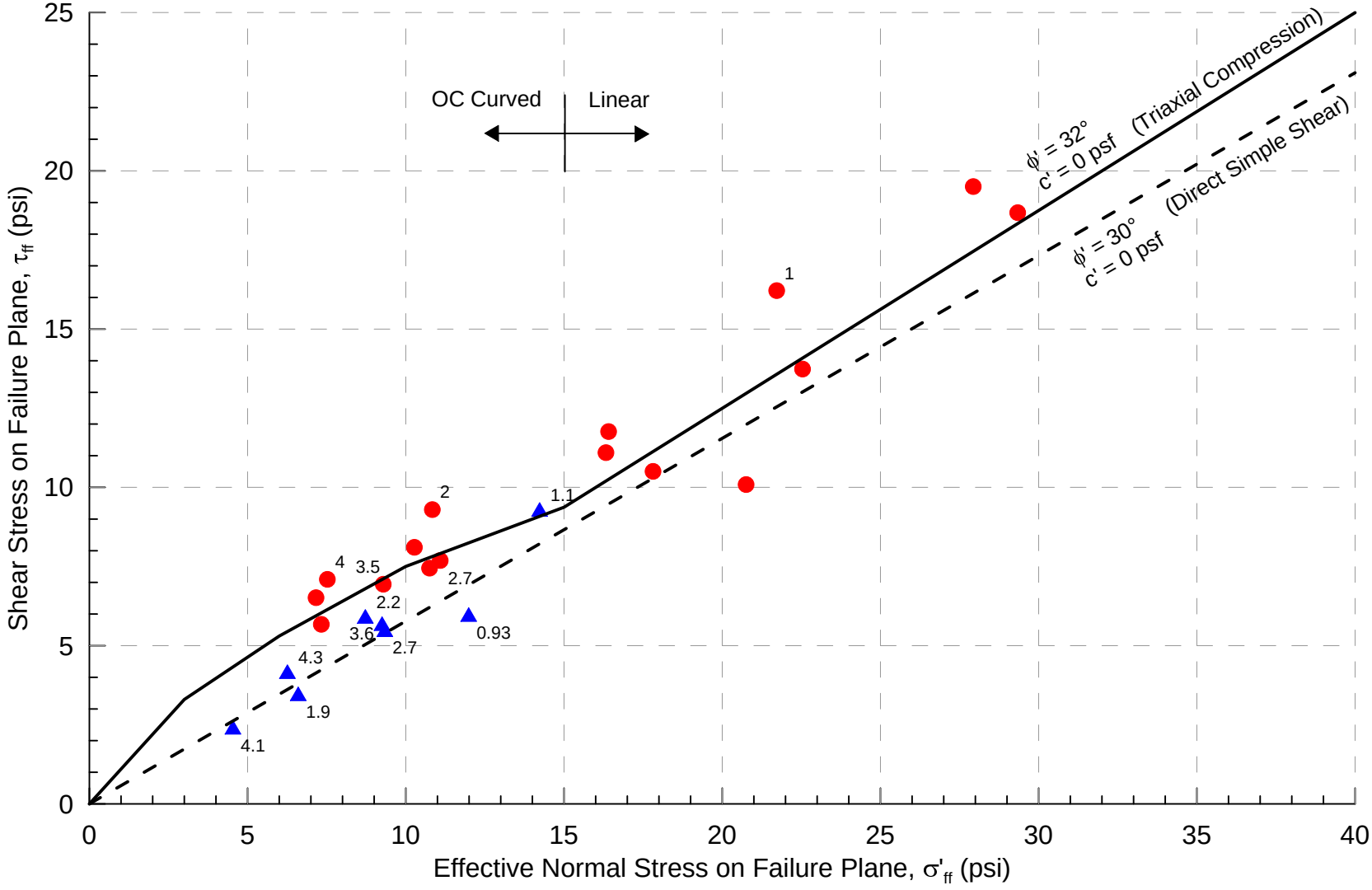
Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

APPENDIX C

Foundation Clay Shear Strength Characterization



CIU' Tests

DSS Tests

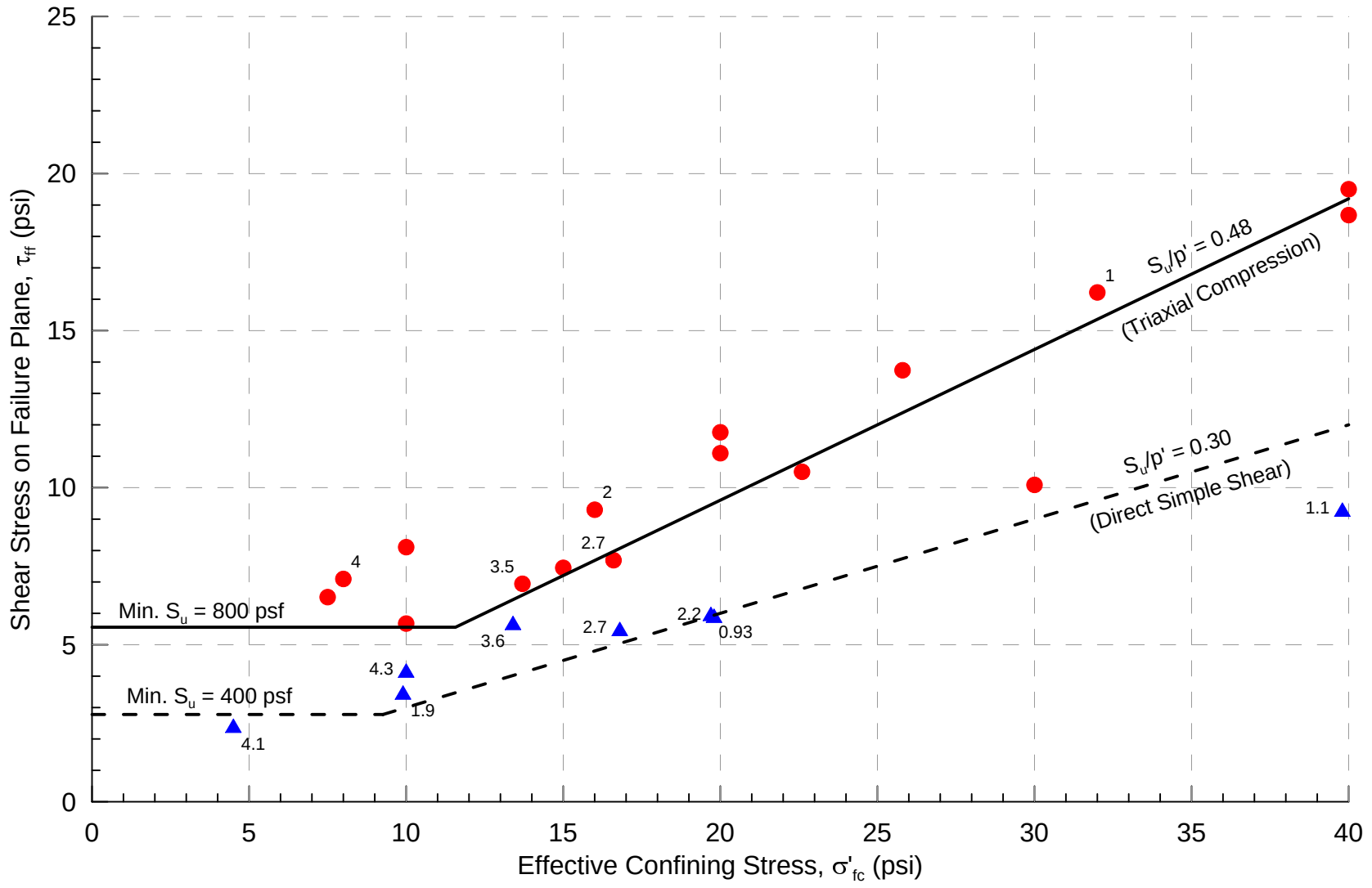
Design Drained Shear Strength Envelope - Below Embankment
[ϕ' = 32°, c' = 0 psf with curved envelope for σ'_{ff} < 15 psi (2160 psf)]

Design Drained Shear Strength Envelope - Free Field
[ϕ' = 30°, c' = 0 psf]

Notes:
1. Number next to point is OCR of sample tested.
2. Strength based on orientation of failure plane below the embankment and in the free field. Strength below embankment based on triaxial compression (CIU' tests), and strength in free field based on direct simple shear (DSS tests).

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Drained Shear Strength Characterization	Figure C.1
AECOM			

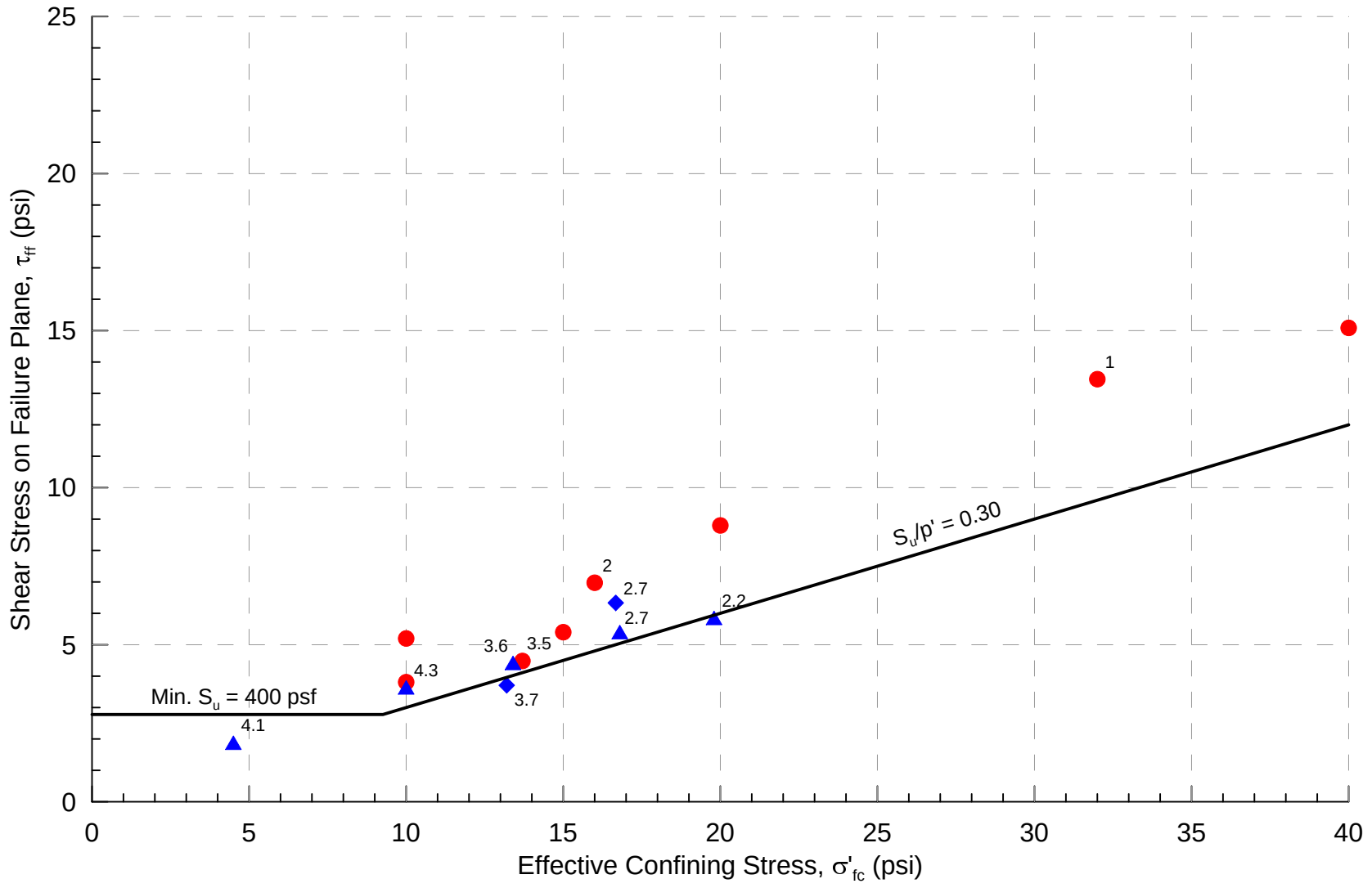
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Drained Strength Chara



Notes:
1. Number next to point is OCR of sample tested.
2. Strength based on orientation of failure plane below the embankment and in the free field. Strength below embankment based on triaxial compression (CIU' tests), and strength in free field based on direct simple shear (DSS tests).

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Undrained Shear Strength Characterization	Figure C.2
AECOM			

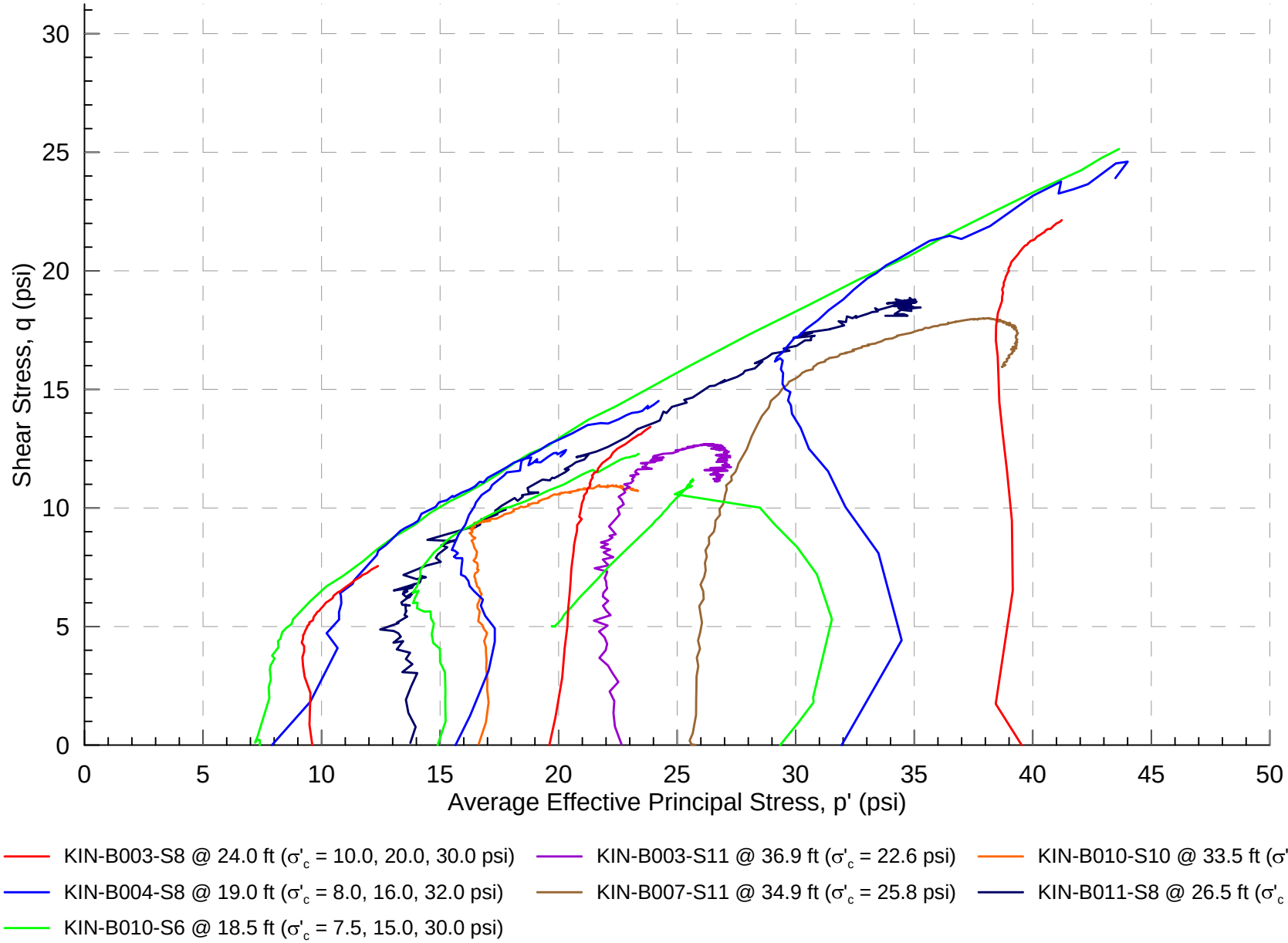
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Undrained Strength Characterization.grf



◆ Post-Cyclic DSS Tests
▲ Quasi Steady State Static DSS Tests
● Quasi Steady State Static CIU' Tests
— Design Post-Earthquake Shear Strength Envelope [S_u/p' = 0.30; Minimum S_u = 2.78 psi (400 psf)]

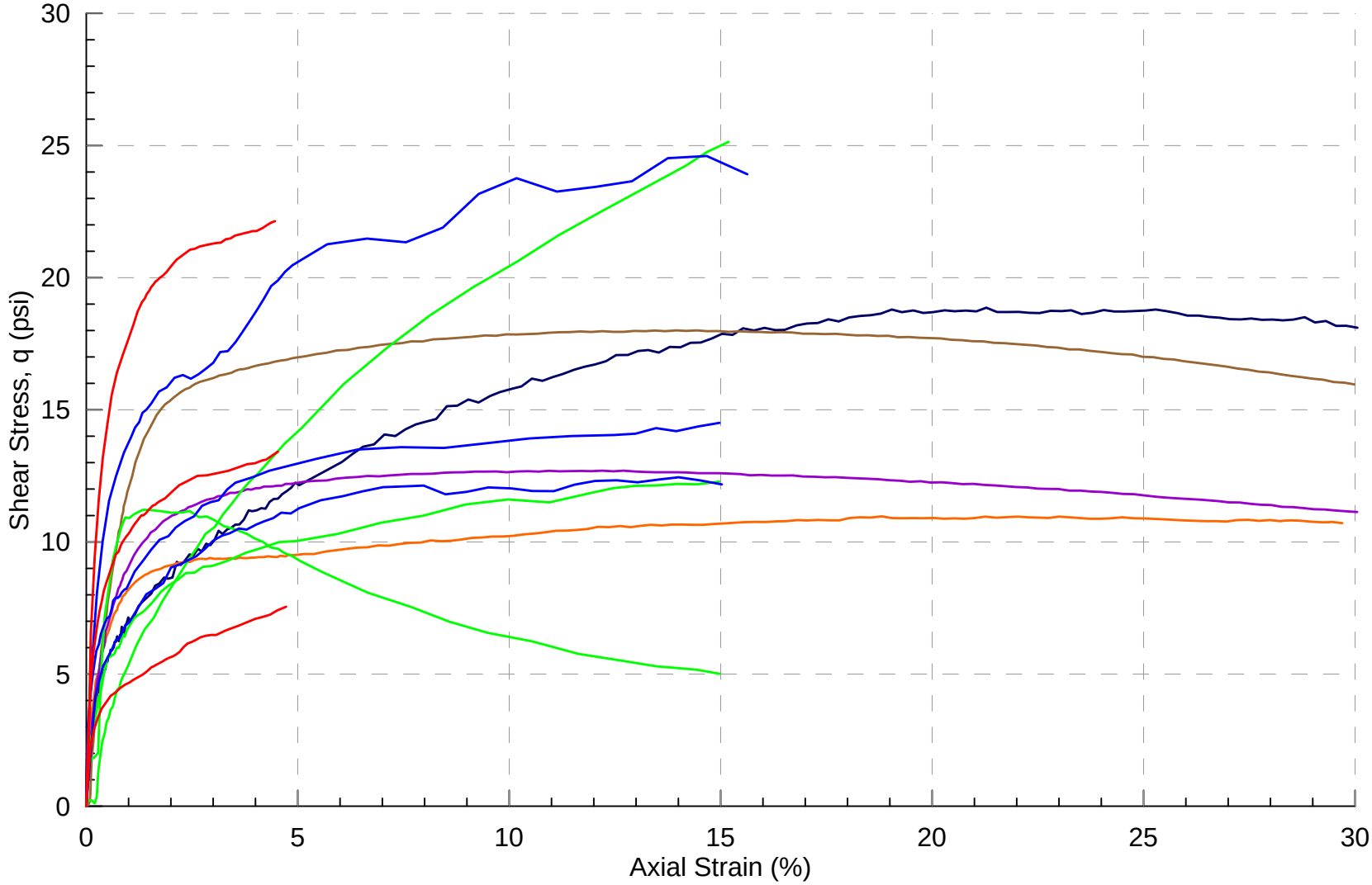
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Post-Earthquake Shear Strength Characterization	Figure C.3
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Post Earthquake Strength Characterization.grf



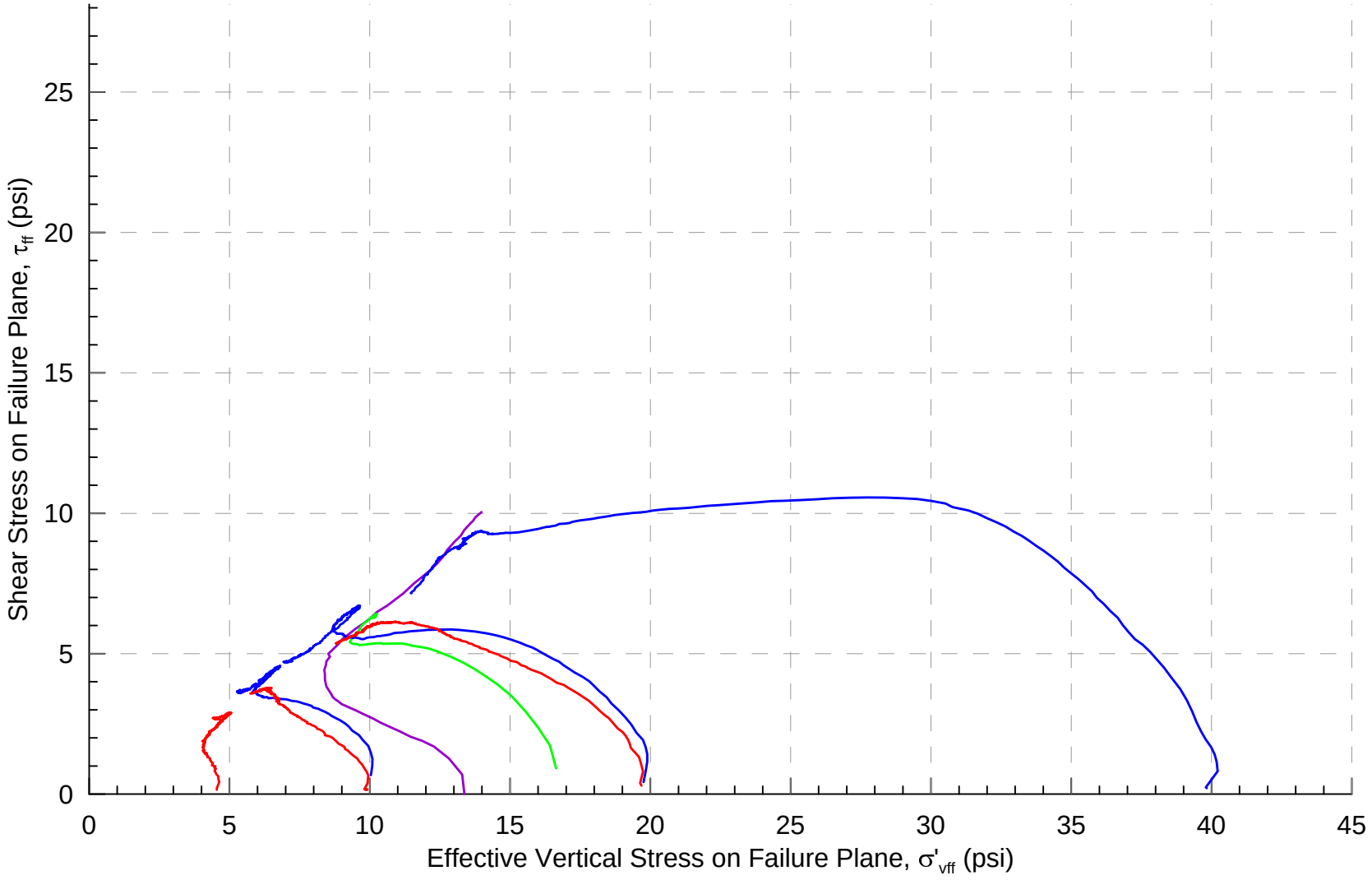
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** CIU' Stress Paths	Figure C.4
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay CIU' Stress Paths.grf



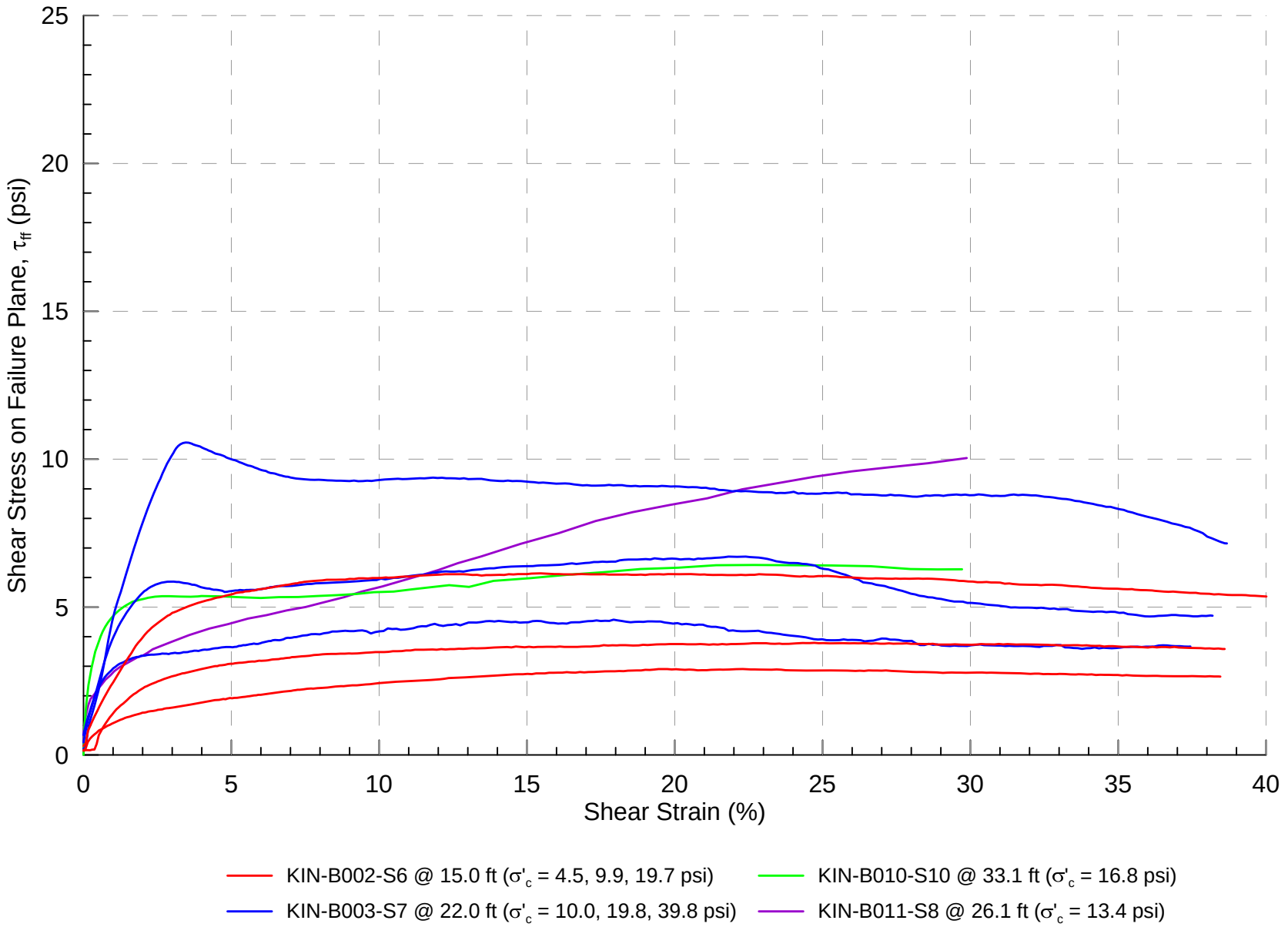
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** CIU' Stress vs Strain	Figure C.5
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay CIU' Stress vs Strain.gr



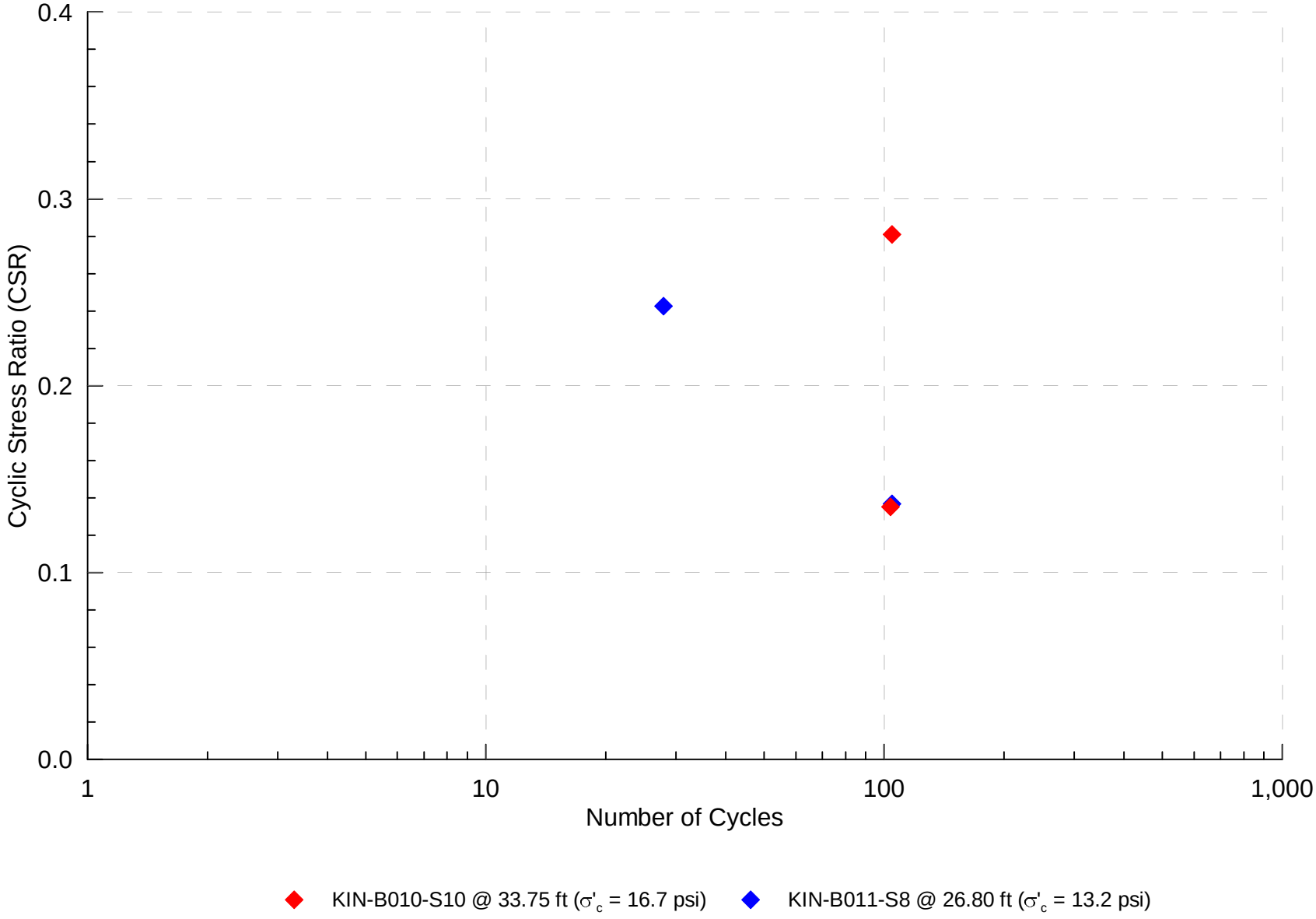
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** DSS Test Paths	Figure C.6
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay DSS Test Paths.grf



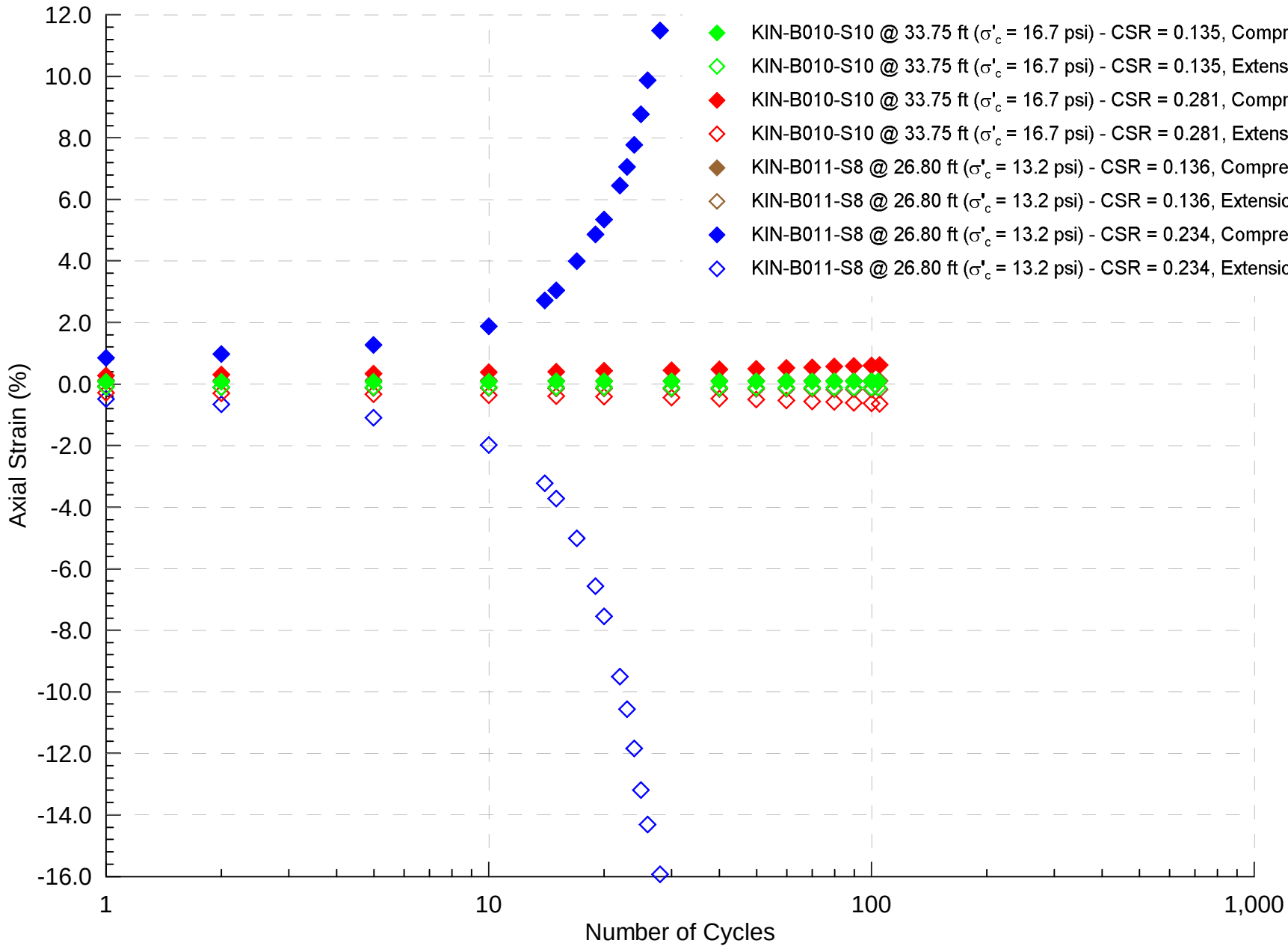
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** DSS Stress vs Strain	Figure C.7
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay DSS Stress vs Strain.gi



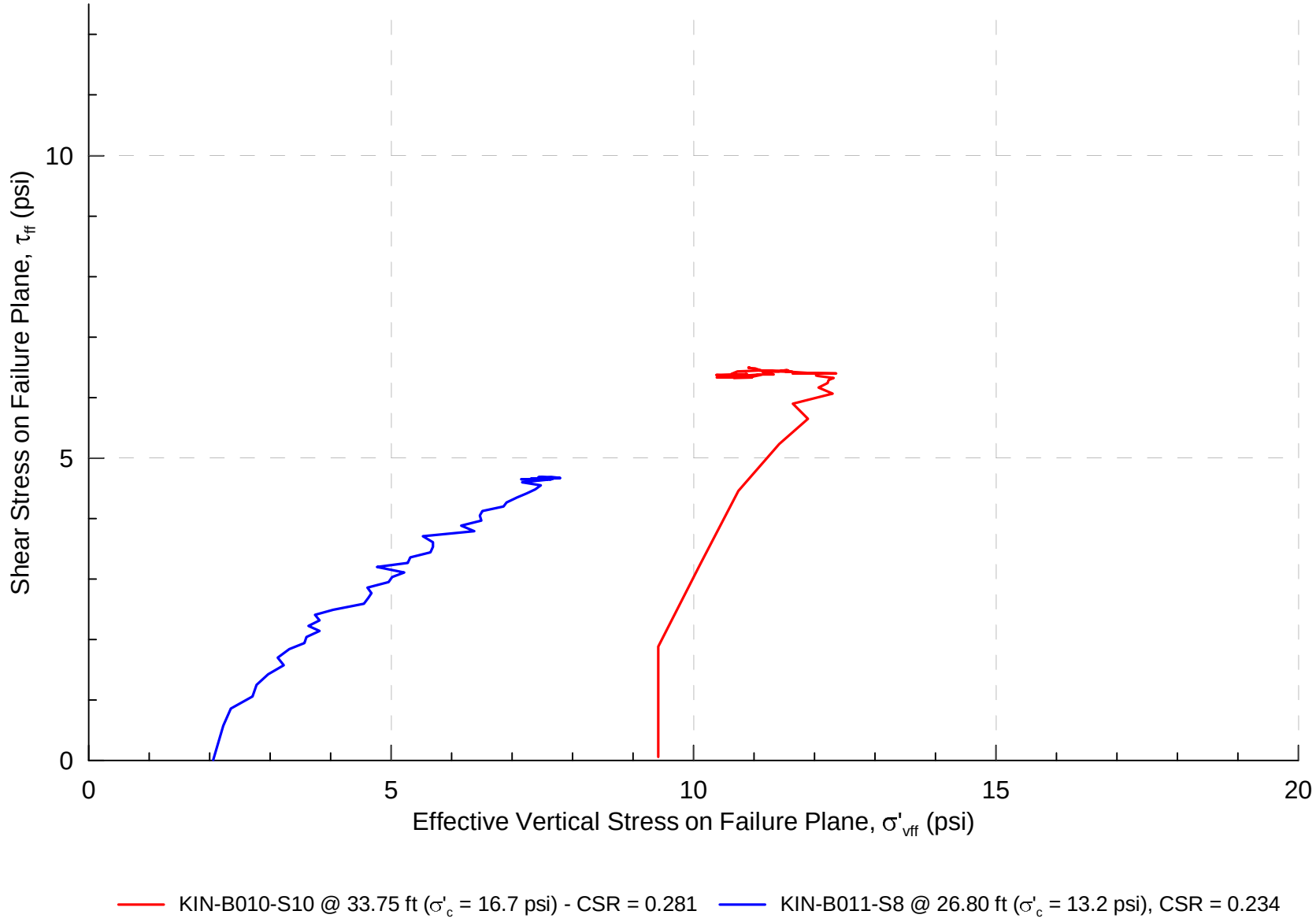
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Cyclic DSS CSR vs Cycles	Figure C.8
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Cyclic DSS CSR vs Cycl



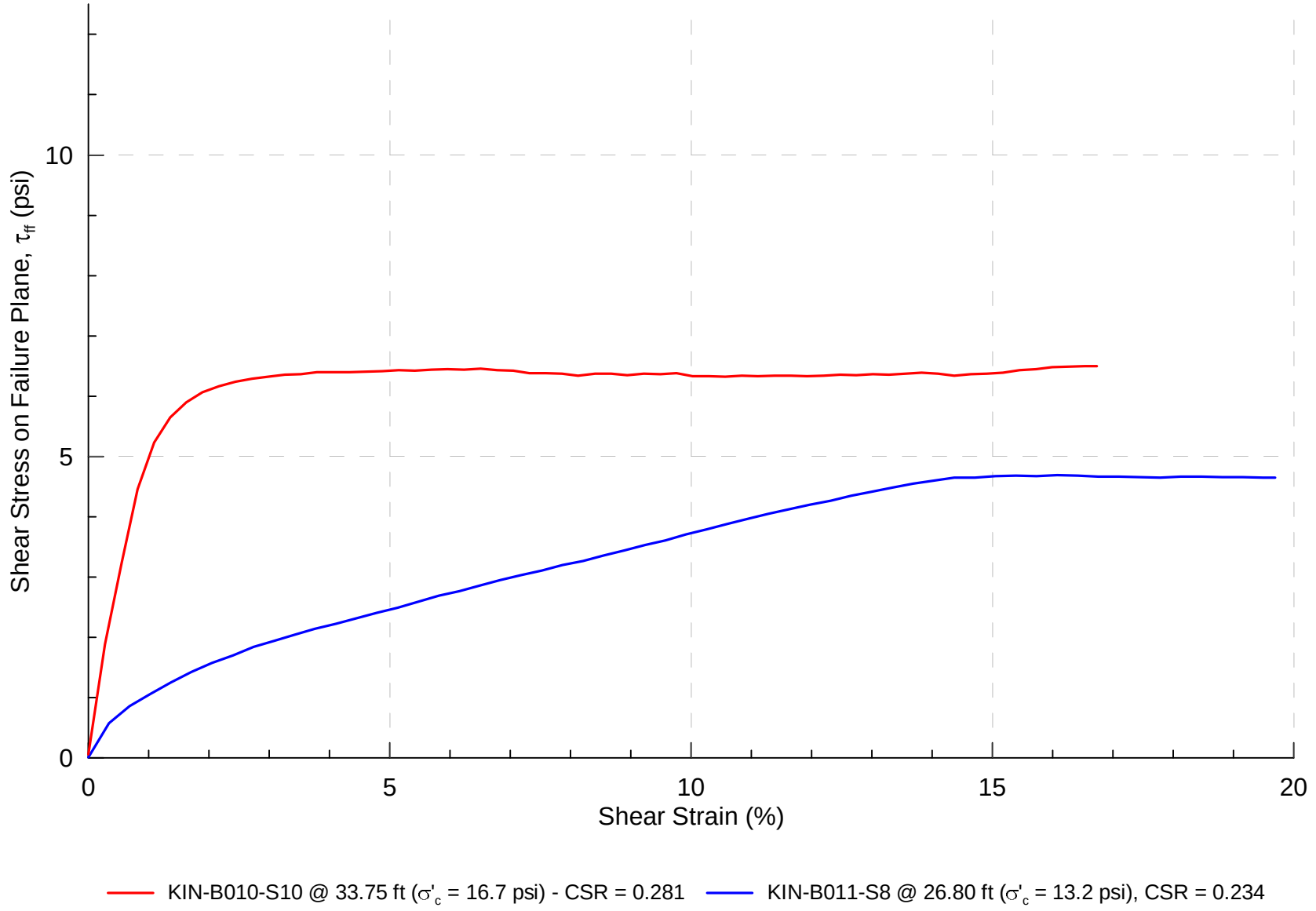
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Cyclic DSS Strain vs Cycles	Figure C.9
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Cyclic DSS Strain vs Cyc



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Post-Cyclic DSS Test Paths	Figure C.10
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Post Cyclic DSS Test Pa



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Post-Cyclic DSS Stress vs Strain	Figure C.11
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Post-Cyclic DSS Stress v

Calculation Notes

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

APPENDIX D

CPT Plots

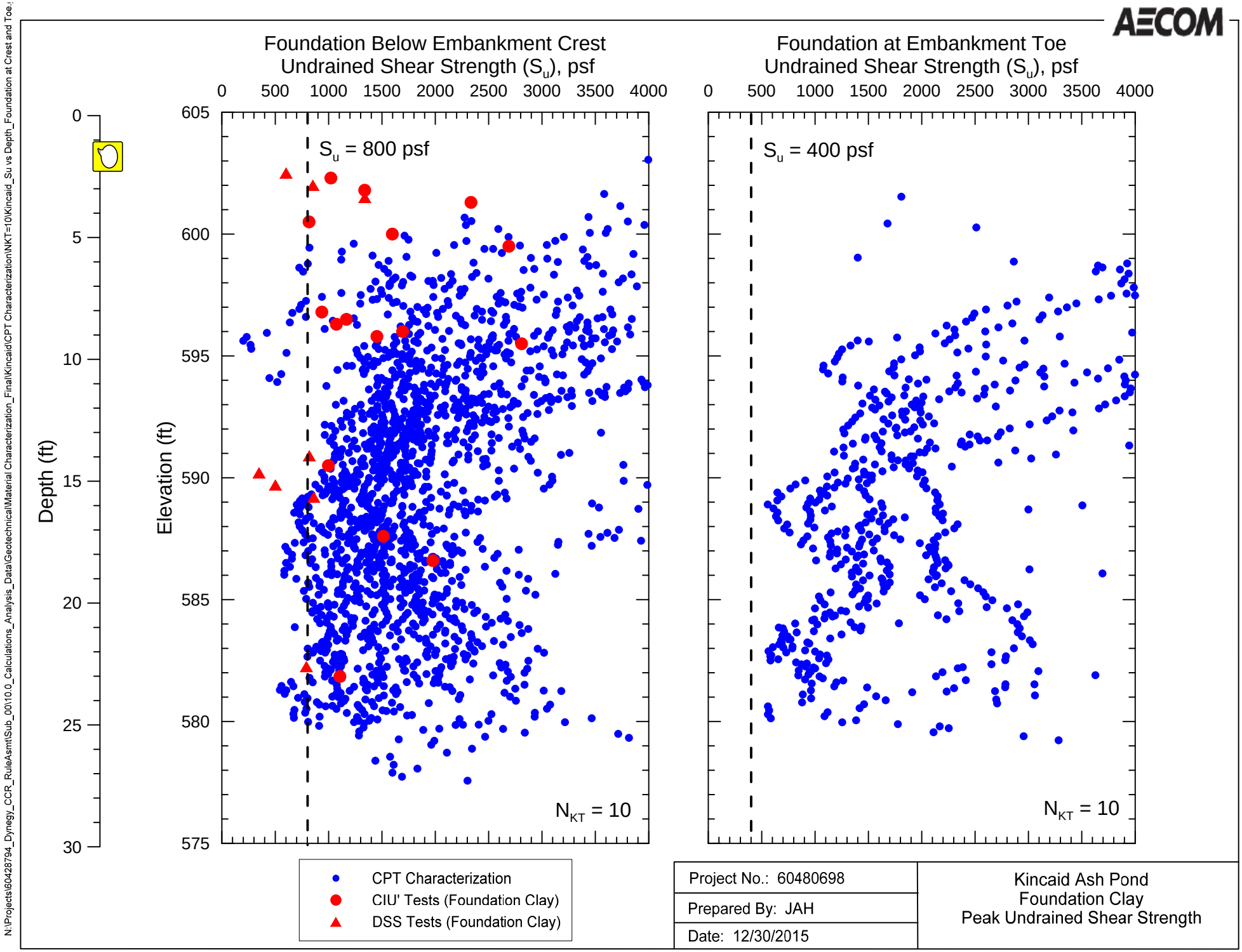

AECOM
Foundation Below Embankment Crest
Undrained Shear Strength (S_u), psf
0 500 1000 1500 2000 2500 3000 3500 4000
S_u = 800 psf
N_{KT} = 10
Depth (ft)
Elevation (ft)
0 5 10 15 20 25 30
605 600 595 590 585 580 575
Foundation at Embankment Toe
Undrained Shear Strength (S_u), psf
0 500 1000 1500 2000 2500 3000 3500 4000
S_u = 400 psf
N_{KT} = 10
CPT Characterization
CIU' Tests (Foundation Clay)
DSS Tests (Foundation Clay)
Project No.: 60480698
Prepared By: JAH
Date: 12/30/2015
Kincaid Ash Pond
Foundation Clay
Peak Undrained Shear Strength
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\CPT Characterization\NKT=10\Kincaid_Su vs Depth_Foundation at Crest and Toe.j

Figure D.1

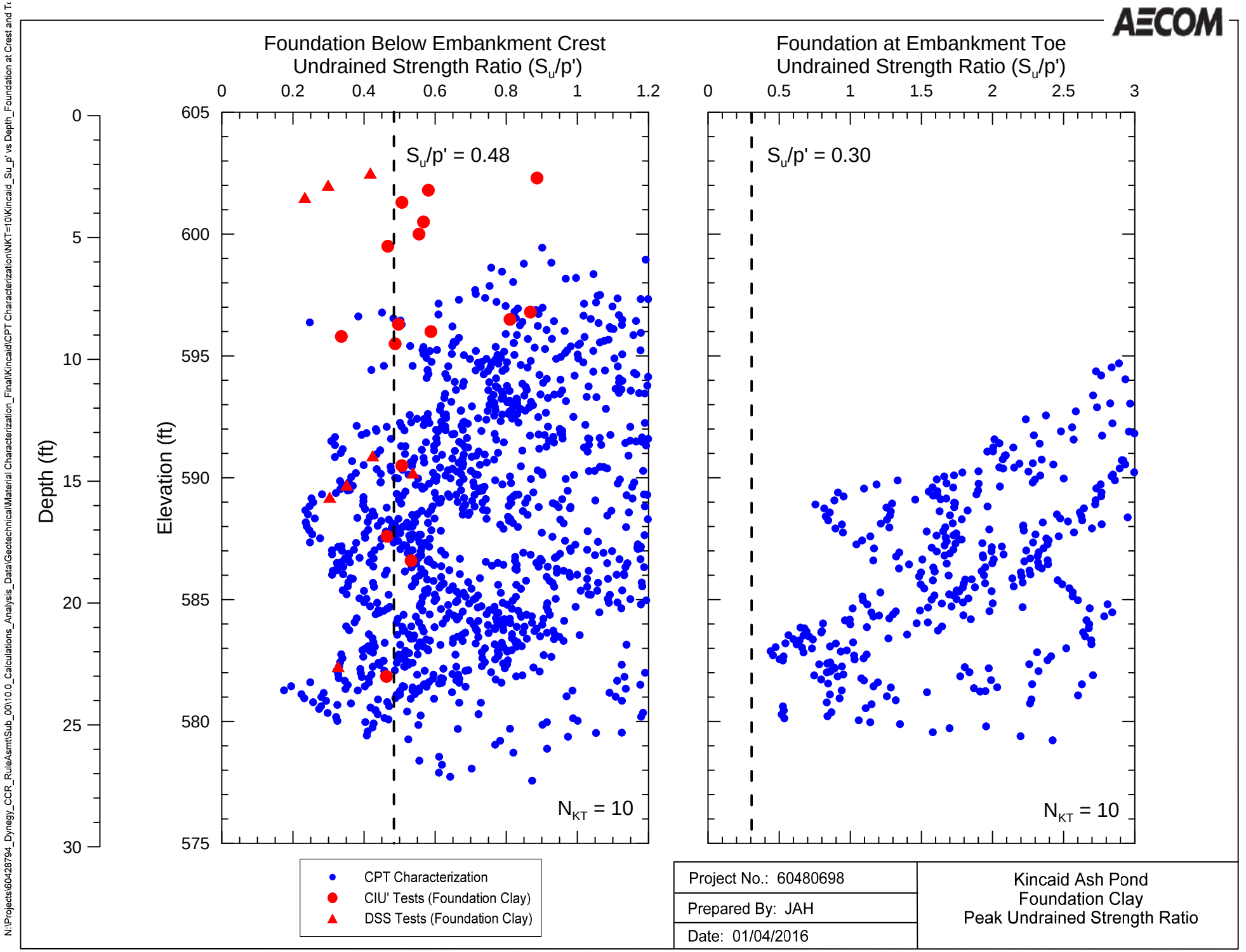

AECOM
Foundation Below Embankment Crest
Undrained Strength Ratio (S_u/p')
Foundation at Embankment Toe
Undrained Strength Ratio (S_u/p')
S_u/p' = 0.48
S_u/p' = 0.30
N_{KT} = 10
N_{KT} = 10
Depth (ft)
Elevation (ft)
CPT Characterization
CIU' Tests (Foundation Clay)
DSS Tests (Foundation Clay)
Project No.: 60480698
Prepared By: JAH
Date: 01/04/2016
Kincaid Ash Pond
Foundation Clay
Peak Undrained Strength Ratio
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\CPT Characterization\NKT=10\Kincaid_Su_p' vs Depth_Foundation at Crest and Tr

Figure D.2

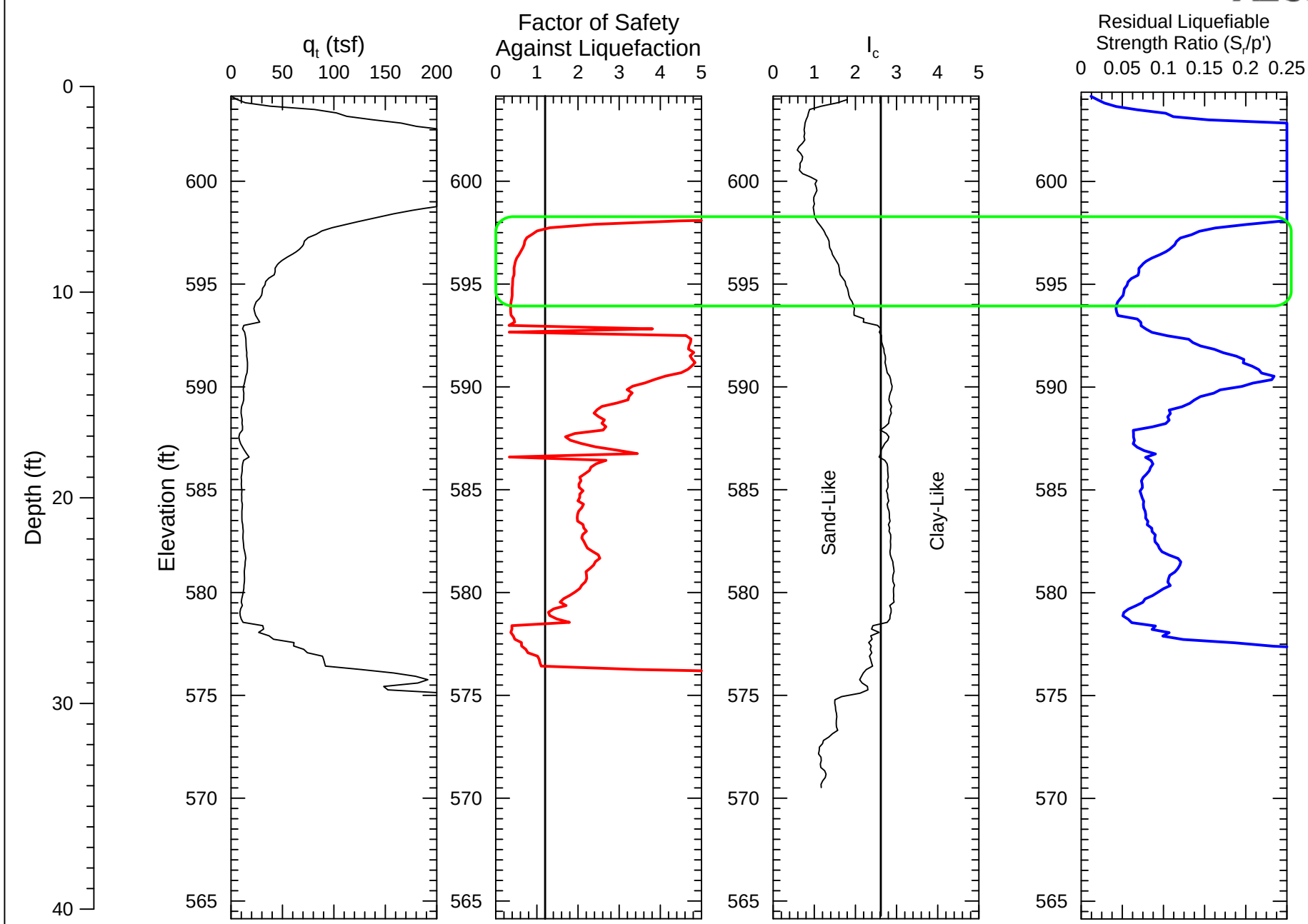
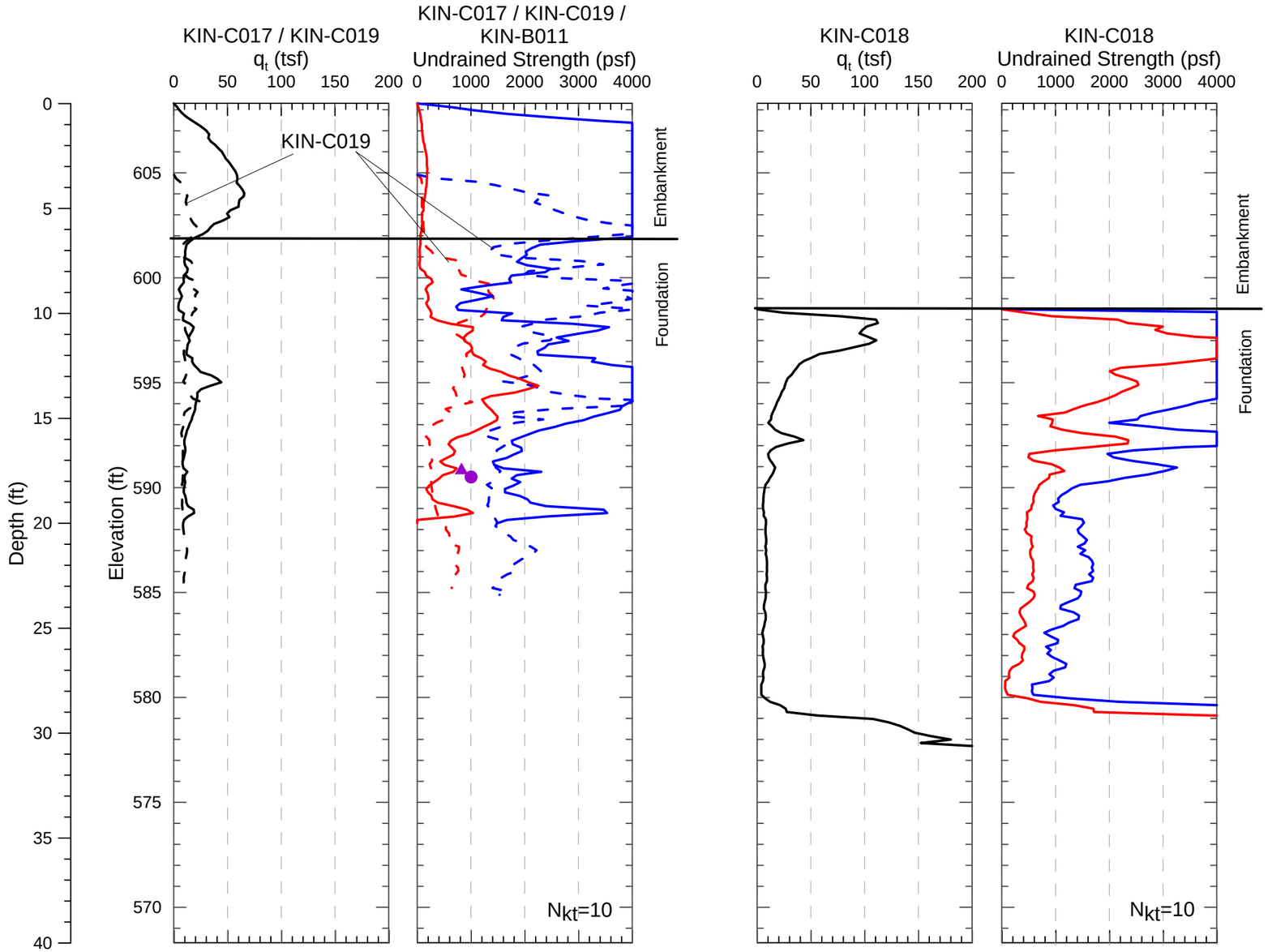
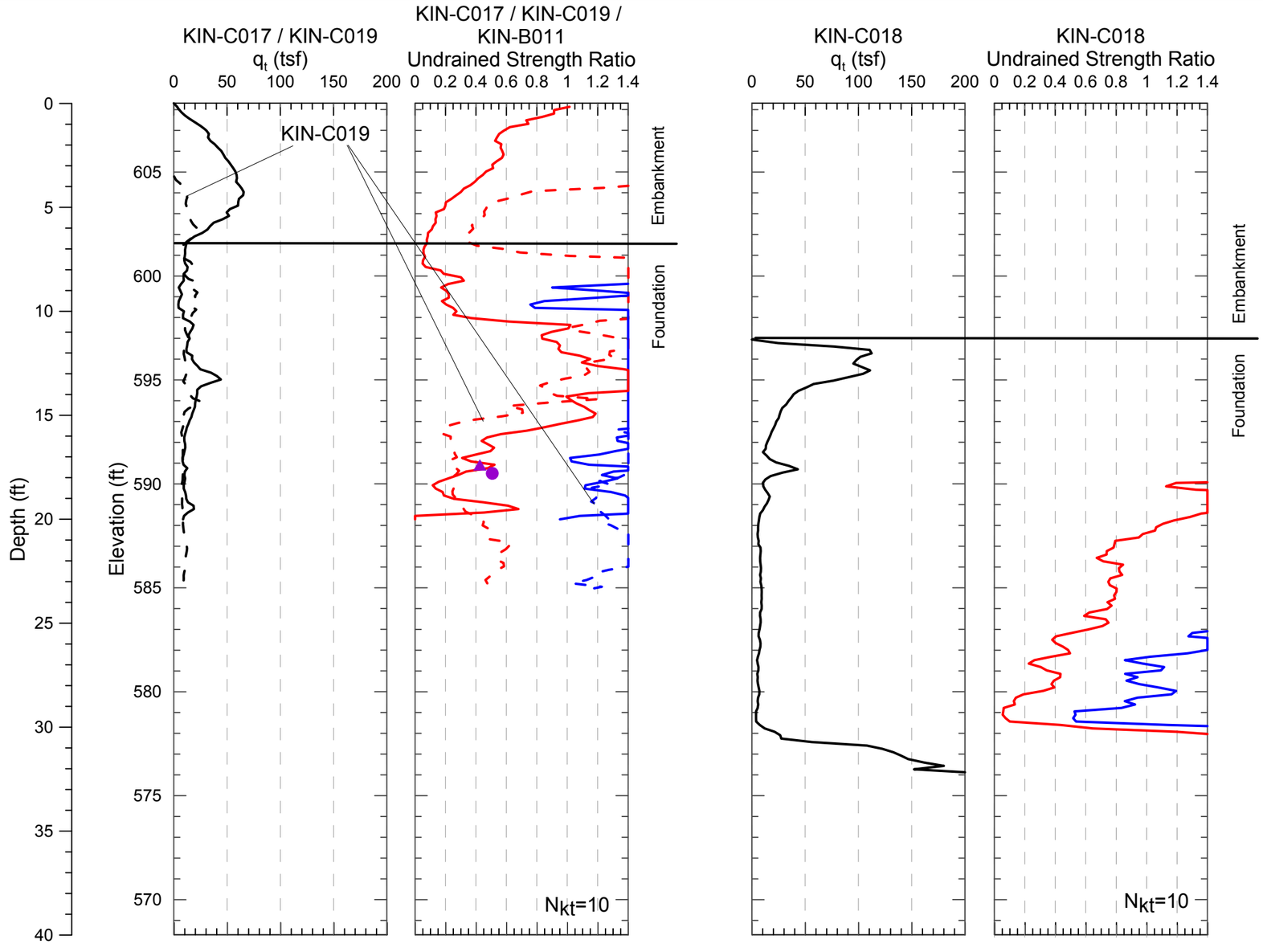

AECOM
q_t (tsf)
0 50 100 150 200
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Residual Liquefiable
Strength Ratio (S_r/p')
0 0.05 0.1 0.15 0.2 0.25
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Residual Liquefiable Strength
Factor of Safety
Estimated Ground Surface
El 604.1 FT
Project No. 60480701
Prepared By: KLR
Date: 01/29/2016
KIN-022
Kincaid Ash Pond
Residual Liquefied Strength
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-022 Triggering_SrCOR.grf

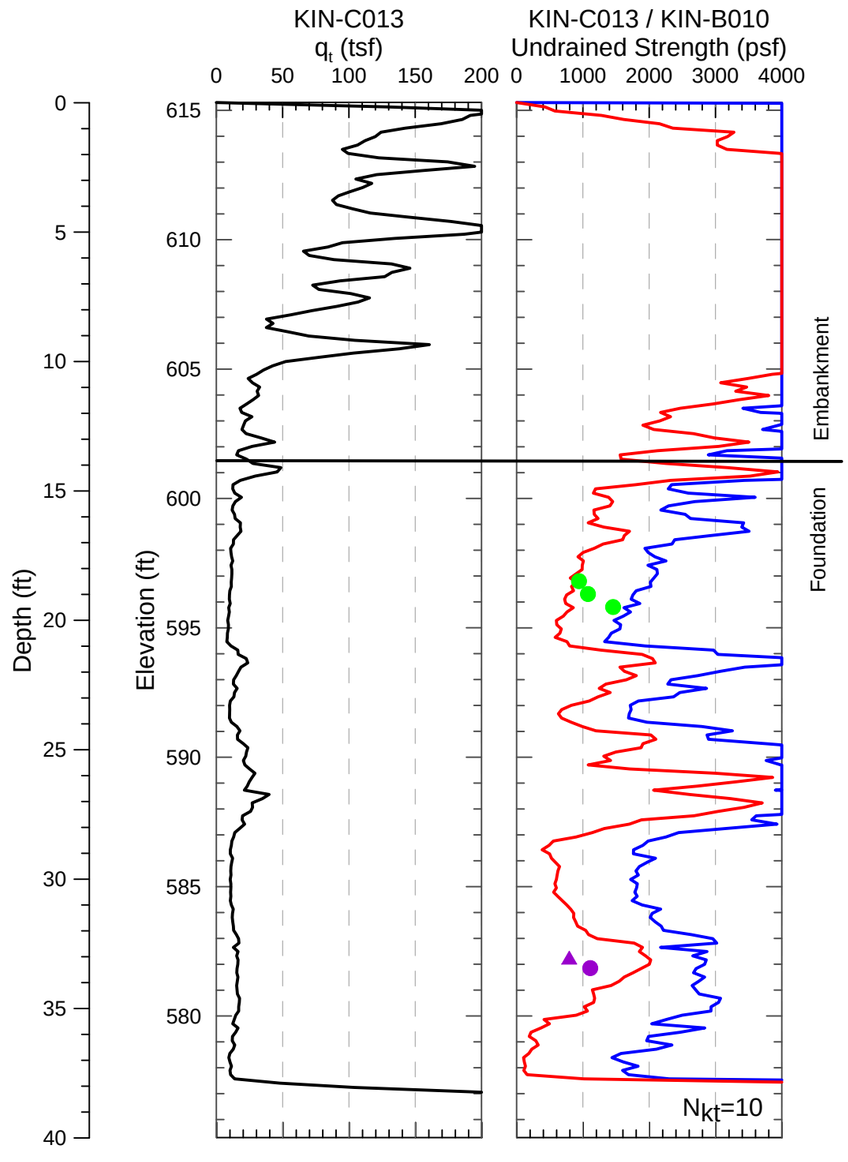
Figure D.3



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 22+00 CPT and Undrained Strength	FIGURE D.4
AECOM			



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 22+00 CPT and Undrained Strength Ratio	FIGURE D.5
AECOM			



Peak Undrained Strength (S_u)

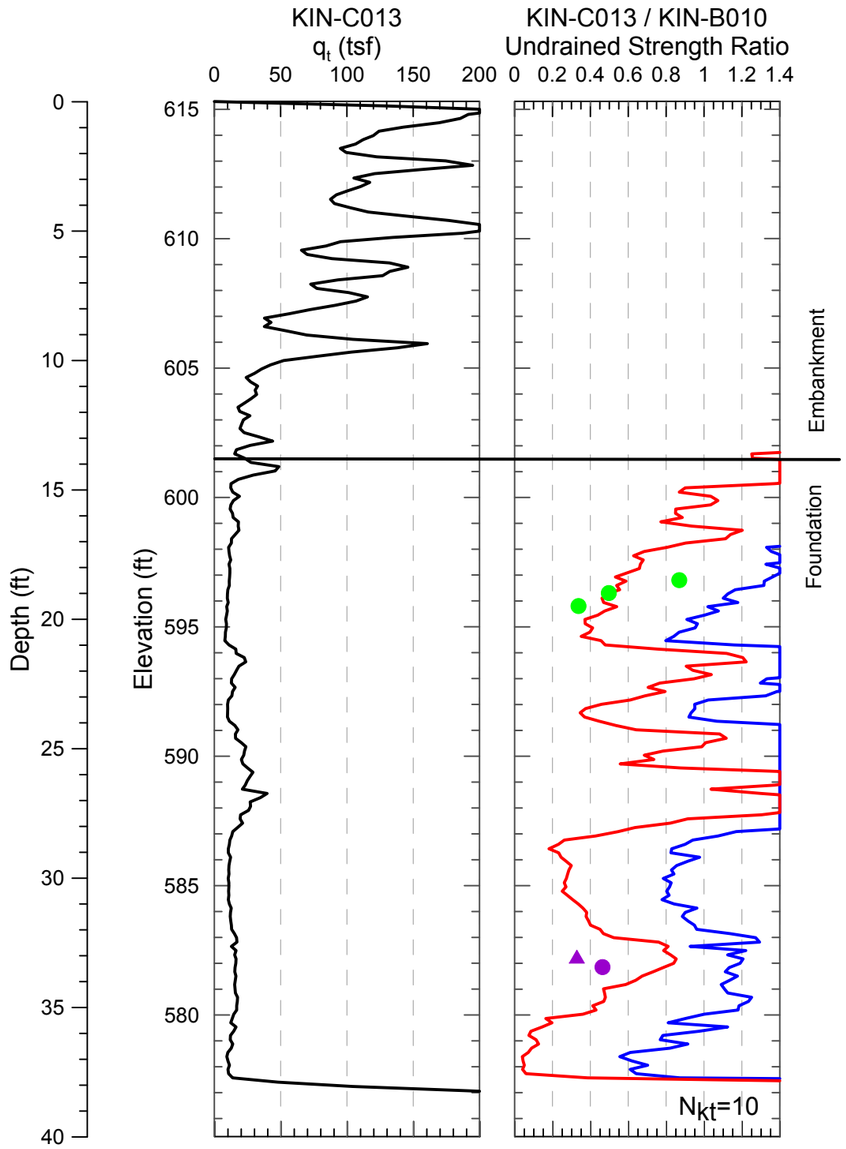
Remolded Undrained Strength (f_s)

CIU' Test (Foundation Clay - Crust)

CIU' Test (Foundation Clay - Lower)

DSS Test (Foundation Clay - Lower)

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 44+00 CPT and Undrained Strength	FIGURE D.6
AECOM			



Peak Undrained Strength Ratio (S_u/p')

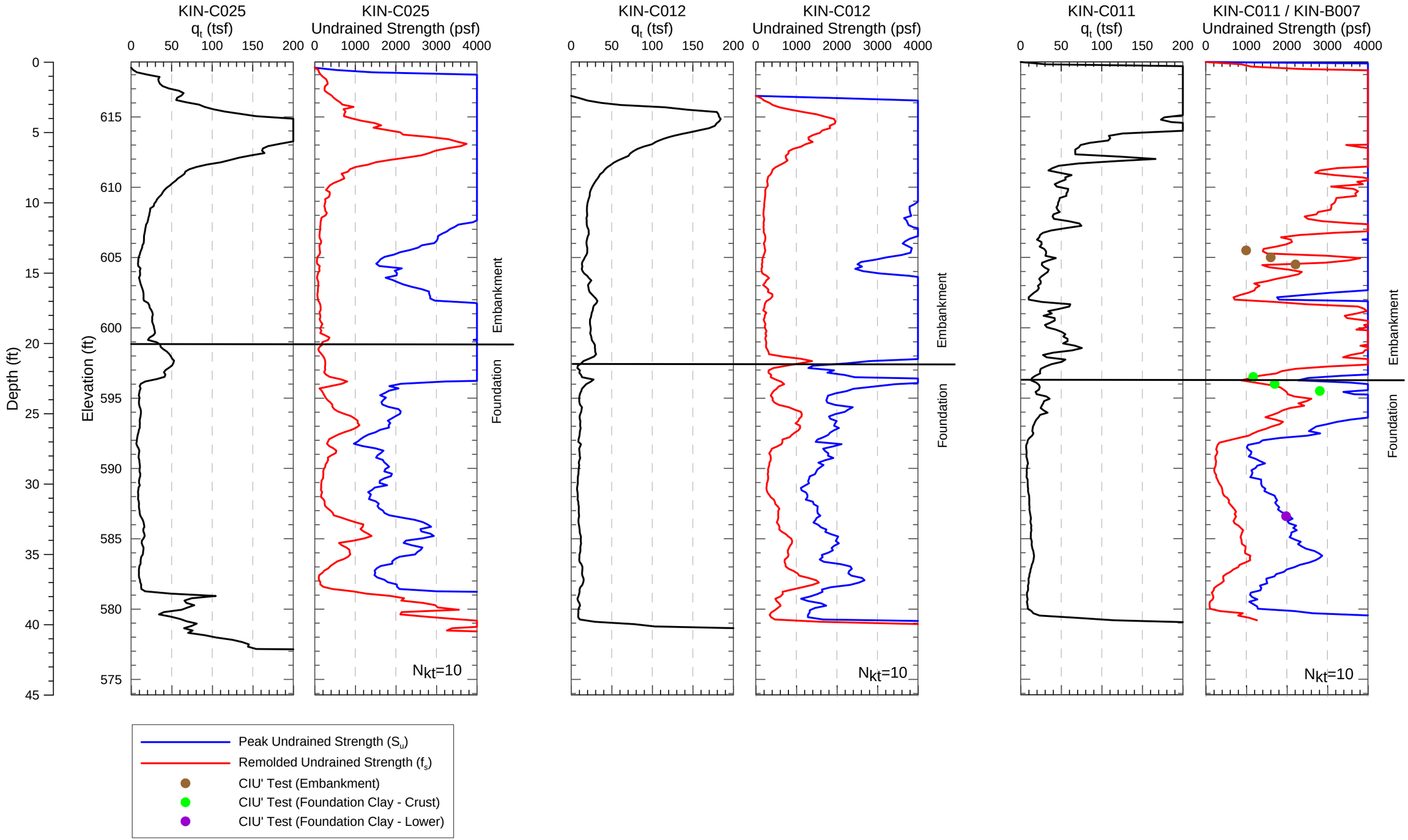
Remolded Undrained Strength Ratio (f_s/σ_v')

CIU' Test (Foundation Clay - Crust)

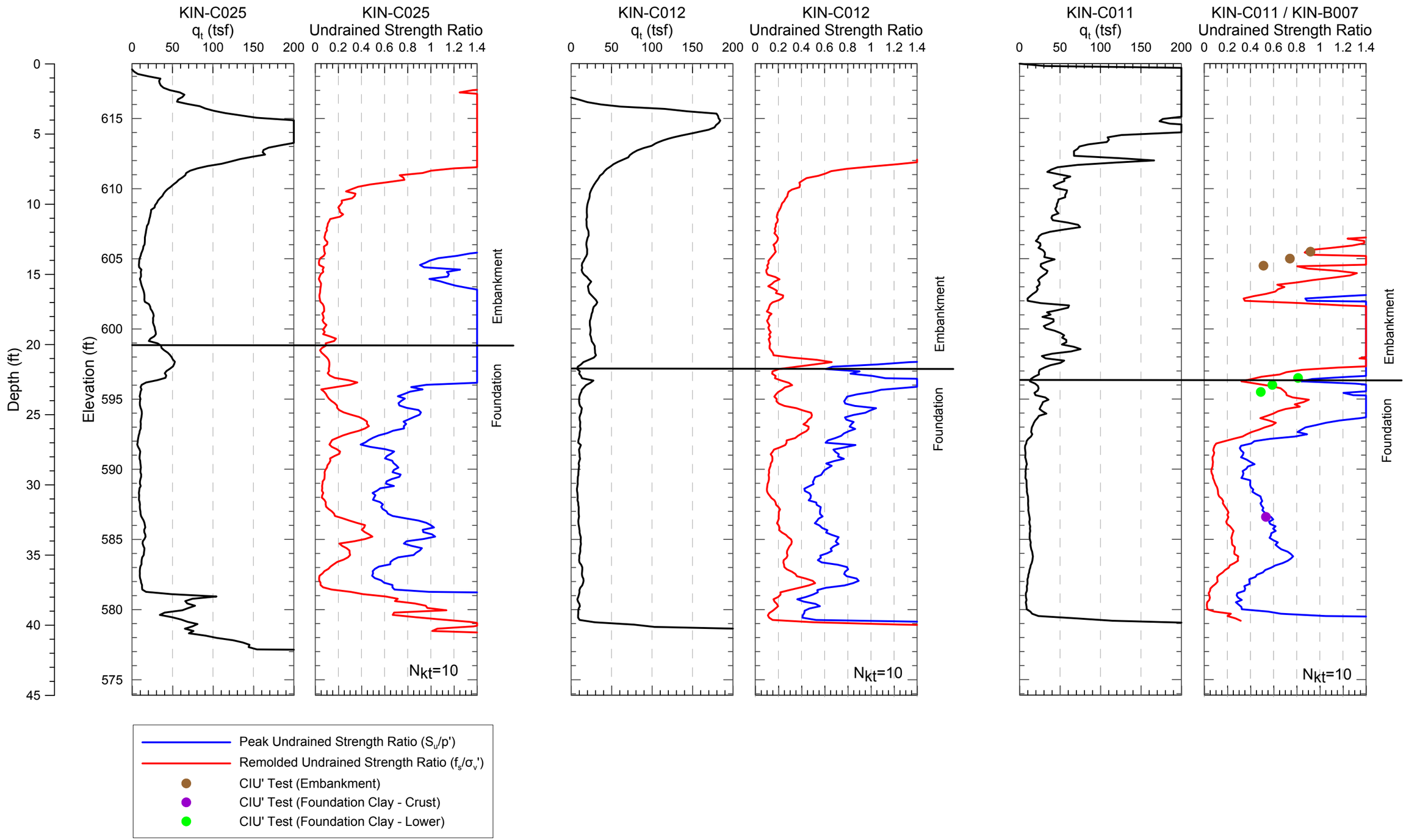
CIU' Test (Foundation Clay- Lower)

DSS Test (Foundation Clay - Lower)

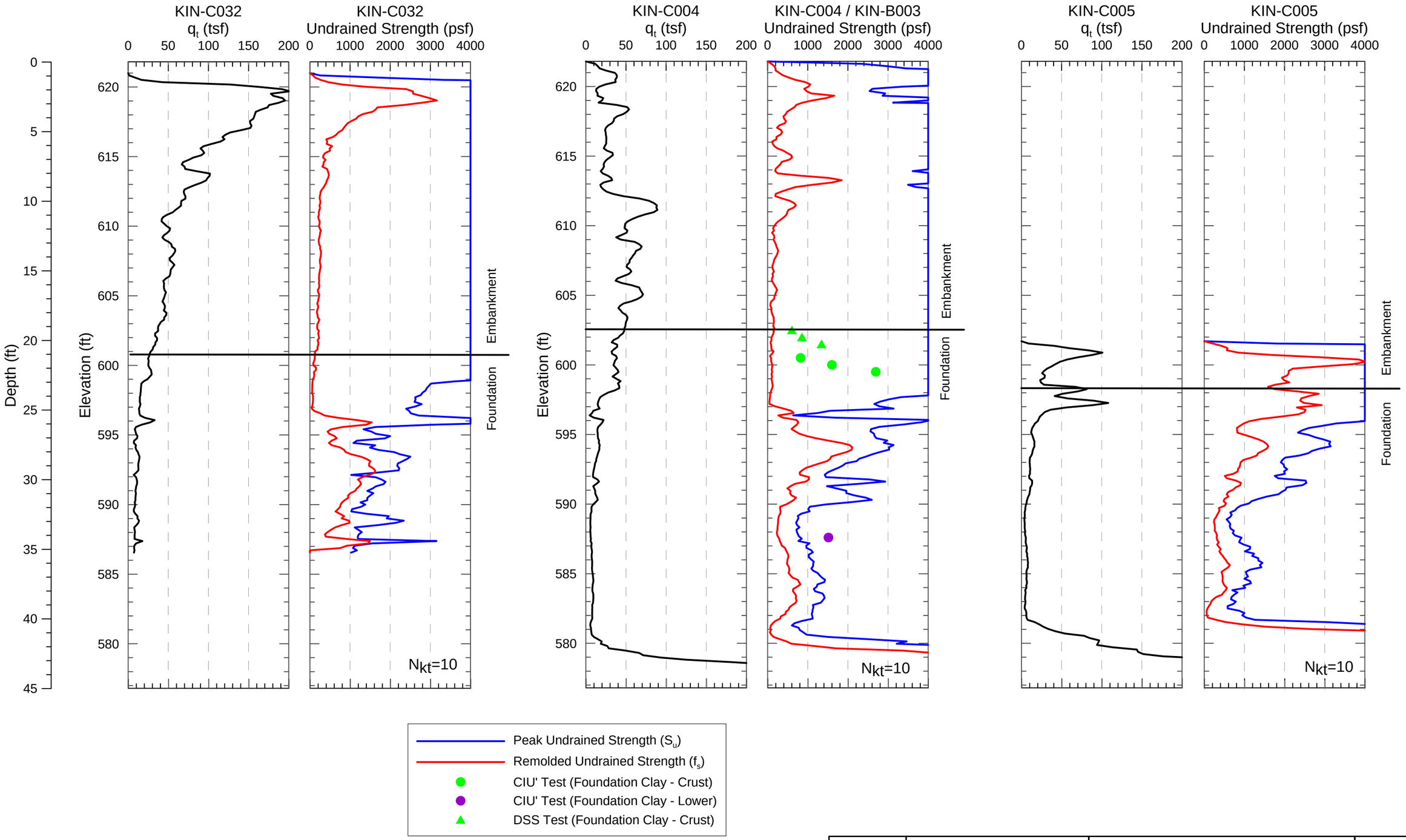
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 44+00 CPT and Undrained Strength Ratio	FIGURE D.7
AECOM			



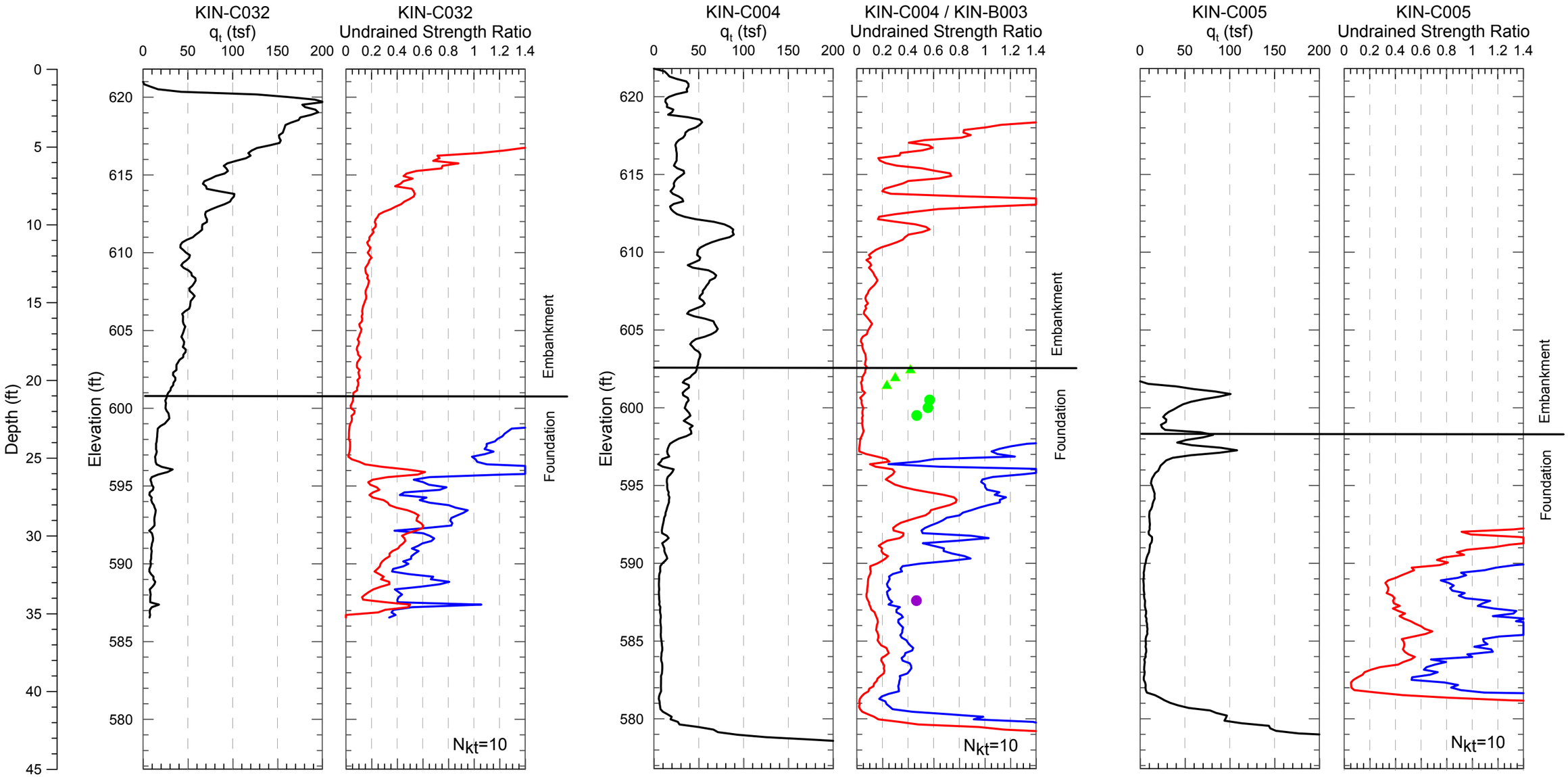
Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 53+00 CPT and Undrained Strength	FIGURE D.8
	AECOM		



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 53+00 CPT and Undrained Strength Ratio	FIGURE D.9
AECOM			



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 83+50 CPT and Undrained Strength	FIGURE D.10
	AECOM		



Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond STA 83+50 CPT and Undrained Strength Ratio	FIGURE D.11
AECOM			

Calculation Notes

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

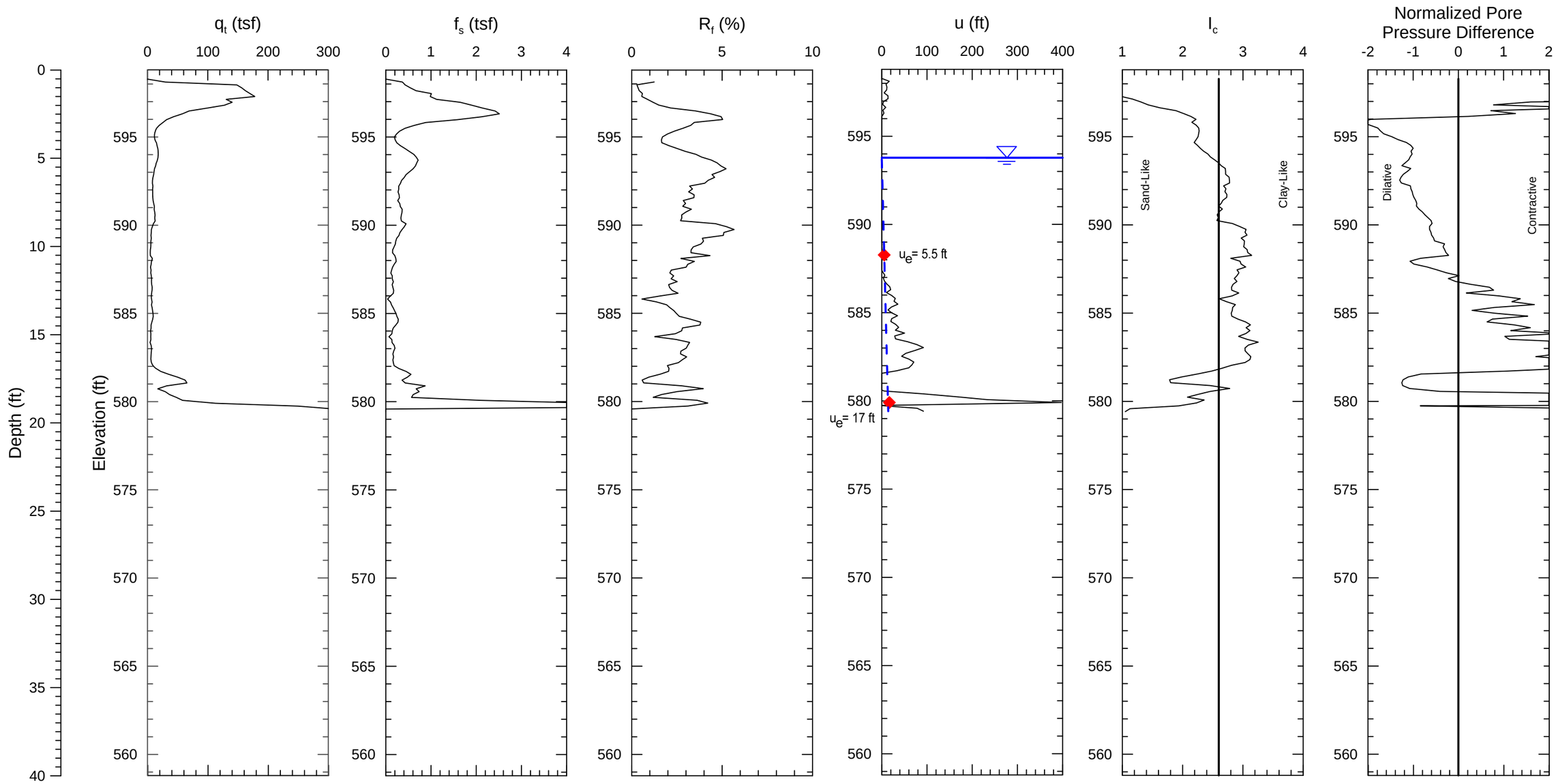
Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

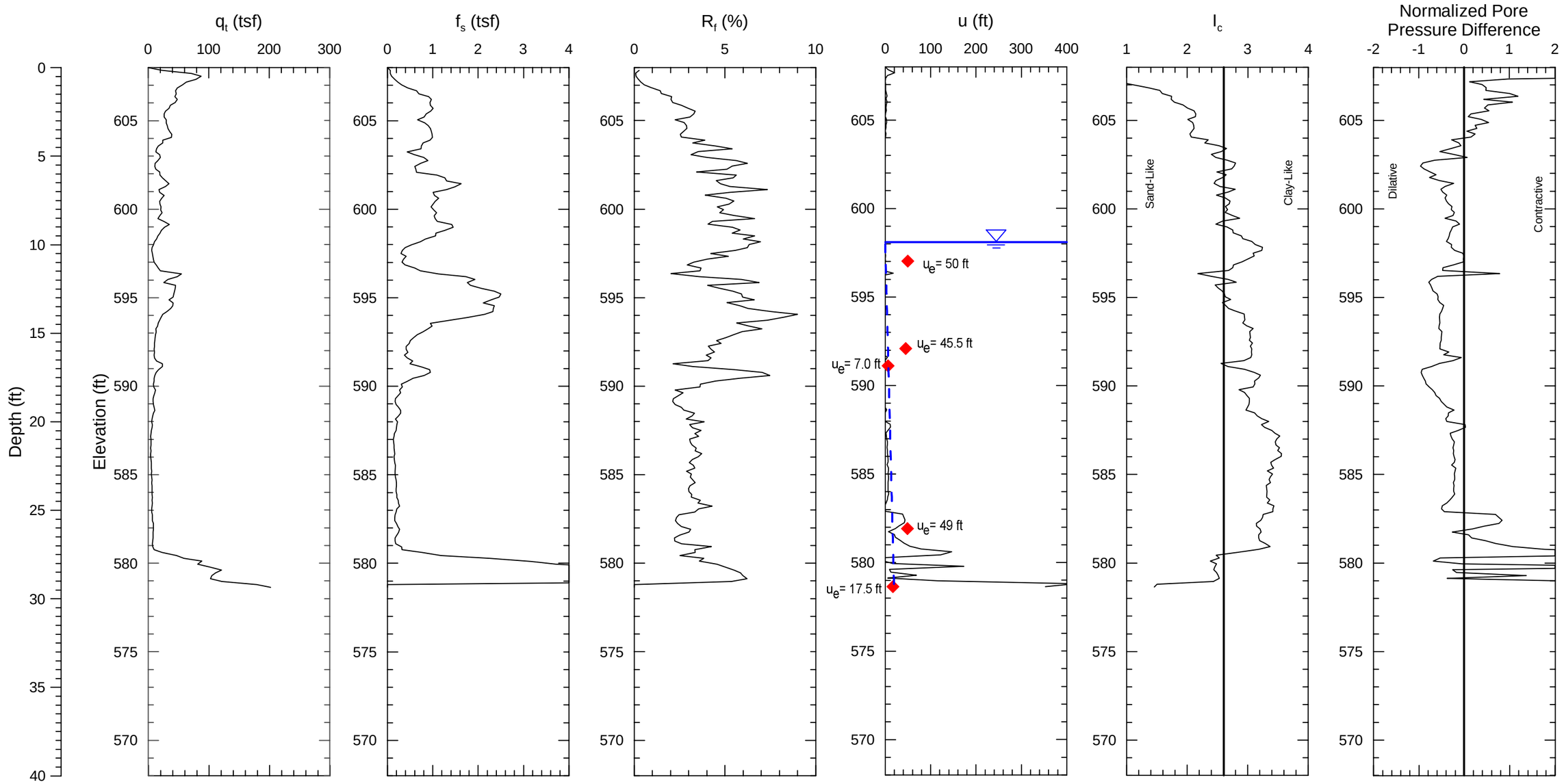
APPENDIX E

CPT Soundings



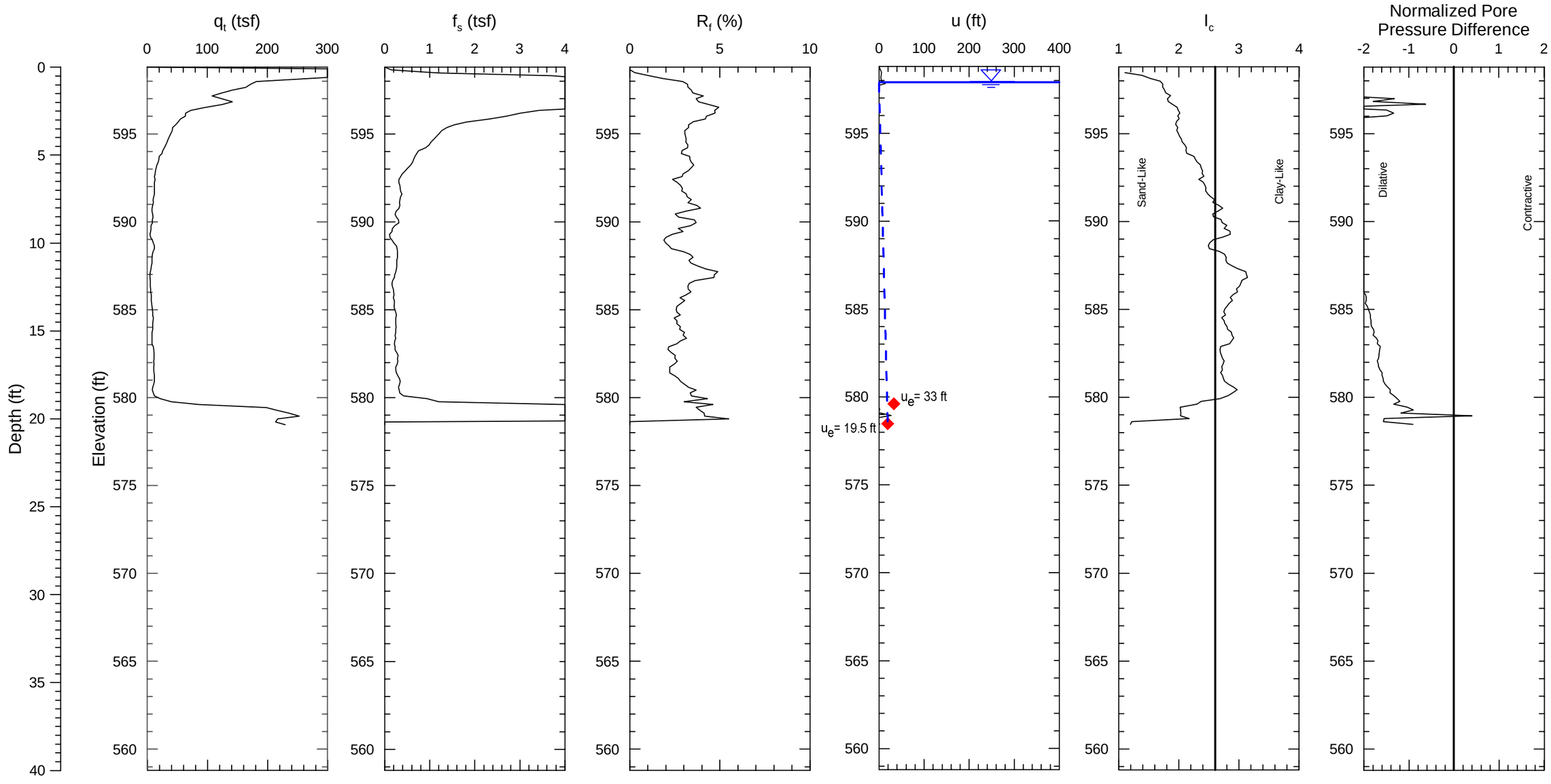
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C001 Kincaid Ash Pond	FIGURE
AECOM			



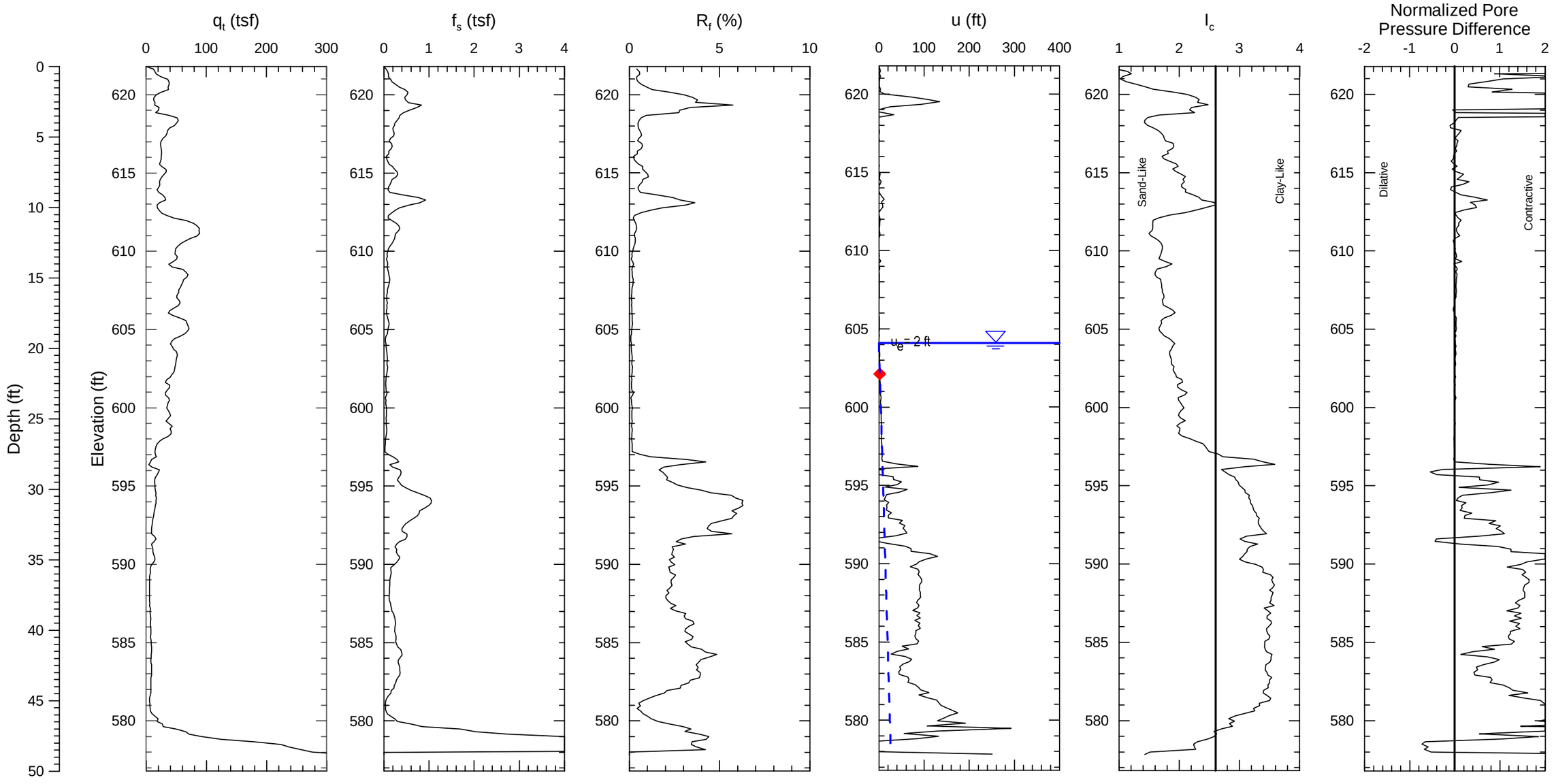
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C002 Kincaid Ash Pond	FIGURE
AECOM			



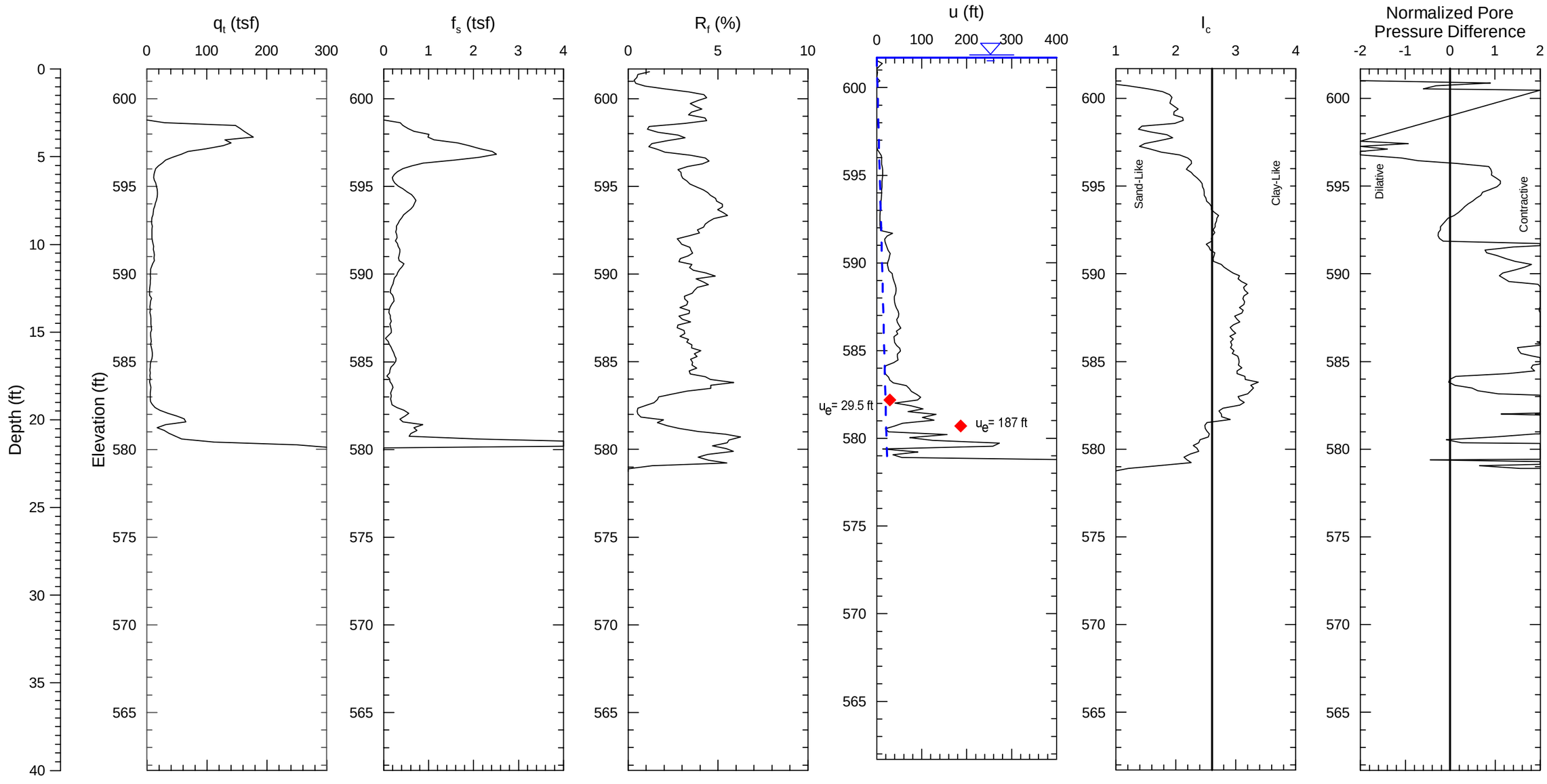
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C003 Kincaid Ash Pond	FIGURE
AECOM			



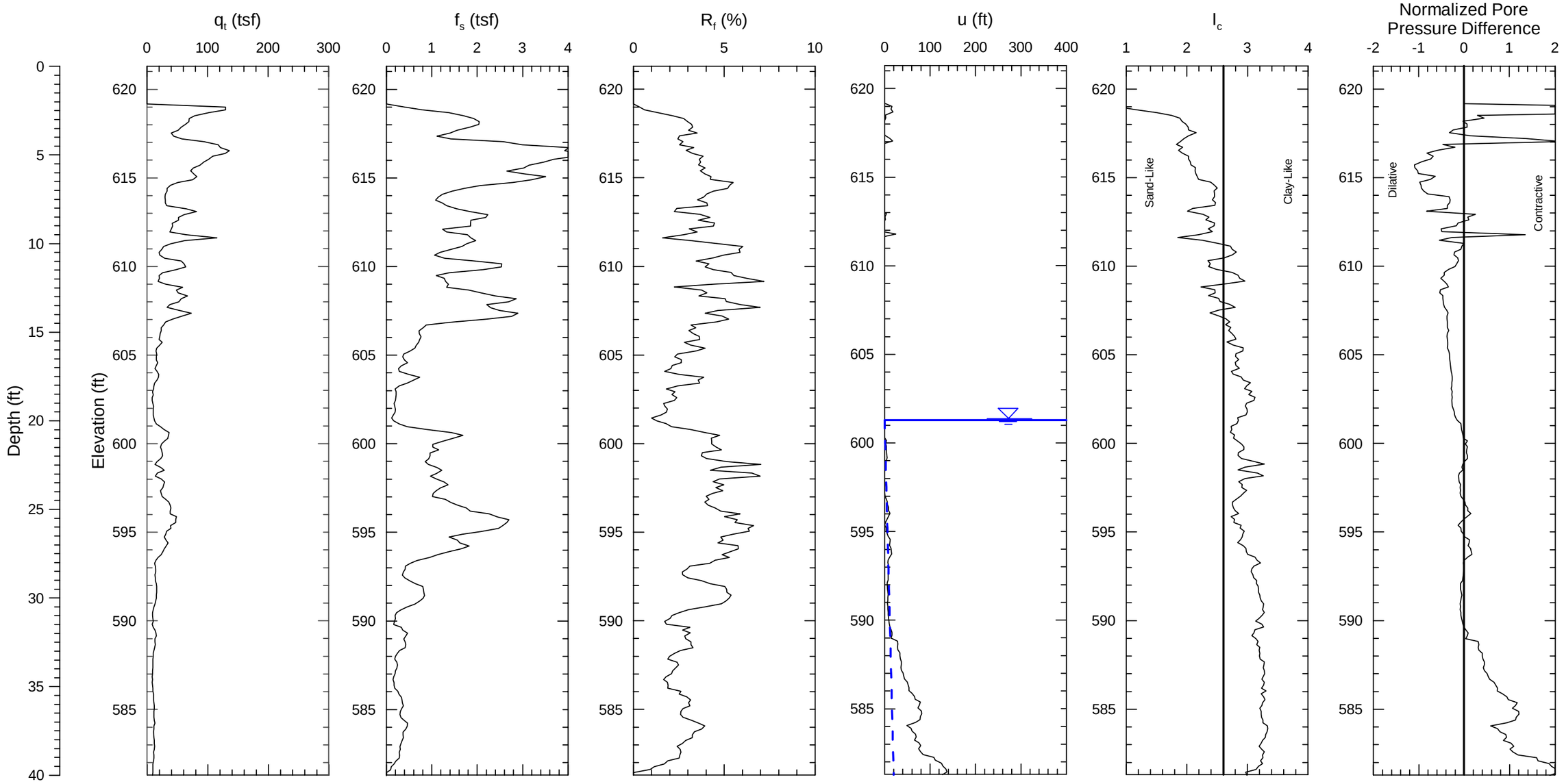
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C004 Kincaid Ash Pond	FIGURE
AECOM			



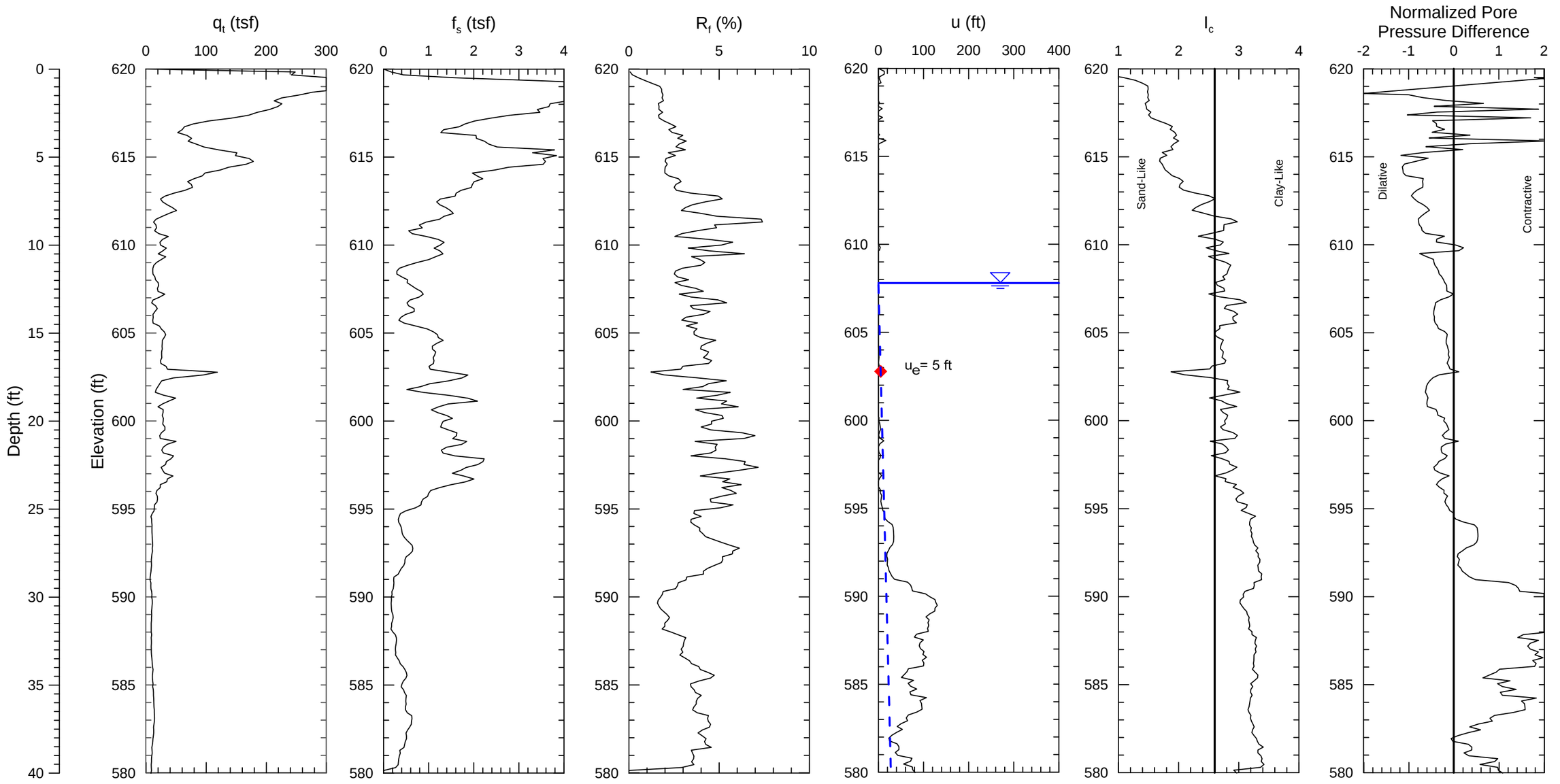
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C005 Kincaid Ash Pond	FIGURE
AECOM			



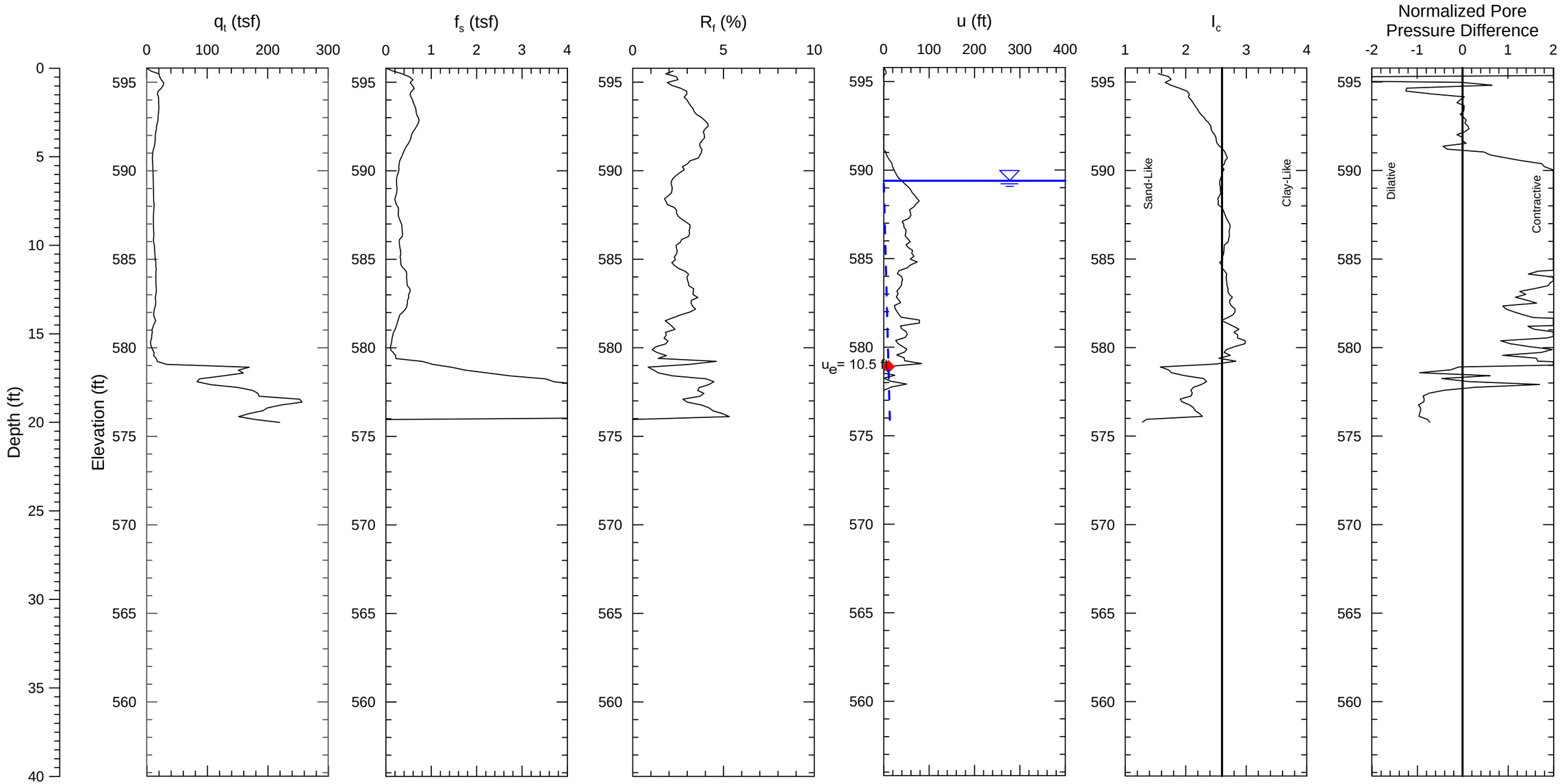
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C006 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C007 Kincaid Ash Pond	FIGURE
AECOM			



◆ Pore Pressure Dissipation Test

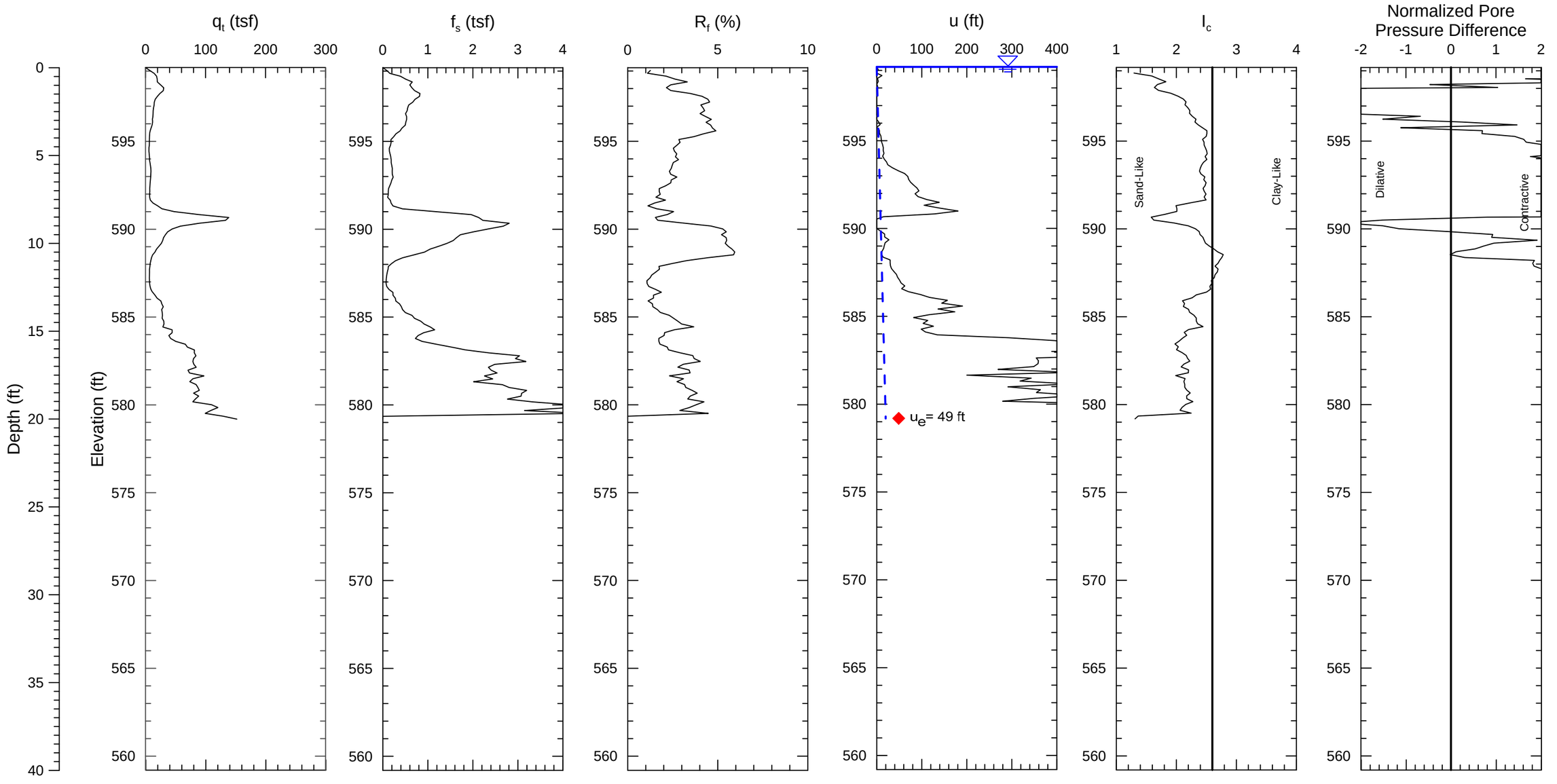
– – – – – 100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C008 Kincaid Ash Pond	FIGURE
AECOM			



◆ Pore Pressure Dissipation Test

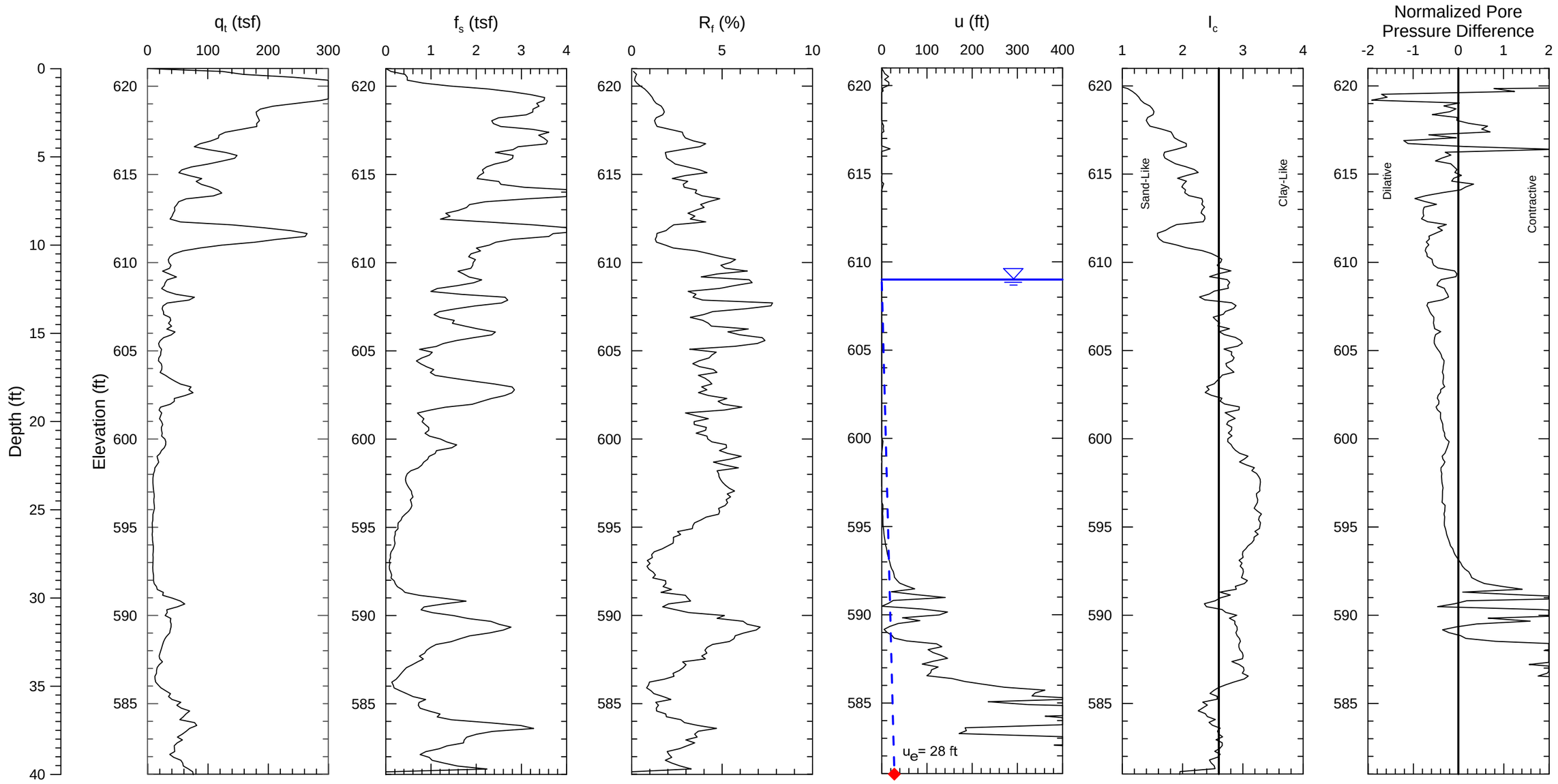
– – – – – 100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

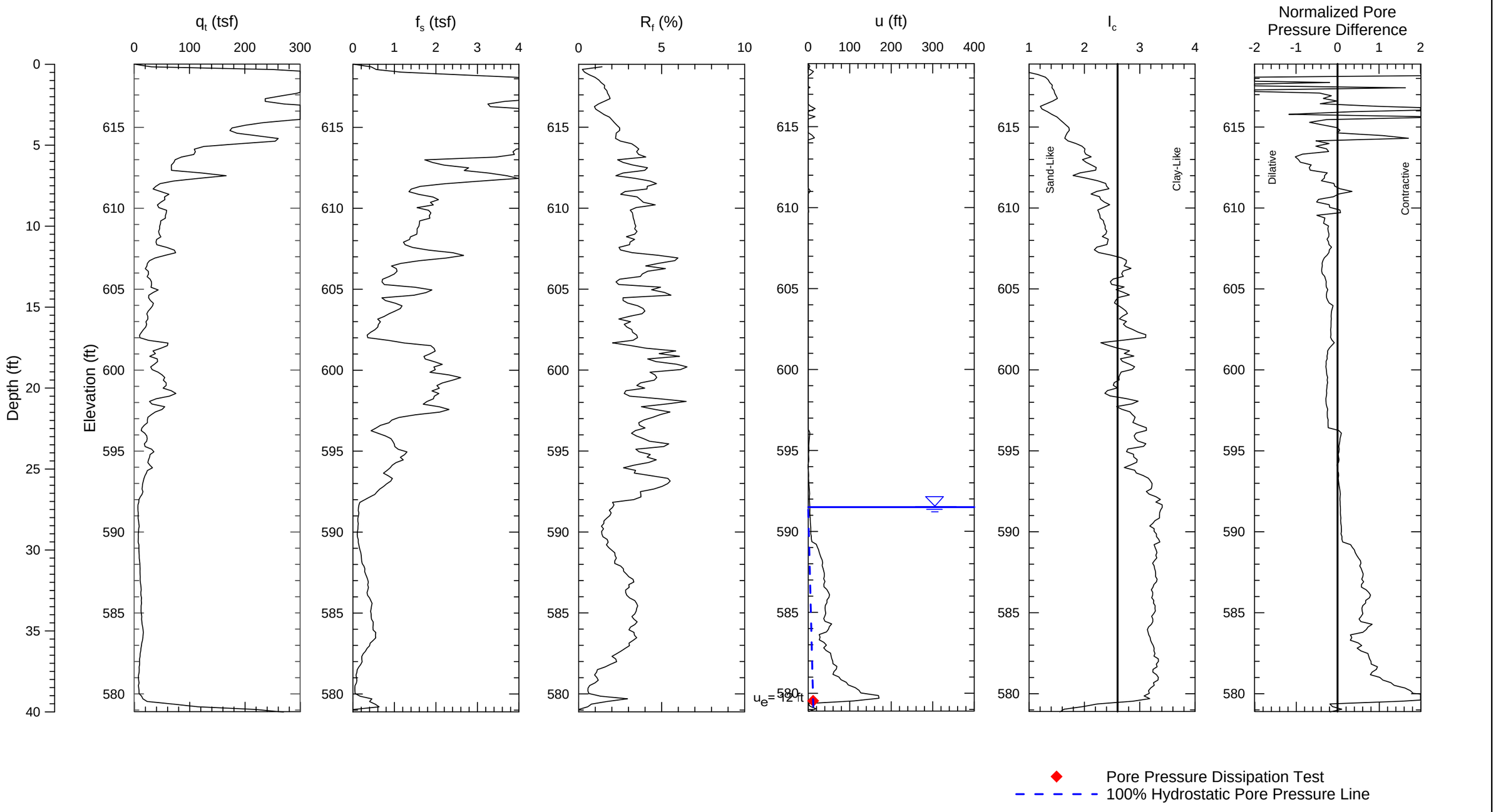
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C009 Kincaid Ash Pond	FIGURE
AECOM			



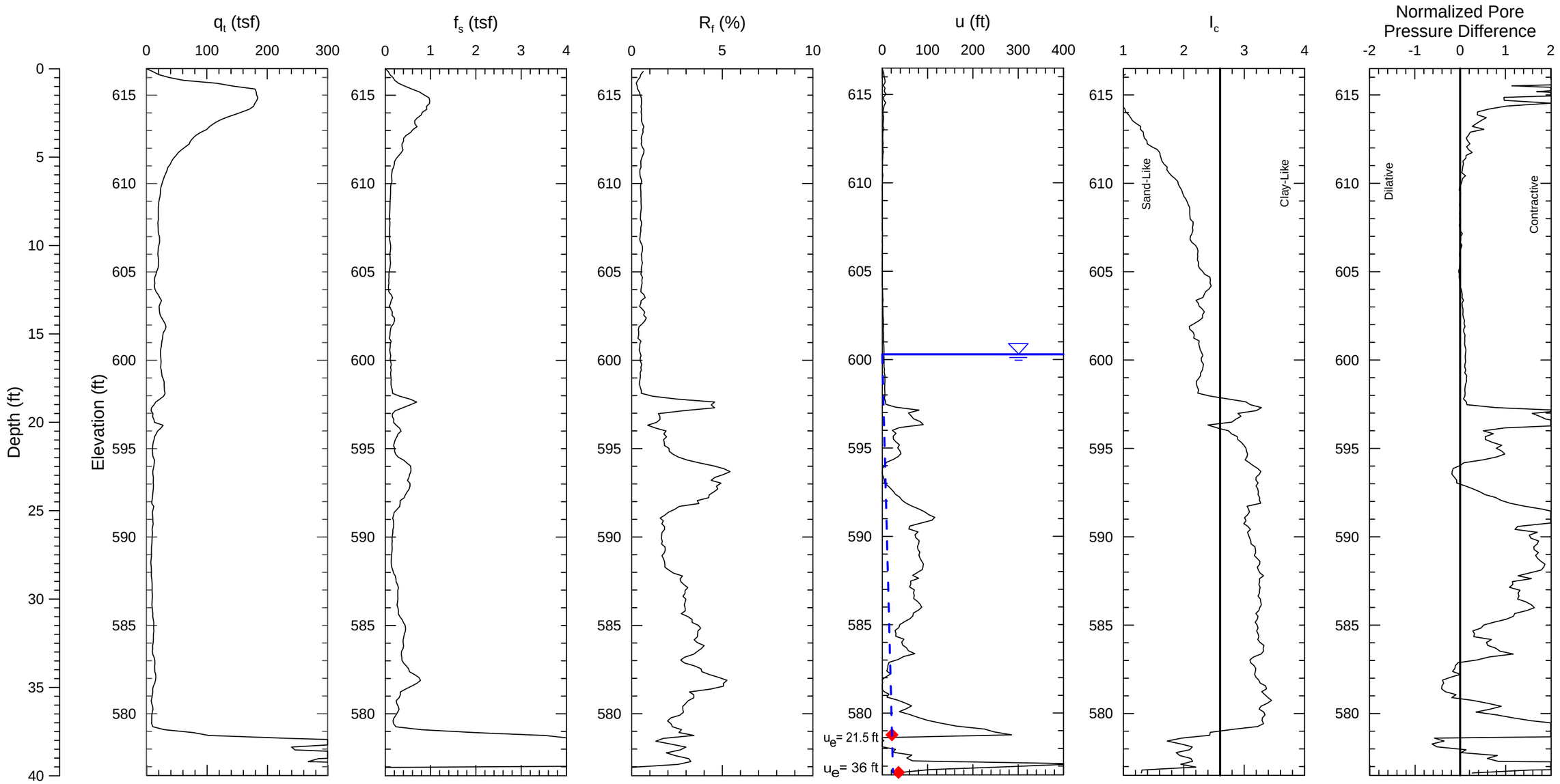
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C010 Kincaid Ash Pond	FIGURE
AECOM			



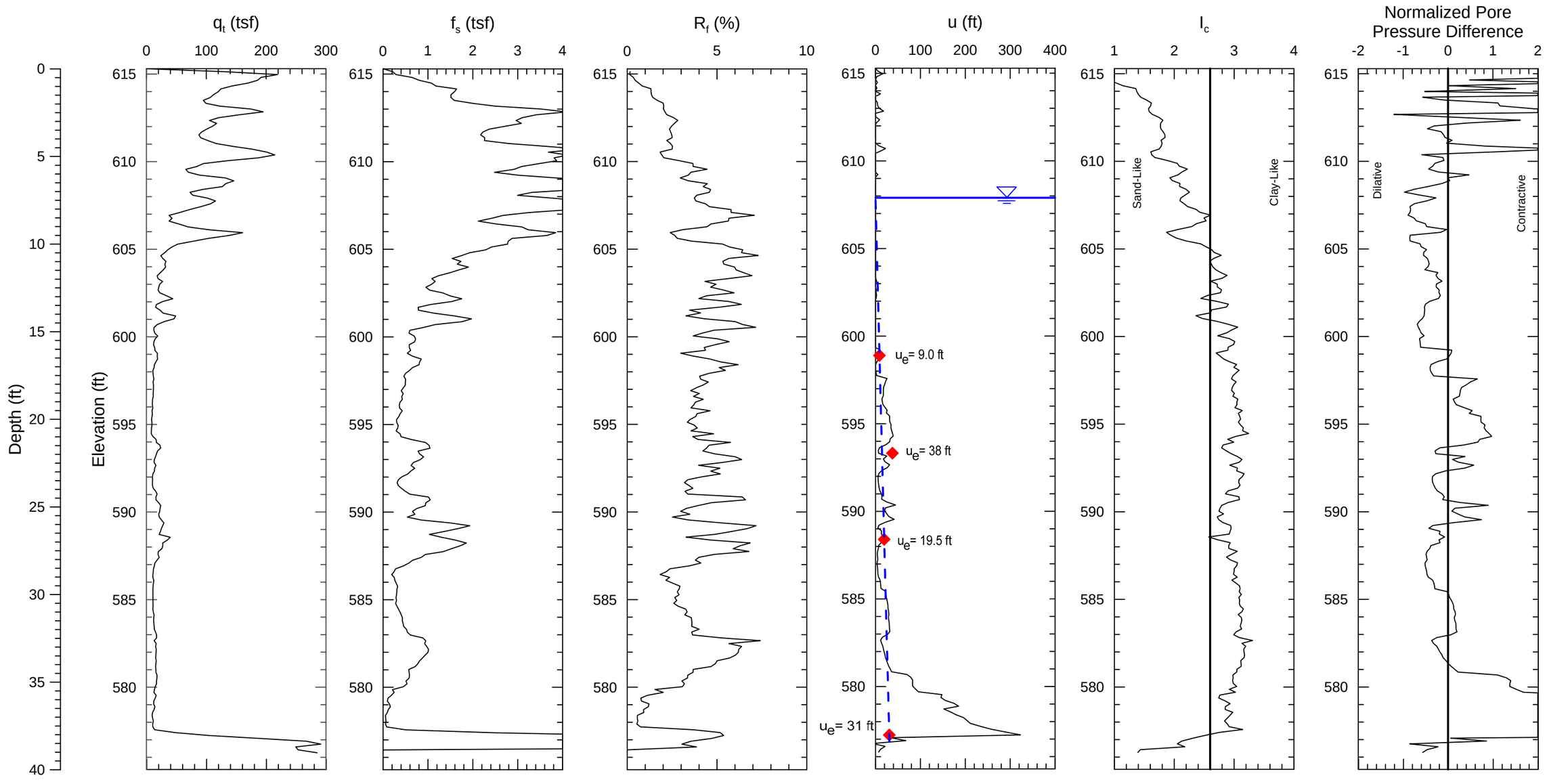
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C011 Kincaid Ash Pond	FIGURE
AECOM			



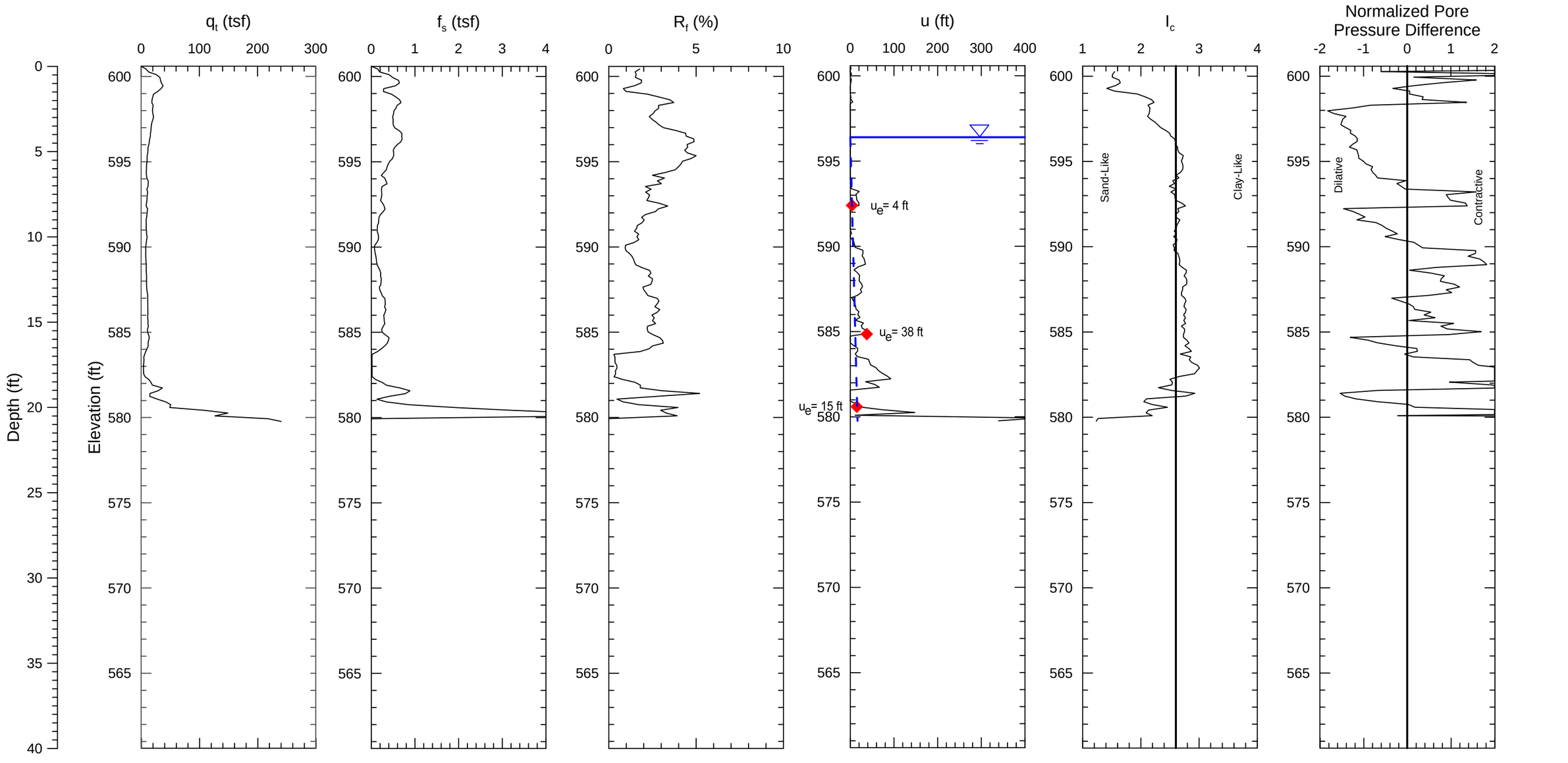
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C012 Kincaid Ash Pond	FIGURE
AECOM			



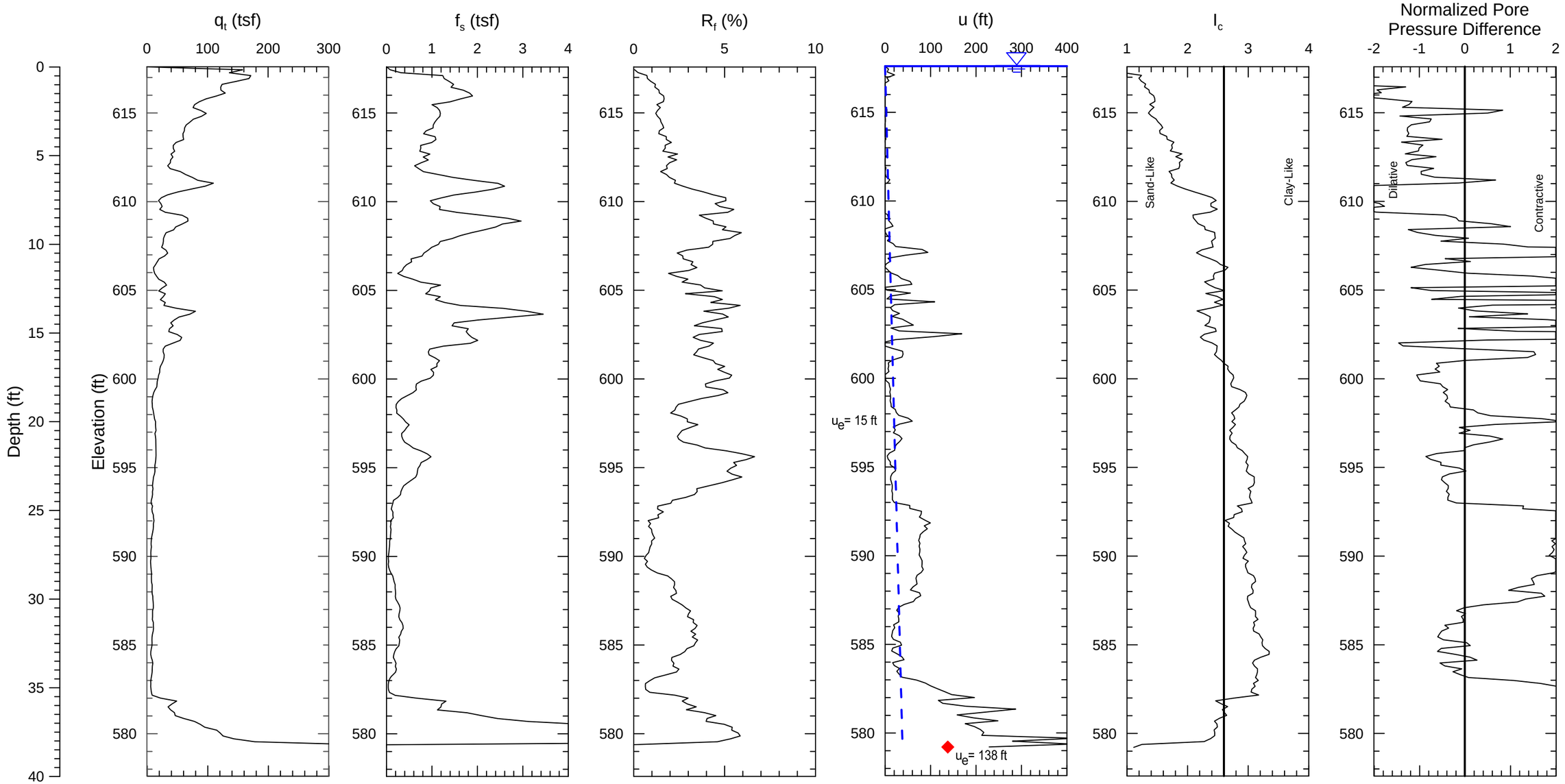
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C013 Kincaid Ash Pond	FIGURE
AECOM			



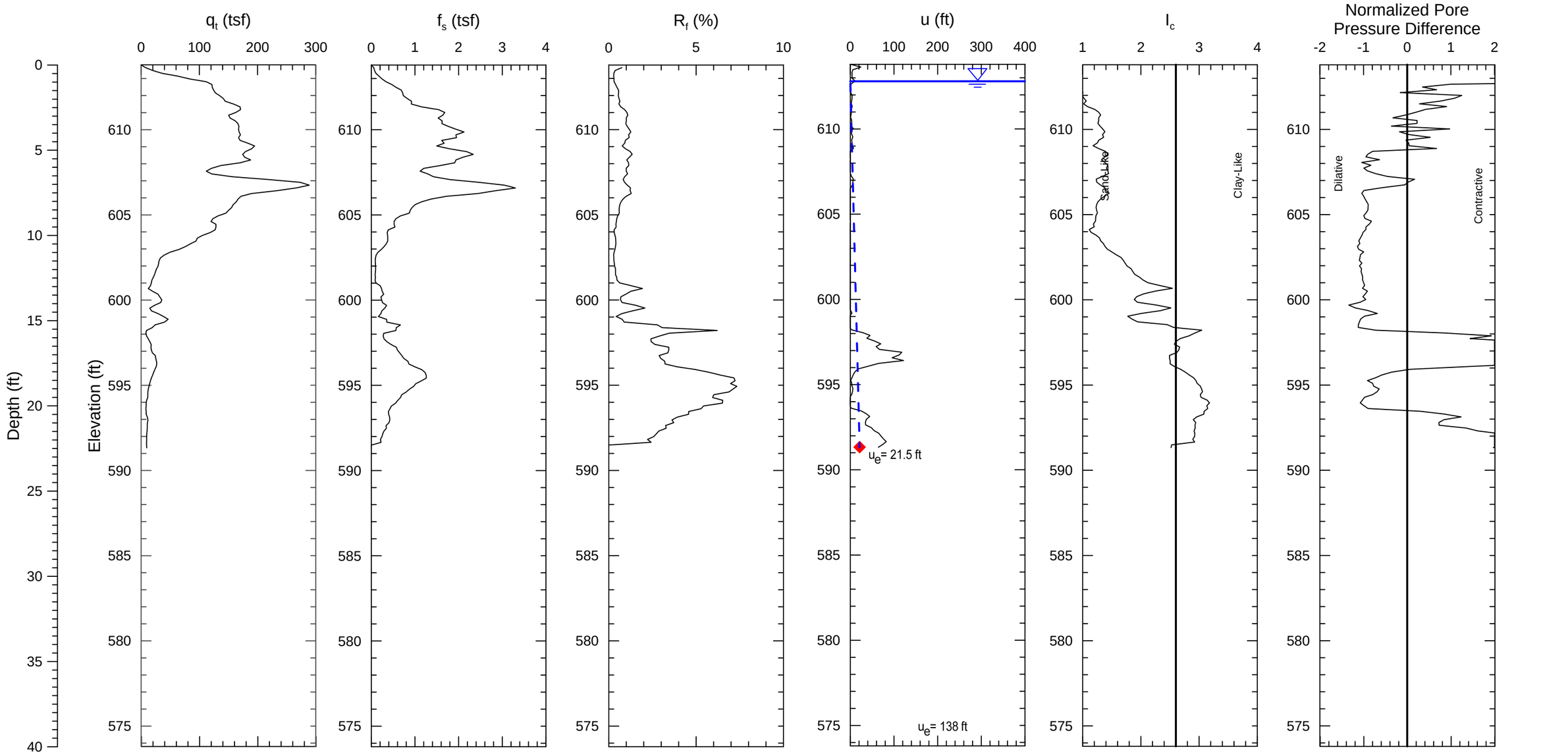
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C014 Kincaid Ash Pond	FIGURE
AECOM			



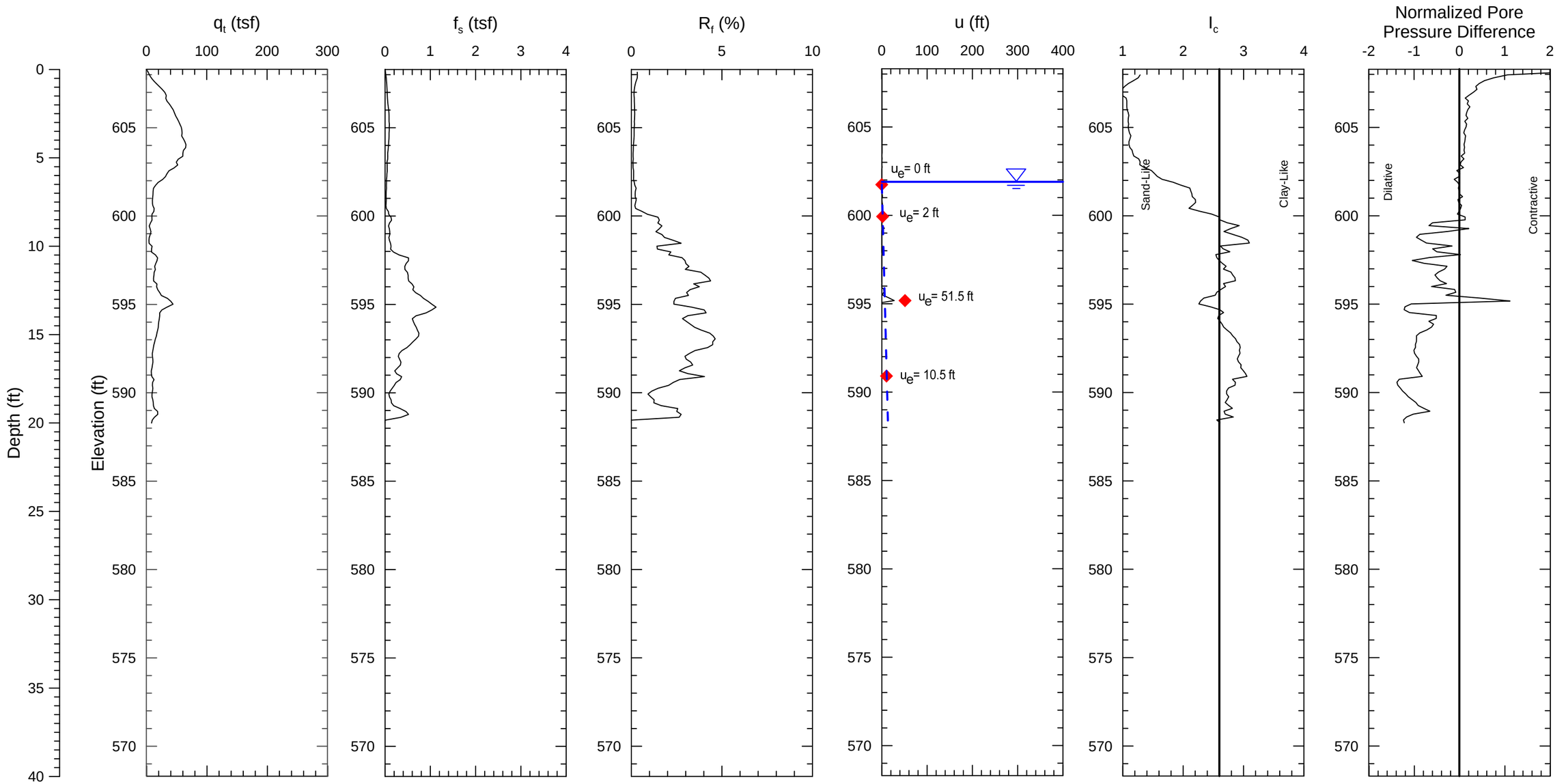
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C015 Kincaid Ash Pond	FIGURE
AECOM			



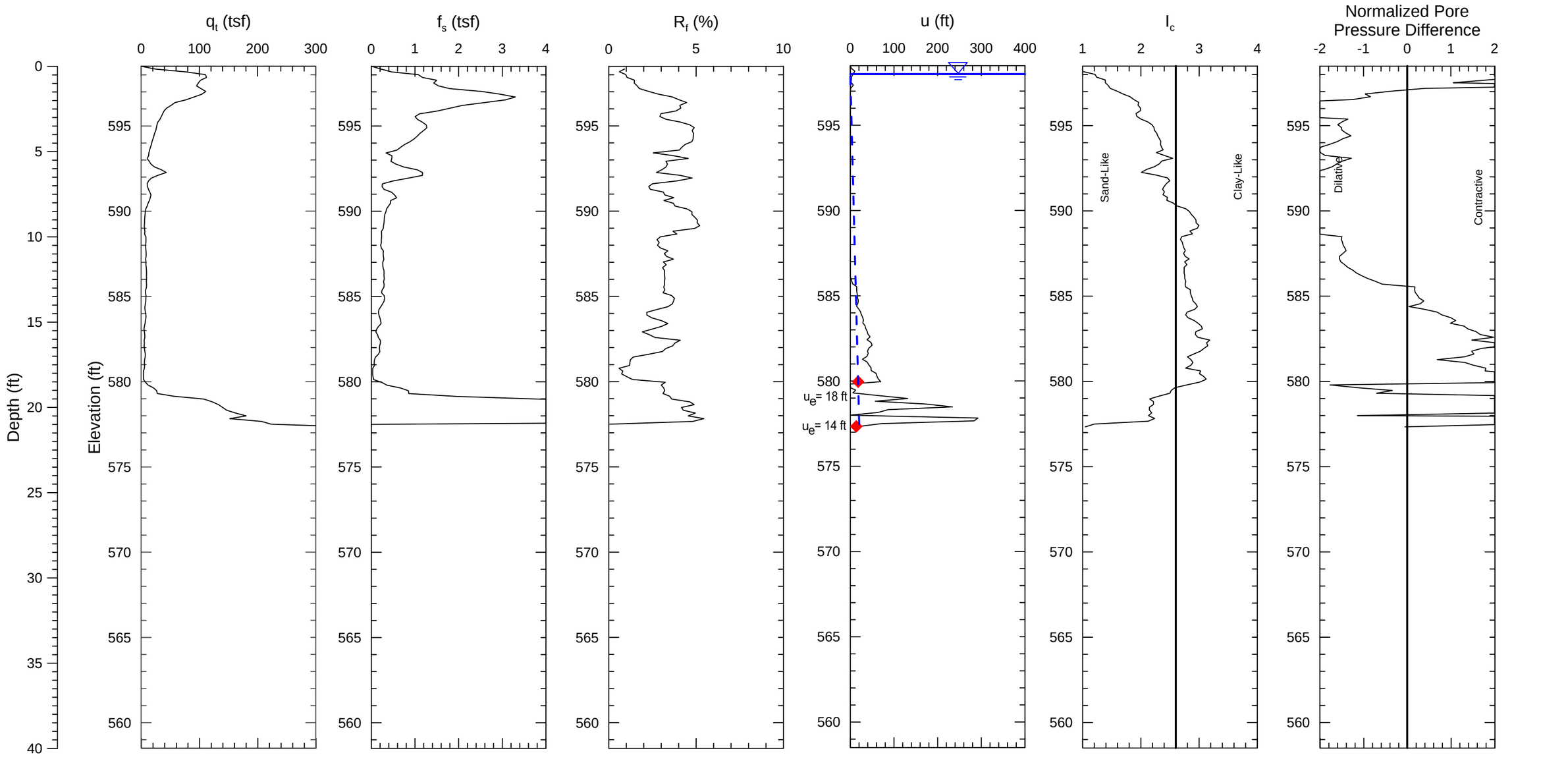
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C016 Kincaid Ash Pond	FIGURE
AECOM			



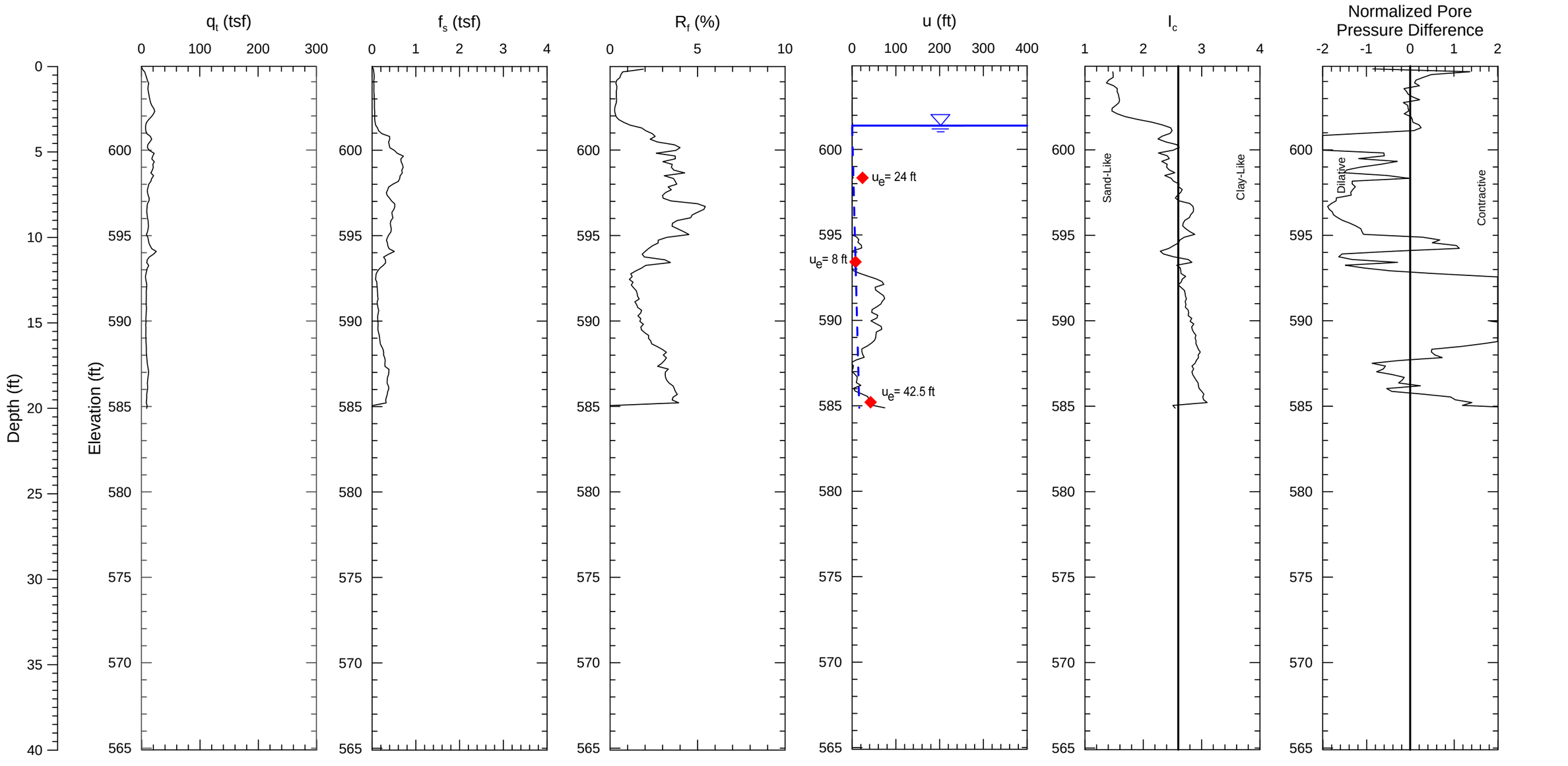
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C017 Kincaid Ash Pond	FIGURE
AECOM			



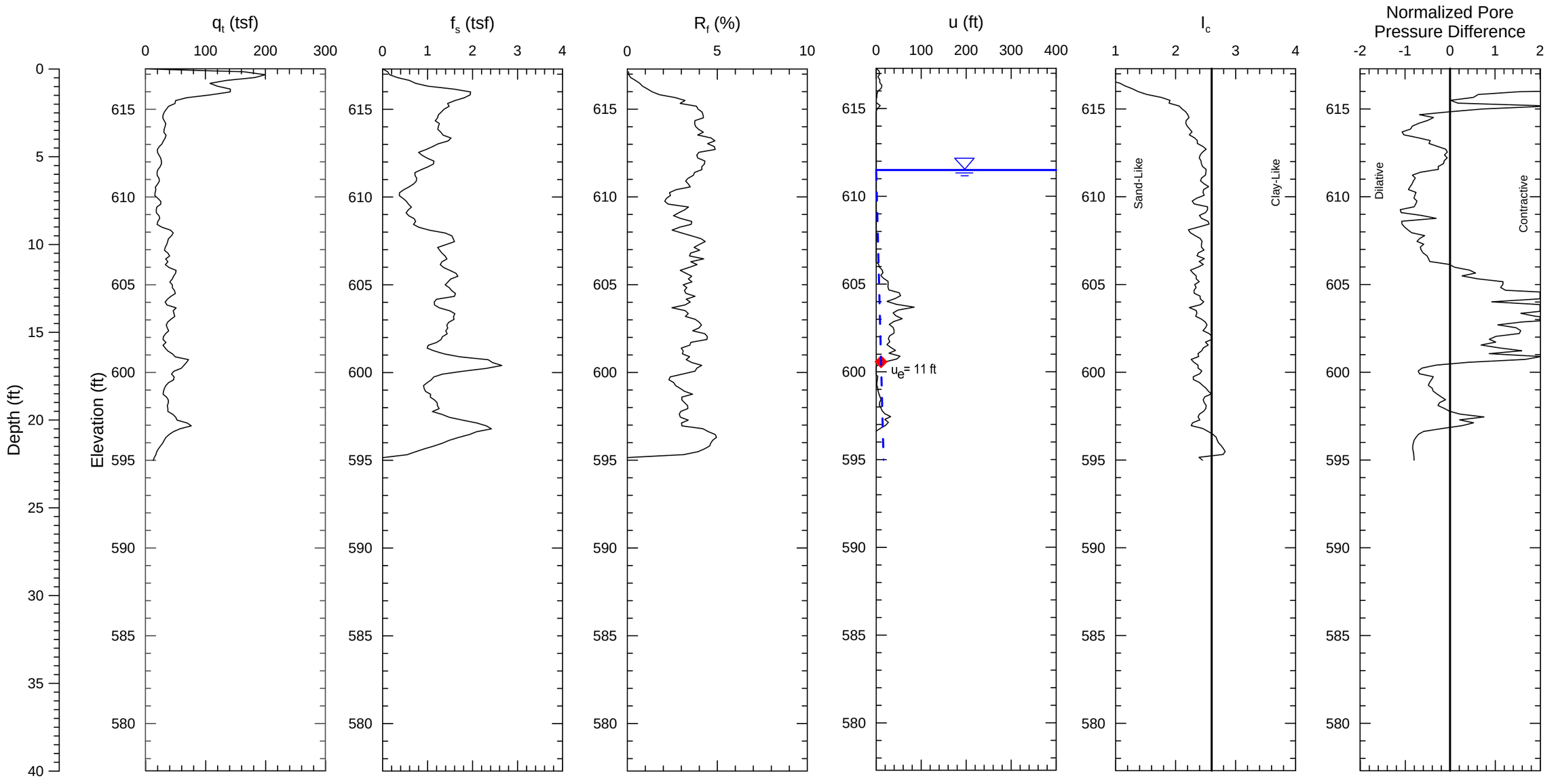
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C018 Kincaid Ash Pond	FIGURE
AECOM			



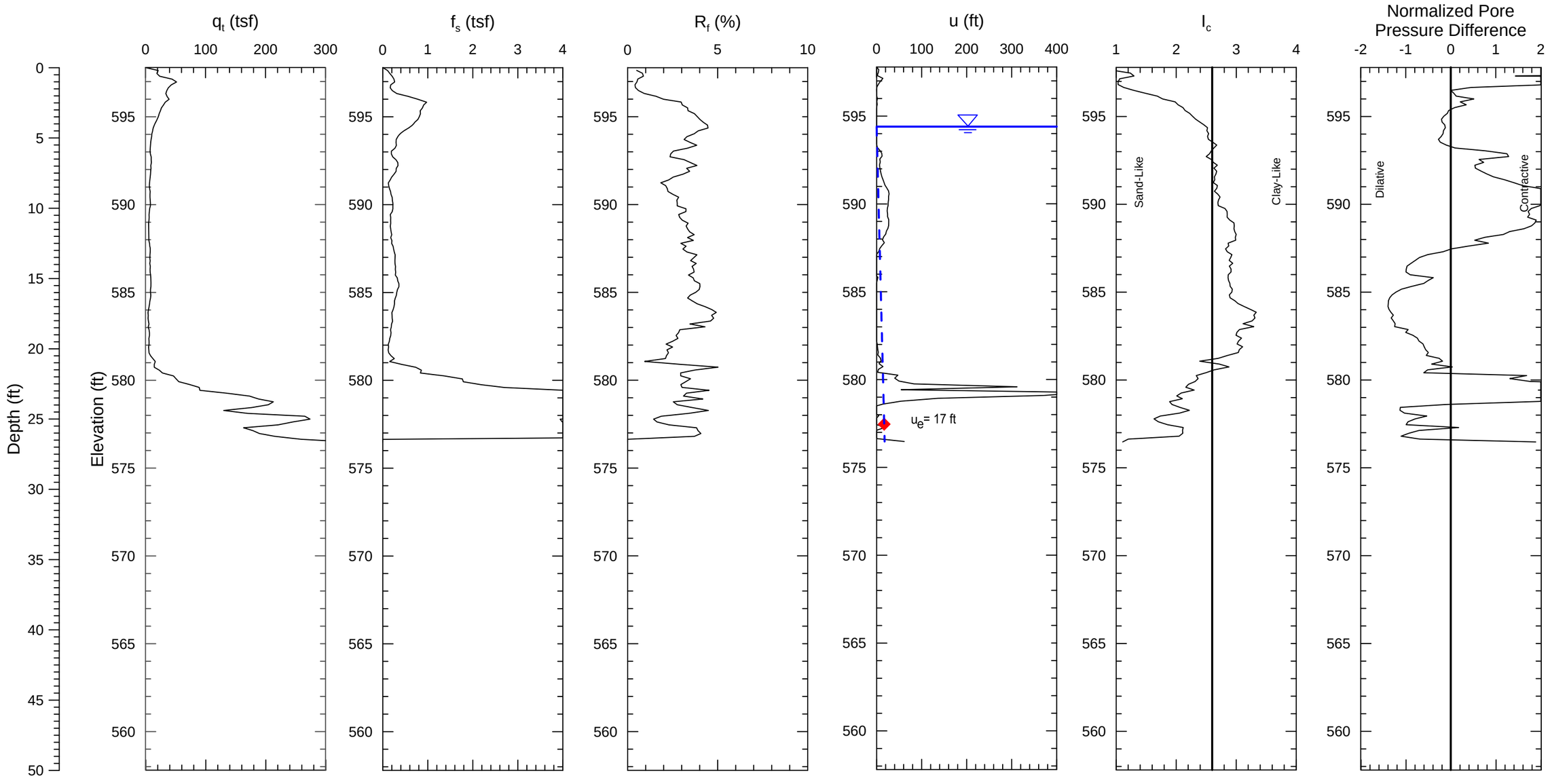
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C019 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C020 Kincaid Ash Pond	FIGURE
AECOM			



Pore Pressure Dissipation Test

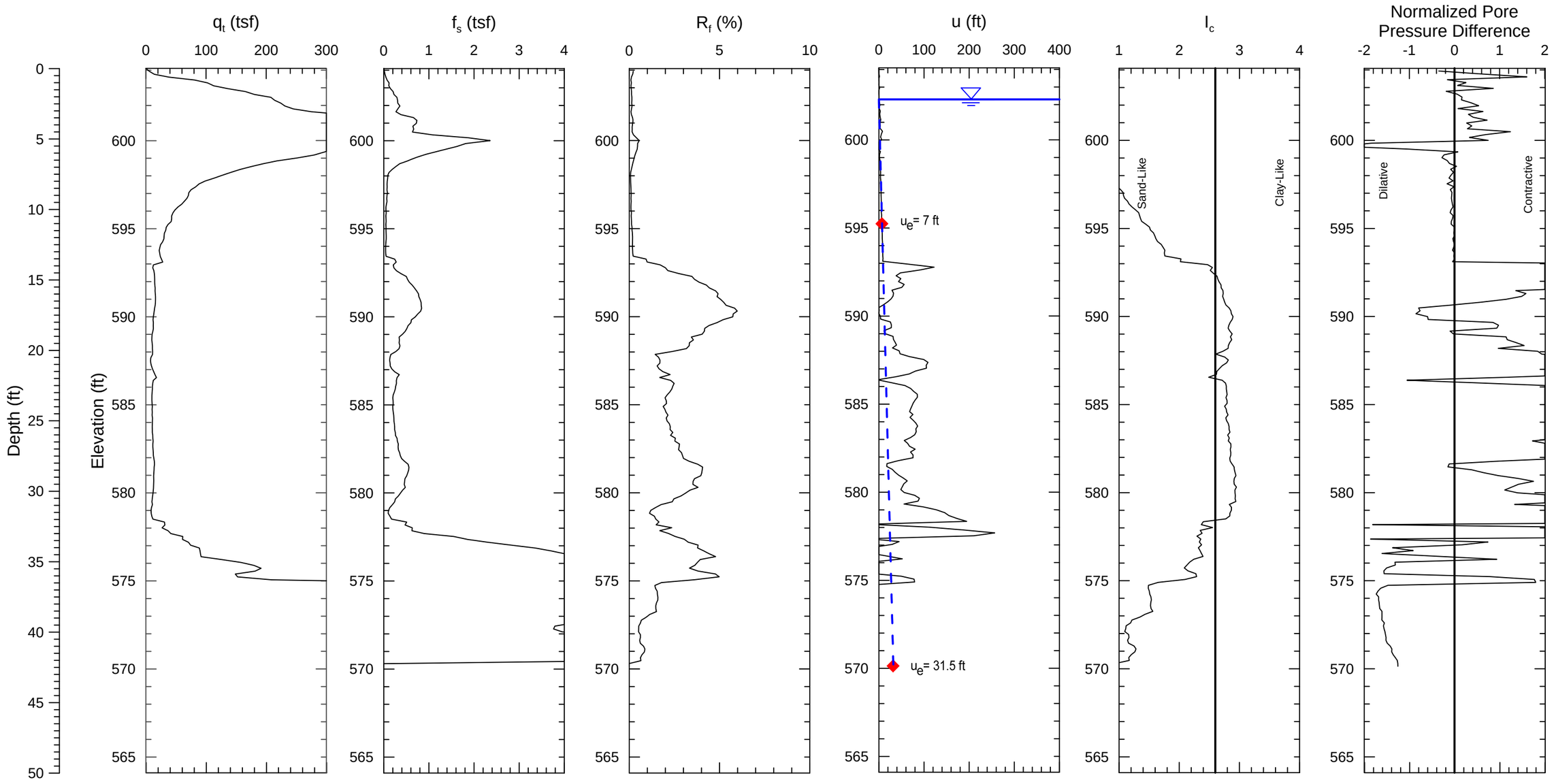
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

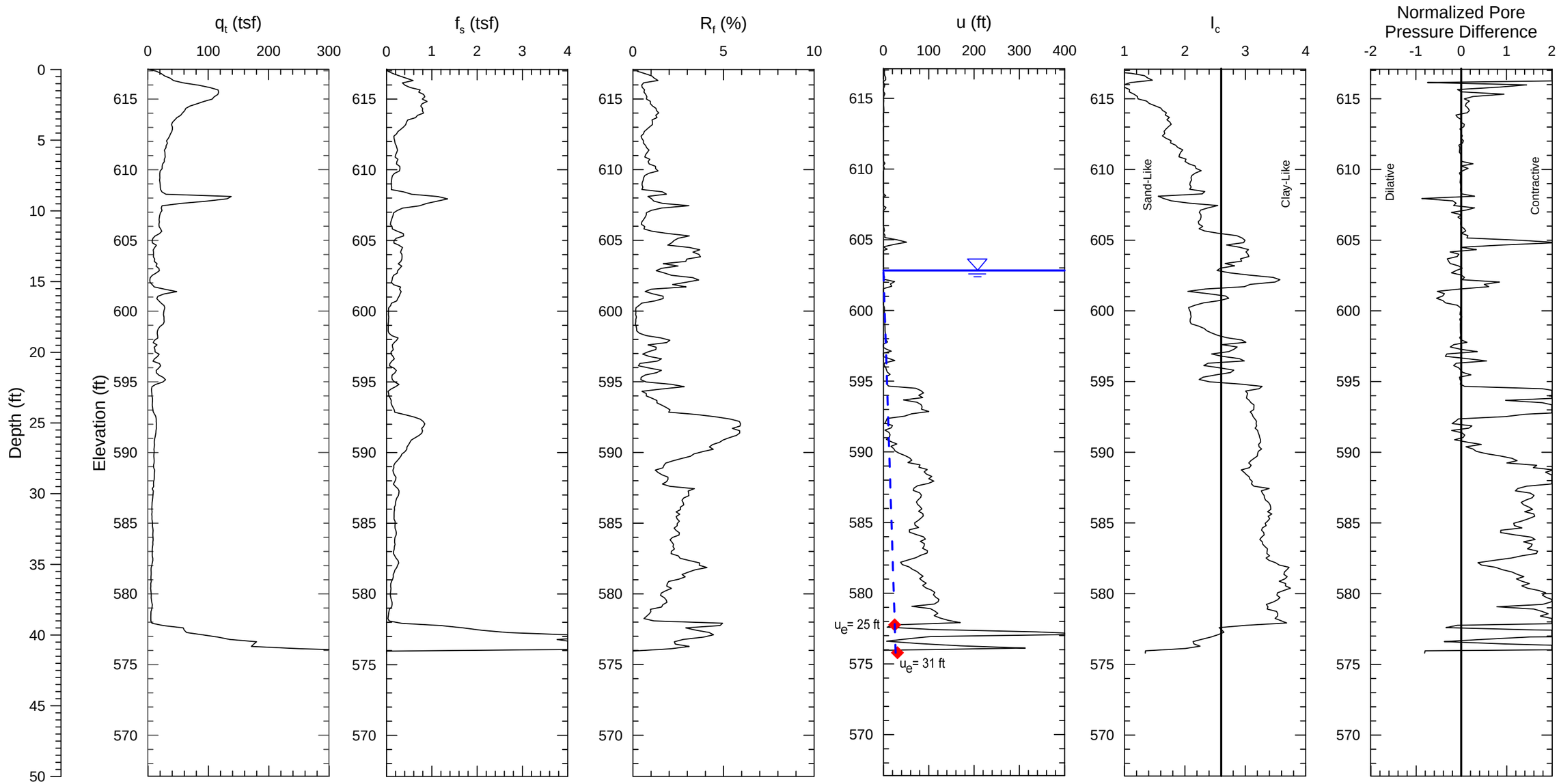
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C021 Kincaid Ash Pond	FIGURE
AECOM			



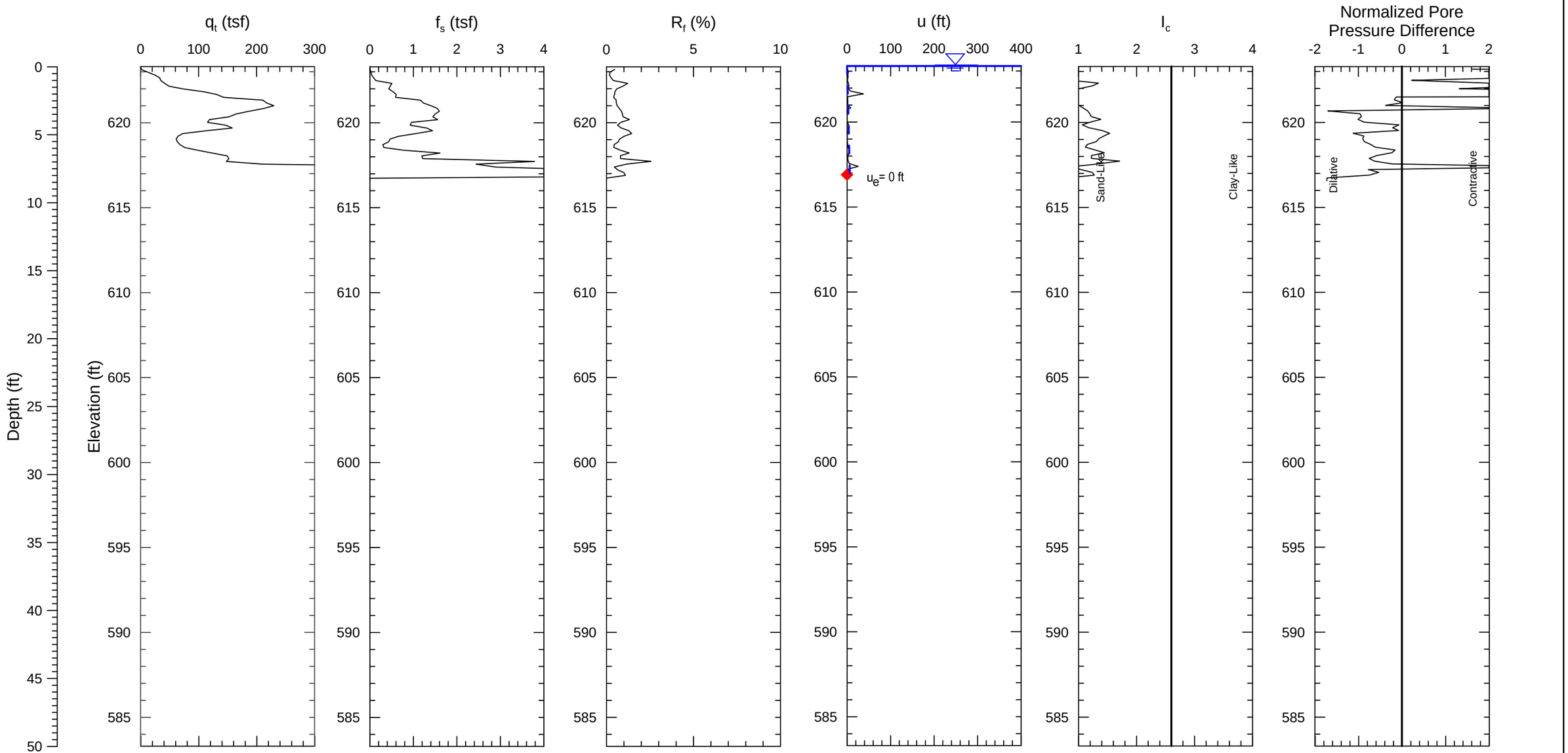
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C022 Kincaid Ash Pond	FIGURE
AECOM			



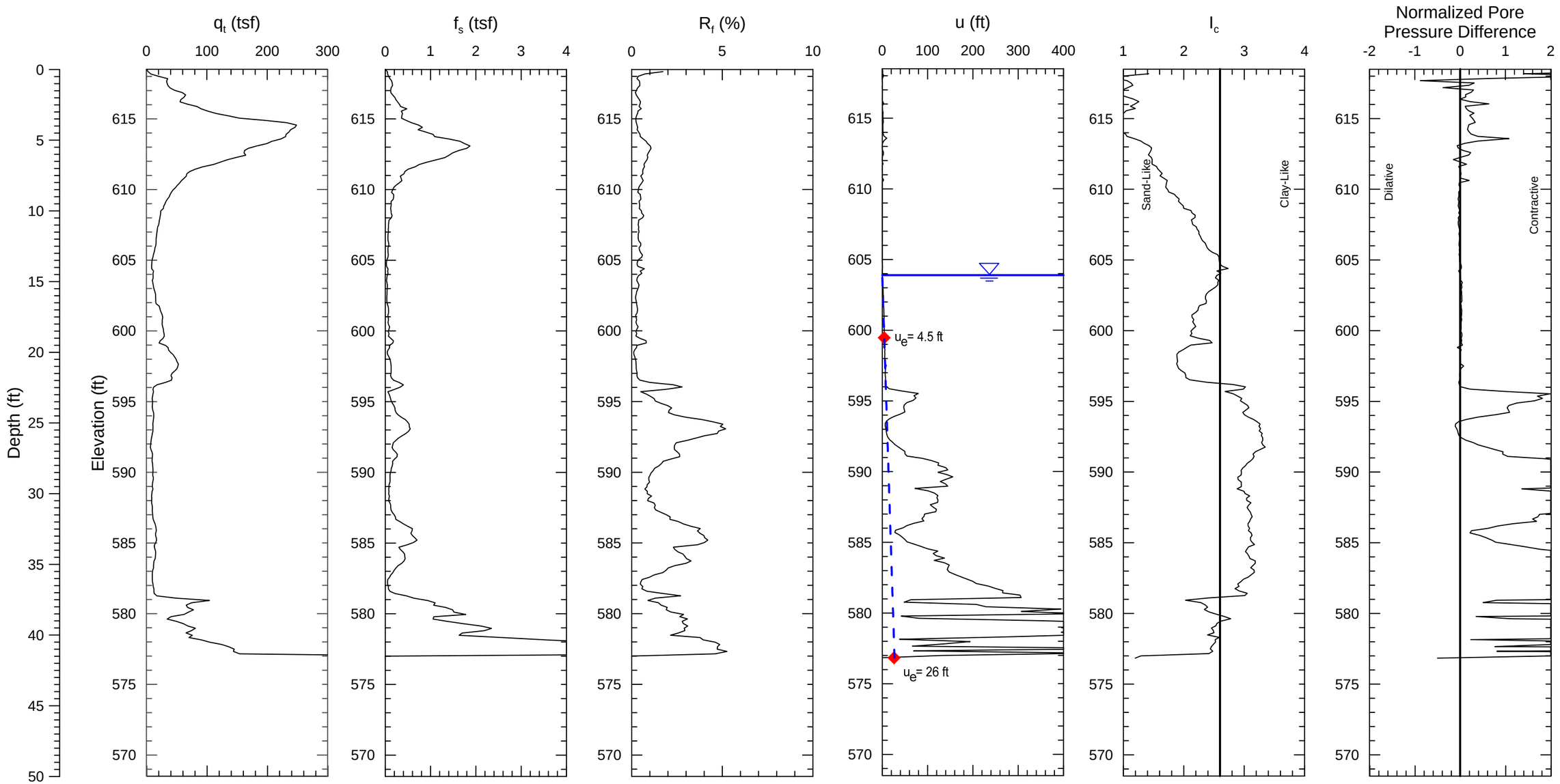
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C023 Kincaid Ash Pond	FIGURE
AECOM			



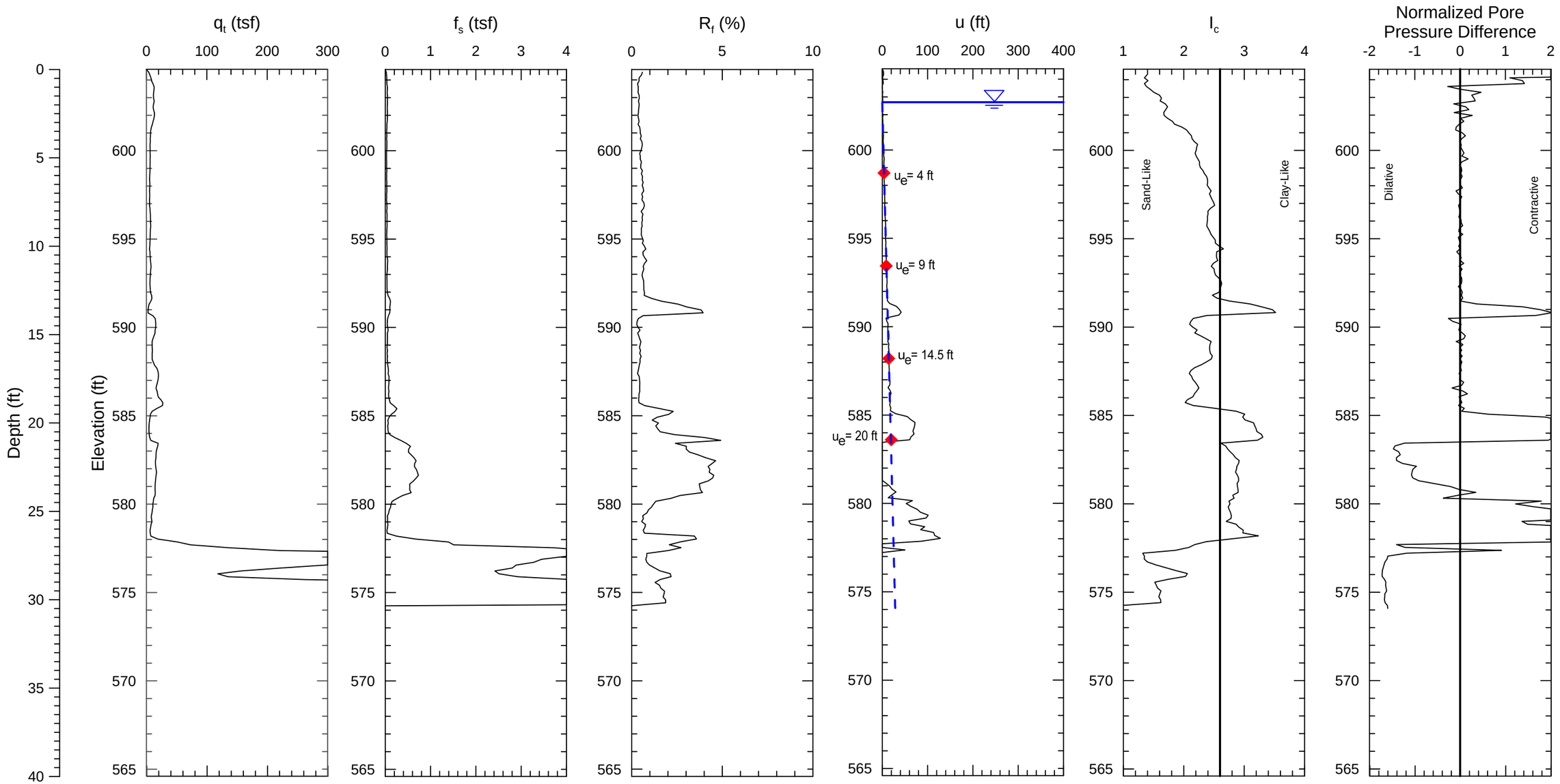
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C024 Kincaid Ash Pond	FIGURE
AECOM			



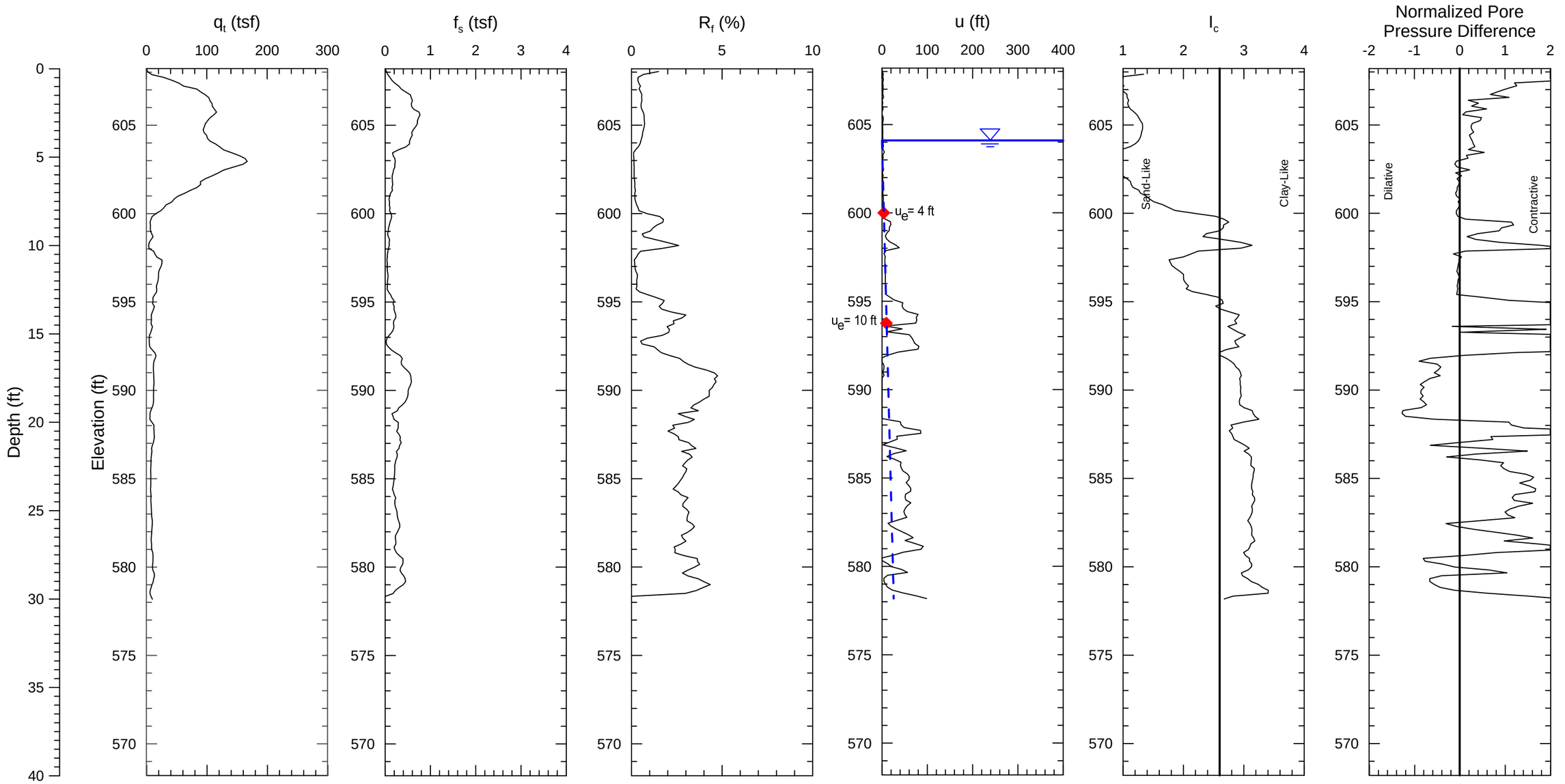
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C025 Kincaid Ash Pond	FIGURE
AECOM			



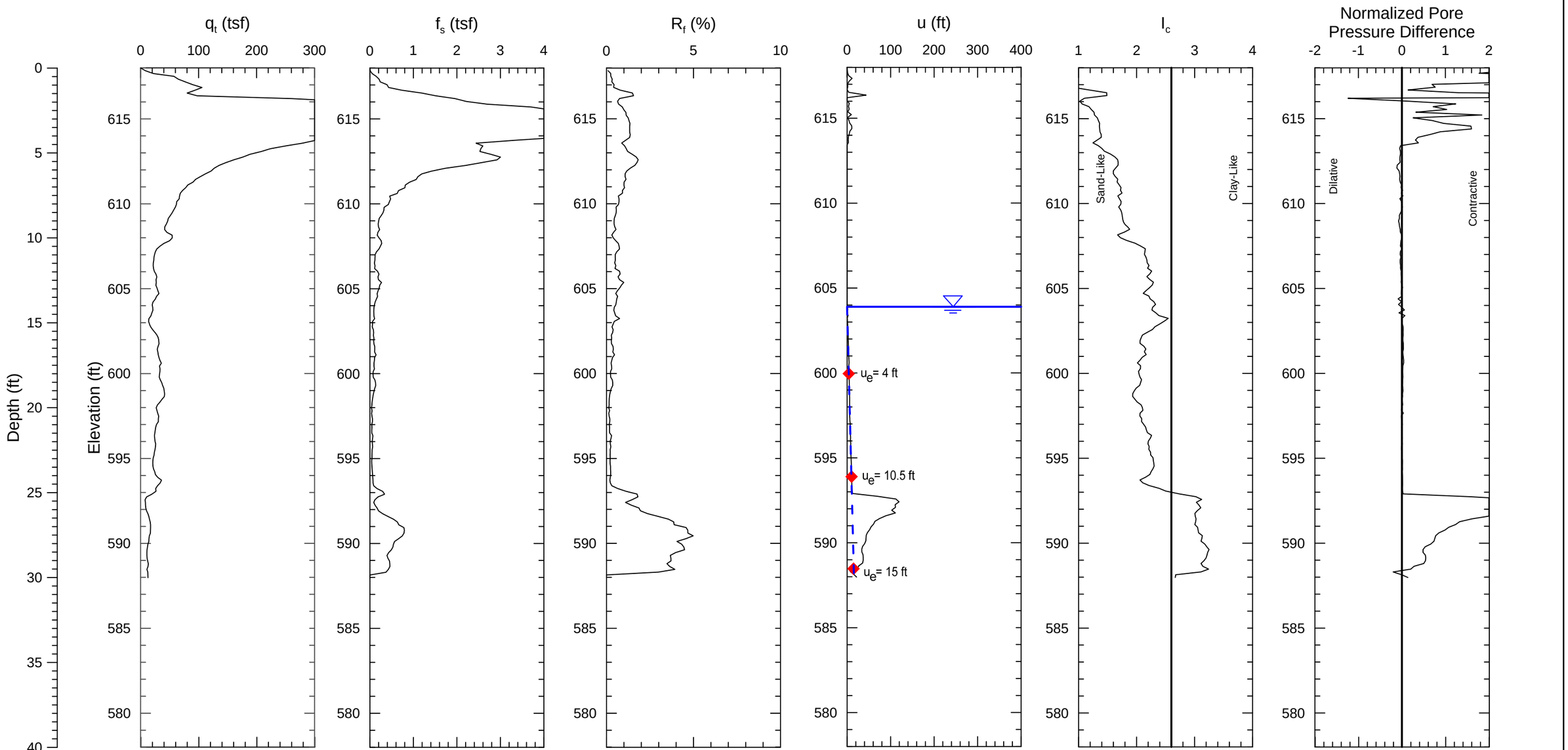
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C026 Kincaid Ash Pond	FIGURE
AECOM			



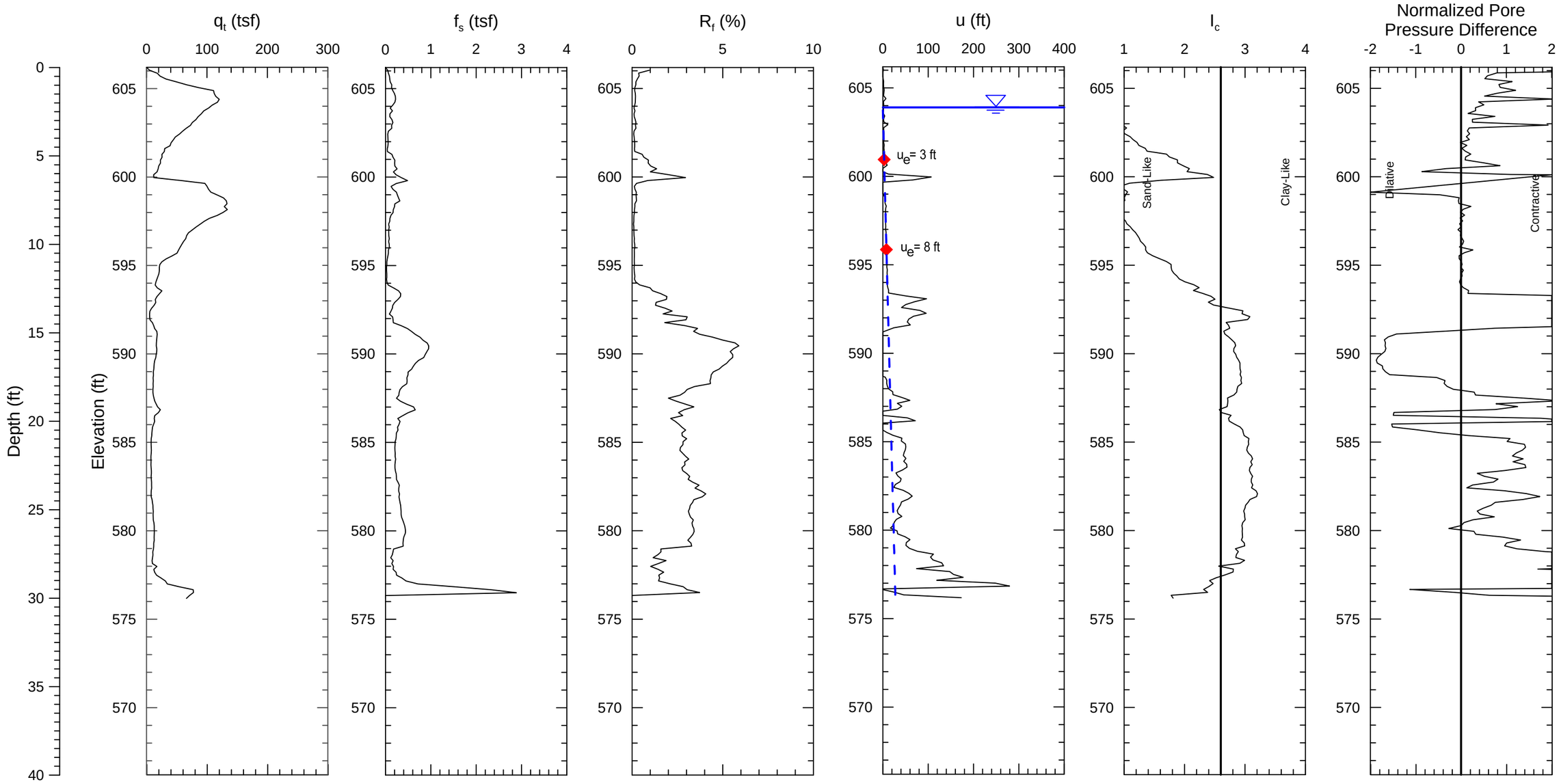
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C027 Kincaid Ash Pond	FIGURE
AECOM			



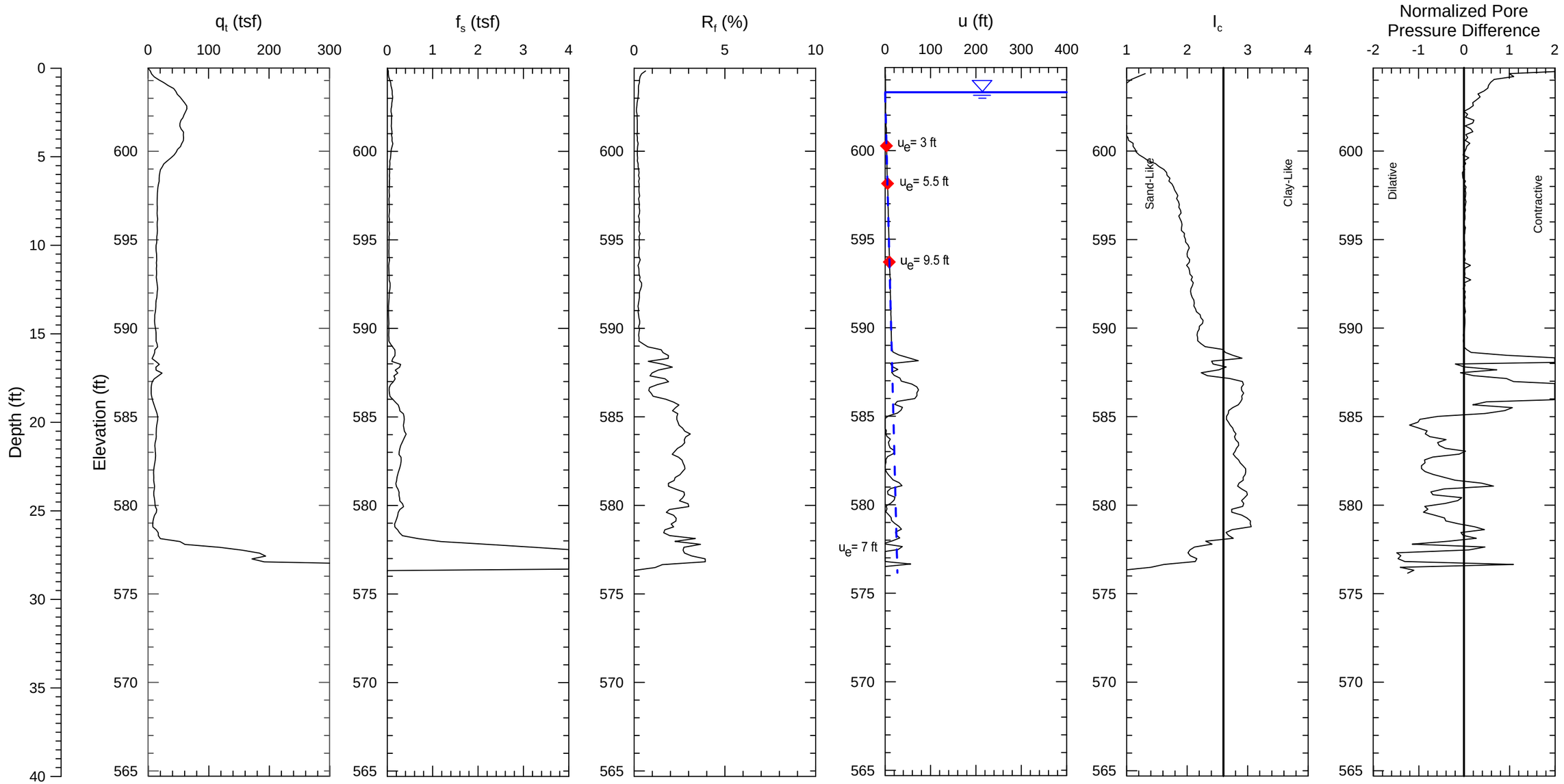
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C028 Kincaid Ash Pond	FIGURE
AECOM			



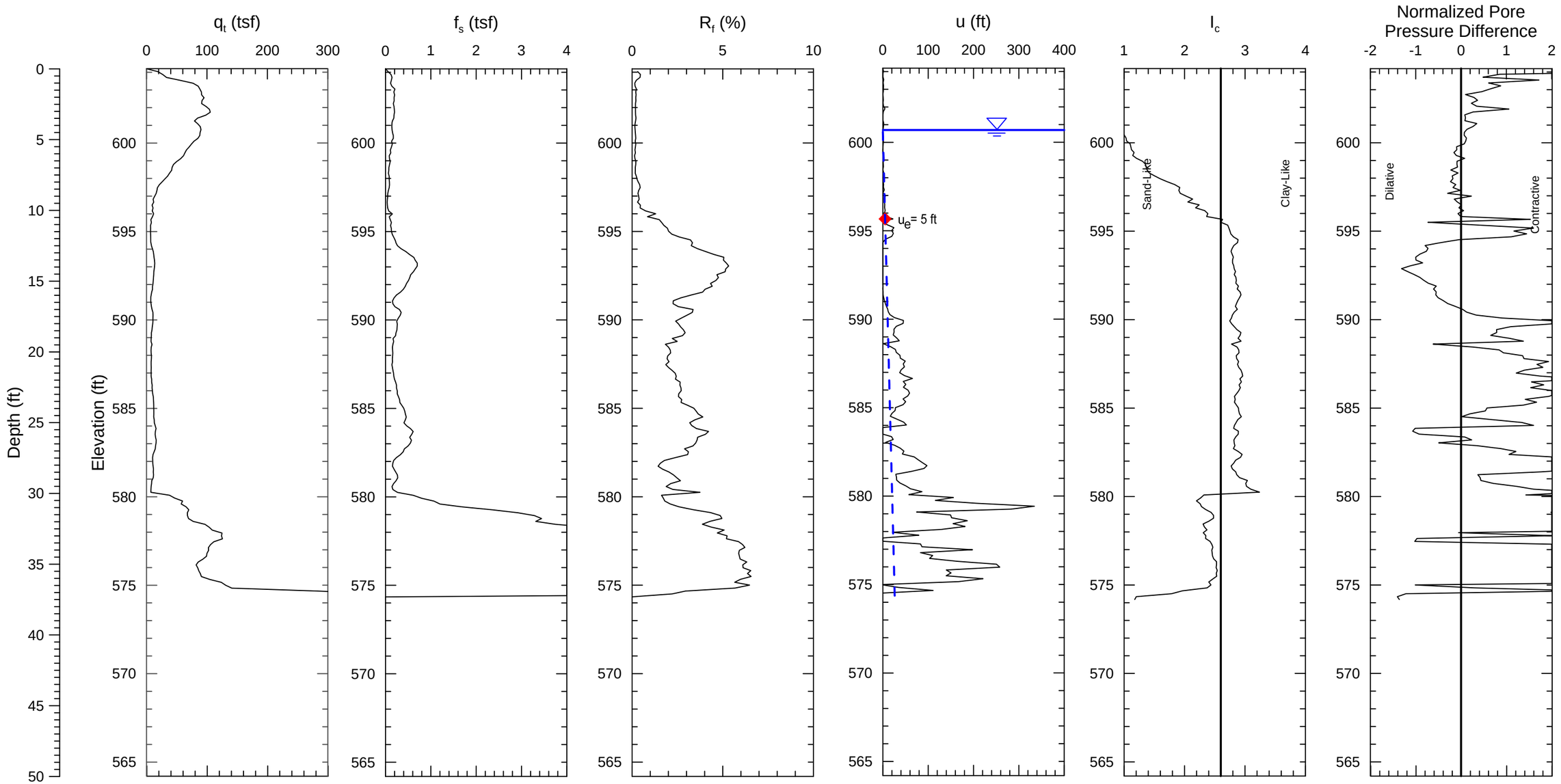
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C029 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C030 Kincaid Ash Pond	FIGURE
AECOM			



Pore Pressure Dissipation Test

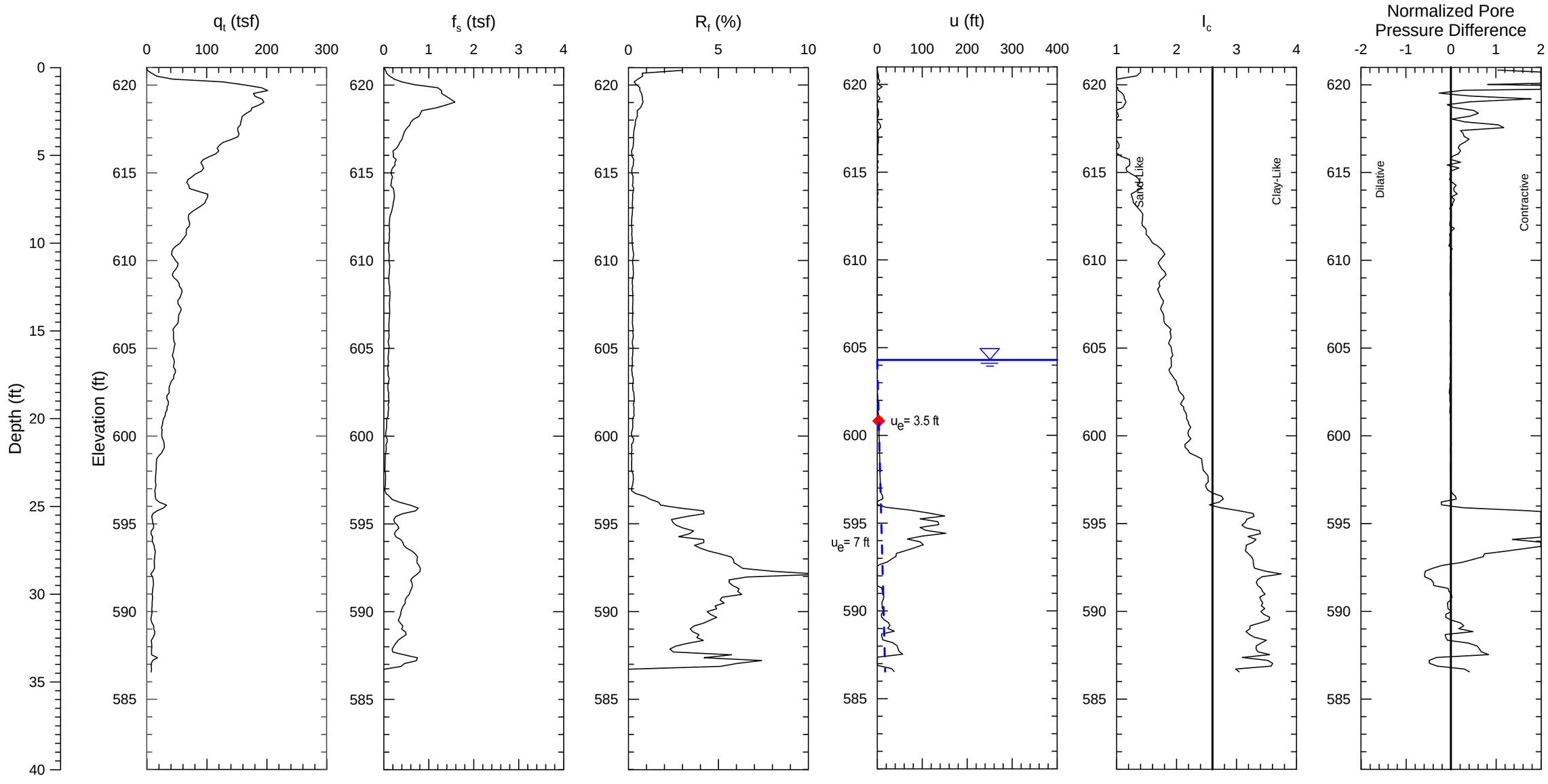
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

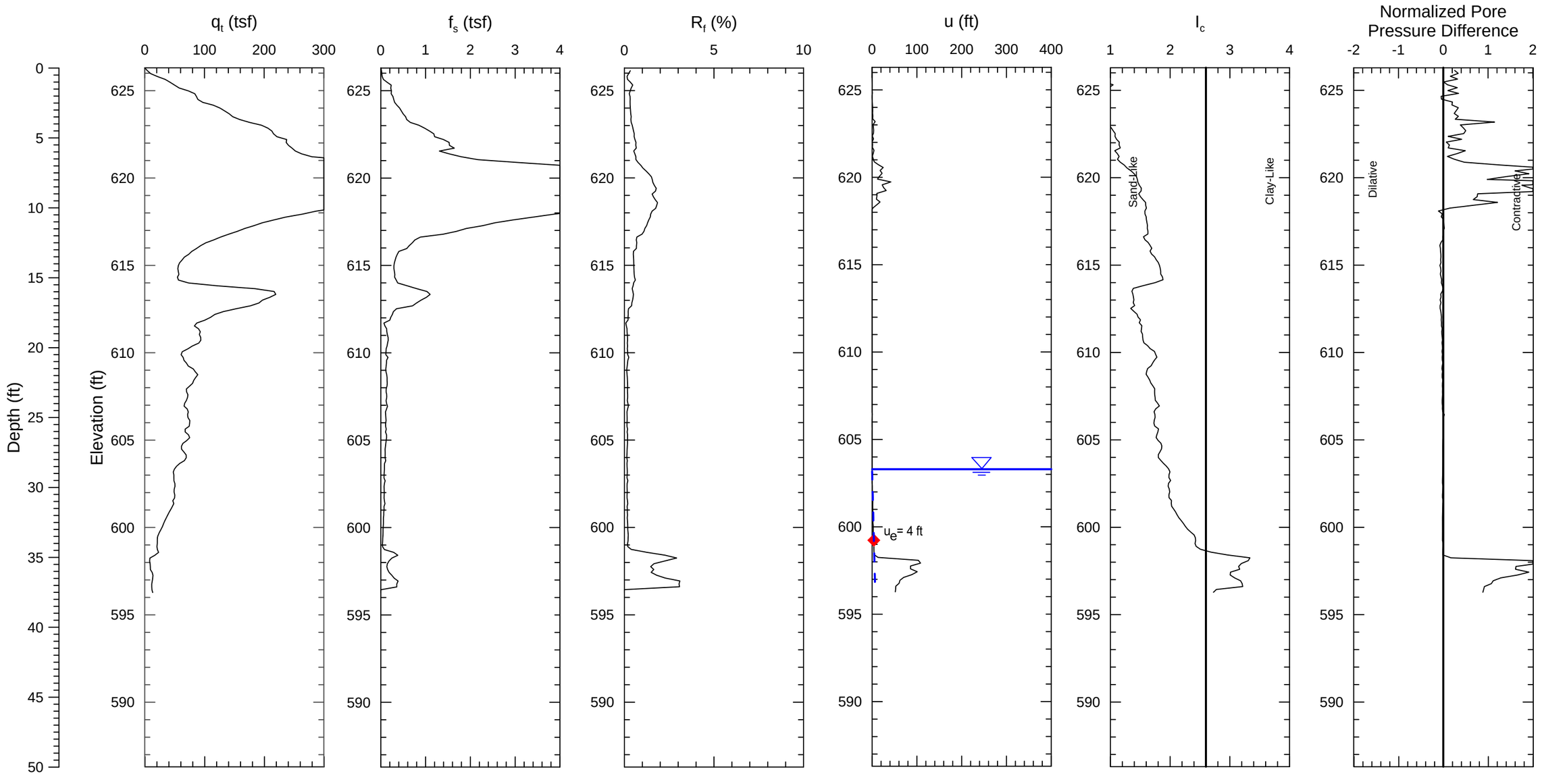
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C031 Kincaid Ash Pond	FIGURE
AECOM			



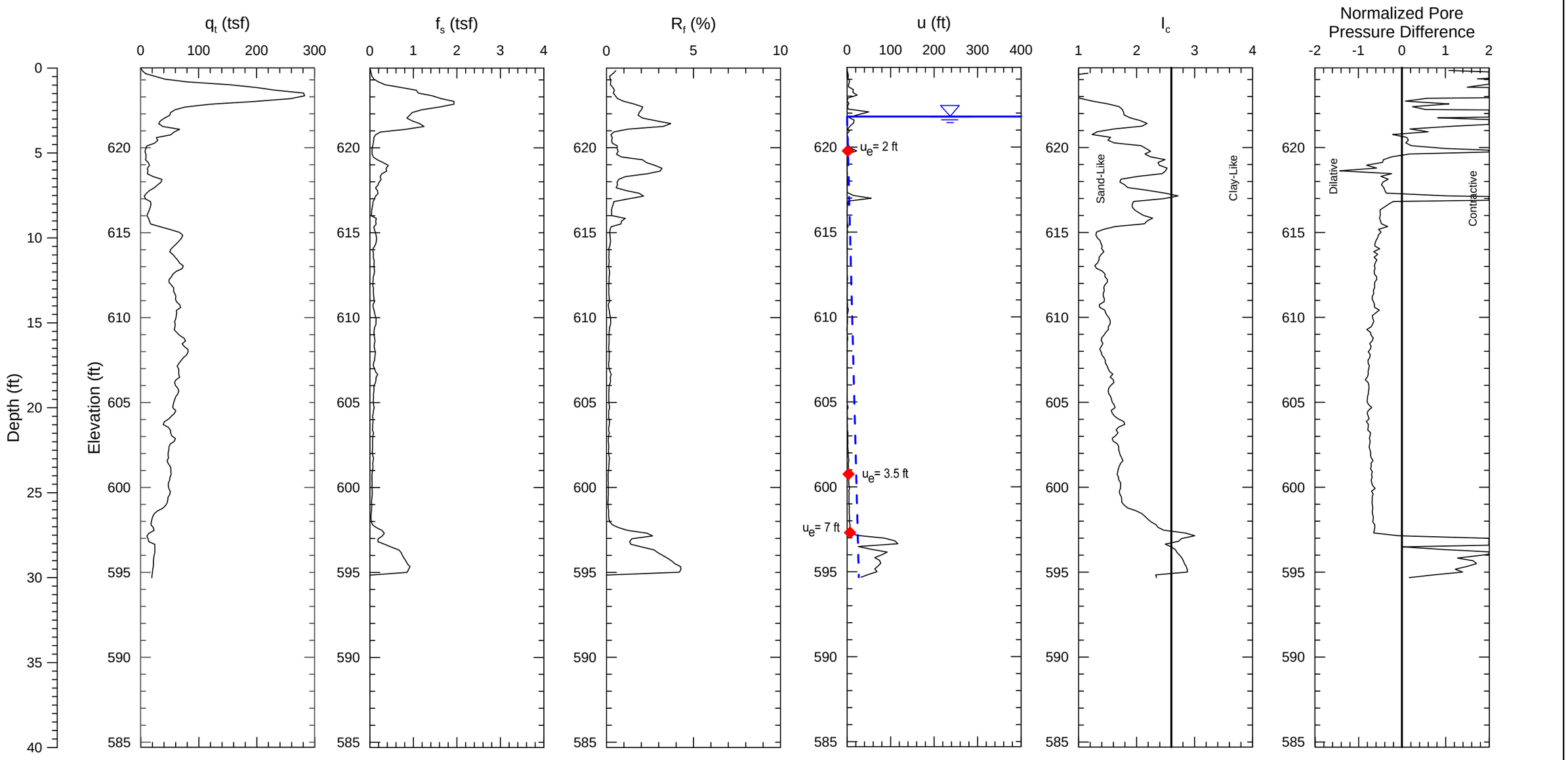
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C032 Kincaid Ash Pond	FIGURE
AECOM			



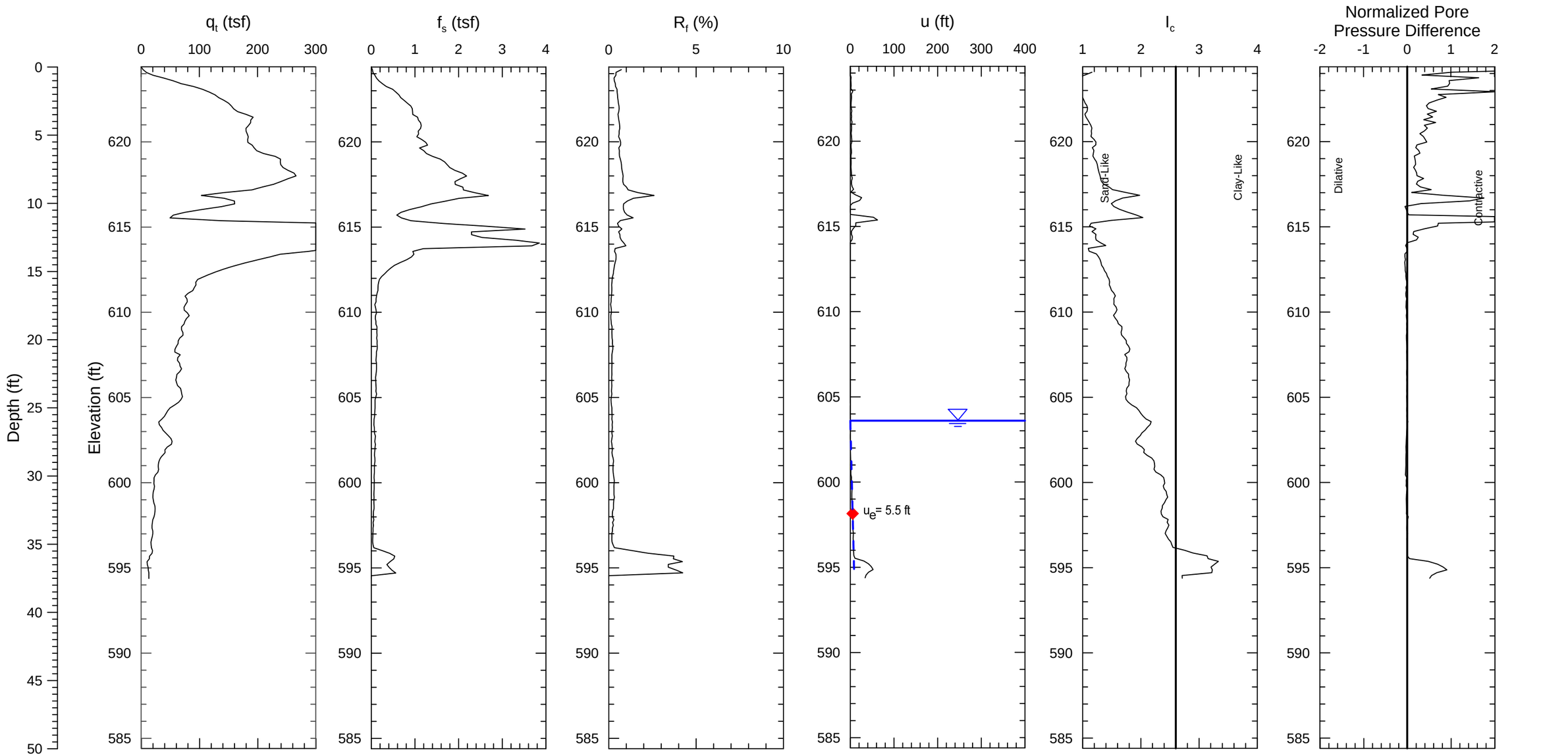
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C033 Kincaid Ash Pond	FIGURE
AECOM			



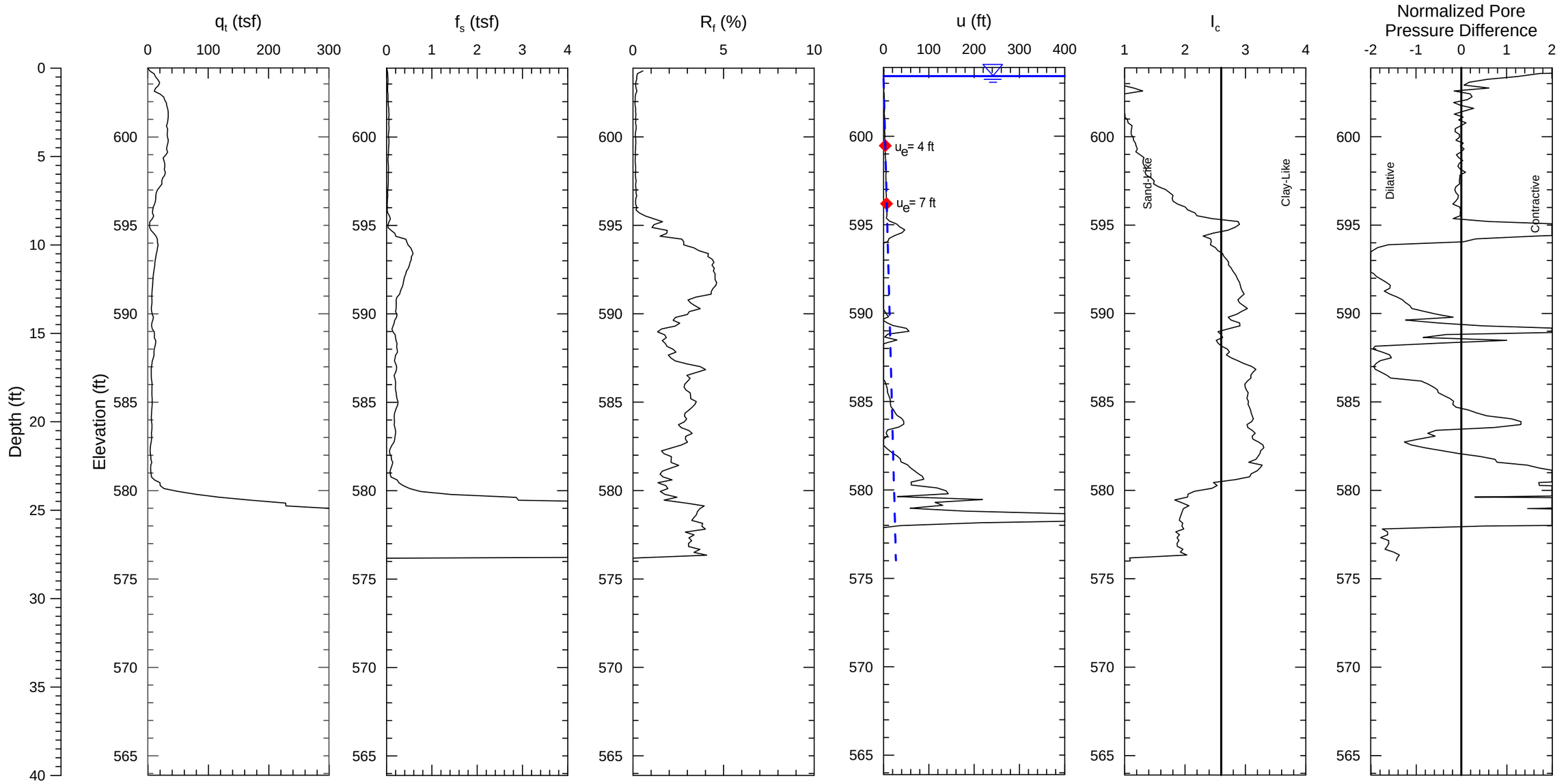
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C034 Kincaid Ash Pond	FIGURE
AECOM			



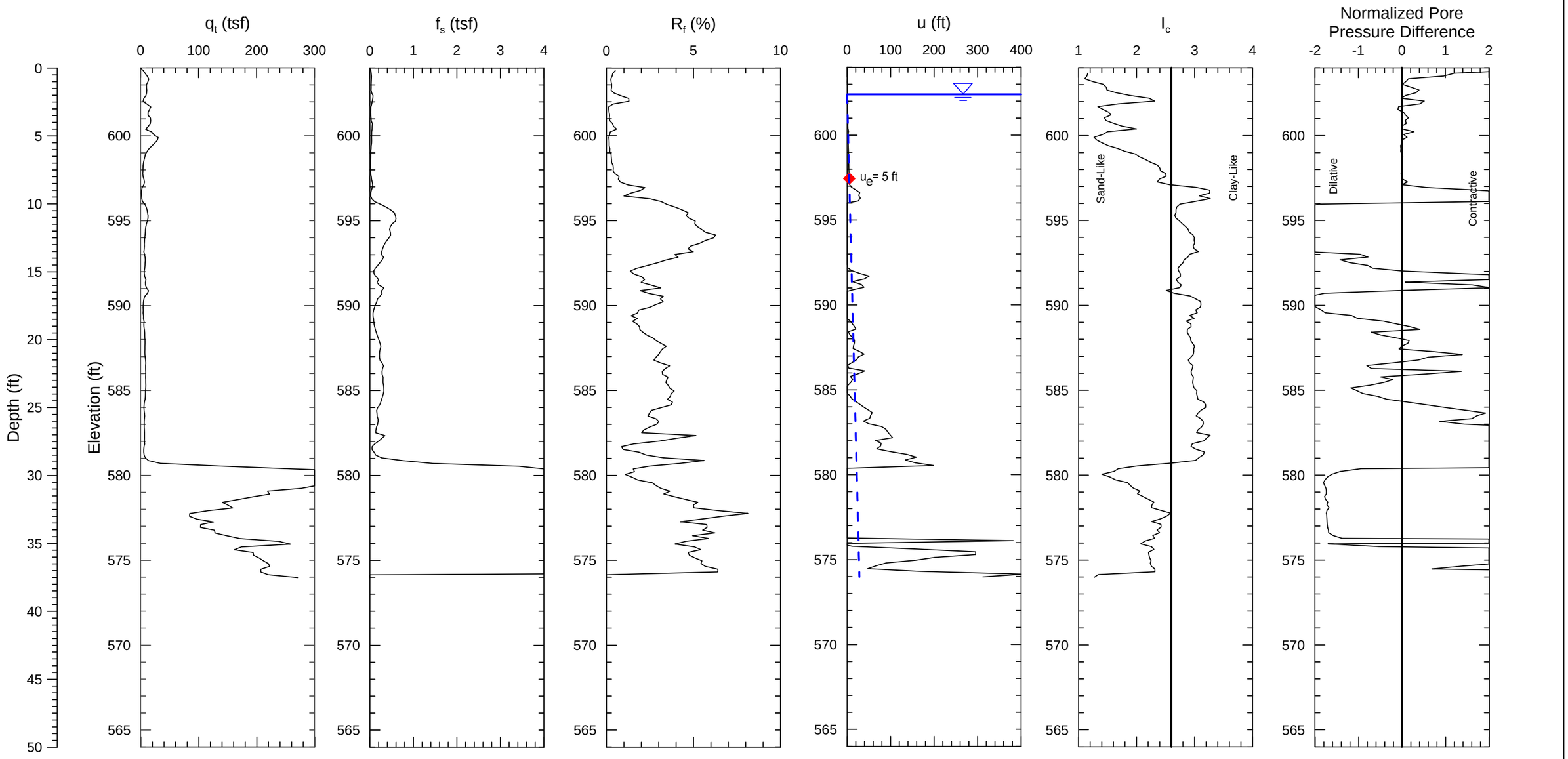
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C035 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C036 Kincaid Ash Pond	FIGURE
AECOM			



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C037 Kincaid Ash Pond	FIGURE
AECOM			

Calculation Notes

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

APPENDIX F

Boring Logs

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Date(s) Drilled	08/14/2015 8:20 AM to 08/14/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	599.204 ft NAVD 88
Borehole Backfill	Piezometer KIN-P001	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066425.165 E 2487814.897 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 599.2 / Depth (feet) 0.0								
			S1	6 6 7	100		Medium dense, brown and gray, low plasticity, CLAY with fine to medium sand, trace fine gravel, with topsoil and roots, (CL) (EMBANKMENT FILL)	11.8				3.0			
595			S2	6 6 6	0										*Rock blocked S2.*
	5						593.2 / 6.0								
			S3	4 5 7	83		Stiff, moist, brown, low plasticity, CLAY with sand, with topsoil, (CL) (EMBANKMENT FILL)	20.8		39	16	4.0			
590			S4	2 2 3	0										
	10						587.2 / 12.0								
			S5				Stiff, gray, low plasticity, silty CLAY, (CL) with reddish brown silt seams, trace fine sand								
585			S6		0										
	15		S7												
							581.2 / 18.0								
			S8	12 24 32	100		Hard, very moist, brown and gray, low plasticity, sandy silty CLAY with orange brown silt seams, trace fine gravel, (CL) (TILL)	8.9		23	8	> 4.5			*Shelby tube refusal at 18 ft.*
580	20														
575							Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
	25		S9	26 50 / 5"	67			8.9				> 4.5			
570			S10	27 41 50 / 4 "	59		Hard, wet, gray, low plasticity, sandy CLAY (CL) (TILL)	10.8				4.5			*Installed Piezometer KIN - P001 in boring.*
	30						569.2 / 30.0								

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B001

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					End of Boring at 30 ft								
565	35													
560	40													
555	45													
550	50													
545	55													
540	60													
535	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:26:12 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Date(s) Drilled	08/12/2015 9:00 AM to 08/13/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	605.234 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P002 5 ft East of KIN-B002)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066464.224 E 2487797.168 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
605	0						605.2 / 0.0								
							Moist, light gray, sandy GRAVEL, trace silt, (GM) (FILL)								
							604.2 / 1.0								
		S	S1	3 5 5	78		Stiff, moist, brown and gray, low plasticity, CLAY, trace sand and gravel with topsoil and roots, (CL) (EMBANKEMENT FILL)	18.1				3.5			
		S	S2		71			19.0	130.7	38	21				
600	5														
		S	S3	2 5 6	100		Stiff, moist, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	13.9				3.5			
							597.2 / 8.0								
		S	S4	2 3 4	94		Medium stiff, moist, dark gray, medium plasticity, CLAY with topsoil, (CL)	28.4		48	26	0.5			*Organic content 5.9%.*
595	10														
		S	S5	2 2 2	100		Soft, wet, brown and gray, medium plasticity, CLAY, (CL)	26.2				1.5			
590	15														
		S	S6		100		Gray and yellowish brown, trace dark gray, medium plasticity, CLAY, trace sand and gravel, (CL)	27.5	121.4	41	24				
		S	S7	WOH 2 2	100		Soft, very wet, brown and gray, medium plasticity, CLAY, trace fine sand, (CL)	27.1				0.5			
585	20														
							582.2 / 23.0								
		S	S8	12 23 41	78		Hard, very moist to wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	12.6	153.0	22	8	> 4.5			*Shelby tube refusal at 23' bgs. No recovery.*
580	25														
		S	S9	30 41 50 / 5"	94		Hard, wet, gray, low plasticity, sandy CLAY, (CL) (TILL)	8.4				> 4.5			
	30														

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B002

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
575	30													
														8/12/15
570	35	S10	16 41 50 / 3"	78		Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	8.9				> 4.5			*Rig needs to be repaired at site, work stopped 12 N.*
														8/13/15
		S11	10 32 50	89			8.8				> 4.5			*Work continued on hole at 9:45 a.m.*
565	40													
														Switch to Rotary drilling.
		S12	27 27 34	100		Hard, very wet, brown and gray, low plasticity, sandy CLAY, (CL) (TILL)	11.9				> 4.5			
560	45													
		S13	17 23 29			Hard, wet, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
555	50					555.2 / 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P002 with 5 ft offset to the East. Coordinates shown are for Boring KIN-B002.*
550	55													
545	60													
	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:32:24 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Sheet 1 of 2

Date(s) Drilled	08/14/2015 1:20 PM to 08/15/2015 3:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	624.454 ft NAVD 88
Borehole Backfill	Piezometer KIN-P003	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1066902.847 E 2485599.511 (ft NAD83)	Groundwater Level(s)	29 ft on 8/14/2015 1:20:00 PM		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 624.5 / Depth (feet) 0.0								
		S	S1	4 4 5	94		Stiff, brown and gray, low plasticity, CLAY with fine to coarse sand, trace fine gravel with roots and topsoil, (CL) (EMBANKMENT FILL)	11.6				> 4.5			
620	5	S	S2	3 4 10	94		Stiff, brown and gray, low plasticity, CLAY with fine to medium sand, trace fine gravel, (CL) (EMBANKMENT FILL)	15.5				> 4.5			
		S	S3	3 4 7	100			16.4				> 4.5			
615	10	S	S4	3 5 7	72		Stiff, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.5				3.0			
610	15	S	S5	3 4 5	100		Stiff, moist, brown and gray, low plasticity, CLAY, trace fine to medium sand, (CL) (EMBANKMENT FILL)	18.0				1.5			
							Elevation (feet) 606.0 / Depth (feet) 18.5								
605	20	S	S6	3 5 7	100		Stiff, moist, brown and gray, high plasticity, CLAY, trace fine to medium sand, (CH) (EMBANKMENT FILL)	23.9	144.2	54	34	2.0			
							Elevation (feet) 602.5 / Depth (feet) 22.0								
		S	S7		100		Moist, dark grayish brown with gray and olive, trace yellowish brown, medium plasticity, CLAY with sand, with organics (CL)	21.4	125.6	47	27				
600	25	S	S8		92		Stiff to very stiff, moist, grayish green, low plasticity, sandy CLAY, trace fine gravel with reddish brown silt seams (CL)	18.4	129.9	31	15				
							Elevation (feet) 595.5 / Depth (feet) 29.0								
595	30	S	S9	3 4 4			Medium stiff, wet, brown and gray, low plasticity, CLAY, (CL)	29.7							

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B003

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					591.5 / 33.0 Very soft, very wet, brown and gray, low plasticity, CLAY, trace fine sand, with reddish brown silt seams, (CL)								
590		S10	WOH WOH 1	100			25.2		36	17	0.5			
	35	S11		96										
585		S12	WOH 1 3	100		Soft, very wet, brown and gray, medium plasticity, sandy CLAY (CL)	26.0		41	23	0.5			
	40					583.5 / 41.0 Hard, gray, medium plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
580		S13	7 16 46	100			9.2				> 4.5			
	45													
575		S14	19 19 50 / 5"			575.5 / 49.0 Very dense, very wet, brown and gray, silty fine to medium SAND, trace clay and fine gravel (SM) (TILL) 574.5 / 50.0	17.3				2.0			
	50					End of Boring at 50 ft								*Installed Piezometer KIN-P003 in boring.*
570														
	55													
565														
	60													
560														
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Sheet 1 of 2

Date(s) Drilled	08/18/2015 3:50 PM to 08/19/2015 12:00 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.345 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout Piezometer KIN-P005	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067820.182 E 2484976.546 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 621.3 / Depth (feet) 0.0								
620	0	S1		9 9 9	72		Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.1				> 4.5			
	5	S2		4 6 10	100		Very stiff, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	12.1		31	16	> 4.5			
615		S3		4 3 4	61		Medium stiff, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	9.8							
	10	S4		2 2 3	67		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel with reddish brown silt seams (CL) (EMBANKMENT FILL)	19.3				1.25			
610															*No S5 Sample.*
	15	S6		6 7 7	0										
605		S7			79		Stiff, moist, dark grayish brown with dark yellowish brown, low plasticity, CLAY with sand, with reddish brown silt seams (CL) (EMBANKMENT FILL)	14.6	135.1	29	14				
	20	S8			92		Dark brown and green, low plasticity, CLAY with sand (CL) (EMBANKMENT FILL)	21.6	125.1	32	14				
600							599.3 / 22.0								
		S9		4 9 10	100		Very stiff, moist, brown and gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel, with organics (CL)	19.0				2.5			
	25						596.3 / 25.0 Very stiff, moist, greenish gray, high plasticity, silty CLAY, (CH).								
595															
		S10		2 4 5	100		Stiff, moist, brown and dark brown, high plasticity, CLAY (CH)	29.0		55	33	2.0			
	30						591.3 / 30.0								

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B004

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30	S11		100		Brown and gray, CLAY (CL)	25.9	126.0						
590														
		S12	WOH 2 3	100		Medium stiff, wet, brown and gray, medium plasticity, CLAY with reddish orange silt seams (CL)	21.2	135.6	42	25	1.0			
	35													
585														
		S13				Brown and gray, medium plasticity, CLAY, trace fine gravel (CL)	21.2	132.8	43	28				
														ST refusal at 39 ft.
	40													
580														
		S14	20 50 / 3"	67		577.3 44.0 Hard, wet, brown and gray, medium plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	9.0				> 4.5			
	45													
575														
		S15	25 30 33			Hard, very moist, brownish gray, medium plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					571.3 50.0 End of Boring at 50 ft								*Installed Piezometer KIN-P005 in boring.*
570														
	55													
565														
	60													
560														
	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:38:27 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Sheet 1 of 3

Date(s) Drilled	08/21/2015 8:00 AM to 08/23/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Mud Rotary / Rock Core	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	85.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	596.38 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P006 5 ft Southeast of KIN-B005)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1067774.633 E 2484937.386 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 596.4 / Depth (feet) 0.0								
	0						Stiff, moist, brown and gray with dark brown, low plasticity, CLAY, with fine to coarse sand (CL) (EMBANKMENT FILL)							
595		S1	2 4 6		83			9.8				4.5			
							593.4 / 3.0								
		S2	2 3 4		100		Medium stiff, moist, brown and gray, low plasticity, CLAY with silt seams (CL)	29.2				2.5			
	5						590.4 / 6.0								
590		S3			92		Grayish brown, low plasticity, CLAY, trace sand (CL)	23.9	127.0	35	12	1.5			
		S4			83		Stiff, moist, grayish brown, low plasticity, CLAY with sand, with reddish brown silt seams (CL).	24.2	126.6	38	16	1.25			
	10														
585															
		S5	2 2 2		100		Soft, very moist to wet, brown and gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel, (CL)	21.9				1.0			
	15														
580		S6			100		579.4 / 17.0	13.8	139.3	22	8	> 4.5			
							Brown and gray, low plasticity, clayey SAND, trace fine gravel, with reddish brown silt seams, (SC) 577.9 / 18.5								
		S7	5 6 8		78		Stiff, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL)	10.2				> 4.5			
	20														
575							572.9 / 23.5								
		S8	22 29 35		100		Hard, moist, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	6.7		20	7	2.0			
	25														
570							567.9 / 28.5								
		S9	6 10 14		100		Very stiff, dry, brownish gray, low plasticity, shaley CLAY, trace silt seams (CL)	27.7				3.5			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30													
565														
		S10	13 18 23	100		562.4 / 34.0 Hard, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	35													
560														
		S11	16 24 30	100		Hard, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.8				> 4.5			
	40													
555														
		S12A	12 23 36	100			8.2				> 4.5			*Auger head broke at 10 a.m. Restart 8/23/15. Grout hole; offset 8 ft. SE, set 14 ft. HSA as casing, drill mud rotary and start sampling at 42 ft (S 12A).*
		S12	20 23 30	100			9.5				> 4.5			
	45													
550														
	50													
545														
		S13	8 14 21	100		Hard, brown, low plasticity, CLAY, trace fine sand (CL) (TILL)	17.5	129.6	36	18	> 4.5			
	55													
540														
	60													
535														
		S14	10 16 26	94		Hard, very wet, brown and gray, low plasticity, sandy CLAY (CL) (TILL)	16.6				> 4.5			
	65													

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 2:50:48 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B005

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
530																
	70															
525							524.9	71.5								
						Hard, gray, low plasticity, shaley CLAY, trace fine gravel (CL) (TILL)	523.9	72.5								
		S15A	23 50 / 5"	72		Very soft, gray, low plasticity, sandy shaley CLAY, trace fine gravel, (CL) (BEDROCK)			15.2 8.4				> 4.5			
	75						521.4	75.0								*Switch to roller bit. Hard drilling 74 - 75'. Rollerbit refusal at 75 ft. Start wireline coring on 8/24/15.*
520						Limestone, hard, medium strong, light to medium gray. qu = 6,500 psi (75.9 - 76.5 ft)			1.0	163.6						
		C1	79	100												
	80						516.8	79.6								
515						SHALE, very soft, laminated, waxy, dark gray SHALE, moderately hard, laminated, black										
		C2	53	91					8.4	116.3						
	85						511.4	85.0								*Installed Piezometer KIN-P006 with 5 ft offset to the Southeast. Coordinates shown are for Boring KIN-B005.*
510						End of Boring at 85 ft										
	90															
505																
	95															
500																
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Date(s) Drilled	08/14/2015 9:30 AM to 08/18/2015 12:00 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Cased, Rotary Wash	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	41.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	618.622 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1068071.624 E 2485451.262 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0					618.6 / 0.0 Dry, black, fine to coarse grained sand (cinders) (ASH)								
		S1	3 3 3	100		Loose, wet, brown and gray, sand (cinders) with clayey silt (ASH)	34.2							
615						615.1 / 3.5								
		S2	WOH 1 WOH	100		Very soft, wet, brown with black, low plasticity, CLAY, with cinders (CL)	71.4				0.5			
	5	S3		0										
610		S4		100		Very wet, dark brown, low plasticity, fine to medium grained sandy CLAY with ash (CL)								*Piston sample.*
	10	S5	WOH	100		Very soft, very wet, dark brown and gray, low plasticity, sandy CLAY, with organics, with ash (CL)	48.0				0.25			
605		S6		47		603.6 / 15.0								*Piston sample. 8/14/15 12:05 work stopped.*
	15					Very loose, wet, coarse grained sand (cinders) (ASH)								
		S7	1 1 1	100		Very loose, very wet, dark brown sand (cinders), with organics and clay (ASH)	38.5							
600														*8/18/15 9:15 work resumed.*
	20	S8		0										*Piston sample.*
		S9		100		Very loose, very wet, black, fine to coarse grained sand (cinders) (ASH)								
595						Very loose, wet, coarse grained sand (cinders) (ASH)								
	25													
590		S10	2 2 3	56		589.6 / 29.0 Medium stiff, very wet, brown and gray, low plasticity, CLAY, trace fine sand, with reddish	30.4		36	15	1.0			
	30													

Report: GEO_SOIL; File \\USDEN5FP0001\GEOCIVIL$\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/8/2016 2:53:00

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B006

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30					brown silt seams (CL)								
						585.1 / 33.5								
585		S11	WOH 2 3	100		Medium stiff, very wet, low plasticity, CLAY, with reddish brown silt seams (CL)	28.2				1.0			
	35													
		S12		100										
580														
	40	S13		46										
						577.6 / 41.0								
						End of Boring at 41 ft								
575														
	45													
570														
	50													
565														
	55													
560														
	60													
555														
	65													

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Sheet 1 of 2

Date(s) Drilled	08/20/2015 11:35 AM to 08/20/2015 2:15 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	621.499 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P007 adj. to KIN-B007).	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069015.221 E 2485646.034 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
	0						621.5 / 0.0 Hard, dry, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)								
620		S1	21 26 31		78			5.5				> 4.5			
		S2	9 12 15		100		617.5 / 4.0 Very stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	8.0				> 4.5			
	5														
615		S3	20 15 8		100			20.8				> 4.5			
							613.0 / 8.5								
		S4	4 6 9		100		Stiff, moist, brown to dark brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	6.2				3.0			*Organic content 3.9%.*
	10														
610															
		S5	4 5 7		100			15.0				4.25			
	15														
605		S6			83		Green, brown and gray, low plasticity, CLAY, with sand (CL) (EMBANKMENT FILL)			35	15				
		S7	3 6 8		100		Stiff, very moist, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (EMBANKMENT FILL)	10.3				3.0			
	20														
600															
		S8	3 5 6		100		597.5 / 24.0 Stiff, very moist, brown and gray with dark gray, low plasticity, CLAY, with fine to medium sand, trace fine gravel (CL) (EMBANKMENT FILL)	24.9				1.5			
	25						596.5 / 25.0 Soft, grayish brown, silty CLAY (CL)								
		S9			100							0.5			
595		S10			100		Medium stiff, very moist, brown to light brown, low plasticity, sandy CLAY, trace silt, trace fine gravel, with roots (CL)	10.8				1.0			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B007

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	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
590	30															
		S11		100				Medium stiff, wet, light brown, low plasticity, sandy CLAY (CL)								
585	35	S12		100												
						583.5	38.0									
		S13	WOH WOH 6	67				Very loose, very wet, brown, low plasticity, clayey SAND, trace fine gravel (SC)	13.8				0.75			
580	40					582.0	39.5	Medium stiff, wet, light brown, low plasticity, sandy CLAY, trace silt (CL) (TILL)								
		S14	24 38 42	100				Hard, very wet, gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	11.2		27	13	> 4.5			
575	45															
		S15	25 34 50					Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.7				> 4.5			
	50					571.5	50.0	End of Boring at 50 ft								*Installed Piezometer KIN-P007 with offset. Coordinates shown are for Boring KIN-B007.*
570																
	55															
565																
	60															
560																
	65															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B008

Sheet 1 of 1

Date(s) Drilled	08/20/2015 7:45 AM to 08/20/2015 11:10 AM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	592.087 ft NAVD 88
Borehole Backfill	Piezometer KIN-P008	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069056.566 E 2485606.651 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 592.1 / Depth (feet) 0.0 Rockfill (3 - 7 inch), little topsoil.								
							591.1 / 1.0								
590		S1	7 5 5		0		Medium stiff, very moist, brown and gray, low plasticity, sandy CLAY, (CL) (EMBANKMENT FILL)								*Rock lodged in S1.*
		S2	2 2 4		100			25.4				2.25			
	5						Soft to medium stiff, wet, brown, low plasticity, sandy CLAY (CL) (EMBANKMENT FILL)								
585		S3	2 2 3		100			22.8				0.25 1.0			
		S4			100		583.1 / 9.0	11.4	140.0	19	7				
	10						Low plasticity, sandy CLAY (CL) (TILL)								*Till material at the bottom of S4.*
580															
		S5	15 30 39		100		Hard, wet, brown and gray, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (TILL)	13.3		25	11	> 4.5			
	15														
575															
		S6	13 31 41		100		Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	10.7	144.8			> 4.5			
	20														
570															
		S7	20 35 43		100		Hard, slightly moist, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.6				> 4.5			
	25														
565															
		S8	18 32 50 / 4"				562.1 / 30.0	7.1				> 4.5			*Installed Piezometer KIN-P008 in boring.*
	30						End of Boring at 30 ft								

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B009

Sheet 1 of 1

Date(s) Drilled	08/14/2015 1:15 PM to 08/14/2015 2:35 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	30.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	590.387 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-P009 adj. to KIN-B009)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069403.056 E 2486422.107 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) 590.4 / Depth (feet) 0.0								
590	0	S1		3 3 4	100		Medium stiff, moist, dark brown, medium plasticity, CLAY, with fine sand, with roots (CL) (EMBANKMENT FILL)	20.3				1.75			
		S2		2 2 3	100		586.4 / 4.0 Medium stiff, moist, dark brown, medium plasticity, CLAY, with sand, with roots (CL) 585.4 / 5.0	23.8		42	23	1.5			
585	5	S3		2 3 5	100		Medium stiff, moist, brown and gray, low plasticity, CLAY, with fine to medium sand, with silt seams (CL) 582.9 / 7.5	21.3				1.0			
		S4			100		Grayish brown, low plasticity, sandy CLAY, with pebbles (CL)	19.9	123.7	28	13				
580	10														*S9 and S10 collocated hole.*
							577.4 / 13.0								
		S5		6 15 19	100		Hard, wet, brown, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)	10.3	113.6			> 4.5			*Shelby tube refusal.*
575	15														
		S6		16 29 40	100		Gray	7.5				> 4.5			
570	20														
		S7		18 32 50 / 5"	94		Hard, gray, low plasticity, sandy silty CLAY, trace fine gravel (CL) (TILL)	11.5				> 4.5			
565	25														*Installed Piezometer KIN-P009 in boring.*
		S8		16 33 50 / 5"	94		Hard, brownish gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	9.2	105.4			> 4.5			
	30						560.4 / 30.0								

End of Boring at 30 ft

AECOM

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Sheet 1 of 3

Date(s) Drilled	08/26/2015 8:00 AM to 08/26/2015 5:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger / Rotary	Drill Bit Size/Type	7.75 in. O.D. HSA / 4 in. Roller Bit	Borehole Depth	75.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	615.29 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout (Installed KIN-010 12 ft West of KIN-B010)	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1069349.893 E 2486428.735 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
							Elevation (feet) / Depth (feet)								
615	0						615.3 / 0.0 Topsoil and gravel basecourse (fill).								
							614.3 / 1.0								
		S1	4 4 6		78		Stiff, moist, brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	4.9				> 4.5			
		S2	4 5 7		89			8.9				4.0			
610	5														
		S3	3 3 4		100		Medium stiff, moist, brown, low plasticity, sandy CLAY, trace fine to coarse gravel (CL) (EMBANKMENT FILL)	9.5		23	9	1.75 3.0			
		S4	4 6 7		89		Stiff, moist, brown and dark brown, low plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	11.8	135.8			> 4.5			
605	10														
		S5	2 5 5		100		Brown and gray	19.5				0.75			
600	15														
		S6			20		Stiff, moist, grayish brown, low plasticity, CLAY, with sand (CL) (EMBANKMENT FILL)	21.1	128.1	33	19	1.5			
595	20						594.3 / 21.0								
		S7			18		Very stiff, low plasticity, CLAY, with sand (CL)	11.8	137.7	31	16	3.5			*ST refusal*
								23.3							
		S8	3 5 7		94		590.9 / 24.4	17.6	136.5			1.25			
590	25						Stiff, very wet, brown and gray with dark brown, low plasticity, CLAY, with fine to medium sand (CL)								
		S9	2 2 3		100		586.3 / 29.0 Medium stiff, dark brown, medium plasticity, CLAY (CL)	28.9		40	20	0.5			*Organic content 5.3%.*
	30														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 3:13:21 PM

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	SAMPLES: Type Number	SAMPLES: Sampling Resist. OR Core RQD (%)	SAMPLES: Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
585	30													*30 - 32': Duttings appear as topsoil.*
						583.3 / 32.0								
		S10		22		Medium stiff, very wet, brown and gray, low plasticity, sandy CLAY, trace fine gravel, (CL)					1.75			
580	35	S11	3 4 4	100			20.9				1.75			
						577.3 / 38.0								
		S12	13 32 50 / 3"	89		Very dense, very wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)	9.8							*38': Hard augering.*
575	40													*40': Mud rotary*
						572.3 / 43.0								
		S13	23 42 50	89		Hard, wet, gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	10.7				> 4.5			
570	45													
		S14	27 50 / 5"	89		Low plasticity	9.9	149.4	23	9	> 4.5			
565	50													
560	55													
		S15	23 35 50 / 5"	100			9.5				> 4.5			
555	60													*61 - 63': Easier drilling.*
	65													

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B010

Elevation (feet)	Depth (feet)	Type Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Elevation (feet)	Depth (feet)	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
550																
		S16	13 50 50 / 1"	89		Greenish gray and brown Shale (BEDROCK)	545.8	69.5	17.0				> 4.5			*Roller bit refusal. S17-SPT bouncing. Switch to rock coring.*
545	70					Shale, dark gray, very soft, waxy	545.0	70.3								
		C1	53	95		Run #1 70.3 - 75': Limestone, gray, thinly bedded, strong, moderately hard, qu = 11,380 psi (70.6 - 71.2 ft)			0.3	165.8						
540	75					End of Boring at 75 ft	540.3	75.0								*Installed Piezometer KIN-P010 with 12 ft offset West.*
535	80															
530	85															
525	90															
520	95															
	100															

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Date(s) Drilled	08/11/2015 11:30 AM to 08/11/2015 4:30 PM	Logged By	Matthew Stone	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	6.50 in. O.D. HSA	Borehole Depth	50.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	617.018 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST	Hammer Data	Automatic
Boring Location	N 1068624.963 E 2487934.93 (ft NAD83)	Groundwater Level(s)	26 ft on 8/11/2015		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	0						Elevation (feet) 617.0 / Depth (feet) 0.0 Sandy gravel fill.								
							616.0 / 1.0								
615		S1	3 4 4		33		Medium stiff, moist, brown, low plasticity, CLAY, with fine sand, (CL) (EMBANKMENT FILL)	16.6							
	5	S2	3 6 7		83		Stiff, moist, brown and dark brown, low plasticity, CLAY, with fine sand, trace fine gravel (CL) (EMBANKMENT FILL)	18.6		38	18				*Organic Content of 2.9%.*
610		S3	3 5 8		100		Stiff, brown and dark brown, medium plasticity, sandy CLAY, trace fine gravel (CL) (EMBANKMENT FILL)	17.2		44	26				
							608.5 / 8.5								
	10	S4	3 5 8		100		Stiff, brown to gray, medium plasticity, CLAY, trace fine sand (CL) (EMBANKMENT FILL)	20.4							
605															
		S5			96		602.5 / 14.5	22.9	118.0	58	37				*Organic content 2.5%.*
	15						Dark brown, high plasticity, CLAY (CH) (EMBANKMENT FILL) 16 - 18': Possible topsoil								
600							599.0 / 18.0								
	20	S6	3 5 6		100		Stiff, brown and gray, medium plasticity, CLAY, trace fine sand (CL)	27.7	140.7	49	29				
595															
		S7	2 2 3		100		593.0 / 24.0 Medium stiff, moist, brown and gray, medium plasticity, CLAY, trace fine sand, with reddish brown silt seams (CL)	26.8				0.75			
	25						▽								
590		S8			96							0.5			
		S9	WOH		100		Very soft, moist, brown and gray, medium plasticity, CLAY, trace fine sand, with reddish	26.5		40	21	0.3			
	30														

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Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B011

Elevation (feet)	Depth (feet)	Sample Type	Sample Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
	30						brown silt seams (CL)								
585		S10		WOH 1 1	100		Very soft, wet, brown and gray, low plasticity, sandy CLAY (CL)	25.0		33	17				
	35						Elevation (feet) 580.0 / Depth (feet) 37.0								
580							Very dense, wet, brown and gray, low plasticity, clayey SAND, trace fine gravel (SC) (TILL)								
		S11		12 21 50 / 2"	100			8.2		23	9				
	40						Elevation (feet) 575.0 / Depth (feet) 42.0								
575							Hard, wet, brownish gray, low plasticity, sandy CLAY, trace fine gravel, (CL) (TILL)								
		S12		37 50 / 3"	61			9.0				> 4.5			
	45														
570															
		S13		50 / 5"	33			9.6				> 4.5			
	50						Elevation (feet) 567.0 / Depth (feet) 50.0								
							End of Boring at 50 ft								
565															
	55														
560															
	60														
555															
	65														

Report: GEO_SOIL; File N:\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/5/2016 3:16:07 PM

Report: GEO_SOIL; File \\USDEN5FP0001\GEOCIVIL$\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/8/2016 2:54:10

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B012

Date(s) Drilled	08/25/2015 8:00 AM to 08/25/2015 12:00 PM	Logged By	Elliott Drumright	Checked By	Elliott Drumright
Drilling Method	Hollow Stem Auger	Drill Bit Size/Type	7.75 in. O.D. HSA	Borehole Depth	40.0 ft
Drill Rig Type	CME-550X	Drilling Contractor	Terracon	Surface Elevation	605.539 ft NAVD 88
Borehole Backfill	Cement-Bentonite Grout	Sampling Method(s)	SS / ST/ Piston Sample	Hammer Data	Automatic
Boring Location	N 1067643.467 E 2486141.078 (ft NAD83)	Groundwater Level(s)	Not Encountered		

Elevation (feet)	Depth (feet)	SAMPLES Type	Number	Sampling Resist. OR Core RQD (%)	Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
605	0						Elevation (feet) 605.5 / Depth (feet) 0.0								
		S1		7 8 12	83		Medium dense, moist, black, fine to coarse grained sand (cinders) (ASH)	11.2							
		S2		12 18 18	100			12.0							
600	5						Very dense, very wet, black, sand (cinders) (ASH)								
		S3			0										*Piston sample 6' to 8': NR. Auger to 8.5'.*
		S4		3 3 4	44		Loose, very wet, black, sand (cinders) (ASH)	19.4							*Ash flowing into auger at 8.5'. Use SPT.*
595	10														
							Elevation (feet) 591.7 / Depth (feet) 13.8								*Piston sampler.*
		S5			60		Very soft, wet, light brown, low plasticity, silty CLAY (CL)					0.25			
590	15	S6			100		Very soft to soft					0.5			
		S7			92		Soft					0.75			
585	20														
		S8			100		Soft, grayish brown, low plasticity, sandy silty CLAY, trace fine gravel (CL)					0.6			
580	25														
							Elevation (feet) 577.5 / Depth (feet) 28.0								
		S9		11 28 43	100		Hard, brown and gray, low plasticity, sandy silty CLAY, trace fine gravel (CL) (TILL)	8.4		19	6	> 4.5			*28' Harder drilling*
	30														

Report: GEO_SOIL; File \\USDEN5FP0001\GEOCIVIL$\PROJECTS\60428794_DYNEGY_CCR_RULEASMT\SUB_00\10.0_CALCULATIONS_ANALYSIS_DATA\SITE INVESTIGATION\KINCAID\BORINGS\GINT TEMPLATE\DYNEGY_KINCAID_2015.GPJ; 2/8/2016 2:54:11

Project: Dynegy

Project Location: Kincaid Power Station, IL

Project Number: 60440697

Log of Boring KIN-B012

Elevation (feet)	Depth (feet)	SAMPLES Type Number	SAMPLES Sampling Resist. OR Core RQD (%)	SAMPLES Recovery (%)	Graphic Symbol	MATERIAL DESCRIPTION (Elevation (feet) / Depth (feet))	Natural Moisture Content (%)	Total Unit Weight (pcf)	Liquid Limit	Plasticity Index	Pocket Pen. Su (ksf)	Torvane Su (ksf)	TXUU (ksf)	REMARKS
575	30													
		S10	22 47 50 / 3"	89		Hard, brown and gray, low plasticity, sandy CLAY, trace fine gravel (CL) (TILL)	7.1							*35' Very hard drilling*
570	35													
						567.5 / 38.0								
		S11	27 38 50 / 4"	89		Very dense, very wet, brown and gray, clayey SAND, trace fine gravel (SC) (TILL)	14.9							
565	40					565.5 / 40.0								
						End of Boring at 40 ft								
560	45													
555	50													
550	55													
545	60													
	65													

Calculation Notes

Subject: Kincaid Ash Pond Material Characterization

Project Name: Dynegy CCR

By: Julie Heitland Date: 01/08/2016

Project No: 60480698

Checked By: Amanda Duvigneaud Date: 01/11/2016

Task No.: 01

APPENDIX G

Lab Test Results

2015 CIU' Triaxial Test Data

Project: Kincaid Ash Pond (Dynegy)
Project No.: 60480698

Notes:
1. Deviator stress (shear stress at failure) calculated using the formula: $q = S_u = (\sigma'_1-\sigma'_3)/2$
2. Effective stress friction angle calculated using the fomula: $\phi' = \sin^{-1}[(\sigma'_1-\sigma'_3)/(\sigma'_1+\sigma'_3)]$
3. Shear stress on the failure plane calculated using the formula: $\tau_{ff} = q^*\cos(\phi')$
4. Effective normal stress on the failure plane calculated using the formula: $\sigma'_{ff} = p' - q\sin\phi'$

io calculated using the formula: OCR = σ'_{max}/σ'_c

CIU' Triaxial Shear Strength Characterization - Failure Criteria: Peak Obliquity (Max PSR)

Sample	Material Description	Raw Test Number	Location: Ground Elevation (ft)	Location: Sample Depth (ft)	Location: Sample Elevation (ft)	Input Data from Lab Sheets: Effective Consolidation Stress σ'_c (psi)	Input Data from Lab Sheets: Principle Stress Ratio (PSR) σ'_1/σ'_3	Input Data from Lab Sheets: Average Effective Principle Stress $p' = (\sigma'_1+\sigma'_3)/2$ (psi)	Input Data from Lab Sheets: Strain (%)	Calculated Data: σ'_1 (psi)	Calculated Data: σ'_3 (psi)	Calculated Data: q [1] (psi)	Calculated Data: ϕ' [2] (degrees)	Calculated Data: τ_{ff} [3] (psi)	Calculated Data: τ_{ff}/σ'_c	Calculated Data: σ'_{ff} [4] (psi)	Conversion to PSF: Effective Consolidation Stress σ'_c (psf)	Conversion to PSF: σ'_1 (psf)	Conversion to PSF: σ'_3 (psf)	Conversion to PSF: τ_{ff} [3] (psf)	Conversion to PSF: τ_{ff}/σ'_c	Stress History: Consolidation Test No.	Stress History: Max Past Pressure σ'_{max} (psi)	Stress History: Tested OCRs	Atterberg Limits: Liquid Limit LL	Atterberg Limits: Plastic Limit PL	Atterberg Limits: Plasticity Index PI
Embankment																						**Embankment**					**Embankment**
KIN-B005-S4	Embankment	KIN-B005-S4-10.0	594.5	8.0	586.5	4.0	4.85	8.77	3.78	14.54	3.00	5.77	41.2	4.35	1.09	4.97	576.00	2094.01	431.75	625.77	1.09			0.0	38	22	16
KIN-B005-S4	Embankment	KIN-B005-S4-10.0	594.5	8.5	586.0	8.0	3.61	11.98	4.38	18.76	5.20	6.78	34.5	5.59	0.70	8.14	1152.00	2702.14	748.10	805.23	0.70			0.0			
KIN-B005-S4	Embankment	KIN-B005-S4-10.0	594.5	9.0	585.5	16.0	3.93	17.34	4.75	27.65	7.03	10.31	36.5	8.29	0.52	11.21	2304.00	3981.37	1012.55	1193.62	0.52			0.0			
KIN-B007-S6	Embankment	KIN-B007-S6-18.0	616.8	16.0	600.8	7.5	5.03	13.85	3.60	23.10	4.60	9.25	41.9	6.89	0.92	7.67	1080.00	3326.98	661.82	991.46	0.92			0.0	35	20	15
KIN-B007-S6	Embankment	KIN-B007-S6-18.0	616.8	16.5	600.3	15.0	5.05	22.31	2.41	37.25	7.37	14.94	42.0	11.10	0.74	12.31	2160.00	5363.60	1061.68	1597.70	0.74			0.0			
KIN-B007-S6	Embankment	KIN-B007-S6-18.0	616.8	17.0	599.8	30.0	4.90	30.92	1.79	51.36	10.48	20.44	41.4	15.34	0.51	17.41	4320.00	7395.39	1509.57	2208.42	0.51			0.0			
KIN-B008-S4	Embankment	KIN-B008-S4-10.0	590.5	8.0	582.5	4.0	9.07	9.82	1.15	17.69	1.95	7.87	53.3	4.71	1.18	3.51	576.00	2547.28	280.88	677.85	1.18			0.0	19	12	7
KIN-B008-S4	Embankment	KIN-B008-S4-10.0	590.5	8.5	582.0	8.0	8.12	16.97	3.15	30.22	3.72	13.25	51.3	8.28	1.03	6.63	1152.00	4351.58	535.78	1192.14	1.03			0.0			
KIN-B008-S4	Embankment	KIN-B008-S4-10.0	590.5	9.0	581.5	16.0	5.04	29.94	1.34	49.97	9.91	20.03	42.0	14.89	0.93	16.54	2304.00	7195.83	1426.89	2143.82	0.93			0.0			
Foundation Clay																						**Foundation Clay**					**Foundation Clay**
KIN-B003-S8	Foundation Clay	KIN-B003-S8-26.0	621.8	24.0	597.8	10.0	4.15	11.72	4.19	18.89	4.55	7.17	37.7	5.67	0.57	7.33	1440.00	2720.08	655.28	816.70	0.57			0.0	31	16	15
KIN-B003-S8	Foundation Clay	KIN-B003-S8-26.0	621.8	24.5	597.3	20.0	3.57	23.87	4.53	37.29	10.45	13.42	34.2	11.10	0.55	16.33	2880.00	5369.62	1504.94	1598.09	0.55			0.0			
KIN-B003-S8	Foundation Clay	KIN-B003-S8-26.0	621.8	25.0	596.8	40.0	3.32	41.23	4.46	63.37	19.09	22.14	32.5	18.68	0.47	29.34	5760.00	9125.57	2748.67	2689.65	0.47			0.0			
KIN-B004-S8	Foundation Clay	KIN-B004-S8-21.0	617.8	19.0	598.8	8.0	5.37	14.21	2.82	23.96	4.46	9.75	43.3	7.09	0.89	7.52	1152.00	3450.02	642.46	1021.35	0.89	KIN-B004-S7	31.81	4.0	32	18	14
KIN-B004-S8	Foundation Clay	KIN-B004-S8-21.0	617.8	19.5	598.3	16.0	4.73	18.81	3.53	31.05	6.57	12.24	40.6	9.29	0.58	10.84	2304.00	4471.69	945.59	1338.45	0.58	KIN-B004-S7	31.81	2.0			
KIN-B004-S8	Foundation Clay	KIN-B004-S8-21.0	617.8	20.0	597.8	32.0	3.98	33.82	4.70	54.05	13.59	20.23	36.7	16.21	0.51	21.72	4608.00	7783.13	1957.03	2334.47	0.51	KIN-B004-S7	31.81	1.0			
KIN-B010-S6	Foundation Clay	KIN-B010-S6-20.5	611.4	18.5	592.9	7.5	5.11	13.08	2.21	21.88	4.28	8.80	42.3	6.51	0.87	7.17	1080.00	3150.10	616.94	937.45	0.87			0.0	33	14	19
KIN-B010-S6	Foundation Clay	KIN-B010-S6-20.5	611.4	19.0	592.4	15.0	3.65	15.91	2.76	24.97	6.85	9.06	34.7	7.45	0.50	10.75	2160.00	3595.84	986.24	1072.51	0.50			0.0			
KIN-B010-S6	Foundation Clay	KIN-B010-S6-20.5	611.4	19.5	591.9	30.0	2.55	25.66	1.34	36.88	14.44	11.22	25.9	10.09	0.34	20.76	4320.00	5310.13	2079.95	1452.63	0.34			0.0			
KIN-B007-S9	Foundation Clay	KIN-B007-S9-27.0	616.8	25.0	591.8	10.0	4.26	16.67	4.20	27.00	6.34	10.33	38.3	8.11	0.81	10.27	1440.00	3887.71	913.25	1167.41	0.81			0.0	-	-	-
KIN-B007-S9	Foundation Clay	KIN-B007-S9-27.0	616.8	25.5	591.3	20.0	3.79	24.84	4.70	39.31	10.37	14.47	35.6	11.76	0.59	16.41	2880.00	5660.72	1493.20	1693.67	0.59			0.0			
KIN-B007-S9	Foundation Clay	KIN-B007-S9-27.0	616.8	26.0	590.8	40.0	3.68	41.55	6.00	65.34	17.76	23.79	34.9	19.50	0.49	27.93	5760.00	9408.38	2558.02	2808.40	0.49			0.0			
Lower Foundation Clay																						**Lower Foundation Clay**					**Lower Foundation Clay**
KIN-B003-S11	NC Foundation Clay	KIN-B003_c_CU Triaxial-NF	621.8	36.9	584.9	22.6	3.06	24.01	4.71	36.20	11.82	12.19	30.5	10.50	0.46	17.82	3254.40	5213.38	1701.50	1512.63	0.46			0.0	54	15	39
KIN-B007-S11	NC Foundation Clay	KIN-B007_c_CU Triaxial-NF	616.8	34.9	581.9	25.8	3.17	30.91	2.75	46.99	14.83	16.08	31.4	13.73	0.53	22.54	3715.20	6766.78	2135.30	1977.65	0.53			0.0	50	15	35
KIN-B010-S10	NC Foundation Clay	KIN-B010_d_CU Triaxial-NF	611.4	33.5	577.9	16.6	3.65	16.42	2.65	25.77	7.07	9.35	34.7	7.69	0.46	11.09	2390.40	3711.32	1017.64	1106.99	0.46	KIN-B010-S10	45.14	2.7	54	14	40
KIN-B011-S8	NC Foundation Clay	KIN-B011_d_CU Triaxial-NF	611.8	26.5	585.3	13.7	3.98	14.47	2.04	23.13	5.81	8.66	36.7	6.94	0.51	9.29	1972.80	3330.20	837.16	998.87	0.51	KIN-B011-S8	48.61	3.5	38	19	19

Quasi Steady State - Foundation Clay																						**Foundation Clay**					**Foundation Clay**
KIN-B003-S8	Foundation Clay	KIN-B003-S8-26.0	621.8	24.0	597.8	10.0	2.78	9.17	0.69	13.49	4.85	4.32	28.1	3.81	0.38	7.14	1440.00	1942.29	698.67	548.56	0.38			0.0	31	16	15
KIN-B004-S8	Foundation Clay	KIN-B004-S8-21.0	617.8	19.5	598.3	16.0	3.26	15.50	0.95	23.72	7.28	8.22	32.0	6.97	0.44	11.14	2304.00	3416.11	1047.89	1003.74	0.44	KIN-B004-S7	31.81	2.0			
KIN-B004-S8	Foundation Clay	KIN-B004-S8-21.0	617.8	20.0	597.8	32.0	3.50	29.13	2.47	45.31	12.95	16.18	33.7	13.46	0.42	20.14	4608.00	6525.12	1864.32	1937.68	0.42	KIN-B004-S7	31.81	1.0			
KIN-B010-S6	Foundation Clay	KIN-B010-S6-20.5	611.4	19.0	592.4	15.0	2.52	13.86	0.77	19.85	7.88	5.99	25.6	5.40	0.36	11.28	2160.00	2857.68	1134.00	777.35	0.36			0.0			
KIN-B007-S9	Foundation Clay	KIN-B007-S9-27.0	616.8	25.0	591.8	10.0	3.00	12.00		18.00	6.00	6.00	30.0	5.20	0.52	9.00	1440.00	2592.00	864.00	748.25	0.52			0.0	-	-	-
KIN-B007-S9	Foundation Clay	KIN-B007-S9-27.0	616.8	25.5	591.3	20.0	2.82	21.00		31.01	10.99	10.01	28.5	8.80	0.44	16.23	2880.00	4464.75	1583.25	1266.72	0.44			0.0			
KIN-B007-S9	Foundation Clay	KIN-B007-S9-27.0	616.8	26.0	590.8	40.0	3.06	34.50		52.00	17.00	17.50	30.5	15.08	0.38	25.62	5760.00	7488.71	2447.29	2172.14	0.38			0.0			
Quasi Steady State - Lower Foundation Clay																						**Lower Foundation Clay**					**Lower Foundation Clay**
KIN-B011-S8	NC Foundation Clay	KIN-B011_d_CU Triaxial-NF	611.8	26.5	585.3	13.7	2.28	12.48	0.39	17.35	7.61	4.87	23.0	4.48	0.33	10.58	1972.80	2498.44	1095.80	645.71	0.33	KIN-B011-S8	48.61	3.5	38	19	19

Note: Foundation Clay & Lower Foundation Clay were combined into a single layer termed "Foundation Clay"

Project: Kincaid Ash Pond (Dynegy)
Project No.: 60480698

Notes:
1. Effective stress friction angle calculated using the fomula: $\phi' = \tan^{-1}(\tau_{ff}/\sigma'_v)$ ✓
2. Equivalent friction angle calculated using the fomula: $\psi = \tan^{-1}(\tau_{ff}/\sigma'_c)$ ✓

Direct Simple Shear Strength Characterization - Failure Criteria: See Individual Test

Sample	Material Description	Raw Test Number	Location: Ground Elevation (ft)	Location: Sample Depth (ft)	Location: Sample Elevation (ft)	Input Data from Lab Sheets: Effective Consolidation Stress σ'_c (psi)	Input Data from Lab Sheets: Vertical Effective Stress σ'_v (psi)	Input Data from Lab Sheets: Shear Stress on the Failure Plane at Failure τ_{ff} (psi)	Input Data from Lab Sheets: Strain(%)	Calculated Data: ϕ' [1] (degrees)	Calculated Data: τ_{ff}/σ'_c	Calculated Data: ψ [2] (degrees)	Calculated Data: Failure Criteria	Conversion to PSF: Effective Consolidation Stress σ'_c (psi)	Conversion to PSF: Vertical Effective Stress σ'_v (psi)	Conversion to PSF: τ_{ff} (psf)	Conversion to PSF: τ_{ff}/σ'_c	Stress History: Consolidation Test No.	Stress History: Max Past Pressure σ'_{max} (psi)	Stress History: Tested OCR [5]	Atterberg Limits: Liquid Limit LL	Atterberg Limits: Plastic Limit PL	Atterberg Limits: Plasticity Index PI
Foundation Clay																		**Foundation Clay**			**Foundation Clay**		
KIN-B002-S6	Foundation Clay	KIN-B002-S6-15.0	604.1	15.0	589.1	4.5	4.54	2.42	9.98	28.1	0.54	28.3	10% Strain	648.00	653.76	348.48	0.54	KIN-B002-S6	18.33	4.1	41	17	24
KIN-B002-S6	Foundation Clay	KIN-B002-S6-15.0	604.1	15.5	588.6	9.9	6.60	3.48	10.01	27.8	0.35	19.4	10% Strain	1425.60	950.40	501.12	0.35	KIN-B002-S6	18.33	1.9			
KIN-B002-S6	Foundation Clay	KIN-B002-S6-15.0	604.1	16.0	588.1	19.7	11.99	5.98	9.92	26.5	0.30	16.9	10% Strain	2836.80	1726.56	861.12	0.30	KIN-B002-S6	18.33	0.9			
KIN-B003-S7	Foundation Clay	KIN-B003-S7-22.0	621.8	22.0	599.8	10.0	6.26	4.18	10.01	33.7	0.42	22.7	10% Strain	1440.00	901.44	601.92	0.42	KIN-B003-S7	43.19	4.3	47	20	27
KIN-B003-S7	Foundation Clay	KIN-B003-S7-22.0	621.8	22.5	599.3	19.8	8.72	5.92	9.91	34.2	0.30	16.6	10% Strain	2851.20	1255.68	852.48	0.30	KIN-B003-S7	43.19	2.2			
KIN-B003-S7	Foundation Clay	KIN-B003-S7-22.0	621.8	23.0	598.8	39.8	14.23	9.30	10.04	33.2	0.23	13.2	10% Strain	5731.20	2049.12	1339.20	0.23	KIN-B003-S7	43.19	1.1			
Lower Foundation Clay																		**Lower Foundation Clay**			**Lower Foundation Clay**		
KIN-B010-S10	NC Foundation Clay	KIN-B010_e_NF	611.4	33.1	578.3	16.8	9.34	5.50	9.82	30.5	0.33	18.1	10% Strain	2419.20	1344.96	792.00	0.33	KIN-B010-S10	45.14	2.7	54	14	40
KIN-B011-S8	NC Foundation Clay	KIN-B011_e_NF	611.8	26.1	585.7	13.4	9.25	5.69	10.11	31.6	0.42	23.0	10% Strain	1929.60	1332.00	819.36	0.42	KIN-B011-S8	48.61	3.6	38	19	19
Post-Cyclic - Foundation Clay																		**Foundation Clay**			**Foundation Clay**		
KIN-B010-S10	Foundation Clay	KIN-B010_c_Post Cyclic_NF	611.4	33.8	577.6	16.7	10.38	6.33	10.03	31.4	0.38	20.8	10% Strain	2400.48	1494.72	911.52	0.38	KIN-B010-S10	45.14	2.7	54	14	40
KIN-B011-S8	Foundation Clay	KIN-B011_c_Post Cyclic_NF	611.8	26.8	585.0	13.2	5.53	3.71	9.92	33.9	0.28	15.7	10% Strain	1900.80	796.32	534.24	0.28	KIN-B011-S8	48.61	3.7	38	19	19
Quasi Steady State - Foundation Clay																		**Foundation Clay**			**Foundation Clay**		
KIN-B002-S6	Foundation Clay	KIN-B002-S6-15.0	604.1	15.0	589.1	4.5	4.04	1.88	4.81	25.0	0.42	22.7	10% Strain	648.00	581.76	270.72	0.42	KIN-B002-S6	18.33	4.1	41	17	24
KIN-B003-S7	Foundation Clay	KIN-B003-S7-22.0	621.8	22.0	599.8	10.0	5.84	3.64	4.75	31.9	0.36	20.0	10% Strain	1440.00	840.96	524.16	0.36	KIN-B003-S7	43.19	4.3	47	20	27
KIN-B003-S7	Foundation Clay	KIN-B003-S7-22.0	621.8	22.5	599.3	19.8	8.66	5.85	8.89	34.0	0.30	16.5	10% Strain	2851.20	1247.04	842.40	0.30	KIN-B003-S7	43.19	2.2			
Quasi Steady State - Lower Foundation Clay																		**Lower Foundation Clay**			**Lower Foundation Clay**		
KIN-B010-S10	NC Foundation Clay	KIN-B010_e_NF	611.4	33.1	578.3	16.8	9.29	5.40	8.56	30.2	0.32	17.8	10% Strain	2419.20	1337.76	777.60	0.32	KIN-B010-S10	45.14	2.7	54	14	40
KIN-B011-S8	NC Foundation Clay	KIN-B011_e_NF	611.8	26.1	585.7	13.4	8.38	4.42	4.89	27.8	0.33	18.3	10% Strain	1929.60	1206.72	636.48	0.33	KIN-B011-S8	48.61	3.6	38	19	19

Note: Foundation Clay + Lower Foundation Clay were combined into a single layer termed "Foundation Clay"

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test Grade NOTE*	USCS Symbol
KIN-B001	S1	1.0	2.5	11.8														
	Color		Brown and gray							Visual Classification			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S2	3.5	5.0															
	Color		NO RECOVERY							Visual Classification								
	S3	6.0	7.5	20.8		39	23	23	Note*									ML
	Color		Brown							Visual Classification			FILL: Silt with sand					
	S4	8.5	10.0															
	Color		NO RECOVERY							Visual Classification								
	S5	12.0	14.0															
	Color		No testing assigned							Visual Classification								
	S6	14.0	16.0															
	Color		POOR RECOVERY - no testing assigned							Visual Classification								
	S7	16.0	18.0															
	Color		No testing assigned							Visual Classification								
	S8	18.5	20.0	8.9		23	15	8	**sieve		2.750							CL-ML
	Color		Brown and gray							Visual Classification			Sandy silty clay, trace fine gravel					
	S9	23.5	25.0	8.9														
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S10	28.5	30.0	10.8														
	Color		Gray							Visual Classification			Sandy lean clay					

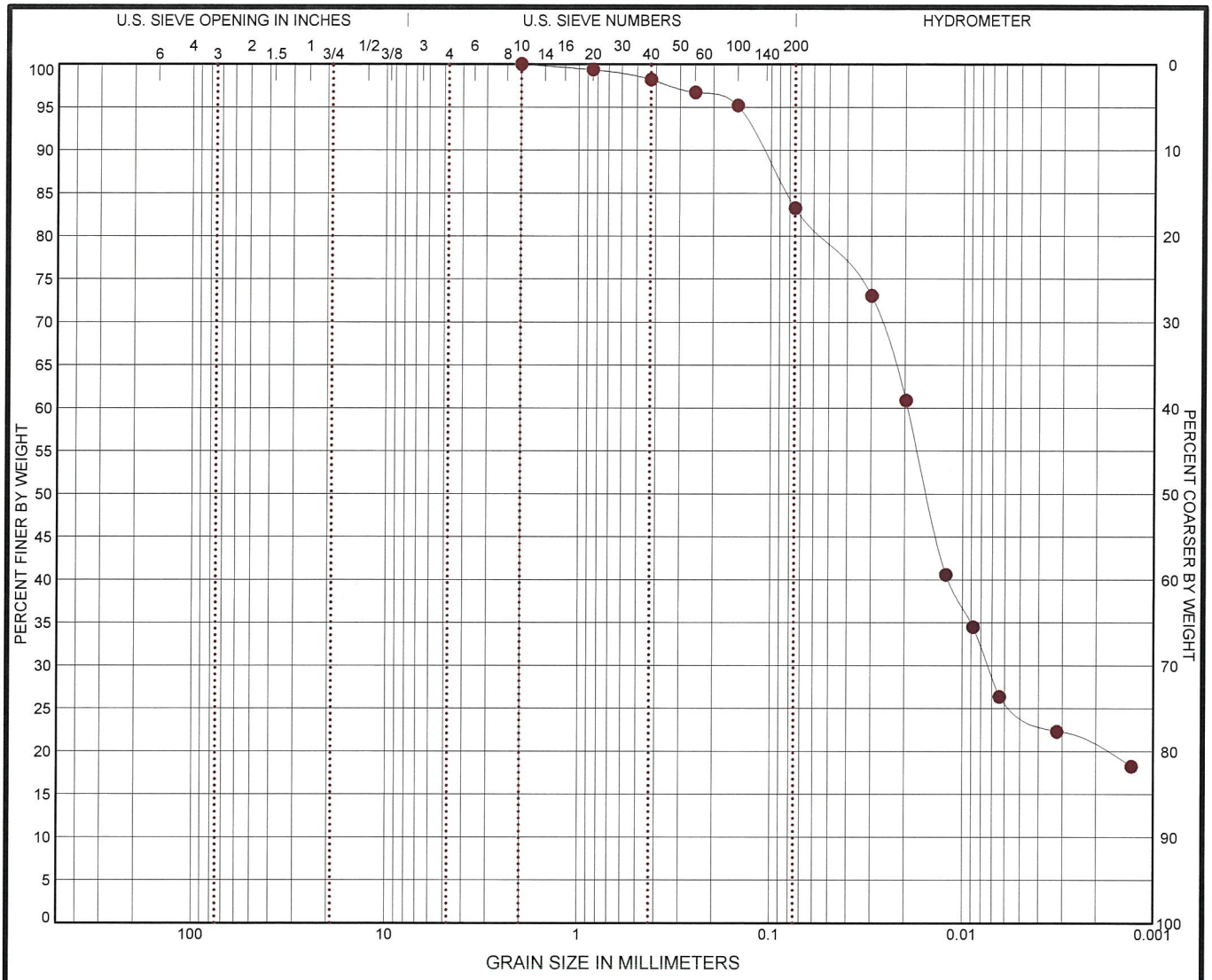
TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B001**	**6**	**0.0**	**0.0**	**16.8**	**58.3**		**24.9**	**ML**

	GRAIN SIZE
	●
D_{60}	**0.019**
D_{30}	**0.007**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	
#10	**100.0**
#20	**99.35**
#40	**98.2**
#60	**96.71**
#100	**95.18**
#200	**83.24**

SOIL DESCRIPTION

● SILT with SAND(ML)

REMARKS

●

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon

51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

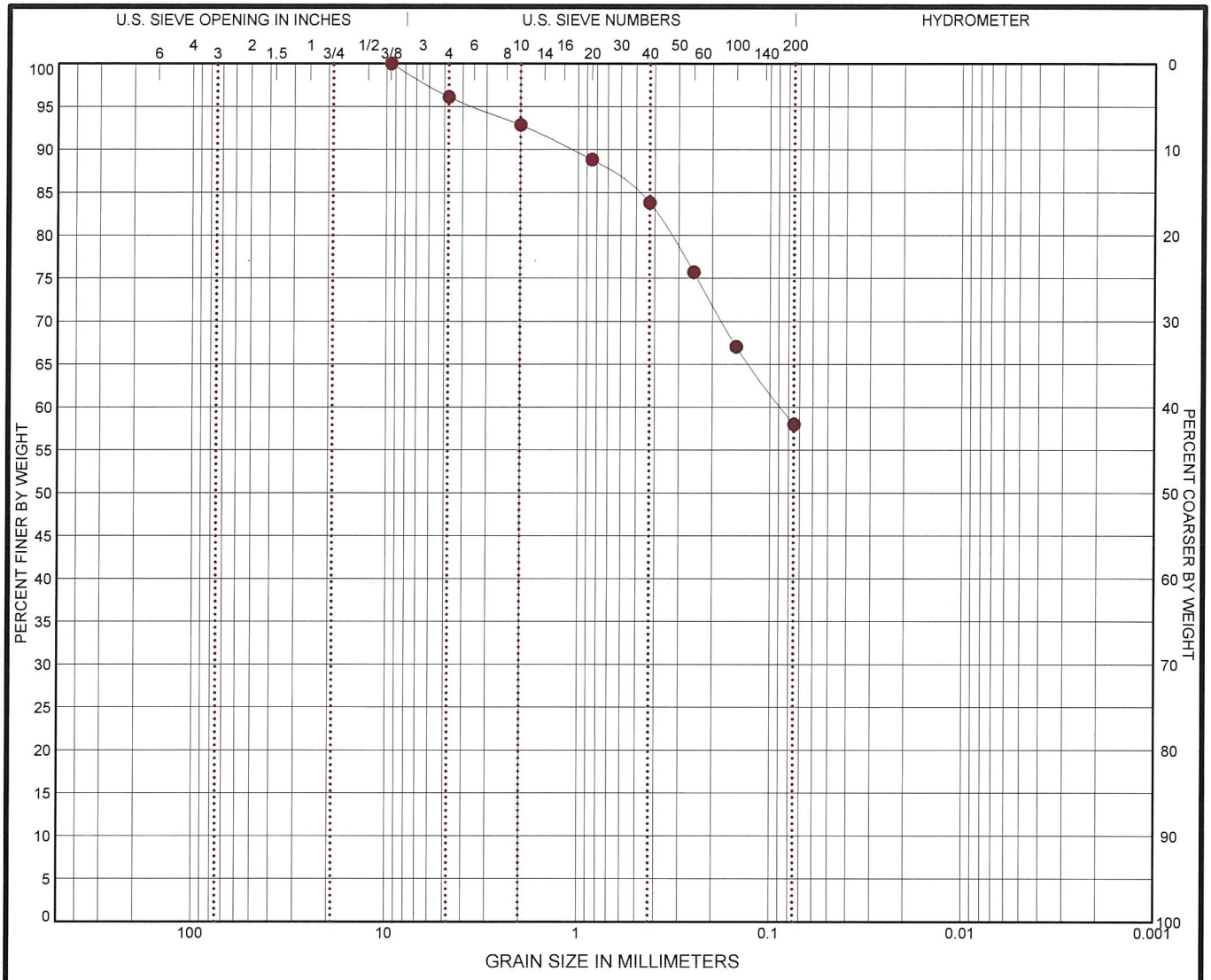
PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B001**	**18.5**	**0.0**	**3.9**	**38.1**		**58.0**		**CL-ML**

	GRAIN SIZE
	●
D_{60}	**0.088**
D_{30}	
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	**100.0**
#4	**96.1**
#10	**92.84**
#20	**88.82**
#40	**83.81**
#60	**75.69**
#100	**67.03**
#200	**57.97**

SOIL DESCRIPTION
● SANDY SILTY CLAY(CL-ML)

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/25/15

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-BOO2	S1	1.0	2.5	18.1														
	Color	Brown and gray								Visual Classification			FILL: Sandy lean clay, trace fine gravel					
	S2	3.0	5.0	19.0	109.8	38	17	21		Note*						Note*	Note*	
	Color	Brown and gray								Visual Classification			FILL: Lean clay, trace sand and gravel					
	S3	6.0	7.5	13.9														
	Color	Brown and gray								Visual Classification			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.5	28.4		48	22	26										
	Color	Dark gray (ORGANIC CONTENT = 5.9%)								Visual Classification			Lean clay					
	S5	13.5	15.0	26.2	NA													
	Color	Brown and gray								Visual Classification			Lean clay					
	S6	15.0	17.0	27.5	95.2	41	17	24		Note*			Note*		Note*	Note*	Note*	
	Color	Gray and yellowish brown, trace dark gray								Visual Classification			Lean clay, trace sand and gravel					
	S7	18.5	20.0	27.1														
	Color	Brown and gray								Visual Classification			Lean clay, trace fine sand					
	S8	23.5	25.0	12.6	135.9	22	14	8										
	Color	Brown								Visual Classification			Sandy lean clay, trace fine gravel					
	S9	28.5	30.0	8.4					** Sieve									
	Color	Gray								Visual Classification			Sandy lean clay					
	S10	33.5	35.0	8.9														
	Color	Gray								Visual Classification			Sandy lean clay, trace fine gravel					
	S11	38.5	40.0	8.8														
	Color	Gray								Visual Classification			Sandy lean clay, trace fine gravel					
	S12	43.5	45.0	11.9					** Sieve									
	Color	Brown and gray								Visual Classification			Sandy lean clay					

TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-BOO2	S13	48.5	50.0															
	Color		Brown and gray							Visual Classification			FILL: Sandy lean clay, trace fine gravel					

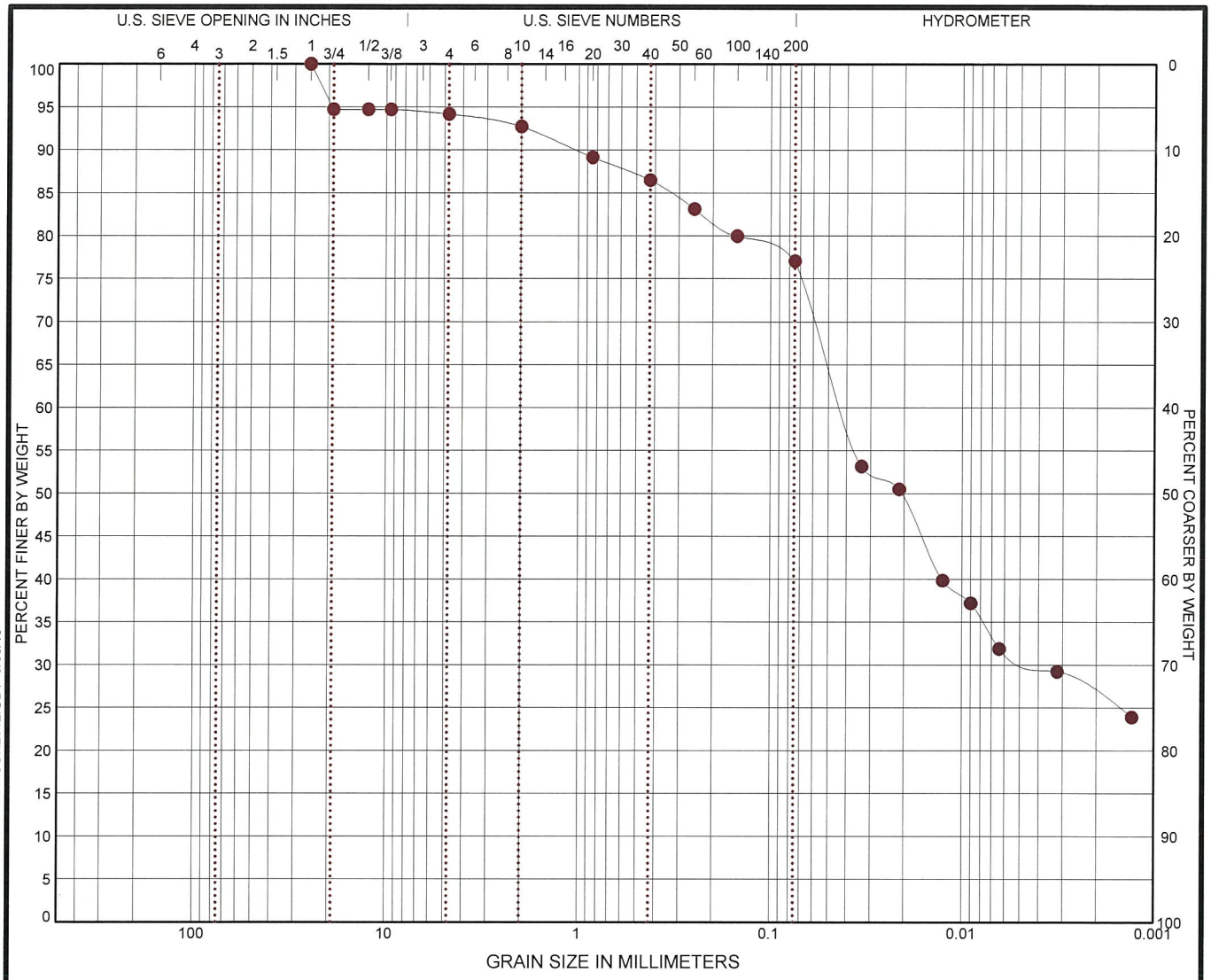
TESTED BY: _____
APPROVED BY: _____

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B002**	**3**	**0.0**	**5.8**	**17.1**	**46.1**		**30.9**	

	GRAIN SIZE
	●
D_{60}	**0.042**
D_{30}	**0.004**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	**100.0**
3/4"	**94.7**
1/2"	**94.7**
3/8"	**94.7**
#4	**94.17**
#10	**92.71**
#20	**89.14**
#40	**86.49**
#60	**83.12**
#100	**79.97**
#200	**77.06**

SOIL DESCRIPTION
●

REMARKS
● Dispersion: 7.3%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

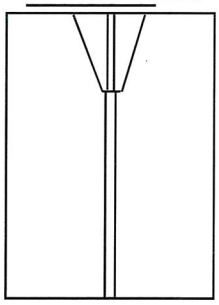
CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B002, S2, 3.0-5.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 21.1%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Grayish Brown Clay

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	7.0	15	0.47						X	X	
2	2	8.0	15	0.53						X	X	
3	2	8.0	15	0.53						X	X	
4	2	8.0	15	0.53						X	X	
5	2	8.5	15	0.57						X	X	
6	2	8.5	15	0.57						X	X	
7	2	9.0	15	0.60						X	X	
8	2	9.0	15	0.60						X	X	
9	2	9.0	15	0.60						X	X	
10	2	9.0	15	0.60						X	X	
1	7	15.0	15	1.00						X	X	
2	7	15.5	15	1.03						X	X	
3	7	16.0	15	1.07						X	X	
4	7	16.0	15	1.07						X	X	
5	7	16.5	15	1.10						X	X	
1	15	20.0	15	1.33						X	X	
2	15	21.0	15	1.40						X	X	
3	15	21.0	15	1.40						X	X	
4	15	21.0	15	1.40						X	X	
5	15	21.0	15	1.40						X	X	
1	40	62.0	30	2.07						X	X	
2	40	60.0	30	2.00						X	X	
3	40	61.0	30	2.03						X	X	
4	40	61.0	30	2.03						X	X	
5	40	61.0	30	2.03						X	X	

CLASSIFICATION = **ND1**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B002	S2	3.0-5.0 feet

2 MIN

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

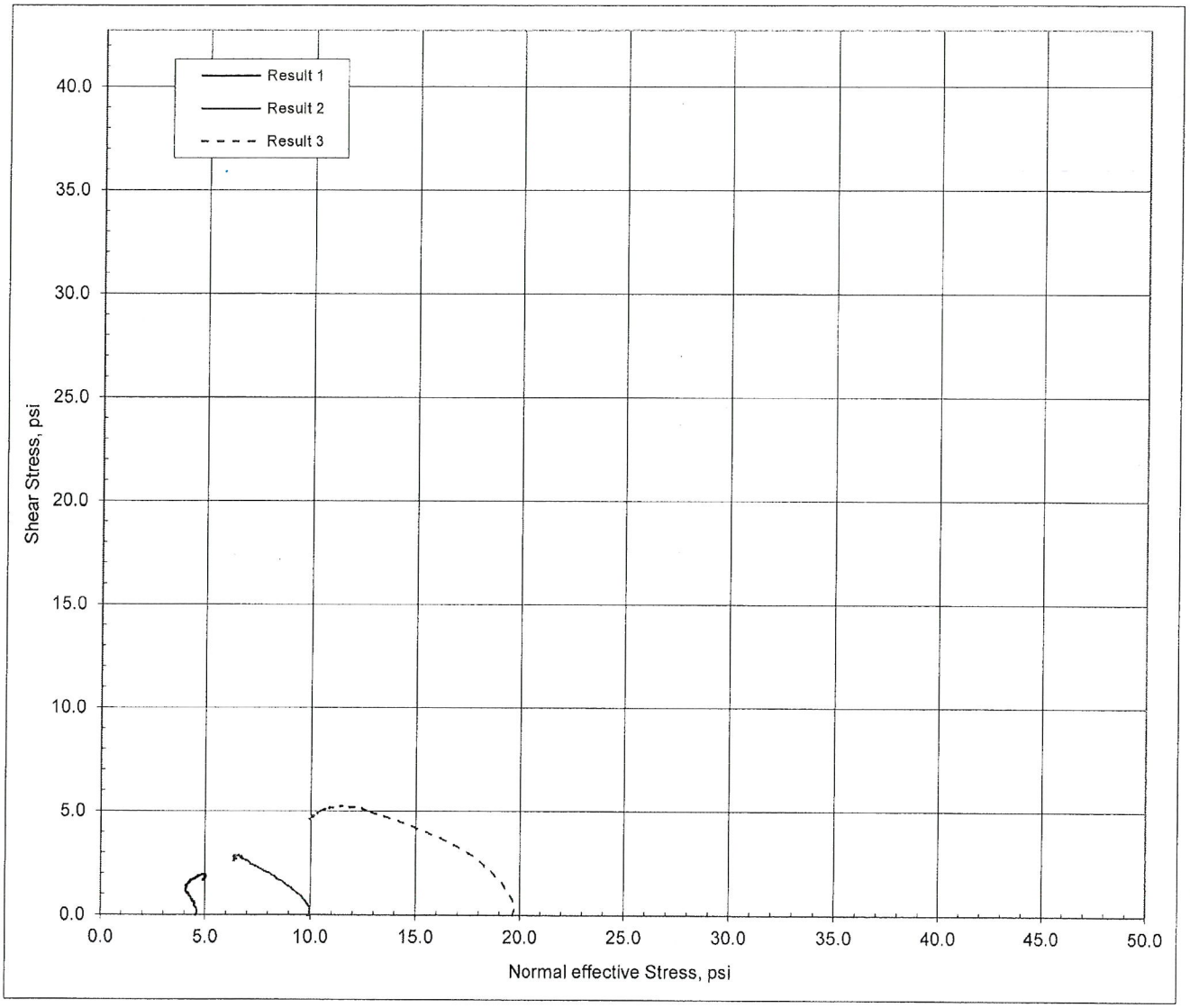
GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Highly Dispersive

Terracon

CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TESTING OF COHESIVE SOILS
ASTM D6528



	RESULT 1	RESULT 2	RESULT 3		RESULT 1	RESULT 2	RESULT 3
INITIAL DATA				NORMAL EFF. STRESS, psi	4.5	9.9	19.7
AREA, inch2	5.383	5.387	5.383	PRESHEAR MOISTURE, %	27.1	28.3	26.7
HEIGHT, inch	0.704	0.703	0.704	PRESHEAR VOID RATIO	0.69	0.70	0.64
MOISTURE, %	27.5	27.6	27.4	FINAL MOISTURE, %	27.1	28.3	26.8
DRY DENSITY, pcf	95.8	95.1	94.7	FINAL VOID RATIO	0.71	0.72	0.68
SATURATION, %	98	96	95	SHEAR STRAIN RATE, %/min	0.088	0.089	0.092
VOID RATIO	0.76	0.77	0.78	t95 @ MAX STESS, min	1.22	2.09	2.09
LIQUID LIMIT	41		PLASTIC LIMIT	17	PLASTICITY INDEX		24
SAMPLE TYPE	UNDISTURBED			SPECIFIC GRAVITY	2.7 ESTIMATED		
SAMPLE DESCRIPTION	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY						

PROJECT NAME: DYNEGY

LOCATION: KINCAID, ILLINOIS

JOB NO.: 15151122

DATE: 9/24/2015

BORING NO. KIN-B002

SAMPLE NO. S6

DEPTH, feet 15.0 - 17.0

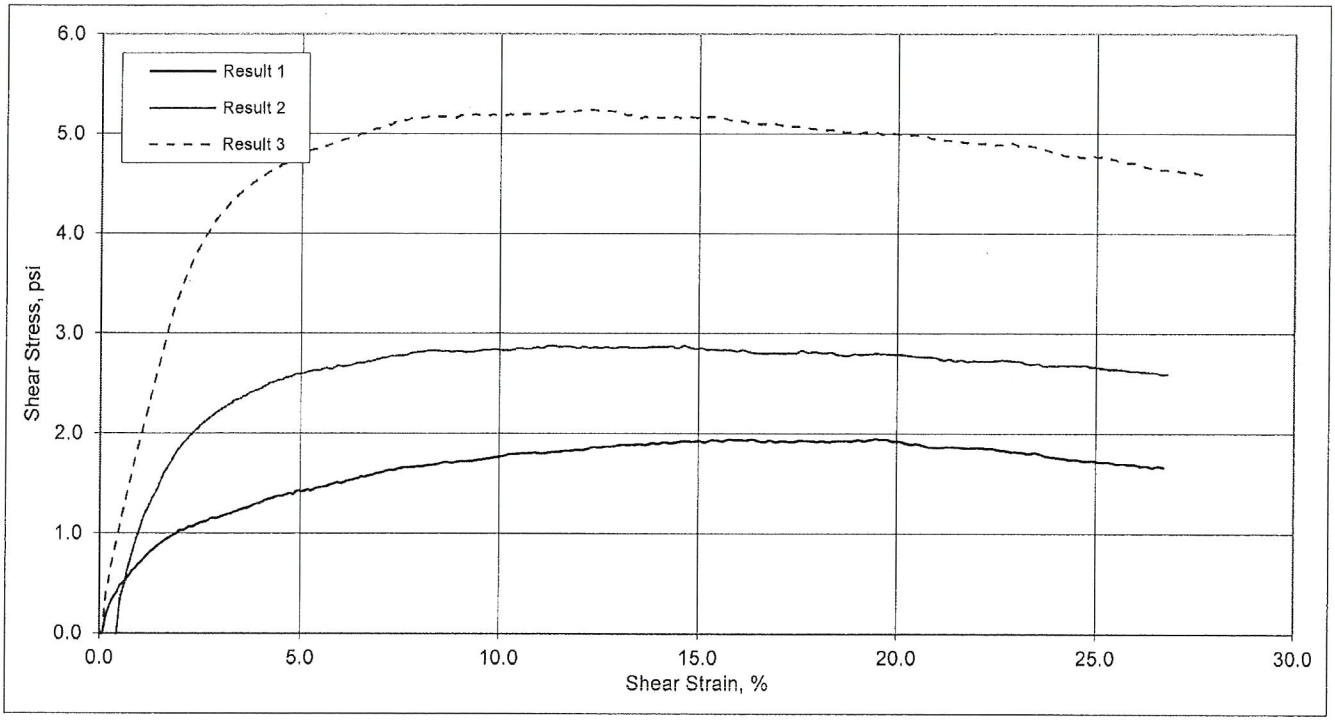
N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 DirectSimpleShear KIN-B00

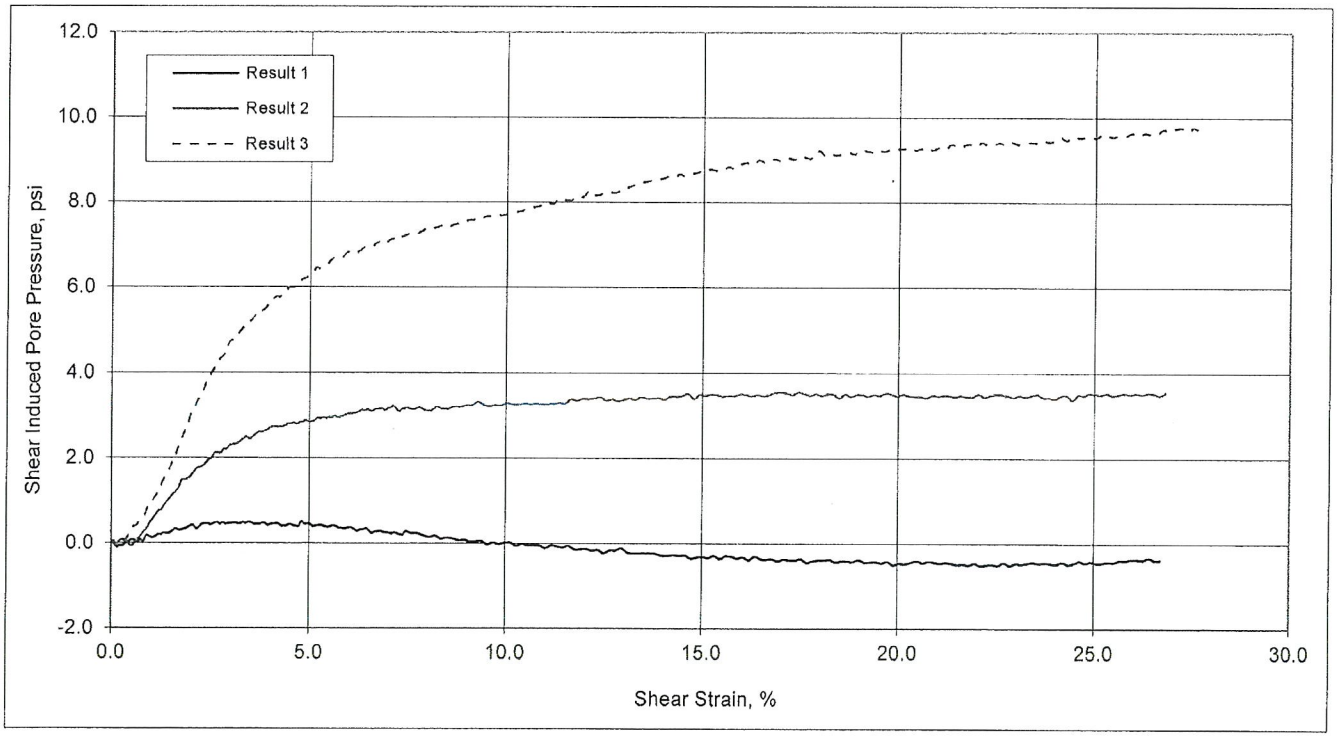
Terracon

Foundation Crust

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B002
SAMPLE NO.	S6
DEPTH, feet	15.0 - 17.0

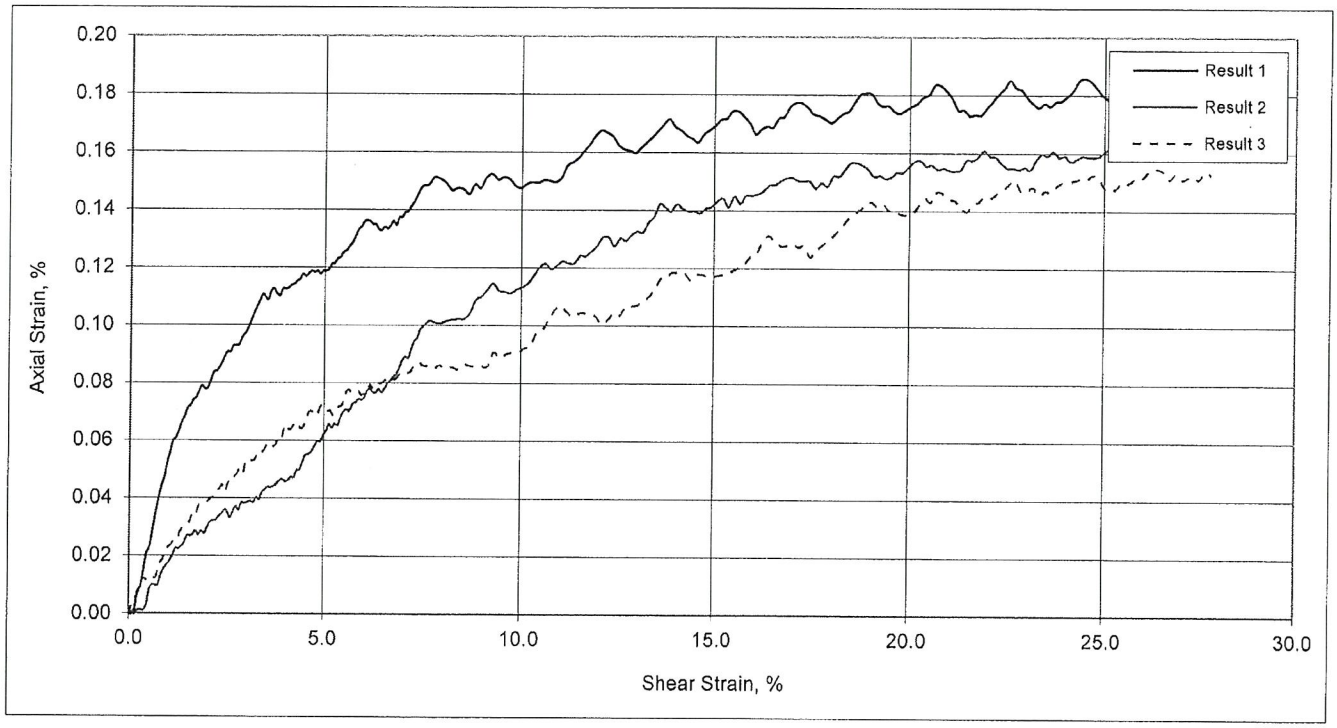


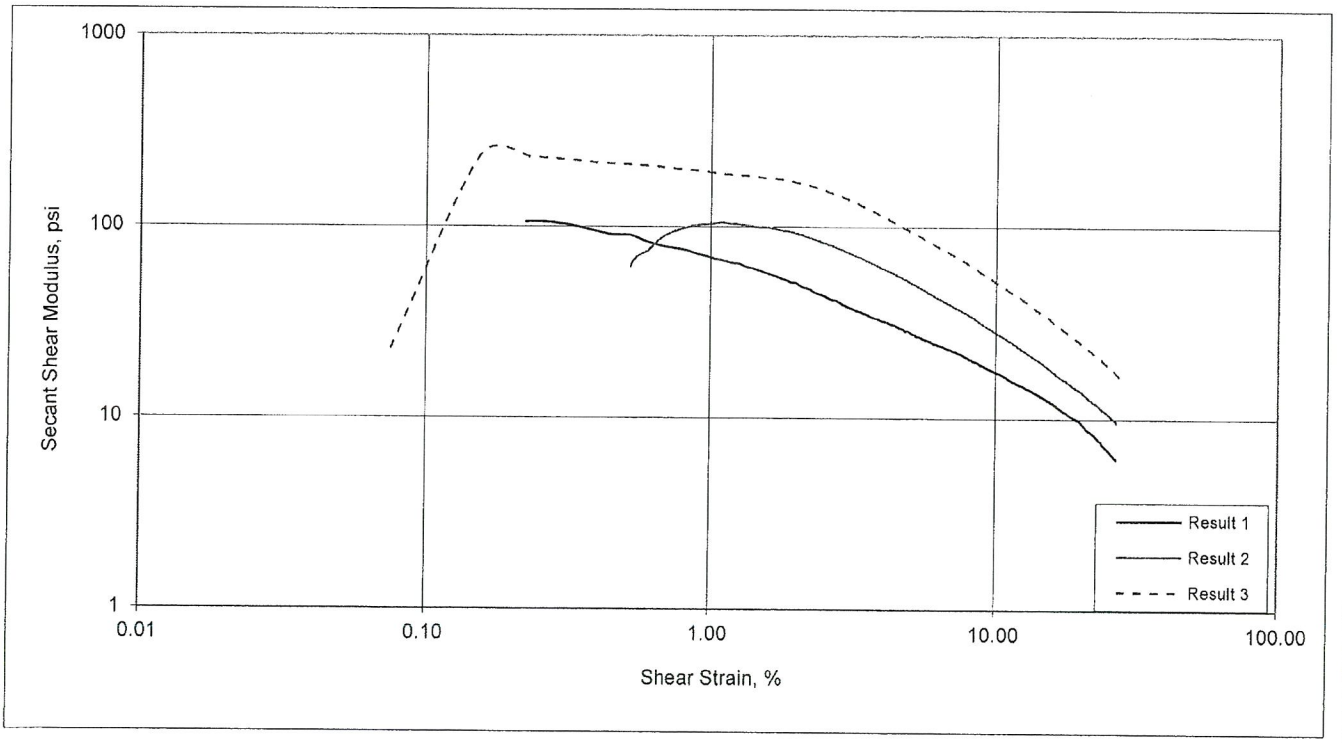


Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B002
SAMPLE NO.	S6
DEPTH, feet	15.0 - 17.0

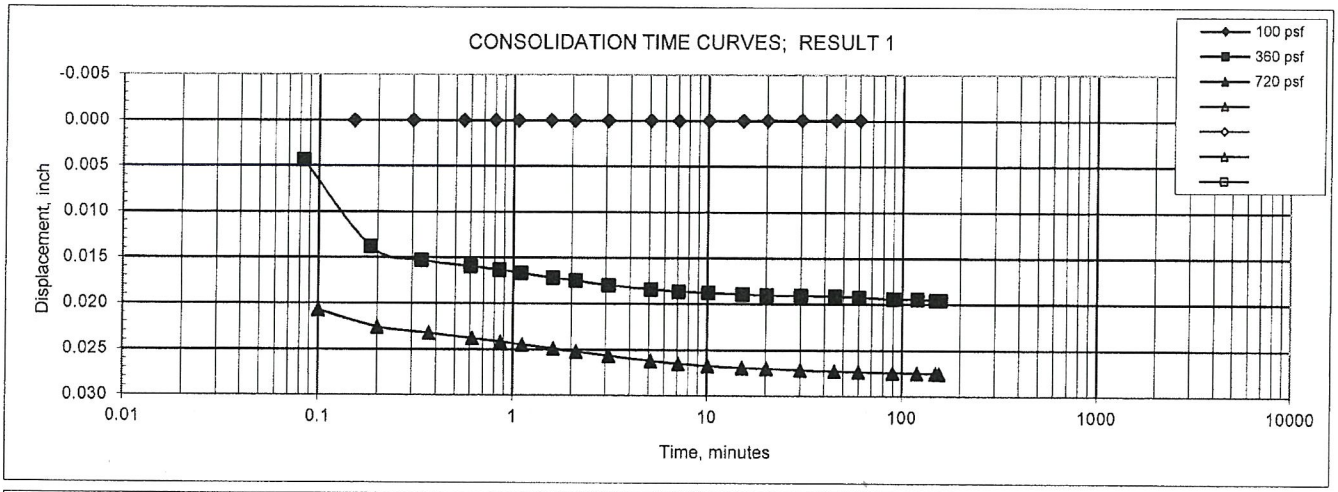


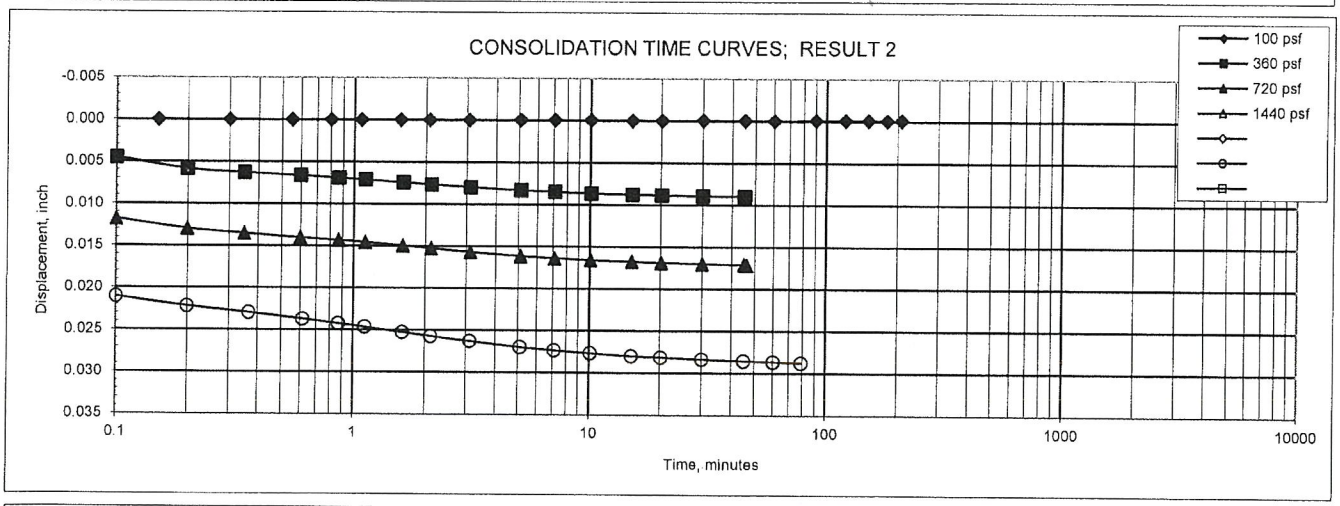


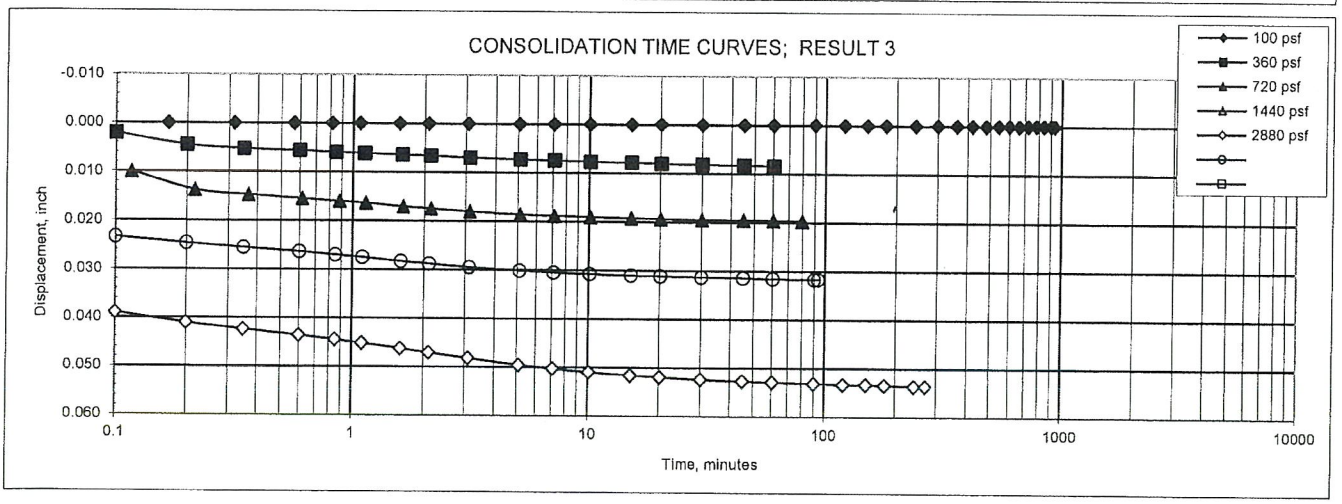
Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

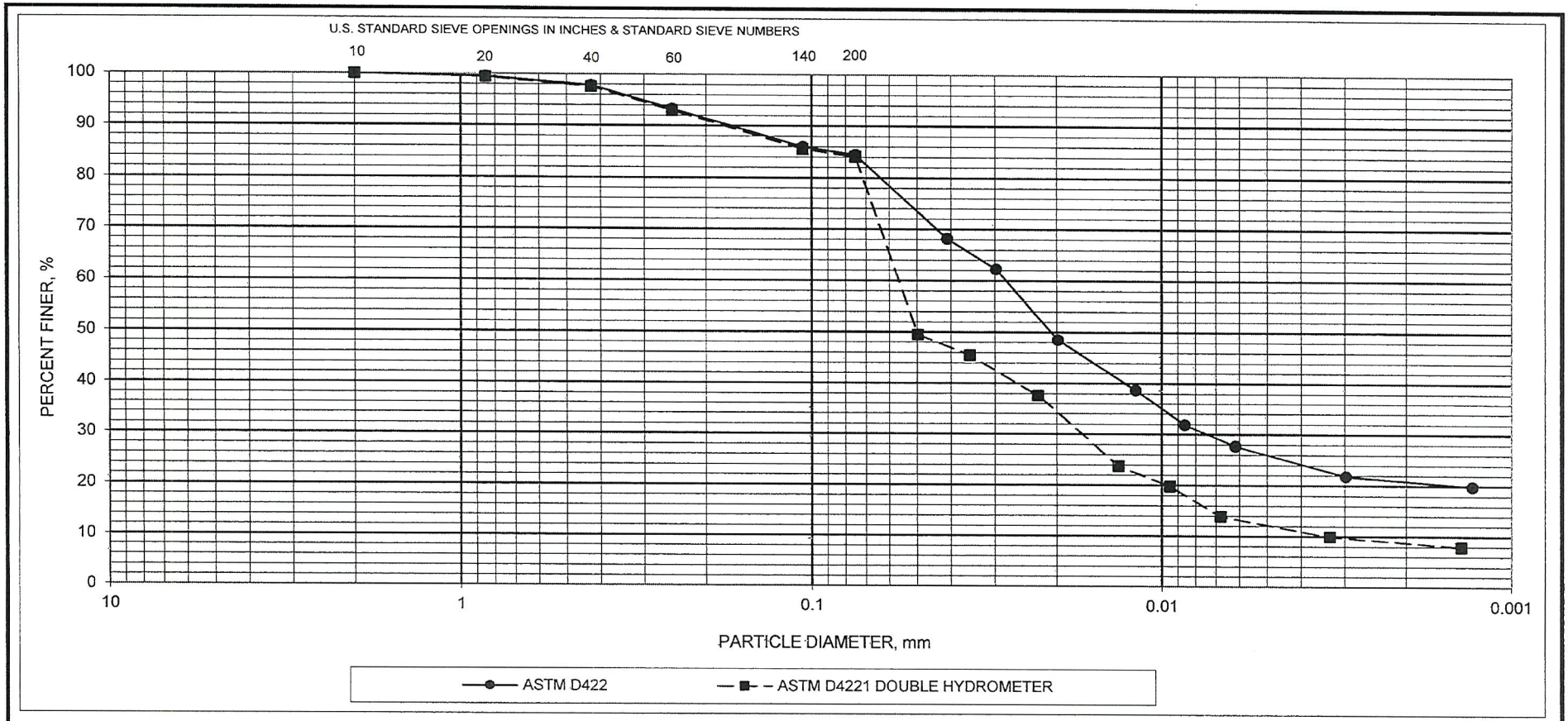
BORING NO.	KIN-B002
SAMPLE NO.	S6
DEPTH, feet	15.0 - 17.0







Terracon



GRAIN SIZE DISTRIBUTION CURVE

ASTM D422, % 0.005 mm	26.0	ASTM D4221 DOUBLE HYDROMETER, % 0.005 mm	12.2	DISPERSION, %	47

BORING NO.	SAMPLE NO.	DEPTH, feet	ASTM DESCRIPTION	UNIFIED SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KIN-B002	S6	15.0 - 17.0	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY			41	17	24

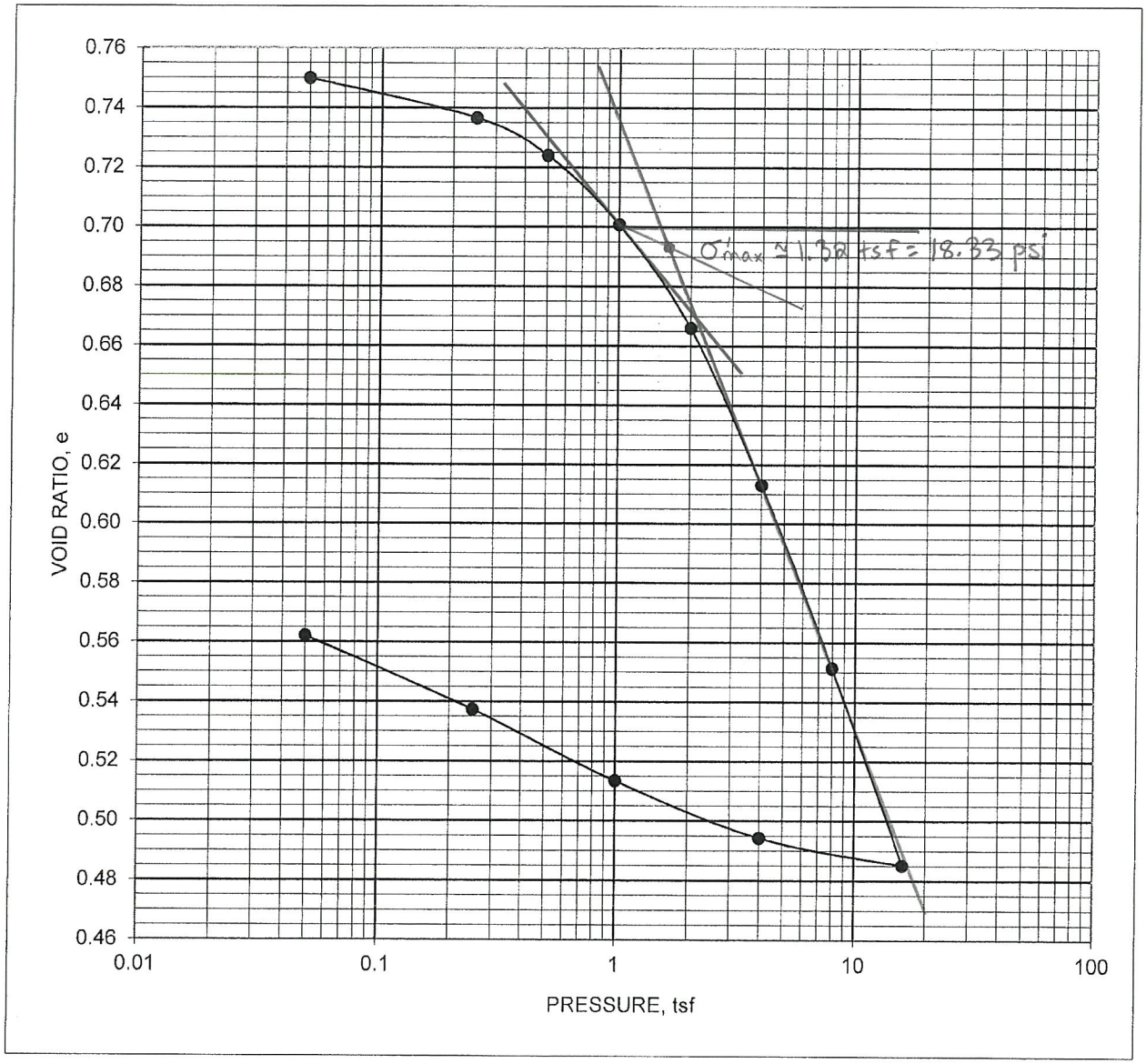
PROJECT DYNEGY

KINCAID, ILLINOIS JOB NO. 15151122 DATE 10/2/2015

N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 HydrometerDoublePlot KINB002-S6-15.0.xls]Hydrometer Data

Terracon

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.53	HEIGHT, mm	25.30	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		0.98		MOISTURE, %		27.2	21.3
PRECONSOL. PRESSURE, tsf		1.32		DRY DENSITY, pcf		96.3	106.9
OVER CONSOLIDATION RATIO		1.3		SATURATION, %		98	101
COMPRESSION INDEX		0.22		VOID RATIO		0.750	0.562
REBOUND INDEX		0.037		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	41	PLASTIC LIMIT	17	PLASTICITY INDEX	24	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY						
BORING NO.	KIN-B002	SAMPLE NO.	S6	DEPTH, feet	15.0 - 17.0		

DYNEGY
KINCAID, ILLINOIS
15151122
10/5/2015

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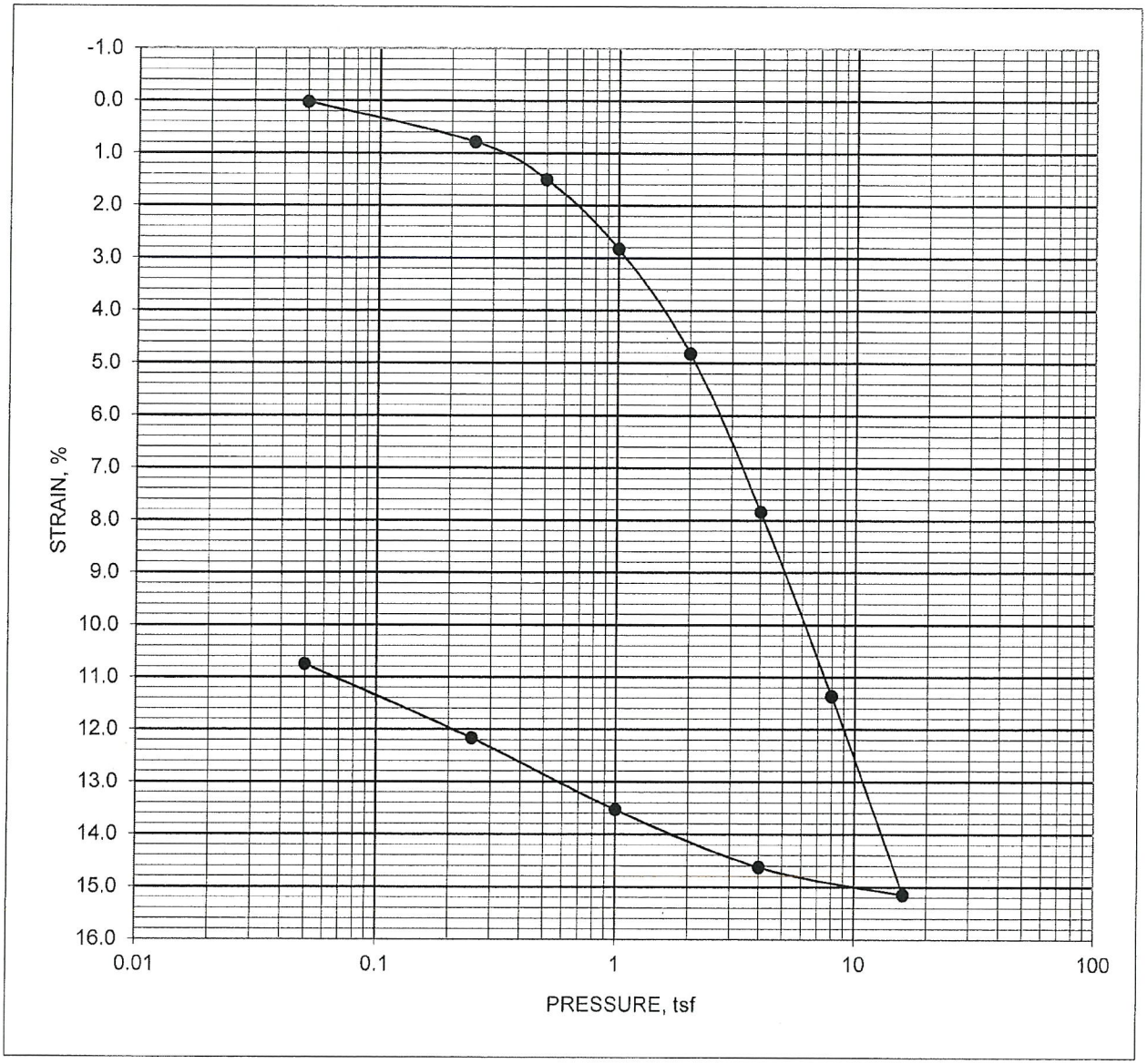
Terracon

Foundation Crust

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.53	HEIGHT, mm	25.30	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		0.98		MOISTURE, %		27.2	21.3
PRECONSOL. PRESSURE, tsf		1.32		DRY DENSITY, pcf		96.3	106.9
OVER CONSOLIDATION RATIO		1.3		SATURATION, %		98	101
COMPRESSION INDEX		0.22		VOID RATIO		0.750	0.562
REBOUND INDEX		0.037		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	41	PLASTIC LIMIT	17	PLASTICITY INDEX	24	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY TRACE SAND & GRAVEL, GRAY & YELLOWISH BROWN TRACE DARK GRAY						
BORING NO.	KIN-B002	SAMPLE NO.	S6	DEPTH, feet	15.0 - 17.0		

DYNEGY
KINCAID, ILLINOIS
15151122
10/5/2015

N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\[15151122 Consolidation KIN-B002-S6-15.0.]

Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
10/5/2015

ADDITIONAL CONSOLIDATION DATA

KIN-B002
S6
15.0 - 17.0

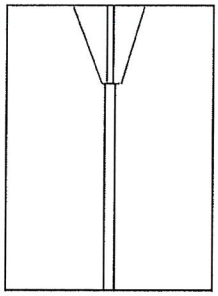
PRESSURE, tsf	Cv50, cm2/sec	Cv90, cm2/sec	Av, cm2/g	Mv, cm2/g	k, cm/sec
0					
0.05			7.18E-06	4.10E-06	
0.25	6.43E-04	6.47E-04	6.82E-05	3.90E-05	2.51E-08
0.5	9.16E-04	9.22E-04	5.17E-05	2.98E-05	2.73E-08
1	6.88E-04	6.92E-04	4.74E-05	2.75E-05	1.89E-08
2	3.46E-04	3.48E-04	3.55E-05	2.09E-05	7.24E-09
4	2.00E-04	2.01E-04	2.70E-05	1.62E-05	3.24E-09
8	1.78E-04	1.79E-04	1.58E-05	9.77E-06	1.74E-09
16	1.64E-04	1.65E-04	8.46E-06	5.45E-06	8.92E-10
AVERAGE	4.48E-04	4.51E-04	3.27E-05	1.91E-05	1.21E-08

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A
10/2/2015

PROJECT DYNEGY COFFEEN & KINCAID POWER STATIONS
JOB NO. 15151122
SAMPLE ID KIN B002; S6; 15.0 - 17.0
COMPACTION CHARACTERISTICS UNDISTURBED
WATER CONTENT 25.8%
DISTILLED WATER ADDED _____ **YES** X **NO**
CURE TIME NATURAL
BY JOHN MARTIN
SAMPLE DESC. LEAN CLAY, DARK GRAY

FLOW STARTED ON 2nd

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	12.8	60	0.21						X	X	
2	2	12.0	60	0.20						X	X	
3	2	12.5	60	0.21						X	X	
4	2	12.5	60	0.21						X	X	
5	2	12.5	60	0.21						X	X	
6	2	12.5	60	0.21						X	X	
7	2	12.5	60	0.21						X	X	
8	2	12.5	60	0.21						X	X	
9	2	12.5	60	0.21						X	X	
10	2	12.5	60	0.21						X	X	
1	7	33.0	60	0.55						X	X	
2	7	33.0	60	0.55						X	X	
3	7	33.0	60	0.55						X	X	
4	7	33.0	60	0.55						X	X	
5	7	33.0	60	0.55						X	X	
1	15	56.0	60	0.93						X		BARELY VISIBLE
2	15	56.0	60	0.93						X		BARELY VISIBLE
3	15	55.5	60	0.93						X		BARELY VISIBLE
4	15	56.5	60	0.94						X	X	
5	15	56.0	60	0.93						X		BARELY VISIBLE
1	40	120.0	60	2.00					X			SLIGHT DARK
2	40	125.0	60	2.08						X		BARELY VISIBLE
3	40	126.0	60	2.10						X		BARELY VISIBLE
4	40	130.0	60	2.17						X		BARELY VISIBLE
5	40	136.0	60	2.27						X		BARELY VISIBLE

CLASSIFICATION = ND1

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

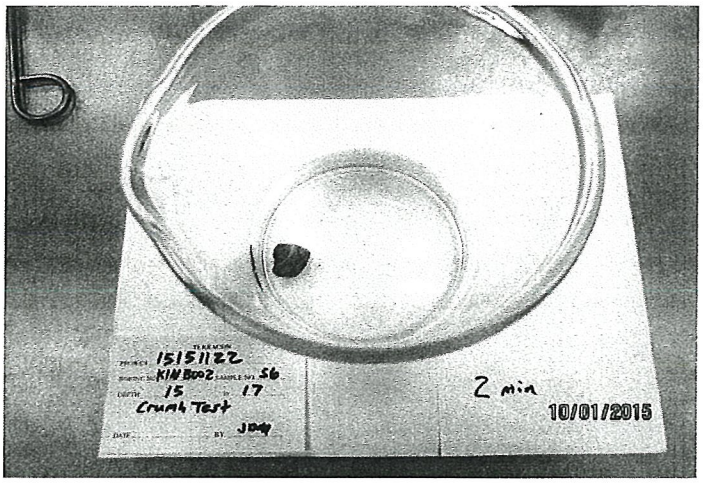
15151122

KIN-B002 S6 15.0 - 17.0 feet

2 MIN

GRADE: 1

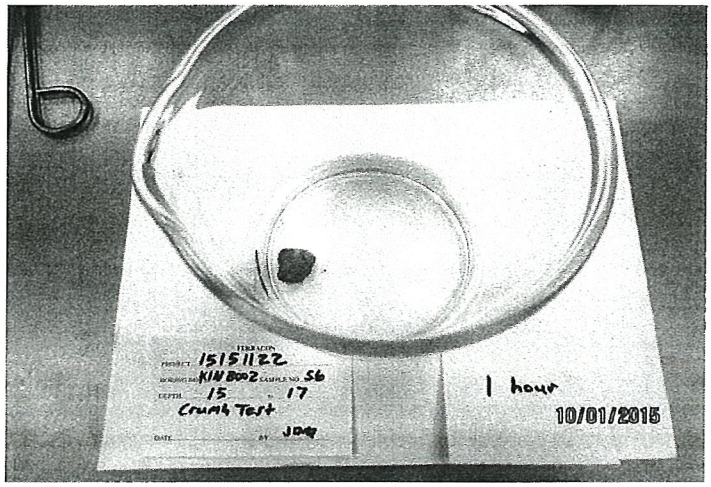
DISPERSIVE CALSSIFICATION: NONDISPERSIVE



1 HOUR

GRADE: 1

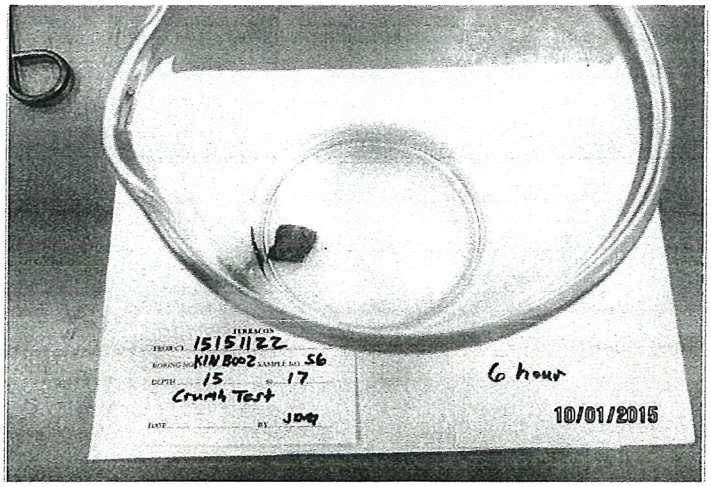
DISPERSIVE CALSSIFICATION: NONDISPERSIVE



6 HOUR

GRADE: 1

DISPERSIVE CALSSIFICATION: NONDISPERSIVE



Grade 1 - Nondispersive

Grade 2 - Intermediate

Grade 3 - Dispersive

Grade 4 - Highly Dispersive

Terracon

CRUMB TEST (ASTM D6572)

Project No.: 15151122 Project Name: Dynegy Location:

Boring No.: KIN B002 Sample No.: S6 Depth: 15-17 [X] ft [ ] m

Visual Classification: LNCL Color: Dark Gray

Moisture Content of Sample:	[X] as-received	[ ] in situ	[ ] air-dried

Tare Number	Wet Mass + Tare (g)	Dry Mass+ Tare (g)	Tare Mass (g)	Water Content (%)
1013	89.81	76.85	28.40	26.7

Specimen Identification:	KIN B002 ; S6 15-17	Specimen Identification:	Specimen Identification:
Spec. Container Identification:	5	Spec. Container Identification:	Spec. Container Identification:
Method: [X] A (Natural) [ ] B (Remolded)		Method: [ ] A (Natural) [ ] B (Remolded)	Method: [ ] A (Natural) [ ] B (Remolded)
Water Type: [X] Distilled [ ] Type IV		Water Type: [ ] Distilled [ ] Type IV	Water Type: [ ] Distilled [ ] Type IV
Initial Water Temp. (°C): 20.4		Initial Water Temp. (°C):	Initial Water Temp. (°C):
Start Time (hh:mm:ss): 7:11:00		Start Time (hh:mm:ss):	Start Time (hh:mm:ss):

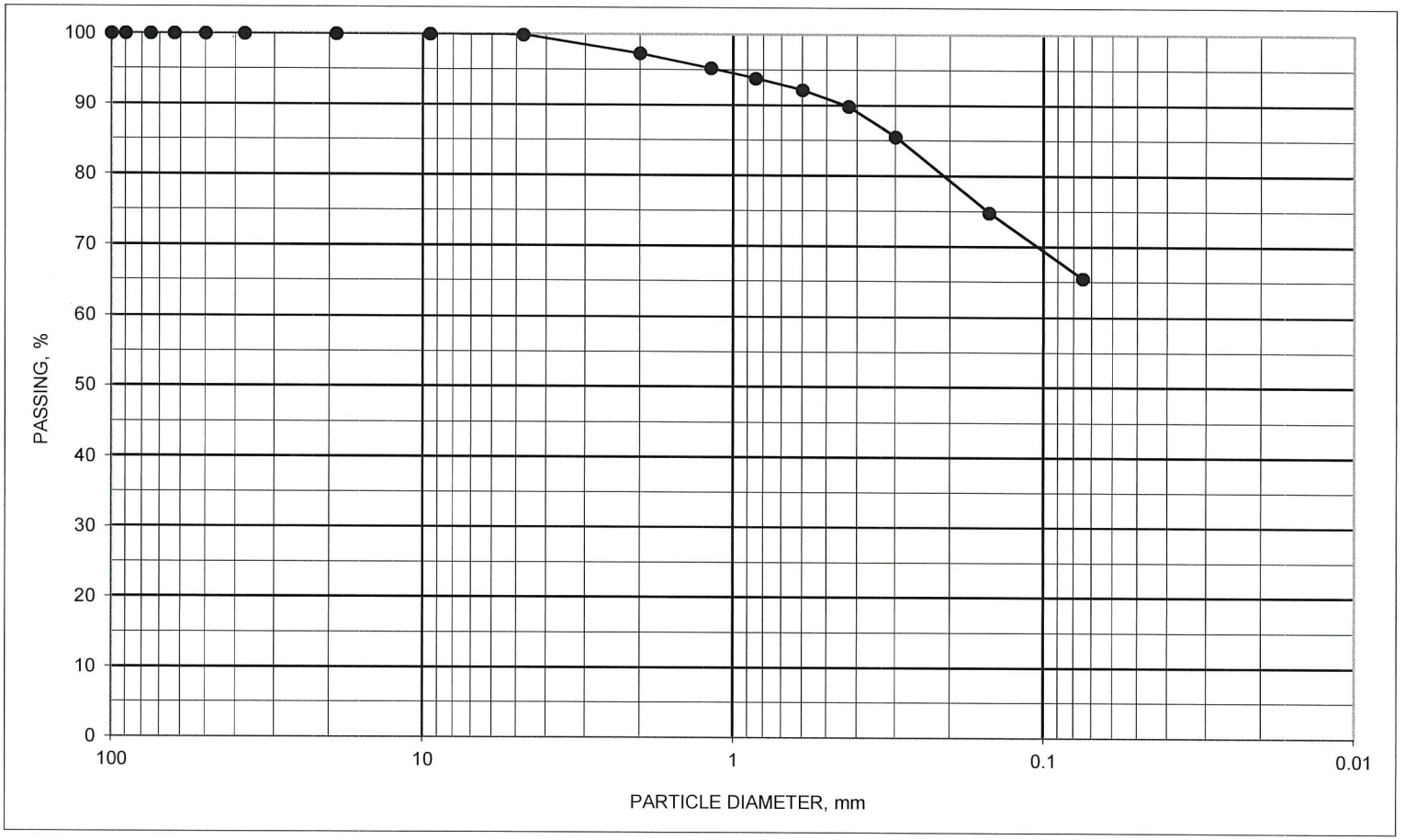
Target Reading	Time Taken	Grade	Temp. (°C)	Target Reading	Time Taken	Grade	Temp. (°C)	Target Reading	Time Taken	Grade	Temp. (°C)
2 min ± 15 s	7:13:00	1	20.0	2 min ± 15 s				2 min ± 15 s			
1 h ± 8 min	8:11:10	1	19.7	1 h ± 8 min				1 h ± 8 min			
6 h ± 45 min	1:15:50	1	20.2	6 h ± 45 min				6 h ± 45 min			

Dispersive Classification:	Nondispersive	Dispersive Classification:	Dispersive Classification:
Additional water added to remold the specimen (Method B): [ ] Y [ ] N		Additional water added to remold the specimen (Method B): [ ] Y [ ] N	Additional water added to remold the specimen (Method B): [ ] Y [ ] N

Remarks:

Prepared By: _____ Date: _____ Tested By: _____ Date: _____ Input By: _____ Date: _____ Reviewed By: _____ Date: _____

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	97
#16	1.18	95
#20	0.85	94
#30	0.600	92
#40	0.425	90
#50	0.300	86
#100	0.150	75
#200	0.075	65.5



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB002	S-9	28.5 TO 30	Sandy lean clay Gray	#VALUE!				

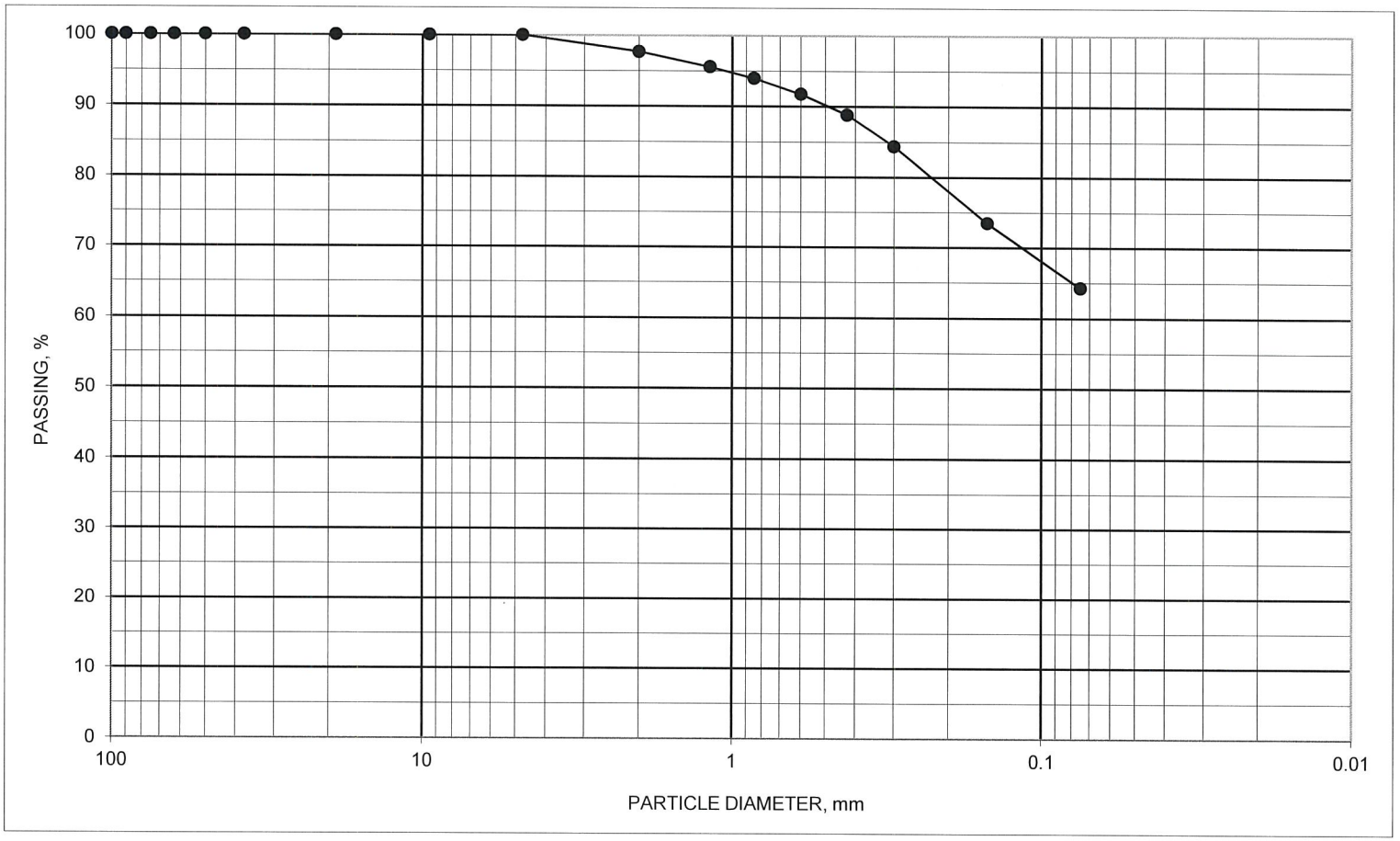
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B002 S-9.xlsx]REPORT

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	98
#16	1.18	96
#20	0.85	94
#30	0.600	92
#40	0.425	89
#50	0.300	84
#100	0.150	73
#200	0.075	64.3



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB002	S-12	43.5 TO 45	Sandy lean clay Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/30/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B002 S-12.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B003	S1	1.0	2.5	11.6														
	Color		Brown and gray							Visual Classification			FILL: Lean clay with fine to coarse sand, trace fine gravel					
	S2	3.5	5.0	15.5														
	Color		Brown and gray							Visual Classification			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S3	6.0	7.5	16.4														
	Color		Brown and gray							Visual Classification			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S4	8.5	10.0	9.5														
	Color		Brown and gray							Visual Classification			FILL: Sandy lean clay clay, trace fine gravel					
	S5	13.5	15.5	18.0														
	Color		Brown and gray							Visual Classification			FILL: Lean clay, trace fine to medium sand					
	S6	18.5	20.0	23.9	116.4	54	20	34										
	Color		Brown and gray							Visual Classification			FILL: Fat clay, trace fine to medium sand					
	S7	22.0	24.0	21.4	103.5	47	20	27					Note*		Note*			
	Color		Dark grayish brown with gray and olive, trace yellowish brown							USCS Classification			FILL: Lean clay with sand					
	S8	24.0	26.0	18.4	109.7	31	16	15		Note*				Note*		Note*	Note*	CL
	Color		Grayish green							Visual Classification			Sandy lean clay, trace fine gravel					
	S9	28.5	30.0	29.7														
	Color		Brown and gray							Visual Classification			Lean to fat clay					
	S10	33.5	35.0	25.2	NA	36	19	17										
	Color		Brown and gray							Visual Classification			Lean clay, trace fine sand					
	S11	35.0	37.0		X	X	X	X				X			X			
	Color		Tube sent to Fugro							Visual Classification								
	S12	38.5	40.0	26.0		41	18	23										
	Color		Brown and gray							Visual Classification			Sandy lean clay					

TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

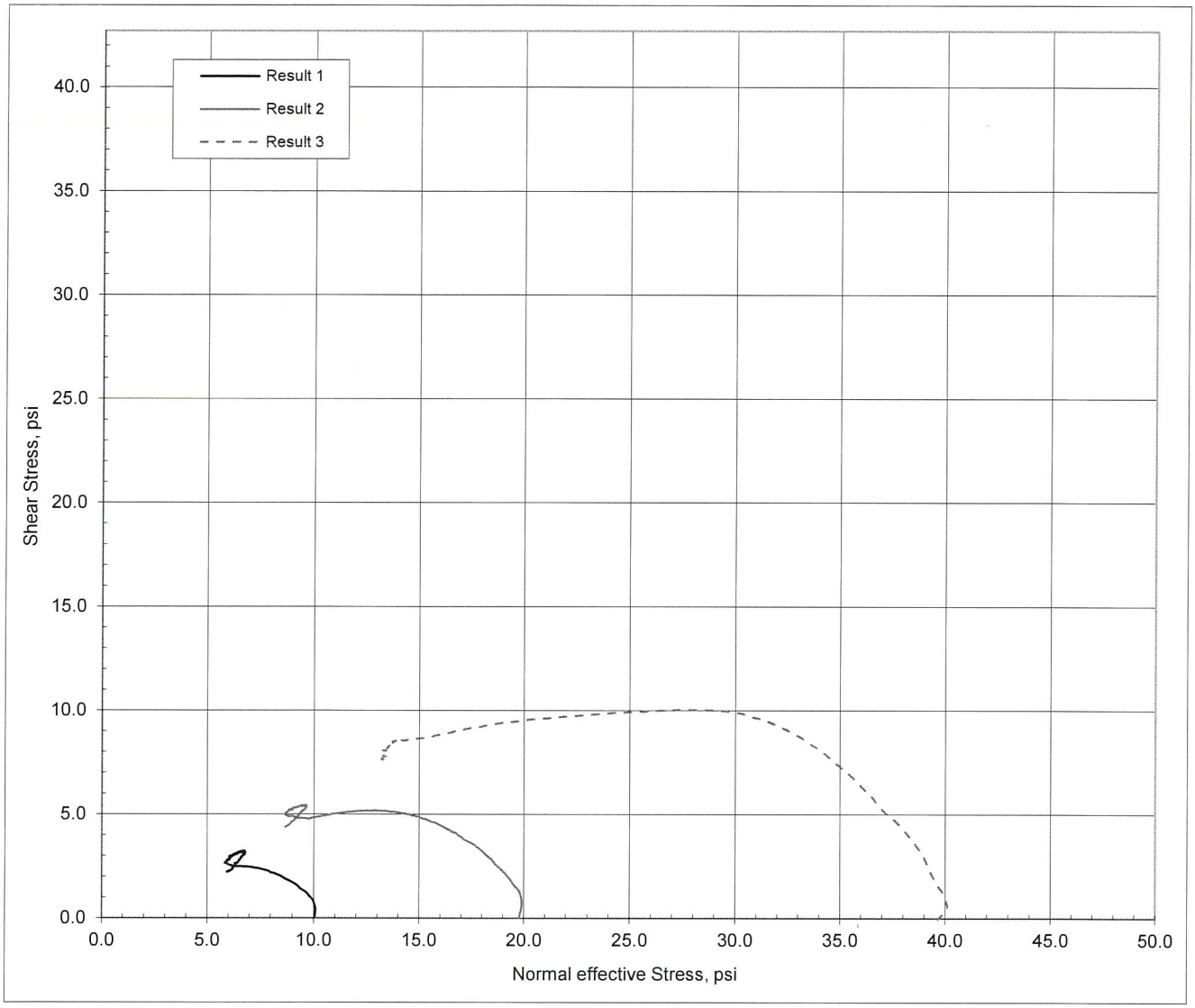
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B003	S13	43.5	45.0	9.2														
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S14	48.5	50.0	17.3														
	Color		Brown and gray							Visual Classification			Silty fine to medium sand, trace clay and fine gravel					

TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

CONSOLIDATED UNDRAINED DIRECT SIMPLE SHEAR TESTING OF COHESIVE SOILS
ASTM D6528



	RESULT 1	RESULT 2	RESULT 3		RESULT 1	RESULT 2	RESULT 3
INITIAL DATA				NORMAL EFF. STRESS, psi	10.0	19.8	39.8
AREA, inch2	5.387	5.391	5.371	PRESHEAR MOISTURE, %	18.7	21.5	22.9
HEIGHT, inch	0.706	0.706	0.701	PRESHEAR VOID RATIO	0.50	0.56	0.54
MOISTURE, %	17.9	19.4	20.5	FINAL MOISTURE, %	18.7	21.6	22.9
DRY DENSITY, pcf	110.5	104.0	104.9	FINAL VOID RATIO	0.51	0.58	0.55
SATURATION, %	92	85	91	SHEAR STRAIN RATE, %/min	0.086	0.088	0.087
VOID RATIO	0.53	0.62	0.61	t95 @ MAX STESS, min	0.29	2.09	2.47
LIQUID LIMIT	47		PLASTIC LIMIT	20	PLASTICITY INDEX		27
SAMPLE TYPE	UNDISTURBED		SPECIFIC GRAVITY		2.7 ESTIMATED		
SAMPLE DESCRIPTION	FILL; LEAN CLAY WITH SAND DARK GRAYISH BROWN WITH GRAY & OLIVE TRACE YELLOWISH BROWN						

PROJECT NAME: DYNEGY

LOCATION: KINCAID, ILLINOIS

JOB NO.: 15151122

DATE: 9/24/2015

BORING NO. KIN-B003

SAMPLE NO. S7

DEPTH, feet 22.0 - 24.0

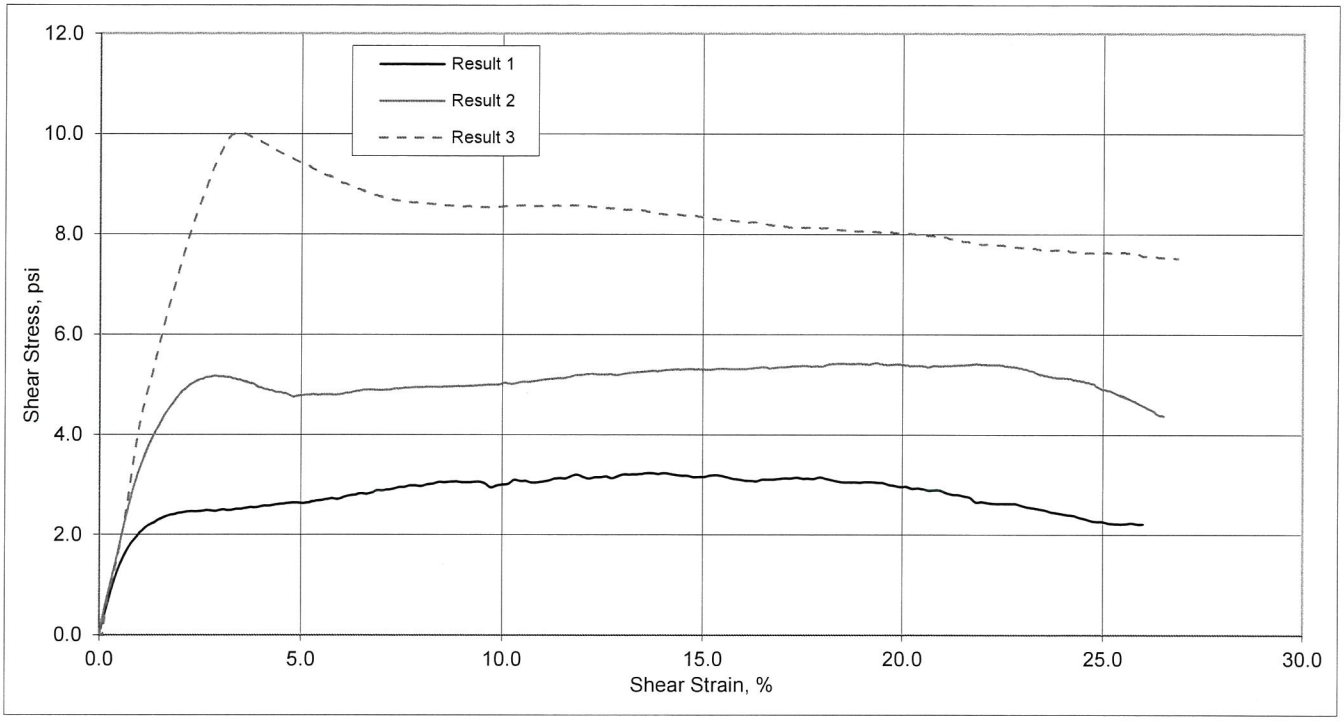
N:\CM\LAB_DATA\00 Projects in Progress\2015 Projects in Progress\15151122 Lab Data\KINCAID\[15151122 DirectSimpleShea

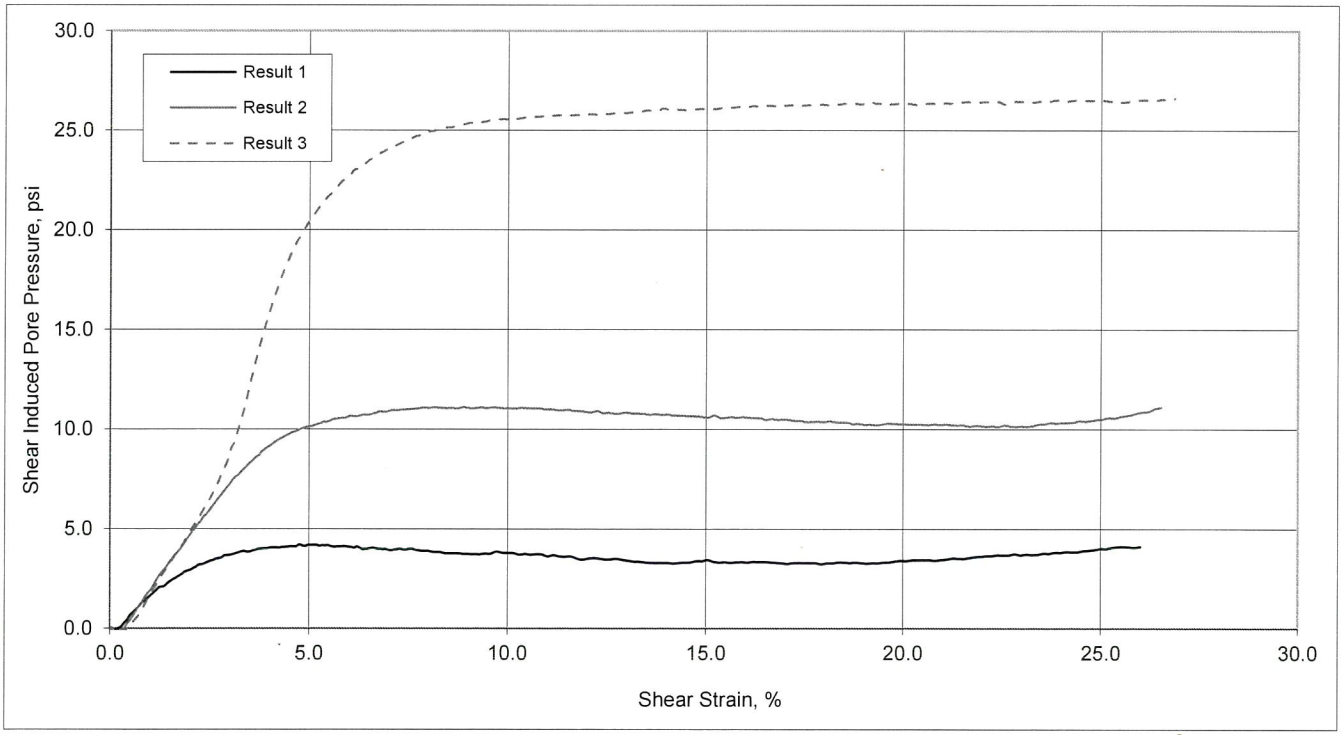
Terracon

Foundation Crust

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B003
SAMPLE NO.	S7
DEPTH, feet	22.0 - 24.0

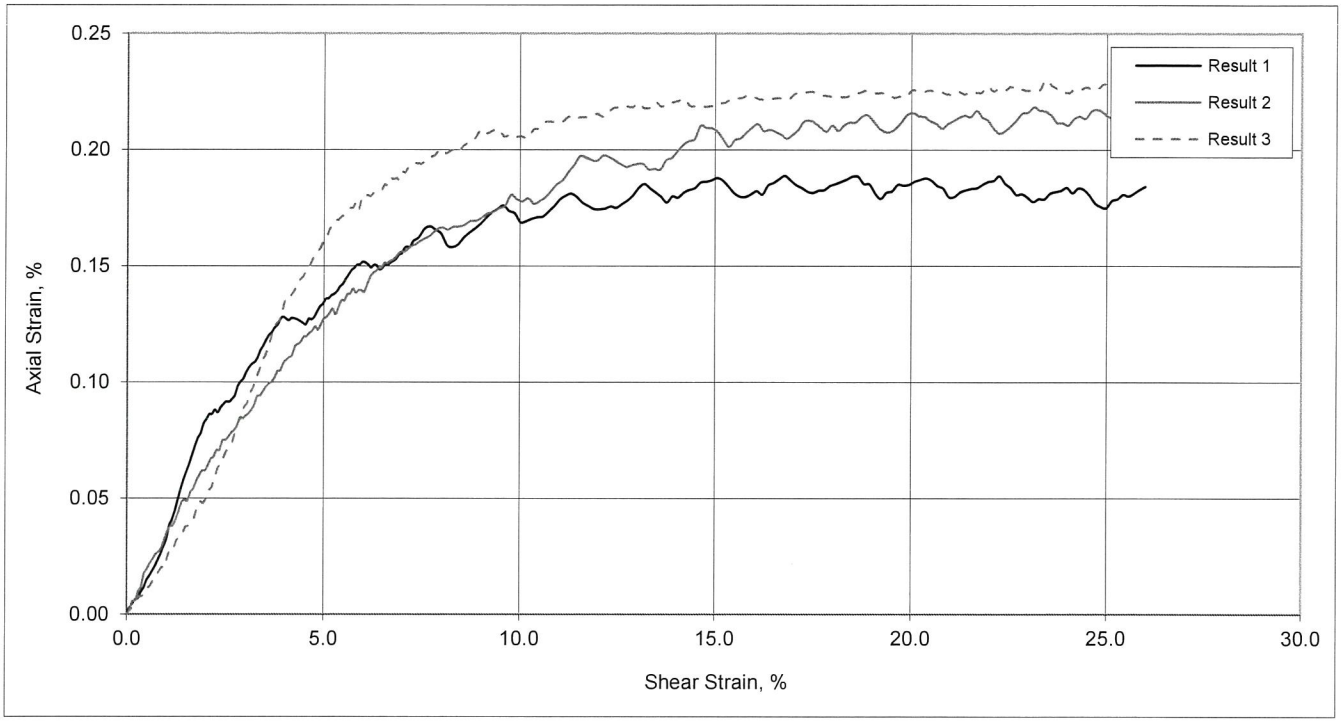


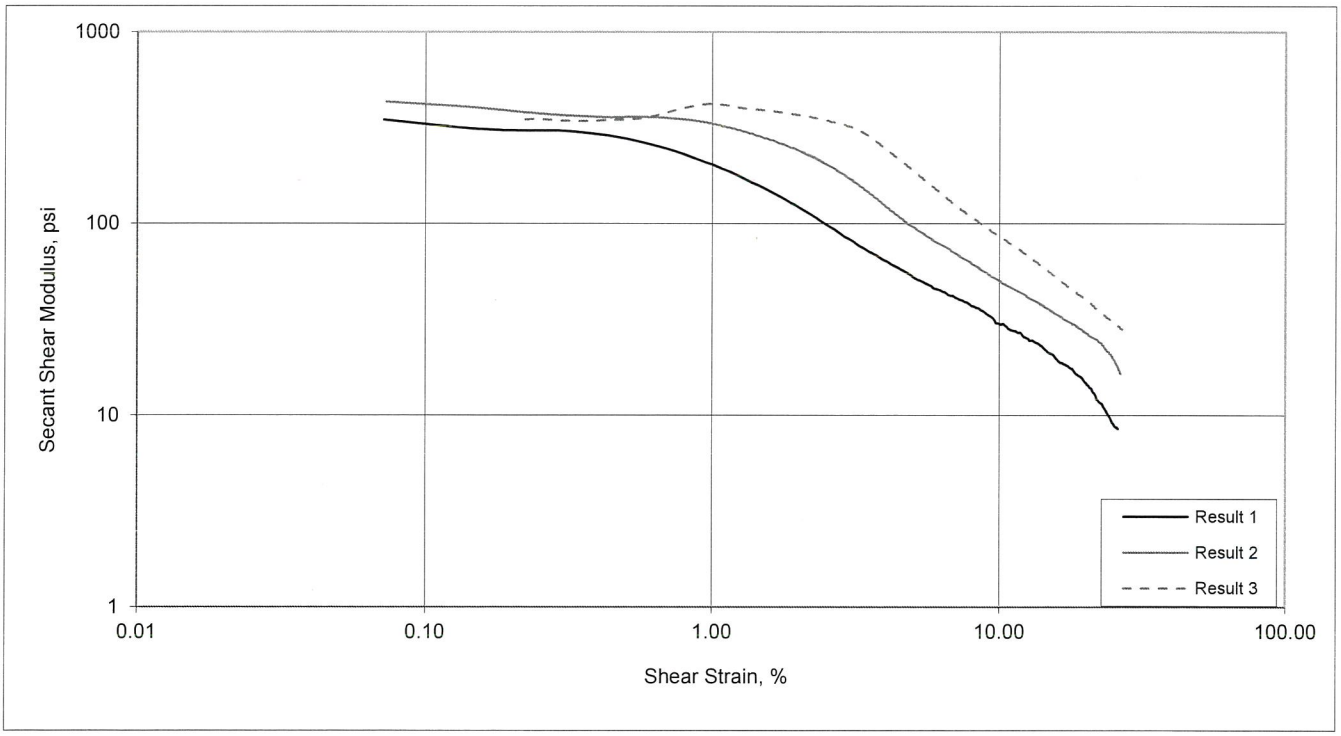


Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

BORING NO.	KIN-B003
SAMPLE NO.	S7
DEPTH, feet	22.0 - 24.0

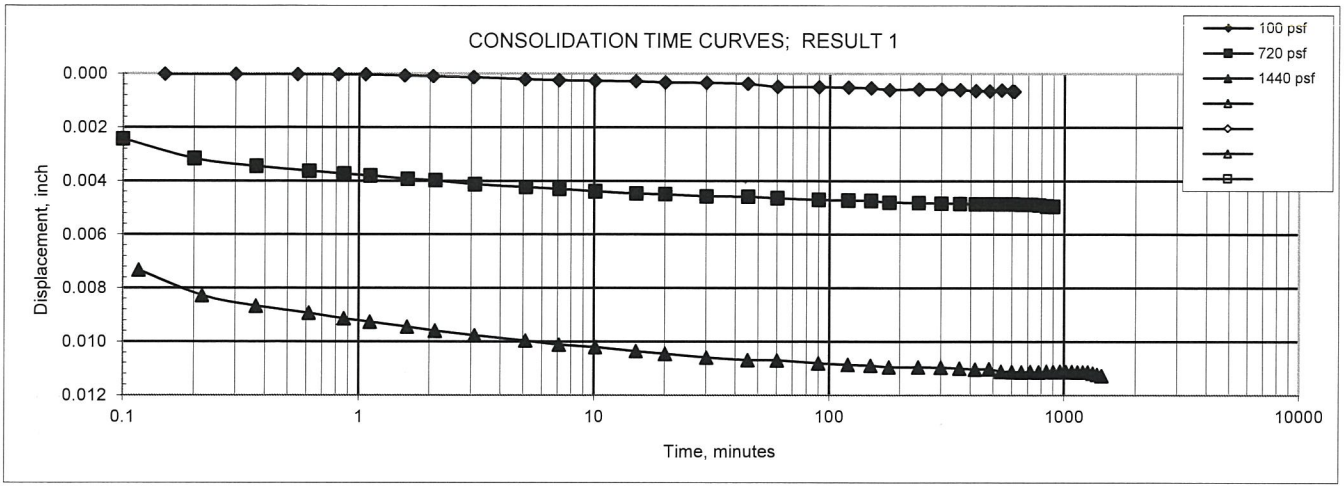


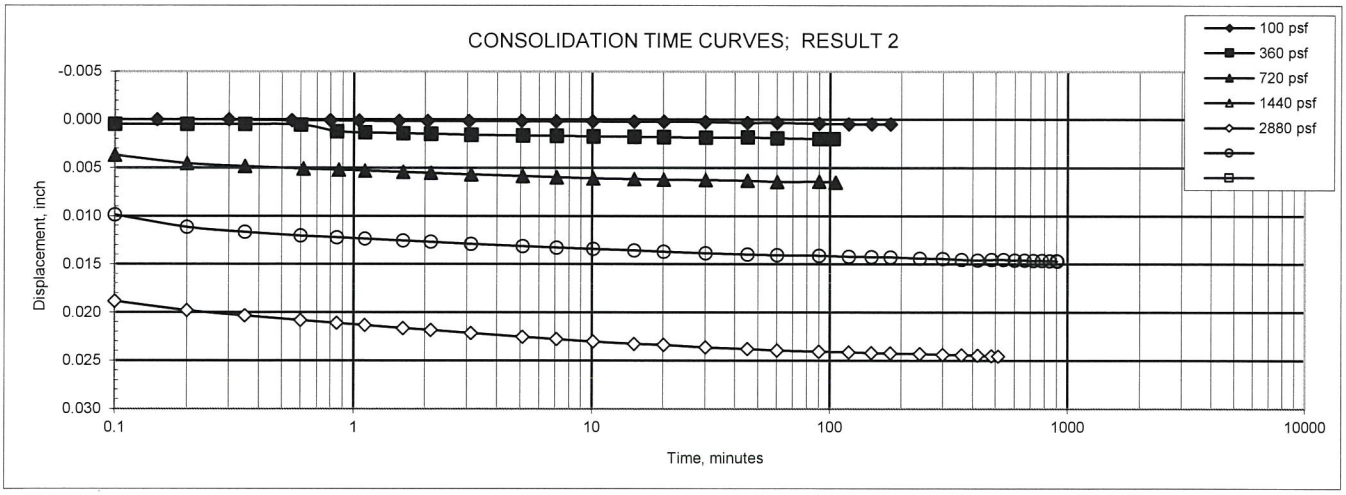


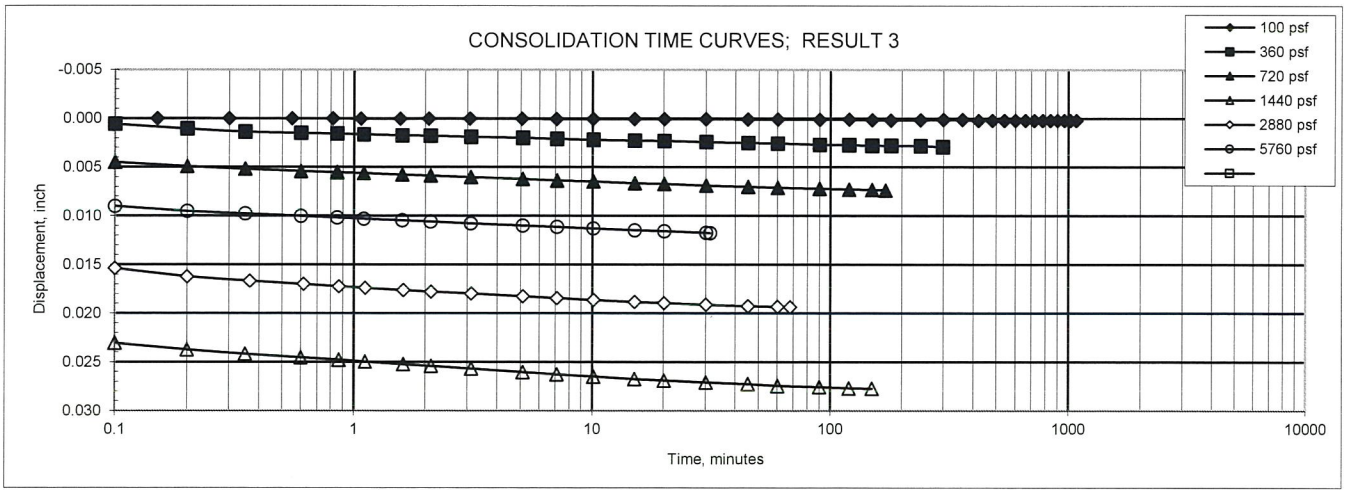
Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/24/2015

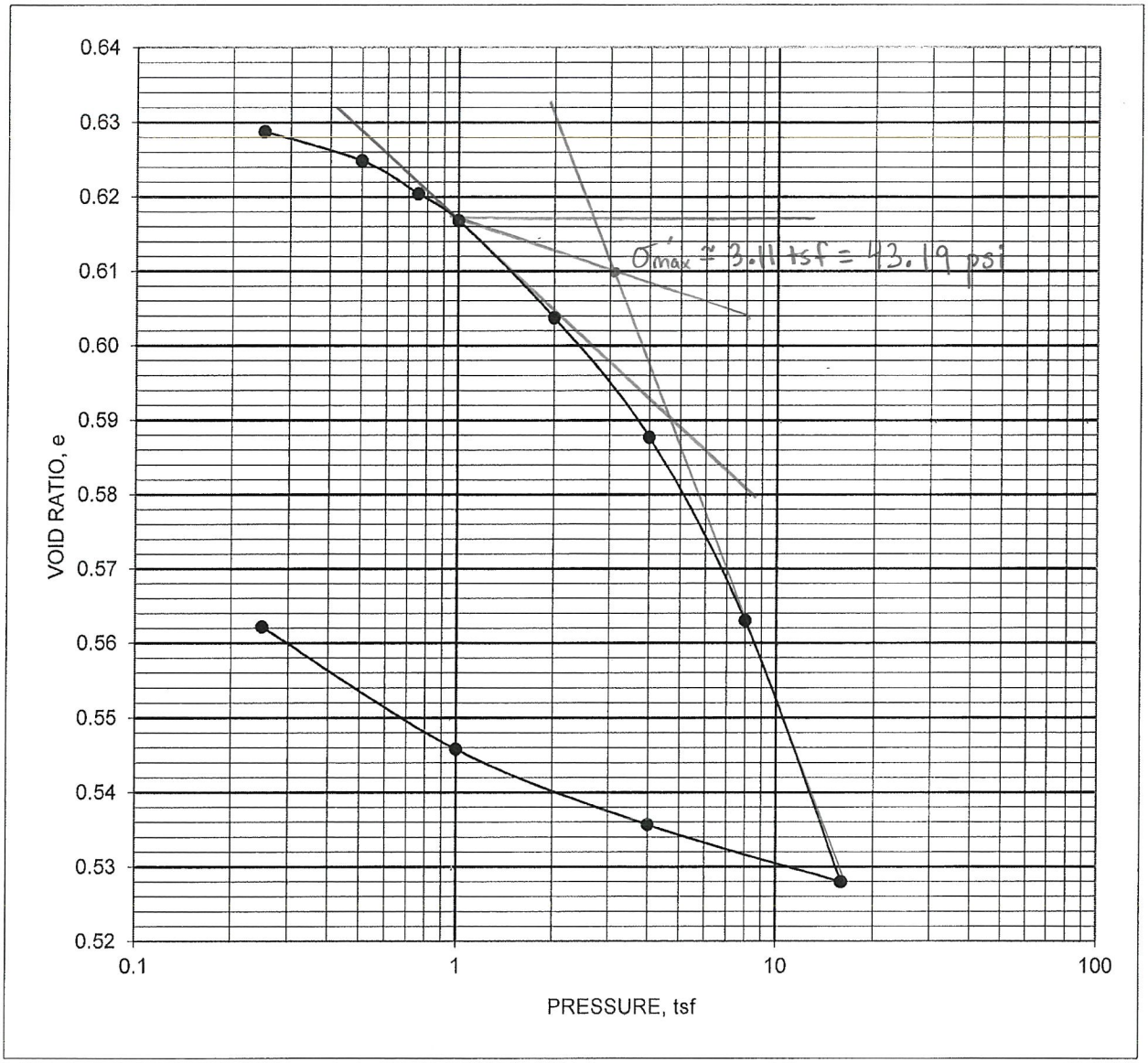
BORING NO.	KIN-B003
SAMPLE NO.	S7
DEPTH, feet	22.0 - 24.0







ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.58	HEIGHT, mm	25.29	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		1.45		MOISTURE, %		21.4	20.8
PRECONSOL. PRESSURE, tsf		3.11		DRY DENSITY, pcf		103.5	107.9
OVER CONSOLIDATION RATIO		2.2		SATURATION, %		92	100
COMPRESSION INDEX		0.11		VOID RATIO		0.629	0.562
REBOUND INDEX		0.022		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	47	PLASTIC LIMIT	20	PLASTICITY INDEX	27	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	FILL: LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH GRAY & OLIVE TRACE YELLOWISH BROWN						
BORING NO.	KIN-B003	SAMPLE NO.	S7	DEPTH, feet	22.0 - 24.0		

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

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Terracon

Foundation Crust

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

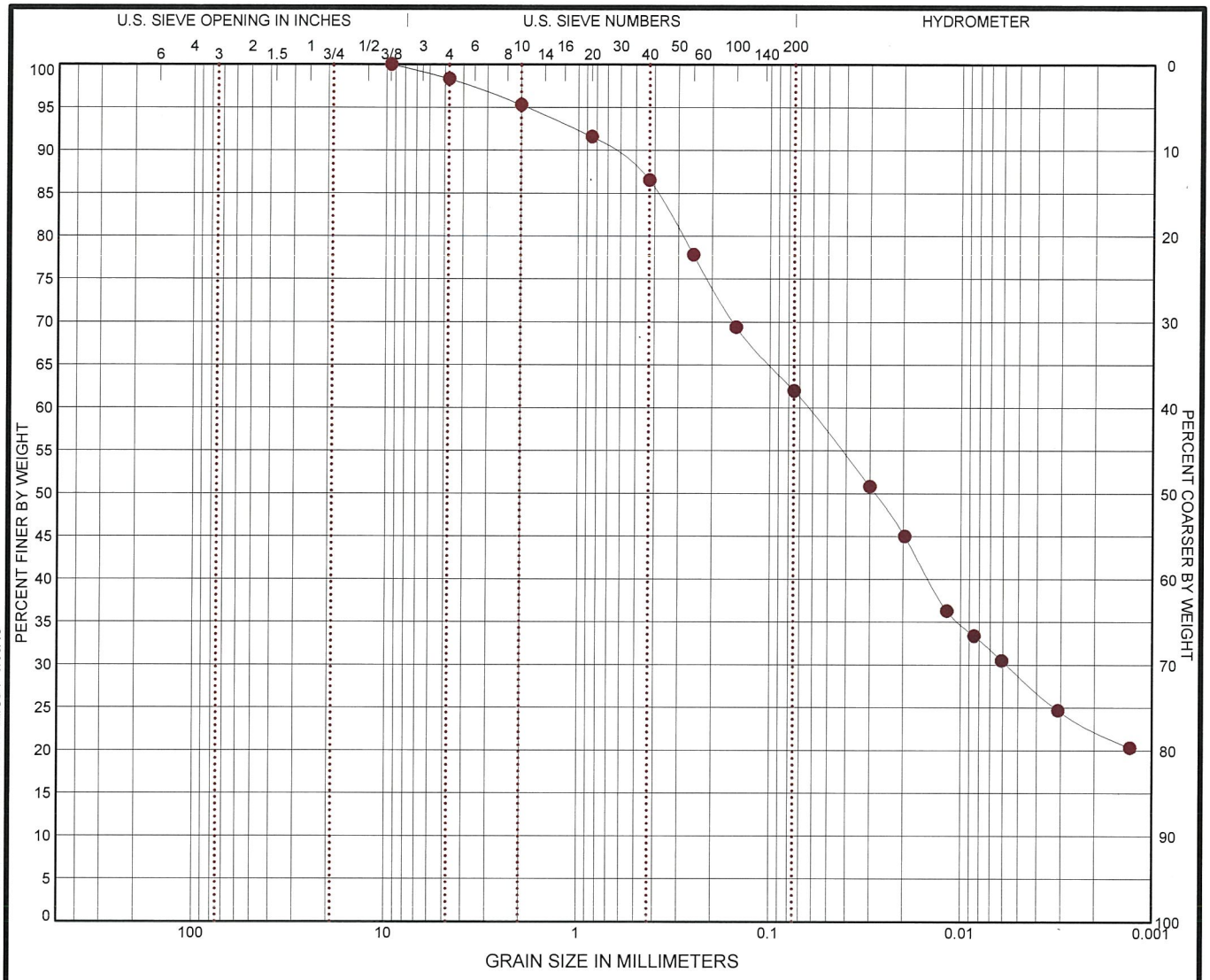
ADDITIONAL CONSOLIDATION DATA

KIN-B003
S7
22.0 - 24.0

PRESSURE, tsf	Cv50, cm2/sec	Cv90, cm2/sec	Av, cm2/g	Mv, cm2/g	k, cm/sec
0					
0.25			6.69E-07	4.11E-07	
0.5	7.17E-04	7.21E-04	1.60E-05	9.85E-06	7.06E-09
0.75	2.48E-04	2.49E-04	1.81E-05	1.11E-05	2.75E-09
1	2.16E-04	2.17E-04	1.47E-05	9.08E-06	1.96E-09
2	1.25E-03	1.26E-03	1.34E-05	8.27E-06	1.03E-08
4	5.02E-04	5.05E-04	8.19E-06	5.11E-06	2.56E-09
8	2.87E-04	2.89E-04	6.31E-06	3.97E-06	1.14E-09
16	1.96E-04	1.97E-04	4.47E-06	2.86E-06	5.60E-10
AVERAGE	4.88E-04	4.91E-04	1.02E-05	6.33E-06	3.77E-09

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B003**	**24**	**0.0**	**1.7**	**36.3**	**33.2**		**28.8**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.064**
D_{30}	**0.006**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	**100.0**
#4	**98.31**
#10	**95.27**
#20	**91.57**
#40	**86.51**
#60	**77.81**
#100	**69.38**
#200	**61.96**

SOIL DESCRIPTION
● SANDY LEAN CLAY(CL)

REMARKS
● Dispersion: 6.19%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

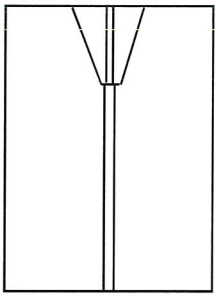
CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B003, S8, 24.0-26.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 14.2%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Sandy Lean Clay

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	45.0	60	0.75						X	X	
2	2	90.0	120	0.75						X	X	
3	2	45.0	60	0.75						X	X	
4	2	90.0	120	0.75						X	X	
5	2	45.0	60	0.75						X	X	
6	2	90.0	120	0.75						X	X	
7	2	45.0	60	0.75						X	X	
8	2	90.0	120	0.75						X	X	
9	2	45.0	60	0.75						X	X	
10	2	90.0	120	0.75						X	X	
1	7	77.0	60	1.28						X	X	
2	7	73.0	60	1.22						X	X	
3	7	73.0	60	1.22						X	X	
4	7	73.0	60	1.22						X	X	
5	7	73.0	60	1.22						X	X	
1	15	86.0	60	1.43						X	X	
2	15	86.0	60	1.43						X	X	
3	15	86.0	60	1.43						X	X	
4	15	86.0	60	1.43						X	X	
5	15	86.0	60	1.43						X	X	
1	40	156.0	60	2.60						X	X	
2	40	156.0	60	2.60						X	X	
3	40	156.0	60	2.60						X	X	
4	40	156.0	60	2.60						X	X	
5	40	156.0	60	2.60						X	X	

CLASSIFICATION = **ND1**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B003	S8	24.0-26.0 feet

2 MIN

GRADE: 2

DISPERSIVE CLASSIFICATION: INTERMEDIATE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

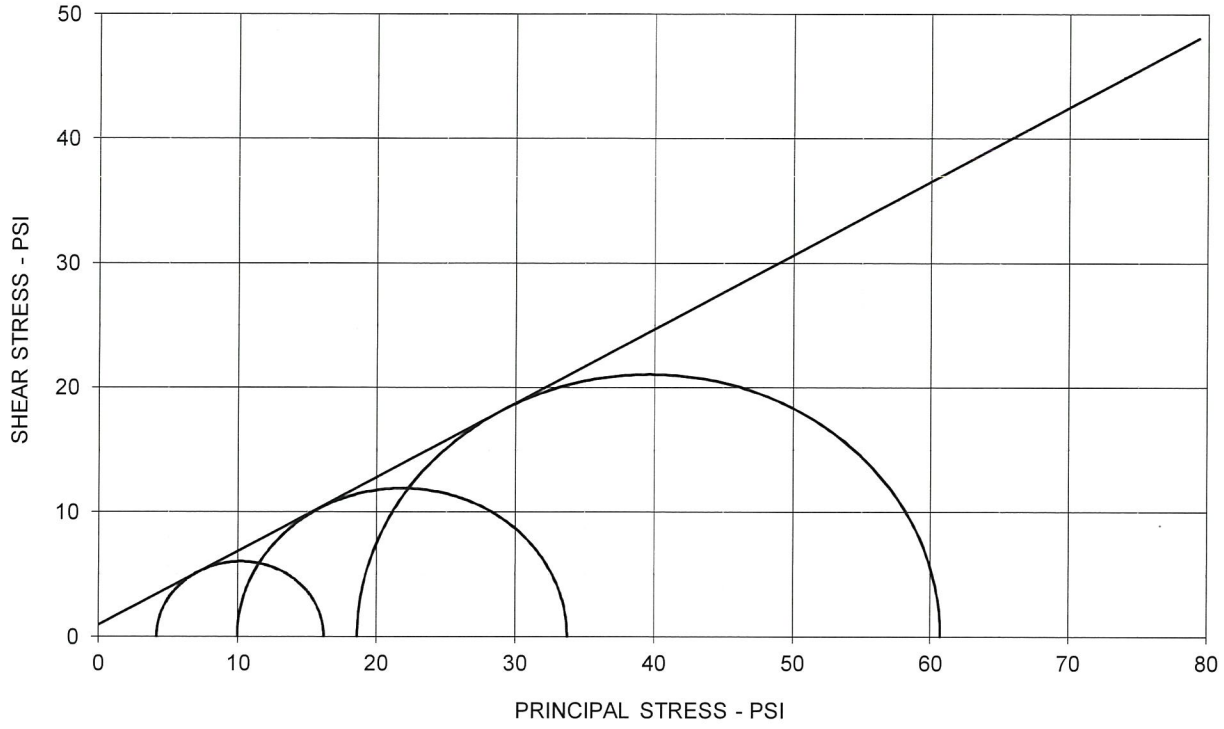
DISPERSIVE CLASSIFICATION: NON DISPERSIVE

rade 1 - Nondispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Highly Dispersive

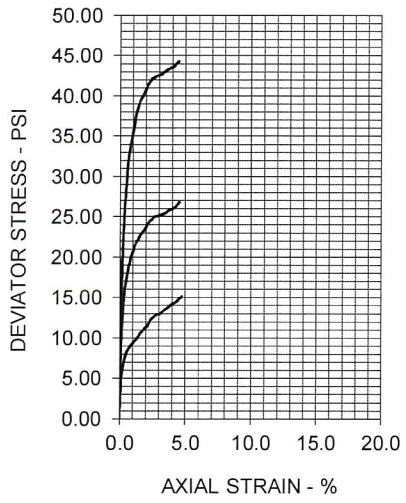
Terracon

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS	ϕ' = 30.7 deg	c' = 0.9 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	18.4	18.4	18.4	
Dry Density - pcf	109.7	109.7	109.7	
Diameter - inches	2.86	2.86	2.86	
Height - inches	5.69	5.69	5.69	
AT TEST				
Final Moisture - %			16.7	
Dry Density - pcf	110.7	112.8	115.3	
Calculated Diameter (in.)	2.86	2.87	2.86	
Height - inches	5.67	5.71	5.69	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.01	23.79	42.12	
Total Pore Pressure - psi	55.8	60.1	71.4	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	2.3	2.0	2.5	
σ_1' Failure - psi	16.19	33.74	60.73	
σ_3' Failure - psi	4.18	9.95	18.61	

TEST DESCRIPTION

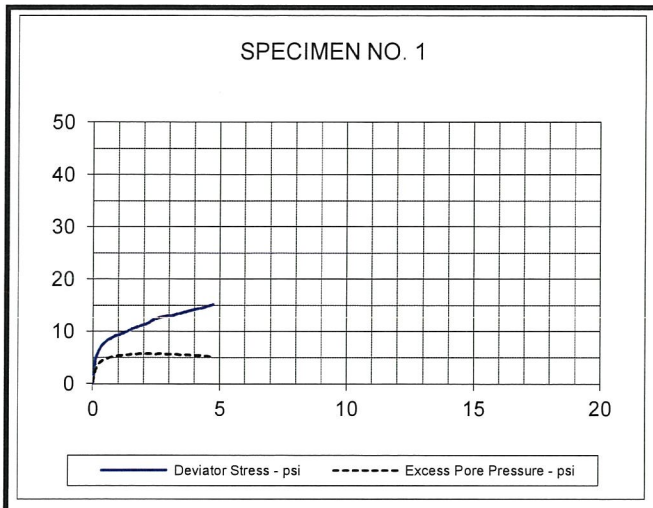
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Sandy Lean Clay (CL)
SAMPLE LOCATION: KIN-B003, S8, 24.0-26.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 31 PL: 16 PI: 15 Percent -200: 62
REMARKS: Multistage Triaxial

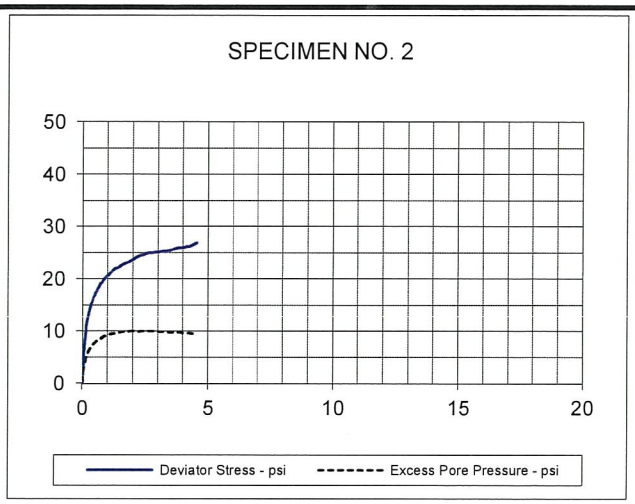
PROJECT INFORMATION

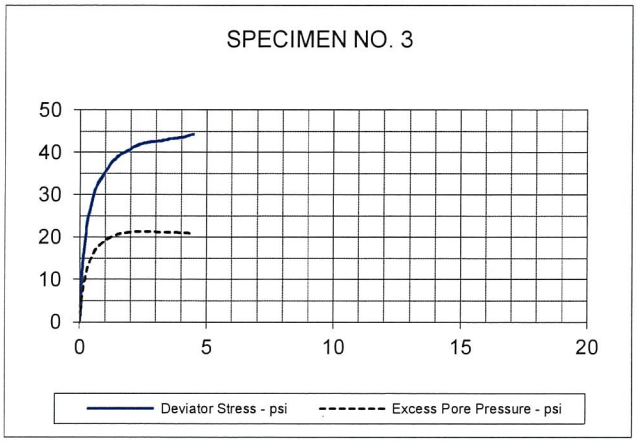
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

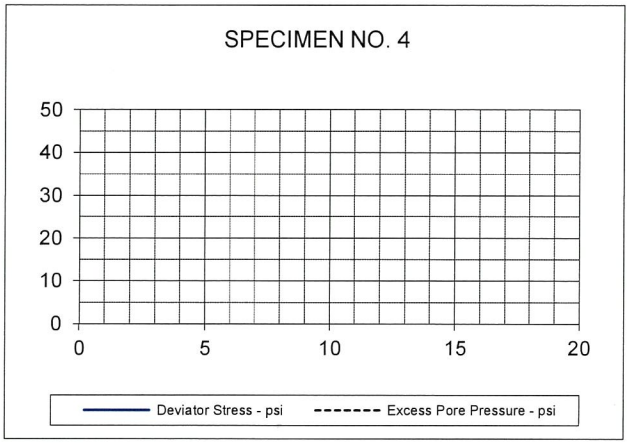
TERRACON

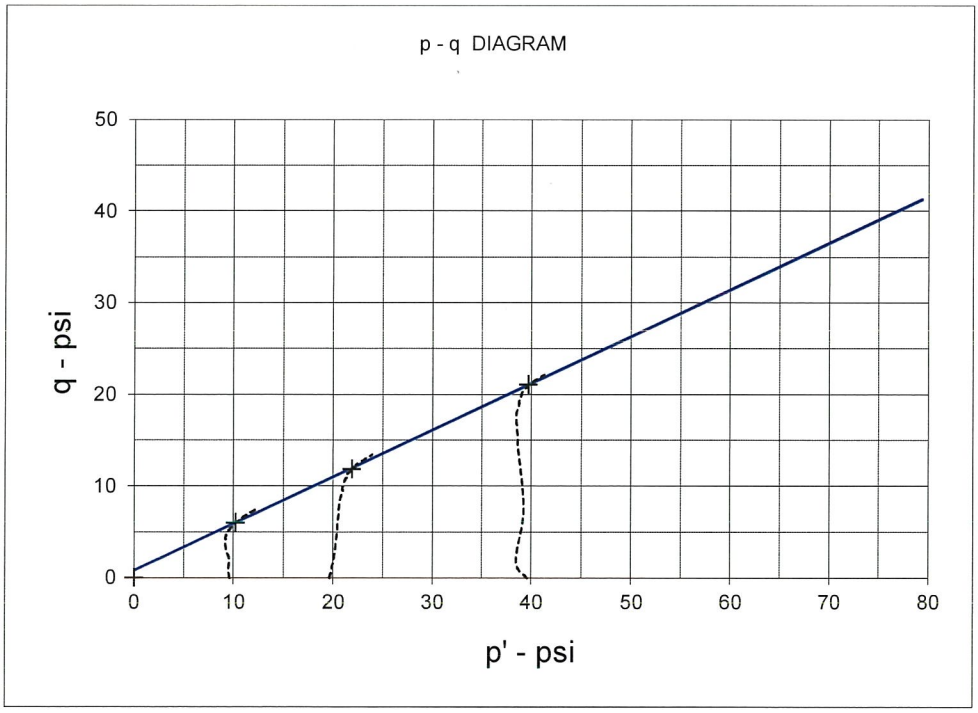
Foundation Crust









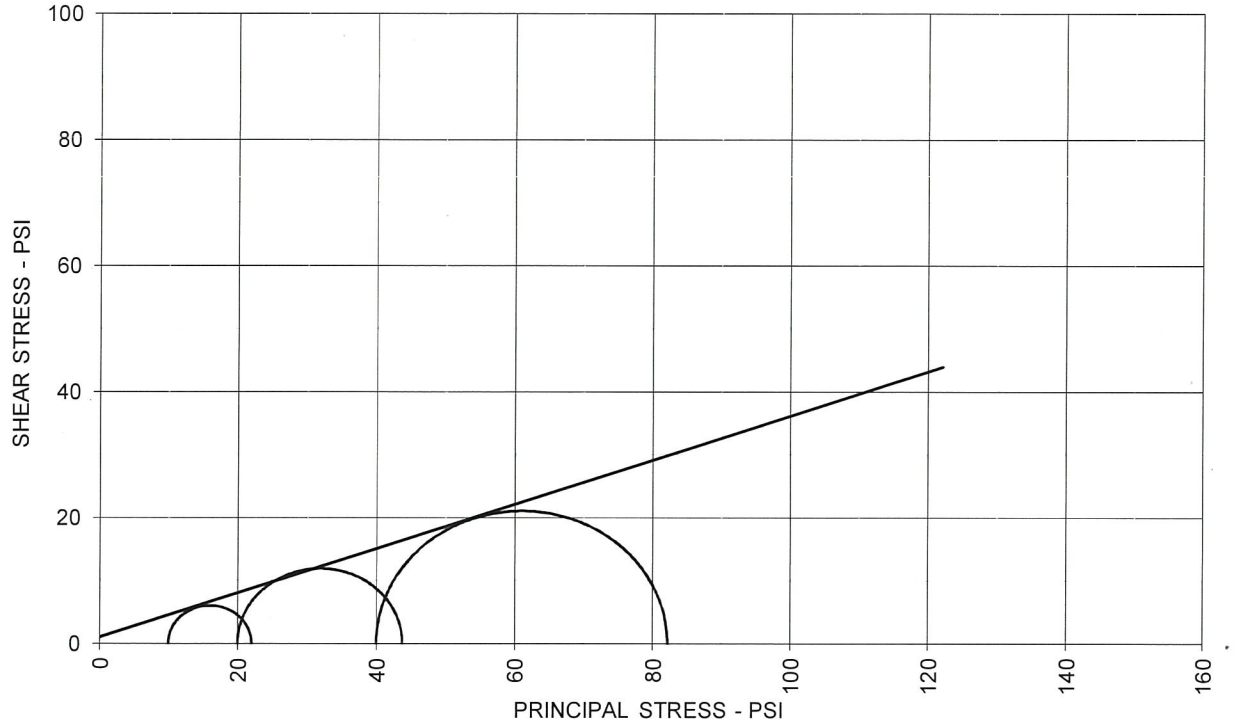


EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 27.1	a (psi) = 0.8
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Sandy Lean Clay (CL)			

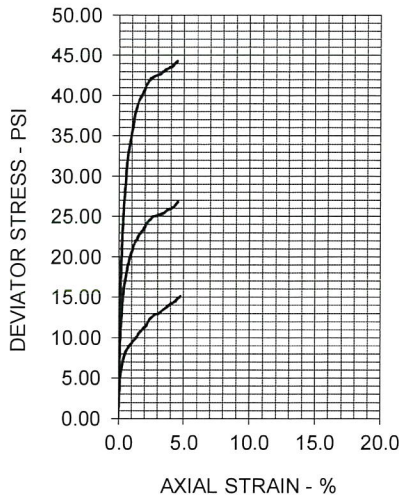
TRIAX_B003@26.xls

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135, Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 19.4 deg	c = 1.0 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	18.4	18.4	18.4	
Dry Density - pcf	109.7	109.7	109.7	
Diameter - inches	2.86	2.86	2.86	
Height - inches	5.69	5.69	5.69	
AT TEST				
Final Moisture - %			16.7	
Dry Density - pcf	110.7	112.8	115.3	
Calculated Diameter (in.)	2.86	2.87	2.86	
Height - inches	5.67	5.71	5.69	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	12.01	23.79	42.12	
Total Pore Pressure - psi	55.8	60.1	71.4	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	2.3	2.0	2.5	
σ_1 Failure - psi	22.01	43.79	82.12	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Sandy Lean Clay (CL)
SAMPLE LOCATION: KIN-B003, S8, 24.0-26.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 31 PL: 16 PI: 15 Percent -200: 62
REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B004	S1	1.0	2.5	9.1														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.5	5.0	12.1		31	15	16			2.664							
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S3	6.0	7.5	9.8					** Sieve									
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.0	19.3														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S5																	
	Color		NO Sample							**Visual Classification**								
	S6	13.5	15.0															
	Color		NO RECOVERY							**Visual Classification**								
	S7	17.0	19.0	14.6	117.9	29	15	14				Note*	Note*		NA			
	Color		Dark grayish brown with dark yellowish brown							**Visual Classification**			Lean clay with sand					
	S8	19.0	21.0	21.6	102.9	32	18	14		Note*				Note*		Note*	Note*	CL
	Color		Dark brown and green							**Visual Classification**			Lean clay with sand					
	S9	23.5	25.0	19.0														
	Color		Brown and gray							**Visual Classification**			FILL: Lean clay with fine to medium sand, trace fine gravel					
	S10	28.5	30.0	29.0	NA	55	22	33										
	Color		Brown and dark brown							**Visual Classification**			Fat clay					
	S11	30.0	32.0	25.9	100.1													
	Color		Brown and gray							**USCA Classification**			Lean clay					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

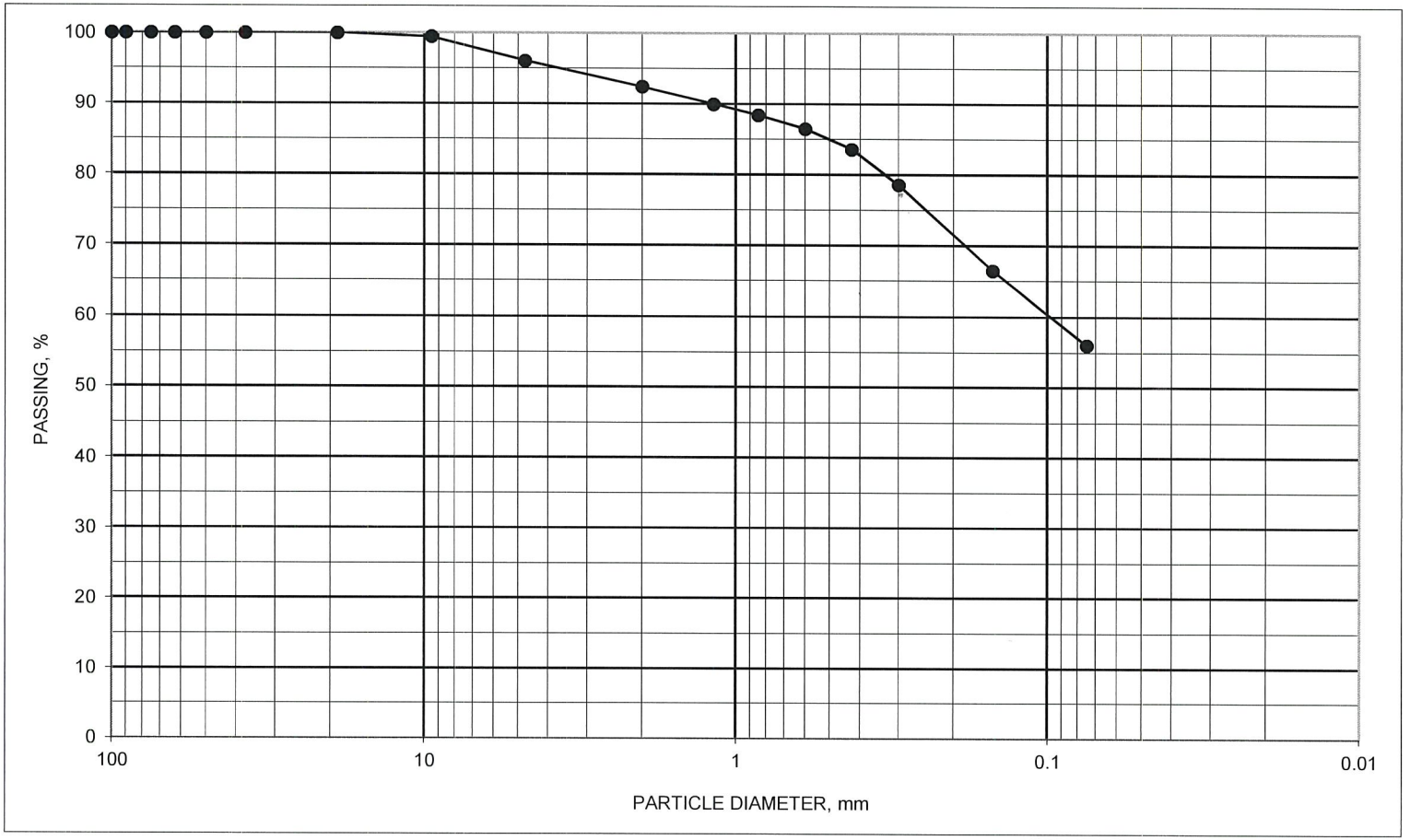
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B004	S12	33.5	35.0	21.2	111.9	42	17	25										
	Color		Brown and gray							Visual Classification			Lean clay					
	S13	37.0	39.0	21.2	109.6	43	15	28										
	Color		Brown and gray							Visual Classification			Lean clay, trace fine gravel					
	S14	43.5	45.0	9.0														
	Color		Brown and gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S15	48.5	50.0	7.7														
	Color		Brownish gray							Visual Classification			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	96
#10	2.00	92
#16	1.18	90
#20	0.85	88
#30	0.600	86
#40	0.425	84
#50	0.300	79
#100	0.150	66
#200	0.075	56.0
	D60	0.0976



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB004	S-3	6 TO 7.5	FILL: Sandy lean clay, trace fine gravel Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B004 S-3.xlsx]REPORT

Terracon

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS
USING A FLEXIBLE WALL PERMEAMETER
ASTM D 5084 - 03 METHOD C TEST WITH INCREASING TAILWATER LEVEL
FLUID: DEAIRED TAP WATER WITH 0.005 N CaSO4

PROJECT NAME:	DYNEGY	PROJECT NUMBER:	15151122
LOCATION:	KINCAID, ILLINOIS	DATE:	9/30/2015
		PANEL IDENTIFICATION:	Lenexa Perm Board
SAMPLE ID:	KIN-B004 S7 17.0 - 19.0 feet	BURETTE AREA:	0.312 cm^2
SAMPLE DESCR.:	LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH DARK YELLOWISH BROWN	BURETTE INCREMENT LENGTH:	1.000 cm
		VOLUME PER INCREMENT:	0.312 cm^3

INITIAL

MOISTURE%		DENSITY			
W & T, g	184.86	WET WT, g	519.7		
D & T, g	166.52	DIA, in	2.869	7.29	cm
T, g	34.30	HT, in	2.201	5.59	cm
		AREA		41.71	cm^2
MOIST-		DENSITY:	139.1	PCF WET	
URE, %	**13.9**	DENSITY:	**122.2**	PCF DRY	

ADDITIONAL DATA

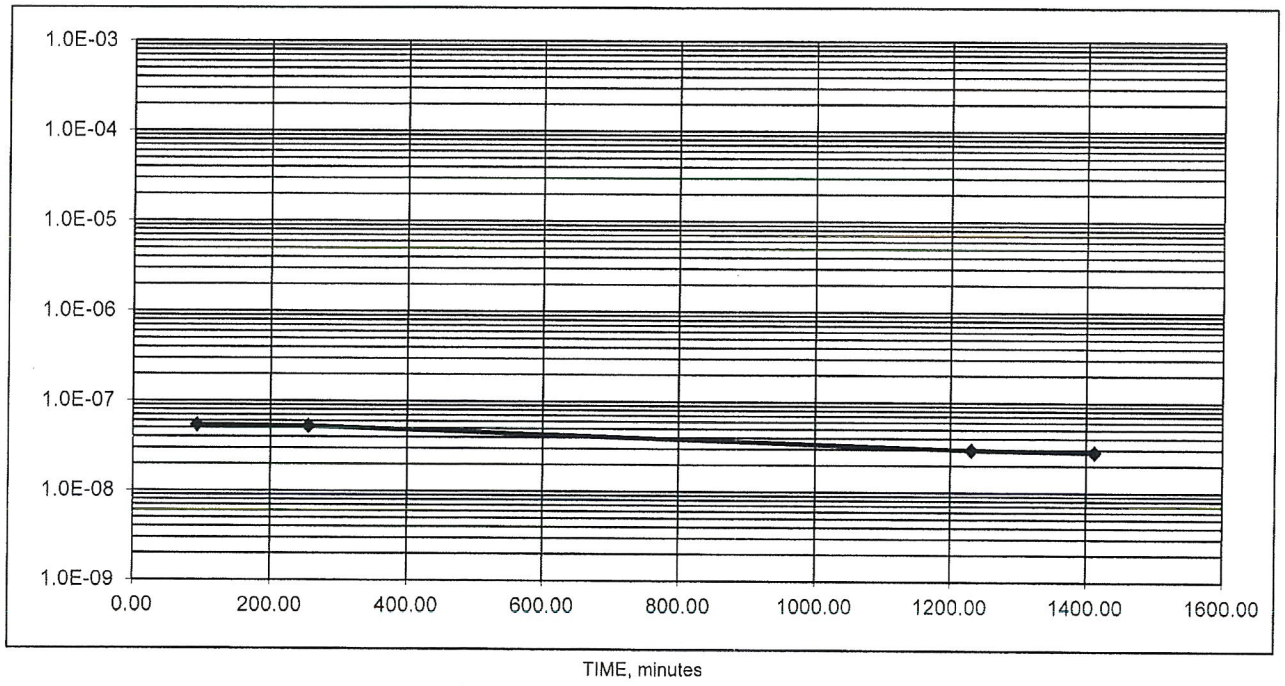
SPECIFIC GRAVITY:	2.70	RECOMPACTED?:	NO
SPECIFIC GRAVITY:	ASSUMED	PROCTOR, pcf:	NA
POROSITY, %:	27.5	OPTIMUM, %:	NA
SATURATION, %:	98.7	COMPACTION, %:	NA
VOID RATIO:	0.38	OVER OPTIMUM, %:	NA

SATURATION:	LATERAL PRESS.:	104.0 psi	BACK PRESSURE (=UPPER=LOWER):	100.0 psi	
DURING TEST:	LATERAL PRESS.:	104.0 psi	H2: 100.0 psi	H1: 100.0 psi	
			BIAS PRESSURE (=H1-H2)	0.0 psi	

H1 VALUE	H2 VALUE	ELAPSED TIME, min	DELTA H cm	Ln H1/H2	HYD CON k, cm/sec	OUT FLOW cm^3	IN FLOW cm^3	OUT/IN RATIO	HYD GRAD	% FROM MEAN k	TEMP.: C	TEMP. CORR.:
8.6	66.9	0.00	58.3									
9.0	66.4	93.00	57.4	0.015558	5.40E-08	0.12	0.16	0.80	10.3	31	23.3	0.925
9.7	65.6	255.00	55.9	0.026480	5.25E-08	0.22	0.25	0.87	10.0	28	23.5	0.920
11.9	63.0	1231.00	51.1	0.089780	2.97E-08	0.69	0.81	0.85	9.1	28	23.2	0.927
12.3	62.6	1412.00	50.3	0.015779	2.82E-08	0.12	0.12	1.00	9.0	31	23.2	0.927

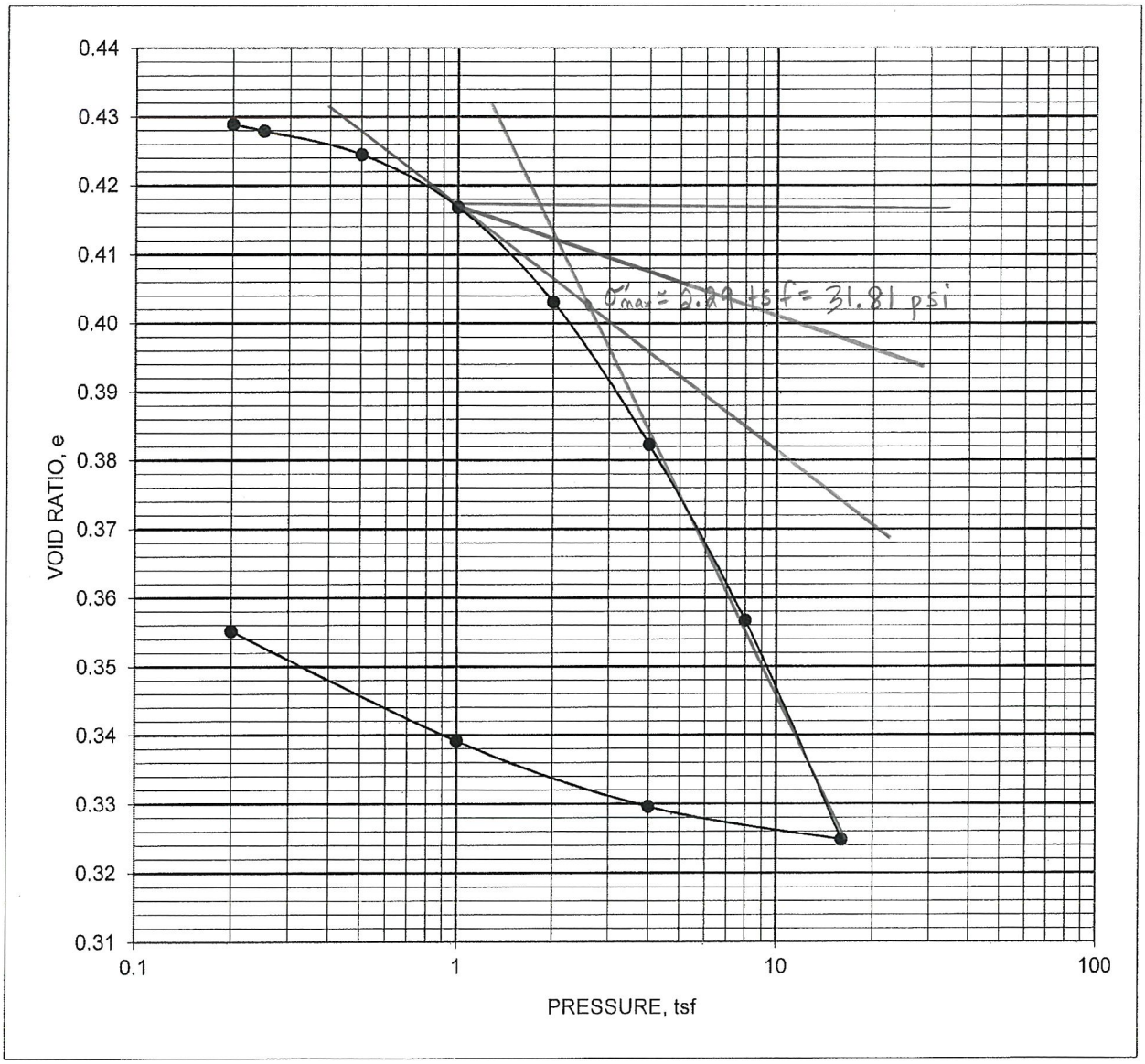
HYDRAULIC CONDUCTIVITY (k_{20}) = AVERAGE 4.1E-08 cm/sec

MAXIMUM	1.0E-03 TO 1.0E-04	2	0.75<	30	% < 25 AT
HYDRAULIC	1.0E-04 TO 1.0E-05	5	RATIO	MAX	> 1.0E-8
GRADIENT	1.0E-05 TO 1.0E-06	10	<1.25	HYDRAULIC	OR
	1.0E-06 TO 1.0E-07	20		GRADIENT	% < 50 AT
	less than 1.0E-07	30		ALLOWED	< 1.0E-8



Terracon

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.57	HEIGHT, mm	19.01	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		1.22		MOISTURE, %		14.6	13.5
PRECONSOL. PRESSURE, tsf		2.29		DRY DENSITY, pcf		117.9	123.7
OVER CONSOLIDATION RATIO		1.9		SATURATION, %		92	102
COMPRESSION INDEX		0.11		VOID RATIO		0.429	0.355
REBOUND INDEX		0.020		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	29	PLASTIC LIMIT	15	PLASTICITY INDEX	14	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH DARK YELLOWISH BROWN						
BORING NO.	KIN-B004	SAMPLE NO.	S7	DEPTH, feet	17.0 - 19.0		

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

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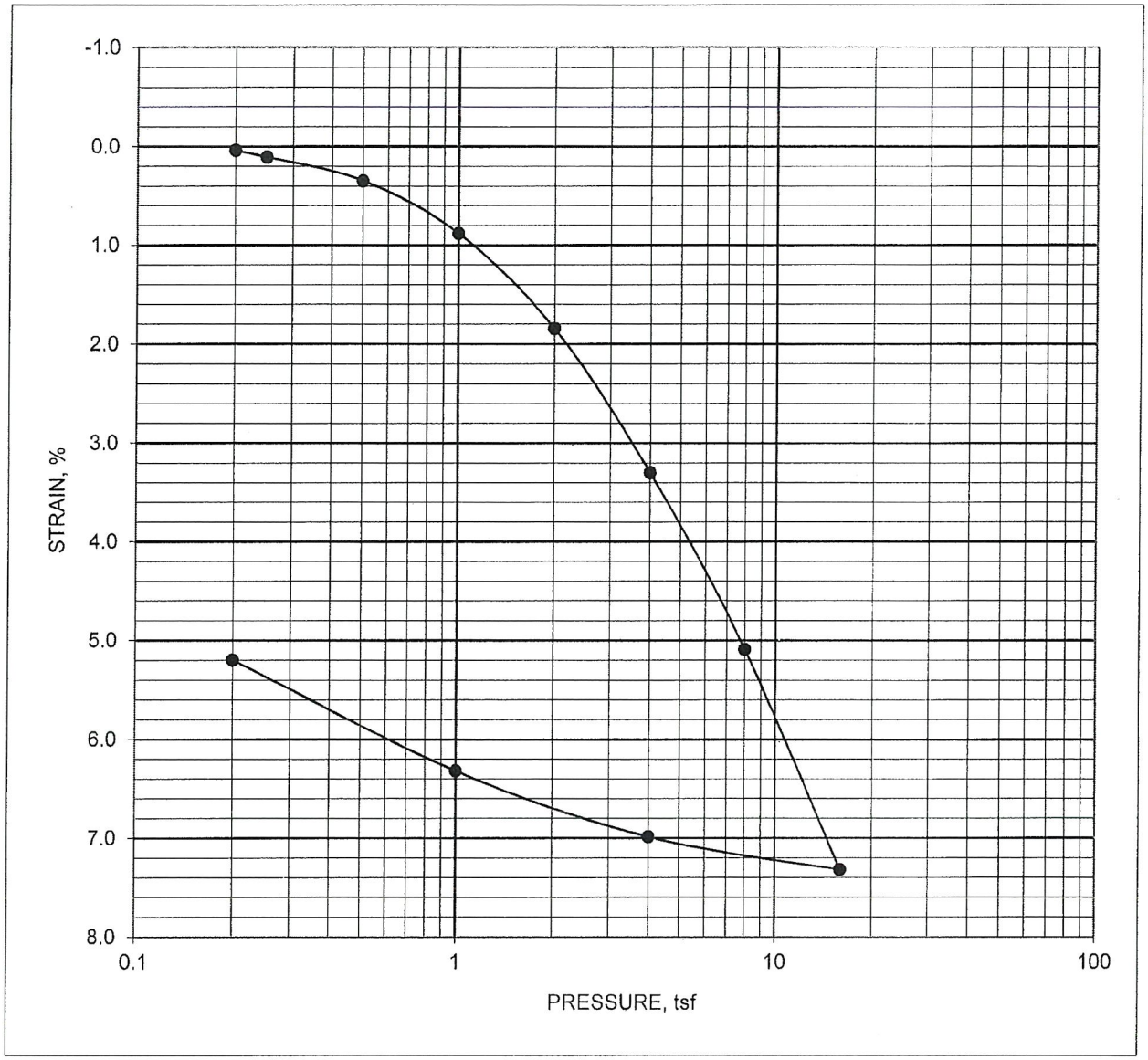
Terracon

Foundation Crust

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES OF COHESIVE SOILS
ASTM D2435



DIAMETER, mm	63.57	HEIGHT, mm	19.01	PROPERTY		BEFORE TEST	AFTER TEST
OVERBURDEN PRESSURE, tsf		1.22		MOISTURE, %		14.6	13.5
PRECONSOL. PRESSURE, tsf		2.29		DRY DENSITY, pcf		117.9	123.7
OVER CONSOLIDATION RATIO		1.9		SATURATION, %		92	102
COMPRESSION INDEX		0.11		VOID RATIO		0.429	0.355
REBOUND INDEX		0.020		SAMPLE TYPE		UNDISTURBED	
LIQUID LIMIT	29	PLASTIC LIMIT	15	PLASTICITY INDEX	14	SPECIFIC GRAVITY	2.7 ESTIMATED
SAMPLE DESCRIPTION	LEAN CLAY WITH SAND, DARK GRAYISH BROWN WITH DARK YELLOWISH BROWN						
BORING NO.	KIN-B004	SAMPLE NO.	S7	DEPTH, feet	17.0 - 19.0		

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

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Terracon

DYNEGY
KINCAID, ILLINOIS
15151122
9/30/2015

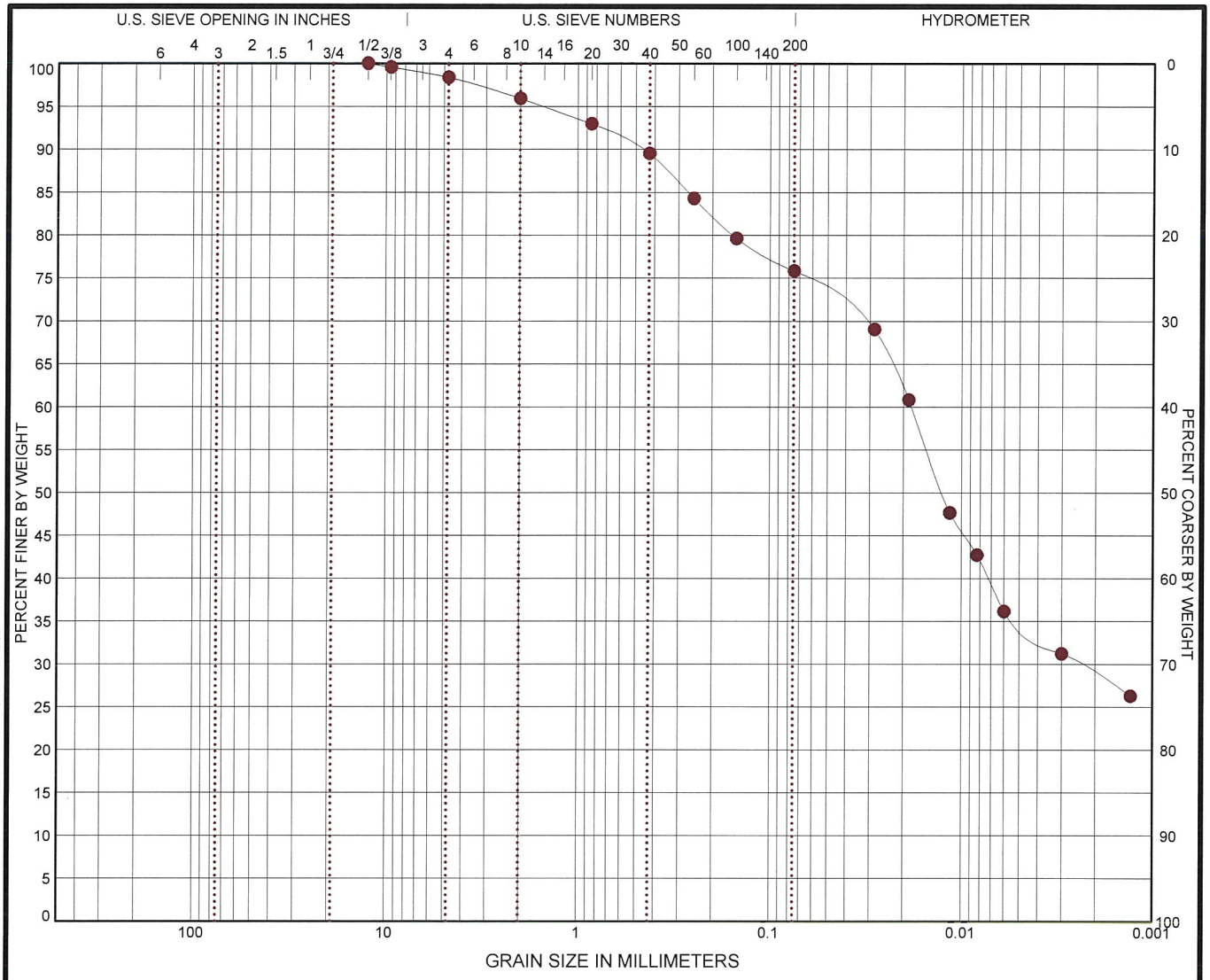
ADDITIONAL CONSOLIDATION DATA

KIN-B004
S7
17.0 - 19.0

PRESSURE, tsf	Cv50, cm2/sec	Cv90, cm2/sec	Av, cm2/g	Mv, cm2/g	k, cm/sec
0					
0.2			2.93E-06	2.05E-06	
0.25	1.23E-04	1.24E-04	1.95E-05	1.37E-05	1.69E-09
0.5	1.34E-03	1.35E-03	1.40E-05	9.84E-06	1.32E-08
1	9.44E-04	9.50E-04	1.56E-05	1.10E-05	1.03E-08
2	1.03E-03	1.03E-03	1.40E-05	9.91E-06	1.02E-08
4	1.04E-03	1.04E-03	1.06E-05	7.58E-06	7.87E-09
8	1.18E-03	1.18E-03	6.54E-06	4.73E-06	5.57E-09
16	8.93E-04	8.98E-04	4.07E-06	3.00E-06	2.68E-09
AVERAGE	9.35E-04	9.41E-04	1.09E-05	7.72E-06	7.36E-09

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B004**	**19**	**0.0**	**1.6**	**22.5**	**41.0**		**34.9**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.018**
D_{30}	**0.002**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	**100.0**
3/8"	**99.55**
#4	**98.37**
#10	**95.91**
#20	**92.96**
#40	**89.51**
#60	**84.28**
#100	**79.62**
#200	**75.84**

SOIL DESCRIPTION
● LEAN CLAY with SAND(CL)

REMARKS
● Dispersion: 5.22%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

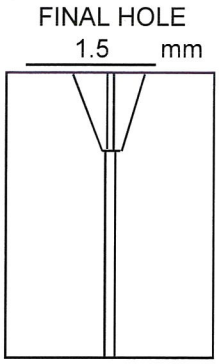
PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B004, S8, 19.0-21.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 22.7%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Lean Clay with Sand



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	12.0	15	0.80						X	X	
2	2	11.0	15	0.73						X	X	
3	2	11.0	15	0.73						X	X	
4	2	11.0	15	0.73						X	X	
5	2	11.0	15	0.73						X	X	
6	2	11.0	15	0.73						X	X	
7	2	11.0	15	0.73						X	X	
8	2	11.0	15	0.73						X	X	
9	2	11.0	15	0.73						X	X	
10	2	11.0	15	0.73						X	X	
1	7	20.0	15	1.33						X	X	
2	7	21.0	15	1.40						X	X	
3	7	21.0	15	1.40						X	X	
4	7	20.0	15	1.33						X	X	
5	7	20.0	15	1.33						X	X	
1	15	43.0	15	2.87					X		X	
2	15	44.0	15	2.93					X		X	
3	15	45.0	15	3.00					X		X	
4	15	45.0	15	3.00					X		X	
5	15	45.0	15	3.00					X		X	
1	40											
2	40											
3	40											
4	40											
5	40											

CLASSIFICATION = ND3

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B004	S8	19.0-21.0 feet

2 MIN

GRADE: 3

DISPERSIVE CLASSIFICATION: DISPERSIVE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Highly Dispersive

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TRIAXIAL SHEAR TEST REPORT

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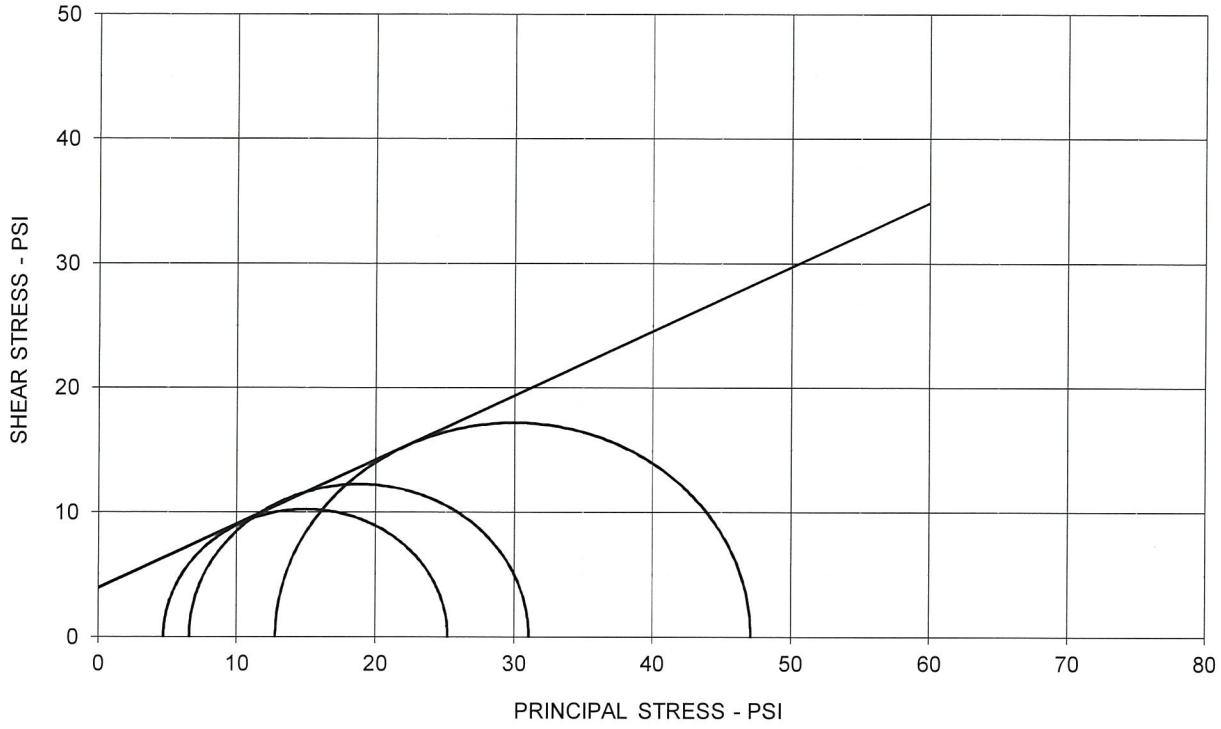
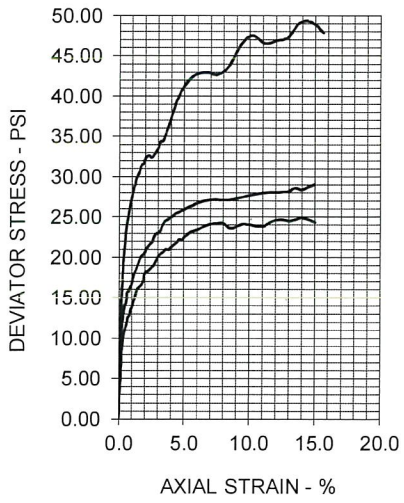


EFFECTIVE STRESS PARAMETERS	ϕ' = 27.3 deg	c' = 3.9 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	24.7	20.1	19.9	
Dry Density - pcf	97.2	104.0	107.6	
Diameter - inches	1.38	1.38	1.37	
Height - inches	2.80	2.80	2.79	
AT TEST				
Final Moisture - %	26.4	21.5	18.9	
Dry Density - pcf	97.6	105.7	110.9	
Calculated Diameter (in.)	1.36	1.37	1.36	
Height - inches	2.73	2.76	2.75	
Effect. Cell Pressure - psi	8.0	16.0	32.0	
Failure Stress - psi	20.47	24.48	34.37	
Total Pore Pressure - psi	53.3	59.4	69.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.2	3.5	3.2	
σ_1' Failure - psi	25.19	31.05	47.15	
σ_3' Failure - psi	4.72	6.57	12.78	

TEST DESCRIPTION

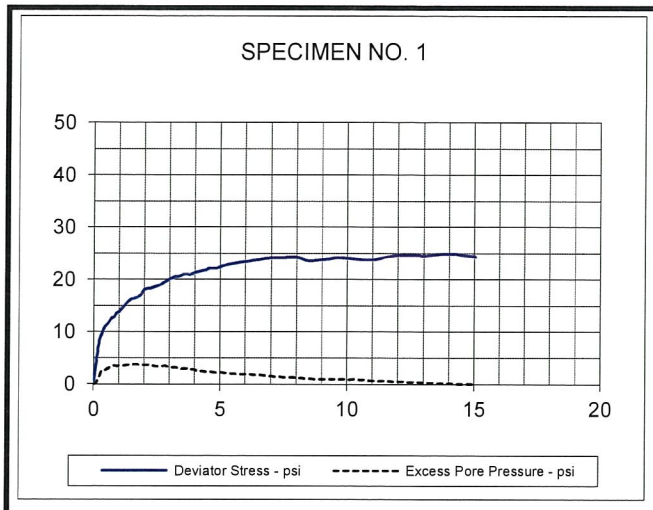
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B004, S8, 19.0-21.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 32 PL: 18 PI: 14 Percent -200: 76
REMARKS: Specimens trimmed to 1.4" diameter.

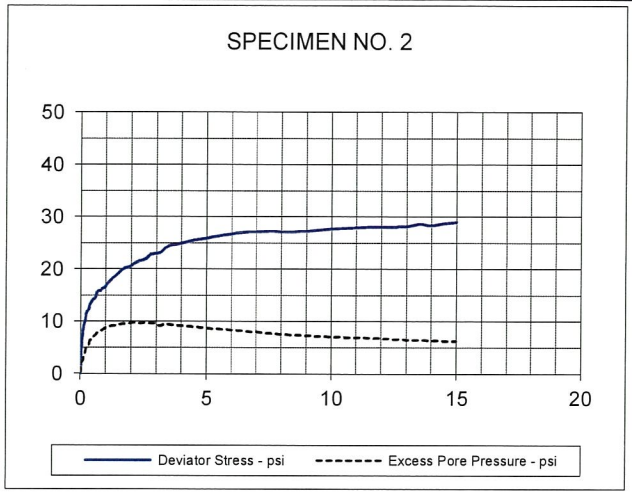
PROJECT INFORMATION

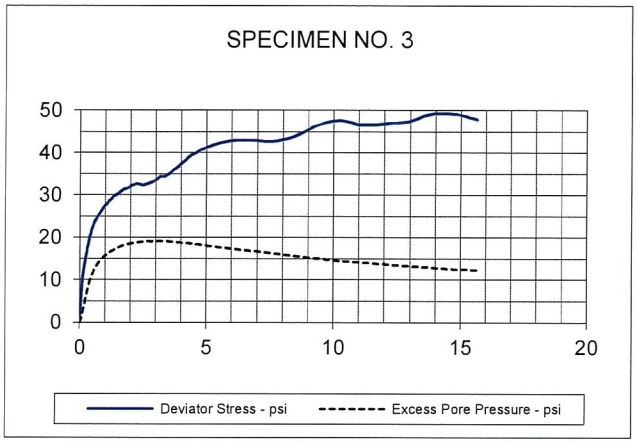
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

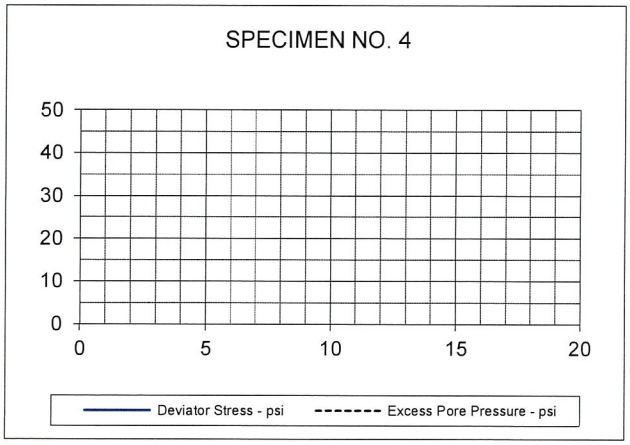
TERRACON

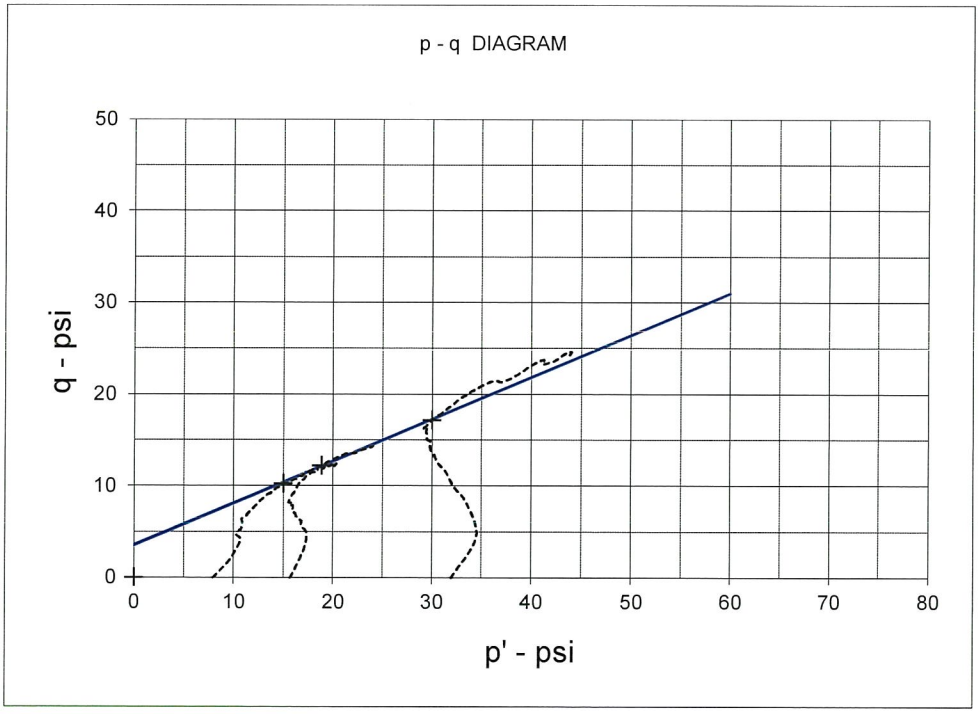
Foundation Crust







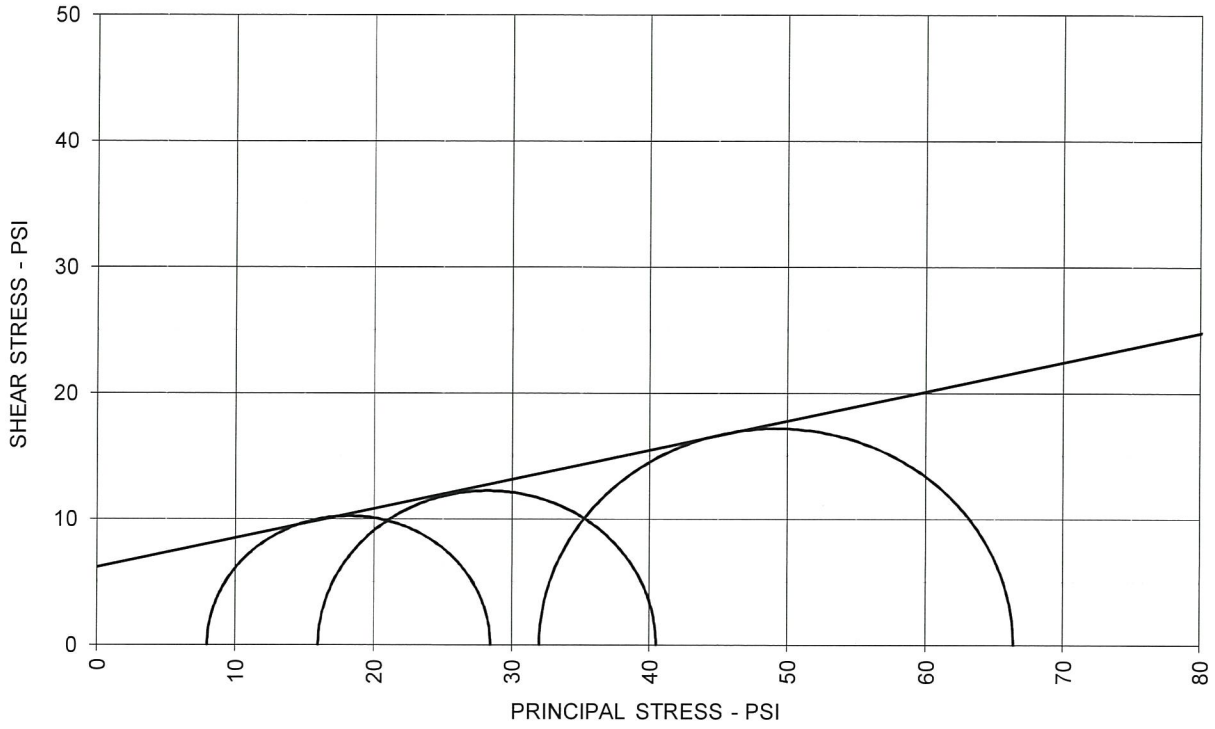




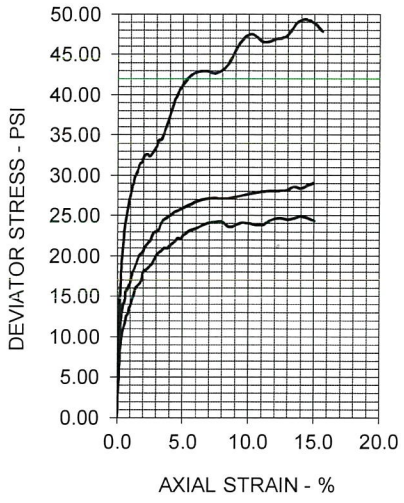
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 24.6	a (psi) = 3.5
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Lean Clay with Sand (CL)			

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 13.1 deg	c = 6.2 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	24.7	20.1	19.9	
Dry Density - pcf	97.2	104.0	107.6	
Diameter - inches	1.38	1.38	1.37	
Height - inches	2.80	2.80	2.79	
AT TEST				
Final Moisture - %	26.4	21.5	18.9	
Dry Density - pcf	97.6	105.7	110.9	
Calculated Diameter (in.)	1.36	1.37	1.36	
Height - inches	2.73	2.76	2.75	
Effect. Cell Pressure - psi	8.0	16.0	32.0	
Failure Stress - psi	20.47	24.48	34.37	
Total Pore Pressure - psi	53.3	59.4	69.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.2	3.5	3.2	
σ_1 Failure - psi	28.47	40.48	66.37	
σ_3 Failure - psi	8.00	16.00	32.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B004, S8, 19.0-21.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 32 PL: 18 PI: 14 Percent -200: 76
REMARKS: Specimens trimmed to 1.4" diameter.

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	Atterberg Limits PL	Atterberg Limits PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B005	S1	1.0	2.5	9.8														
	Color		Brown and gray with dark brown							**Visual Classification**			FILL: Lean clay with fine to coarse sand					
	S2	3.5	5.0	29.2														
	Color		Brown and gray							**Visual Classification**			Fat clay					
	S3	6.0	8.0	23.9	102.5	35	23	12		Note*		Note*				Note*	Note*	CL
	Color		Grayish brown							**Visual Classification**			Lean clay, trace sand					
	S4	8.0	10.0	24.2	101.9	38	22	16						Note*				
	Color		Grayish brown							**Visual Classification**			Lean clay with sand					
	S5	13.5	15.0	21.9														
	Color		Brown and gray							**Visual Classification**			Lean clay with fine to medium sand, trace fine gravel					
	S6	16.0	18.0	13.8	122.4	22	14	8	** Sieve									
	Color		Brown and gray							**Visual Classification**			Clayey sand, trace fine gravel					
	S7	18.5	20.0	10.2														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S8	23.5	25.0	6.7		20	13	7										
	Color		Brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S9	28.5	30.0	27.7														
	Color		Brownish gray							**Visual Classification**			Lean to fat shaley clay, trace silt seams					
	S10	33.5	35.0	7.7														
	Color		Brown							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S11	38.5	40.0	7.8														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S12	43.5	45.0	9.5														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					
	S12A	42.0	43.5	8.2														
	Color		Brown and gray							**Visual Classification**			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B005	S13	52.0	53.5	17.5	110.3	36	18	18										
	Color		Brown							**Visual Classification**			Lean clay, trace fine sand					
	S14	62.0	63.5	16.6					** Sieve		2.748							
	Color		Brown and gray							**Visual Classification**			Sandy lean clay					
	S15A	72.0	72.5	15.2														
	Color		Gray							**Visual Classification**			Shaley lean clay, trace fine gravel					
	S15B	72.5	73.0	8.4														
	Color		Gray							**Visual Classification**			Sandy shaley lean clay, trace fine gravel					
												Rock Unconf. Comp.						
	RUN #1	75.9	76.5	1.0	162.0							6503 psi						
	Color		Gray							**Visual Classification**			Limestone					
	RUN #1	78.0	79.6															
	Color									**Visual Classification**								
	RUN #2	80.8	81.6															
	Color									**Visual Classification**								
	RUN #2	83.0	83.6	8.4	107.3							NA						
	Color		Dark gray							**Visual Classification**			Shale					

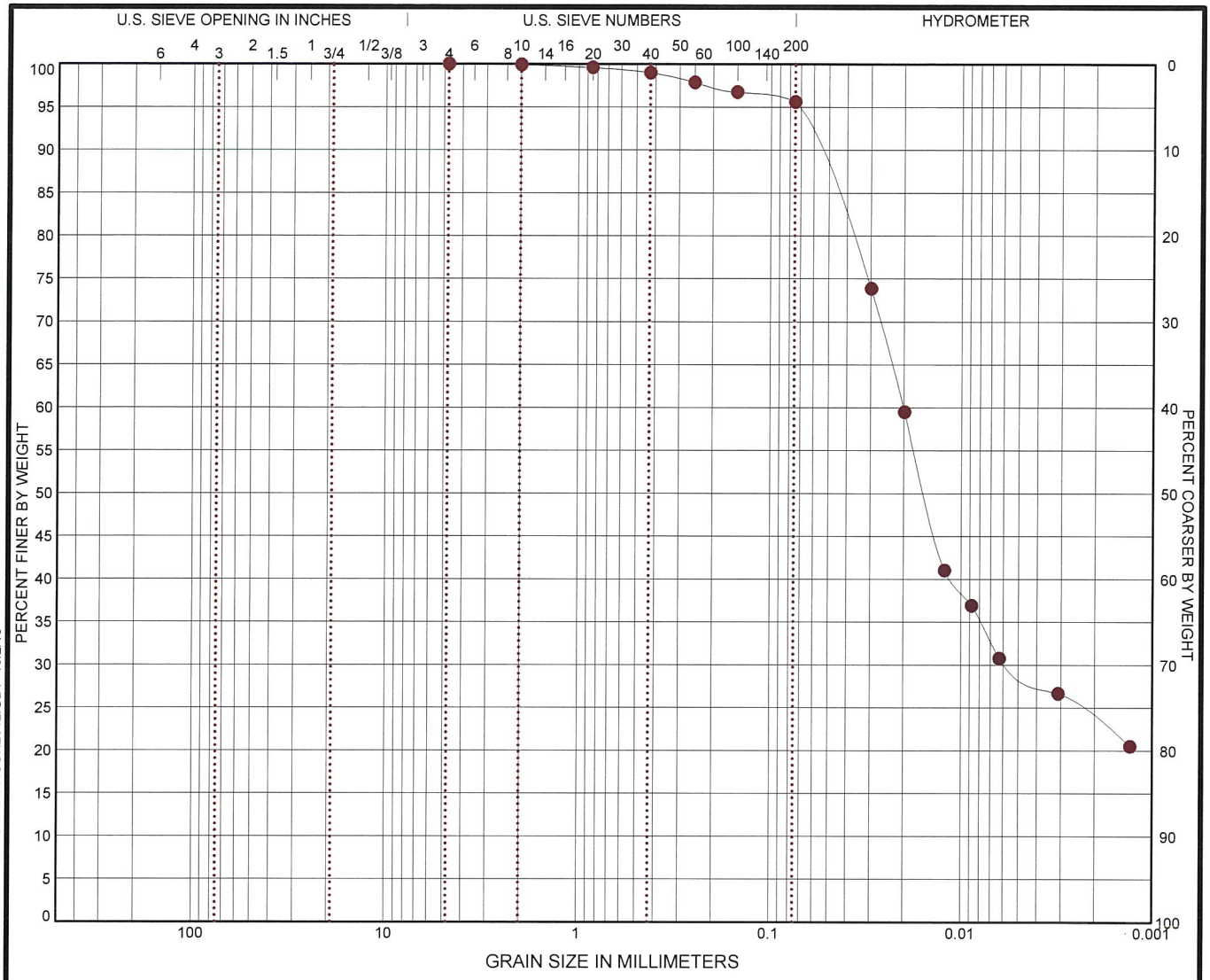
TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B005**	**6**	**0.0**	**0.0**	**4.4**	**66.2**		**29.4**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.02**
D_{30}	**0.006**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	**100.0**
#10	**99.91**
#20	**99.57**
#40	**98.97**
#60	**97.84**
#100	**96.73**
#200	**95.59**

SOIL DESCRIPTION
● LEAN CLAY(CL)

REMARKS
● Dispersion: 18.39%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 10/2/15

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project :	Dynegy-Kincaid						
Date:	9/30/2015	Panel Number :	P-1				
Project No. :	15151122	Permometer Data					
Boring No.:	B005	a_p =	0.031416 cm^2	Set Mercury to Pipet Rp at beginning	Equilibrium	1.6	cm^3
Sample:	S3	a_a =	0.767120 cm^2		Pipet **Rp**	**16.1**	cm^3
Depth (ft):	6.0-8.0	M_1 =	0.030180	C = 0.0004023	Annulus **Ra**	1.0	cm^3
Other Location:	Tube	M_2 =	1.040953	T = 0.0689682			
Material Description :	Grayish Brown Silty Clay						

SAMPLE DATA

					Before Test		After Test	
Wet Wt. sample + ring or tare :			559.64	g				
Tare or ring Wt. :			0.0	g				
Wet Wt: of Sample :			559.64	g	Tare No.:	328	Tare No.:	299
Diameter :	2.83	in	7.18	cm^2	Wet Wt.+tare:	118.39	Wet Wt.+tare:	101.15
Length :	2.67	in	6.79	cm	Dry Wt.+tare:	99.39	Dry Wt.+tare:	85.82
Area:	6.27	in^2	40.44	cm^2	Tare Wt:	20.23	Tare Wt:	21.16
Volume :	16.76	in^3	274.66	cm^3	Dry Wt.:	79.16	Dry Wt.:	64.66
Unit Wt.(wet):	**127.15**	pcf	**2.04**	$g/cm^{\wedge 3}$	Water Wt.:	19	Water Wt.:	15.33
Unit Wt.(dry):	**102.54**	pcf	**1.64**	$g/cm^{\wedge 3}$	% moist.:	**24.0**	% moist.:	**23.7**

Assumed Specific Gravity: **2.70** Max Dry Density(pcf) = _____ OMC = _____

% of max = _____ +/- OMC = _____

Calculated % saturation: 99.41 Void ratio (e) = **0.64** Porosity (n)= **0.39**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.1 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)	Reset = *
9/28/2015	60	14.7	1.399446	21	0.977	6.65E-07	1.88E-03	
9/28/2015	120	13.8	2.299446	21	0.977	5.65E-07	1.60E-03	
9/28/2015	180	13	3.099446	21	0.977	5.25E-07	1.49E-03	
9/28/2015	240	12.3	3.799446	21	0.977	4.98E-07	1.41E-03	

SUMMARY

k_a =	5.63E-07	cm/sec		Acceptance criteria =	50	%
ki			Vm			
k1 =	6.65E-07	cm/sec	18.0	%	Vm = $\frac{\lvert ka-ki \rvert}{ka}$	x 100
k2 =	5.65E-07	cm/sec	0.4	%		
k3 =	5.25E-07	cm/sec	6.8	%		
k4 =	4.98E-07	cm/sec	11.7	%		

Hydraulic conductivity	k =	**5.63E-07**	cm/sec	**1.60E-03**	ft/day
Void Ratio	e =	**0.64**			
Porosity	n =	**0.39**			
Bulk Density	γ =	**2.04**	g/cm^3	**127.1**	pcf
Water Content	W =	**0.40**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**5.77E-12**	cm^2	(at 20 deg C)	

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B005	S3	6.0-8.0 feet

2 MIN

GRADE: 2

DISPERSIVE CLASSIFICATION: INTERMEDIATE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

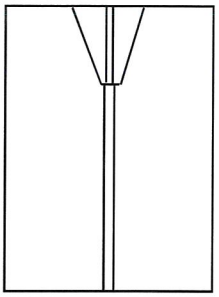
rade 1 - Nondispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Highly Dispersive

Terracon

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B005, S3, 6.0-8.0 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 24.0%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Grayish Brown Silty Clay

FINAL HOLE
1.0 mm



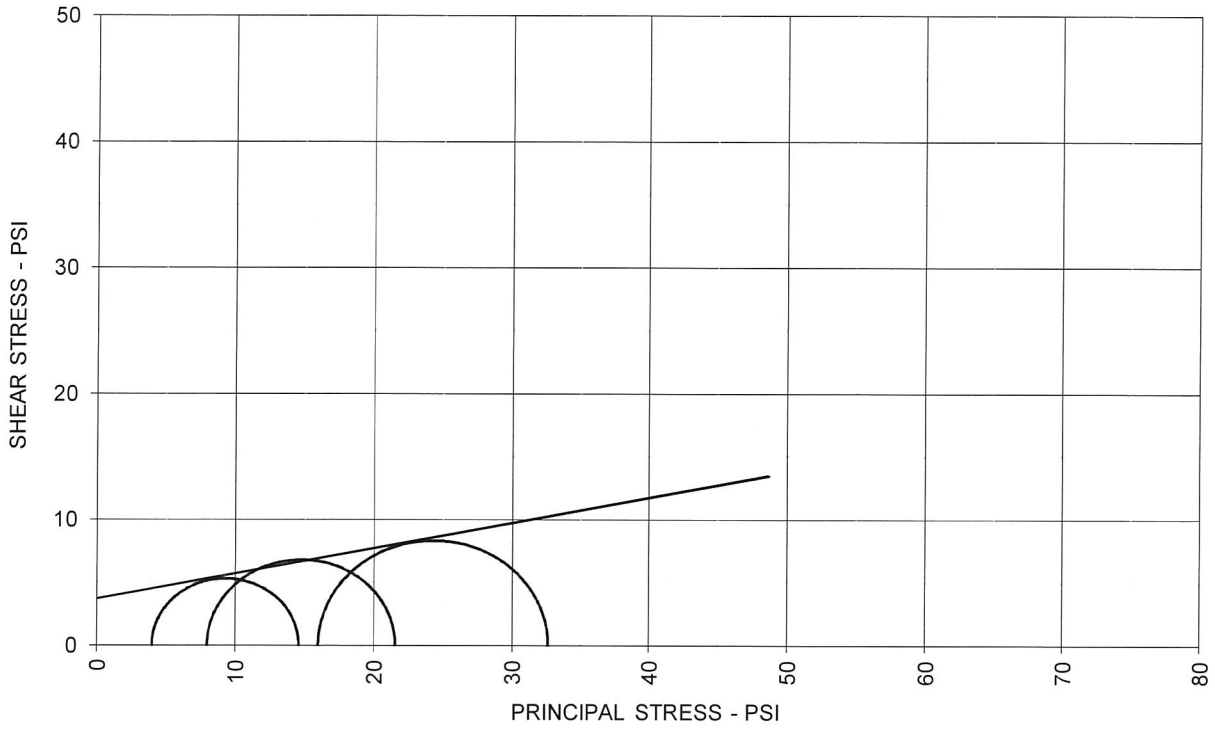
TIME, min	HEAD, inch	FLOW, ml	FLOW, sec	FLOW RATE, ml/sec	TURBIDITY FROM SIDE: VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR	CLEAR FROM TOP	REMARKS
1	2	8.0	15	0.53						X	X	
2	2	8.5	15	0.57						X	X	
3	2	8.0	15	0.53						X	X	
4	2	9.0	15	0.60						X	X	
5	2	8.0	15	0.53						X	X	
6	2	8.0	15	0.53						X	X	
7	2	9.0	15	0.60						X	X	
8	2	9.5	15	0.63						X	X	
9	2	9.5	15	0.63						X	X	
10	2	9.5	15	0.63						X	X	
1	7	18.0	15	1.20						X	X	
2	7	18.5	15	1.23						X	X	
3	7	19.0	15	1.27						X	X	
4	7	19.0	15	1.27						X	X	
5	7	19.0	15	1.27						X	X	
1	15	27.0	15	1.80						X	X	
2	15	26.0	15	1.73						X	X	
3	15	26.0	15	1.73						X	X	
4	15	26.0	15	1.73						X	X	
5	15	26.0	15	1.73						X	X	
1	40	115.0	30	3.83					X			
2	40	118.0	30	3.93					X			
3	40	120.0	30	4.00					X			
4	40	120.0	30	4.00					X			
5	40	120.0	30	4.00					X			

CLASSIFICATION = **ND2**

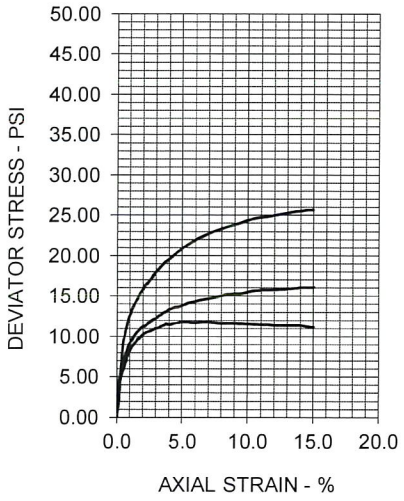
Terracon

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135, Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 11.4 deg	c = 3.7 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	25.3	23.9	23.4	
Dry Density - pcf	100.1	101.8	104.0	
Diameter - inches	1.99	1.99	1.98	
Height - inches	4.00	3.99	4.00	
AT TEST				
Final Moisture - %	24.7	23.7	21.7	
Dry Density - pcf	100.1	102.0	105.5	
Calculated Diameter (in.)	1.97	1.98	1.96	
Height - inches	3.96	3.96	3.96	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	10.59	13.57	16.65	
Total Pore Pressure - psi	51.1	52.8	59.6	
Strain Rate - inches/min.	0.00040	0.00040	0.00040	
Failure Strain - %	2.4	4.4	2.4	
σ_1 Failure - psi	14.59	21.57	32.65	
σ_3 Failure - psi	4.00	8.00	16.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Clay with Sand
SAMPLE LOCATION: KIN-B005, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 38 PL: 22 PI: 16 Percent -200: X
REMARKS: Specimens trimmed to 2.0" diameter.

PROJECT INFORMATION

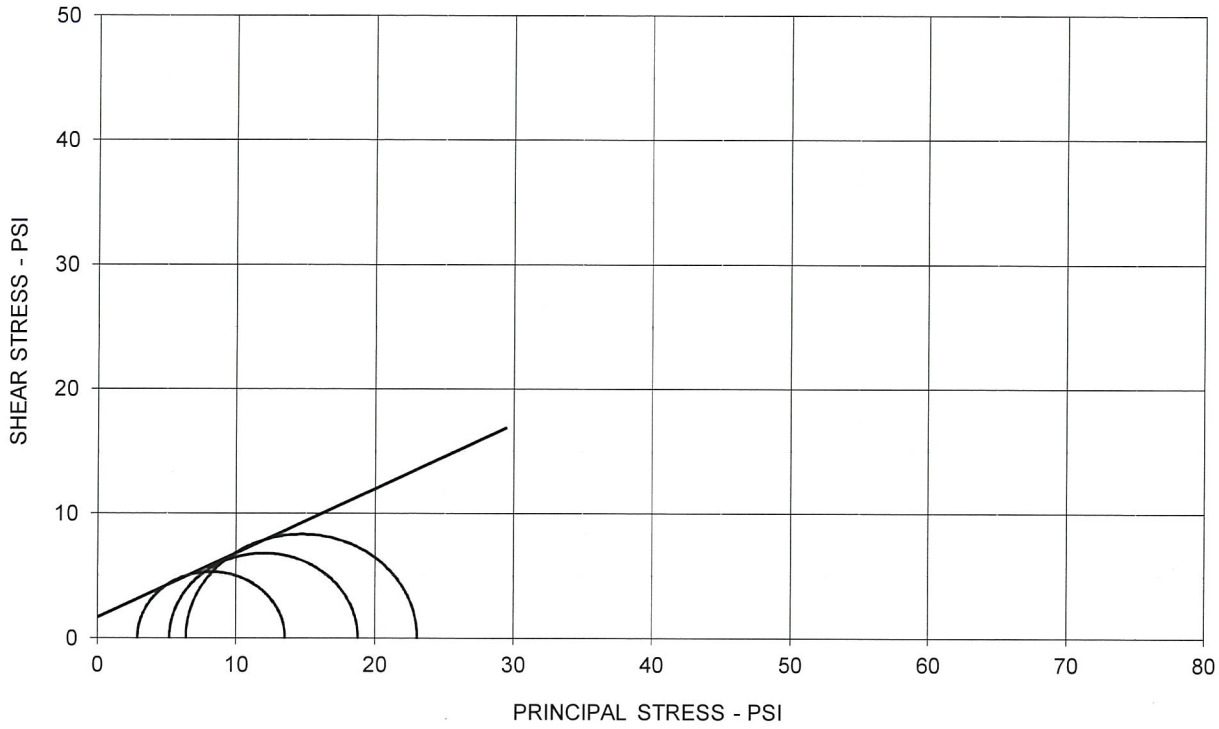
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

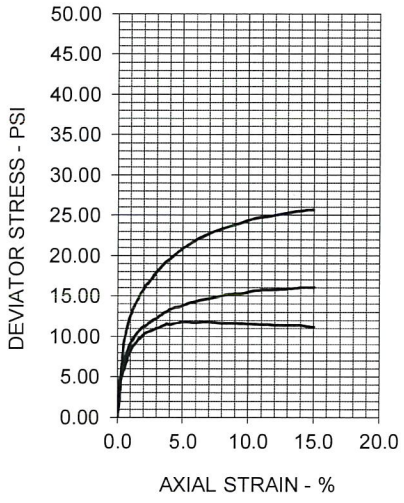
Embankment

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS	ϕ' = 27.4 deg	c' = 1.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	25.3	23.9	23.4	
Dry Density - pcf	100.1	101.8	104.0	
Diameter - inches	1.99	1.99	1.98	
Height - inches	4.00	3.99	4.00	
AT TEST				
Final Moisture - %	24.7	23.7	21.7	
Dry Density - pcf	100.1	102.0	105.5	
Calculated Diameter (in.)	1.97	1.98	1.96	
Height - inches	3.96	3.96	3.96	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	10.59	13.57	16.65	
Total Pore Pressure - psi	51.1	52.8	59.6	
Strain Rate - inches/min.	0.00040	0.00040	0.00040	
Failure Strain - %	2.4	4.4	2.4	
σ_1' Failure - psi	13.49	18.77	23.04	
σ_3' Failure - psi	2.90	5.20	6.39	

TEST DESCRIPTION

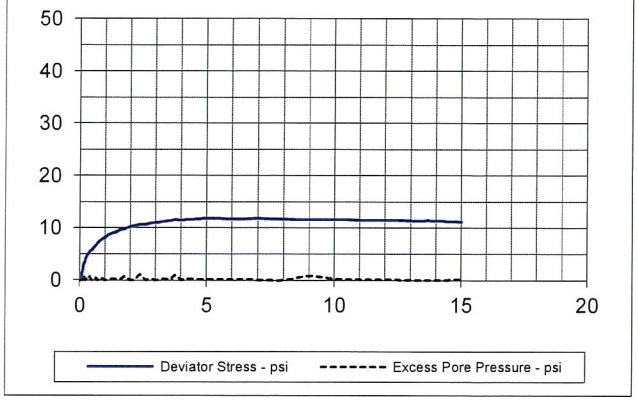
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Clay with Sand
SAMPLE LOCATION: KIN-B005, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 38 PL: 22 PI: 16 Percent -200: X
REMARKS: Specimens trimmed to 2.0" diameter.

PROJECT INFORMATION

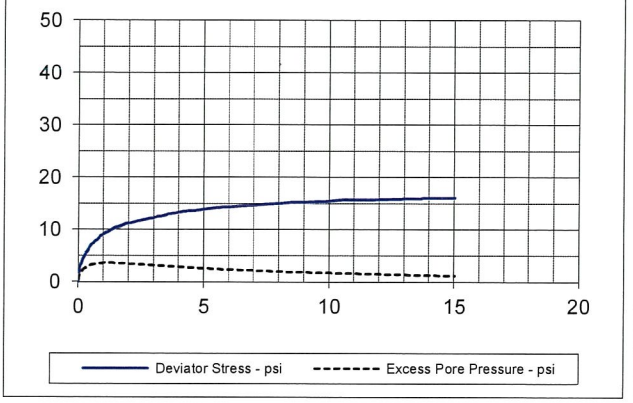
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

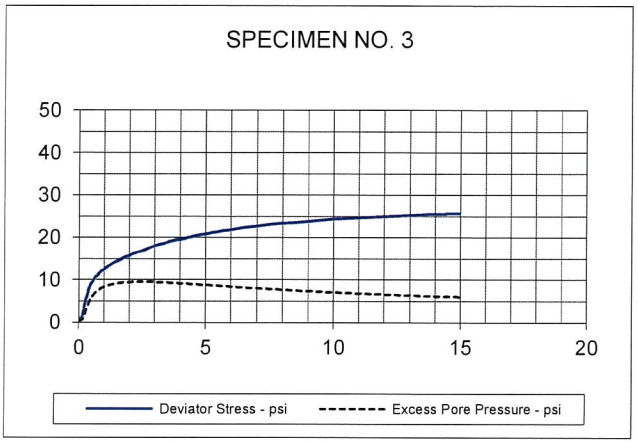
SPECIMEN NO. 1



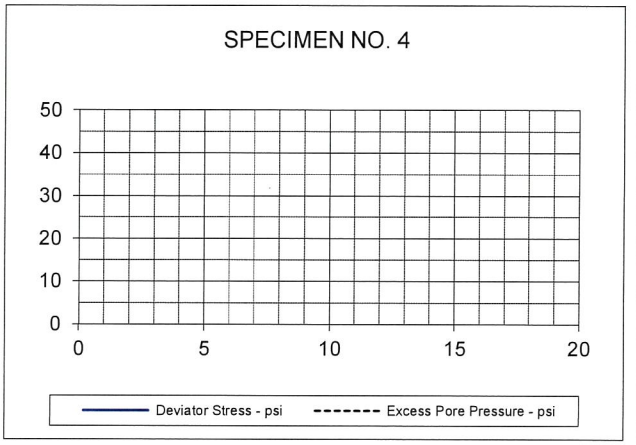
SPECIMEN NO. 2



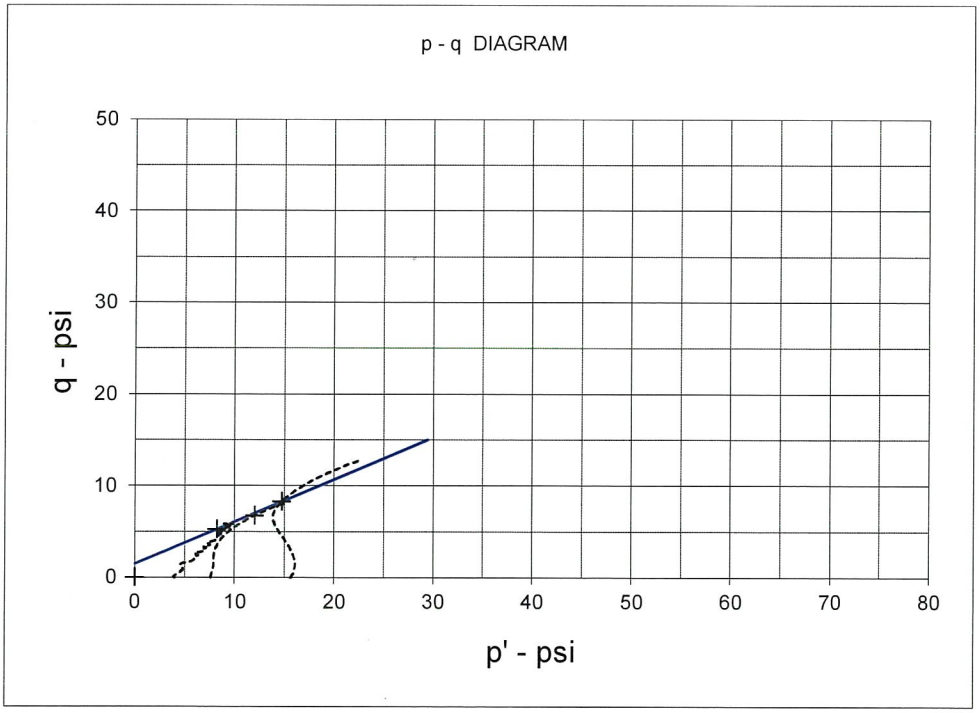
SPECIMEN NO. 3



SPECIMEN NO. 4

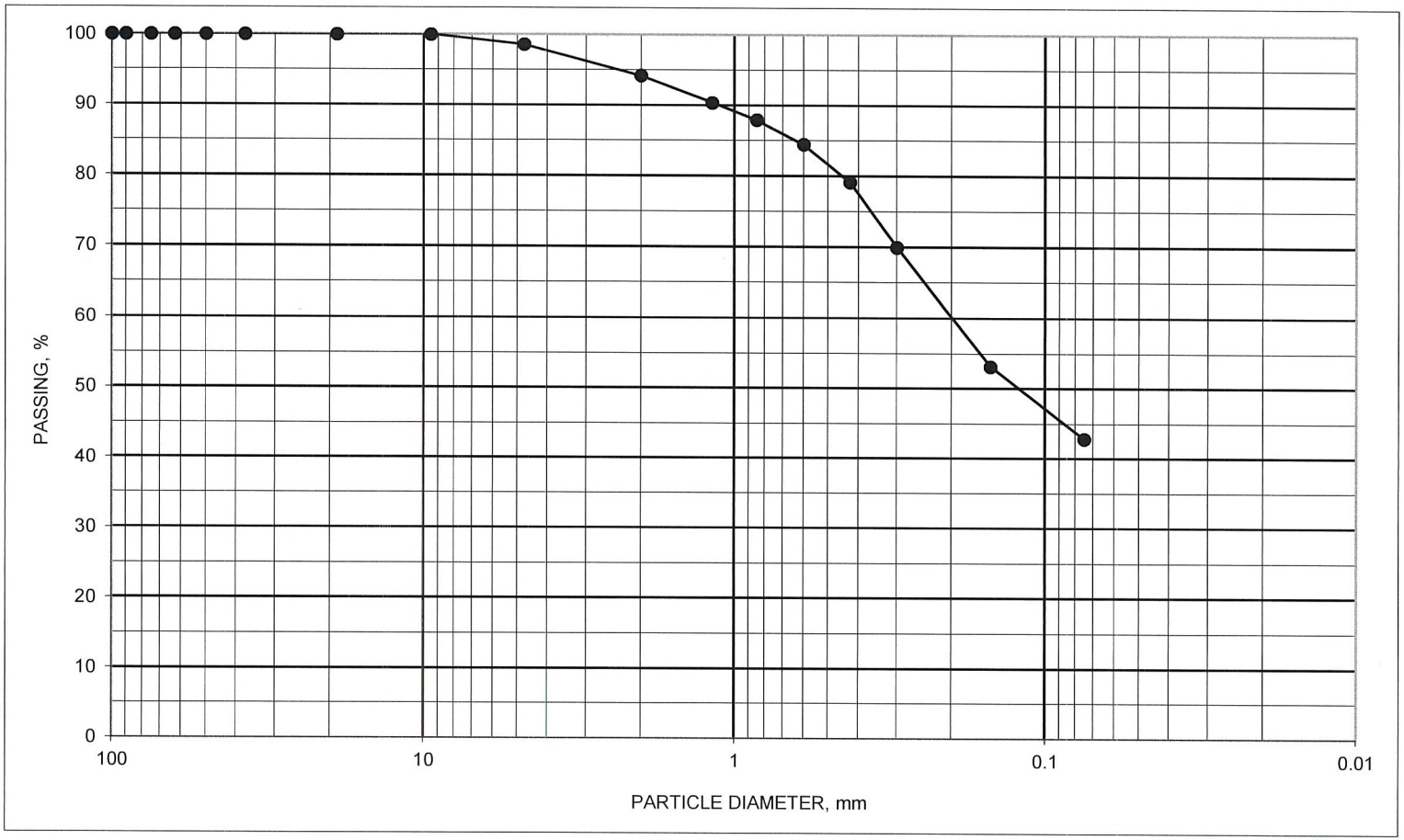


p - q DIAGRAM



EFFECTIVE STRESS PARAMETERS	R^2 = 0.99	α (deg) = 24.7	a (psi) = 1.4
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Grayish Brown Clay with Sand			

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	99
#10	2.00	94
#16	1.18	90
#20	0.85	88
#30	0.600	84
#40	0.425	79
#50	0.300	70
#100	0.150	53
#200	0.075	42.8
	D60	0.1989



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB005	S-6	16 TO 18	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

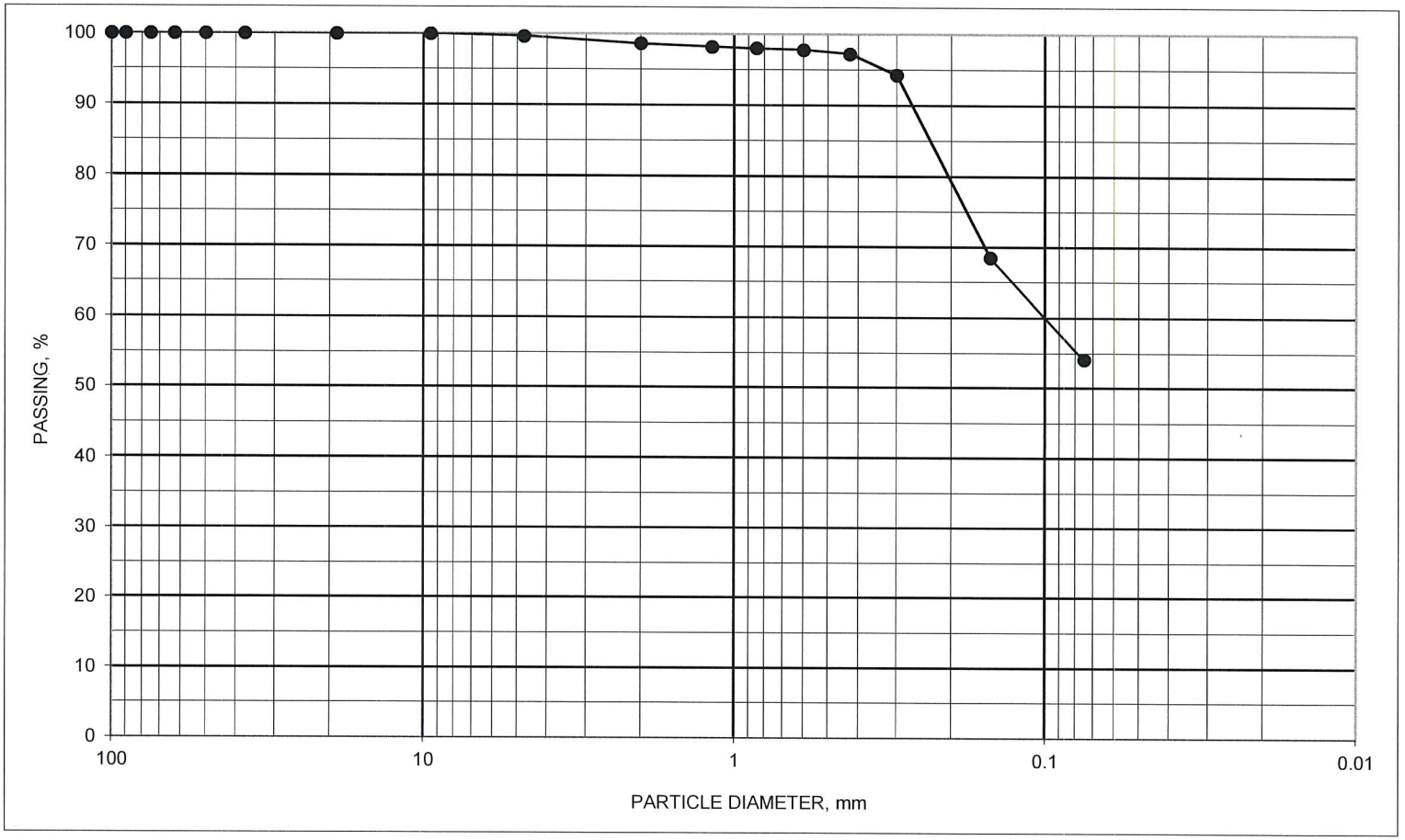
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B005 S-6.xlsx]REPORT

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	99
#16	1.18	98
#20	0.85	98
#30	0.600	98
#40	0.425	97
#50	0.300	94
#100	0.150	68
#200	0.075	54.1
	D60	0.0998



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB005	S-14	62 TO 63.5	Sandy lean clay Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B005 S-14.xlsx]REPORT

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B006	S1	1.0	2.5	34.2					** Sieve		2.653							
	Color	Brown and black								**Visual Classification**	FILL: Cinders with clayey silt							
	S2	3.5	5.0	71.4														
	Color	Brown with black								**Visual Classification**	FILL: Lean clay with cinders							
	S3			NO RECOVERY														
	Color									**Visual Classification**								
	S4	8.0	10.5															
	Color	No testing assigned								**Visual Classification**	PISTON SAMPLE: ASH							
	S5	12.0	13.5	48.0					** Sieve									
	Color	Dark brown and gray								**Visual Classification**	FILL: Sandy lean clay with organics							
	S6	13.5	16.0															
	Color	No testing assigned								**Visual Classification**	PISTON SAMPLE: ASH							
	S7	17.0	18.5	38.5					** Sieve									
	Color	Dark brown								**Visual Classification**	FILL: Cinders with organics and clay							
	S8	20.0	22.0	NO RECOVERY														
	Color									**Visual Classification**	PISTON SAMPLE - NO RECOVERY							
	S9	22.0	24.5															
	Color	Not at lab - No testing assigned								**Visual Classification**	PISTONE SAMPLE: ASH							
	S10	28.5	30.0	30.4		36	21	15			2.742							
	Color	Brown and gray								**Visual Classification**	Lean clay, trace fine sand							
	S11	33.5	35.0	28.2														
	Color	Brown and gray								**Visual Classification**	Fat clay							
	S12	37.0	39.0															
	Color	No testing assigned								**Visual Classification**								

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

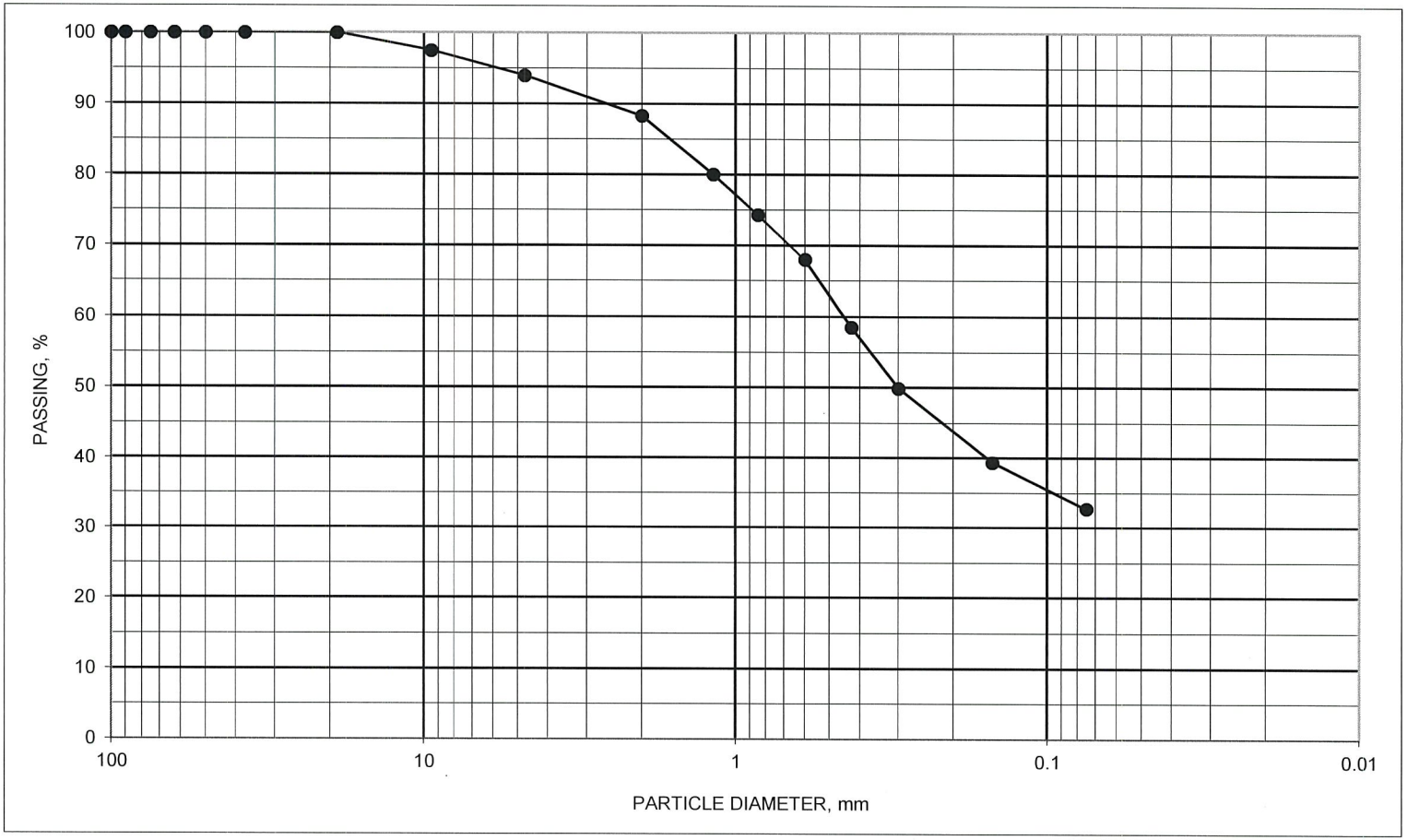
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B006	S13	39.0	41.0															
	Color		No testing assigned							Visual Classification								

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	98
#4	4.8	94
#10	2.00	88
#16	1.18	80
#20	0.85	74
#30	0.600	68
#40	0.425	58
#50	0.300	50
#100	0.150	39
#200	0.075	32.7
	D60	0.4490



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB006	S-1	1 TO 2.5	Cinders with clayey silt Brown and black	#VALUE!				

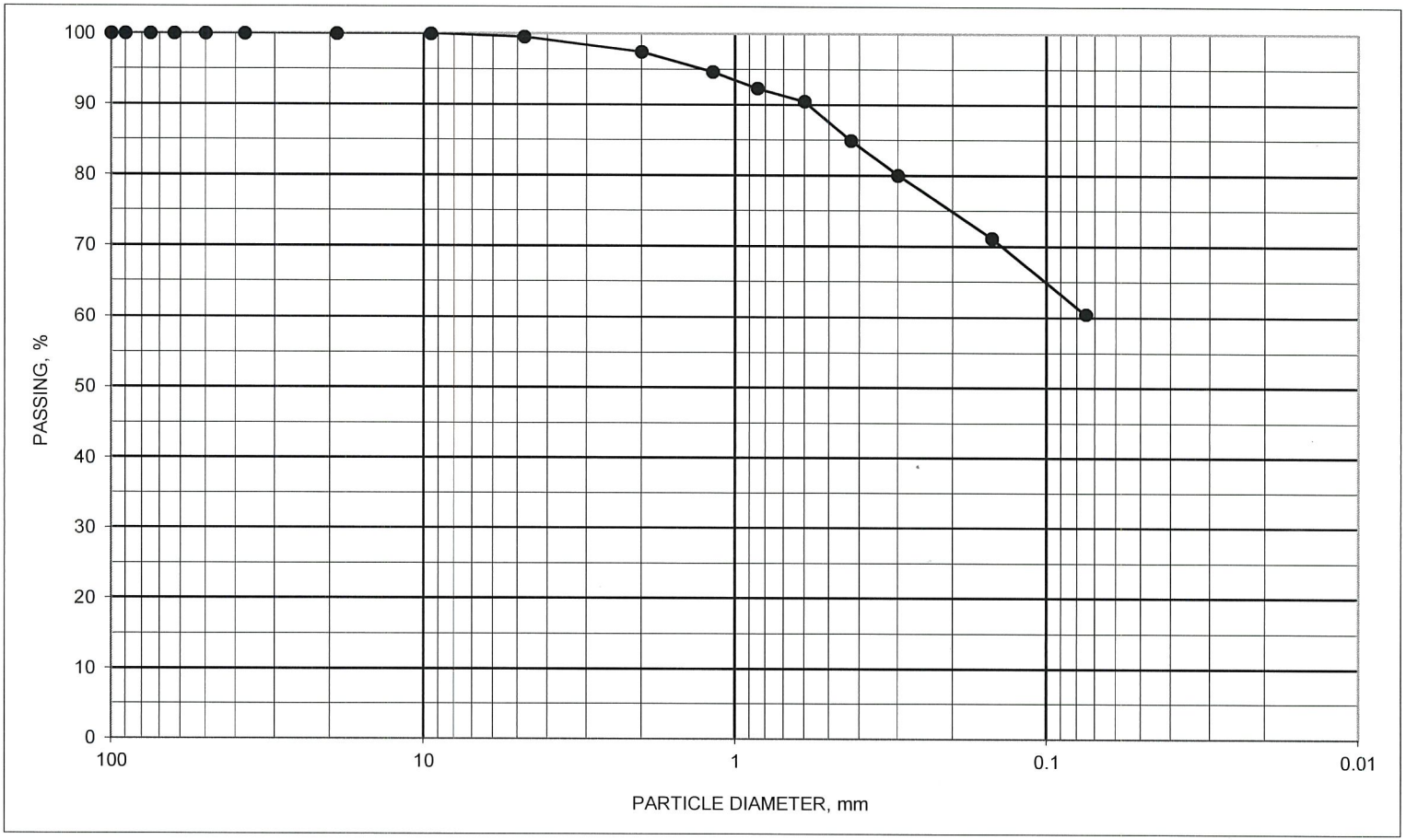
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B006 S-1.xlsx]REPORT

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	100
#10	2.00	97
#16	1.18	95
#20	0.85	92
#30	0.600	90
#40	0.425	85
#50	0.300	80
#100	0.150	71
#200	0.075	60.5



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB006	S-5	12 TO 13.5	FILL: Sandy lean clay with organics Dark brown and gray	#VALUE!				

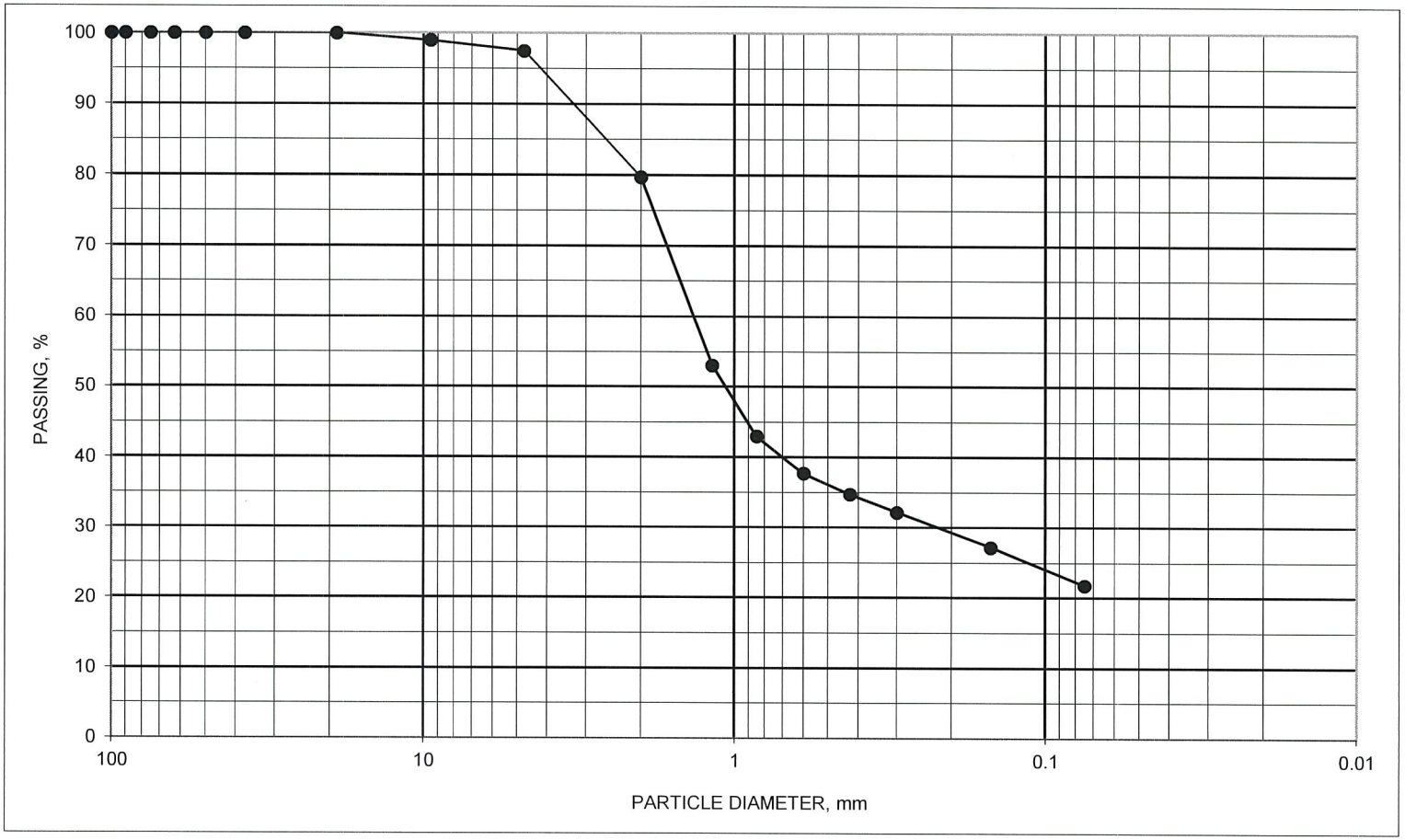
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B006 S-5.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	98
#10	2.00	80
#16	1.18	53
#20	0.85	43
#30	0.600	38
#40	0.425	35
#50	0.300	32
#100	0.150	27
#200	0.075	21.8
	D60	1.3539
	D30	0.2218



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB006	S-7	17 TO 18.5	FILL: Cinders with organics and clay Dark brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B006 S-7.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B007	S1	1.0	2.5	5.5														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.5	5.0	8.0														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S3	6.0	7.5	20.8														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.0	6.2														
	Color		Brown and dark brown (ORGANIC CONTENT = 3.9%)							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S5	13.5	15.0	15.0														
	Color		Brown and dark brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S6	16.0	18.0			35	20	15				Note*		Note*				
	Color		Green, brown, and gray							**Visual Classification**			Lean clay with sand					
	S7	18.5	20.0	10.3														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S8	23.5	25.0	24.9														
	Color		Brown and gray with dark gray							**Visual Classification**			FILL: lean to fat clay with fine to medium sand, trace fine gravel					
	S9	25.0	27.0											Note*				
	Color		Grayish brown							**Visual Classification**			Silty clay					
	S10	27.0	29.0	10.8														
	Color		TUBE TO FUGRO							**Visual Classification**								
	S11	33.0	35.0															
	Color		TUBE TO FUGRO							**Visual Classification**								
	S12	35.0	37.0	X	X	X	X	X	**Sieve	X					X	X	X	
	Color		ON HOLD							**Visual Classification**								

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B007	S13	38.5	40.0	13.8														
	Color		Brown							Visual Classification			Clayey sand, trace fine gravel					
	S14	43.5	45.0	11.2		27	14	13	**Sieve									
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S15	48.5	50.0	7.7														
	Color		Brownish gray							Visual Classification			Sandy lean clay, trace fine gravel					
	Color									Visual Classification								

TESTED BY: _____
APPROVED BY: _____

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

Terracon

HYDRAULIC CONDUCTIVITY DETERMINATION
FLEXIBLE WALL PERMEAMETER - CONSTANT VOLUME
(Mercury Permometer Test)

Project :	Dynegy-Kincaid							
Date:	9/30/2015	Panel Number : P-1						
Project No. :	15151122	Permometer Data						
Boring No.:	B007	a_p =	0.031416	cm^2	Set Mercury to Pipet Rp at beginning	Equilibrium	1.6	cm^3
Sample:	S6	a_a =	0.767120	cm^2		Pipet **Rp**	**16.8**	cm^3
Depth (ft):	16.0-18.0	M_1 =	0.030180	C = 0.0017006		Annulus **Ra**	1.0	cm^3
Other Location:	Tube	M_2 =	1.040953	T = 0.0658646				

Material Description : Greenish Gray and Brown Clay with Sand

SAMPLE DATA

					Before Test		After Test	
Wet Wt. sample + ring or tare :			144.80	g				
Tare or ring Wt. :			0.0	g				
Wet Wt: of Sample :			144.80	g	Tare No.:	215	Tare No.:	123
Diameter :	1.41	in	3.57	cm^2	Wet Wt.+tare:	93.56	Wet Wt.+tare:	102.39
Length :	2.80	in	7.11	cm	Dry Wt.+tare:	81.86	Dry Wt.+tare:	89.97
Area:	1.55	in^2	10.02	cm^2	Tare Wt:	21.00	Tare Wt:	31.26
Volume :	4.35	in^3	71.24	cm^3	Dry Wt.:	60.86	Dry Wt.:	58.71
Unit Wt.(wet):	**126.83**	pcf	**2.03**	$g/cm^{\wedge 3}$	Water Wt.:	11.7	Water Wt.:	12.42
Unit Wt.(dry):	**106.38**	pcf	**1.70**	$g/cm^{\wedge 3}$	% moist.:	**19.2**	% moist.:	**21.2**

Assumed Specific Gravity: **2.70** Max Dry Density(pcf) = OMC =
% of max = +/- OMC =
Calculated % saturation: 97.72 Void ratio (e) = **0.58** Porosity (n)= **0.37**

Test Pressures During Hydraulic Conductivity Test

Cell Pressure (psi) = 55.00 Back Pressure (psi) = 50.00 Confining Pressure = 5.00 psi

Note: The above value is Effective Confining Pressure

TEST READINGS

Z_1(Mercury Height Difference @ t_1): 15.8 cm Hydraulic Gradient = 28.00

Date	elapsed t (seconds)	Z (pipet @ t)	ΔZp (cm)	temp (deg C)	α (temp corr)	k (cm/sec)	k (ft./day)	Reset = *
9/28/2015	120	13.8	2.982666	21	0.977	3.03E-06	8.58E-03	
9/28/2015	240	11.9	4.882666	21	0.977	2.69E-06	7.61E-03	
9/28/2015	360	10.6	6.182666	21	0.977	2.41E-06	6.84E-03	
9/28/2015	480	9.7	7.082666	21	0.977	2.17E-06	6.16E-03	

SUMMARY

ka =	2.58E-06	cm/sec		Acceptance criteria =	50 %
ki			Vm		
k1 =	3.03E-06	cm/sec	17.6	%	Vm = $\frac{\lvert ka-ki \rvert}{ka} \times 100$
k2 =	2.69E-06	cm/sec	4.3	%	
k3 =	2.41E-06	cm/sec	6.3	%	
k4 =	2.17E-06	cm/sec	15.6	%	

Hydraulic conductivity	k =	**2.58E-06**	cm/sec	**7.30E-03**	ft/day
Void Ratio	e =	**0.58**			
Porosity	n =	**0.37**			
Bulk Density	γ =	**2.03**	g/cm^3	**126.8**	pcf
Water Content	W =	**0.33**	cm^3/cm^3	(at 20 deg C)	
Intrinsic Permeability	k_{int} =	**2.64E-11**	cm^2	(at 20 deg C)	

TRIAXIAL SHEAR TEST REPORT

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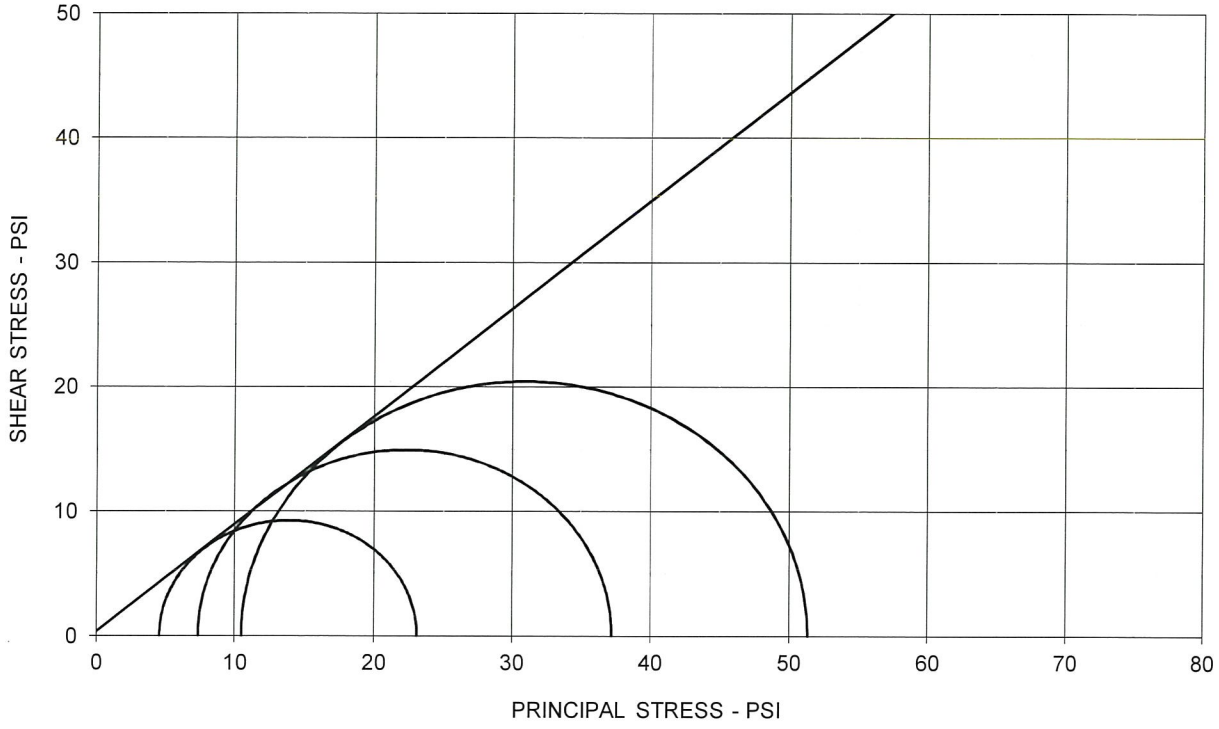
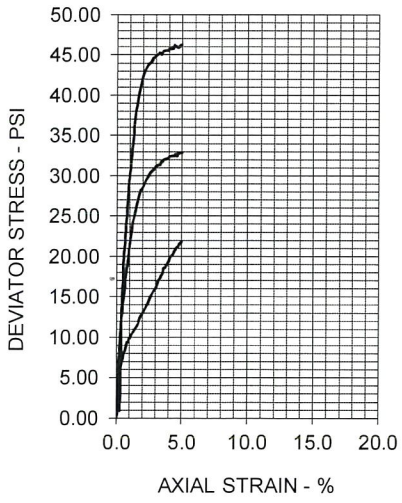


EFFECTIVE STRESS PARAMETERS	ϕ' = 40.9 deg	c' = 0.3 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	19.2	19.2	19.2	
Dry Density - pcf	106.2	106.2	106.2	
Diameter - inches	1.41	1.41	1.41	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %			11.8	
Dry Density - pcf	107.6	112.0	126.8	
Calculated Diameter (in.)	1.40	1.41	1.41	
Height - inches	2.78	2.80	2.81	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	18.51	29.87	40.88	
Total Pore Pressure - psi	52.9	57.6	69.5	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.6	2.4	1.8	
σ_1' Failure - psi	23.10	37.24	51.36	
σ_3' Failure - psi	4.59	7.37	10.48	

TEST DESCRIPTION

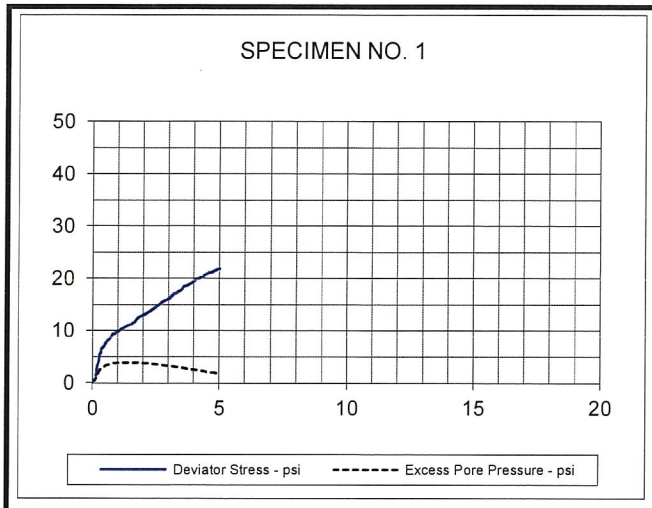
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Green, Brown, Gray Clay with Sand
SAMPLE LOCATION: KIN-B007, S6, 16.0-18.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 35 PL: 20 PI: 15 Percent -200: X
REMARKS: Multistage Triaxial

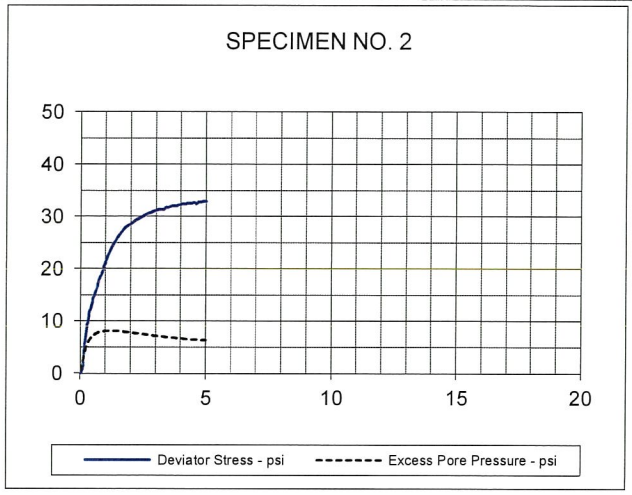
PROJECT INFORMATION

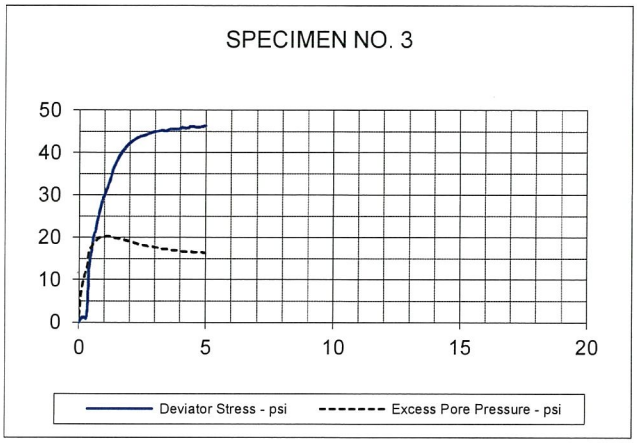
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

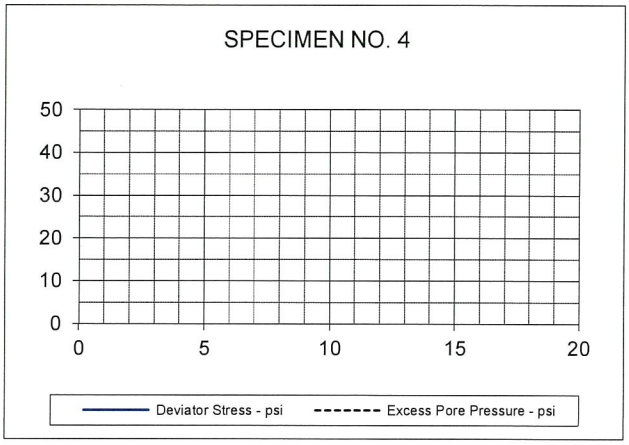
TERRACON

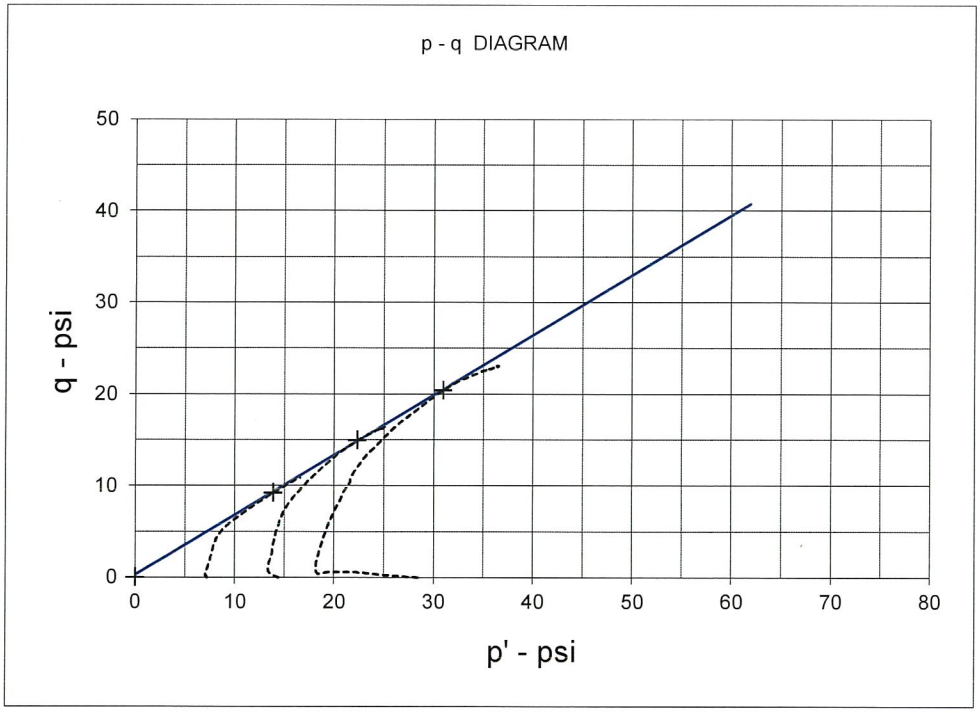
Embankment











EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 33.2	a (psi) = 0.2
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Green, Brown, Gray Clay with Sand			

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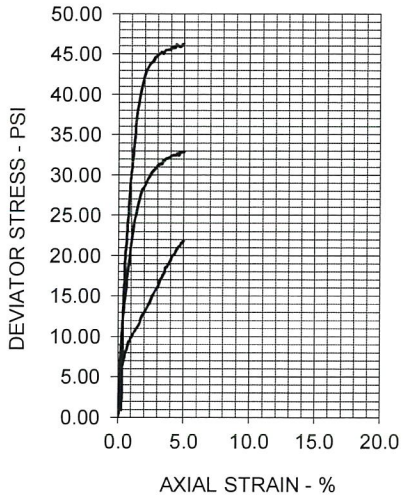
TOTAL STRESS PARAMETERS	ϕ = 19.1 deg	c = 4.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	19.2	19.2	19.2	
Dry Density - pcf	106.2	106.2	106.2	
Diameter - inches	1.41	1.41	1.41	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %			11.8	
Dry Density - pcf	107.6	112.0	126.8	
Calculated Diameter (in.)	1.40	1.41	1.41	
Height - inches	2.78	2.80	2.81	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	18.51	29.87	40.88	
Total Pore Pressure - psi	52.9	57.6	69.5	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	3.6	2.4	1.8	
σ_1 Failure - psi	26.01	44.87	70.88	
σ_3 Failure - psi	7.50	15.00	30.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Green, Brown, Gray Clay with Sand
SAMPLE LOCATION: KIN-B007, S6, 16.0-18.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 35 PL: 20 PI: 15 Percent -200: X
REMARKS: Multistage Triaxial

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

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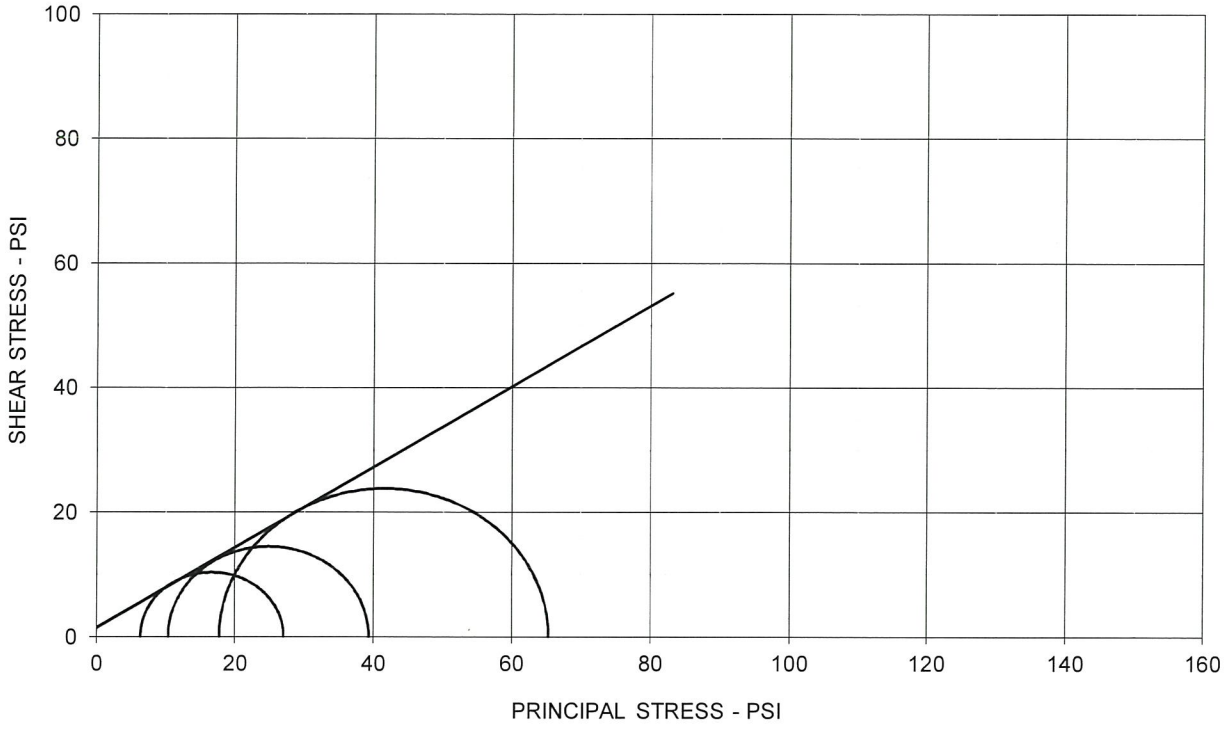
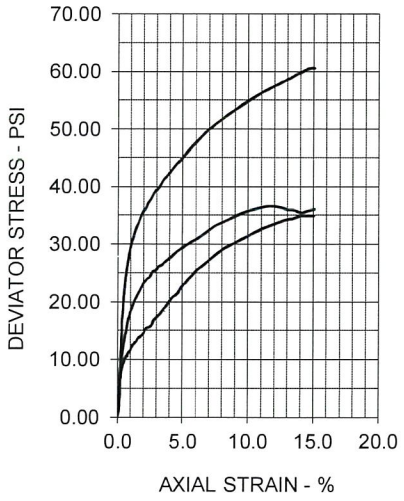


EFFECTIVE STRESS PARAMETERS	ϕ' = 32.9 deg	c' = 1.4 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.5	22.4	22.0	
Dry Density - pcf	102.1	103.2	102.3	
Diameter - inches	1.40	1.40	1.41	
Height - inches	2.80	2.79	2.80	
AT TEST				
Final Moisture - %	23.5	22.0	21.7	
Dry Density - pcf	102.4	104.7	105.5	
Calculated Diameter (in.)	1.39	1.39	1.40	
Height - inches	2.78	2.77	2.76	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	20.65	28.94	47.57	
Total Pore Pressure - psi	53.7	59.6	72.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	4.2	4.7	6.0	
σ_1' Failure - psi	26.99	39.31	65.33	
σ_3' Failure - psi	6.34	10.37	17.76	

TEST DESCRIPTION

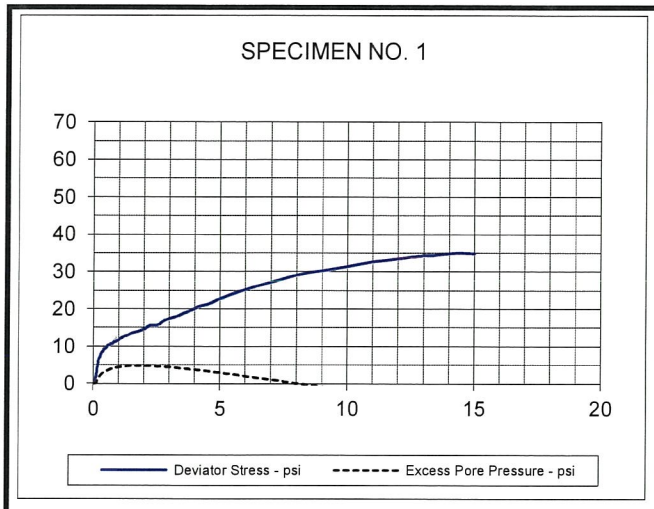
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Silty Clay
SAMPLE LOCATION: KIN-B007, S9, 25.0-27.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: X PL: X PI: X Percent -200: X
REMARKS: Specimens trimmed to 1.4" diameter.

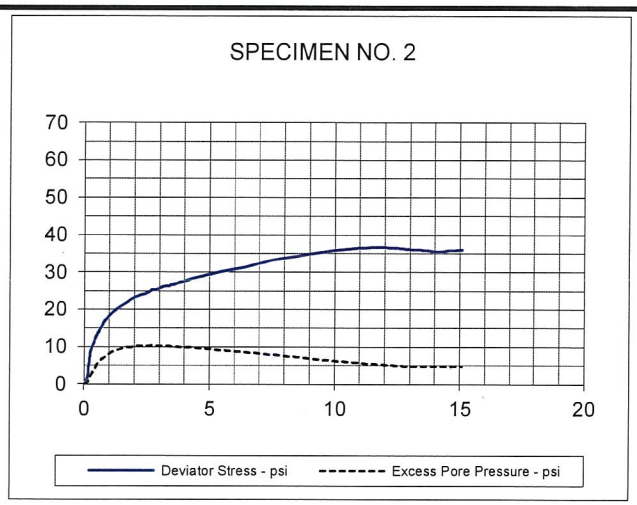
PROJECT INFORMATION

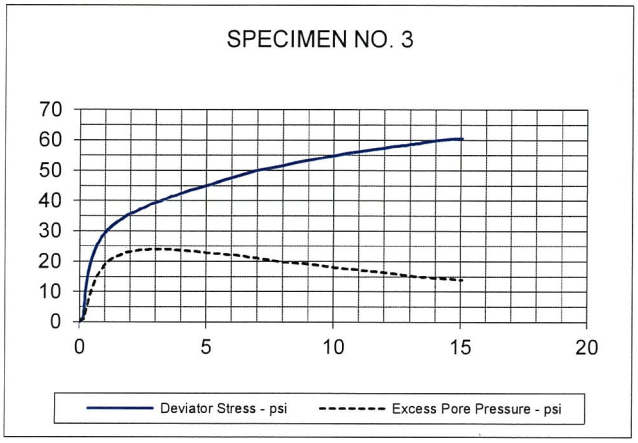
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/13/15

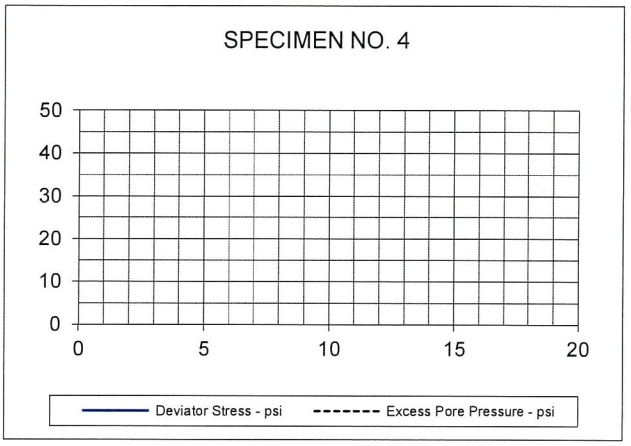
TERRACON

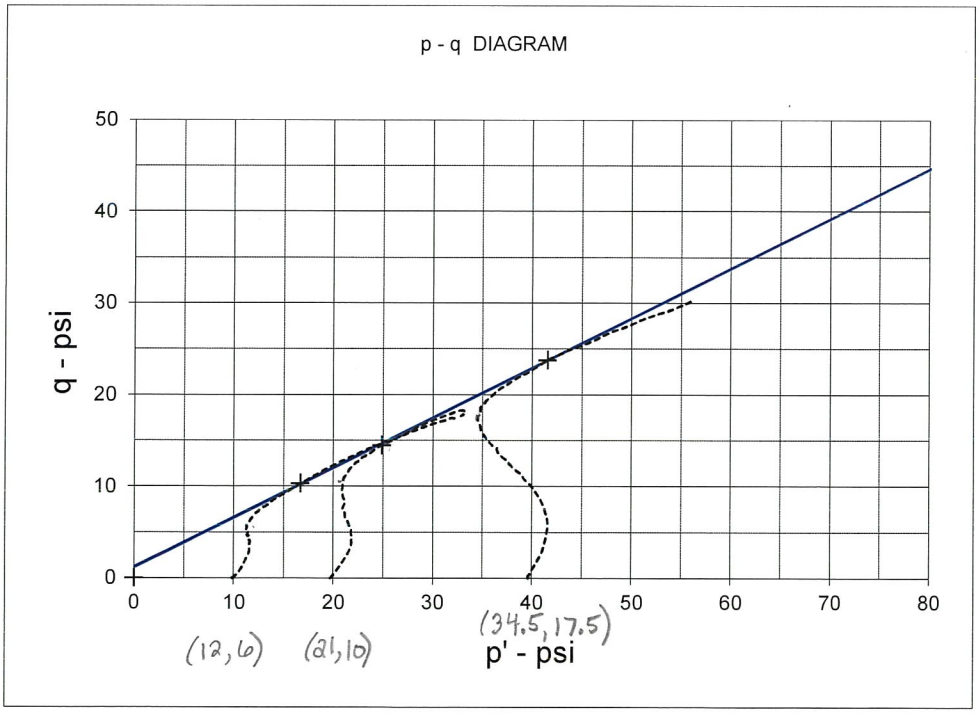
Foundation Crust











EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 28.5	a (psi) = 1.1
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Grayish Brown Silty Clay			

URS

DATE _____

PROJECT NO. _____

PAGE NO. _____ OF _____ BY _____

QSS

$$p' = \frac{\sigma_1' + \sigma_3'}{2} \rightarrow \sigma_1' = 2p' - \sigma_3'$$

$$q = \frac{\sigma_1' - \sigma_3'}{2} \rightarrow \sigma_3' = \sigma_1' - 2q$$

$$\sigma_1' = 2p' - \sigma_1' + 2q$$

$$\sigma_1' = \frac{2p' + 2q}{2} = p' + q$$

KIN-B007-S9

$\sigma_c' = 10$ psi : $p' \simeq 12$ psi, $q \simeq 6$ psi

$\sigma_1' = 18$ psi, $\sigma_3' = 6$ psi $\rightarrow \sigma_1'/\sigma_3' = 3.00$

$\sigma_c' = 20$ psi : $p' \simeq 21$ psi, $q \simeq 10$ psi

$\sigma_1' = 31$ psi, $\sigma_3' = 11$ psi $\rightarrow \sigma_1'/\sigma_3' = 2.82$

$\sigma_c' = 40$ psi : $p' \simeq 34.5$ psi, $q \simeq 17.5$ psi

$\sigma_1' = 52$ psi, $\sigma_3' = 17$ psi $\rightarrow \sigma_1'/\sigma_3' = 3.06$

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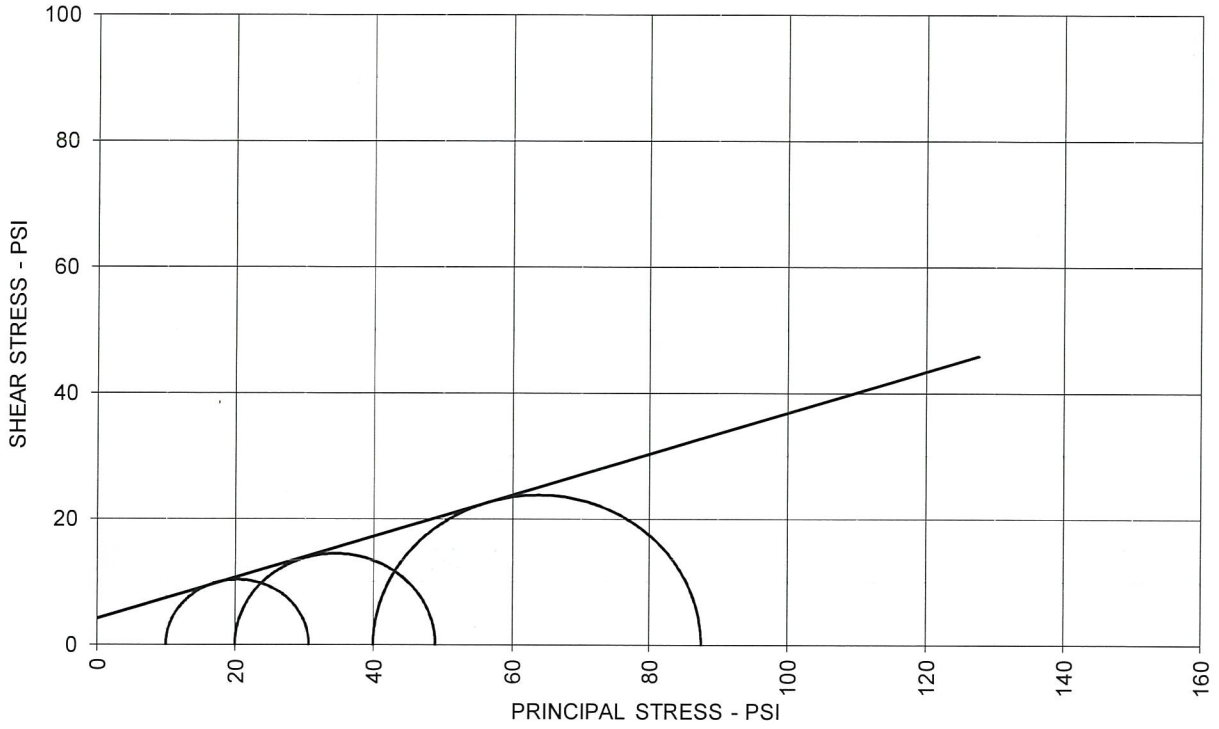
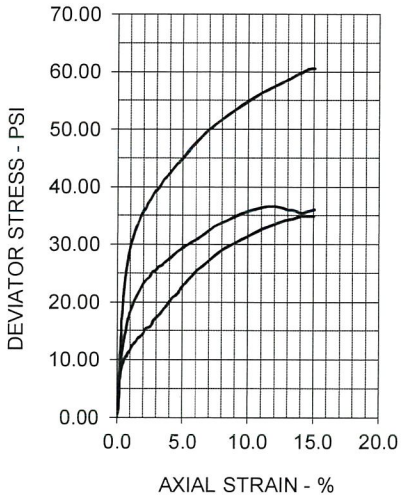


TOTAL STRESS PARAMETERS	ϕ = 18.1 deg	c = 4.1 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.5	22.4	22.0	
Dry Density - pcf	102.1	103.2	102.3	
Diameter - inches	1.40	1.40	1.41	
Height - inches	2.80	2.79	2.80	
AT TEST				
Final Moisture - %	23.5	22.0	21.7	
Dry Density - pcf	102.4	104.7	105.5	
Calculated Diameter (in.)	1.39	1.39	1.40	
Height - inches	2.78	2.77	2.76	
Effect. Cell Pressure - psi	10.0	20.0	40.0	
Failure Stress - psi	20.65	28.94	47.57	
Total Pore Pressure - psi	53.7	59.6	72.2	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	4.2	4.7	6.0	
σ_1 Failure - psi	30.65	48.94	87.57	
σ_3 Failure - psi	10.00	20.00	40.00	

TEST DESCRIPTION

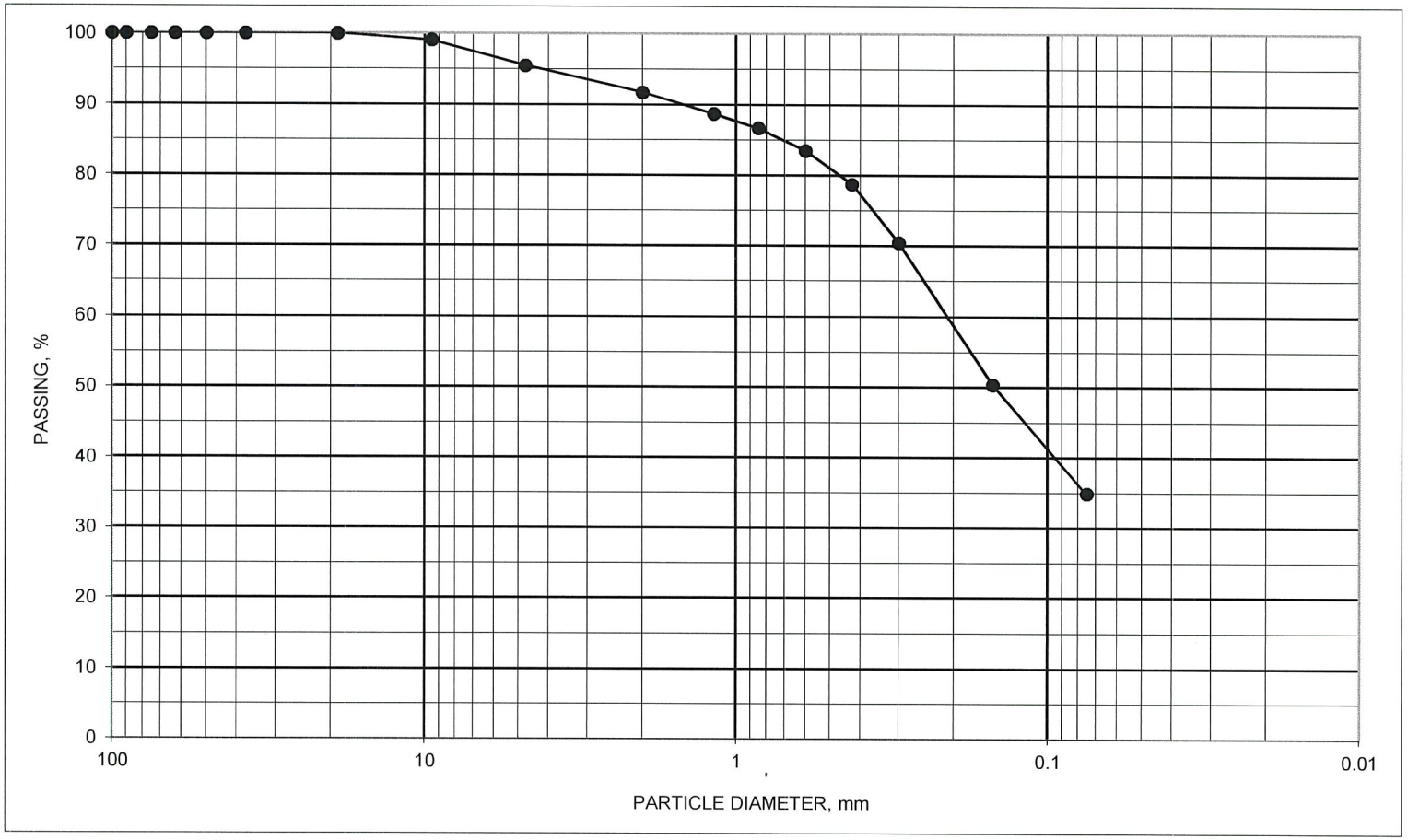
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Silty Clay
SAMPLE LOCATION: KIN-B007, S9, 25.0-27.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: X PL: X PI: X Percent -200: X
REMARKS: Specimens trimmed to 1.4" diameter.

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/13/15

TERRACON

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	96
#10	2.00	92
#16	1.18	89
#20	0.85	87
#30	0.600	84
#40	0.425	79
#50	0.300	70
#100	0.150	50
#200	0.075	34.9
	D60	0.2095



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB007	S-13	38.5 TO 40	Clayey sand, trace fine gravel Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B007 S-13.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B008	S1	1.0	2.5	NO RECOVERY														
	Color									Visual Classification								
	S2	3.5	5.0	25.4														
	Color			Brown and gray						USCS Classification			FILL: Sandy lean clay					
	S3	6.0	7.5	22.8														
	Color			Brown						Visual Classification			Sandy lean clay					
	S4	8.0	10.0	11.4	125.7	19	12	7						Note*				
	Color									Visual Classification								
	S5	13.5	15.0	13.3		25	14	11	** Sieve									
	Color			Brown and gray						Visual Classification			Sandy lean clay, trace fine to coarse gravel					
	S6	18.5	20.0	10.7	130.8													
	Color			Gray						Visual Classification			Sandy lean clay, trace fine gravel					
	S7	23.5	25.0	7.6														
	Color			Brownish gray						Visual Classification			Sandy lean clay, trace fine gravel					
	S8	28.5	30.0	7.1														
	Color			Brownish gray						Visual Classification			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

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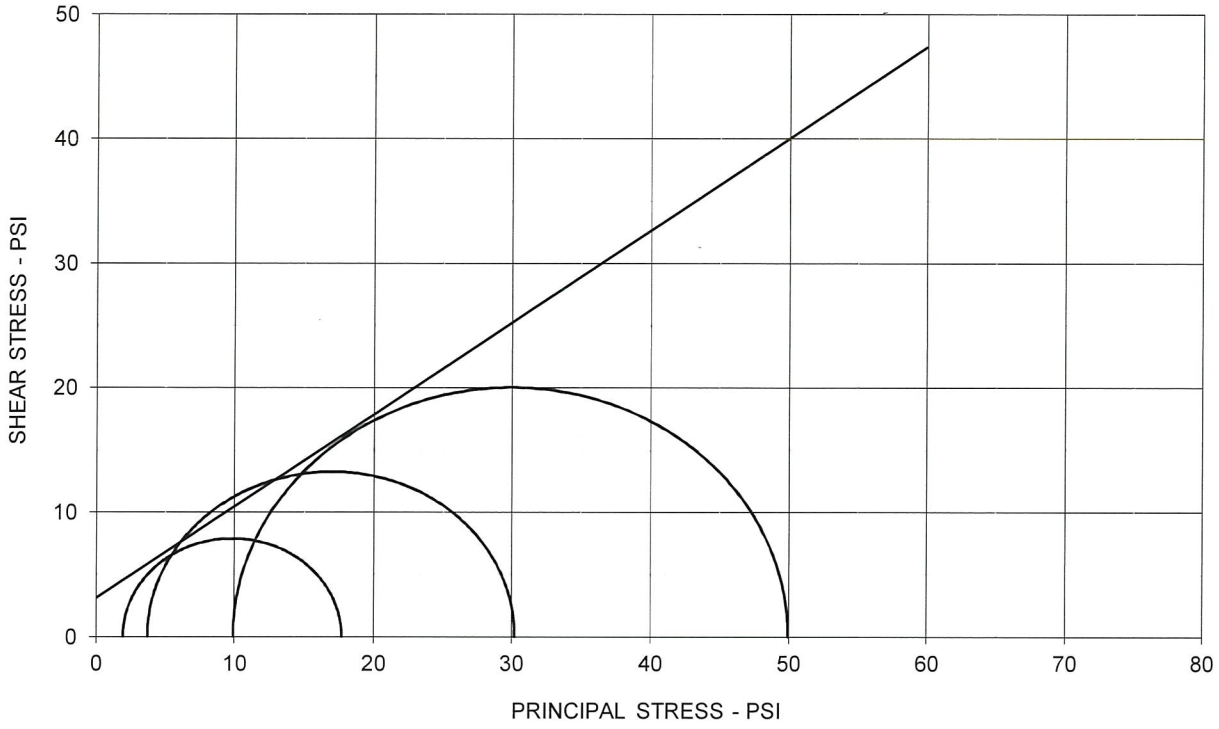
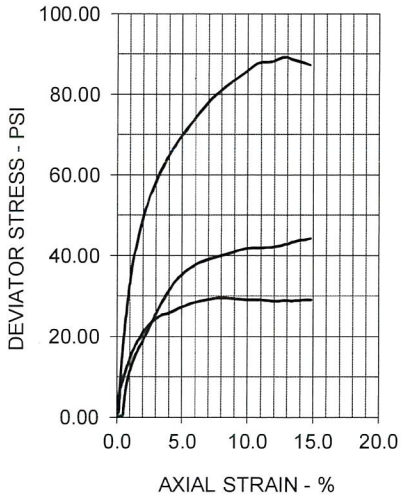


EFFECTIVE STRESS PARAMETERS	ϕ' = 36.5 deg	c' = 3.1 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	13.1	11.8	9.3	
Dry Density - pcf	122.3	122.6	132.2	
Diameter - inches	2.86	2.88	2.87	
Height - inches	5.68	5.68	5.69	
AT TEST				
Final Moisture - %	13.8	13.4	9.8	
Dry Density - pcf	122.3	122.7	132.9	
Calculated Diameter (in.)	2.84	2.85	2.86	
Height - inches	5.64	5.60	5.64	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	15.75	26.50	40.06	
Total Pore Pressure - psi	52.1	54.3	56.1	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	1.2	3.2	1.3	
σ_1' Failure - psi	17.70	30.22	49.97	
σ_3' Failure - psi	1.95	3.72	9.91	

TEST DESCRIPTION

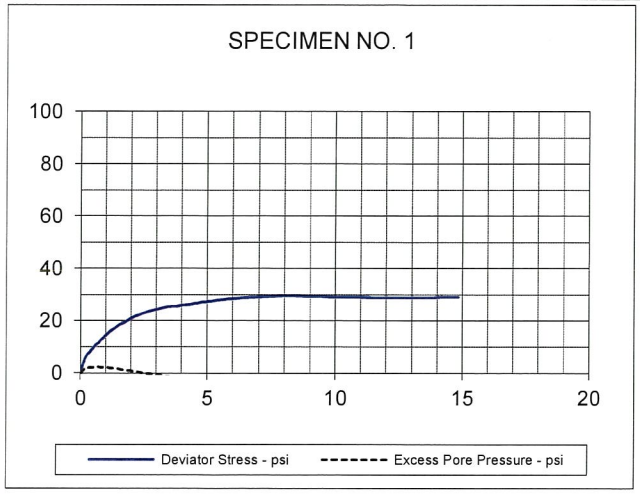
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Sandy Clay
SAMPLE LOCATION: KIN-B008, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 19 PL: 12 PI: 7 Percent -200: X
REMARKS: Three specimen series.

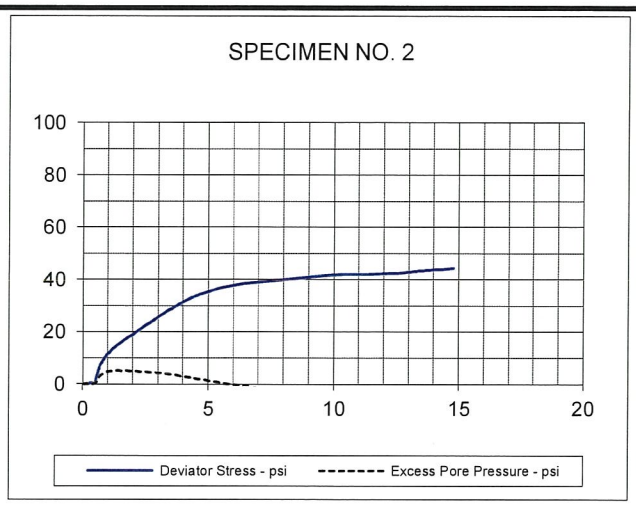
PROJECT INFORMATION

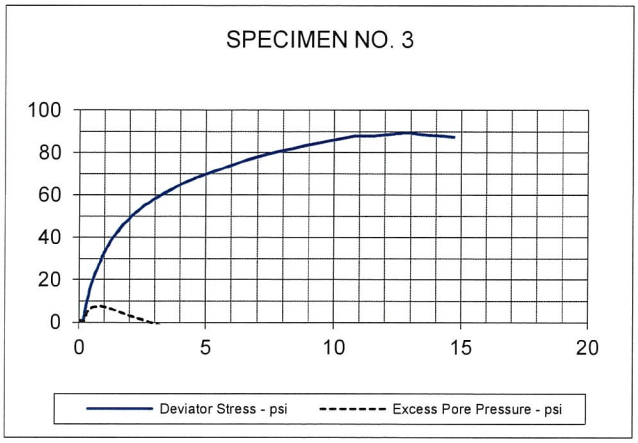
PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

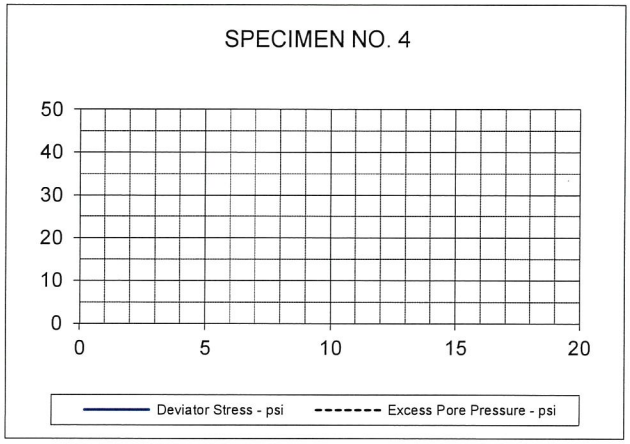
TERRACON

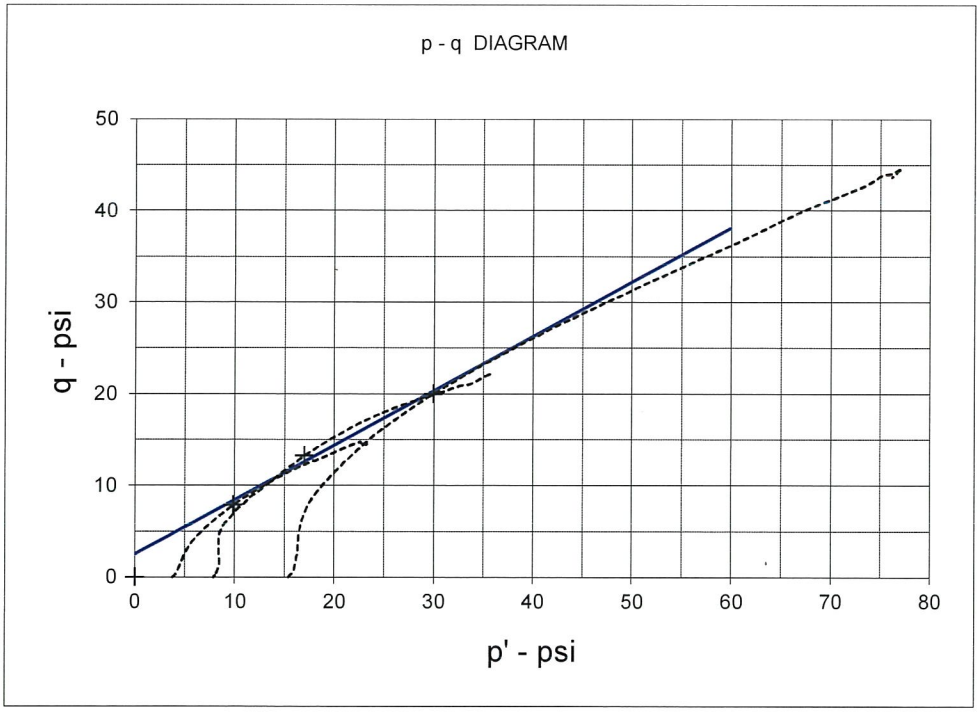
Embankment







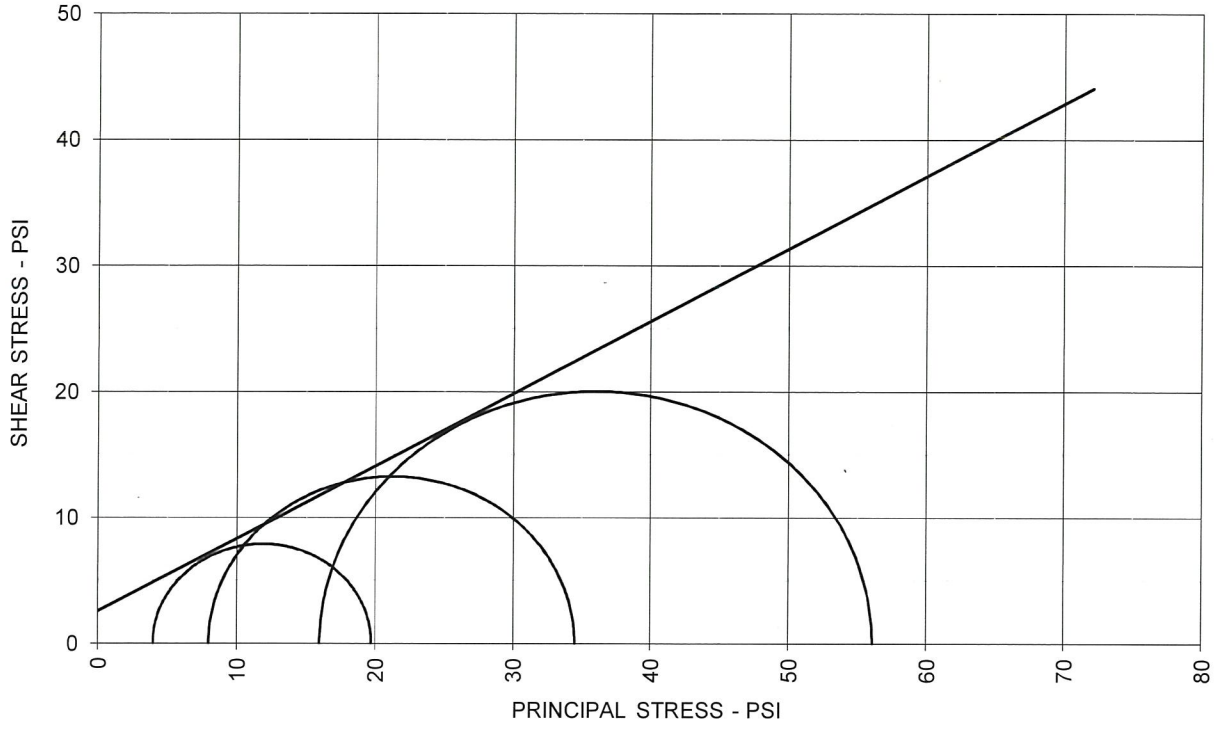




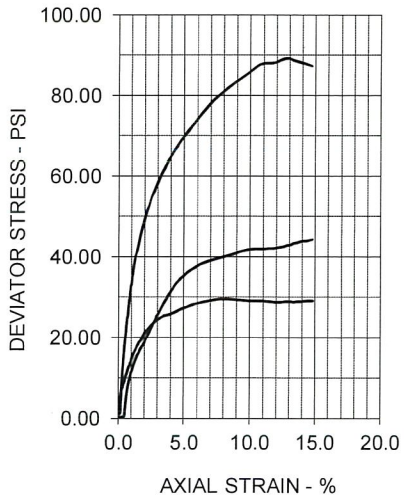
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 30.7	a (psi) = 2.5
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Grayish Brown Sandy Clay			

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135, Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 29.9 deg	c = 2.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	13.1	11.8	9.3	
Dry Density - pcf	122.3	122.6	132.2	
Diameter - inches	2.86	2.88	2.87	
Height - inches	5.68	5.68	5.69	
AT TEST				
Final Moisture - %	13.8	13.4	9.8	
Dry Density - pcf	122.3	122.7	132.9	
Calculated Diameter (in.)	2.84	2.85	2.86	
Height - inches	5.64	5.60	5.64	
Effect. Cell Pressure - psi	4.0	8.0	16.0	
Failure Stress - psi	15.75	26.50	40.06	
Total Pore Pressure - psi	52.1	54.3	56.1	
Strain Rate - inches/min.	0.00060	0.00060	0.00060	
Failure Strain - %	1.2	3.2	1.3	
σ_1 Failure - psi	19.75	34.50	56.06	
σ_3 Failure - psi	4.00	8.00	16.00	

TEST DESCRIPTION

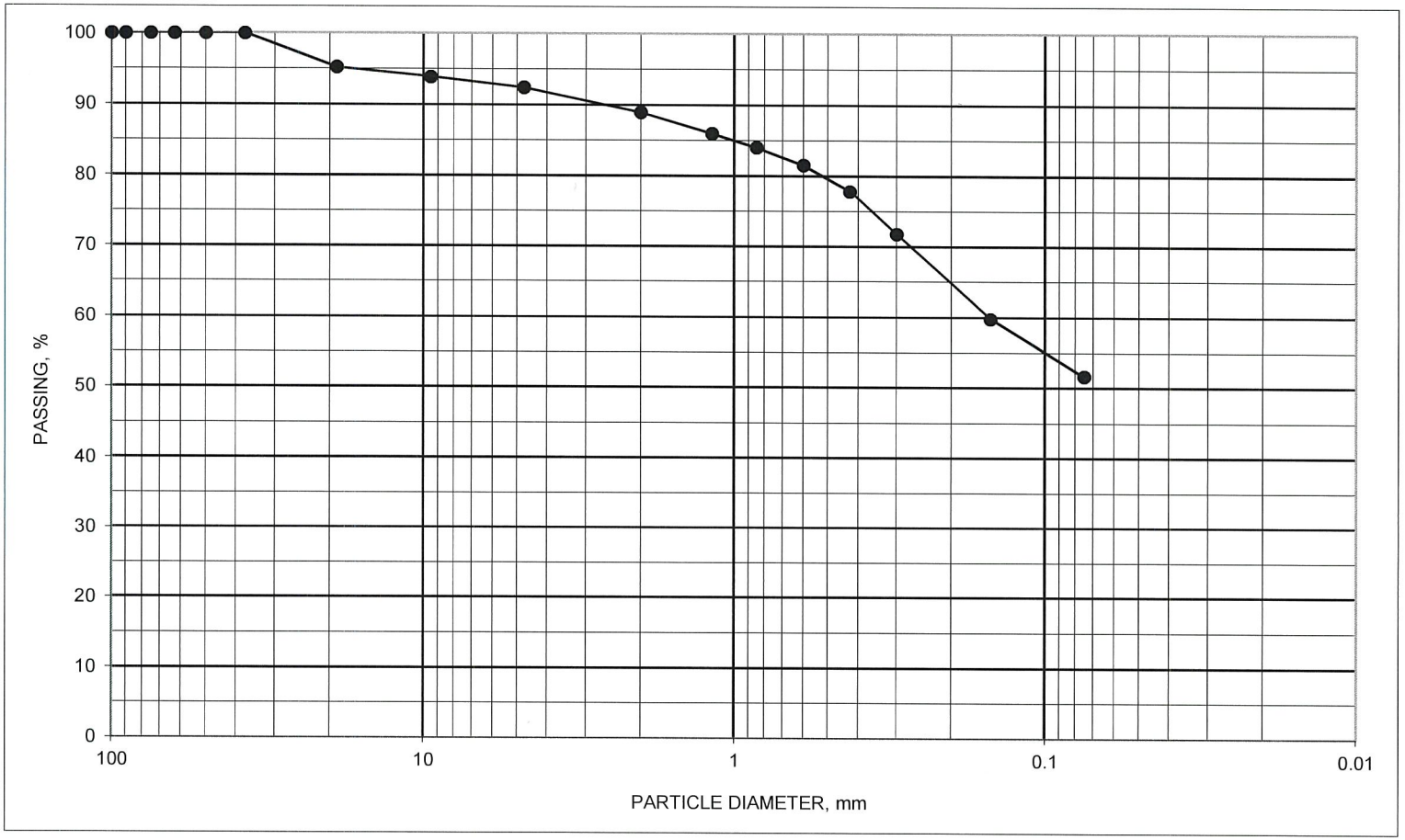
TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Grayish Brown Sandy Clay
SAMPLE LOCATION: KIN-B008, S4, 8.0-10.0 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 19 PL: 12 PI: 7 Percent -200: X
REMARKS: Three specimen series.

PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	95
3/8"	9.5	94
#4	4.8	92
#10	2.00	89
#16	1.18	86
#20	0.85	84
#30	0.600	82
#40	0.425	78
#50	0.300	72
#100	0.150	60
#200	0.075	51.7
	D60	0.1515



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB008	S-5	13.5 TO 15	Sandy lean clay, trace fine to coarse gravel Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B008 S-5.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

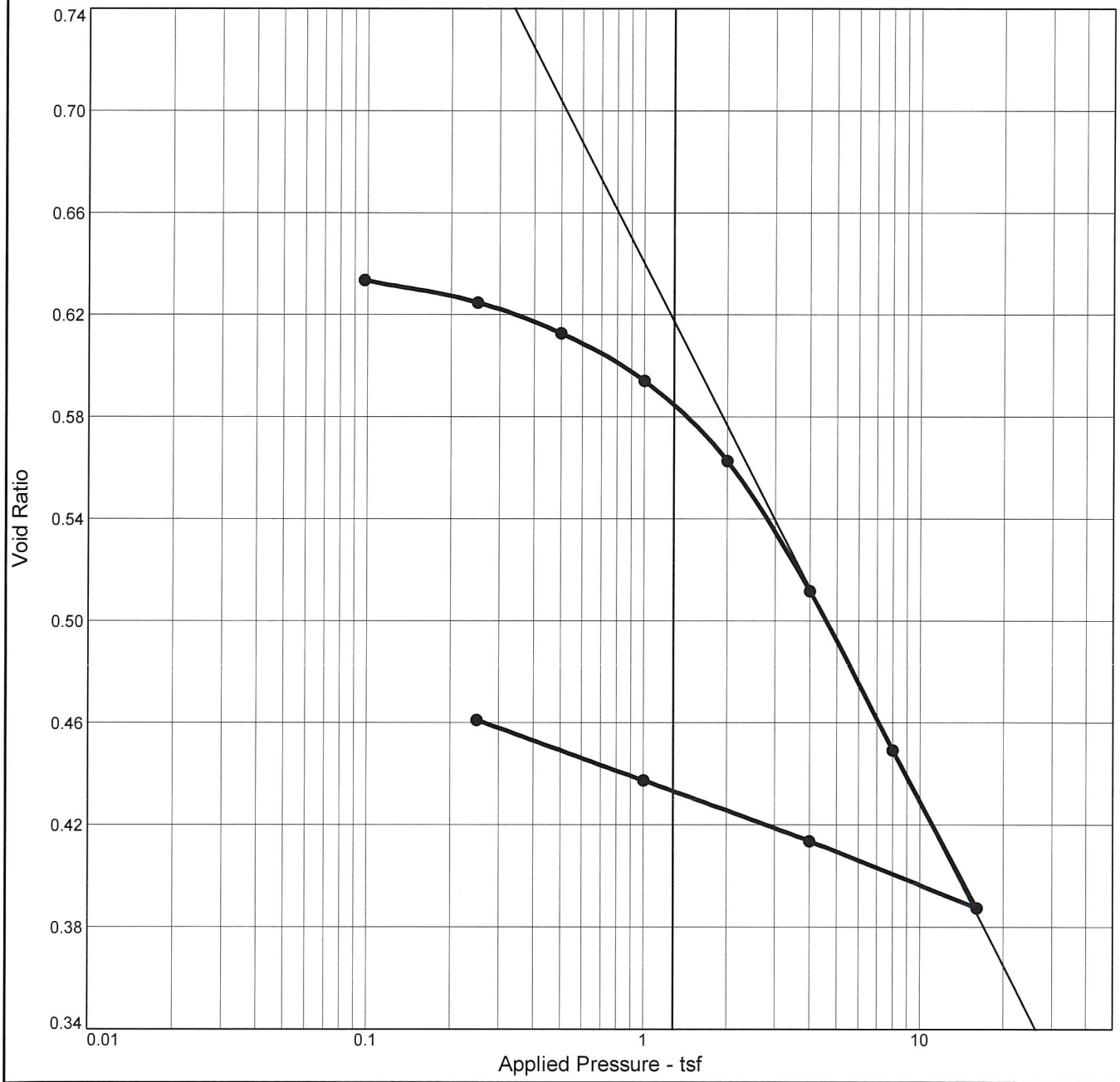
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B009	S1	1.0	2.5	20.3														
	Color		Dark brown							Visual Classification			FILL: Lean clay with fine sand					
	S2	3.5	5.0	23.8		42	19	23										
	Color		Dark brown							Visual Classification			FILL: Lean clay with fine sand					
	S3	6.0	7.5	21.3														
	Color		Brown and gray							USCS Classification			FILL: Fat clay with fine to medium sand					
	S4	7.5	9.5	19.9	103.2	28	15	13					Note*					
	Color		Grayish brown							Visual Classification			Sandy lean clay with pebbles					
	S5	13.5	15.0	10.3	103.0													
	Color		Brown							Visual Classification			Sandy lean clay, trace fine gravel					
	S6	18.5	20.0	7.5														
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S7	23.5	25.0	11.5		19	14	5										
	Color		Gray							Visual Classification			Sandy silty lean clay, trace fine gravel					
	S8	28.5	30.0	9.2	96.5													
	Color		Brownish gray							Visual Classification			Sandy lean clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (tsf)	P_c (tsf)	C_c	C_r	Initial Void Ratio
Saturation	Moisture									
84.6 %	19.9 %	103.2	28	13	2.7	0.49	2.02	0.21	0.04	0.634

MATERIAL DESCRIPTION	USCS	AASHTO
Grayish Brown Sandy Clay with Pebbles	X	X

Project No. 15151122 **Client:** AECOM

Project: Dynegy-Kincaid

Source of Sample: KIN-B009 **Depth:** 7.5-9.5 ft **Sample Number:** S4

Terracon Consultants, Inc.

Chattanooga, TN

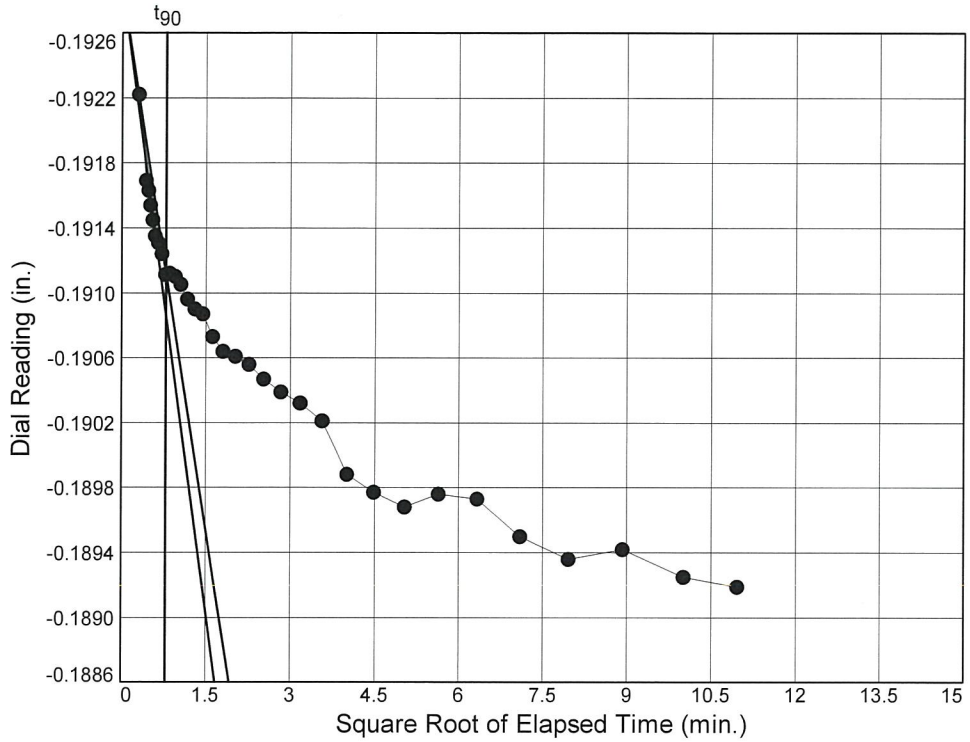
Remarks:

Swell pressure of 195 psf.

Dial Reading vs. Time

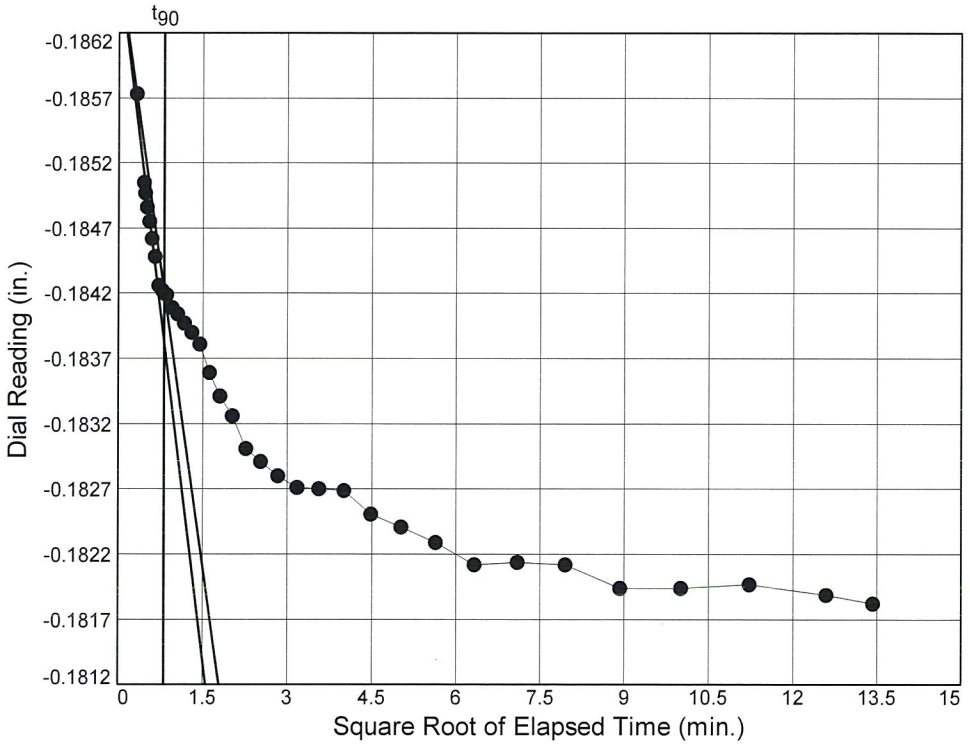
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 2
Load= 0.25 tsf
D_0 = -0.1929
D_{90} = -0.1911
D_{100} = -0.1909
T_{90} = 0.62 min.

C_v @ T_{90}
0.0364 cm.^{2}/sec.



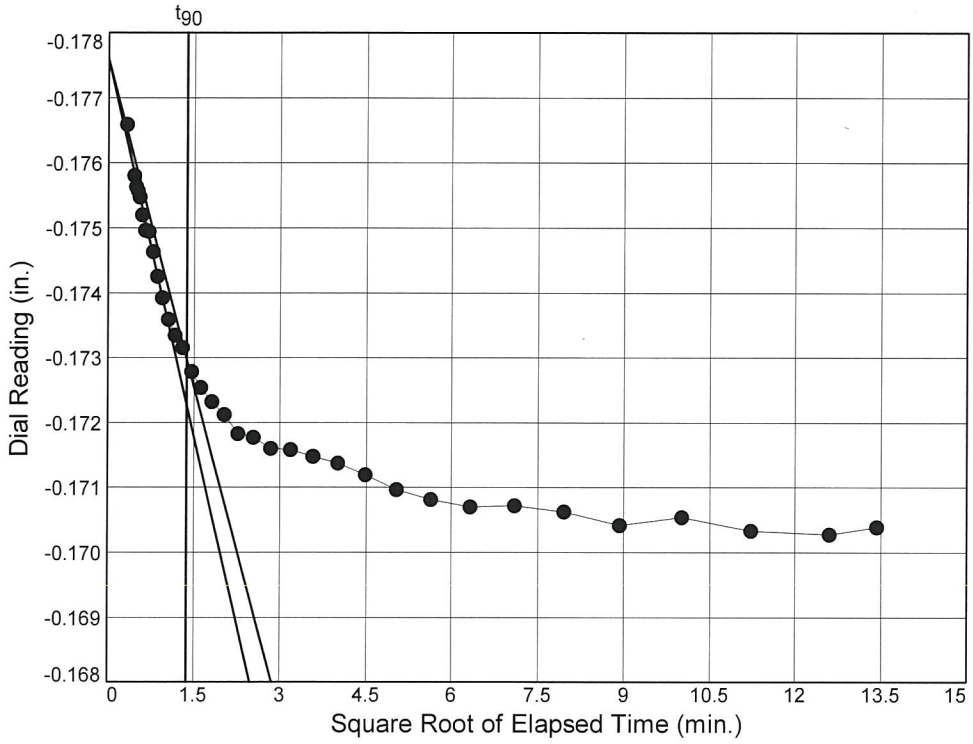
Load No.= 3
Load= 0.50 tsf
D_0 = -0.1867
D_{90} = -0.1842
D_{100} = -0.1839
T_{90} = 0.66 min.

C_v @ T_{90}
0.0339 cm.^{2}/sec.

Dial Reading vs. Time

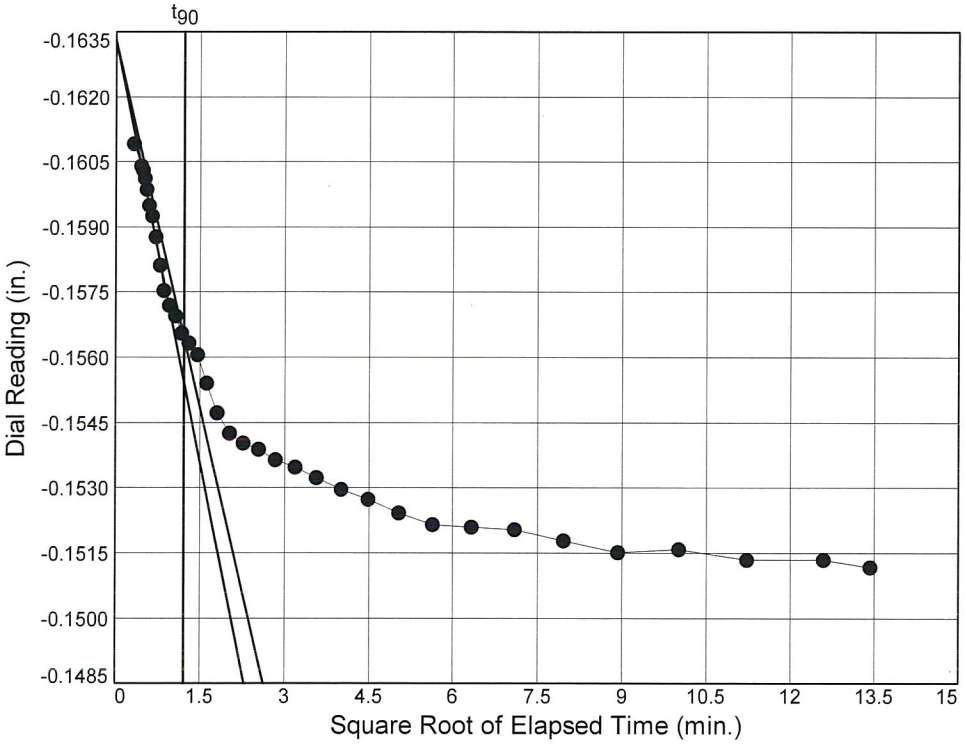
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 4
Load= 1.00 tsf
D_0 = -0.1776
D_{90} = -0.1730
D_{100} = -0.1725
T_{90} = 1.89 min.

C_v @ T_{90}
0.0116 cm.^{2}/sec.



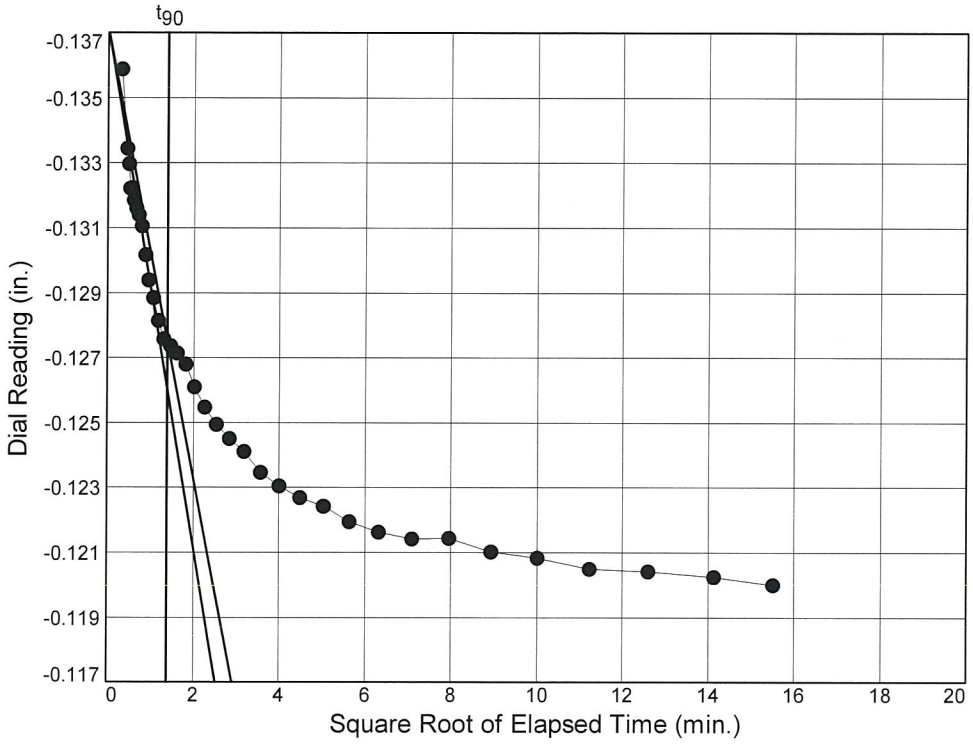
Load No.= 5
Load= 2.00 tsf
D_0 = -0.1633
D_{90} = -0.1565
D_{100} = -0.1557
T_{90} = 1.47 min.

C_v @ T_{90}
0.0145 cm.^{2}/sec.

Dial Reading vs. Time

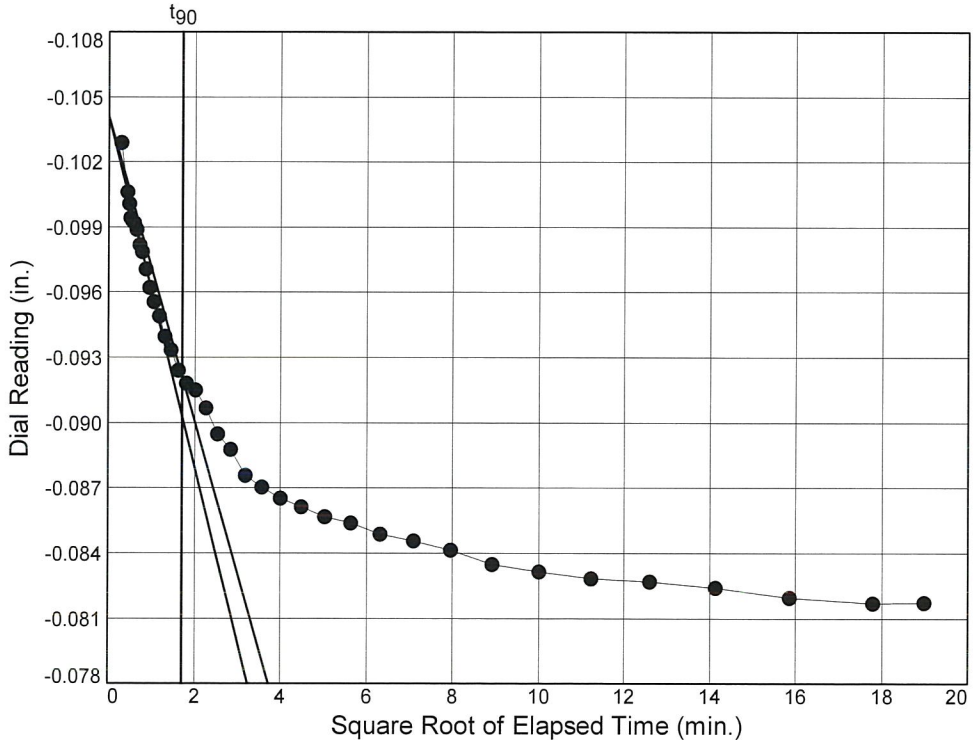
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 6
Load= 4.00 tsf
D_0 = -0.1370
D_{90} = -0.1274
D_{100} = -0.1264
T_{90} = 1.94 min.

C_v @ T_{90}
0.0104 cm.^{2}/sec.



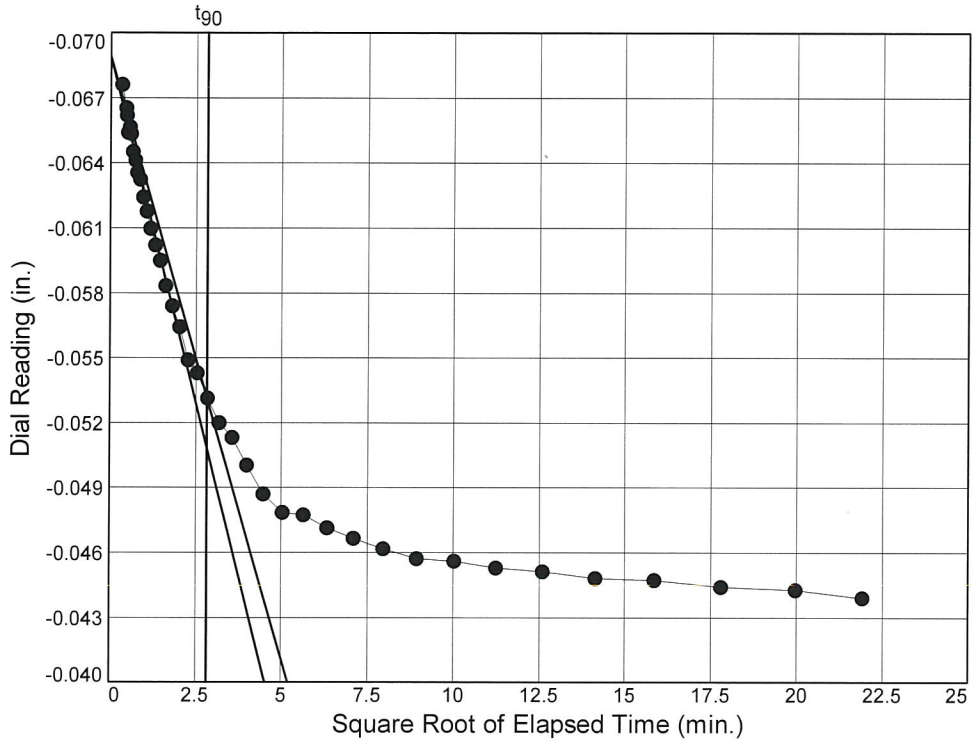
Load No.= 7
Load= 8.00 tsf
D_0 = -0.1040
D_{90} = -0.0922
D_{100} = -0.0908
T_{90} = 2.89 min.

C_v @ T_{90}
0.0065 cm.^{2}/sec.

Dial Reading vs. Time

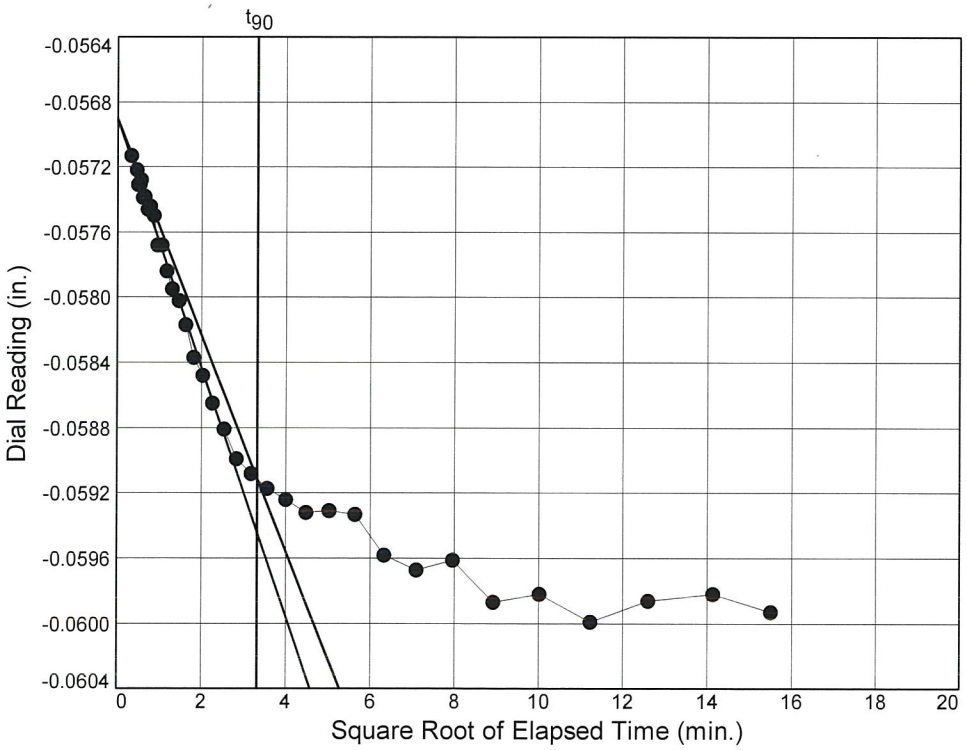
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 8
Load= 16.00 tsf
D_0 = -0.0689
D_{90} = -0.0532
D_{100} = -0.0515
T_{90} = 7.97 min.

C_v @ T_{90}
0.0022 cm.^{2}/sec.



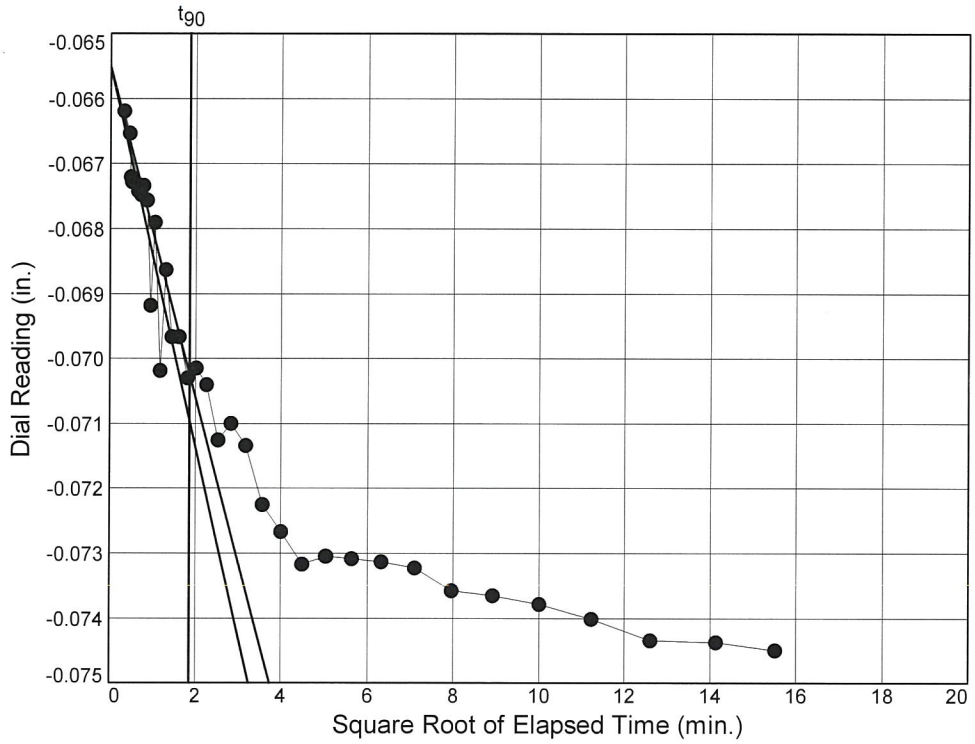
Load No.= 9
Load= 4.00 tsf
D_0 = -0.0569
D_{90} = -0.0591
D_{100} = -0.0594
T_{90} = 11.12 min.

C_v @ T_{90}
0.0015 cm.^{2}/sec.

Dial Reading vs. Time

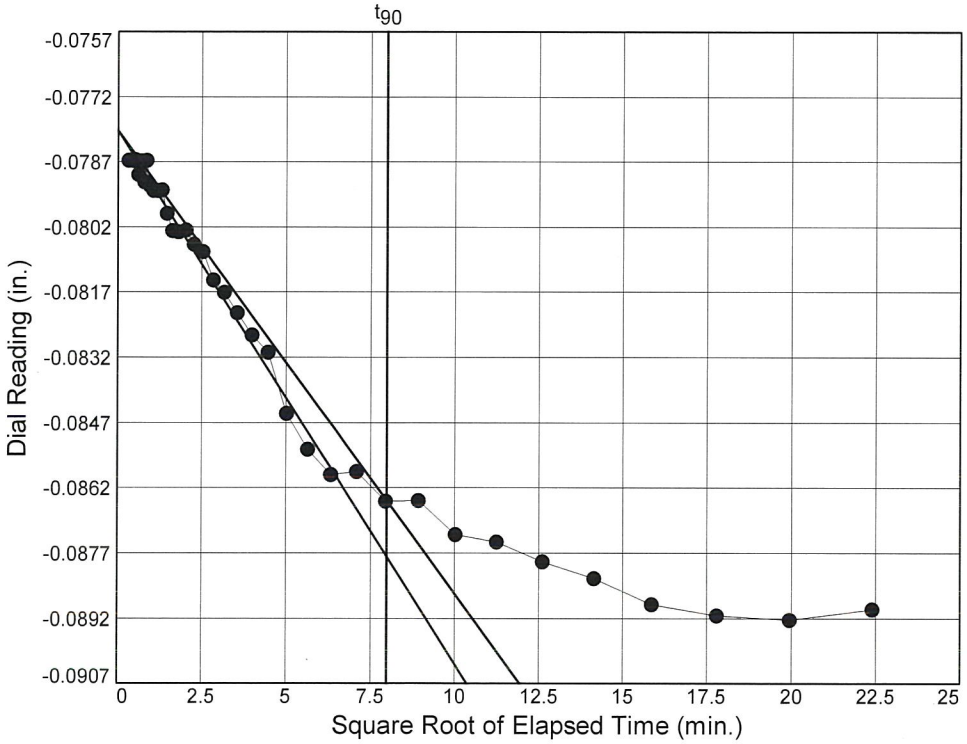
Project No.: 15151122
Project: Dynegy-Kincaid

Source of Sample: KIN-B009 Depth: 7.5-9.5 ft Sample Number: S4



Load No.= 10
Load= 1.00 tsf
D_0 = -0.0655
D_{90} = -0.0703
D_{100} = -0.0708
T_{90} = 3.49 min.

C_v @ T_{90}
0.0050 cm.^{2}/sec.



Load No.= 11
Load= 0.25 tsf
D_0 = -0.0780
D_{90} = -0.0865
D_{100} = -0.0874
T_{90} = 63.68 min.

C_v @ T_{90}
0.0003 cm.^{2}/sec.

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B010	S1	1.0	2.5	4.9														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S2	3.5	5.0	8.9														
	Color		Brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S3	6.0	7.5	9.5		23	14	9	** Sieve									
	Color		Brown							**USCS Classification**			FILL: Sandy lean clay, trace fine to coarse gravel					
	S4	8.5	10.0	11.8	121.5													
	Color		Brown and dark brown							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S5	13.5	15.0	19.5														
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S6	18.5	20.5	21.1	105.8	33	14	19		Note*				Note*		Note*	Note*	CL
	Color									**Visual Classification**			Lean clay with sand					
	S7	20.5	22.5	11.8	123.2	31	15	16										
	Color		Brown and gray							**Visual Classification**			FILL: Sandy lean clay, trace fine gravel					
	S8	23.5	24.4	23.3	110.7													
	Color		Brown and gray with dark brown							**Visual Classification**			FILL: Fat clay with fine to medium sand					
	S8A	29.4	25.0	17.6														
	Color		Brown and gray with dark brown							**Visual Classification**			FILL: Fat clay with fine to medium sand					
	S9	28.5	30.0	28.9	NA	40	20	20										
	Color		Dark brown (ORGANIC CONTENT = 5.3%)							**Visual Classification**			Lean clay					
	S10	32.0	34.0															
	Color		TUBE TO FRUGO							**Visual Classification**								
	S11	33.5	35.0	20.9					Note*									
	Color		Brown and gray							**Visual Classification**			Sandy lean to fat clay, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

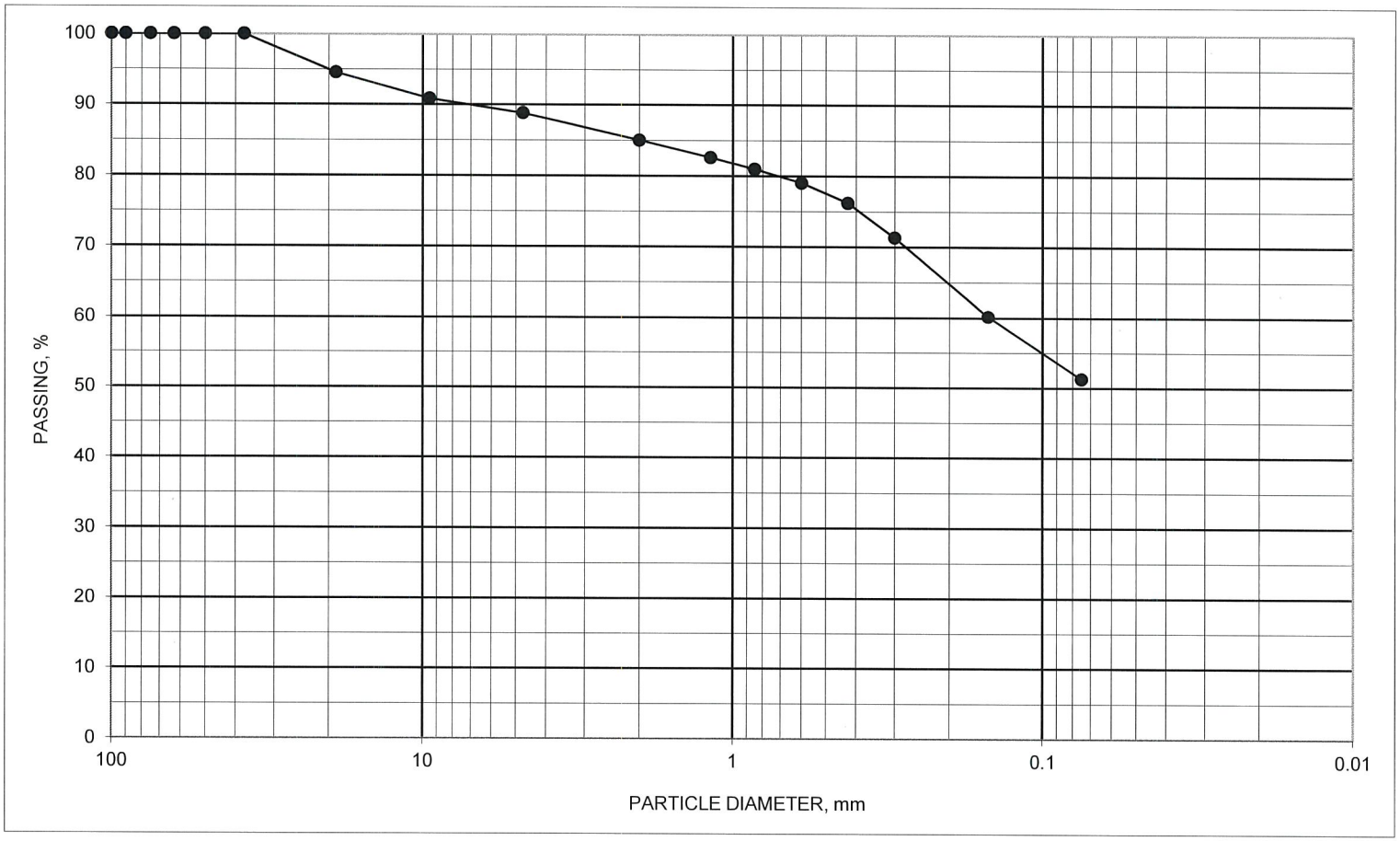
Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
	S12	38.5	40.0	9.8					** Sieve									
	Color		Brown and gray							Visual Classification			Clayey sand, trace fine gravel					
KIN-B010	S13	43.5	45.0	10.7														
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S14	48.5	50.0	9.9	135.9	23	14	9										
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S15	58.5	60.0	9.5														
	Color		Gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S16	68.5	70.0	17.0														
	Color		Greenish gray and brown							Visual Classification			Sandy lean clay, trace fine gravel					
												Rock Unconf. Comp.						
	RUN #1	70.6	71.2	0.3	165.3							11377 psi						
	RUN #1	71.5	72.5															
	Color		Gray							Visual Classification			Limestone					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	95
3/8"	9.5	91
#4	4.8	89
#10	2.00	85
#16	1.18	83
#20	0.85	81
#30	0.600	79
#40	0.425	76
#50	0.300	71
#100	0.150	60
#200	0.075	51.3
	D60	0.1481



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB010	S-3	6 TO 7.5	Sandy lean clay, trace fine to coarse gravel Brown	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/30/2015

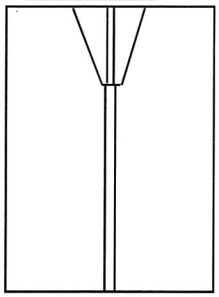
N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B010 S-3.xlsx]GRADATION

Terracon

DISPERSIVE CLAY SOILS BY THE PINHOLE TEST
ASTM D 4647, METHOD A

PROJECT Dynegy-Kincaid
JOB NO. 15151122
SAMPLE ID B010, S6, 18.5-20.5 ft
COMPACTION CHARACTERISTICS Undisturbed
WATER CONTENT 22.7%
DISTILLED WATER ADDED X **YES** _____ **NO**
CURE TIME Zero
BY Ryan Rogers
SAMPLE DESC. Lean Clay with Sand

FINAL HOLE
1.0 mm



TIME,	HEAD,	FLOW,		FLOW RATE,	TURBIDITY FROM SIDE						CLEAR FROM TOP	REMARKS
					VERY DARK	DARK	MOD. DARK	SLIGHT DARK	BARELY VISIBLE	CLEAR		
min	inch	ml	sec	ml/sec								
1	2	10.0	15	0.67						X	X	
2	2	10.5	15	0.70						X	X	
3	2	10.5	15	0.70						X	X	
4	2	11.0	15	0.73						X	X	
5	2	11.5	15	0.77						X	X	
6	2	12.0	15	0.80						X	X	
7	2	11.0	15	0.73						X	X	
8	2	11.5	15	0.77						X	X	
9	2	11.5	15	0.77						X	X	
10	2	11.0	15	0.73						X	X	
1	7	17.5	15	1.17						X	X	
2	7	17.5	15	1.17						X	X	
3	7	18.0	15	1.20						X	X	
4	7	18.0	15	1.20						X	X	
5	7	18.0	15	1.20						X	X	
1	15	25.5	15	1.70						X	X	
2	15	25.5	15	1.70						X	X	
3	15	25.0	15	1.67						X	X	
4	15	26.0	15	1.73						X	X	
5	15	25.0	15	1.67						X	X	
1	40	81.0	30	2.70						X	X	
2	40	81.0	30	2.70						X	X	
3	40	78.0	30	2.60						X	X	
4	40	79.0	30	2.63						X	X	
5	40	80.0	30	2.67						X	X	

CLASSIFICATION = **ND1**

Terracon

CRUMB TEST D6572

DYNEGY

KINCAID, ILLINOIS

15151122

KIN-B010	S6	18.5-20.5 feet

2 MIN

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

1 HOUR

GRADE: 1

DISPERSIVE CLASSIFICATION: NON DISPERSIVE

6 HOUR

GRADE: 1

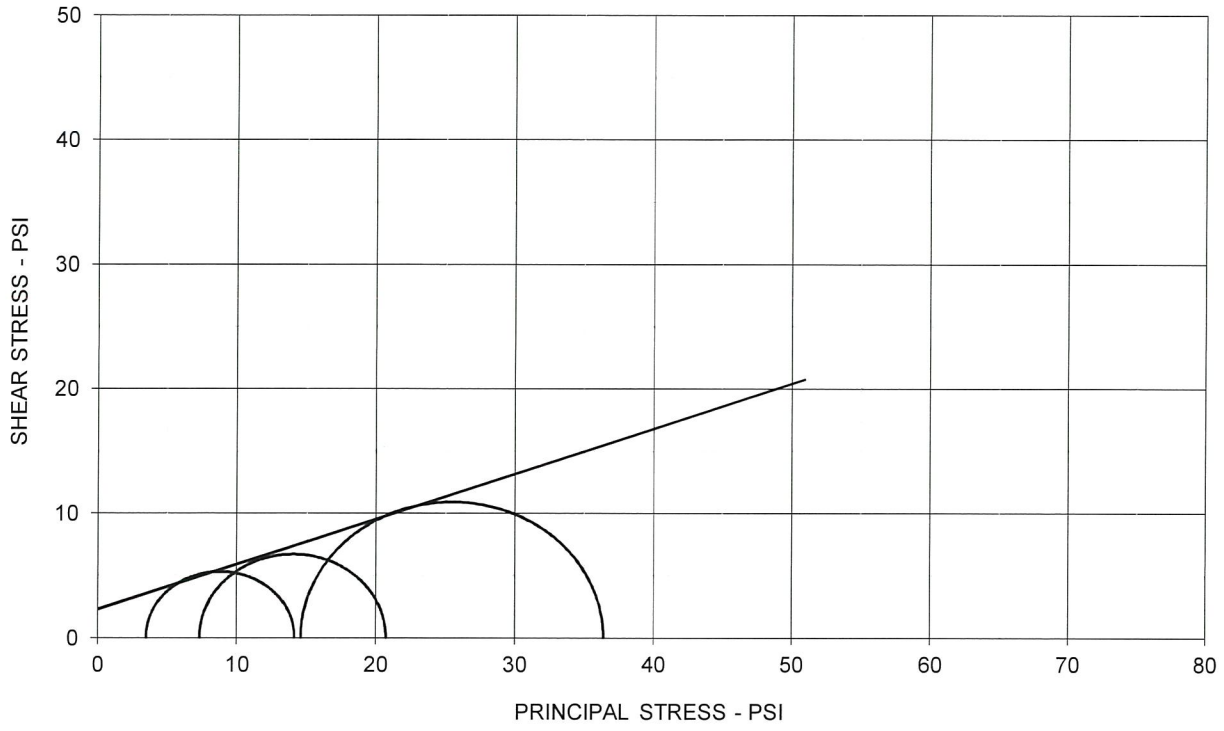
DISPERSIVE CLASSIFICATION: NON DISPERSIVE

Grade 1 - Nondispersive
Grade 2 - Intermediate
Grade 3 - Dispersive
Grade 4 - Highly Dispersive

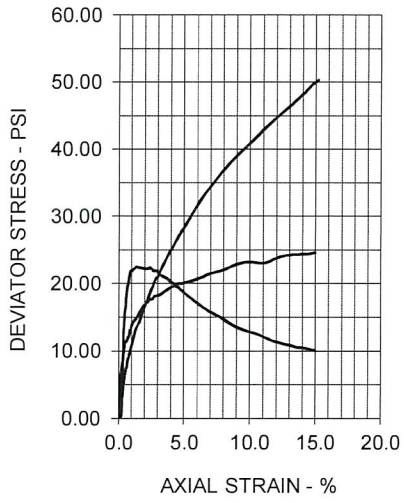
Terracon

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135 Chattanooga, TN 37406



EFFECTIVE STRESS PARAMETERS	ϕ' = 19.9 deg	c' = 2.3 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.7	20.5	20.2	
Dry Density - pcf	103.4	105.9	108.1	
Diameter - inches	1.39	1.40	1.39	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %	23.1	20.0	17.7	
Dry Density - pcf	103.4	108.4	113.3	
Calculated Diameter (in.)	1.38	1.39	1.38	
Height - inches	2.75	2.78	2.77	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	10.61	13.39	21.81	
Total Pore Pressure - psi	54.0	57.7	65.4	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	1.0	1.0	1.0	
σ_1' Failure - psi	14.11	20.72	36.38	
σ_3' Failure - psi	3.50	7.33	14.57	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B010, S6, 18.5-20.5 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 33 PL: 14 PI: 19 Percent -200: 84
REMARKS: Specimens trimmed to 1.4" diameter.

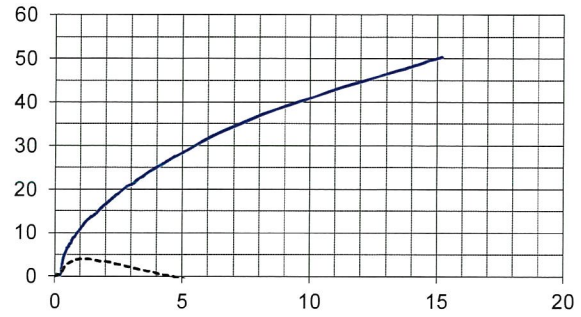
PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

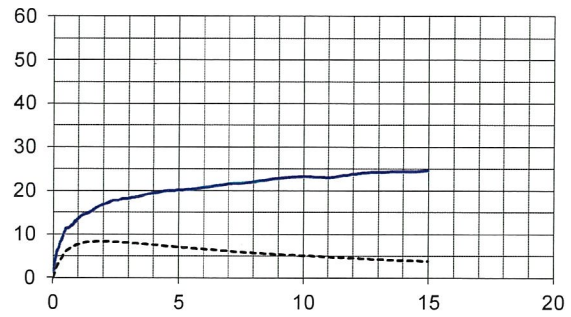
TERRACON

Foundation Crust

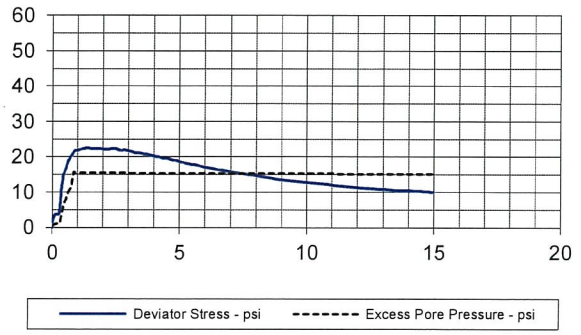
SPECIMEN NO. 1



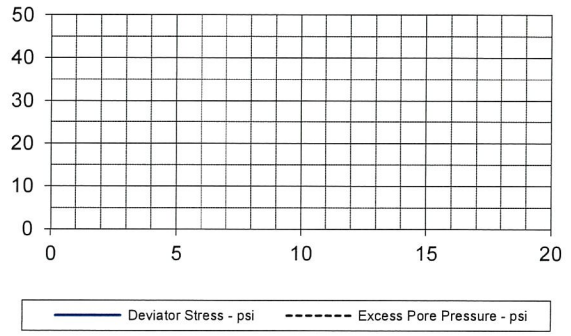
SPECIMEN NO. 2



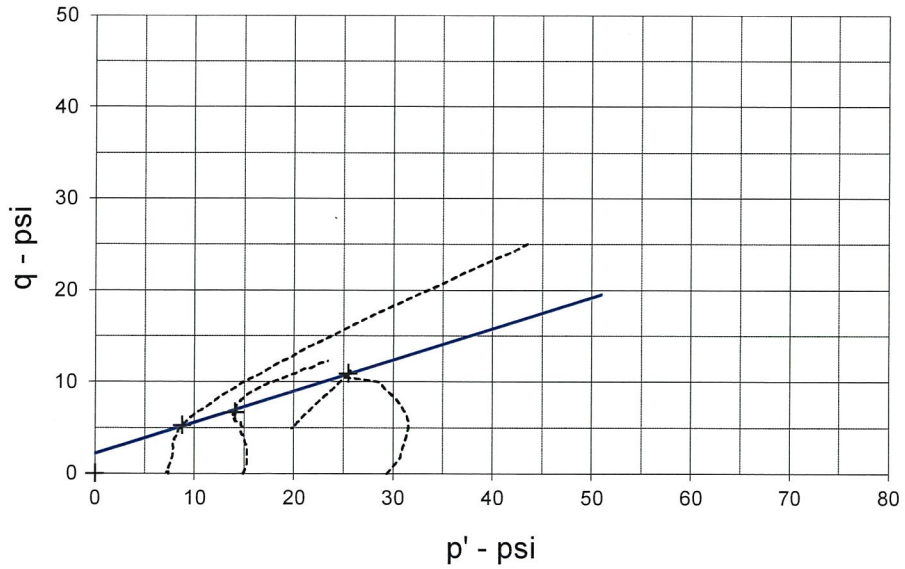
SPECIMEN NO. 3



SPECIMEN NO. 4



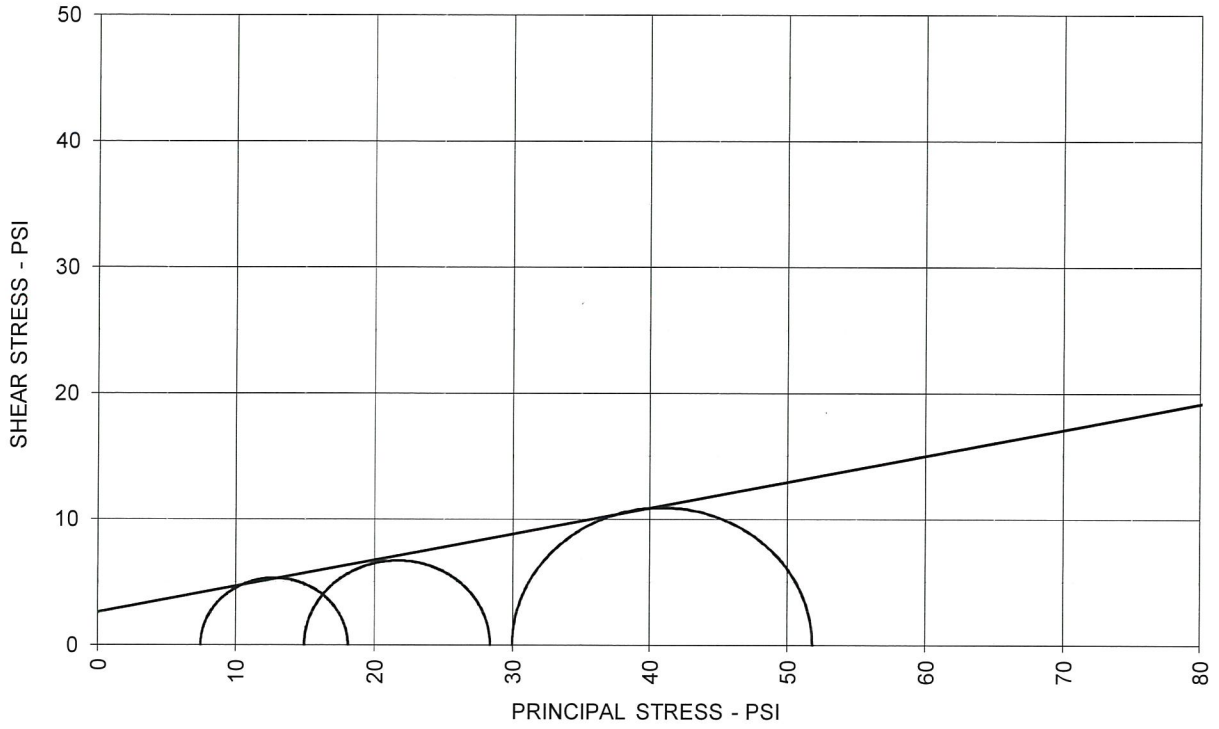
p - q DIAGRAM



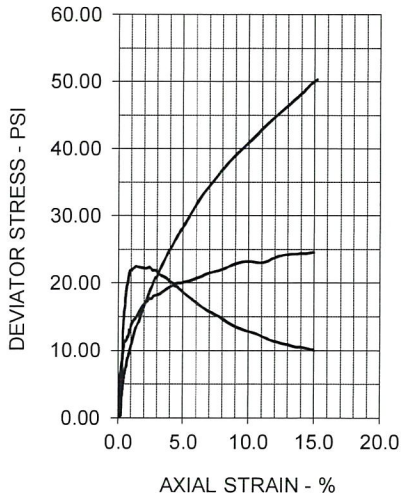
EFFECTIVE STRESS PARAMETERS	R^2 = 1.00	α (deg) = 18.8	a (psi) = 2.1
PROJECT: Dynegy-Kincaid		TYPE OF TEST & NO: CU with Pore Pressure	
PROJECT NO: 15151122		**TERRACON**	
DESCRIPTION: Lean Clay with Sand (CL)			

TRIAXIAL SHEAR TEST REPORT

Terracon
P.O. Box 5010, 51 Lost Mound Drive, Suite 135, Chattanooga, TN 37406



TOTAL STRESS PARAMETERS	ϕ = 11.7 deg	c = 2.6 psi



SPECIMEN NO.	1	2	3	4
INITIAL				
Moisture Content - %	22.7	20.5	20.2	
Dry Density - pcf	103.4	105.9	108.1	
Diameter - inches	1.39	1.40	1.39	
Height - inches	2.80	2.80	2.80	
AT TEST				
Final Moisture - %	23.1	20.0	17.7	
Dry Density - pcf	103.4	108.4	113.3	
Calculated Diameter (in.)	1.38	1.39	1.38	
Height - inches	2.75	2.78	2.77	
Effect. Cell Pressure - psi	7.5	15.0	30.0	
Failure Stress - psi	10.61	13.39	21.81	
Total Pore Pressure - psi	54.0	57.7	65.4	
Strain Rate - inches/min.	0.00030	0.00030	0.00030	
Failure Strain - %	1.0	1.0	1.0	
σ_1 Failure - psi	18.11	28.39	51.81	
σ_3 Failure - psi	7.50	15.00	30.00	

TEST DESCRIPTION

TYPE OF TEST & NO: CU with Pore Pressure
SAMPLE TYPE: Tube
DESCRIPTION: Lean Clay with Sand (CL)
SAMPLE LOCATION: KIN-B010, S6, 18.5-20.5 ft.
ASSUMED SPECIFIC GRAVITY: 2.7
LL: 33 PL: 14 PI: 19 Percent -200: 84
REMARKS: Specimens trimmed to 1.4" diameter.

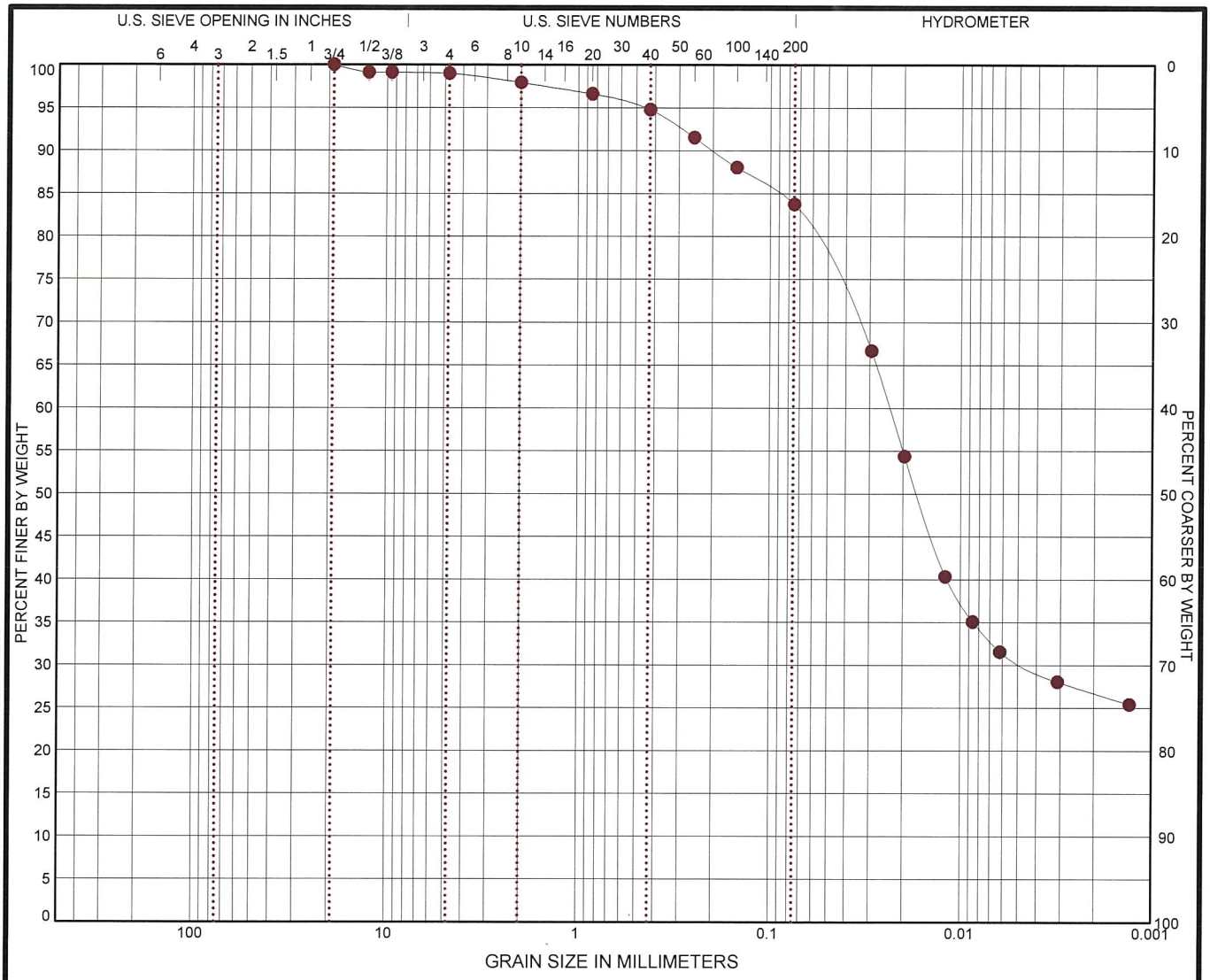
PROJECT INFORMATION

PROJECT: Dynegy-Kincaid
LOCATION: Kincaid, IL
PROJECT NO: 15151122
CLIENT: AECOM
DATE: 10/1/15

TERRACON

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B010**	**18.5**	**0.0**	**1.0**	**15.3**	**53.3**		**30.5**	**CL**

	GRAIN SIZE
	●
D_{60}	**0.024**
D_{30}	**0.005**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	**100.0**
1/2"	**99.11**
3/8"	**99.11**
#4	**98.99**
#10	**97.92**
#20	**96.61**
#40	**94.77**
#60	**91.52**
#100	**88.02**
#200	**83.73**

SOIL DESCRIPTION
● LEAN CLAY with SAND(CL)

REMARKS
● Dispersion: 18.42%

PROJECT: Dynegy

SITE: Kincaid Power Station

Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

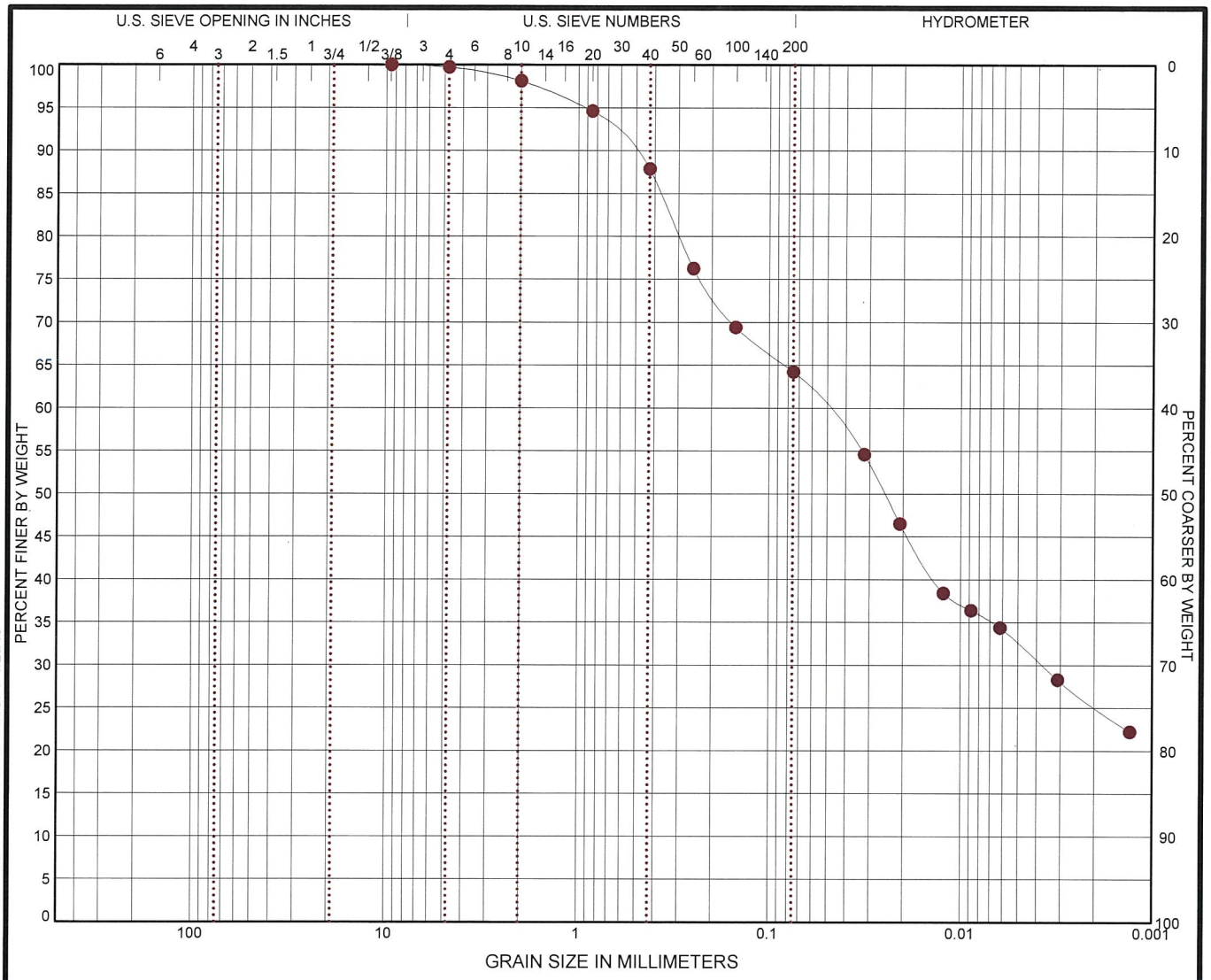
PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/30/15

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B010**	**33.5**	**0.0**	**0.3**	**35.5**	**31.7**		**32.5**	

	GRAIN SIZE
	●
D_{60}	**0.052**
D_{30}	**0.004**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	**100.0**
#4	**99.71**
#10	**98.09**
#20	**94.59**
#40	**87.85**
#60	**76.23**
#100	**69.37**
#200	**64.2**

SOIL DESCRIPTION
●

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

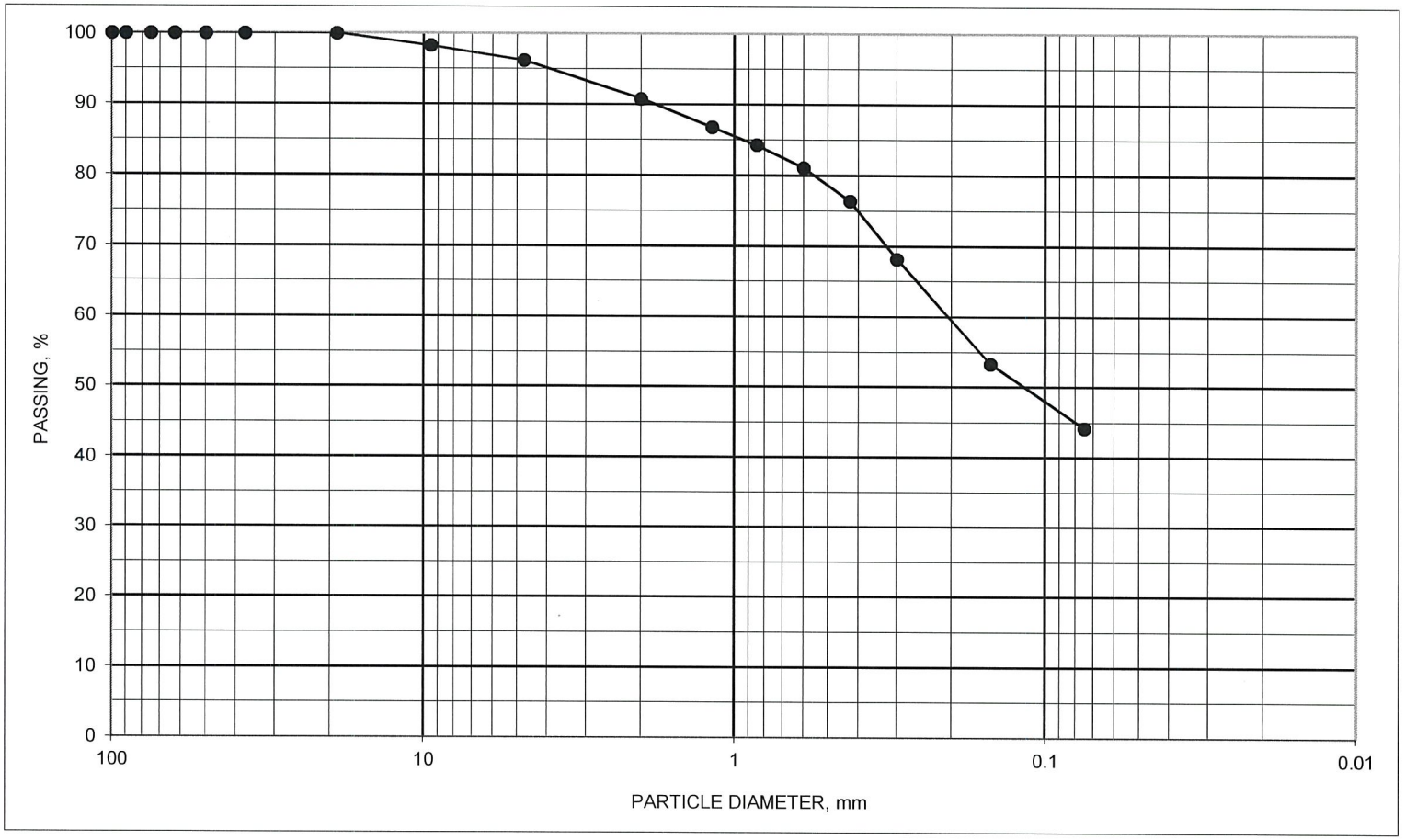
Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/25/15

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	98
#4	4.8	96
#10	2.00	91
#16	1.18	87
#20	0.85	84
#30	0.600	81
#40	0.425	76
#50	0.300	68
#100	0.150	53
#200	0.075	44.2
	D60	0.2049



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB010	S-12	38.5 TO 40	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B010 S-12.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B011	S1	1.0	2.5	16.6														
	Color	Brown								Visual Classification			FILL: Lean clay with fine sand					
	S2	3.5	5.0	18.6		38	20	18										
	Color	Brown and dark brown (ORGANIC CONTENT = 2.9%)								Visual Classification			FILL: Lean clay with fine sand, trace fine gravel					
	S3	6.0	7.5	17.2	NA	44	18	26										
	Color	Brown and dark brown								Visual Classification			FILL: Sandy lean clay, trace fine gravel					
	S4	8.5	10.0	20.4														
	Color	Brown and gray								Visual Classification			FILL: Lean to fat clay, trace fine sand					
	S5	13.5	15.5	22.9	96.0	58	21	37										
	Color	Dark brown (ORGANIC CONTENT = 2.5%)								Visual Classification			FILL: Fat clay					
	S6	18.5	20.0	27.7	110.2	49	20	29										
	Color	Brown and gray								Visual Classification			FILL: Lean to fat clay, trace fine sand					
	S7	23.5	25.0	26.8					Note*									
	Color	Brown and gray								Visual Classification			Lean clay, trace fine sand					
	S8	25.5	27..5	TUBE TO FUGRO														
	Color									Visual Classification								
	S9	28.5	30.0	26.5		40	19	21										
	Color	Brown and gray								Visual Classification			Lean clay, trace fine sand					
	S10	33.5	35.0	25.0		33	16	17										
	Color	Brown and gray								Visual Classification			Sandy lean clay					
	S11	38.5	40.0	8.2		23	14	9	** Sieve									
	Color	Brown and gray								Visual Classification			Clayey sand, trace fine gravel					

TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.
*** Testing Not Possible

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B011	S12	43.5	45.0	9.0					** Sieve									
	Color		Brownish gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S13	48.5	50.0	9.6														
	Color		Brownish gray							Visual Classification			Sandy lean clay, trace fine gravel					

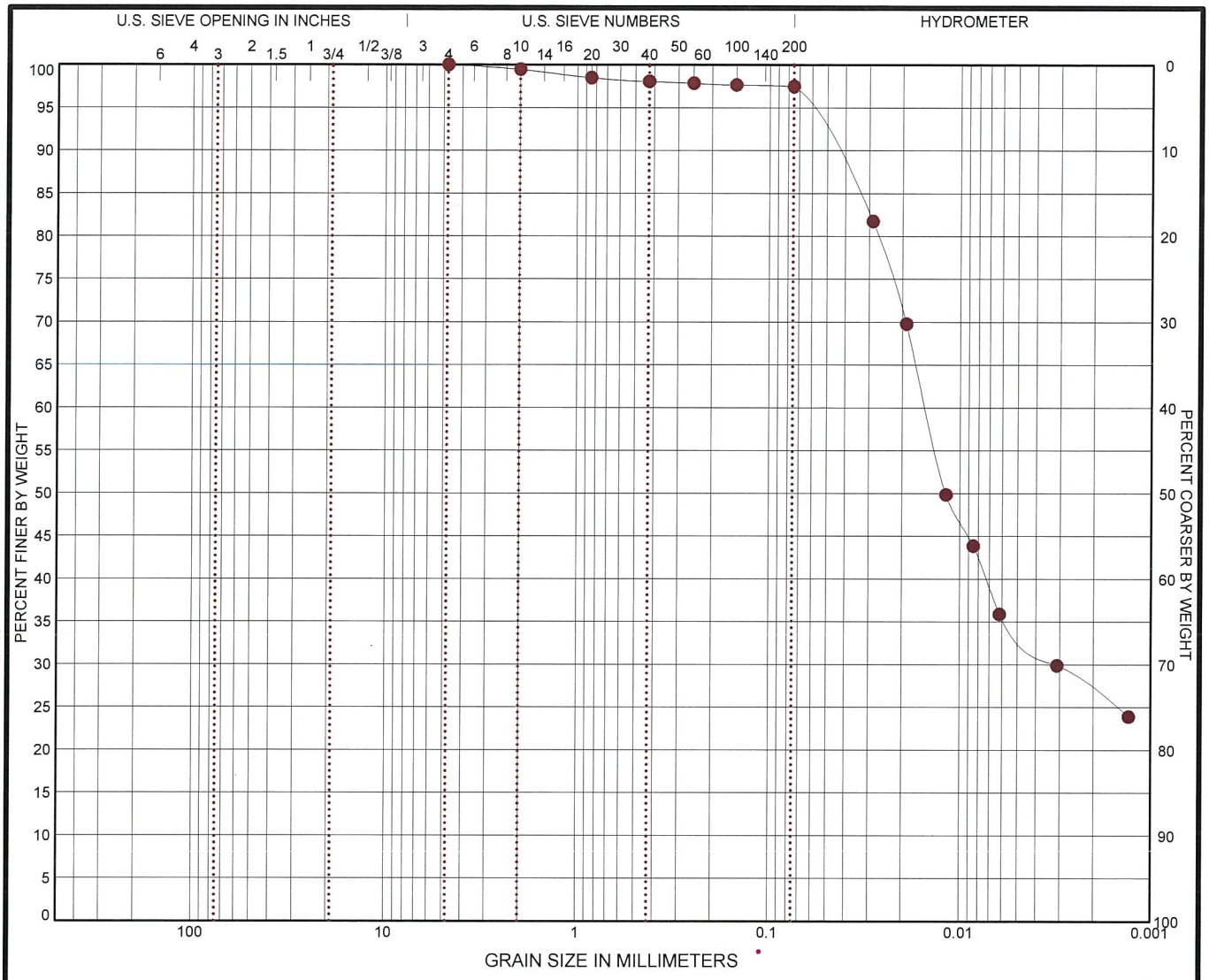
TESTED BY: JLB, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.
*** Testing Not Possible

Terracon

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	**KIN-B011**	**23.5**	**0.0**	**0.0**	**2.5**	**63.4**		**34.0**	

	GRAIN SIZE
	●
D_{60}	**0.015**
D_{30}	**0.003**
D_{10}	
	COEFFICIENTS
C_C	
C_U	

SIEVE (size)	PERCENT FINER ●
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	**100.0**
#10	**99.44**
#20	**98.47**
#40	**98.03**
#60	**97.83**
#100	**97.63**
#200	**97.46**

SOIL DESCRIPTION
●

REMARKS
●

PROJECT: Dynegy

SITE: Kincaid Power Station

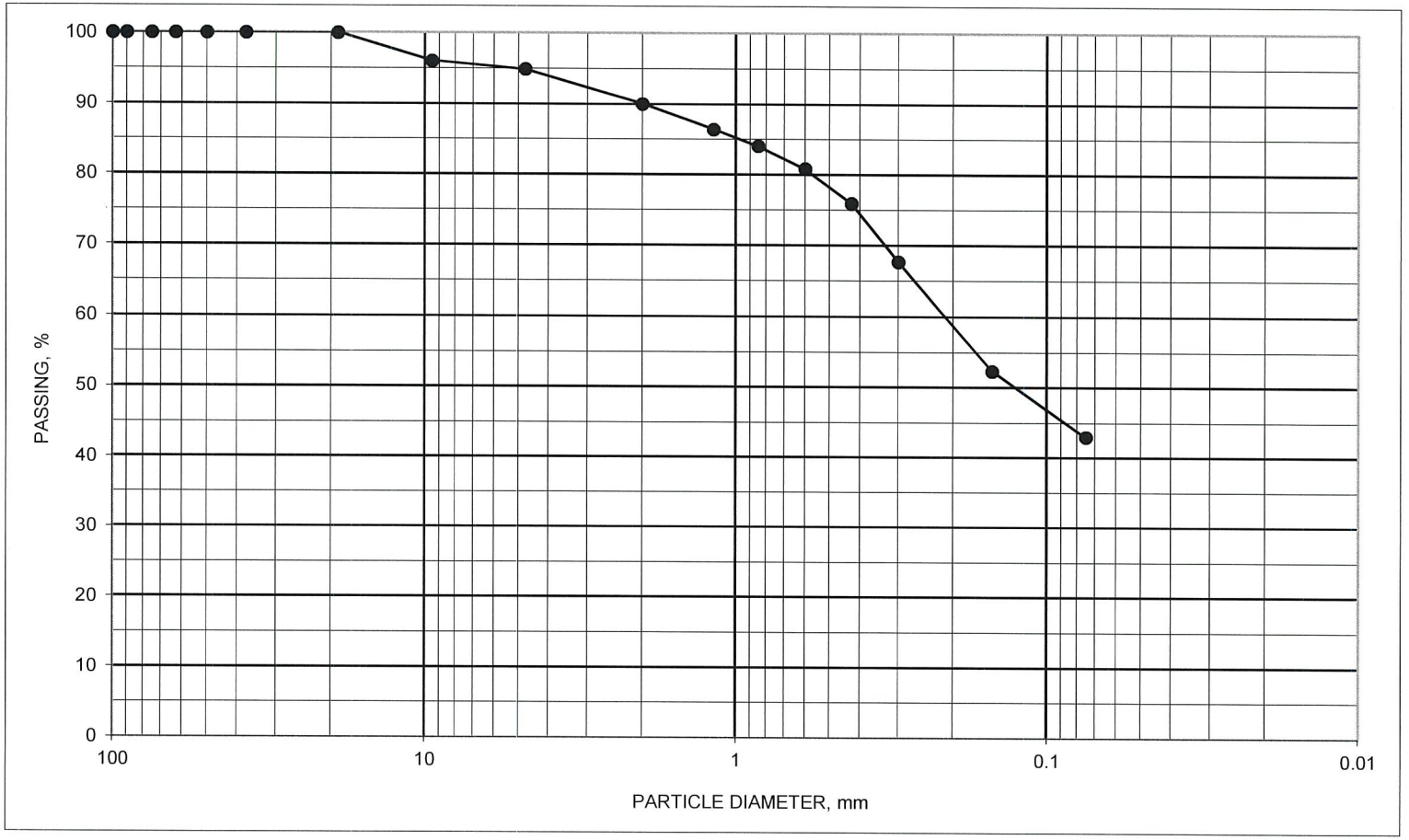
Terracon
51 Lost Mound Drive, Suite 135
Chattanooga, Tennessee

PROJECT NUMBER: 15151122

CLIENT: AECOM

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 15151122 KINCAID.GPJ TERRACON2012.GDT 9/25/15

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	96
#4	4.8	95
#10	2.00	90
#16	1.18	86
#20	0.85	84
#30	0.600	81
#40	0.425	76
#50	0.300	68
#100	0.150	52
#200	0.075	42.9
	D60	0.2122



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB011	S-11	38.5 TO 40	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

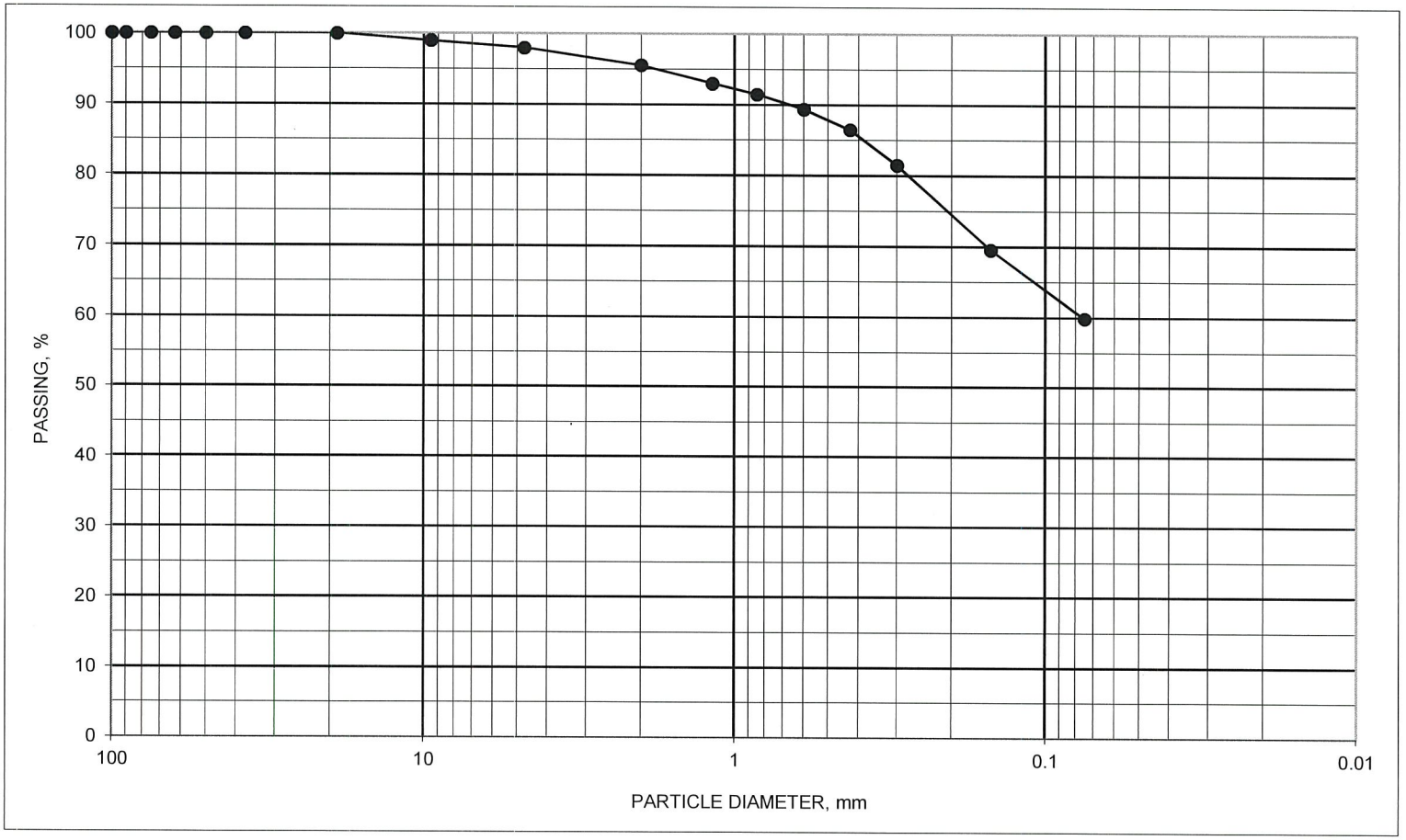
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B011 S-11.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	99
#4	4.8	98
#10	2.00	96
#16	1.18	93
#20	0.85	91
#30	0.600	89
#40	0.425	86
#50	0.300	81
#100	0.150	70
#200	0.075	59.9
	D60	0.0755



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB011	S-12	43.5 TO 45	Sandy lean clay, trace fine gravel Brownish gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B011 S-12.xlsx]GRADATION

Terracon

DYNEGY - KINCAID, ILLINOIS
15151122
10/7/2015

Boring	Sample ID	Depth From, feet	Depth To, feet	Moisture Content, %	Dry Unit Weight	Atterberg Limits LL	PL	PI	Particle Size Analysis NOTE*	Double Hydro % Disp. NOTE*	Specific Gravity	Perm cm/sec NOTE*	Consol NOTE*	CU Triaxial NOTE*	Direct Simple Shear NOTE*	Pinhole Disp. NOTE*	Crumb Test NOTE*	USCS Symbol
KIN-B012	S1	1.0	2.5	11.2					** Sieve									
	Color		Black							Visual Classification			FILL: Cinders					
	S2	3.5	5.0	12.0					** Sieve		2.829							
	Color		Black							Visual Classification			FILL: Cinders					
	S3	7.0	9.0	X														
	Color		Piston sample - no recovery							Visual Classification								
	S4	8.5	10.0	19.4														
	Color		Black							Visual Classification			FILL: Cinders					
	S5	13.0	15.5	X														
	Color		PISTON SAMPLE - ASH OVERLAY							Visual Classification								
	S6	15.5	17.5															
	Color		No testing assigned							Visual Classification								
	S7	18.5	20.5	X	X	X	X	X			X		X		X			
	Color		ON HOLD							Visual Classification								
	S8	23.5	25.0															
	Color		No testing assigned							Visual Classification								
	S9	28.5	30.0	8.4	NA	19	13	6										
	Color		Brown and gray							Visual Classification			Sandy Silty lean clay, trace fine gravel					
	S10	33.5	35.0	7.1														
	Color		Brown and gray							Visual Classification			Sandy lean clay, trace fine gravel					
	S11	38.5	40.0	14.9					** Sieve									
	Color		Brown and gray							Visual Classification			Clayey sand, trace fine gravel					

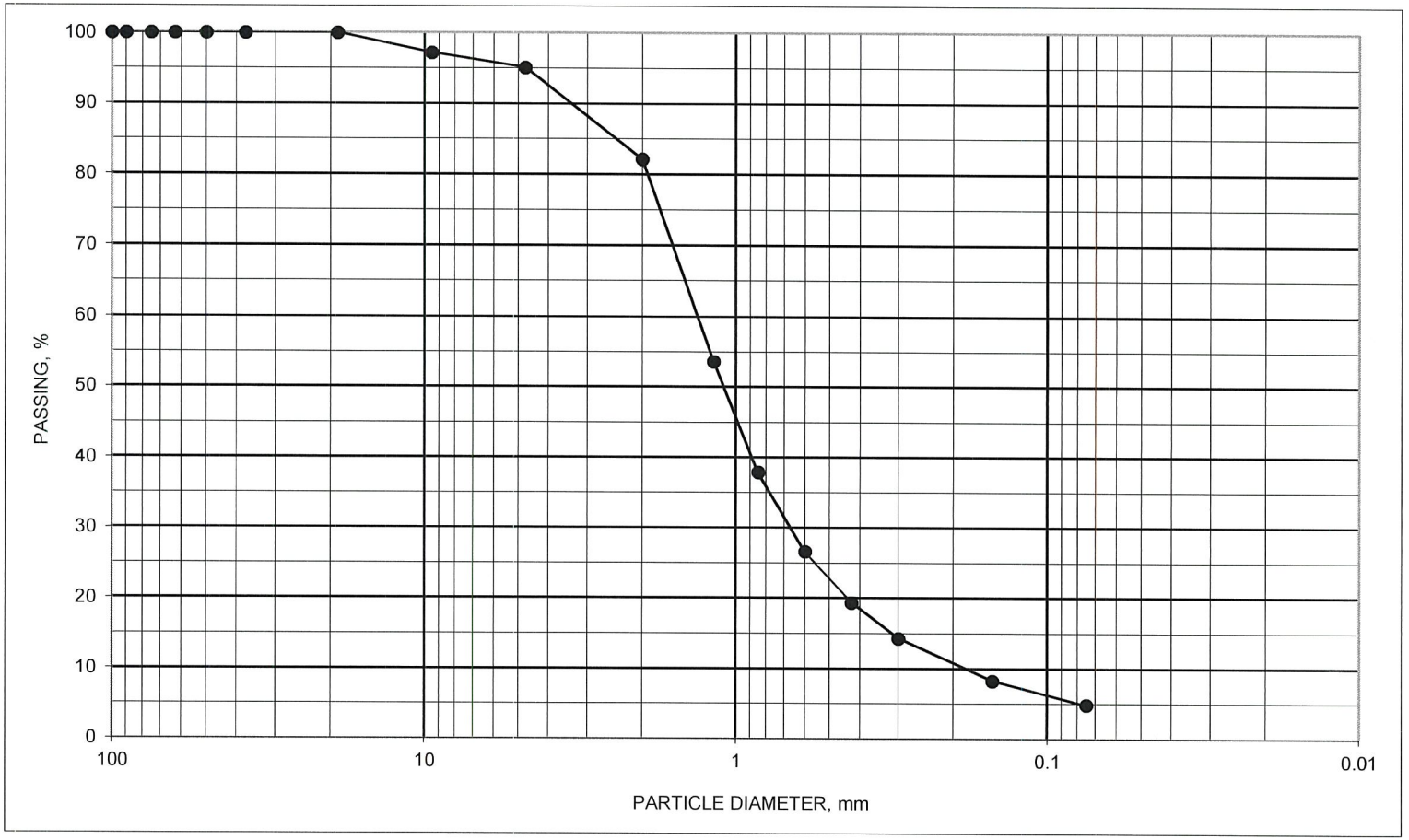
TESTED BY: JLB, KL, RR, SS
APPROVED BY: JLB

NOTE*: SEE ATTACHED DATA SHEETS.
*** Testing Not Possible

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	97
#4	4.8	95
#10	2.00	82
#16	1.18	54
#20	0.85	38
#30	0.600	27
#40	0.425	19
#50	0.300	14
#100	0.150	8
#200	0.075	4.8

D60	1.3289
D30	0.6670
D10	0.1833
Cu	7.2
Cc	1.8



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB012	S-1	1 TO 2.5	FILL: Cinders Black	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

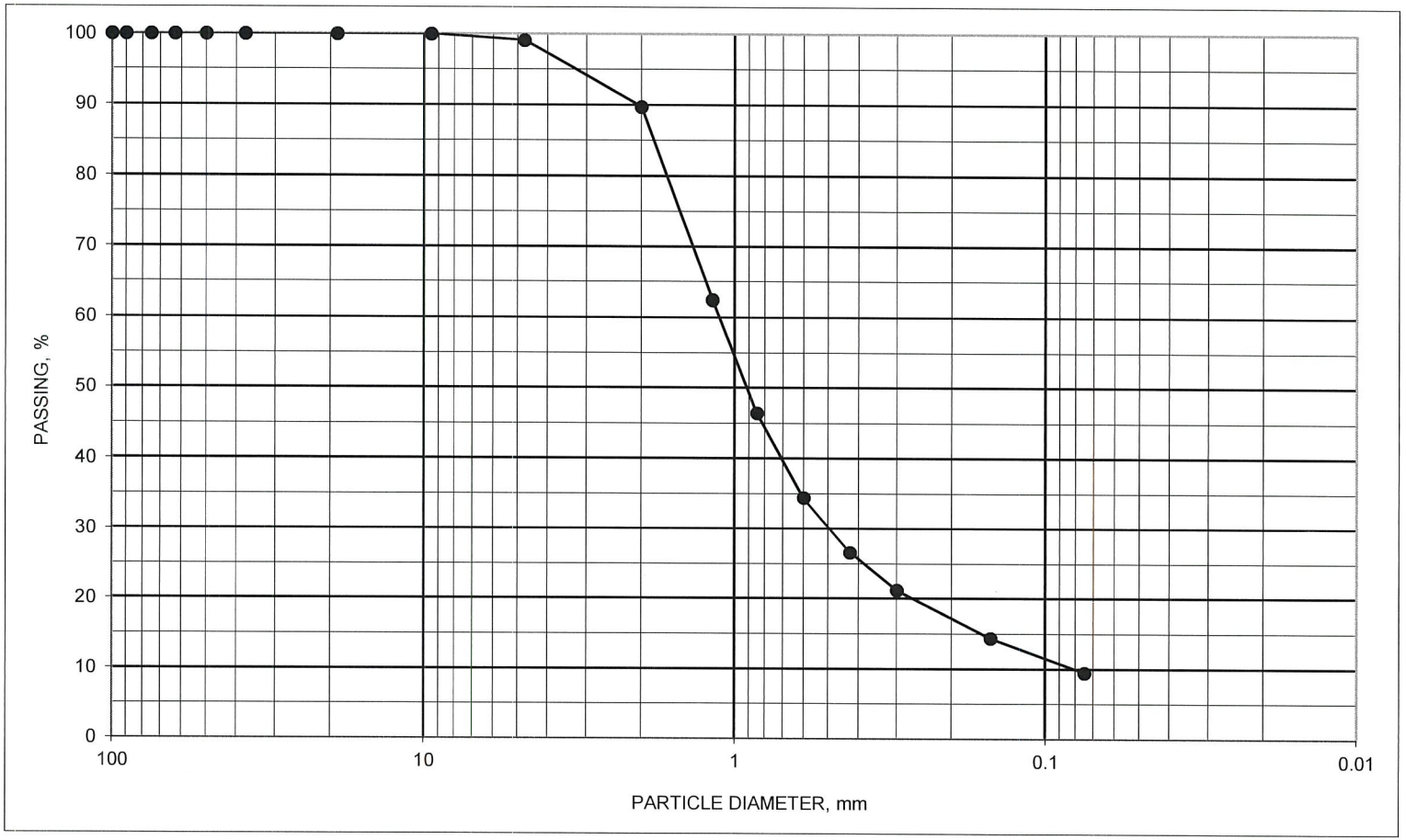
JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B012 S-1.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	99
#10	2.00	90
#16	1.18	62
#20	0.85	46
#30	0.600	34
#40	0.425	27
#50	0.300	21
#100	0.150	14
#200	0.075	9.4

D60	1.1222
D30	0.4940
D10	0.0812
Cu	13.8
Cc	2.7



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB012	S-2	3.5 TO 5	FILL: Cinders Black	#VALUE!				

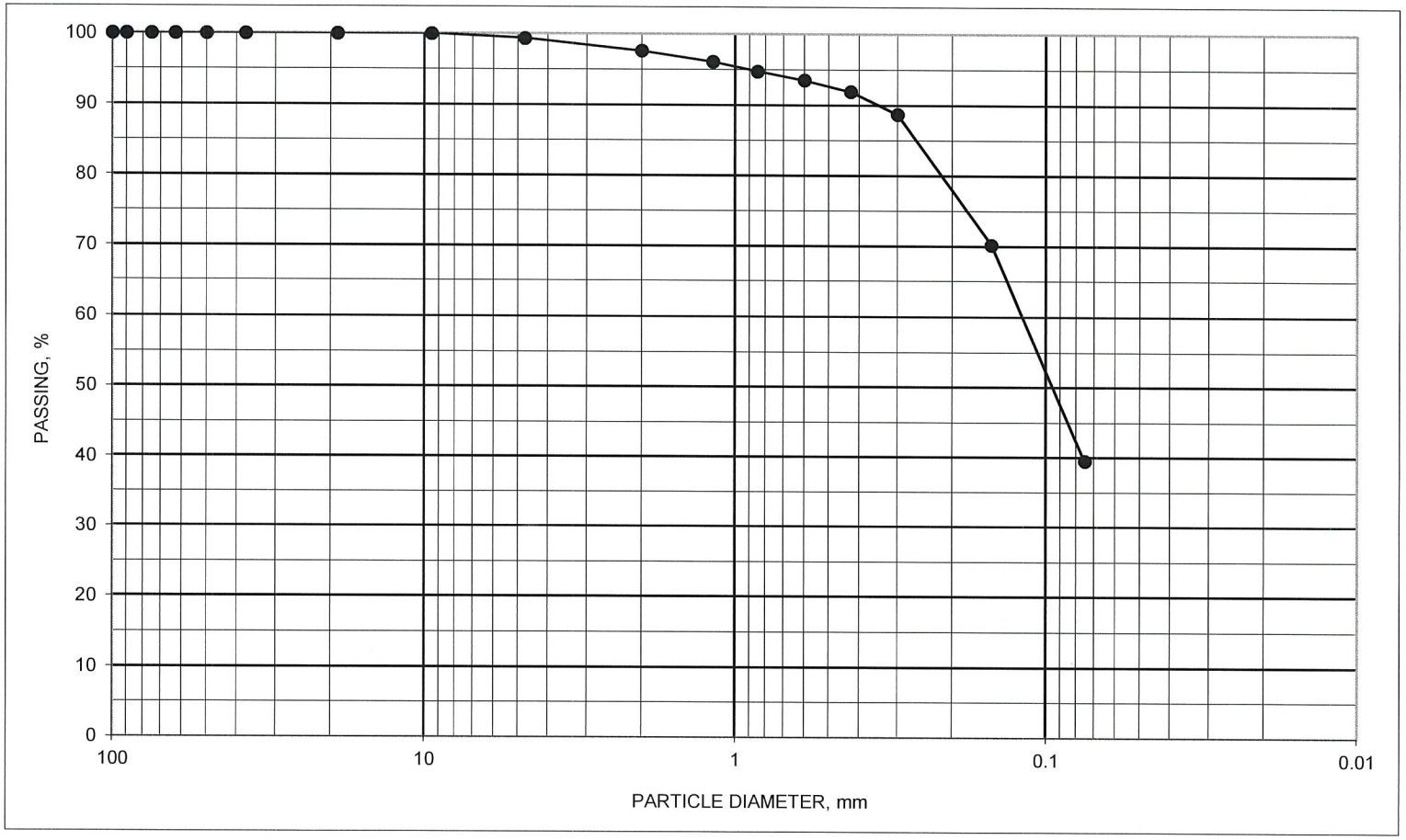
PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B012 S-2.xlsx]GRADATION

Terracon

SIEVE SIZE	DIAMETER, mm	PASS, %
4"	100.0	100
3.5"	90.0	100
3"	75.0	100
2.5"	63.0	100
2"	50.0	100
1.5"	37.5	100
3/4"	19.0	100
3/8"	9.5	100
#4	4.8	99
#10	2.00	98
#16	1.18	96
#20	0.85	95
#30	0.600	94
#40	0.425	92
#50	0.300	89
#100	0.150	70
#200	0.075	39.5
	D60	0.1192



ASTM D1140 / C117 #200 WASH SIEVE AND C136 SIEVE ANALYSIS

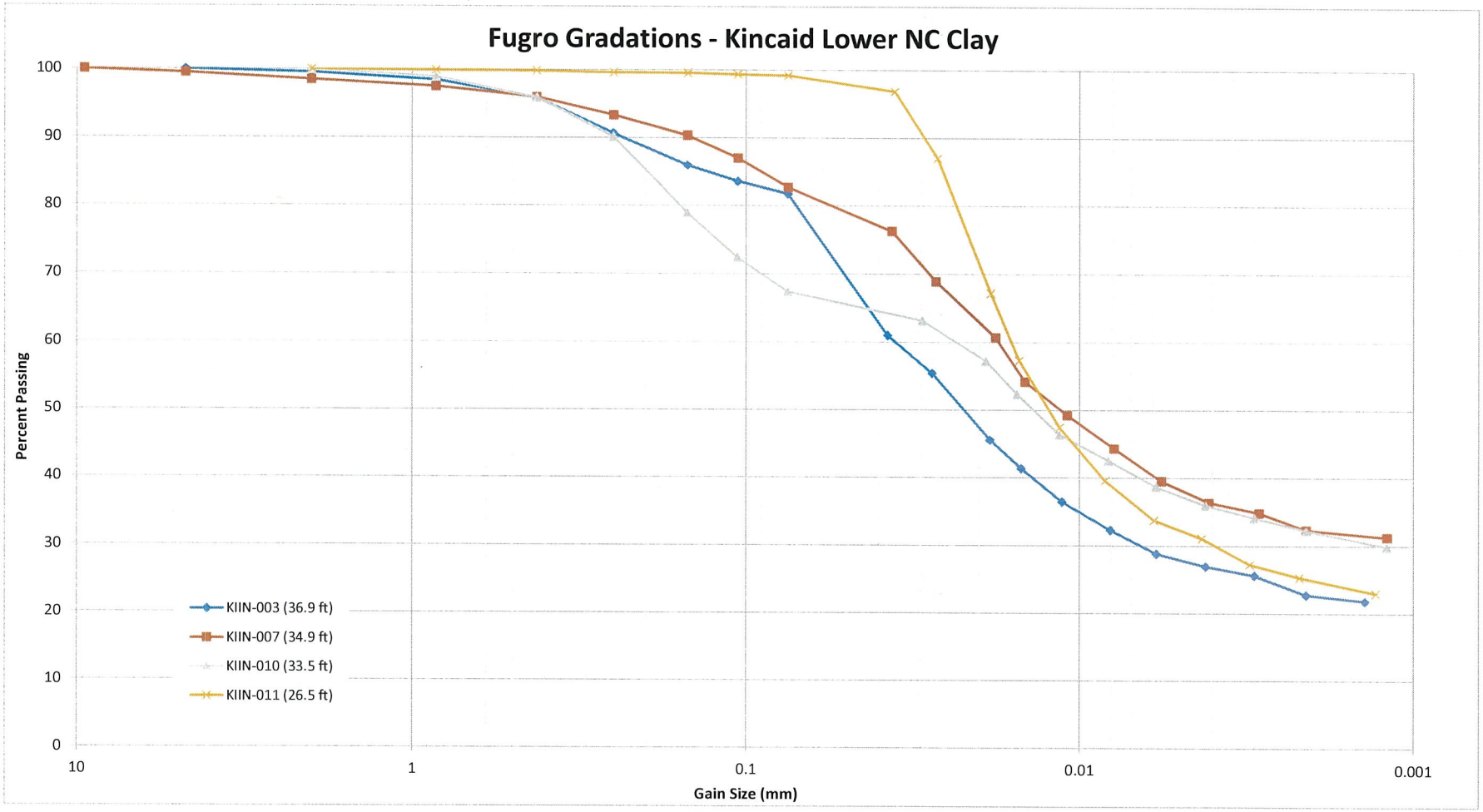
BORING ID	SAMPLE ID	DEPTH, feet	DESCRIPTION	SYMBOL	NAT M%	ATTERBERG LIMITS LL	PL	PI
KINB012	S-11	38.5 TO 40	Clayey sand, trace fine gravel Brown and gray	#VALUE!				

PROJECT Dynergy - Kincaid, IL.

JOB NO. 15151122 DATE 9/24/2015

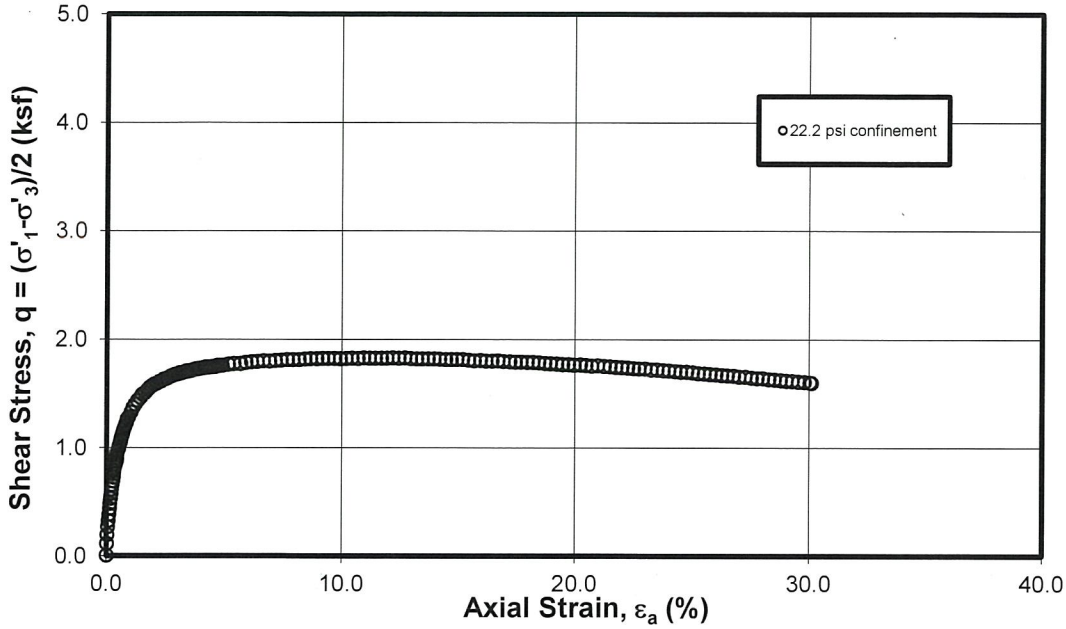
N:\Projects\2015\15151122\Working Files\Laboratory-Field Data-Boring Logs\Kincaid\[200 Wash Plot B012 S-11.xlsx]GRADATION

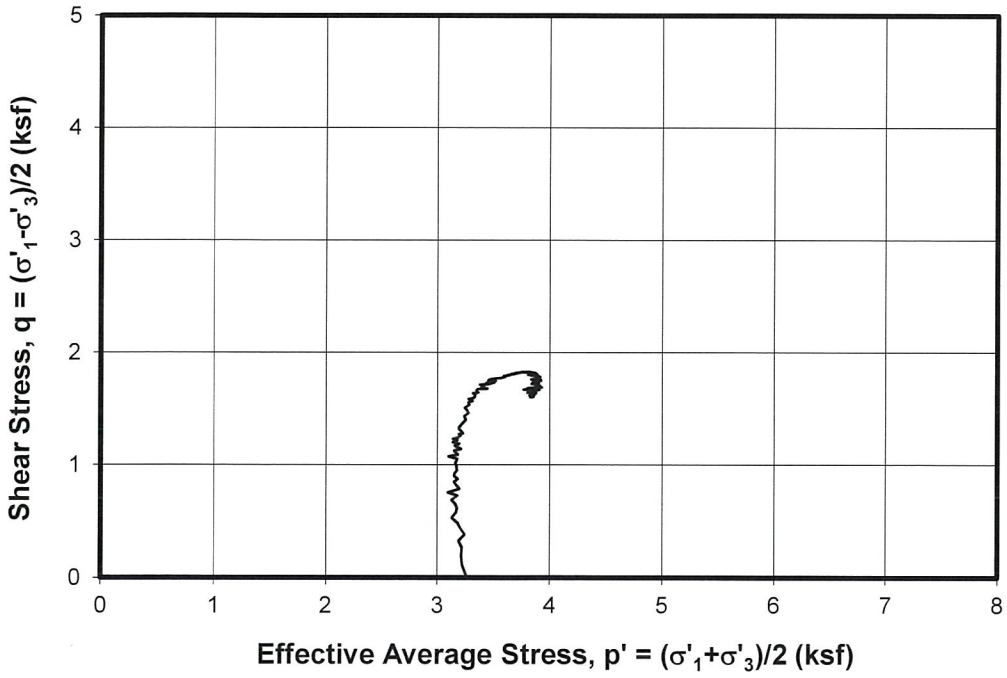
Terracon


Fugro Gradations - Kincaid Lower NC Clay
Percent Passing
100
90
80
70
60
50
40
30
20
10
0
10
1
0.1
0.01
0.001
Gain Size (mm)
KIIN-003 (36.9 ft)
KIIN-007 (34.9 ft)
KIIN-010 (33.5 ft)
KIIN-011 (26.5 ft)

Fugro

Fugro



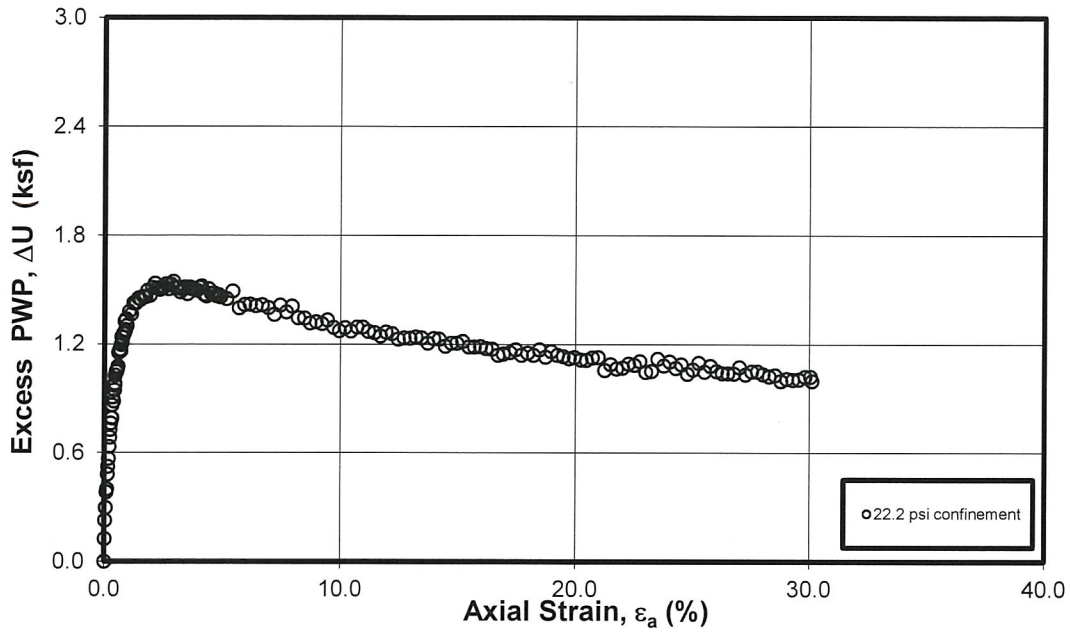


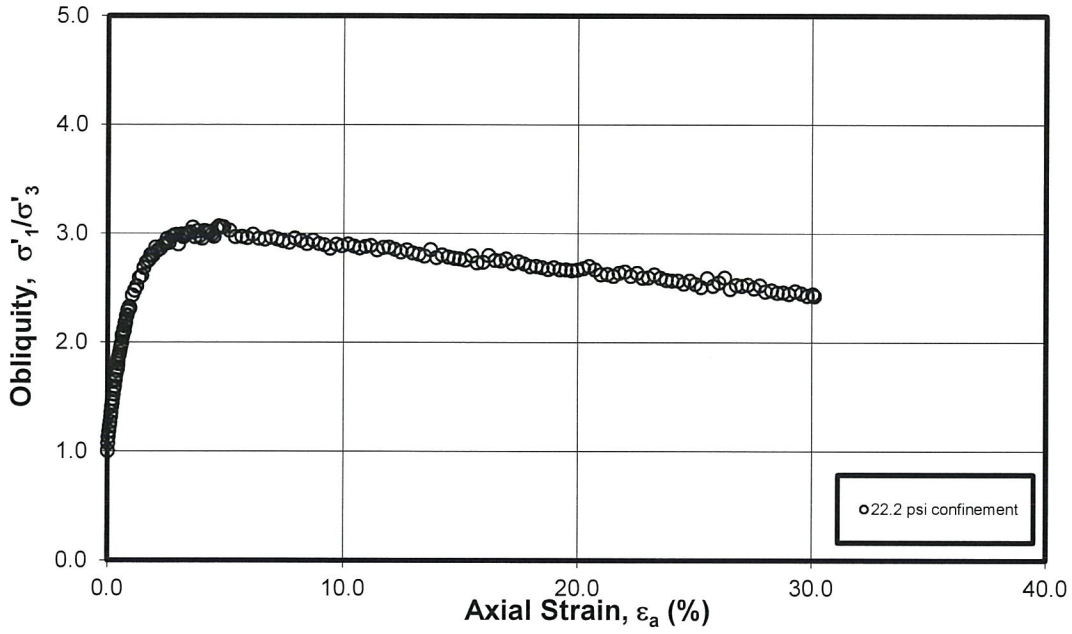
UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-11c - Depth: 36.90 ft
Boring KIN-B003

LL = 54
PL = 15
PI = 39

SG = 2.705

NC Clay Foundation





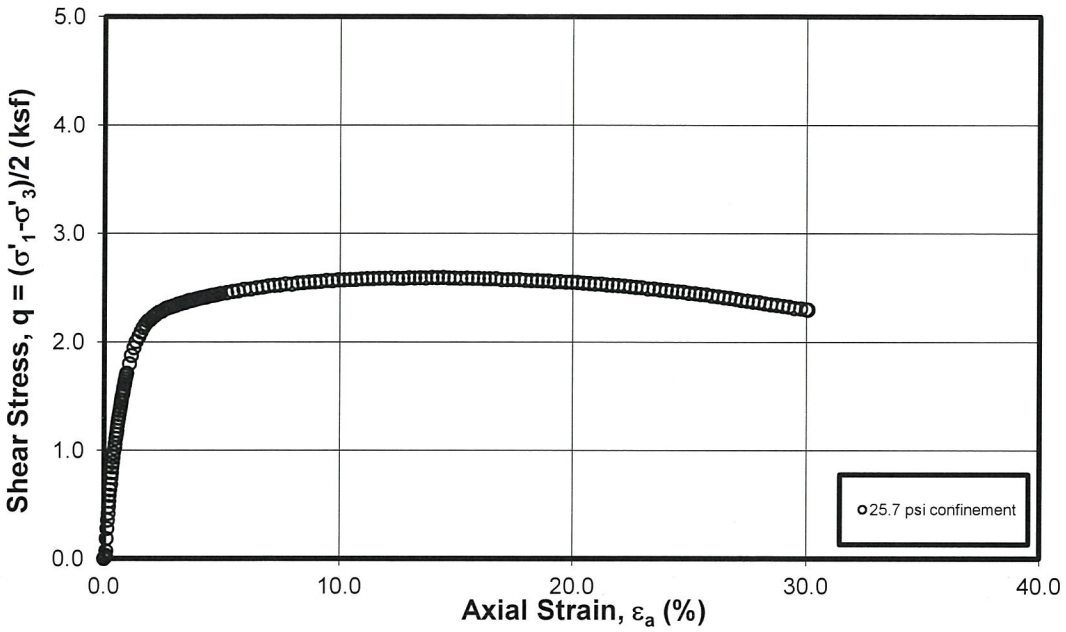
UNDRAINED TRIAXIAL COMPRESSION TEST

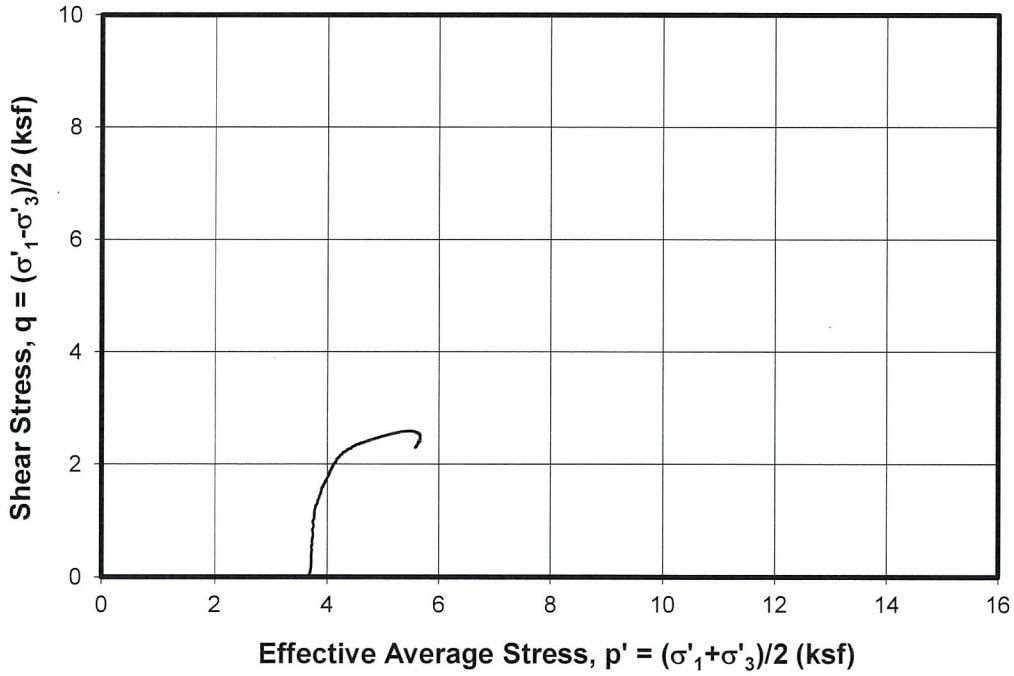
Isotropically Consolidated

Sample: S-11c - Depth: 36.90 ft

Boring KIN-B003

Fugro



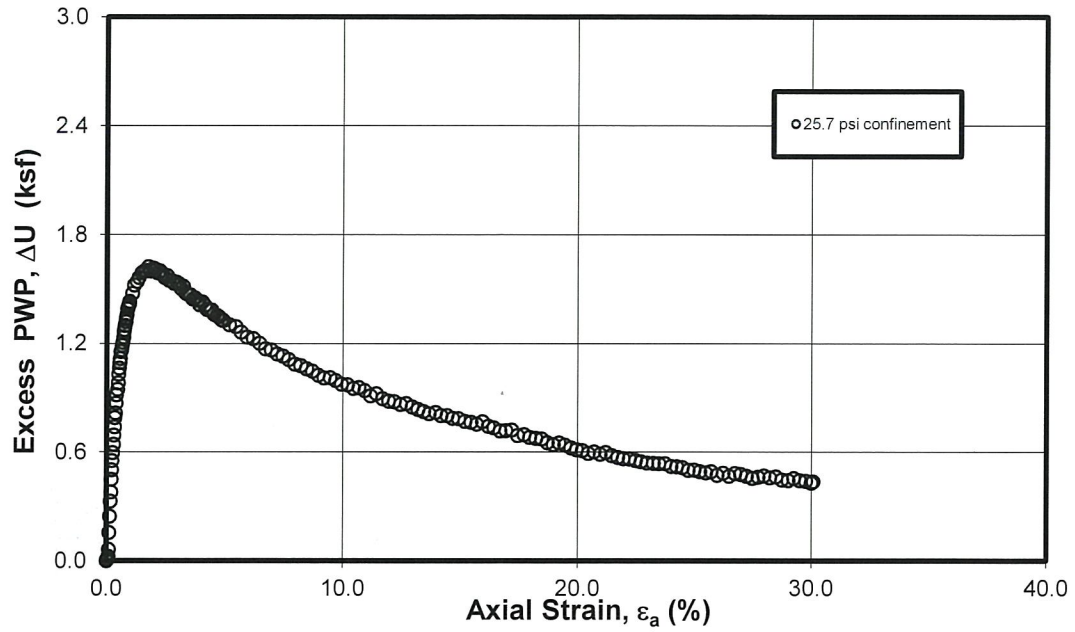


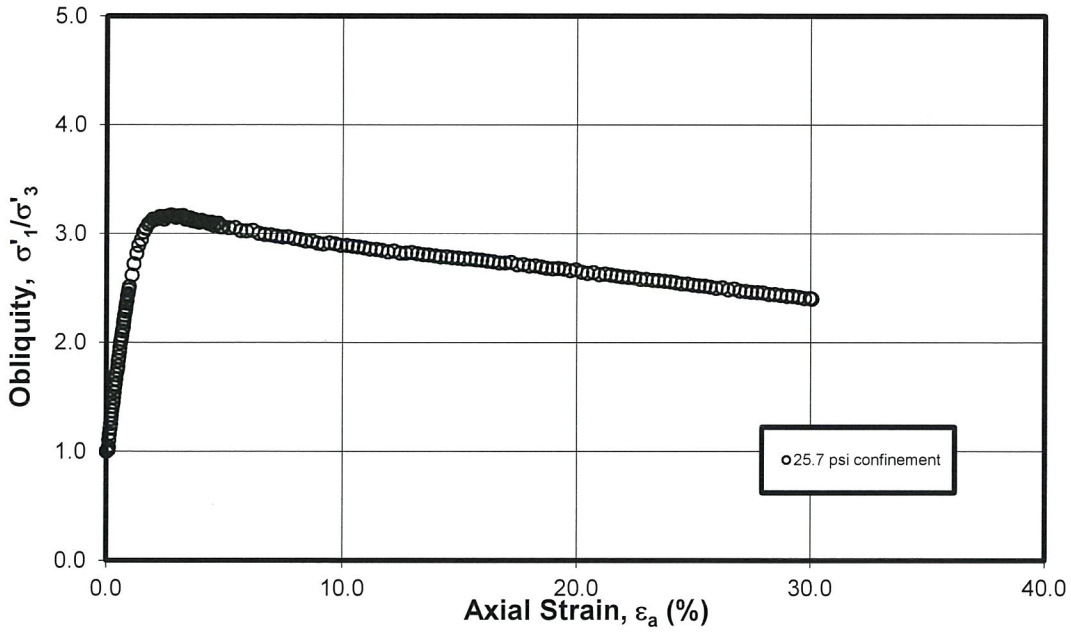
UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-11c - Depth: 34.90 ft
Boring KIN-B007

LL = 50
PL = 15
PI = 35

SG = 2.699

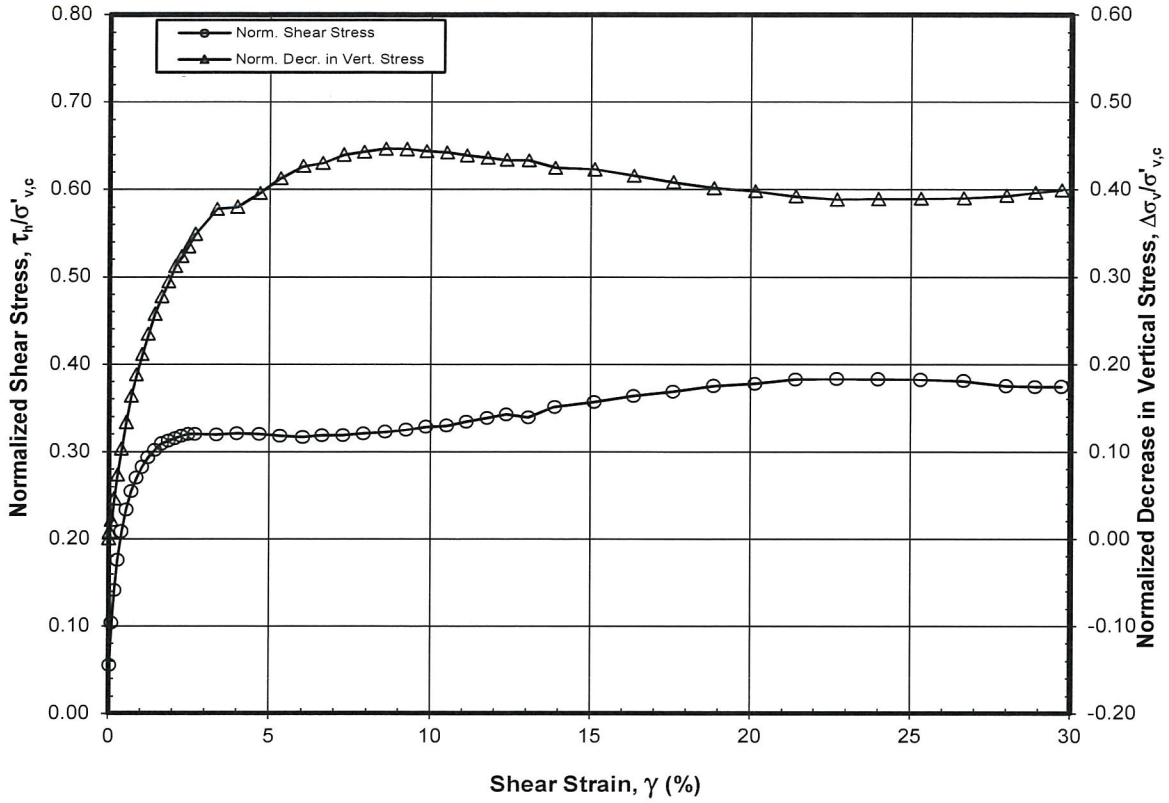
NC Clay Foundation

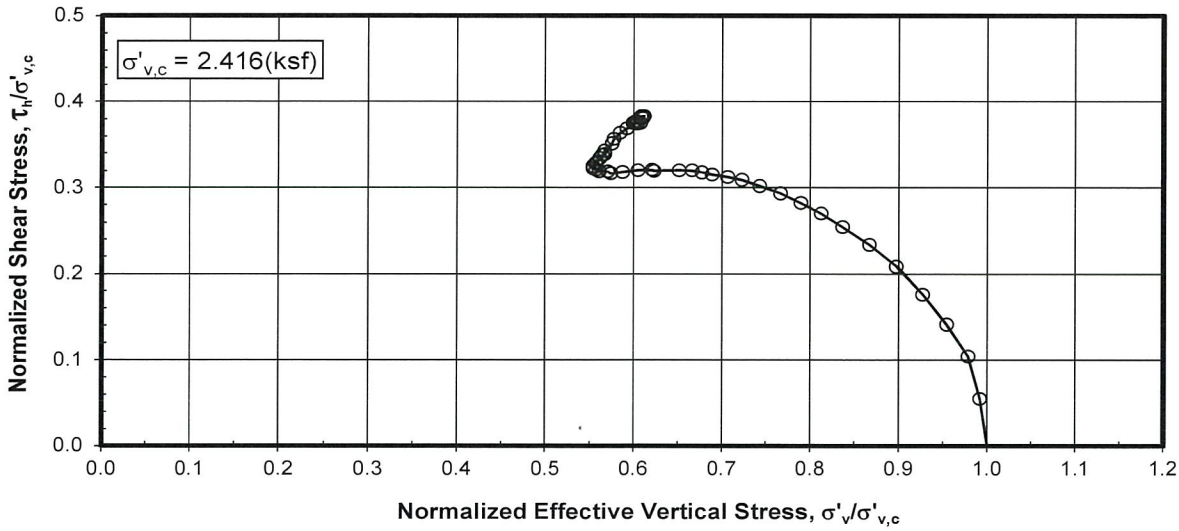




UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-11c - Depth: 34.90 ft
Boring KIN-B007

Fugro



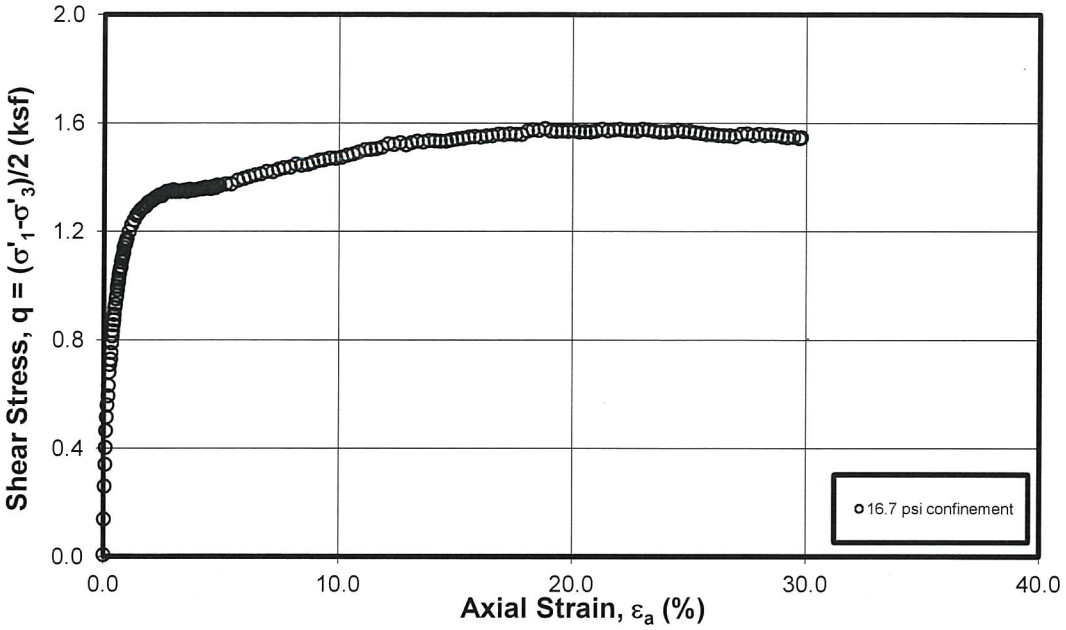


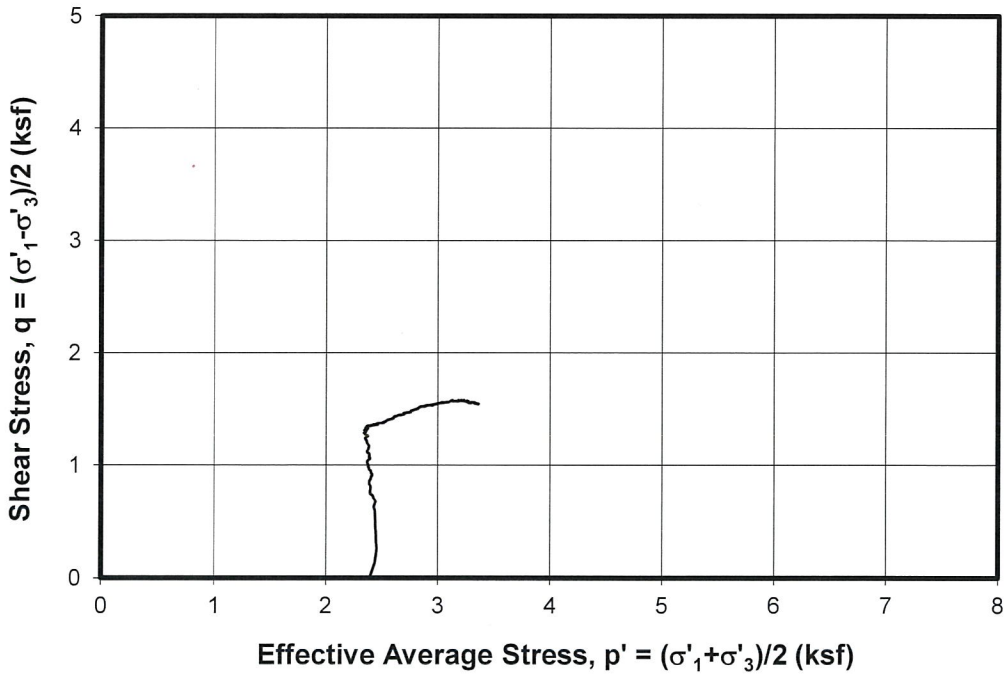
Boring KIN-B010 @ 33.1 ft

STATIC DSS TEST

NC Foundation Clay

Fugro

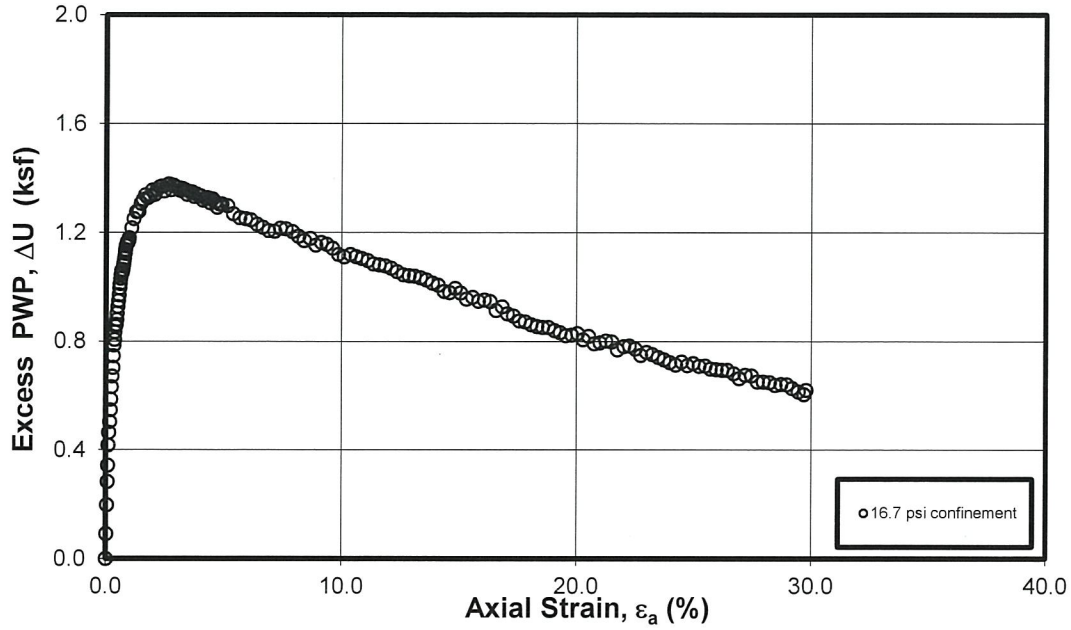


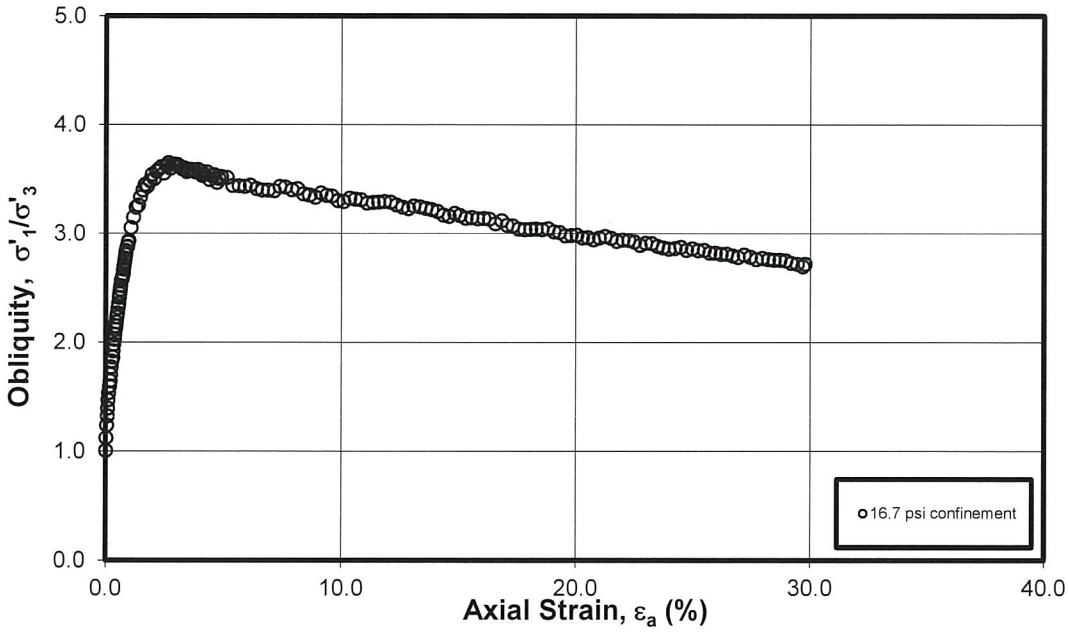


UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-10d - Depth: 33.45 ft
Boring KIN-B010

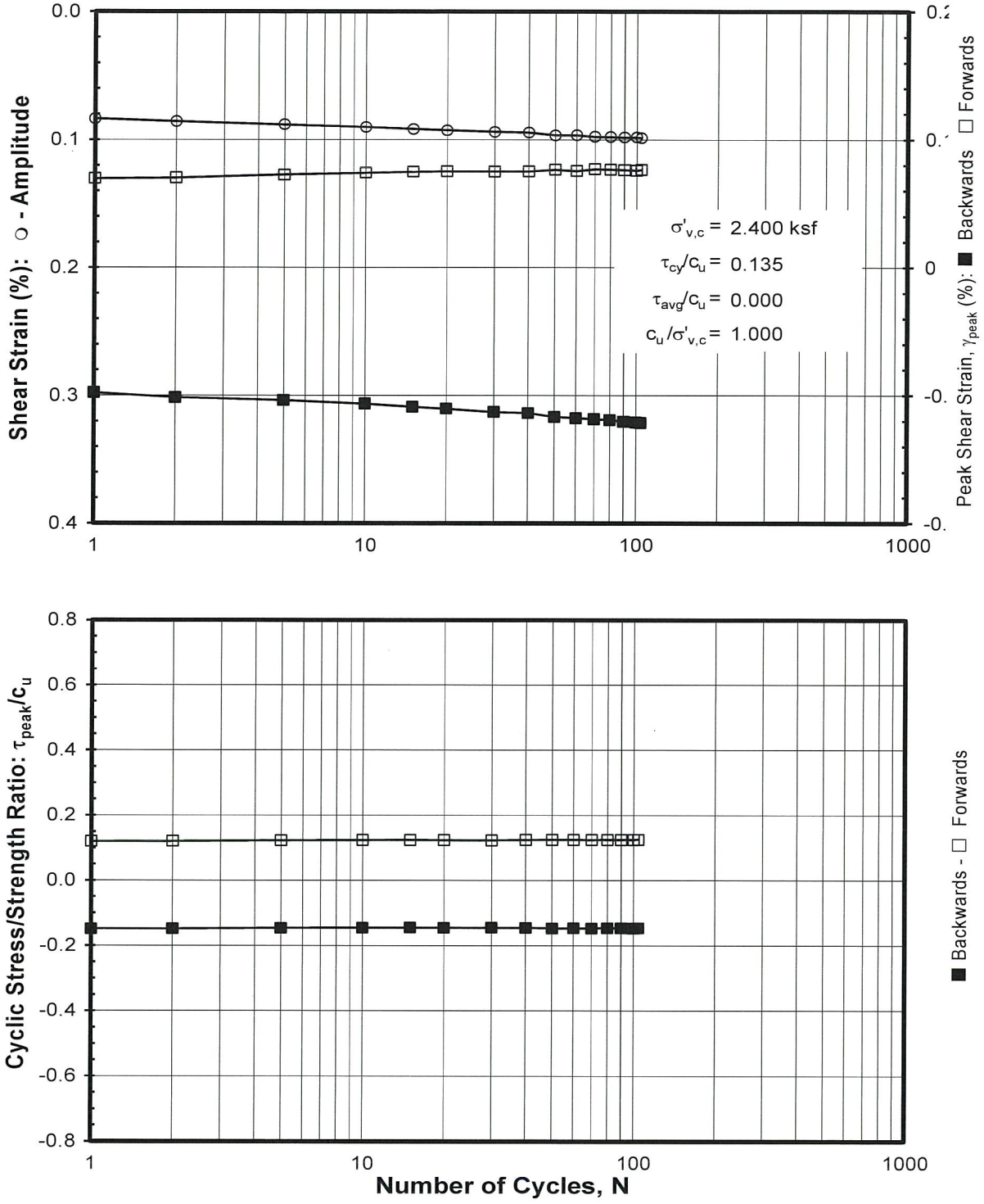
LL=54
PL=14
PI=40

SG=2.697
NC Foundation Clay





UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-10d - Depth: 33.45 ft
Boring KIN-B010



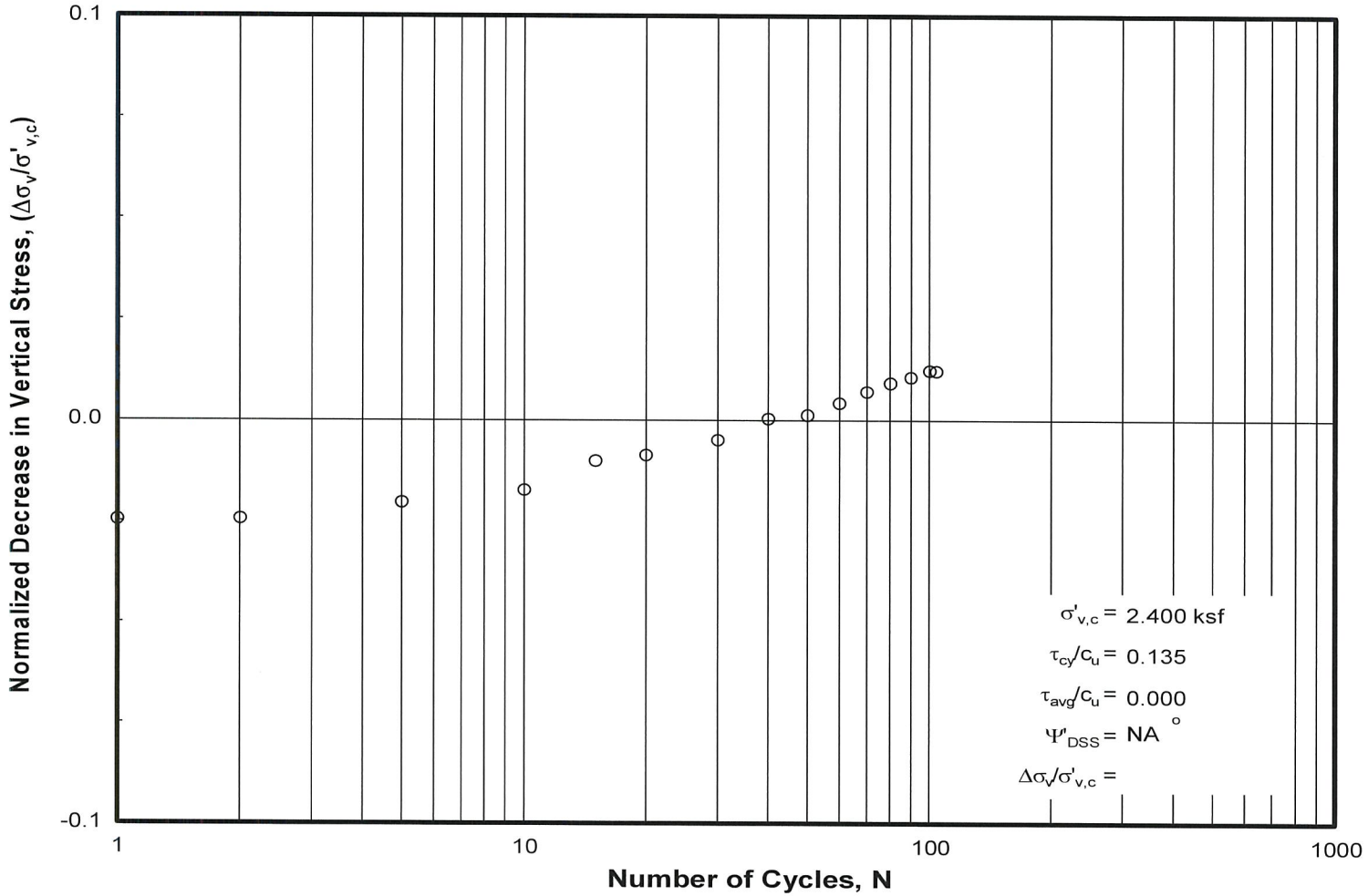
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



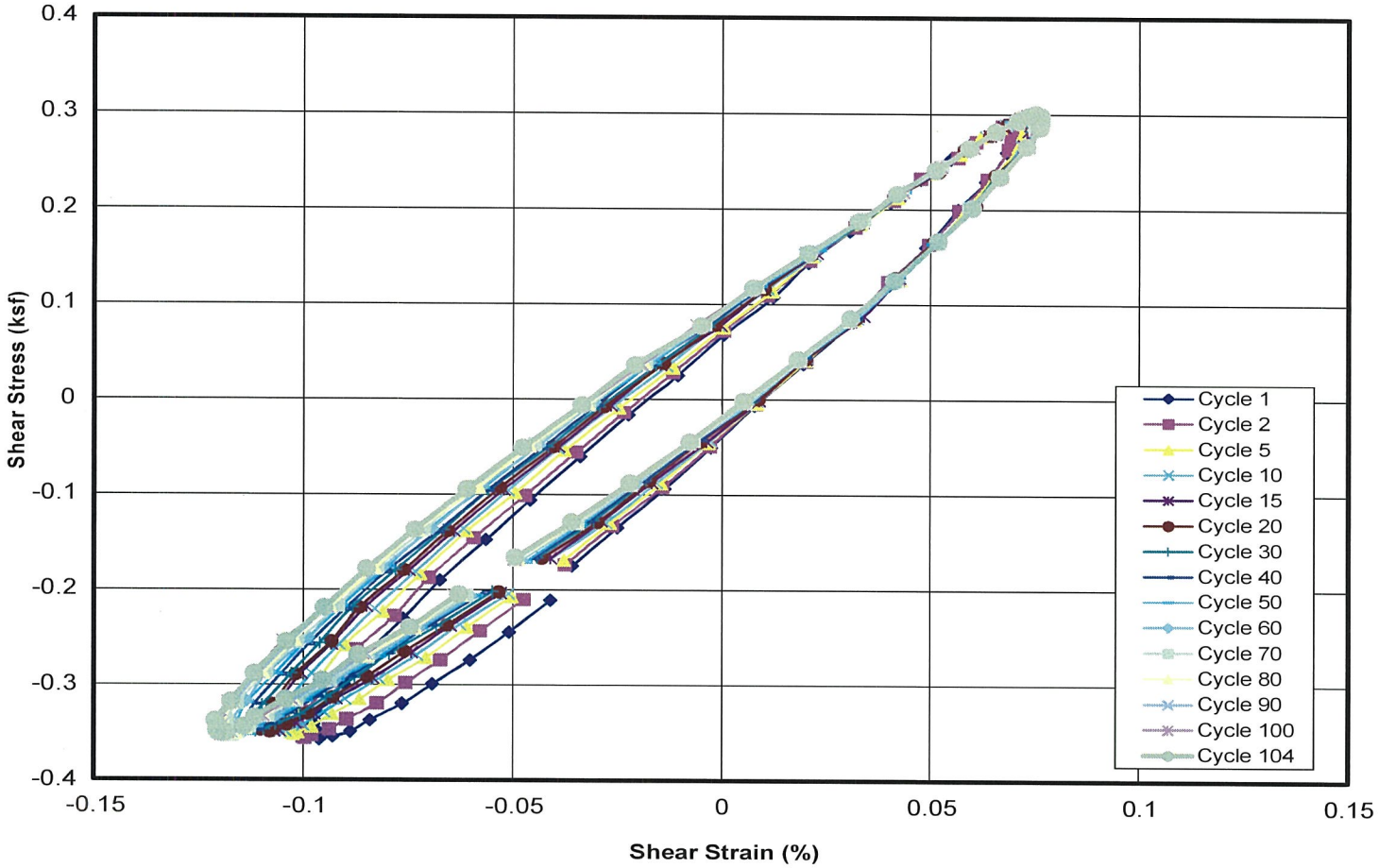
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



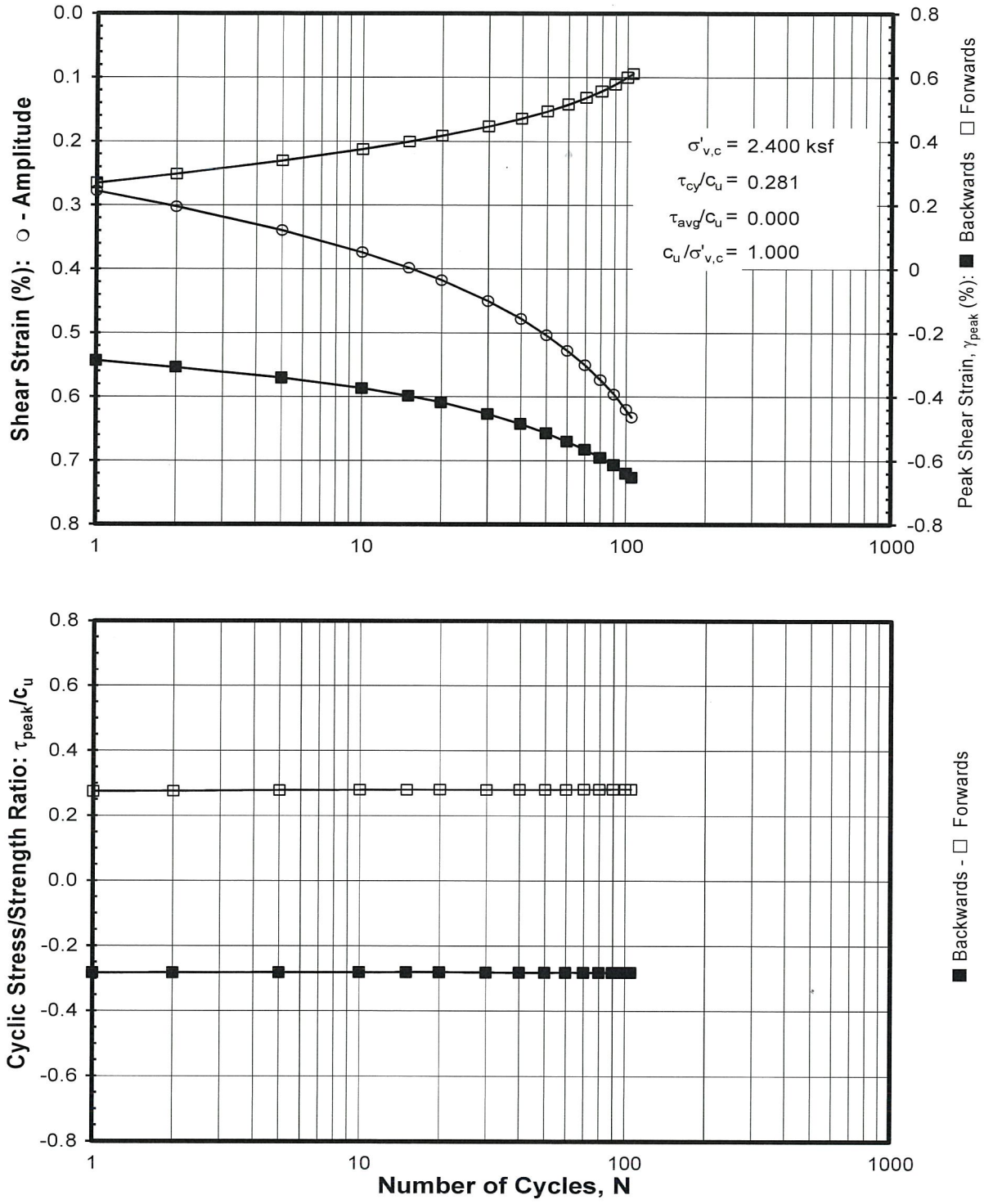
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

Denegy CCR Assessment of Plants



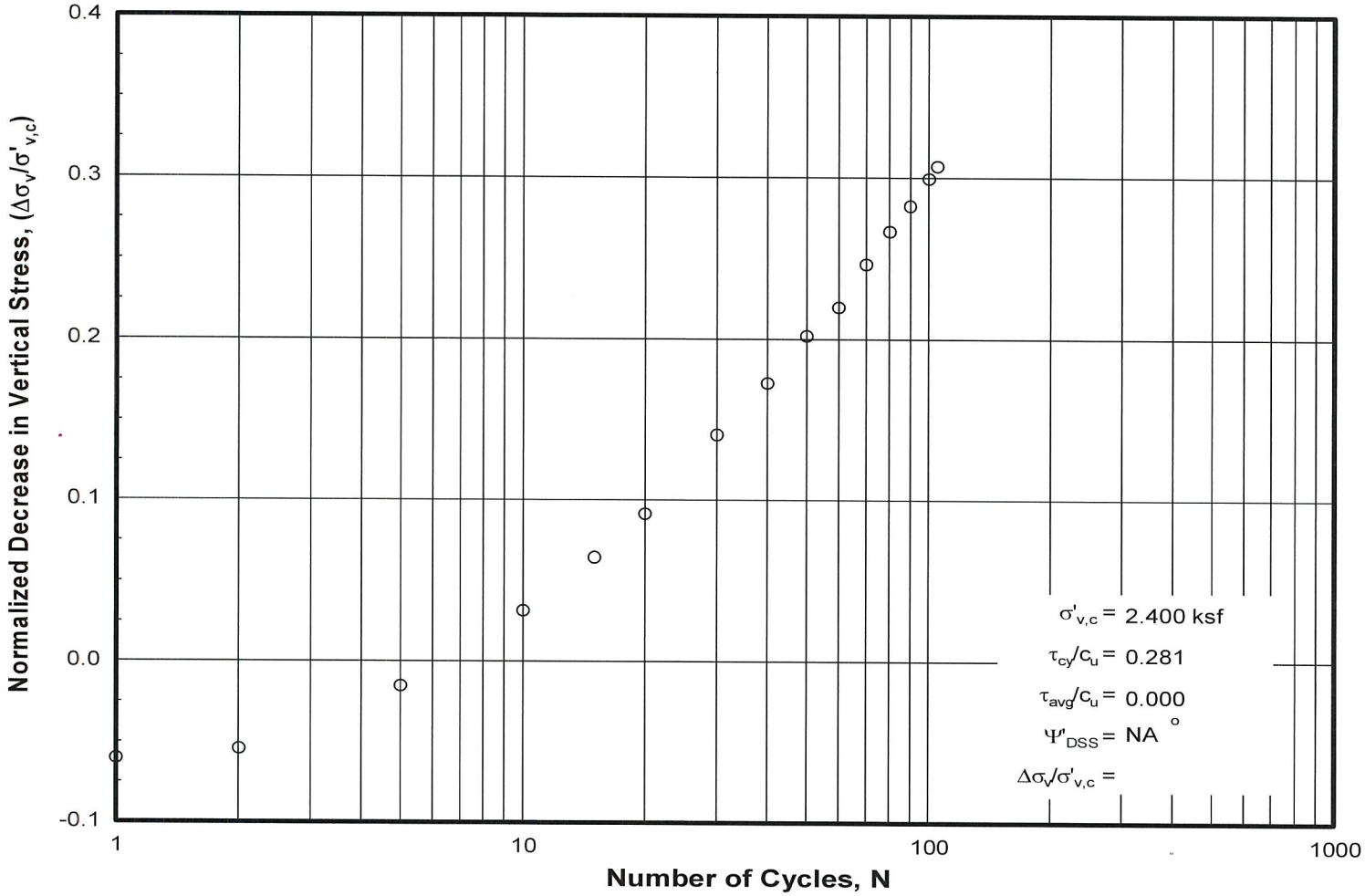
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

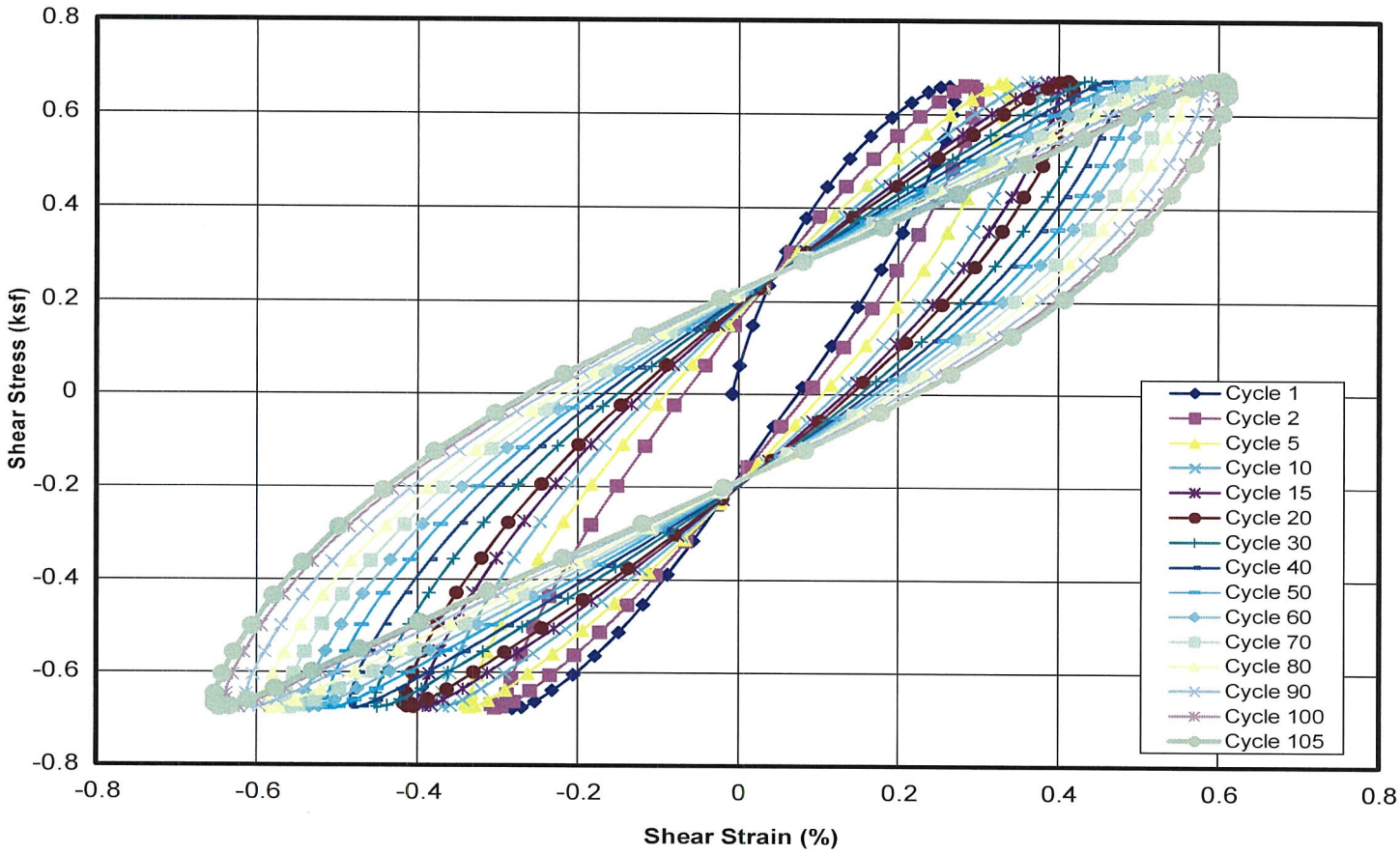
Sample: S-10c - Depth: 33.75 ft

Boring KIN-B010

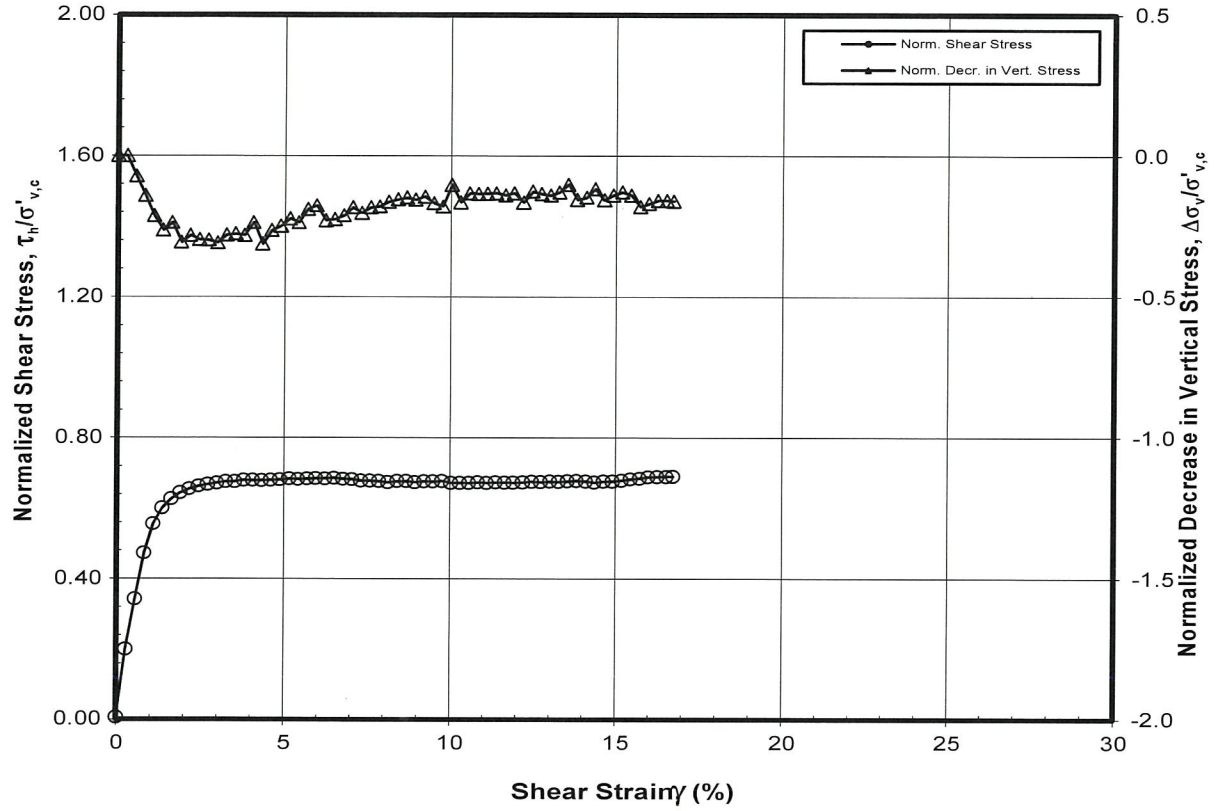
Denegy CCR Assessment of Plants

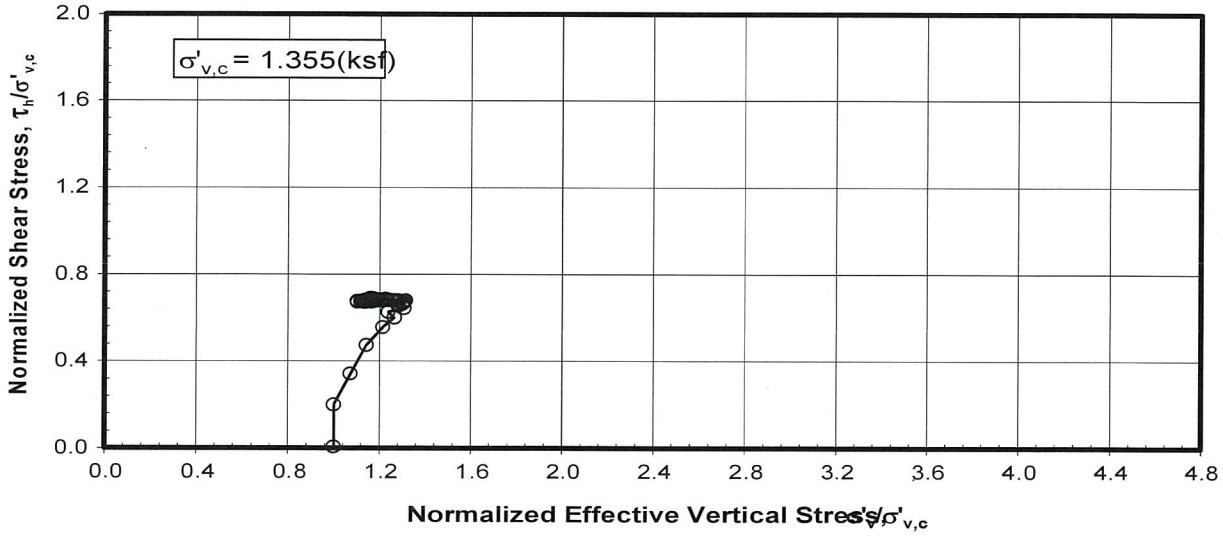


CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress
OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: S-10c - Depth: 33.75 ft
Boring KIN-B010
Denegy CCR Assessment of Plants



CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress
OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: S-10c - Depth: 33.75 ft
Boring KIN-B010
Denegy CCR Assessment of Plants





POST CYCLIC STATIC DSS TEST

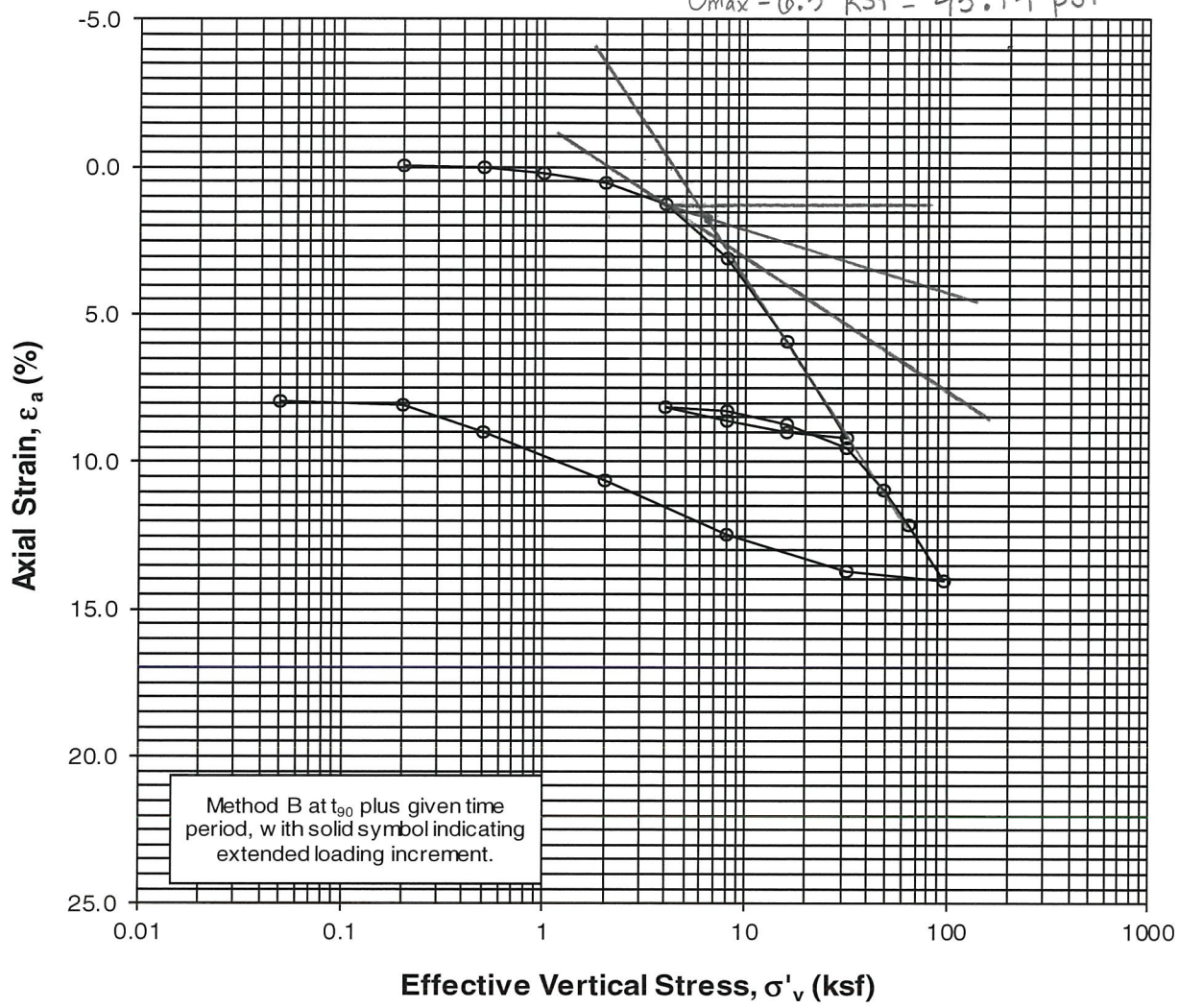
K_o Consolidation - OCR = 1 - Strain Rate = 5 %/hr

Sample: S-10c - Depth: 33.75 ft.

Boring KIN-B010

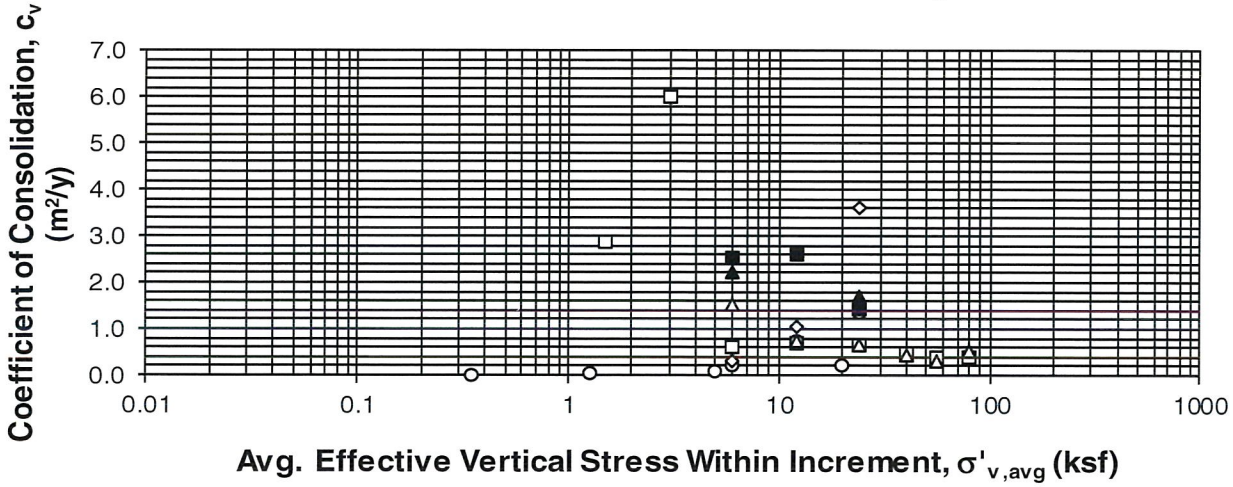
Fugro

$\sigma'_{max} = 6.5$ ksf = 45.14 psi



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading

with solid symbols indicating reloading increments



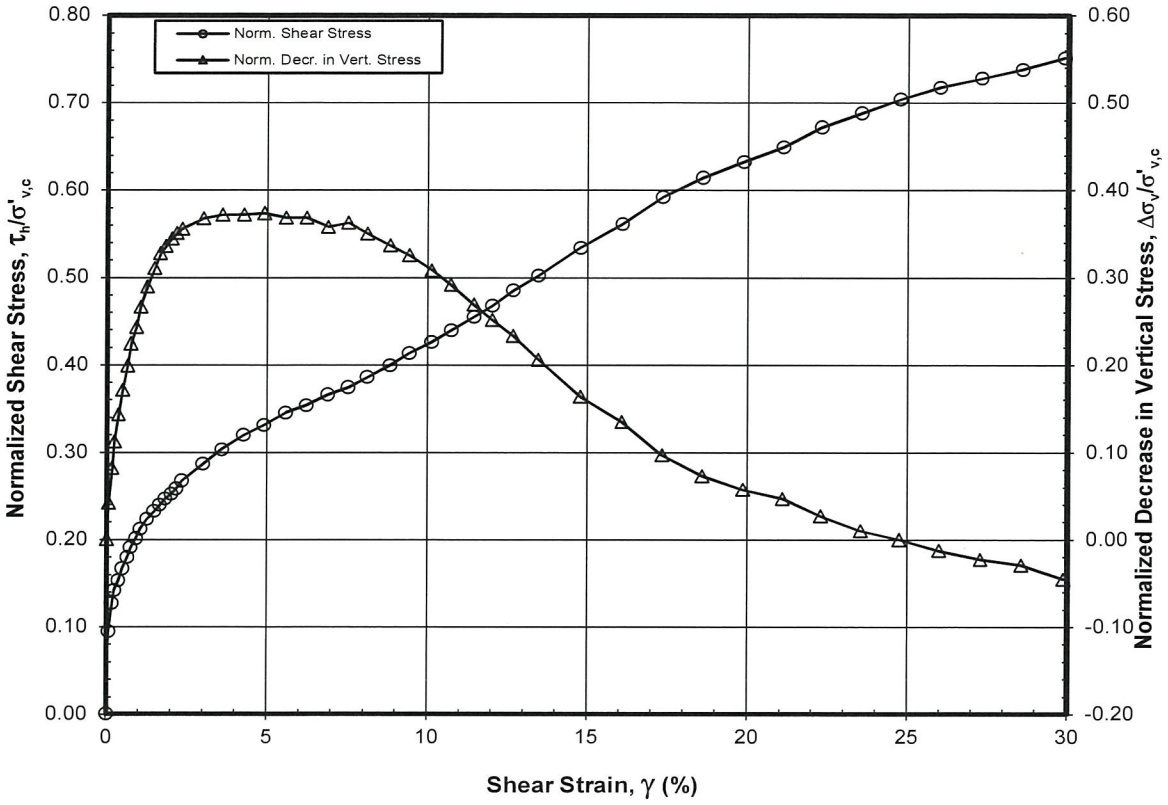
1-D CONSOLIDATION TEST: INC

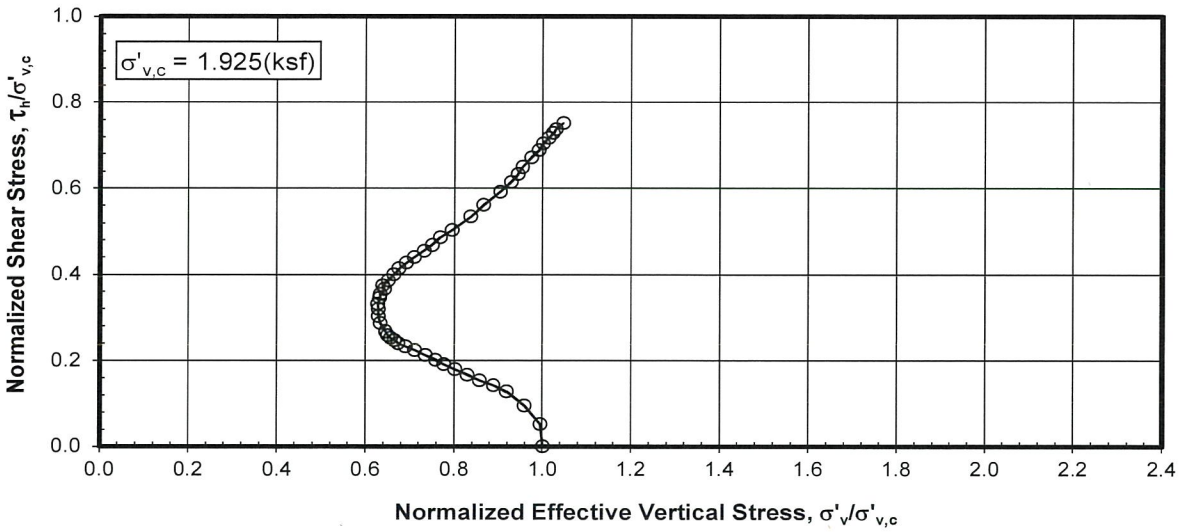
Sample No. 10a Depth 33.6 ft

Boring KIN-B010

Foundation Clay

Fugro



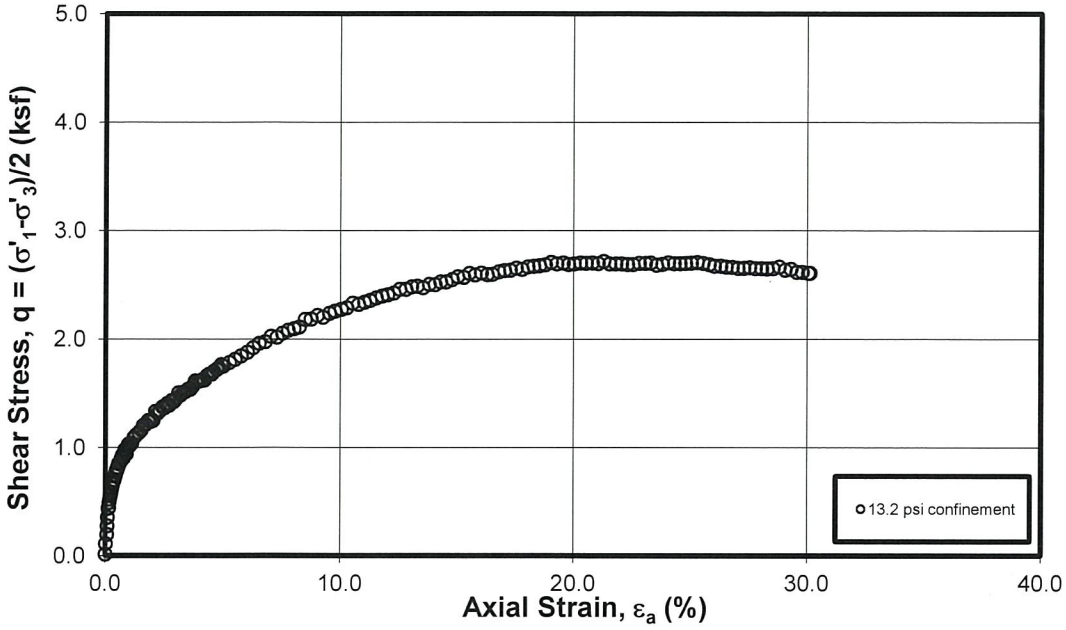


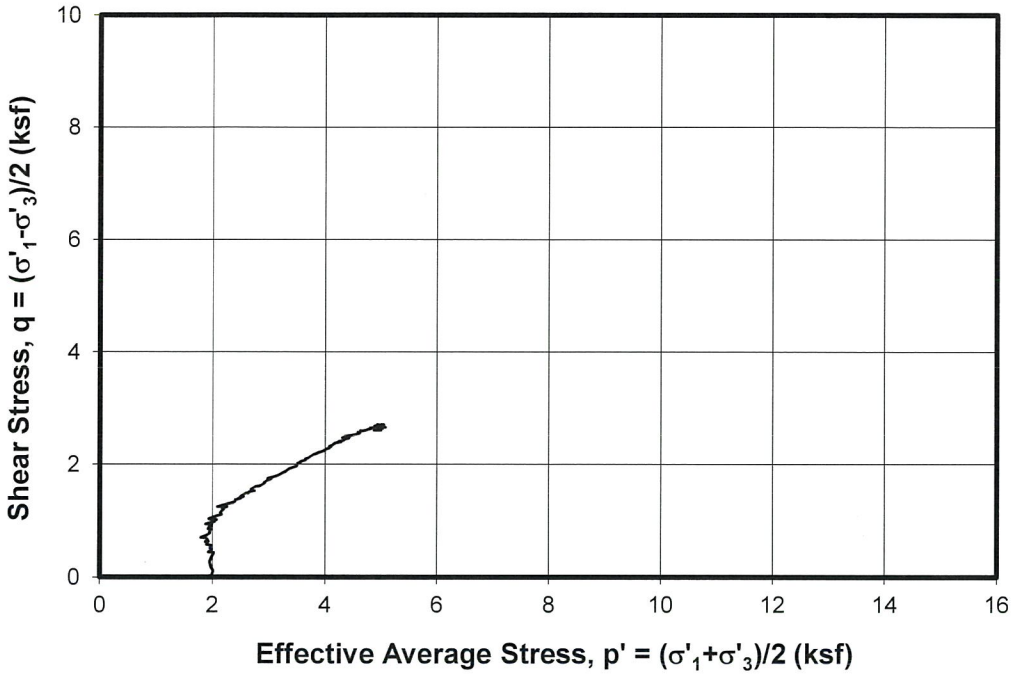
Boring KIN B011 @ 26.1 ft

STATIC DSS TEST

NC Foundation Clay

Fugro



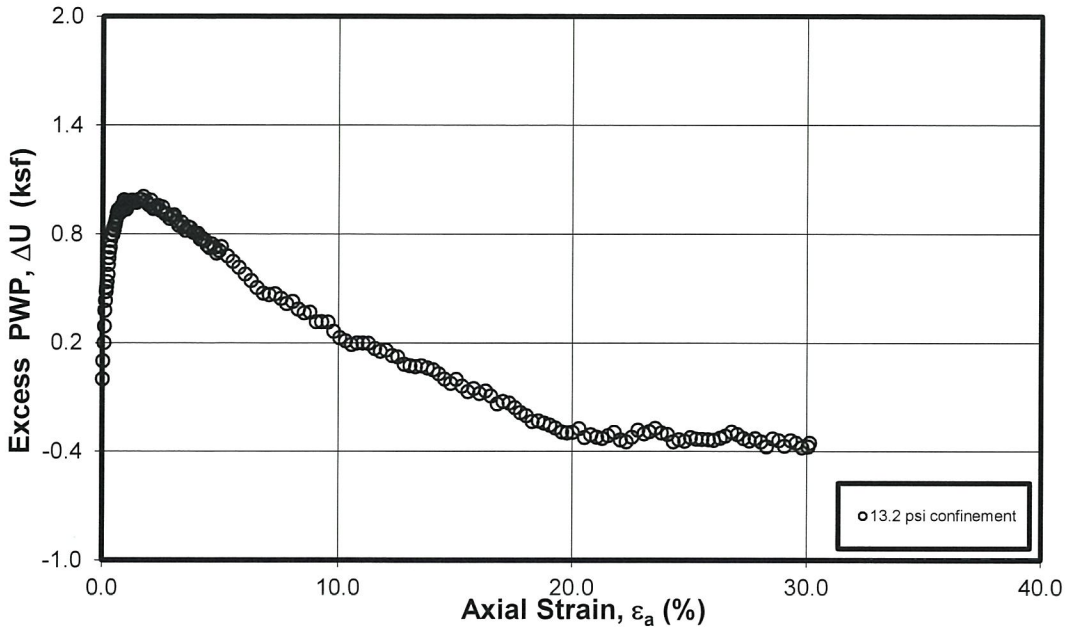


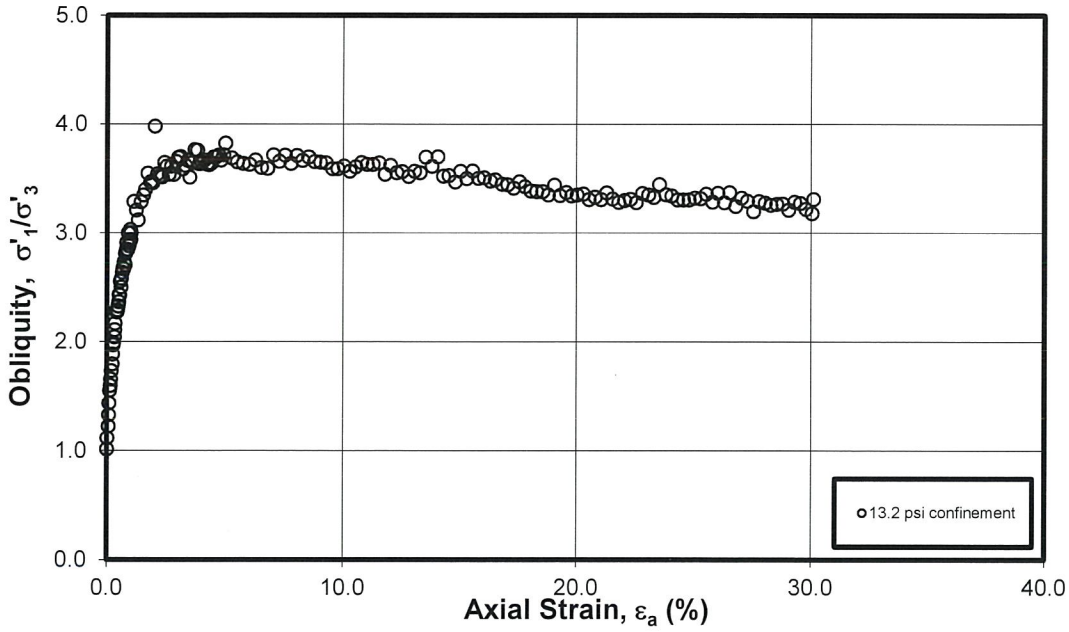
UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-08d - Depth: 26.50 ft
Boring KIN-B011

LL = 38
PL = 19
PI = 19

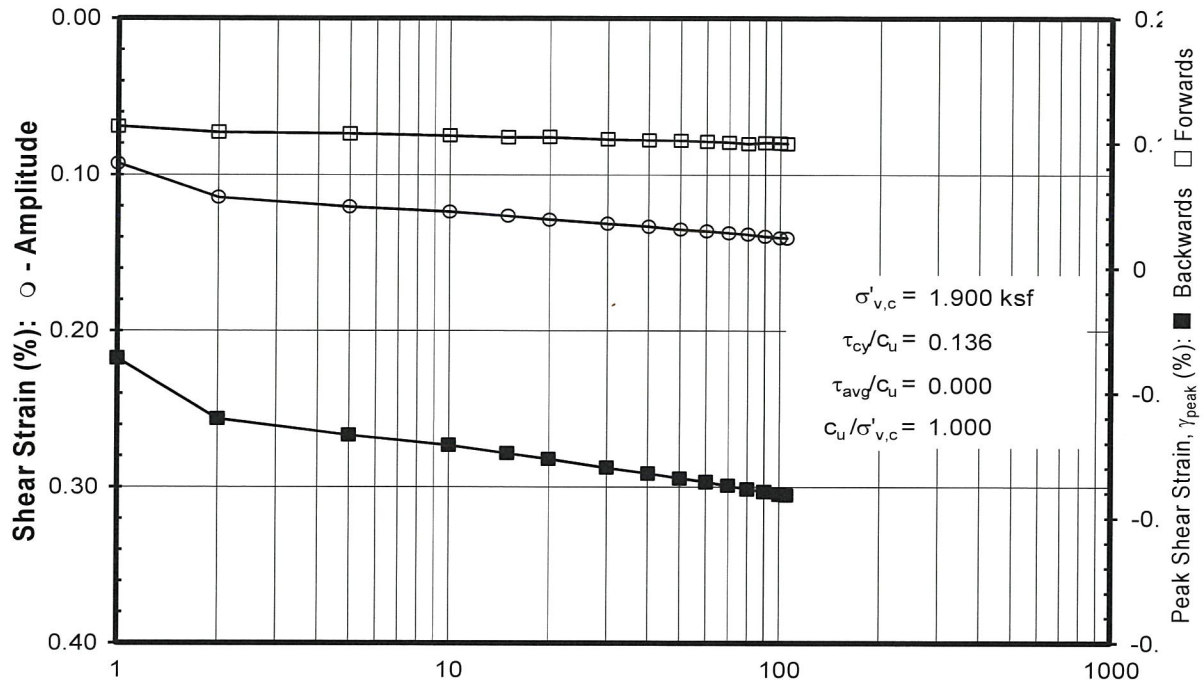
SG = 2.680

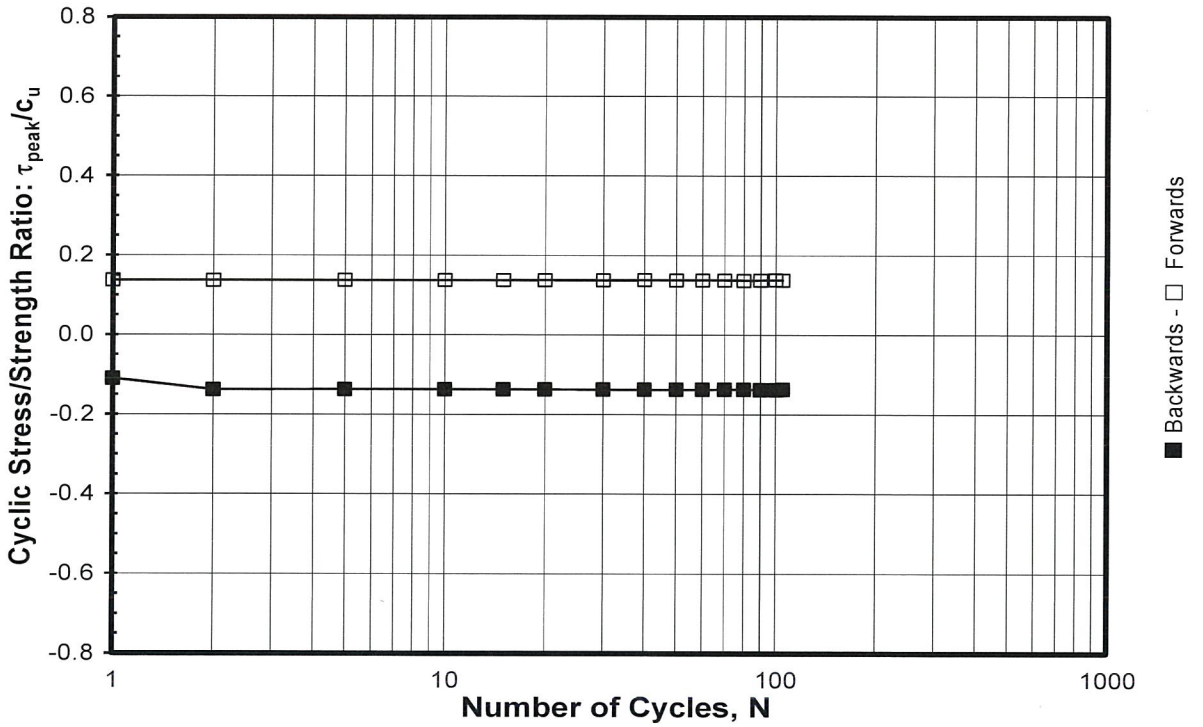
NC Foundation Clay





UNDRAINED TRIAXIAL COMPRESSION TEST
Isotropically Consolidated
Sample: S-08d - Depth: 26.50 ft
Boring KIN-B011





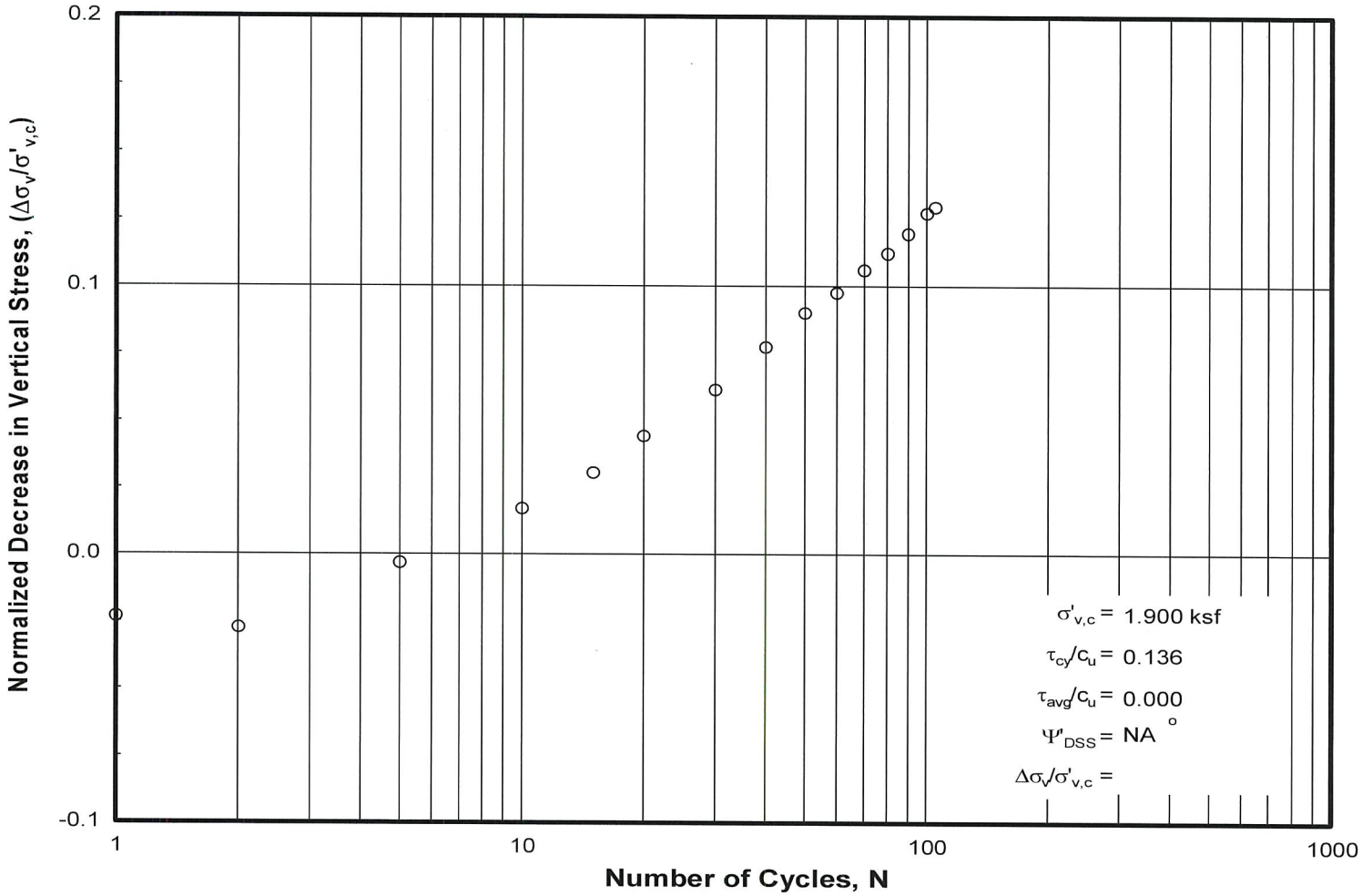
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



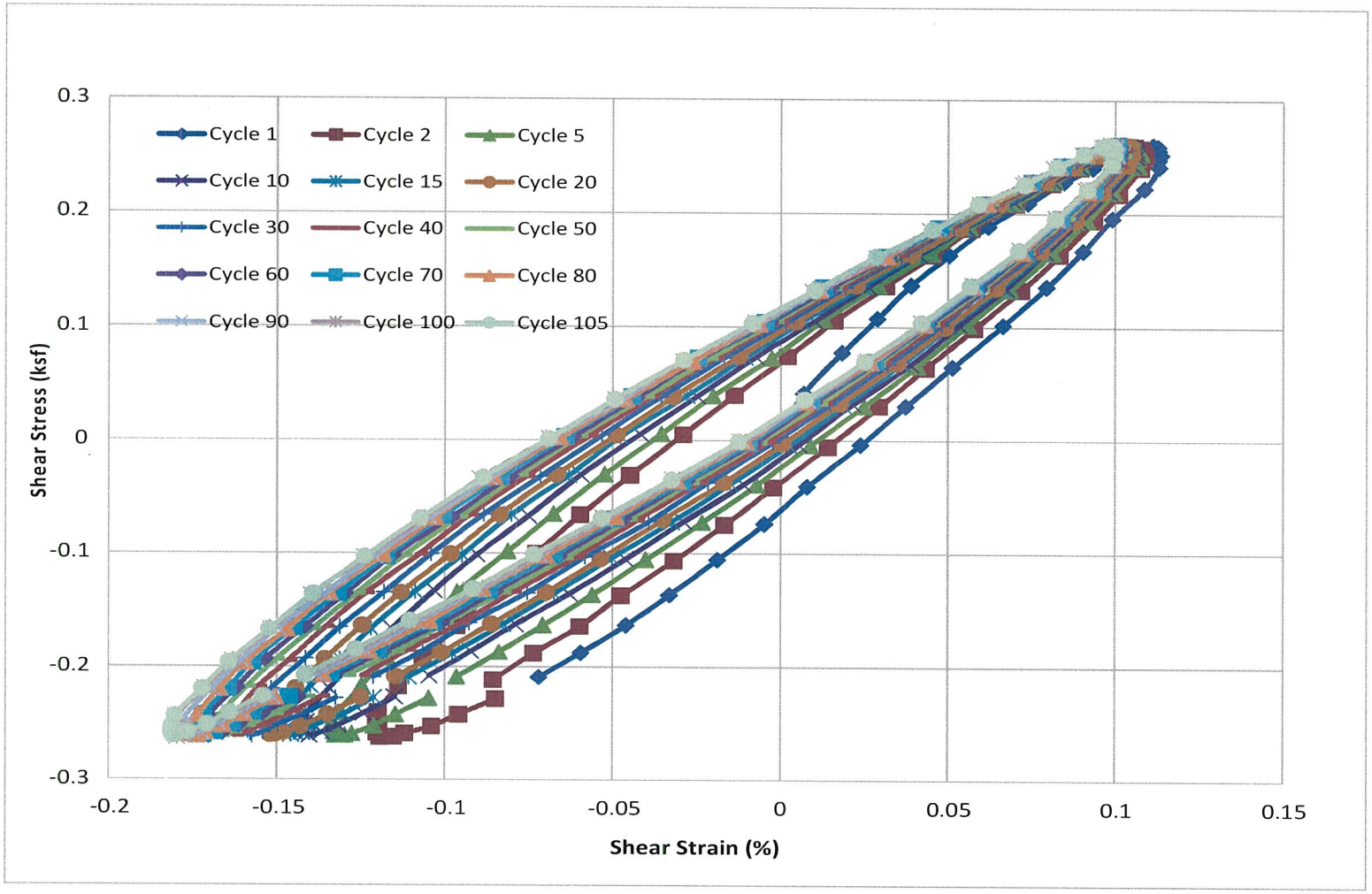
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

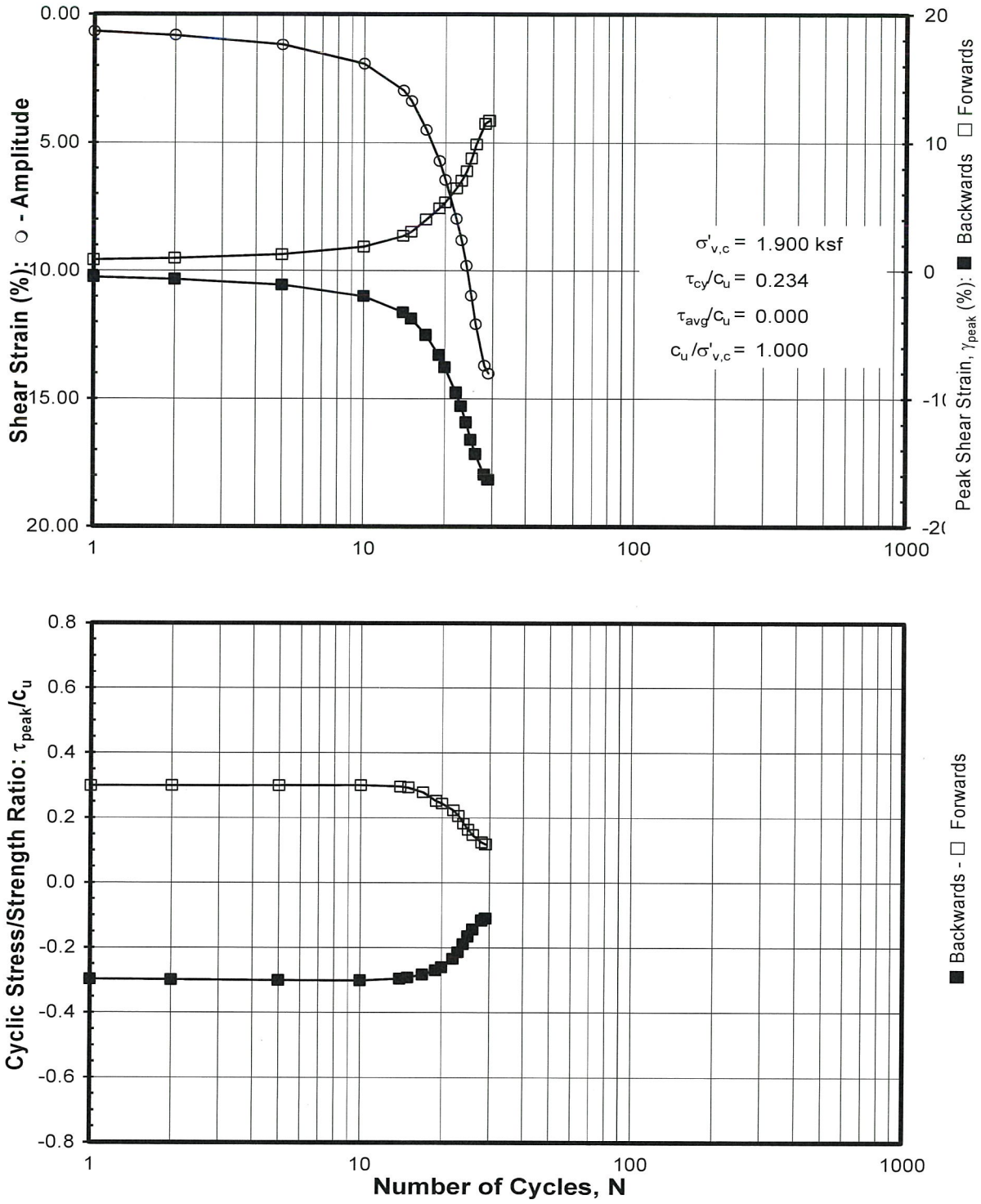
Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress
OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: 8c - Depth: 26.80 ft
Boring KIN-B011
Denegy CCR Assessment of Plants



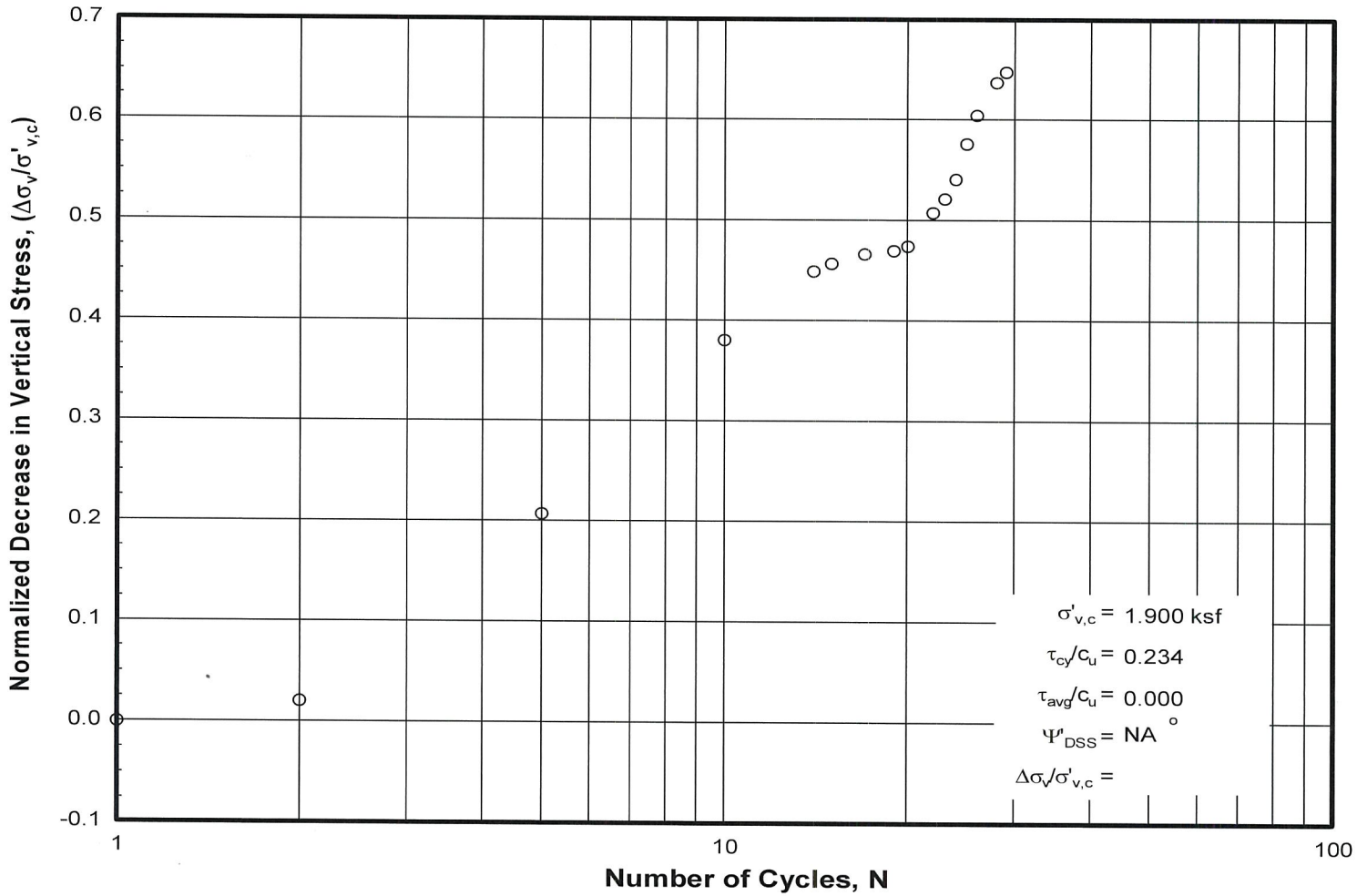
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

OCR = 1 - Cyclic Rate: 1.0 Hz

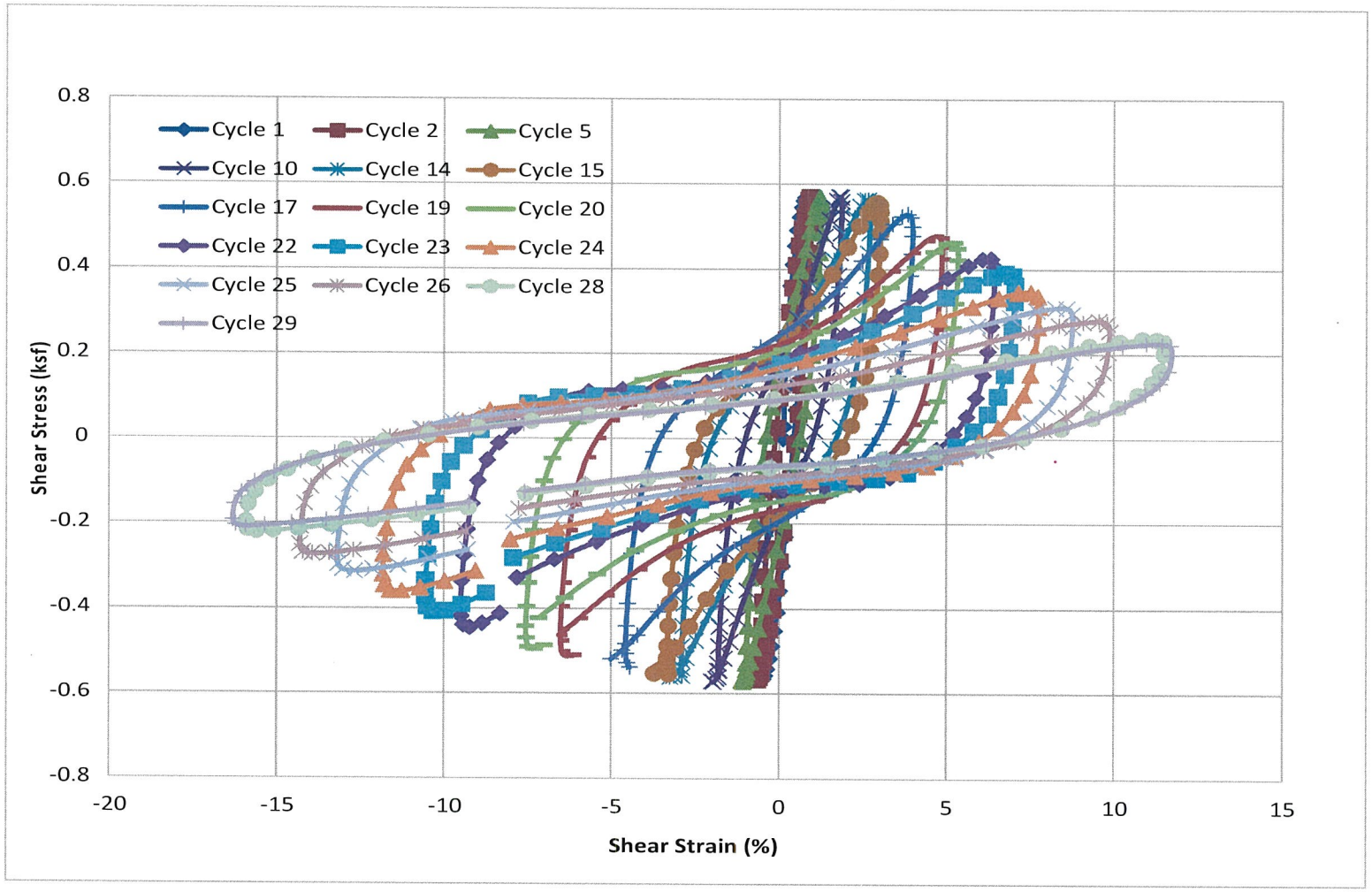
Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants



CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress
OCR = 1 - Cyclic Rate: 1.0 Hz
Sample: 8c - Depth: 26.80 ft
Boring KIN-B011
Denegy CCR Assessment of Plants



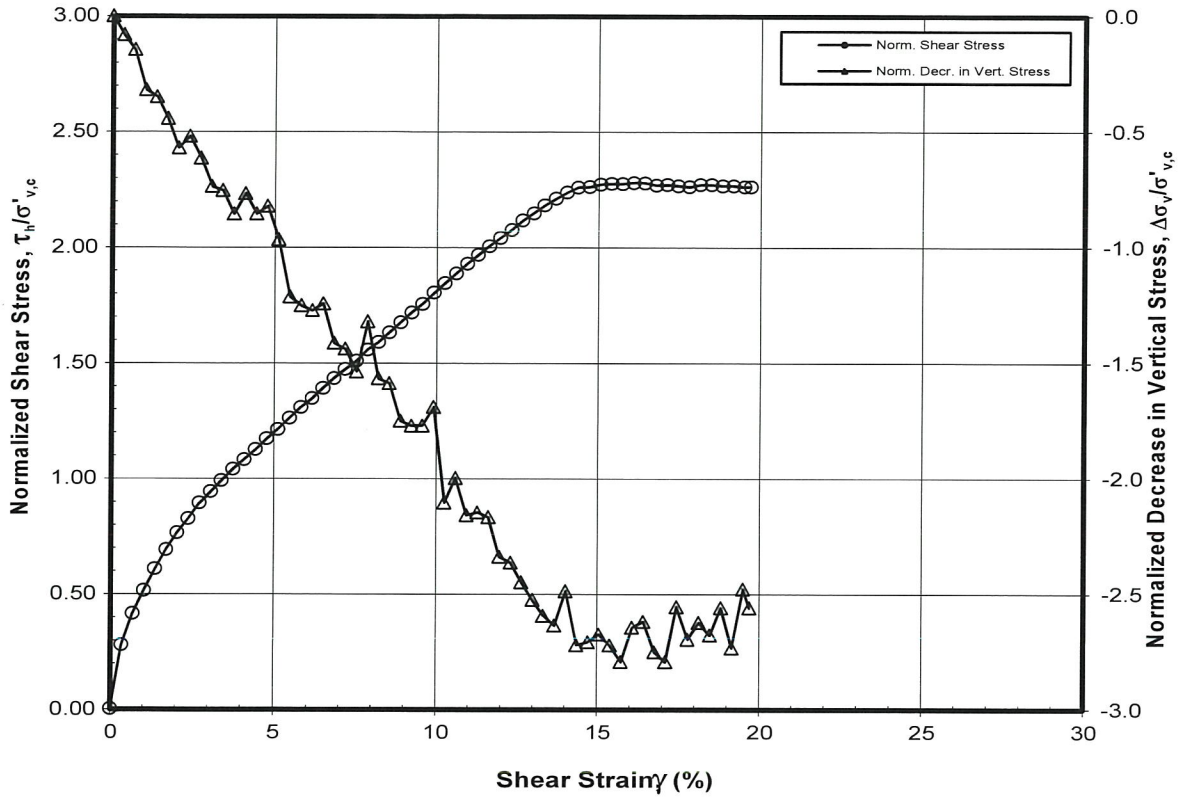
CYCLIC DSS STRENGTH TEST: Without Undrained Bias Shear Stress

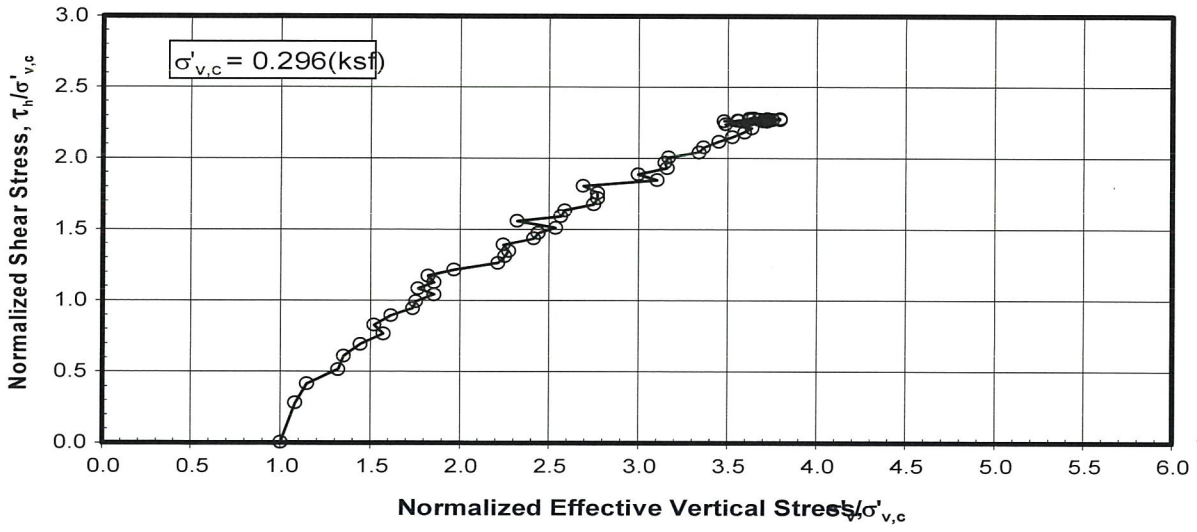
OCR = 1 - Cyclic Rate: 1.0 Hz

Sample: 8c - Depth: 26.80 ft

Boring KIN-B011

Denegy CCR Assessment of Plants





POST CYCLIC STATIC DSS TEST

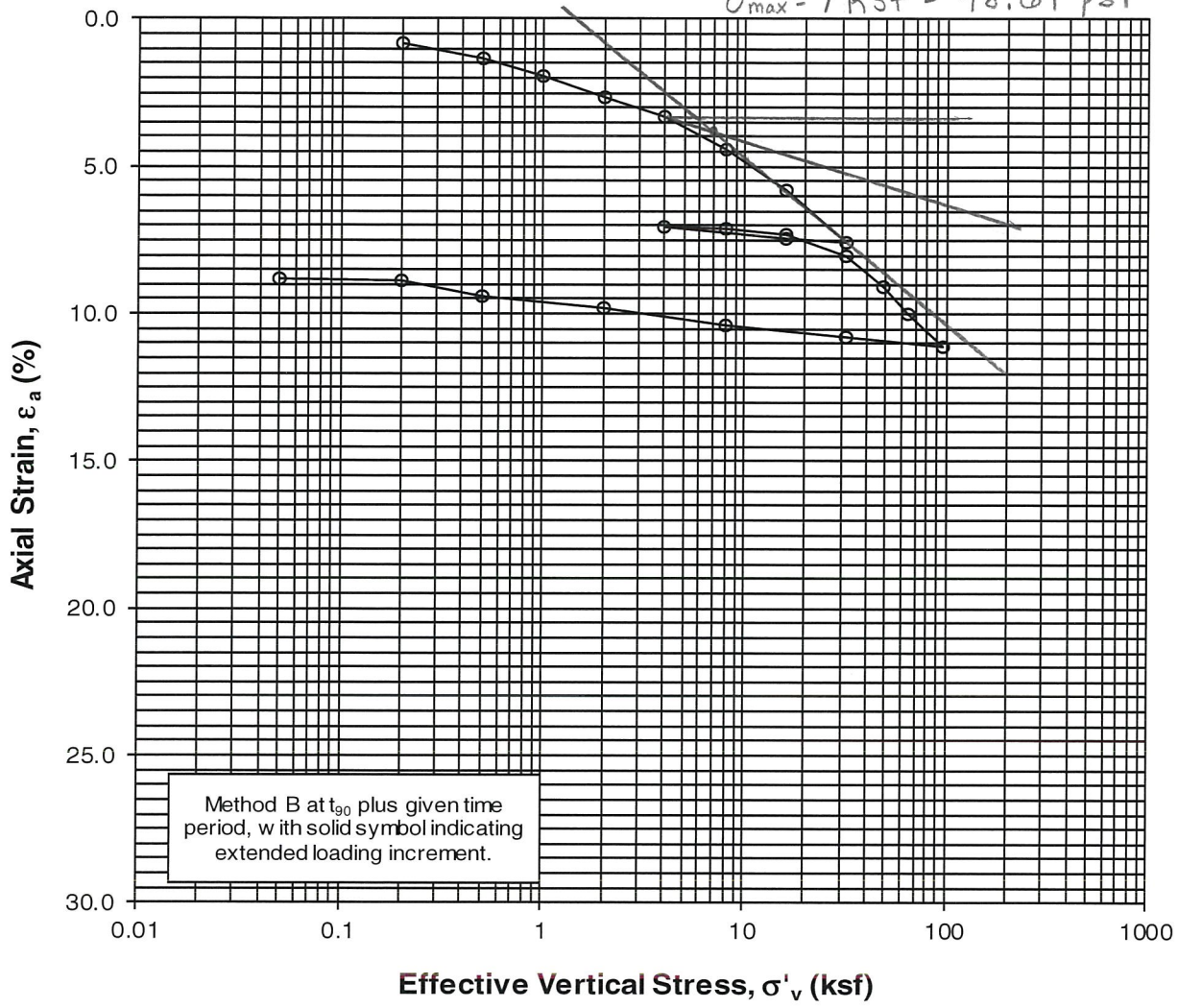
K_o Consolidation - OCR = 1 - Strain Rate = 5 %/hr

Sample: 8c - Depth: 26.80 ft.

Boring KIN-B011

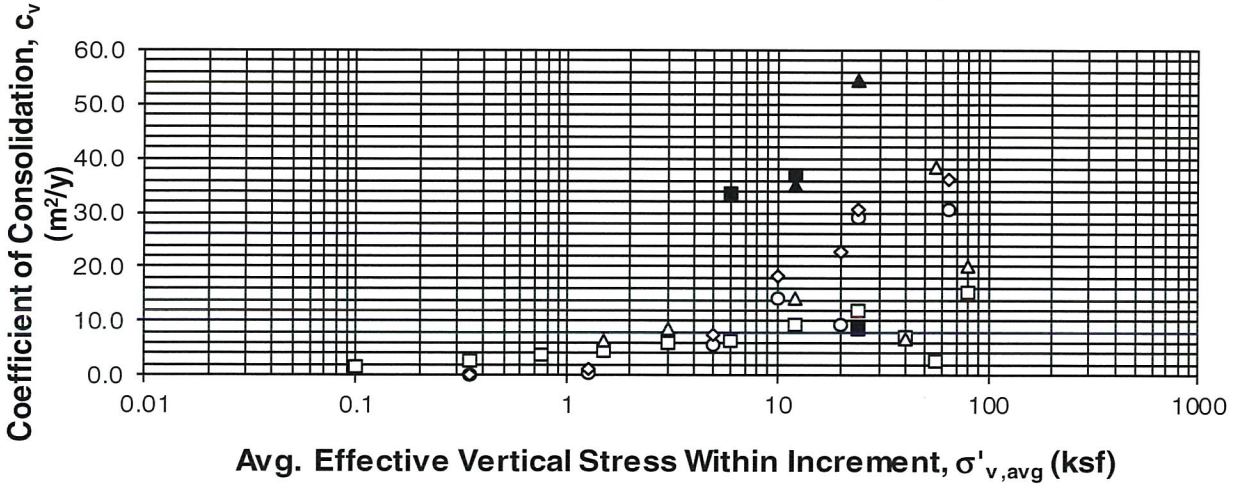
Fugro

σ'_{max} = 7 ksf = 48.61 psi



Fitting Methods: - Sqr. Rt. Time: □ - Loading ○ - Unloading
- Log of Time: Δ - Loading ◊- Unloading

with solid symbols indicating reloading increments



1-D CONSOLIDATION TEST: INC

Sample No. 8a Depth 26.65 ft

Boring KIN-B011

Foundation Clay

Attachment I. Slope Stability Analysis Calculations

AECOM

QMS Form 3-3 (MM)
Rev. 2013 QMS
Date: 28 Feb 2013

IE QMS - Americas

Detail Check - Calculations

Project Name	Dynegy CCR Management Program	**Client**	Dynegy, Inc.
Project Location	Kincaid, Illinois	**PM**	Eric Glazier
Project Number	60480698	**PIC**	Vic Modeer

IDENTIFYING INFORMATION

(This section is to be completed by the Originator.)

Calculation Medium: *(Select as appropriate)*
☒ Electronic
☒ Hard-copy

File Name: Kincaid_Ash_Pond_Stability_LPC_20160128v0.pdf
Unique Identification: N/A
Number of pages: 5 plus attachments

Discipline:	Geotechnical
Title of Calculation:	Kincaid Slope Stability Analysis
Calculation Originator:	Lucas P. Carr
Calculation Contributors:	Matt Nanak
Calculation Checker:	Kevin Ritter

DESCRIPTION & PURPOSE

See attached.

BASIS / REFERENCE / ASSUMPTIONS

See attached.

ISSUE / REVISION RECORD

Checker comments, if any, provided on: ☐ hard-copy ☐ electronic file ☐ Form 3-5

No.	Description	P	S	F	Originator Initials	Date	Checker Initials	Date
0	Initial Issue	☒	☐	☐	LPC	1/28/16		
1	Rev ash post-EQ strength	☐	☒	☐	LPC	2/1/16		
2	Revised stratigraphy	☐	☒	☐	LPC	2/9/16	KR	2/9/16
3		☐	☐	☐				

For a given Revision, indicate either P (Preliminary), S (Superseding) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

APPROVAL and DISTRIBUTION

☒ The below individuals assert that the Detail Check – Calculations is complete.

Originator Signature	January 28, 2016
	Date
Checker Signature	2/9/16
	Date
Project Manager (or Designee) Signature	February 9, 2016
	Date

Distribution:

Project Central File – Quality File Folder
Other – Specify: Enter names here.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Slope Stability Analysis

Project Name: Dynegy CCR

By: Lucas Carr Date: 02-01-2016

Project No: 60480698

Checked By: Kevin Ritter Date: 02-09-2016

Task No.: 01

Objective

A slope stability analysis was performed to calculate factors of safety (FoS) for normal operating conditions, surcharge pool, and earthquake (pseudostatic and post-earthquake) loading conditions at the Kincaid Ash Pond. The factors of safety have been compared to the USEPA CCR Rule criteria for each loading condition. The methodology used to perform the slope stability analysis is summarized in the following sections.

Development of Sections for Analysis

Slope stability analyses were performed at cross-sections stations18+50, 48+50, 63+00, 71+00, and 94+50 at the Ash Pond. The rationale behind selecting each section for analysis is described below:

- Station 18+50: Area of steepest dike along east side of the Ash Pond
- Station 48+50: Area of tallest and steepest dike along north side of the Ash Pond
- Station 63+00: Area of steepest dike along northwest corner of the Ash Pond, including the slope into the toe lake
- Station 71+00: Area of steepest and tallest dike along the west side of the Ash Pond, outside of the slope into the toe lake
- Station 94+50: Area of tallest and steepest dike along south side of the Ash Pond

Subsurface material boundaries (stratigraphy) at each section were developed by projecting nearby subsurface explorations (CPTs and borings) on to the cross-section. Material interfaces inferred from the subsurface explorations were sketched onto the cross-section and a reasonable interpretation of the subsurface stratigraphy between the subsurface exploration locations was developed. The following materials are present at each cross-section:

- Impounded Ash
- Embankment
- Foundation Clay
- Till

A description of each material can be found in the *Kincaid Ash Pond Material Characterization* calculation package.

Analysis Methodology

Loading Conditions

The slope stability analysis evaluated the following loading conditions, as required by the USEPA CCR Rule:

- Long-Term, Maximum Storage Pool Loading Condition (Static Drained), Min FoS = 1.50: This case models the static stability of the embankment under long-term conditions, using drained soil strengths. A normal operating pool elevation of 603.5 ft was assumed in Ash Pond, and pore pressures for analysis are taken from a piezometric line based on AECOM's interpretation of groundwater levels from piezometer, CPT, and boring data. Thicknesses of ash retained by the pond are based on 2015 survey data and AECOM's interpretations.
- Maximum Surcharge Pool Loading Condition (Surcharge), Min FoS = 1.40: This case models the static stability of the embankment under short-term flood loading conditions. The flood pool elevation was assumed to be El. 609.9 ft, which corresponds to the maximum pool level in Ash Pond likely to occur during the Probable Maximum Precipitation (PMP) event, following AECOM's hydraulic and hydrologic calculations. Due to the short-term nature of the PMP event and the low permeability of the clayey embankment and foundation soils, undrained soil strengths were used for analysis. Pore pressures in the embankment were assumed to be similar to the static drained conditions, however the pool level in Ash Pond was increased to model additional loading from the surcharge pool.
- Seismic Condition (Pseudostatic), Min FoS = 1.00: This case models the stability of the embankment under earthquake loading. Normal pool conditions (El. 603.5 ft) and groundwater conditions are assumed. Seismic loads were taken from a probabilistic seismic hazard analysis (PSHA) and dynamic response analyses performed by AECOM, and were adjusted to account for topographic amplification of the seismic loads by the embankment. A pseudostatic seismic coefficient (k_h) of 0.07g was selected based on these analyses. Peak undrained soil strengths were used for this analysis, due to the short duration of the loading and the fine-grained, slow-draining nature of the embankment and foundation soils.
- Liquefaction Condition (Post-Earthquake), Min FoS = 1.20: This case models the stability of the embankment immediately following earthquake loading. Normal pool conditions (El. 603.5 ft) and groundwater conditions are assumed. For materials susceptible to cyclic softening and a loss of strength during earthquake loading, as determined from laboratory testing, reduced post-earthquake undrained shear strengths are assumed.

Stability Analysis Approach

The slope stability analysis was conducted using SLOPE/W within the GeoStudio 2012 software package (Version 8.15.1.11236). The following approach was used to conduct the analysis:

- Analysis Method: Spencer
- Slip Surface Definition: Entry and exit. Slip surfaces were allowed to enter the ground surface upstream of the middle of the embankment crest and downstream of the embankment toe

- Minimum Slip Surface Depth: 10 ft
- Optimization: Critical slip surfaces were optimized.
- Tension Cracks: Added if necessary to reduce interslice tensile forces. The tension crack was assumed to be full of water.
- Pore Pressures: From piezometric line

Material Properties

Material properties for analysis were taken from the *Kincaid Ash Pond Material Characterization* calculation package. The material properties are summarized in the following tables.

Table 1 – Kincaid Ash Pond Slope Stability Material Properties

Material	Unit Weight (pcf)	Peak Drained Shear Strength		Peak Undrained Shear Strength	Post-Earthquake Shear Strength
		Cohesion, c' (psf)	Friction Angle, ϕ' (degrees)	S_u/p'	S_u/p'
Ash	112	0	32	0.40	0.06
Embankment	135	0	40 *with curved envelope for* σ'_{ff} *< 1440 psf (SEE NOTE 1)*	S_u/p' = 0.68, Minimum S_u = 575 psf	Peak Undrained
Foundation Clay	125	0	Below Embankment: ϕ' = 32 *with curved envelope for* σ'_{ff} *< 2160 psf (SEE NOTE 2)* Free Field: ϕ' = 30	Below Embankment: S_u/p' = 0.48, Minimum S_u = 800 psf Free Field: S_u/p' = 0.30, Minimum S_u = 400 psf	S_u/p' = 0.30, Minimum S_u = 400 psf
Till	135	0	40	S_u/p' = 0.64, Minimum S_u = 800 psf	Peak Undrained

Table 2 – Embankment Nonlinear Drained Shear Strength Envelope

σ'_{ff} (psf)	τ_{ff} (psf)
0	0
432	490
864	850
1440	1208
4320	3625

Table 3 – Foundation Clay Below Embankment Nonlinear Drained Shear Strength Envelope

σ'_{ff} (psf)	τ_{ff} (psf)
0	0
432	475
864	763
1440	1080
2160	1350
5760	3599

As discussed in the calculation package, separate shear strengths were developed for the foundation clay beneath the embankment (based on CIU' triaxial tests) and the foundation clay near and beyond the toe of the embankment (based on direct simple shear [DSS] tests). Within the foundation clay, the boundary between the two different strengths was iterated during the slope stability analysis based on the orientation of the slip surface. DSS strengths were assigned for the near-horizontal portions of the slip surface under and downstream of the embankment while CIU strengths were assigned for inclined portions of the slip surface where it is dipping into the foundation clay.

The results of the liquefaction triggering analysis and cyclic DSS testing indicated that the foundation clay had a potential for cyclic softening under high cyclic stress ratios (CSR). The post-earthquake shear strength listed in Table 1 for this material is based on the results from cyclic DSS testing at a CSR of 0.28. Cyclic DSS testing at a CSR of 0.14 did not result in cyclic softening of the foundation clay. For analysis sections without QUAD4 analysis to define the cyclic stress ratios induced by the design earthquake, the post-earthquake shear strength was conservatively assigned to the entire foundation clay layer.

Pseudostatic Analysis

For the pseudostatic stability analysis, the seismic coefficient was determined based on the site-specific peak ground acceleration at the embankment crest and the simplified procedure in Makdisi and Seed (1977). For a full height slip surface (one the extends into the foundation of the embankment), the seismic coefficient can be calculated as Kh = 0.34(PGAcrest) = 0.34(0.20g) = 0.07g.

Sta. 48+50 Post-Earthquake Analysis

Preliminary post-earthquake stability analysis for Station 48+50, using the post-earthquake shear strengths in Table 1 for the entire foundation clay layer, resulted in factors of safety less than the USEPA CRR criteria of 1.20. Based on the results of the cyclic DSS testing on samples from B010 and B011, this material is not expected to cyclically soften for CSR values less than or equal to 0.14. Therefore, peak undrained soil strengths are appropriate for CSR's below 0.14. A QUAD4M dynamic response analysis was performed for Sta. 48+50, in order to evaluate cyclic stress ratios (CSRs) in the foundation soils.

The analysis found that CSR's are below 0.14 for most of the foundation clay, other than an isolated zone near the toe of the dike. Post-earthquake softened shear strengths were applied for this zone, while peak shear strengths were applied for the remainder of the foundation clay.

For the remaining cross-sections, post-earthquake softened shear strengths were used as indicated in Table 1, and dynamic response analyses were not performed to estimate the earthquake induced CSRs in the foundation.

Results

The table on the following page summarizes the results of the slope stability analyses at Kincaid Ash Pond.

References

Makdisi, F.I., Seed, H.B., (1977) "A Simplified Procedure for Estimating Earthquake Induced Deformation in Dams and Embankments", Report No. UBC-EERI-77/19, Earthquake Engineering Research Center, August, 1977.

Stability Analysis Results Table - Dynegy Kincaid Ash Pond

Cross-Section	Analysis Case	CCR Rule Minimum Factor of Safety	Calculated Factor of Safety - Circle
Sta. 18+50	Pseudostatic	1.00	1.69
	Surcharge Pool	1.40	2.15
	Post-Earthquake	1.20	1.76
	Static Drained	1.50	2.50
Sta. 48+50	Pseudostatic	1.00	1.27
	Surcharge Pool	1.40	1.46
	Post-Earthquake*	1.20	1.50
	Static Drained	1.50	1.57
Sta. 63+00	Pseudostatic	1.00	1.46
	Surcharge Pool	1.40	1.63
	Post-Earthquake	1.20	1.43
	Static Drained	1.50	1.63
Sta. 71+00	Pseudostatic	1.00	1.65
	Surcharge Pool	1.40	1.85
	Post-Earthquake	1.20	1.52
	Static Drained	1.50	1.78
Sta. 94+50	Pseudostatic	1.00	1.54
	Surcharge Pool	1.40	1.91
	Post-Earthquake	1.20	1.54
	Static Drained	1.50	2.06

*For Sta. 48+50, two types of shallow (grid-radius and entry-exit) slip surfaces were analyzed, along with a deeper entry-exit slip surface. The lowest factor of safety from all three analyses is present.

Calculation Notes

Subject: Kincaid Ash Pond Slope Stability Analysis

Project Name: Dynegy CCR

By: Lucas Carr Date: 02-01-2016

Project No: 60480698

Checked By: Kevin Ritter Date: 02-09-2016

Task No.: 01

APPENDIX A

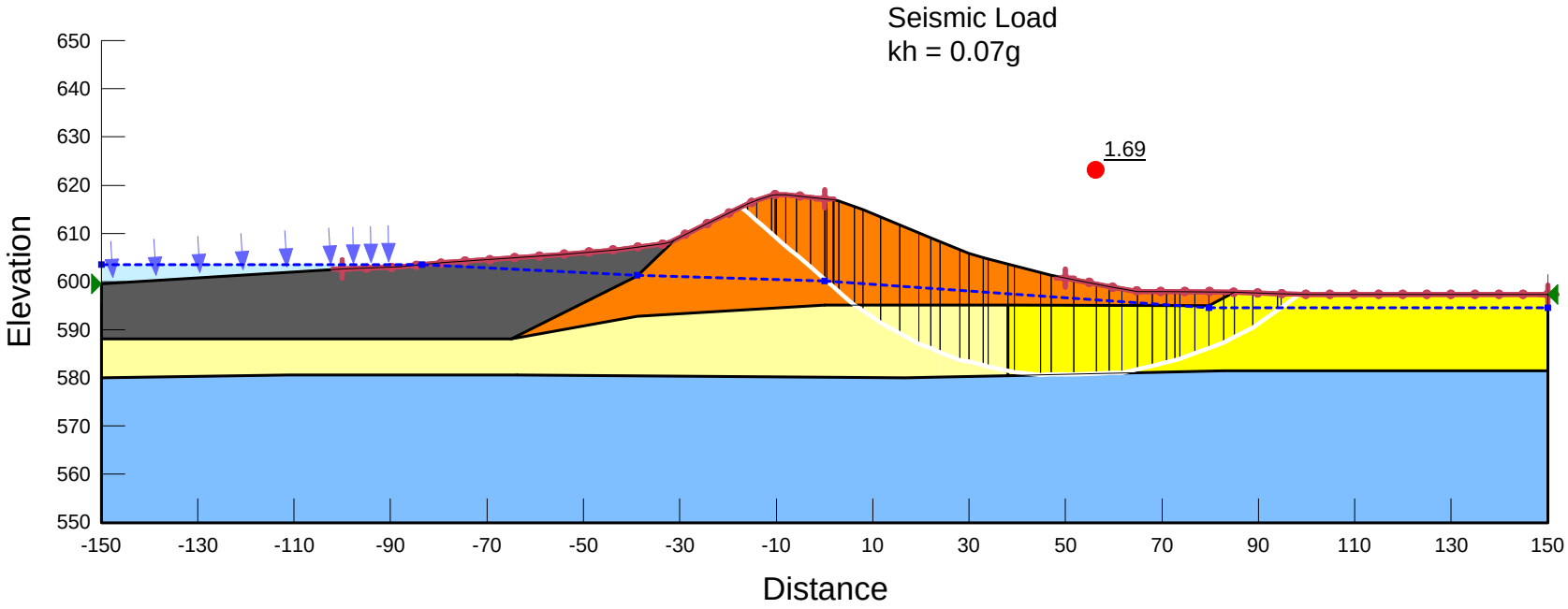
Stability Analysis Output

Dynegy Kincaid
Station 18+50
Peak Undrained Soil Strengths
Pseudostatic - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials
- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU)



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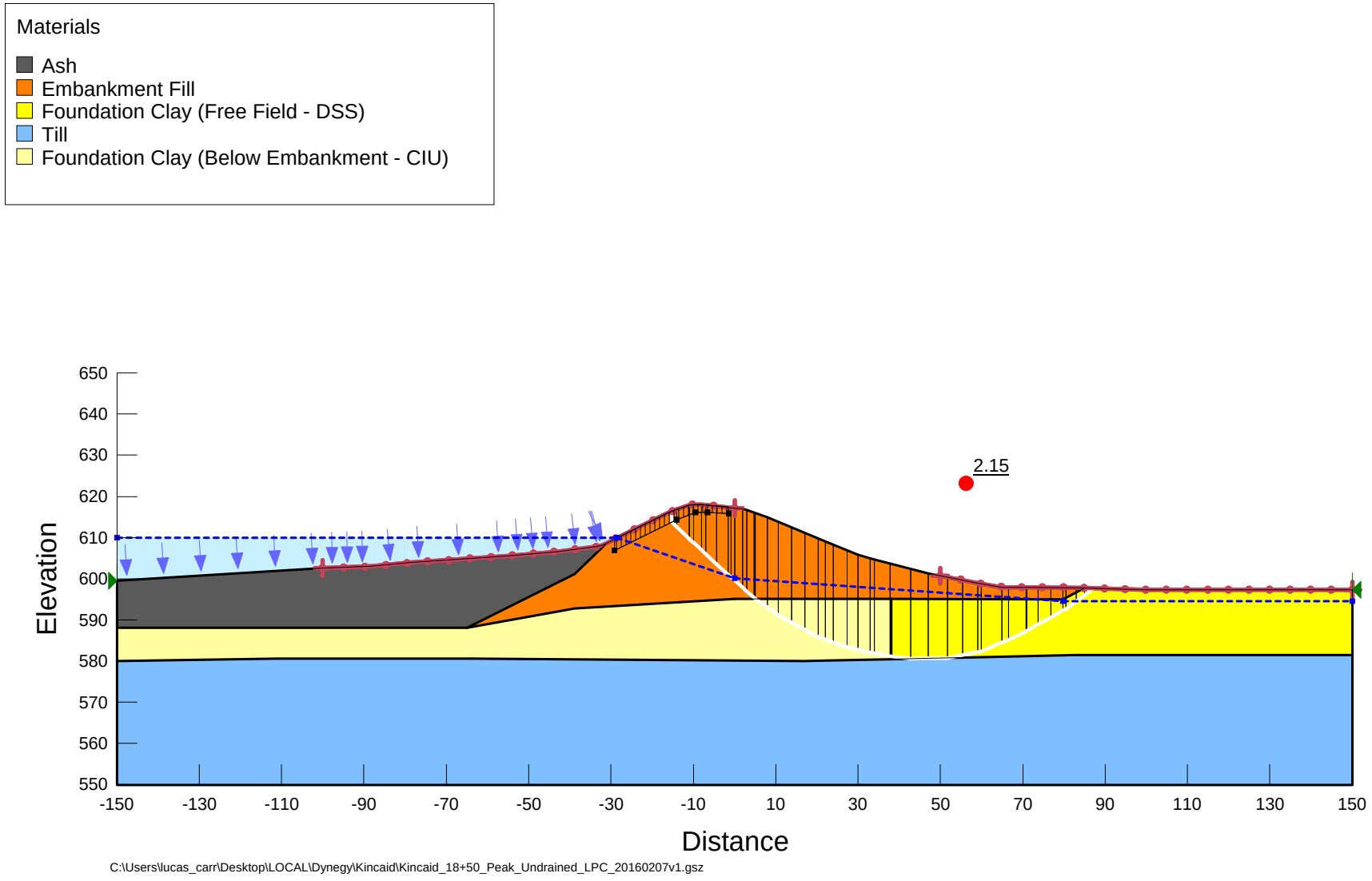
Dynegy Kincaid
Station 18+50
Peak Undrained Soil Strengths
Surcharge Pool - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1



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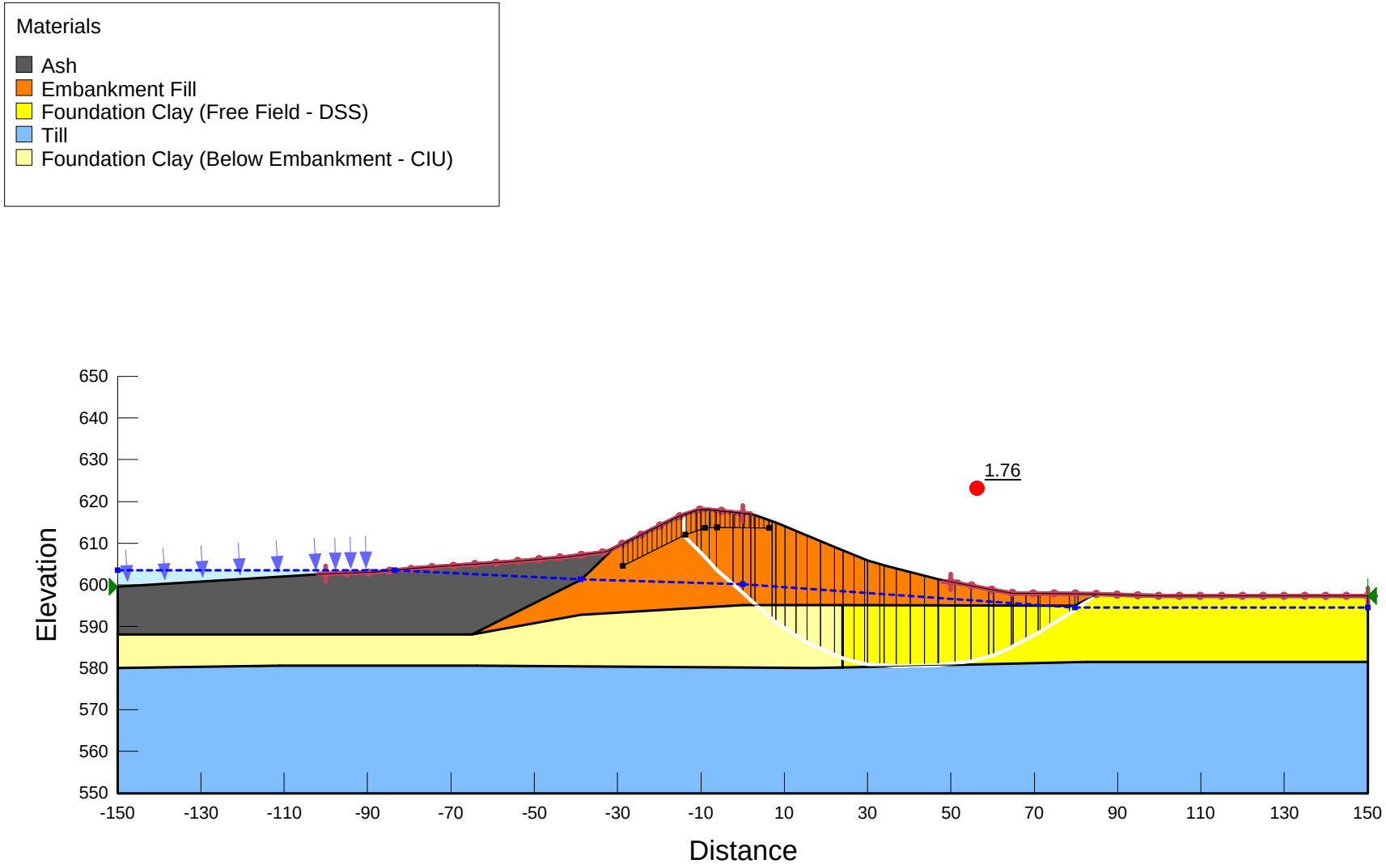
Dynegy Kincaid
Station 18+50
Slope Stability - Post Earthquake

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1



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Dynegy Kincaid
Station 18+50
Slope Stability - Static Drained

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

Name: Ash Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1

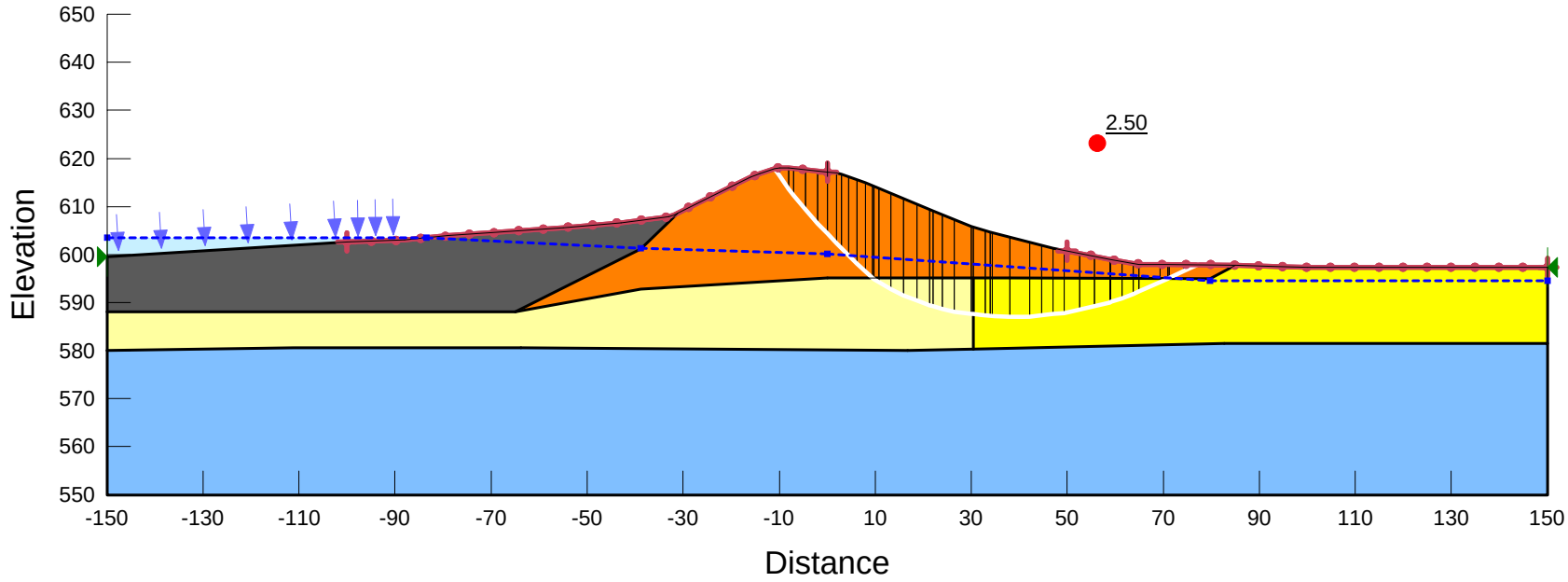
Name: Embankment Fill Model: Shear/Normal Fn. Unit Weight: 135 pcf Strength Function: Embankment Fill Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1

Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Below Embankment - CIU) Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: Foundation Clay (Below Embankment - CIU) Phi-B: 0 ° Piezometric Line: 1

Materials
- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU)



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Dynegy Kincaid
Station 48+50
Peak Undrained Soil Strengths
Pseudostatic - Entry & Exit

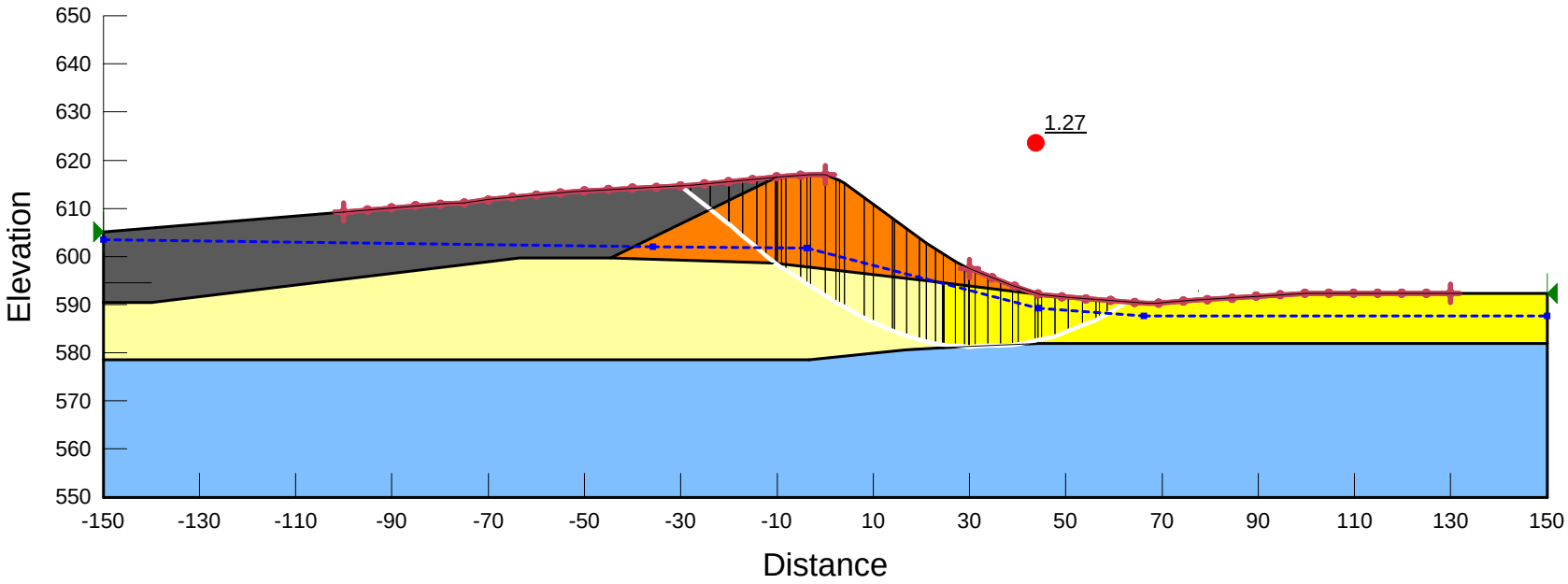
Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials

- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU)

Seismic Load
kh = 0.07 g



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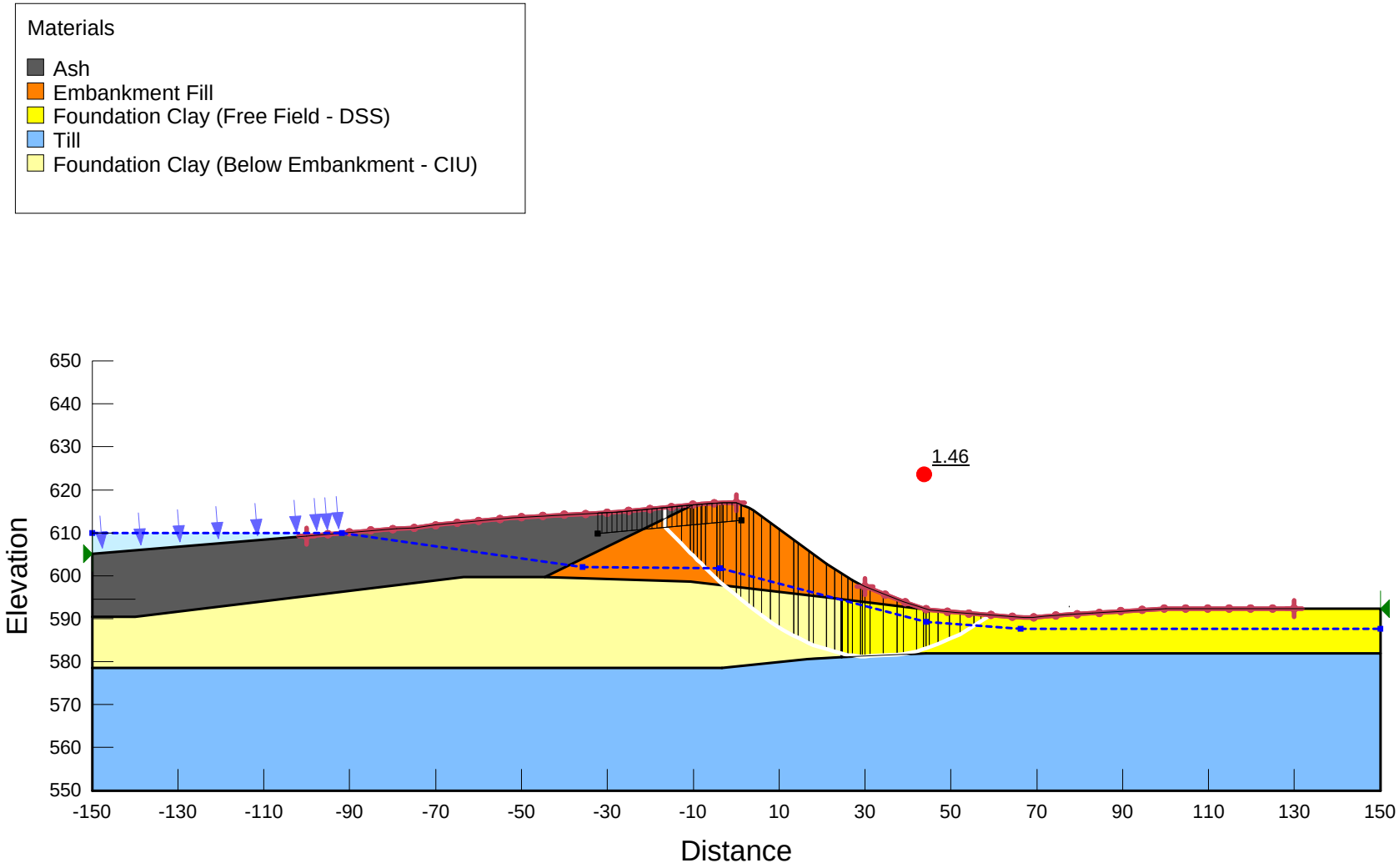
Dynegy Kincaid
Station 48+50
Peak Undrained Soil Strengths
Surcharge Pool - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1



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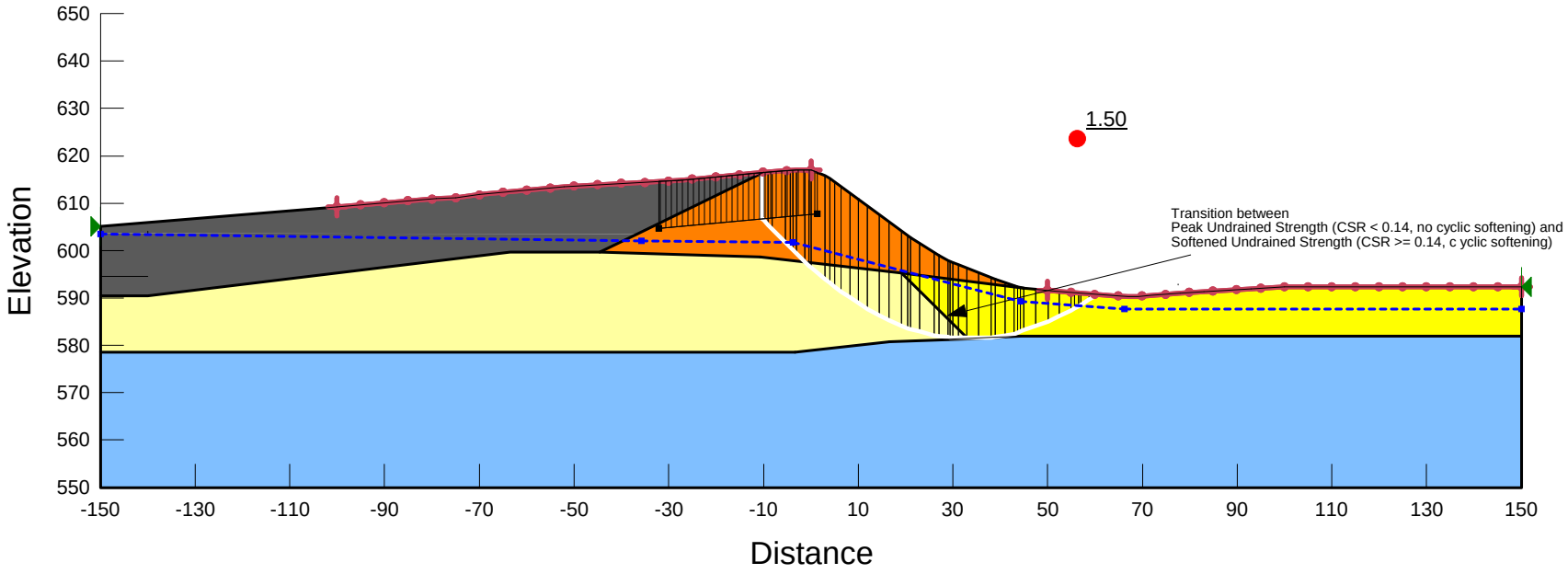
Dynegy Kincaid
Station 48+50
Post-EQ - Entry & Exit - Deep

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU - PEAK) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials
- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU - PEAK)



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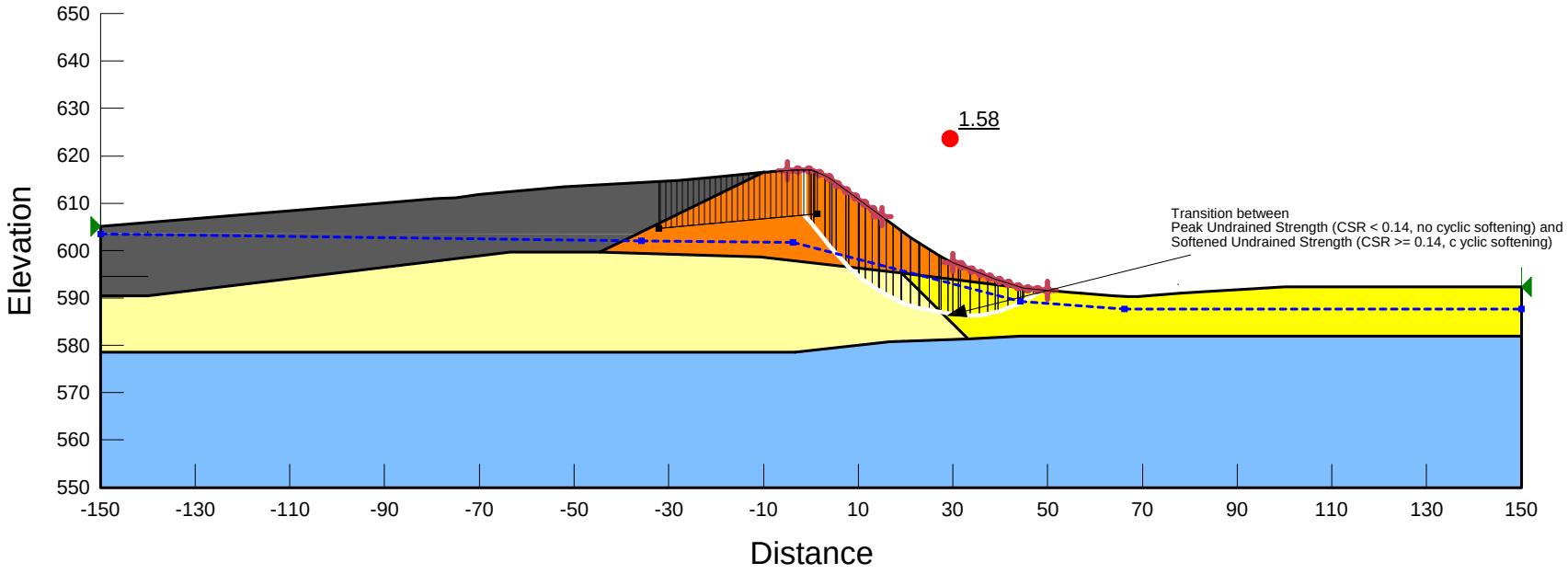
Dynegy Kincaid
Station 48+50
Post-EQ - Entry & Exit - Shallow

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU - PEAK) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials
- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU - PEAK)



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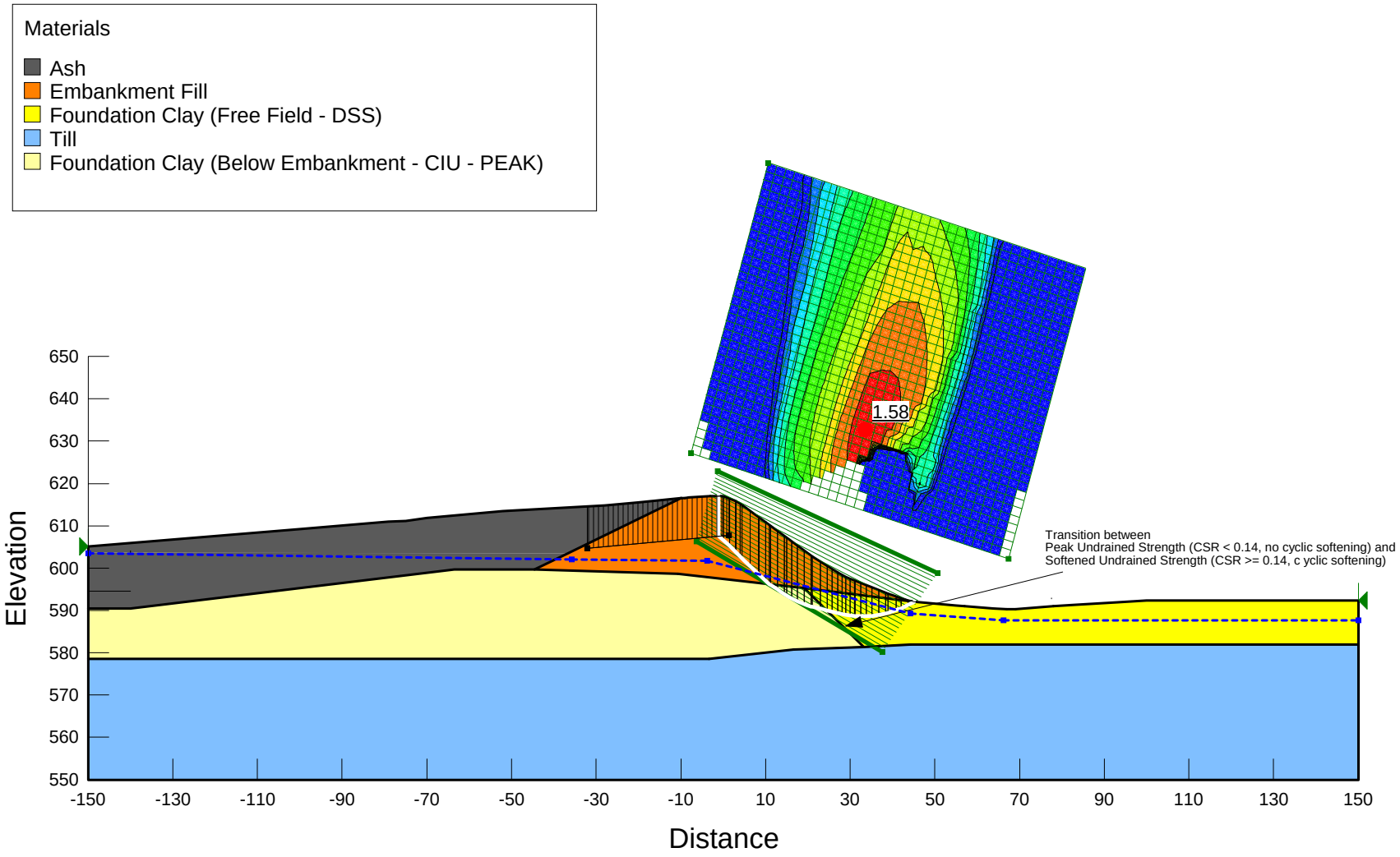
Dynegy Kincaid
Station 48+50
Post-EQ - Grid & Radius - Shallow

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU - PEAK) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1



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Dynegy Kincaid
Station 48+50
Static Drained - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1

Name: Embankment Fill Model: Shear/Normal Fn. Unit Weight: 135 pcf Strength Function: Embankment Fill Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1

Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1

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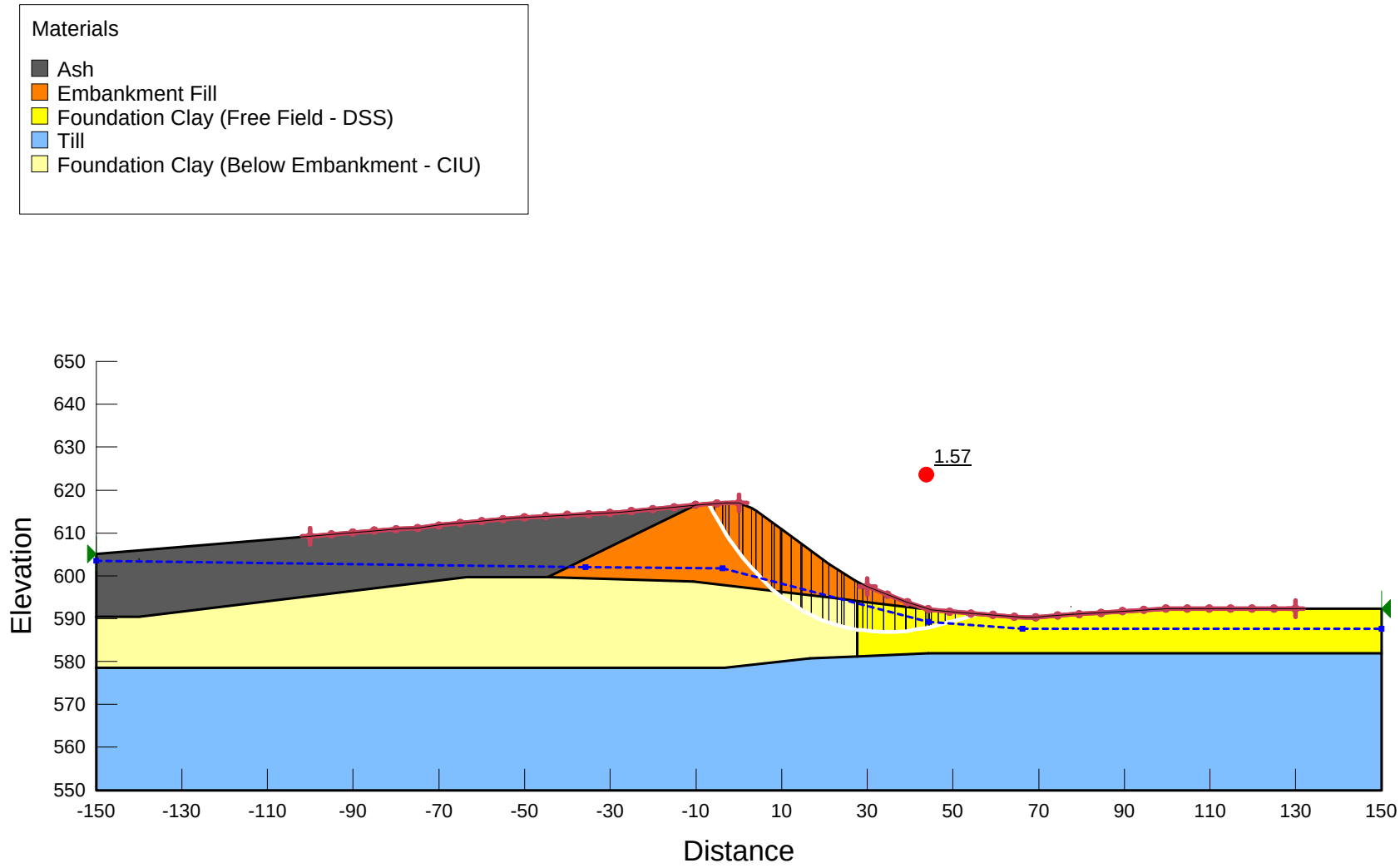

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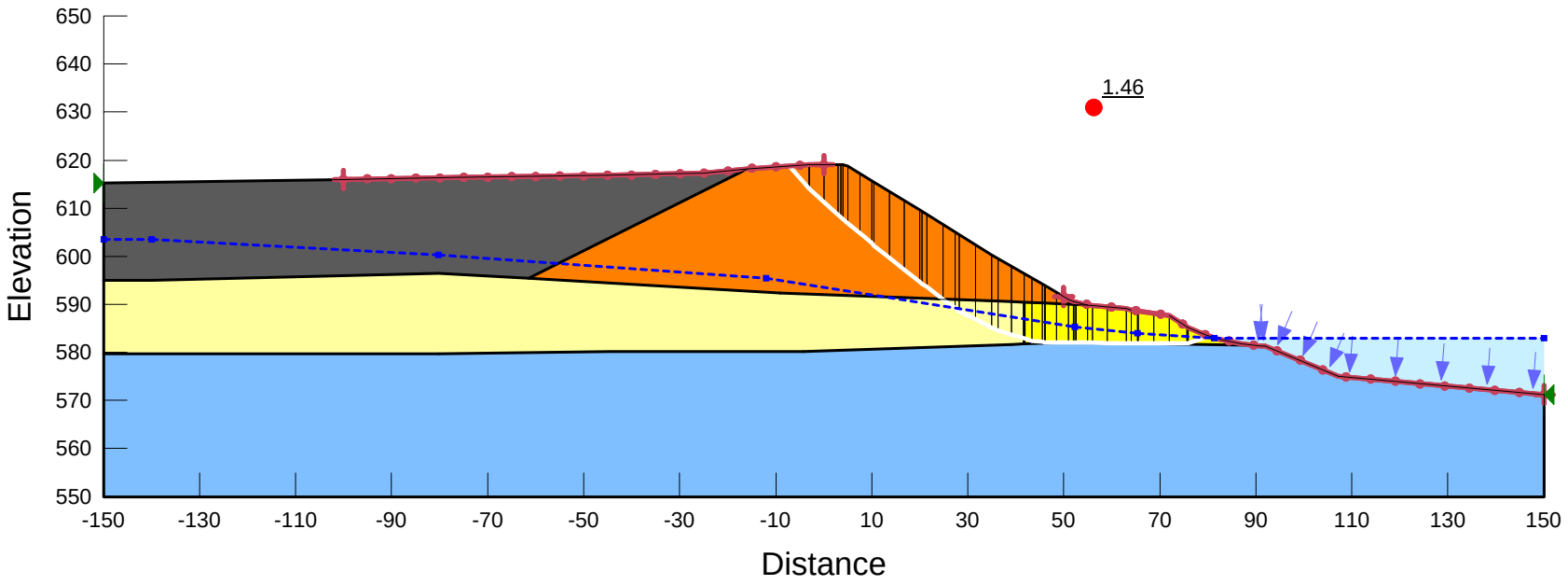
Dynegy Kincaid
Station 63+00
Peak Undrained Soil Strengths
Name: Pseudostatic - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials
- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU)

Seismic Load
kh = 0.07 g



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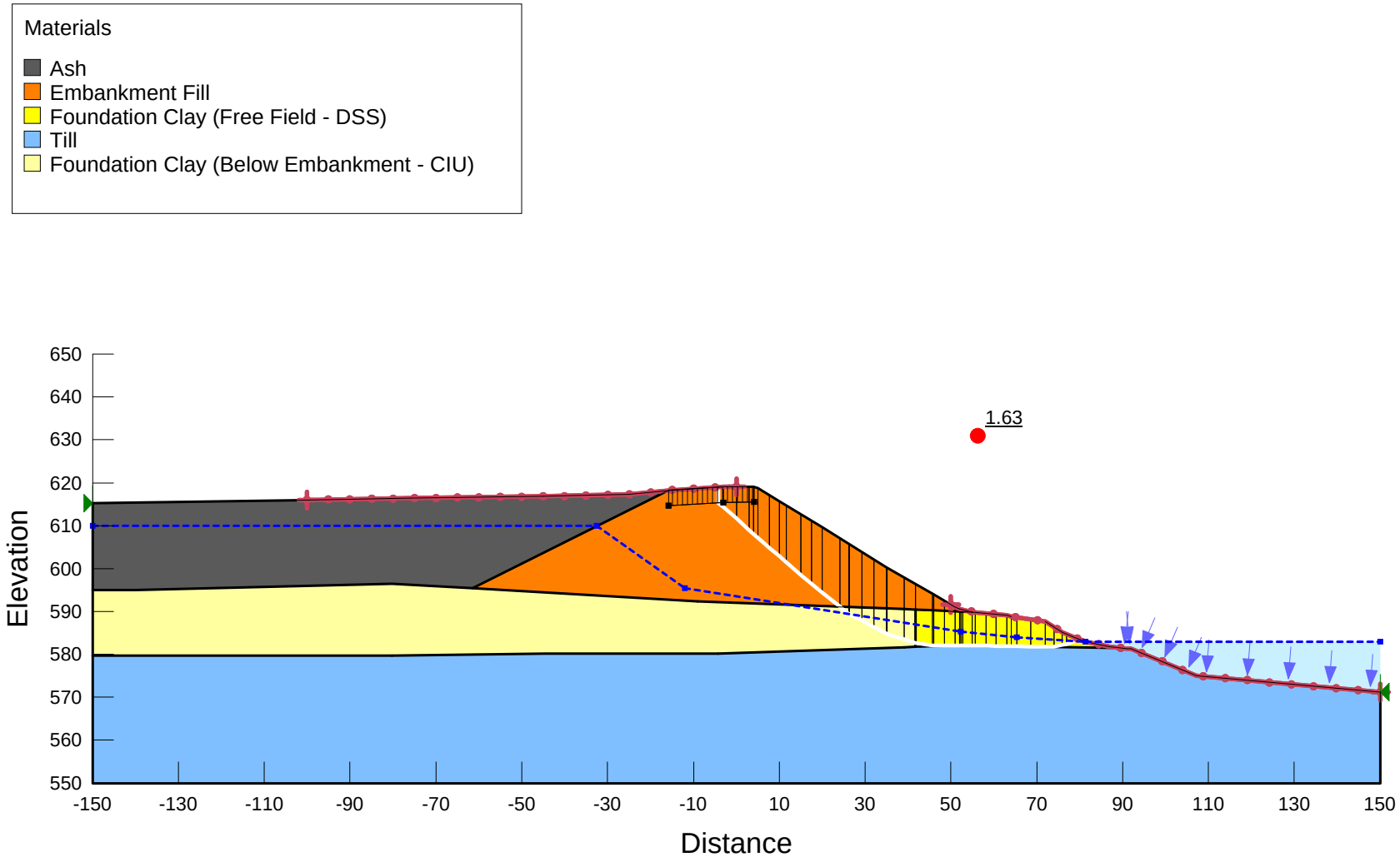
Dynegy Kincaid
Station 63+00
Peak Undrained Soil Strengths
Name: Surcharge Pool - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1



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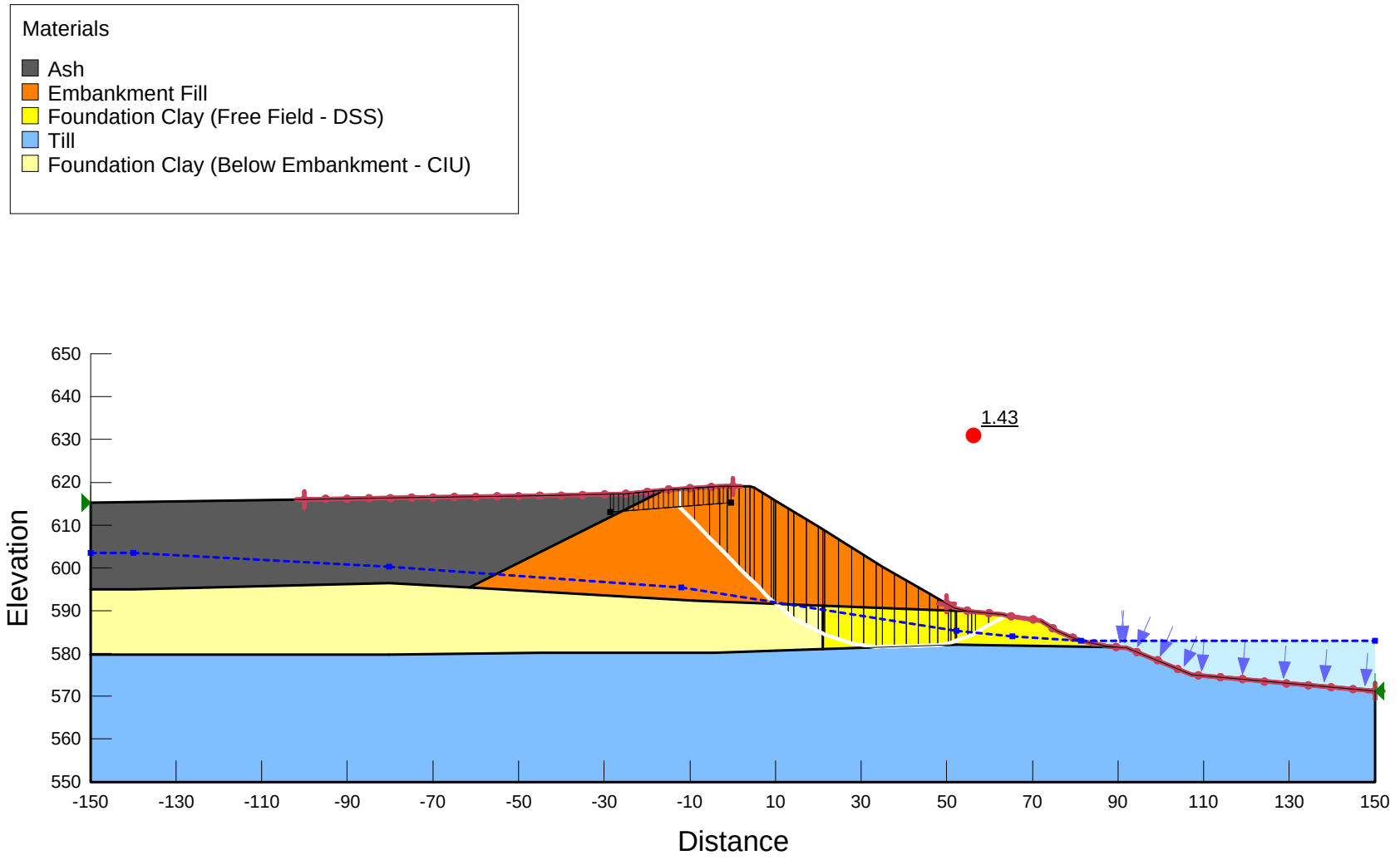
Dynegy Kincaid
Station 63+00
Slope Stability - Post Earthquake

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1



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Dynegy Kincaid
Station 63+00
Slope Stability - Static Drained

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

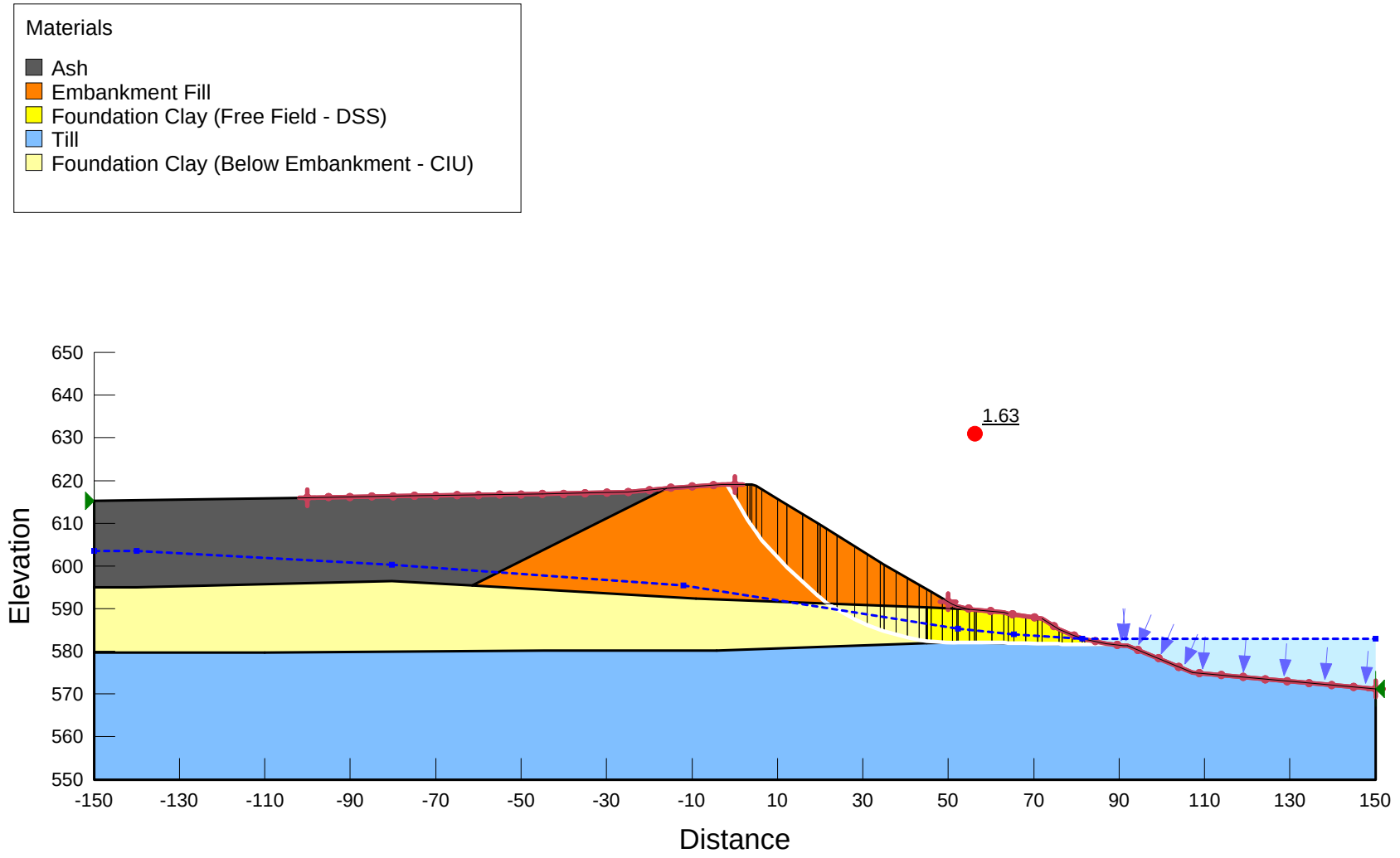
Name: Ash Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1

Name: Embankment Fill Model: Shear/Normal Fn. Unit Weight: 135 pcf Strength Function: Embankment Fill Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1

Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Below Embankment - CIU) Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: Foundation Clay (Below Embankment - CIU) Phi-B: 0 ° Piezometric Line: 1



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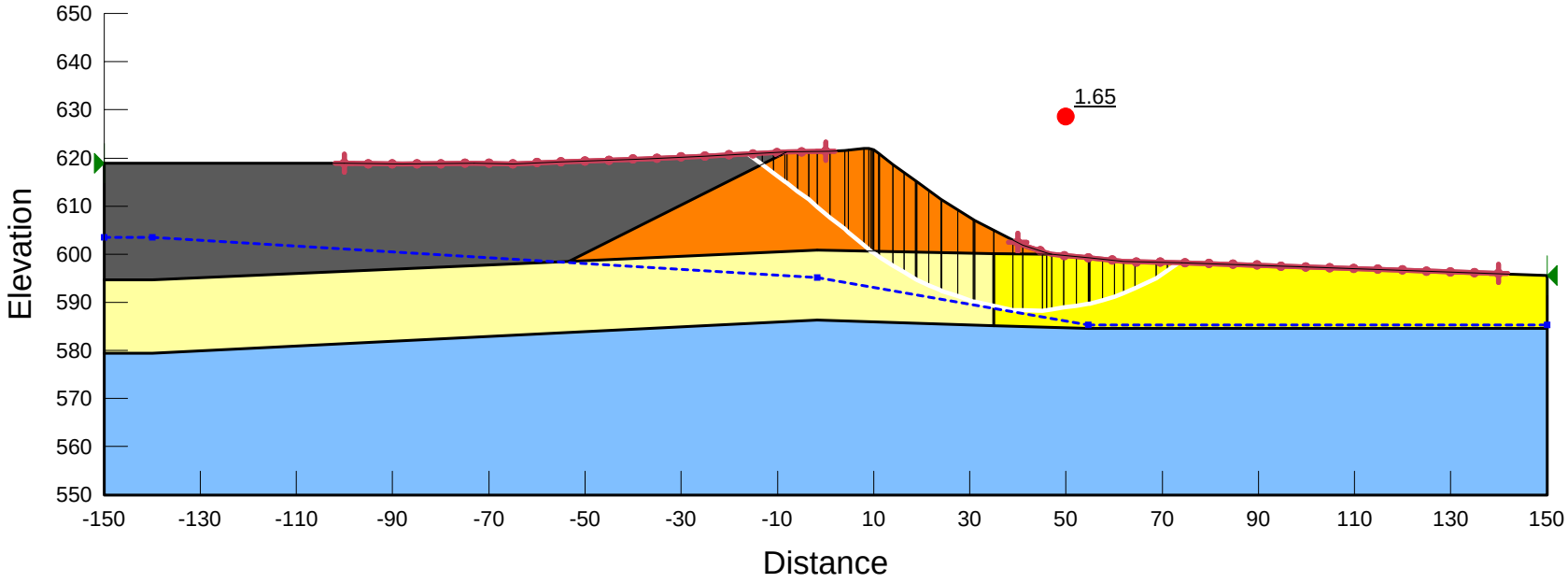
Dynegy Kincaid
Station 71+00
Peak Undrained Soil Strengths
Pseudostatic - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials
- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU)

Seismic Load
kh = 0.07 g



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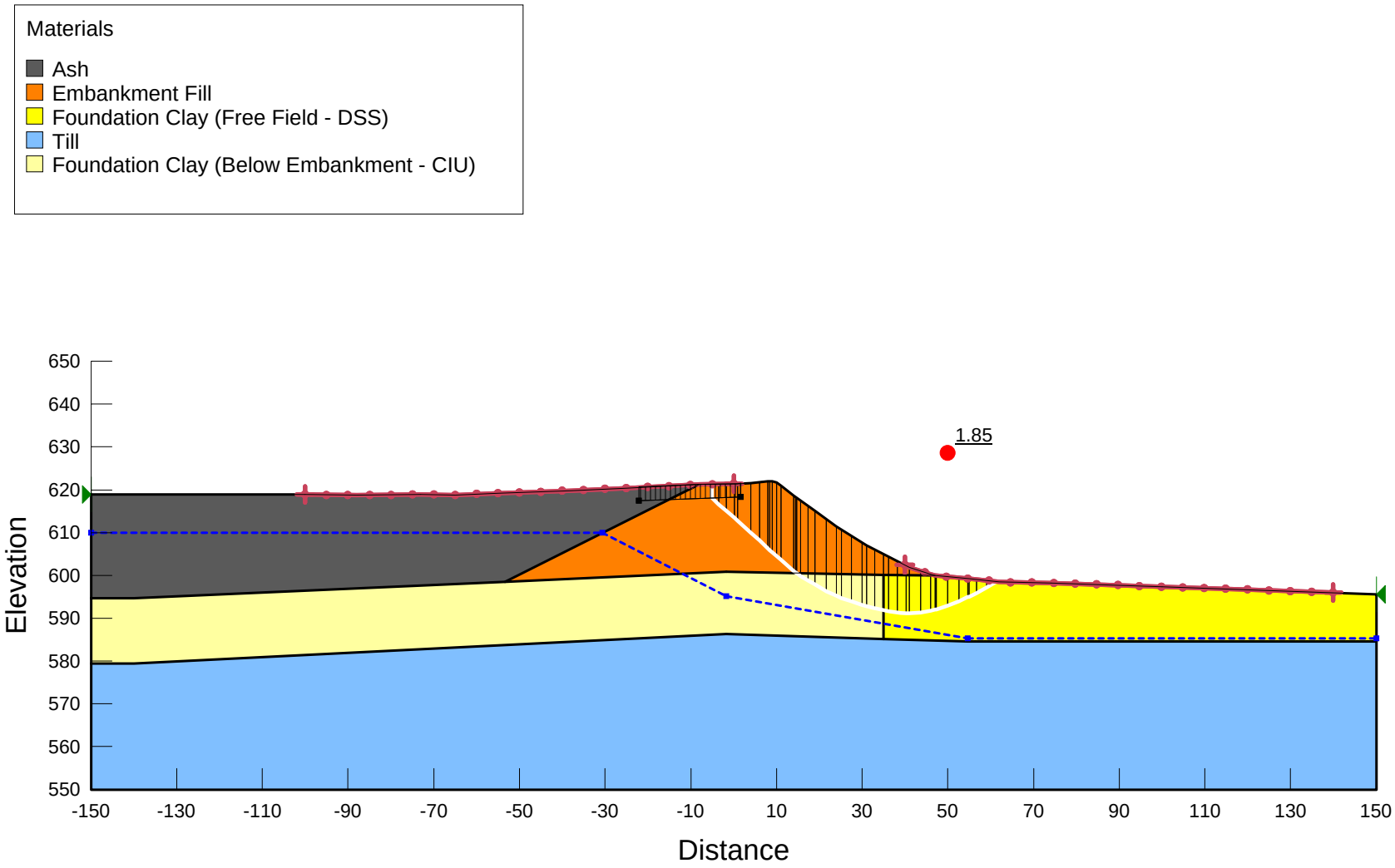
Dynegy Kincaid
Station 71+00
Peak Undrained Soil Strengths
Surcharge Pool - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1



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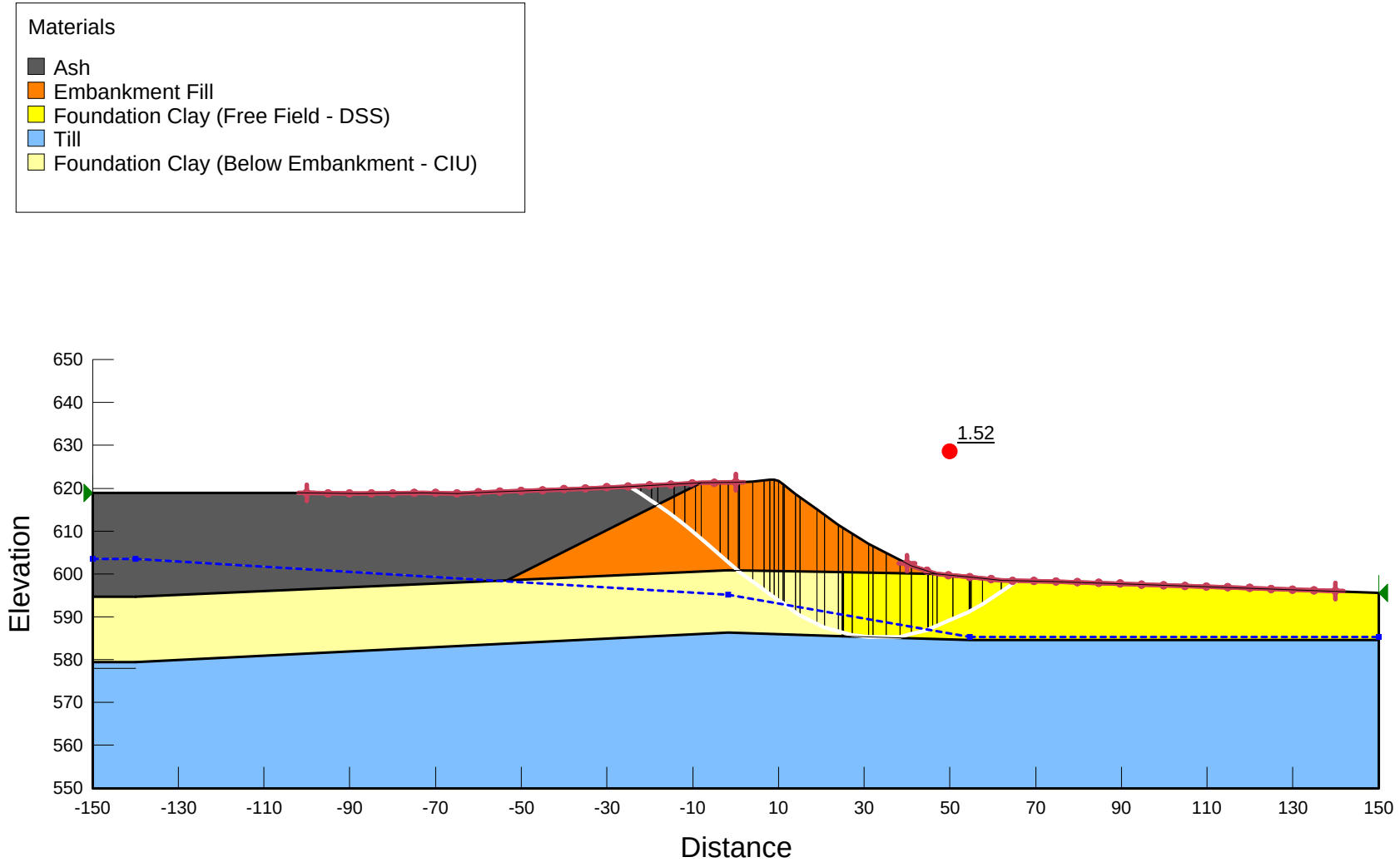
Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Dynegy Kincaid
Station 71+00
Slope Stability - Post Earthquake

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1
Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1
Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1
Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line:



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Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Dynegy Kincaid
Station 71+00
Slope Stability - Static Drained

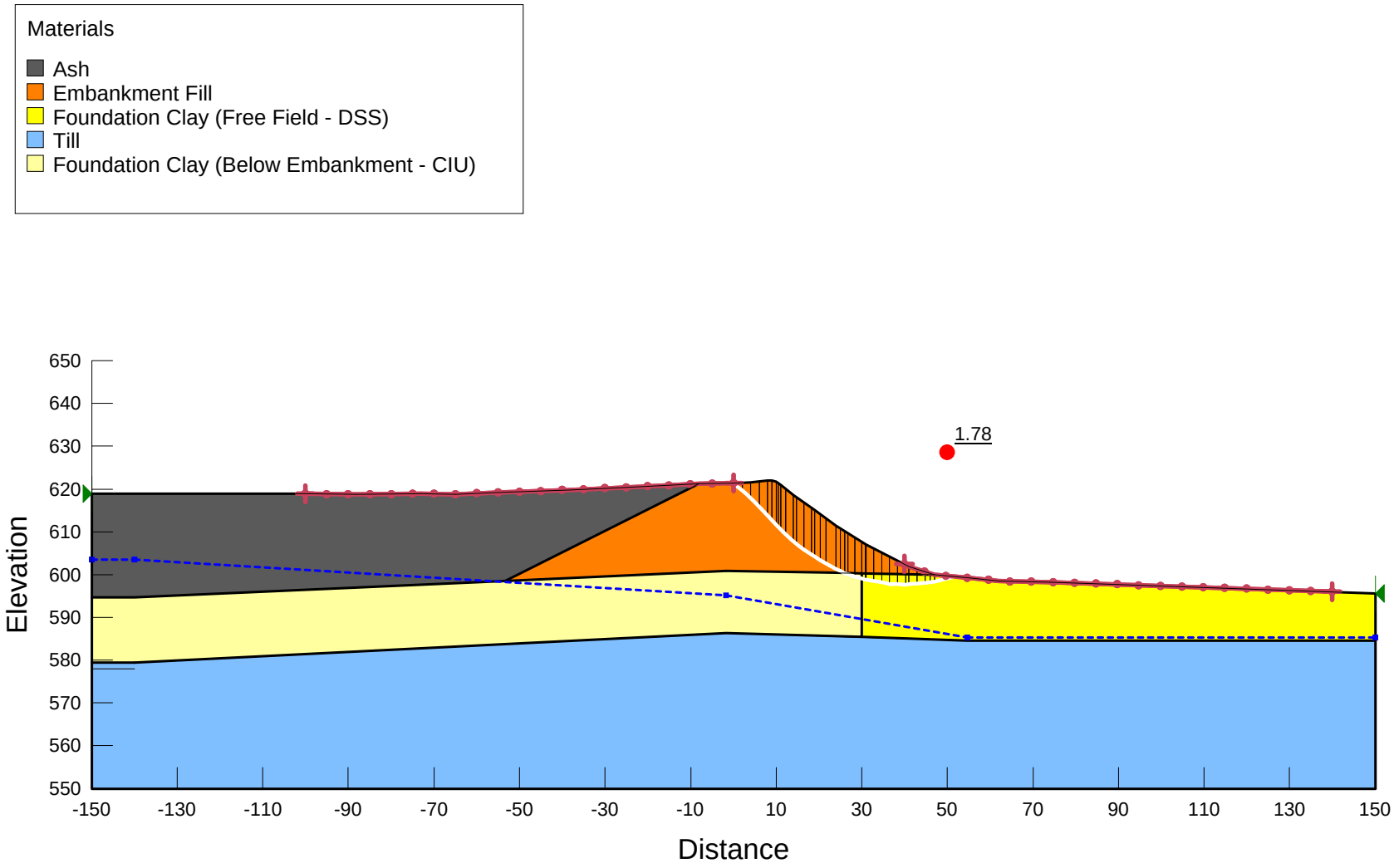
Name: Ash Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1

Name: Embankment Fill Model: Shear/Normal Fn. Unit Weight: 135 pcf Strength Function: Embankment Fill Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1

Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Below Embankment - CIU) Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: Foundation Clay (Below Embankment - CIU) Phi-B: 0 ° Piezometric Line: 1



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Dynegy Kincaid
Station 94+50
Peak Undrained Soil Strengths
Pseudostatic - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1

Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1

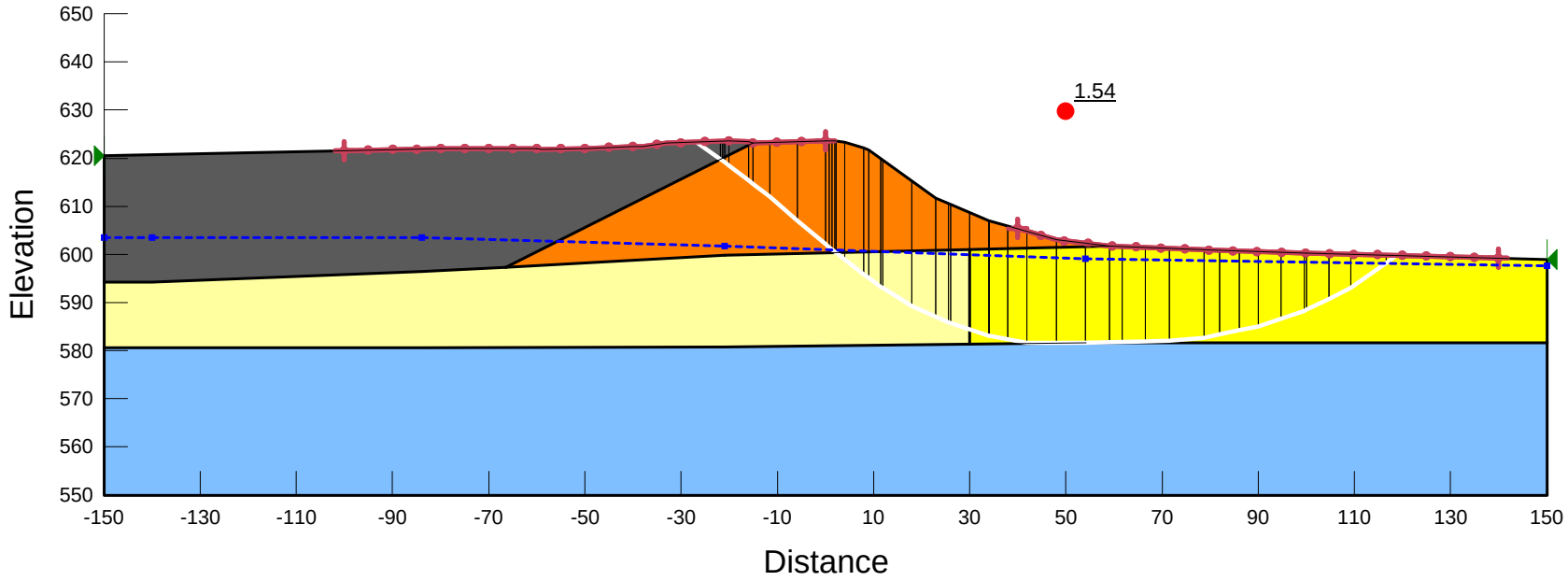
Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1

Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1

Materials

- Ash
- Embankment Fill
- Foundation Clay (Free Field - DSS)
- Till
- Foundation Clay (Below Embankment - CIU)

Seismic Load
kh = 0.07 g



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Dynegy Kincaid
Station 94+50
Peak Undrained Soil Strengths
Surcharge Pool - Entry & Exit

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/7/2016

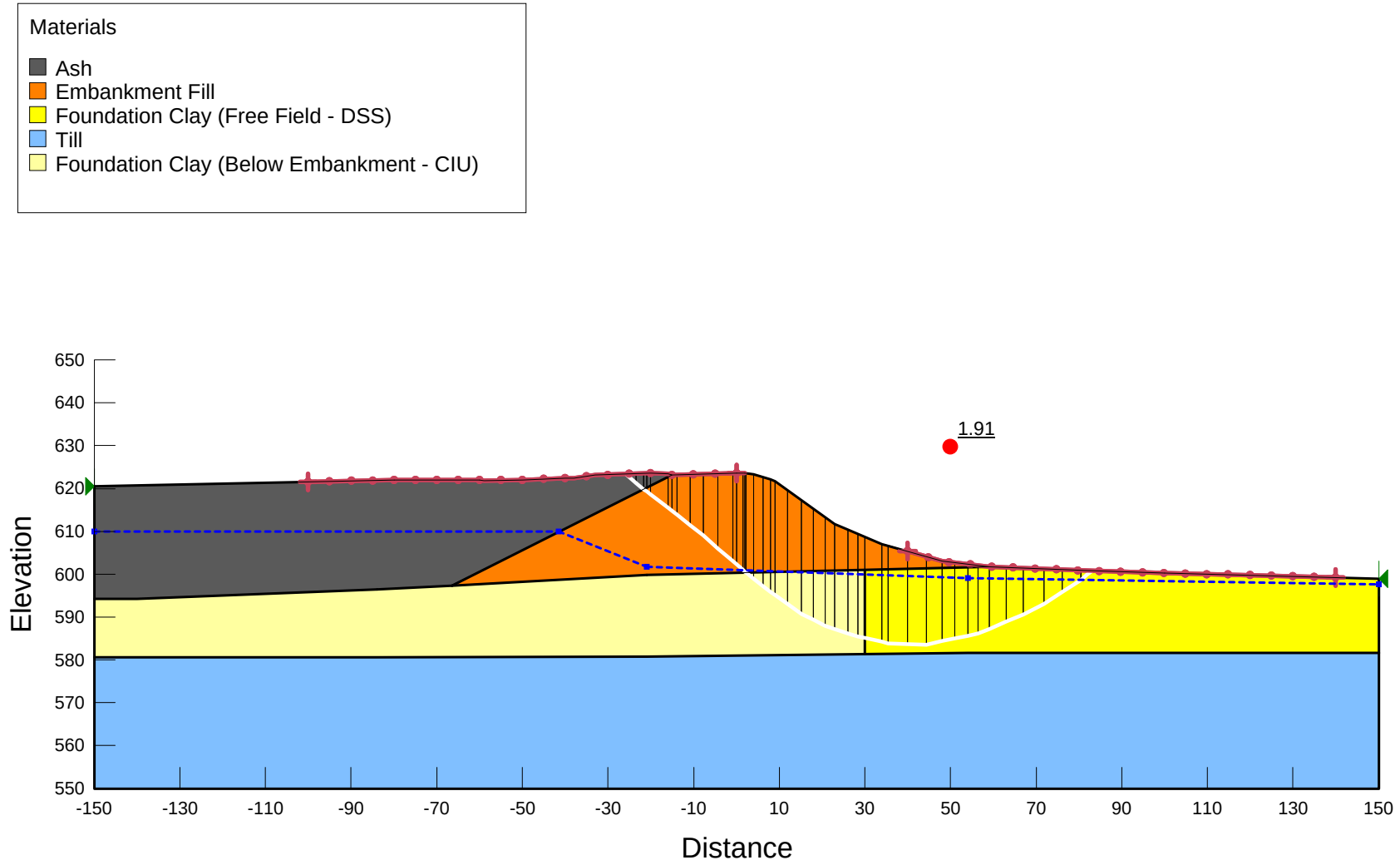
Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.4 Minimum Strength: 0 psf Piezometric Line: 1

Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1

Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1

Name: Foundation Clay (Below Embankment - CIU) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.48 Minimum Strength: 800 psf Piezometric Line: 1



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Dynegy Kincaid
Station 94+50
Slope Stability - Post Earthquake

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

Name: Ash Model: S=f(overburden) Unit Weight: 112 pcf Tau/Sigma Ratio: 0.06 Minimum Strength: 0 psf Piezometric Line: 1

Name: Embankment Fill Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.68 Minimum Strength: 575 psf Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: S=f(overburden) Unit Weight: 125 pcf Tau/Sigma Ratio: 0.3 Minimum Strength: 400 psf Piezometric Line: 1

Name: Till Model: S=f(overburden) Unit Weight: 135 pcf Tau/Sigma Ratio: 0.64 Minimum Strength: 800 psf Piezometric Line: 1

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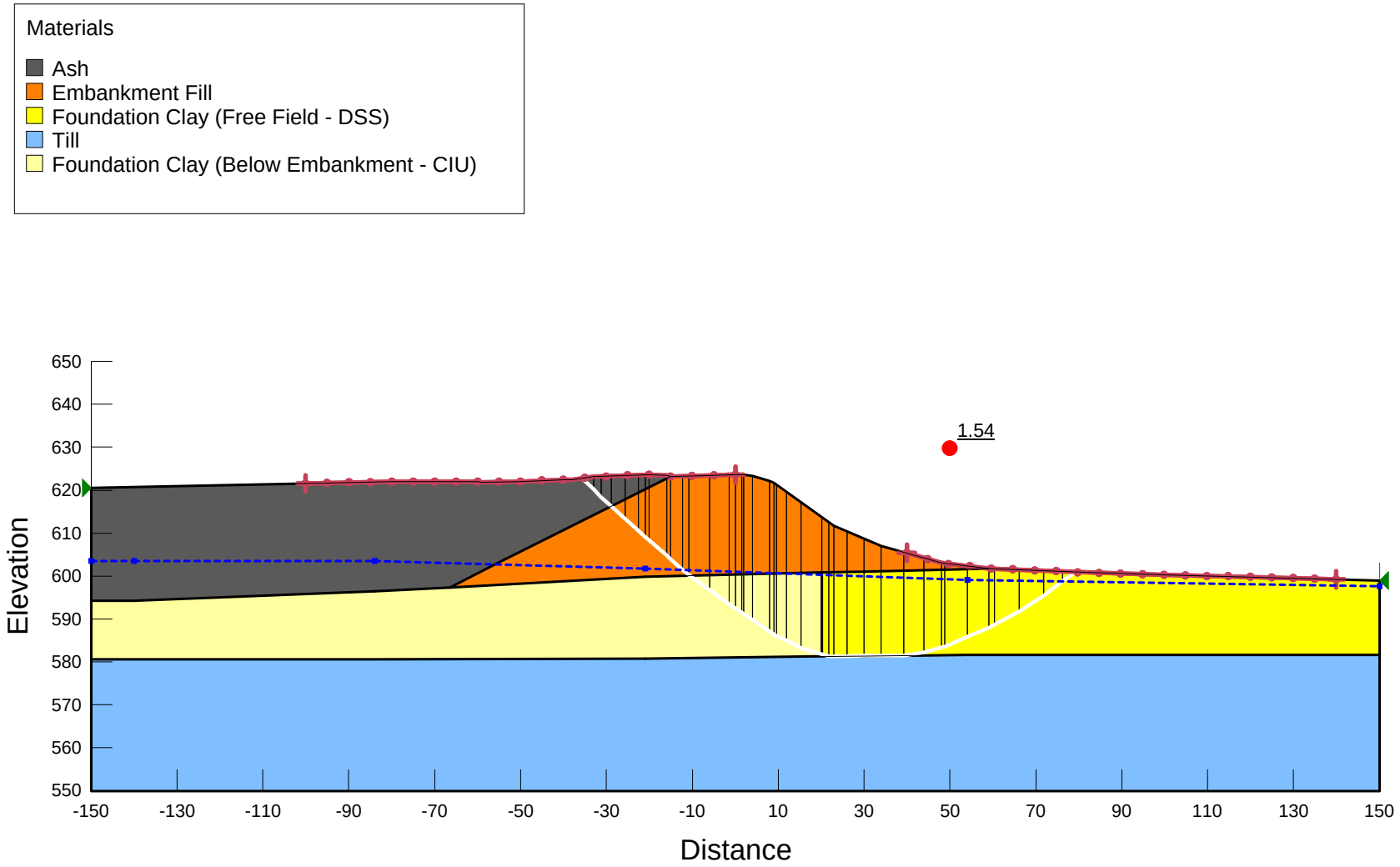

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Dynegy Kincaid
Station 94+50
Slope Stability - Static Drained

Design by: Lucas Carr
Checked by: K. Ritter
Date: 2/9/2016

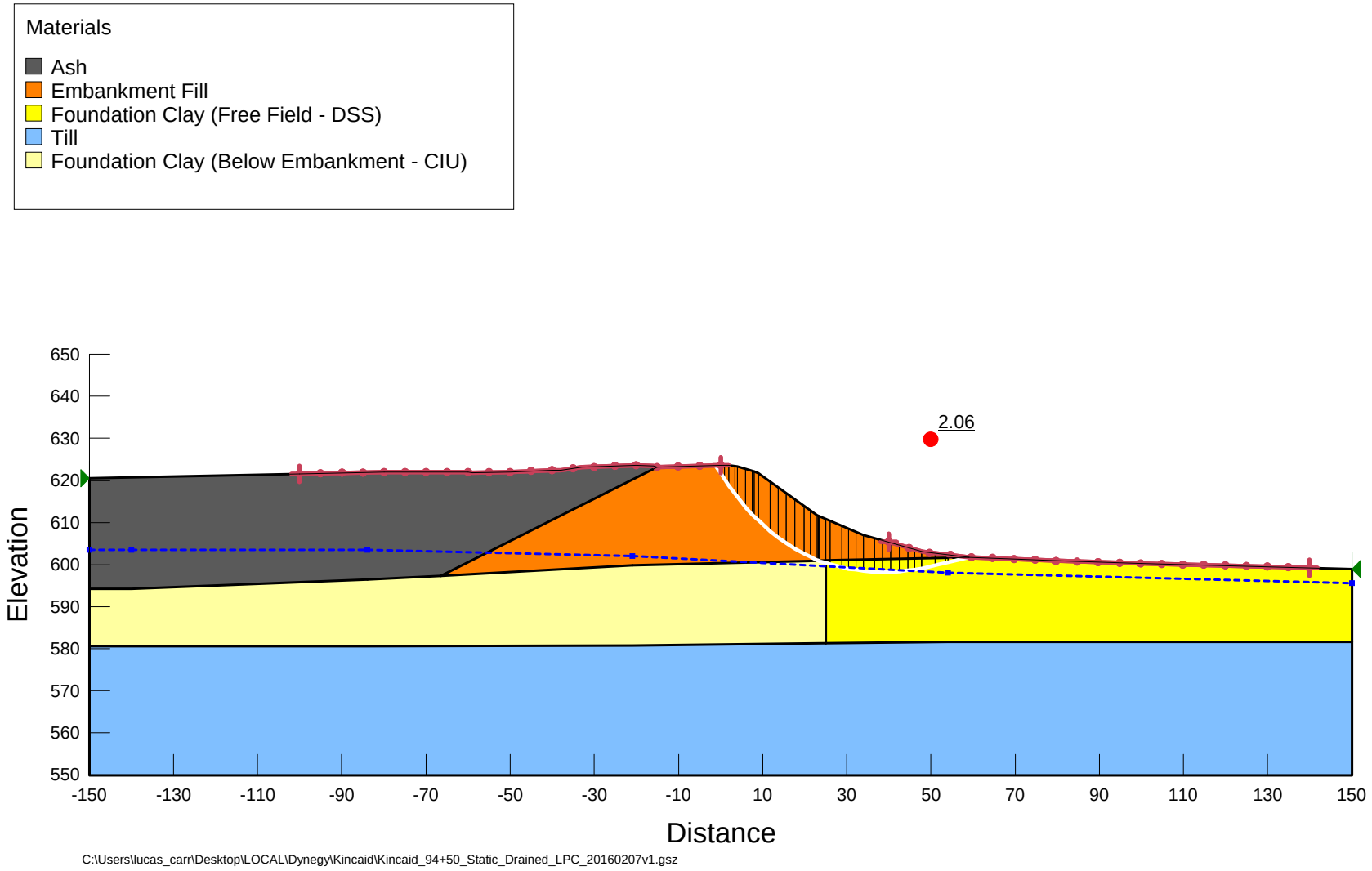
Name: Ash Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Piezometric Line: 1

Name: Embankment Fill Model: Shear/Normal Fn. Unit Weight: 135 pcf Strength Function: Embankment Fill Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Piezometric Line: 1

Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Piezometric Line: 1

Name: Foundation Clay (Below Embankment - CIU) Model: Shear/Normal Fn. Unit Weight: 125 pcf Strength Function: Foundation Clay (Below Embankment - CIU) Phi-B: 0 ° Piezometric Line: 1



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Attachment J. Probabilistic Seismic Hazard Analysis Report

Final Report

Site-Specific Probabilistic Seismic Hazard Analysis, Site Response Analysis and Development of Time Histories for the Kincaid Power Station in Central Illinois

Prepared for

Dynegy
Houston, Texas

6 January 2016

Prepared by

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Pacific Engineering and Analysis
856 Sea View Drive, El Cerrito, CA 94530

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A site-specific seismic hazard analysis has been performed for the Kincaid Power Station in southern Illinois to develop Safety Evaluation Earthquake (SEE) ground motions for use in liquefaction and dynamic deformation analyses of the facility. The SEE ground motions consist of acceleration response spectra and time histories. The power station is located in the Midcontinent of the U.S. away from active plate boundaries but in a region that exhibits a moderate level of historical seismicity. The site is capable of experiencing strong ground shaking from moderate to large earthquakes (moment magnitude [**M**] > 6) particularly from the adjacent New Madrid Seismic Zone (NMSZ) and the Wabash Valley Seismic Zone. The New Madrid fault system (NMFS) which is contained in the NMSZ produced the series of three **M** > 7 earthquakes in 1811 and 1812. These are the largest earthquakes known to have occurred in the central and eastern U.S. (CEUS).

In this study, four major tasks were performed: 1) seismic source characterization; 2) probabilistic seismic hazard analysis (PSHA); 3) site response analysis; and 4) development of the SEE ground motion parameters. The SEE ground motions are based on a probabilistic assessment of the seismic hazard at the site using the PSHA approach. The annual probability considered in this study was 1/2500 or a return period of 2,500 years. There are two major inputs into a PSHA: a characterization of all seismic sources that can generate significant ground shaking at the site and ground motion prediction models that relate primarily magnitude, distance, and site condition to levels of ground shaking at a site. For the seismic source characterization, we used the recently developed seismic source model developed for the CEUS by the Electric Power Research Institute (EPRI), the U.S. Department of Energy (DOE), and the U.S. Nuclear Regulatory Commission (NRC). This model is being used in the PSHAs for nuclear power plants and other critical facilities in the CEUS.

In a similar fashion, we used the EPRI ground motion prediction models developed in 2013 that are also being used in the PSHAs for nuclear power plants. A limitation of all existing ground motion models for the CEUS including the EPRI models is that they were developed for a hard rock site condition (shear-wave velocity [V_S] of 2,830 m/sec and greater).

The products of the PSHA are hard rock hazard curves and deaggregation information. The deaggregation indicated that the most important seismic sources to the power station site were the Illinois Basin Extended Basement Zone (IBEB) in which the site is located and the NMFS.

The power station is situated on Quaternary glacial till. Hard rock (in this case Precambrian basement rock), is at a depth of greater than 1,645 m. Hence a site response analysis was performed to estimate the ground motions at the top of the glacial till by accounting for any site effects of the geology beneath the site down to basement rock. The inputs required in a site response analysis are a best-estimate V_S profile and dynamic properties of the geologic units beneath the site. A V_S profile was developed from the ground surface down to basement rock based on available data, none of it being site-specific in nature. Dynamic properties were assigned to the unconsolidated materials and firm rock above the basement in the analysis. The hard rock hazard curves from the PSHA were adjusted to the top of the glacial till using amplification factors computed from the site response analysis.

Based on the results of the PSHA and site response analysis, a horizontal SEE Uniform Hazard Spectrum (UHS) was calculated. The SEE UHS is provided in the table below. The SEE peak

horizontal ground acceleration (PGA) at the site is 0.11 g. Three sets of two-component horizontal time histories were spectrally matched to the SEE UHS.

2,500-Year Return Period Mean SEE UHS for the Ground Surface

Period (sec)	SA (g)
0.01 (PGA)	0.11
0.02	0.15
0.03	0.17
0.04	0.18
0.10	0.25
0.20	0.21
0.40	0.13
1.0	0.10
2.0	0.06
3.0	0.04
4.0	0.03
5.0	0.03

At the request of Dynegy, a site-specific probabilistic seismic hazard analysis (PSHA) and site response analysis has been performed for the Kincaid Power Station in central Illinois to develop Safety Evaluation Earthquake (SEE) ground motions (Figure 1). The SEE ground motions will be used to evaluate the seismic design of the station. Horizontal acceleration time histories were also developed. The hazard was defined at the top of the Quaternary till beneath the site and will be used in liquefaction and deformation analyses of the power station.

Kincaid Power Station is located in the Midcontinent region of the U.S. away from active plate boundaries in a region that exhibits a moderate level of historical seismicity (Figure 1). There have been five known earthquakes larger than moment magnitude (**M**) 5.0 within 200 km of the site. The region is capable of experiencing strong ground motions from moderate to large earthquakes (**M** > 6) particularly from the New Madrid Seismic Zone (NMSZ) to the south of the site and the Wabash Valley Seismic Zone (WVSZ) to the east of the site (Figure 1).

This report presents the results of the site-specific PSHA, the site response analysis, and development of the horizontal acceleration time histories consistent with the 2,500-year Uniform Hazard Spectrum (UHS) at the ground surface.

1.1 SCOPE OF WORK

In site-specific seismic hazard analyses, the available geologic and seismologic data are used to evaluate and characterize (1) potential seismic sources, (2) the likelihood of earthquakes of various magnitudes occurring on those sources, and (3) the likelihood of the earthquakes producing ground motions over a specified level. Based on a site-specific PSHA and site response analysis, SEE spectra and time histories were developed. The following tasks were performed:

Task 1 – Seismic Source Characterization

Seismic source parameters that are needed in order to characterize an active (seismogenic) fault for ground motion hazard assessments include: the geometry and rupture dimensions of the fault; the size of the maximum earthquake; the nature (style) and amount of slip on the fault expected for the maximum earthquake; and the rate and nature of earthquake recurrence. These parameters should be estimated for all significant seismic sources. In addition to the known active faults located in the region that can impact the site, the hazard from buried and unknown faults must also be accounted for. Hence, seismic sources will consist of active and potentially active faults and regional seismic source zones, which account for buried and unknown faults. In this study, we utilized the recently developed seismic source model developed for the central and eastern U.S. (CEUS) by the Electric Power Research Institute (EPRI), the U.S. Department of Energy (DOE), and the U.S. Nuclear Regulatory Commission (NRC). This model is being used in the seismic hazard analyses for nuclear power plants and other critical structures/facilities in the CEUS.

Task 2 – Probabilistic Seismic Hazard Analysis

Site-specific probabilistic ground motions were calculated for the project site for a 2,500-year return period. The PSHA methodology allows for the explicit inclusion of the range of possible interpretations in components of the seismic hazard model, including seismic source characterization and ground motion estimation. Uncertainties in models and parameters are

incorporated into the hazard analysis through the use of logic trees. State-of-the-art ground motion prediction models were selected for the types of seismic sources considered in the PSHA. In this case, EPRI (2013) models for hard rock and the CEUS were used in the PSHA. Hard rock is defined by a V_S30 (time-averaged shear-wave velocity [V_S] in the top 30 m) greater than 2,830 m/sec.

Task 3 – Site Response Analysis

Site response analyses were performed consistent with NUREG/CR-6728 (McGuire *et al.*, 2001) to adjust the hard rock hazard to site-specific free-field ground surface conditions. The inputs into the analyses were V_S profiles representative of the site and non-linear dynamic properties. The V_S profiles were randomized using a correlation model to capture the variability in V_S across the site. Site response analyses were performed to calculate a suite of amplification factors at selected spectral frequencies i.e., PGA, 0.2 and 1.0 sec spectral acceleration and input motions. A state-of-the-art random-vibration-theory (RVT) methodology based on an equivalent-linear approach was used.

Task 4 – Development of SEE Ground Motion Parameters and Final Report

Horizontal design response spectra for a 2,500-year return period were developed and provided for the soil-structure interaction (SSI) analysis. A total of three time histories were developed. A final report was produced that describes and summarizes the above analyses.

1.2 ACKNOWLEDGMENTS

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The PSHA approach used in this study is based on the model developed principally by Cornell (1968). The occurrence of earthquakes on a fault is assumed to be a Poisson process. The Poisson model is widely used and is a reasonable assumption in regions where data are sufficient to provide only an estimate of average recurrence rate (Cornell, 1968). The occurrence of ground motions at the site in excess of a specified level is also a Poisson process, if (1) the occurrence of earthquakes is a Poisson process, and (2) the probability that any one event will result in ground motions at the site in excess of a specified level is independent of the occurrence of other events.

The probability that a ground motion parameter "*Z*" exceeds a specified value "*z*" in a time period "t" is given by:

$$p(Z > z) = 1\text{-}e^{-\nu(z)\cdot t} \qquad (2\text{-}1)$$

where $\nu(z)$ is the annual mean number (or rate) of events in which *Z* exceeds *z*. It should be noted that the assumption of a Poisson process for the number of events is not critical. This is because the mean number of events in time t, $\nu(z) \bullet t$, can be shown to be a close upper bound on the probability $p(Z > z)$ for small probabilities (less than 0.10) that generally are of interest for engineering applications. The annual mean number of events is obtained by summing the contributions from all sources, that is:

$$\nu(z) = \sum_{n} \nu_n(z) \qquad (2\text{-}2)$$

where $\nu_n(z)$ is the annual mean number (or rate) of events on source n for which *Z* exceeds *z* at the site. The parameter $\nu_n(z)$ is given by the expression:

$$\nu_n(z) = \sum_{i}\sum_{j} ß_n(m_i) \bullet p(R=r_j|m_i) \bullet p(Z>z|m_i,r_j) \qquad (2\text{-}3)$$

where:

$ß_n(m_i)$ = annual mean rate of recurrence of earthquakes of magnitude increment m_i on source n;

$p(R=r_j|m_i)$ = probability that given the occurrence of an earthquake of magnitude m_i on source n, r_j is the closest distance increment from the rupture surface to the site;

$p(Z > z|m_i,r_j)$ = probability that given an earthquake of magnitude m_i at a distance of r_j, the ground motion exceeds the specified level *z*.

The calculations were made using the computer program HAZ38CEUS. The basic program (HAZ38) has been validated in the Pacific Earthquake Engineering Research (PEER) Center-sponsored "Validation of PSHA Computer Programs" Project (Thomas *et al.*, 2010). Modifications were made to HAZ38 to incorporate the CEUS-SSC model and the resulting revision, HAZ38CEUS, was validated by comparing hazard results with the test case results contained in EPRI/DOE/NRC (2012).

The following is a general overview of PSHA methodology used by AECOM. For this study, we have adopted the EPRI/DOE/NRC (2012) seismic source model, which required modifications to our general approach. For a detailed description, see EPRI/DOE/NRC (2012). A sample logic tree is shown on Figure 2. Logic trees such as shown on Figure 3 are used in the EPRI/DOE/NRC (2012) model.

2.1 SEISMIC SOURCE CHARACTERIZATION

Three types of earthquake sources are characterized in the CEUS-SSC model: (1) known fault sources; (2) seismotectonic zones; and (3) Mmax zones. Fault sources are modeled as three-dimensional fault surfaces and details of their behavior are incorporated into the source characterization. The inventory of fault sources in the CEUS is small and undoubtedly incomplete. Given this shortcoming, the historical seismicity is used as a proxy to address the hazard from those buried or unknown faults. The spatial density of the historical seismicity was assumed to be stationary; in this model the recurrence rates per area for each small area were smoothed using a Gaussian filter.

The geometric source parameters for faults include fault location, segmentation model, dip, and thickness of the seismogenic zone (Figure 3). The recurrence parameters include recurrence model, recurrence rate (slip rate or average recurrence interval for the maximum event), slope of the recurrence curve (*b*-value), and maximum magnitude. Clearly, the geometry and recurrence are not totally independent. For example, if a fault is modeled with several small segments instead of large segments, the maximum magnitude is lower, and a given slip rate requires many more small earthquakes to accommodate a cumulative seismic moment. For areal source zones, only the area, seismogenic thickness, maximum magnitude, and recurrence parameters (based on the historical earthquake record) need to be defined (Figure 2).

Uncertainties in the CEUS-SSC source parameters are modeled using logic trees. In this procedure, values of the source parameters are represented by the branches of logic trees with weights that define the distribution of values. Sample logic trees are shown on Figures 2 and 3. In general, three or five values for each parameter were weighted and used in the analysis. Note that the weights associated with the percentiles are not equivalent to probabilities for these values, but rather are weights assigned to define the distribution.

2.1.1 Source Geometry

In the PSHA, it is assumed that earthquakes of a certain magnitude may occur randomly along the length of a given fault or segment. The distance from an earthquake to the site is dependent on the source geometry, the size and shape of the rupture on the fault plane, and the likelihood of the earthquake occurring at different points along the fault length. The distance to the fault is defined to be consistent with the specific ground motion prediction model used to calculate the ground motions. The distance, therefore, is dependent on both the dip and depth of the fault plane, and a separate distance function is calculated for each geometry and each ground motion prediction model. The size and shape of the rupture on the fault plane are dependent on the magnitude of the earthquake, with larger events rupturing longer and wider portions of the fault plane. For a given magnitude, the associated rupture surface is uniformly distributed along the fault length and width. Ruptures are constrained to occur entirely on the defined fault plane.

The rupture dimensions are modeled using magnitude-rupture area and rupture width relationships.

2.1.2 Fault Recurrence

The recurrence relationships for faults are generally modeled using the exponentially truncated Gutenberg-Richter, characteristic earthquake, and the maximum moment (magnitude) recurrence models. These models are weighted to represent judgment on their applicability to the sources. For the areal source zones, only a truncated exponential recurrence relationship is assumed appropriate.

The general approach of Molnar (1979) and Anderson (1979) is often used to arrive at the recurrence for the exponentially truncated model. The number of events exceeding a given magnitude, *N(m)*, for the truncated exponential relationship is

$$N(m) = \alpha(m^o)\frac{10^{-b(m-m^o)} - 10^{-b(m^u-m^o)}}{1 - 10^{-b(m^u-m^o)}} \qquad (2\text{-}4)$$

where $\alpha(m^o)$ is the annual frequency of occurrence of earthquake greater than the minimum magnitude, m^o; b is the Gutenberg-Richter parameter defining the slope of the recurrence curve; and m^u is the upper-bound magnitude event that can occur on the source. A m^o of **M** 5.0 was used for the hazard calculations; this value is also used by the USGS in the National Hazard Maps (Frankel *et al*., 1996; Petersen *et al*., 2008).

A popular model often used in PSHA is where faults rupture with a "characteristic" magnitude on specific segments; this model is described by Aki (1983) and Schwartz and Coppersmith (1984). For the characteristic model, the numerical model of Youngs and Coppersmith (1985) is often used. In the characteristic model, the number of events exceeding a given magnitude is the sum of the characteristic events and the non-characteristic events. The characteristic events are distributed uniformly over a ± 0.25 magnitude unit around the characteristic magnitude and the remainder of the moment rate is distributed exponentially up to the characteristic range using the above equation (Youngs and Coppersmith, 1985).

The maximum moment model can be regarded as an extreme version of the characteristic model. The model proposed by Wesnousky (1986) is often used when there is no exponential portion of the recurrence curve, i.e., no events can occur between the minimum magnitude of **M** 5.0 and the distribution about the maximum magnitude.

The recurrence rates for the fault sources are defined by either the slip rate or the average return time for the maximum or characteristic event and the recurrence *b*-value. The slip rate is used to calculate the moment rate on the fault using the following equation defining the seismic moment:

$$M_o = \mu A D \qquad (2\text{-}5)$$

where M_o is the seismic moment, μ is the shear modulus, A is the area of the rupture plane, and D is the slip on the plane. Dividing both sides of the equation by time results in the moment rate as a function of slip rate:

$$\dot{M}_o = \mu A S \quad (2\text{-}6)$$

where $\dot{M}_o$ is the moment rate and S is the slip rate. M_o has been related to moment magnitude, **M**, by Hanks and Kanamori (1979):

$$\mathbf{M} = 2/3 \log M_o - 10.7 \quad (2\text{-}7)$$

Using this relationship and the relative frequency of different magnitude events from the recurrence model, the slip rate can be used to estimate the absolute frequency of different magnitude events.

The average return time for the characteristic or maximum magnitude event defines the high magnitude (low likelihood) end of the recurrence curve. When combined with the relative frequency of different magnitude events from the recurrence model, the recurrence curve is established.

2.2 GROUND MOTION PREDICTION

To characterize the ground motions at a specified site as a result of the seismic sources considered in the PSHA, we used ground motion prediction models for spectral accelerations (Figure 2; Section 4.2). Ground motion prediction models have at a minimum the variables of magnitude, distance, and site condition (e.g., rock, soil).

The uncertainty in ground motion models was included in the PSHA by using the log-normal distribution about the median values as defined by the standard deviation associated with each model. This distribution was truncated at five standard deviations above the median value predicted by the each model. We have tested our approach using the five sigma truncation against the test cases contained in EPRI/DOE/NRC (2012) where sigma was untruncated. The differences are insignificant.

In this section, we describe the seismotectonic setting and historical seismicity of the site region and the site geology.

3.1 SEISMOTECTONIC SETTING

Kincaid Power Station is located in central Illinois, about 155 km northwest of the WVSZ and 260 km north of the NMSZ (Figure 4). Although the site is located within the continental interior and far from active plate boundaries, the preexisting structures formed in earlier tectonic settings are still capable of generating seismicity that can pose a hazard to the region. This seismicity has included several large historical earthquakes in the region (**M** > 7), e.g., the 1811 and 1812 New Madrid earthquakes (Figure 1).

The CEUS is part of a broad mid-plate compressive stress province that also includes most of Canada (Zoback and Zoback, 1991). Over this large region, the stress field is oriented with a relatively uniform east-northeast direction of maximum horizontal compression. This compression direction corresponds well to the direction of absolute plate motion of the North American Plate, which suggests that a far-field tectonic source such as ridge-push or basal drag at the Mid-Atlantic Ridge may be the primary source of stress in the mid-plate region (Zoback and Zoback, 1991).

3.2 HISTORICAL SEISMICITY

The following is a discussion of the historical seismicity and significant earthquakes in the region surrounding the Kincaid Power Station.

3.2.1 Historical Seismicity Catalog

A historical seismicity catalog was derived mainly from the CEUS Seismic Source Characterization (CEUS-SSC) catalog (EPRI/NRC/DOE, 2012) (Figure 4). This catalog includes data primarily from the catalog compiled by the U.S. Geological Survey (USGS) for the National Seismic Hazard Mapping Project (Mueller *et al*., 1997; Petersen *et al*., 2008) and from the Geological Survey of Canada (GSC) catalog for seismic hazard analyses (Adams and Halchuk, 2003). The main source for the USGS catalog was the NCEER-91 catalog (Seeber and Ambruster, 1991) which updated the original EPRI-SOG (EPRI 1988) catalog. The catalog was then updated using the National Earthquake Information Center's (NEIC) Preliminary Determination of Epicenters (PDE) and data from the National Earthquake Database (NEDB) of Canada. Researchers reviewed original catalogs and special earthquake studies to verify and if needed update original entries, and regional catalogs were incorporated into the continental scale catalogs described above (see EPRI/NRC/DOE, 2012 for details of special study references and list of regional catalogs used). The CEUS-SSC catalog spans the time period of 1568 to 2008. We updated this catalog with more recent data (up to May 2015) from the Advanced National Seismic System (ANSS) catalog as shown on Figure 1.

All of the events in the USGS catalog used to compile the CEUS-SSC catalog have body-wave (m_b) magnitude values, which were converted to **M** using the equations of Atkinson and Boore (1995):

$$\mathbf{M} = -0.39 + 0.98Mn \text{ for magnitudes} \leq 5.5$$

$\mathbf{M} = 2.715 - 0.277Mn + 0.127(Mn^2)$ for magnitudes > 5.5

and Johnston (1996):

$\mathbf{M} = 1.14 + 0.24\ m_b + 0.0933\ m_b^2$

Mn (Nuttli magnitude) was considered to be equivalent to m_b. All events in the PDE catalog that we used to update the CEUS-SSC catalog were Mn or M_D. We converted the PDE Mn magnitudes to **M** using the average of Atkinson and Boore (1995) and Johnston (1996). For the M_D values, we used the same conversion used in the CEUS-SSC catalog to convert them to **M** values for the Midcontinent U.S. east of 100º W (EPRI/DOE/NRC, 2012).

$\mathbf{M} = 0.869 + 0.762\ M_D$

3.2.2 Significant Earthquakes

The most significant earthquakes to have occurred in the CEUS are the 1811-1812 **M** 7 to 8 New Madrid earthquake sequence and the 1886 **M** 6.8 Charleston, South Carolina, earthquake (Figure 1). The New Madrid earthquake sequence occurred over the winter of 1811-1812 in southeastern Missouri/northeastern Arkansas. This sequence, which was felt as far away as the East Coast (Figure 5), consisted of three principal events on 16 December 1811, 23 January 1812, and 7 February 1812 (referred to as NM1, NM2, and NM3, respectively in Hough *et al*., 2000) (Figure 6). Because the epicentral region was sparsely populated at the time of the events, little structural damage occurred, and the maximum Modified Mercalli (MM) intensity is IX (NM1) as reinterpreted by Hough *et al.* (2000). The Kincaid Power Station site probably underwent strong ground shaking of MM VI to VII in the 16 December 1811 mainshock (Figure 5). The NMSZ is currently the most seismically active area in the CEUS (Figure 1).

The Wabash Valley, which encompasses southern Illinois and southwestern Indiana and is 155 km southeast of the Kincaid Power Station, has historically been seismically active with several earthquakes of **M** 4.5 and larger (Figure 1). Hence, the site has been strongly shaken numerous times after the 1811-1812 and 1886 earthquakes. An event on 27 September 1891 occurred near Mt. Vernon, Illinois, which caused chimney damage in the epicentral area (Stover and Coffman, 1993). The size of the earthquake was estimated to be a body-wave magnitude (m_b) 5.8 and the event was felt widely in several states (Figure 7). Shaking at the site could have been as strong as MM IV to V.

On 31 October 1895, an earthquake of estimated surface wave magnitude (M_S) 6.7 struck the northern end of the NMSZ (Figures 1 and 8). This is the largest earthquake to have occurred in the central Mississippi Valley since 1811-1812 (Stover and Coffman, 1993). The event caused extensive damage in the town of Charleston, Missouri. Sand blows due to liquefaction were also reported in the epicentral area (Stover and Coffman, 1993). In the area of the site, the ground shaking was probably at MM V level (Figure 8).

On 9 November 1968, a m_b 5.5 earthquake struck southern Illinois and neighboring states with a maximum reported MM VII (Figures 1 and 9). Damage consisted of damaged chimneys, broken windows, cracked or fallen plaster, cracked foundations, and scattered instances of collapsed parapets (Stover and Coffman, 1993). The site was probably subjected to MM IV to V ground

shaking from this event. Another notable earthquake was the 18 April 2008 **M** 5.4 Southern Illinois earthquake southeast of the site (Figure 1).

On 27 July 1980, a **M** 5.1 earthquake struck the area near Sharpsburg, Kentucky. This event, the strongest in the history of Kentucky, occurred approximately 510 km southeast of the site and caused over $1 million in property damage (Stover and Coffman, 1993). The site was probably subjected to intensities of MM I to II (Figure 10).

3.3 SITE GEOLOGY

The site lies in the west-central portion of the Illinois Basin, a northwest-southeast oriented regional-scale structural depression that includes Illinois, Indiana, Kentucky and portions of Tennessee and Missouri. The bedrock in the site area dips gently to the southeast toward the center of the Illinois Basin which lies in southern Illinois. Underlying the region is thousands of meters sedimentary bedrock of deposited from Cambrian to Pennsylvanian periods. More recent Quaternary deposits of glacial, loess, and alluvial soils cover the bedrock at depths ranging from tens to hundreds of feet.

The regional bedrock consists of sequences of shale, siltstone, sandstone, coal, and limestone overlying Precambrian crystalline basement rock. The thickness of the sedimentary bedrock units varies and is controlled by depositional environment and geologic structure. The total thickness of the sedimentary rocks in the region is reported to be about 2,000 m based upon oil test borings and seismic profiles (Horberg, 1950).

Pleistocene-aged glacial and loess deposits cover the bedrock at the site. Glacial till/drift deposits from the Illinoian Stage glaciation form dense, compact silts, sand, clay, and gravel mixtures (Frye *et al.*, 1968; Jacobs and Lineback, 1969). Windblown loess, silts blown from river valleys, cover the glacial deposits and are interbedded in select areas with modern alluvium. At the Kincaid site these unconsolidated deposits are approximately 60 feet thick.

Underlying the Quaternary deposits at the site is a ~715 foot-thick section of the Pennsylvanian Bond Formation that includes sandstone, siltstone, shale, limestone, coal, and clay (Treworgy*et al.*, 1994; Treworgy and Whitaker, 1990). The Pennsylvanian System lies unconformably above the Mississippian strata, which are comprised mainly of limestones and siltstone and to a lesser extent shale, with a total thickness of ~584 feet clay (Treworgy *et al.*, 1994; Treworgy and Whitaker, 1990).

The Devonian System beneath the Mississippian only consists of the Lower Devonian Series at the Kincaid site: a relatively thin sequence of carbonate limestone and chert deposits approximately 125 feet in thickness clay (Treworgy *et al.*, 1994; Treworgy and Whitaker, 1990). Beneath the Devonian, the Silurian System contains a reddish argillaceous limestone to calcareous siltstone, a homogeneous limestone, and a cherty limestone and is estimated to be 475 feet thick at the Kincaid site clay (Treworgy *et al.*, 1994; Treworgy and Whitaker, 1990).

Underlying the Silurian, the Ordovician System, approximately 700 feet thick at the site, contains several major groups: the Maquoketa Group, the Galena Group, the Platteville Group and the Joaquim Dolomite clay (Treworgy *et al.*, 1994; Treworgy and Whitaker, 1990; Horberg, 1950). Formations within these groups consist of the St. Peter Sandstone, the Galena-Platteville Limestone and Dolomite, and the Maquoketa Shale. The St. Peter Sandstone is a distinct, very

well-sorted fine- and medium-grained quartz sandstone. The Galena-Platteville Group is comprised of numerous dolomite and limestone formations of varying composition. The Maquoketa Group, about 250 feet thick at the site, consists of three shale formations and one limestone formation. The Maquoketa Group was estimated to have lower strength than the surrounding dolomite and limestone rock and accordingly this group was assigned as a separate sub-unit of the site stratigraphy within the Ordovician System.

The Cambrian System rocks, primarily siltstone, shale sandstone, and dolomite, are the thickest sedimentary rocks at the site, projected to be approximately 4,000 ft thick. Below the rocks of the Cambrian system lie stronger crystalline basement rocks, predominately granite with associated granodiorite and rhyolite.

The following section discusses the two major inputs into the PSHA: the seismic source model and the ground motion prediction models.

4.1 SEISMIC SOURCE MODEL

Seismic source characterization is concerned with three fundamental elements: (1) the location, geometry, and characteristics of significant sources of future earthquakes; (2) the maximum size of these earthquakes; and (3) the rate at which different size earthquakes occur. Two types of seismic sources were considered in this PSHA: discrete fault or fault zone sources and regional seismic source zones.

The seismic source characterization presented here is adopted from the comprehensive seismic source characterization of the CEUS, developed for nuclear facilities by EPRI/DOE/NRC (2012). Two zonation models that account for earthquakes associated with buried or generally unknown faults (background) were characterized and included in the PSHA; these models include multiple zones, many having alternative geometries (Figures 11 and 12). In addition, the source parameters for several fault sources or RLMEs (repeated large magnitude earthquakes) (Figure 11) were characterized for input into the PSHA.

A major challenge in understanding the earthquake potential in the CEUS has been associating the observed seismicity with specific geologic structures. Few active faults are known east of the Rocky Mountains. Thus the traditional approach in addressing the seismic hazard in the CEUS has been to rely on the historical earthquake record in conjunction with seismic source zones that separate regions of different seismotectonic characteristics and hence possibly different earthquake potential. Each seismic source zone is defined and characterized according to geologic, tectonic, and seismicity data. The zones comprise regions having a common geologic history that distinguishes them from neighboring areas. They may have a similar structure (e.g., faults or fractures of similar age, type, orientation), a similar pattern of seismicity, and/or a homogeneous stress regime. The EPRI/DOE/NRC (2012) model retains this methodology by dividing the CEUS into numerous “seismotectonic zones”, defined by differences in various seismic source assessment criteria such as style of faulting, earthquake recurrence, maximum magnitude, seismogenic thickness, etc. The model includes an alternative approach to dividing the CEUS into source zones, which is based solely on the expected maximum magnitude in the zone. This alternative zonation approach divides the study area into “Mmax zones” (Figure 12). The seismotectonic zone approach receives slightly higher weight, 0.6, than the Mmax zone approach, 0.4.

Figures 11 and 12 show the locations of the seismotectonic and Mmax zones, respectively. There are three Mmax zones and 12 seismotectonic zones in the EPRI/DOE/NRC model. The Mmax zones and some seismotectonic zones have one or more alternate geometries. Table 1 summarizes the source zone parameters used in the analysis. (Not all seismic source zones are shown on Figure 11.) The Kincaid Power Station lies in the Illinois Basin Extended Basin Zone (IBEB) zone, 155 km from the Wabash Valley RLME, 250 km from the Commerce fault zone and 260 km from the New Madrid North fault (NMN) (Figures 6 and 11).

Table 1
Seismic Source Zones Incorporated Into Analysis

Source Zone	Symbol	Mmax (M)[1]	Seismogenic Depth[2] (km)	Area (km^2)
Seismotectonic Zones				
Atlantic Highly Extended Crust	AHEX	6.0 6.7 7.2 7.7 8.1	8 (0.5) 15 (0.5)	177683
Extended Continental Crust–Atlantic Margin Zone	ECC-AM	6.0 6.7 7.2 7.7 8.1	13 (0.4) 17 (0.4) 22 (0.2)	881480
Extended Continental Crust–Gulf Coast	ECC-GC	6.0 6.7 7.2 7.7 8.1	13 (0.4) 17 (0.4) 22 (0.2)	1239288
Gulf Highly Extended Crust	GHEX	6.0 6.7 7.2 7.7 8.1	8 (0.5) 15 (0.5)	509090
Great Meteor Hotspot Zone	GMH	6.0 6.7 7.2 7.7 8.1	25 (0.5) 30 (0.5)	32250
Illinois Basin Extended Basin Zone	IBEB	6.5 6.9 7.4 7.8 8.1	13 (0.4) 17 (0.4) 22 (0.2)	114526
Midcontinent Craton Zone (all alternatives)	MidC	5.6 6.1 6.6 7.2 8.0	13 (0.4) 17 (0.4) 22 (0.2)	4258598 4246625 4025001 4013028
Northern Appalachian Zone	NAP	6.1 6.7 7.2 7.7 8.1	13 (0.4) 17 (0.4) 22 (0.2)	378331
Oklahoma Aulacogen Zone	OKA	5.8 6.4 6.9 7.4 8.0	15 (0.5) 20 (0.5)	53583

Source Zone	Symbol	Mmax (M)[1]	Seismogenic Depth[2] (km)	Area (km^2)
Paleozoic Extended Crust (Narrow and Wide alternatives)	PEZ	5.9 6.4 6.8 7.2 7.9	13 (0.4) 17 (0.4) 22 (0.2)	365395 598992
Reelfoot Rift Zone	RR	6.2 6.7 7.2 7.7 8.1	13 (0.4) 15 (0.4) 17 (0.2)	69479
Reelfoot Rift with Rough Creek Graben Zone	RR and RR_RCG	6.1 6.6 7.1 7.6 8.1	13 (0.4) 15 (0.4) 17 (0.2)	81452
St. Lawrence Rift Zone	SLR	6.2 6.8 7.3 7.7 8.1	25 (0.5) 30 (0.5)	329322
Mmax Zones				
Mesozoic and Younger Extended Crust - Narrow	MESE-N	6.4 6.8 7.2 7.7 8.1	13 (0.4) 17 (0.4) 22 (0.2)	3616923
Mesozoic and Younger Extended Crust - Wide	MESE-W	6.5 6.9 7.3 7.7 8.1	13 (0.4) 17 (0.4) 22 (0.2)	4342413
Non-Mesozoic and Younger Extended Crust - Narrow	NMESE-N	6.4 6.8 7.1 7.5 8.0	13 (0.4) 17 (0.4) 22 (0.2)	4792101
Non-Mesozoic and Younger Extended Crust - Wide	NMESE-W	5.7 6.1 6.6 7.2 7.9	13 (0.4) 17 (0.4) 22 (0.2)	4066611
Study Region	Study Region	6.5 6.9 7.2 7.7 8.1	13 (0.4) 17 (0.4) 22 (0.2)	8409024

Notes:

[1] Weights for all magnitude distributions are 0.101/0.244/0.310/0.244/0.101, a discrete five-point approximation to an arbitrary continuous distribution (EPRI/DOE/NRC, 2012).

[2] Weights for depth in parentheses

The EPRI/DOE/NRC (2012) model includes sources defined based on RLMEs rather than only fault sources. Many of the RLMEs correlate with identified geologic faults, but some are defined solely by geographically clustered paleoliquefaction events that suggest a localized source even if the responsible fault has not been identified and characterized. The site lies approximately 155 km from the Wabash Valley RLME (Figure 11). Although quite distant from the site, we include the Charleston source (Figure 11) in the PSHA because its maximum earthquakes and relatively high activity rates often dominate the hazard in the CEUS, particularly at long-period ground motions. Tables 2 and 3 summarize the RLME (fault) source parameters used in the analysis.

4.1.1 Seismotectonic Zones

This section describes the seismotectonic characteristics of the most significant seismotectonic zones to the site, the basis for delineating the zones and for defining the model values for style of faulting, geometry, seismogenic depth, and Mmax. Recurrence for the zones is discussed in Section 4.1.3.

Illinois Basin Extended Basement Zone (IBEB)

The Illinois Basin Extended Basement (IBEB) zone encompasses southwestern Indiana and southeastern Illinois; the site is located in the IBEB zone (Figure 11). Southern Indiana and southern Illinois are characterized by several moderate-sized paleoearthquakes and by higher rates of seismicity than adjacent craton regions (Figure 4). Several characteristics combine to support the delineation of IBEB as a separate seismotectonic zone. The southern part of the Illinois basin is one of the most structurally complex areas of the Midcontinent (McBride *et al*., 2002), with a crust distinct from that of the neighboring craton. Numerous moderately dipping reflectors interpreted to be faults are present in the basement. Moderate-sized historical earthquakes that appear to be spatially associated with Precambrian basement faults and with Paleozoic faults suggest continued reactivation of older basement features as well as younger Paleozoic structures (McBride *et al*., 2002). Stresses induced by Mesozoic rifting possibly extend into the southern Illinois basin causing the reactivation of deep structures (Braile *et al*., 1984). The IBEB source zone is defined to characterize sources of moderate- to large-magnitude earthquakes (excluding those attributed to the Wabash Valley RLME source) that may occur on deep structures in the Precambrian basement and as Paleozoic faults that extend into the overlying Paleozoic sedimentary rocks (EPRI/DOE/NRC 2012).

Fault dips are generalized based on sense of slip, with strike-slip ruptures assigned steep dips between 70° and 90° and reverse ruptures assigned moderate dips between 40° and 70°. Seismogenic thickness ranges from 13 to 22 km, the default values for the entire study area (EPRI/NRC/DOE, 2012). The seismogenic thickness is based on reported depths of seismicity within the IBEB. The deepest well-constrained earthquake hypocenters in the deep part of the Illinois basin, are located at depths of 20 to 22 km (McBride *et al.*, 2002; Yang *et al*., 2009). However, the average depth throughout the IBEB zone based on other historical earthquakes may be less (EPRI/DOE/NRC, 2012).

Table 2
New Madrid Fault System RLME Source Model

Cluster?	wt	Localizing Structures	Southern Fault Geometry	wt	Northern Fault Geometry	wt	Central Fault Geometry	wt	Thickness (km)	wt	Mmax	wt	Recurrence method	wt	Recurrence Data	wt	Earthquake Recurrence Model	wt	Repeat Time Coefficient of Variation	wt	Rate (yrs)	wt
All In	0.9	NMS NMN RFT	BA-BL	0.6	NMN-S	0.7	RFT-S	0.7	13	0.4	NMS, RFT, NMN 7.9, 7.8, 7.6	0.167	Intervals	1.0	1811-1812, 1450, and 900 AD	1.0	Poisson	0.75	NA		167	0.101
																					270	0.244
																					417	0.310
																					714	0.244
																					1613	0.101
											7.8, 7.7, 7.5	0.167	same as above				Renewal	0.25	0.3	0.2	286	0.101
											7.6, 7.8, 7.5	0.25									909	0.244
											7.2, 7.4, 7.2	0.085									3125	0.310
											6.9, 7.3, 7.0	0.25									15625	0.244
											6.7, 7.1, 6.8	0.085									212766	0.101
									15	0.4	same as above								0.5	0.5	208	0.101
									17	0.2											455	0.244
							RFT-L	0.3	same as above												1124	0.310
					NMN-L	0.3	same as above														3846	0.244
																					32258	0.101
			BA-BFZ	0.4	same as above														0.7	0.3	227	0.101
																					455	0.244
																					1000	0.310
																					2941	0.244
																					21277	0.101
All out except RFT	0.05	RFT	NA		NA		RFT-S	0.7	13	0.4	7.8	0.167	Intervals	1.0	2000 BC and 1000 AD	1.0	Poisson	1.0	NA		769	0.101
																					1389	0.244
																					2381	0.310
																					4545	0.244
																					12500	0.101
											7.7	0.167	same as above									
											7.8	0.25										
											7.4	0.085										
											7.3	0.25										
											7.1	0.085										
									15	0.4	same as above											
									17	0.2												
							RFT-L	0.3	same as above													
All Out	0.05	None	Revert to background																			

Table 3
RLME (Fault) Sources Incorporated Into Analysis

Fault	Geometry	Style of Faulting[1]	Mmax (M)	Dip (deg)	Seismogenic Thickness (km)	Recurrence Data[2]	Recurrence Interval (yr)[3]
Reelfoot Rift - Eastern Rift Margin Fault (ERM)							
ERM-N	ERM-N (1.0)	SS	6.7 (0.3) 6.9 (0.3) 7.1 (0.3) 7.4 (0.1)	90	13 (0.3) 15 (0.5) 17 (0.2)	1 event in 12-35 kyr (0.9)	3448 6667 12500 25000 71429
						2 events in 12-35 kyr (0.1)	2564 4545 7692 13889 31250
ERM-S	ERM-SCC (0.6)	SS	6.7 (0.15) 6.9 (0.2) 7.1 (0.2) 7.3 (0.2) 7.5 (0.2) 7.7 (0.05)	90	same as above	2 events in 17.7-21.7 kyr (0.333)	2857 4762 7143 12500 27778
						3 events in 17.7-21.7 kyr (0.334)	2326 3571 5263 8333 16129
						4 events in 17.7-21.7 kyr (0.333)	2000 2941 4167 6250 11111
	ERM-SRP (0.4)	same as above	same as above	same as above	same as above	same as above	same as above
Reelfoot Rift-Marianna In cluster (0.5) [Out of cluster (0.5) - default to background]	Marianna NW-strike (0.5)	SS	6.7 (0.15) 6.9 (0.2) 7.1 (0.2) 7.3 (0.2) 7.5 (0.2) 7.7 (0.05)	90	13 (0.3) 15 (0.5) 17 (0.2)	3 events in 9.6-10.2 kyr	1449 2381 3704 6250 13889
						4 events in 9.6-10.2 kyr	1190 1818 2703 4167 8333
	Marianna NE-strike (0.5)	same as above	same as above	same as above	same as above	same as above	same as above

Fault	Geometry	Style of Faulting[1]	Mmax (M)	Dip (deg)	Seismogenic Thickness (km)	Recurrence Data[2]	Recurrence Interval (yr)[3]
Reelfoot Rift - Commerce Fault Zone	Commerce fault (1.0)	SS	6.7 (0.15) 6.9 (0.35) 7.1 (0.35) 7.3 (0.1) 7.7 (0.05)	90	13 (0.3) 15 (0.5) 17 (0.2)	2 events in 18.9-23.6 kyr	4000 7143 12500 25000 71429
						3 events in 18.9-23.6 kyr	3030 5000 7692 13158 29412
Wabash Valley	Wabash Valley zone (1.0)	SS	6.75 (0.05) 7 (0.25) 7.25 (0.35) 7.5 (0.35)	90		2 events in 11-13 kyr	2273 4000 7143 13889 41667
Charleston	Local (0.5)	SS	6.7 (0.1) 6.9 (0.25) 7.1 (0.3) 7.3 (0.25) 7.5 (0.1)	90	13 (0.4) 17 (0.4) 22 (0.2)	2,000-yr record (0.8) 4 events in 2 kyr (1.0)	213 323 476 769 1471
						5,500-yr record (0.2) 4 events in 5.5 kyr (0.2)	213 323 476 769 1471
						5 events in 5.5 kyr (0.3)	370 526 769 1136 2000
						5 events in 5.5 kyr (0.2)	526 769 1086 1562 2941
						6 events in 5.5 kyr (0.3)	455 667 909 1282 2174
	Narrow (0.3)	SS	same as above	90	same as above	same as above	same as above
	Regional (0.2)	SS	same as above	90	same as above	same as above	same as above
New Madrid Fault System (NMFS)	see Table 2						

Note: Values in parentheses are weights. All faults are modeled with the Characteristic recurrence model

[1] SS Strike-slip

[2] "Recurrence Data" describes datasets used to calculate recurrence intervals.

[3] Weights for all distributions are: 0.101/0.244/0.310/0.244/0.101.

The largest earthquakes in the IBEB zone include an August 1891 **M** 5.5 event, a September 1891 **M** 5.0 event in eastern Nebraska, and a 2008 **M** 5.3 event. Four prehistoric earthquakes inferred from the paleoliquefaction studies have estimated magnitudes (**M** 6.2 to 6.3) that are larger than the historical earthquakes (EPRI/DOE/NRC, 2012). Maximum magnitudes modeled in the IBEB range from **M** 6.5 to 8.1, with a value of **M** 7.4 being preferred.

Reelfoot Rift Zone (RR)

The Reelfoot Rift (RR) is a north-northeast-trending major crustal rift located within the Mississippi Embayment of the south-central United States (Figure 11). The RR originally formed in late Precambrian to early Paleozoic time during the breakup of Rodinia and Iapetan rifting (Bond *et al*., 1971; Hildenbrand, 1985; Thomas, 2006), but experienced middle to late Paleozoic uplift and Mesozoic extension and deposition (Kolata and Nelson, 1991). Geologic evidence for faulting from post-Cretaceous to Holocene time in the RR and adjacent areas includes shallow seismic reflection data (Koffi *et al*., 1997; Schweig and Van Arsdale, 1996; Sexton *et al*., 1996); faulting and fault-related deformation exposed in exploratory trenches (Kelson *et al*., 1996); and regional paleoliquefaction features (Tuttle and Schweig, 1995; Tuttle *et al*., 1996a and 1996b; Tuttle and Schweig, 1996; Wolf *et al*., 1996).

The RR zone contains several RLME sources in the EPRI/DOE/NRC source model, including the New Madrid fault system, the Eastern Rift Margin (ERM), Marianna zone (MAR), and Commerce fault zone (CFZ) (Figure 6). The NMFS is discussed in detail in Section 4.1.4 because of its relatively high rate of activity.

The RR zone is characterized by having experienced Mesozoic extension and having a higher rate of seismicity than the surrounding MidC cratonic seismotectonic zone, as well as containing a unique concentration of Quaternary active faults. The RR zone has two alternative geometries, based on inclusion or exclusion of the east-west-trending Rough Creek graben. The Rough Creek graben was formed as part of the late Proterozoic-Cambrian Iapetan intracontinental rifting episode that created the RR. Some structures may have been reactivated during the Appalachian-Ouachita Orogeny (Kolata and Nelson, 1991) like the RR. However, due to the lack of associated igneous rocks, Wheeler (1997) infers that deeply penetrating faults were not reactivated. This coupled with the different strike of the major faults in the RCG compared to those in the RR leads EPRI/DOE/NRC (2012) to put lower weight (0.33) on the combined RR-RCG zone; rather, they prefer to include the RCG in the MidC zone.

The largest historical earthquakes in the RR zone are the 1811-1812 **M** 7.5 to 8 events, which are included in the characterization of the NMFS RLME (Figure 6). Large magnitude paleoseismic events are also included in nearby RLME characterizations. The largest non-RLME historical earthquakes include two approximately **M** 6 events in 1843 and 1895. The Mmax distribution for the RR zone ranges from **M** 6.1 to **M** 8.1, with a preferred value of **M** 7.1 (Table 1). Seismogenic depth in the RR zone, based on seismicity, ranges from 13 to 17 km.

Midcontinent-Craton Zone (MidC)

The MidC zone occupies most of the CEUS study area, dominating the central United States and encompassing most of the Great Plains area (Figure 11). The MidC zone includes those regions of the continent that have not occupied the Phanerozoic continental margin, specifically

Precambrian basement rocks of the Canadian shield and the platform (EPRI/DOE/NRC, 2012). The craton was formed by Paleoproterozoic accretion and now forms a cold, strong crustal core to the continent. Two orthogonal sets of structures, northeast-striking ductile shear zones and northwest-striking brittle-ductile faults dominate the Precambrian basement structure (Sims *et al*., 2005). Numerous geophysical anomalies have been observed within the MidC zone and may represent zones of crustal weakness that could localize future seismicity. Seismicity in the MidC zone is spatially variable and includes a few concentrations of activity that constitute seismic zones within the greater seismotectonic zone, such as the Anna seismic zone and Northeast Ohio seismic zone in Ohio, and the Nehama Ridge seismic zone in Kansas.

The fundamental distinguishing characteristic of the MidC zone is that it contains crust that has not experienced Mesozoic or younger extension, and generally not Paleozoic extension either. The characterization of the seismotectonic zone includes four alternative geometries, based on the inclusion or exclusion of smaller Mid-Continent regions. These smaller zones include a northeast-trending band of crust along the Appalachian Mountains that is included either within the PEZ or within the MidC zone, and the Rough Creek Graben, which is included either in the RR or in the MidC zone (Figure 11).

The largest earthquakes in the MidC zone include a 1909 **M** 5.7 event in eastern Montana, an 1877 **M** 5.5 event in eastern Nebraska, and a 1964 **M** 4.8 earthquake in eastern Ontario. Maximum magnitudes have a broader distribution in the MidC than most other seismotectonic zones, ranging from **M** 5.6 to 8.0, with a value of **M** 6.6 being preferred.

Few data exist to characterize independently the deep Precambrian structures within the intracratonic MidC region on which future earthquakes might be preferentially located. Thus the characterization of the MidC region is equivalent to what EPRI/DOE/NRC (2012) calls the "default" seismotectonic characteristics, representative of the entire study region. Thus both strike-slip and reverse mechanisms are included, with a 2/3 weight on strike-slip, reflecting the occurrence of both mechanisms in focal mechanism data, the state of stress, and the orientation of existing geologic structures in the region. Strikes include northwest, north-south, northeast and east-west orientations, determined based on focal mechanism data, tectonic stress, and structural grain within the study area. The dips are generalized based on sense of slip, with strike-slip ruptures assigned steep dips between 60° and 90° and reverse ruptures assigned moderate dips between 30° and 60°. Seismogenic thickness ranges from 13 to 22 km.

4.1.2 Mmax Zones

The Mmax zones are based on the observation that within the global catalogue of earthquakes within stable continental regions, there is little to distinguish any of them in a statistically significant way except that larger earthquakes seem to occur more commonly within those parts of the stable continental regions that have undergone extension, especially Mesozoic or younger extension (Johnston *et al*., 1994). Consequently, the zonation model is based on using global analogues to characterize the maximum magnitudes, with regions divided into extended and cratonic categories, each with a different distribution of maximum magnitudes. We adopt the zone boundaries and maximum magnitude distribution of EPRI/DOE/NRC (2012). The maximum magnitude distributions are used for the background seismicity.

The EPRI/DOE/NRC statistical analysis of the global database of earthquakes in stable continental regions (SCR) showed that the distinction between Mesozoic extended crust and non-extended crust noted by Johnston *et al*. (1994), while present, is only marginally significant. Therefore, within the Mmax zonation approach, two models are included: 1) the CEUS is divided into two Mmax zones, each with its own Mmax distribution, based on the presence or absence of Mesozoic-extended crust, and 2) the CEUS can be described by a single Mmax zone with a single Mmax distribution (Figure 12). The former model has slightly higher weight because of the marginally significant difference observed in the statistical analyses.

Mesozoic and Younger Extended Crust (MESE)

The Mesozoic extended zone (MESE) includes areas that underwent Paleozoic and Mesozoic or younger extension and includes the Atlantic and Gulf coastal regions as well as the failed rifts in the central U.S. (including the RR and southern Oklahoma aulocogen) (Figure 12). The site is located within the MESE-W and the NMESE-N (Figure 12).

Non-Mesozoic and Younger Extended Crust (NMESE)

The Non-Mesozoic and Younger extended crust (NMESE) includes that part of the CEUS stable continental region that has not undergone Mesozoic or younger extension. This includes primarily interior cratonic regions and overlaps significantly with the MidC seismotectonic zone (Figure 12).

The boundaries between the extended and non-extended Mmax zones have two alternatives, reflecting uncertainty in the geographic extent of extended crust (Figure 12). The MESE-N (N = "narrow") zone includes regions that have definitively experienced Mesozoic extension as inferred based on the presence of certain distinguishing characteristics. These may include: Mesozoic grabens and rift basins, Mesozoic and younger plutons, Mesozoic and younger uplift and unroofing associated with normal faulting (EPRI/DOE/NRC, 2012). Generally, regions that meet most of these criteria are considered to be extended and are assigned to the MESE-N zone. Regions with less compelling evidence, such as localized Mesozoic and younger reactivation of older structures or the presence of structures favorably oriented for reactivation, are less certainly extended and are assigned to the MESE-W (W = "wide") zone. The NMESE-N and NMESE-W zones include the rest of the CEUS region outside the MESE-N and MESE-W zones, respectively (Figure 12). The narrow boundary, dividing definitively extended crust from the rest of the craton receives most of the weight (0.8) due to the lack of clear evidence for extension in the MESE-W zone.

The narrow and wide geometry for each zone has its own maximum magnitude distribution for this region, based on the largest historical earthquake known in each zone. These appear in Table 1 (Table 6.3.2-1 in EPRI/DOE/NRC, 2012).

Study Region

The single-zone alternative of the Mmax zone model includes the Study Region (StudyR) source zone (Figure 12), which encompasses the entire study area, which is represented by a single Mmax distribution. The distributions for seismogenic depth and Mmax for this zone appear in Table 1.

4.1.3 Recurrence for Seismic Zonation

The CEUS-SSC model is based on the spatial stationarity of seismicity, which is defined from small- to moderate-magnitude earthquakes that have occurred during a relatively short historical and instrumental record (EPRI/DOE/NRC, 2012).

For the seismotectonic and Mmax source zones, the seismicity rates are determined from the historical seismicity catalog. All dependent earthquakes were removed from the catalog, and earthquakes associated with the RLME sources were also removed to avoid double-counting. The cell size for all seismotectonic source zones except MidC was 0.25 degrees; the cell size for MidC was set to 0.5 degrees. The spatial smoothing operation, a penalized-likelihood function, is based on calculations of earthquake recurrence within each cell. Both *a*- and *b*- values are allowed to vary, but the degree of variation has been optimized such that *b*-values vary little across the study region, and the *a*-values are neither too smooth or spikey. Also, the recurrence calculations consider weighting of magnitudes in the recurrence rate calculations, with moderate events assigned more weight than smaller events.

Five alternative cases were considered for weights, which affect the degree of smoothing, for various magnitude bins; Cases A, B, C, D, and E (EPRI/DOE/NRC, 2012). Case C was dropped as it is very similar to Case B, and Case D was considered too extreme. Thus for each source zone three magnitude weighted cases were used: A, B, and E, with weights of 0.3, 0.3, and 0.4, respectively.

Furthermore, more than point estimates of the recurrence parameters are needed as modern PSHA requires an assessment of the epistemic uncertainty associated with these estimates, including correlations between the recurrence parameters of cells in the same geographical region, which may jointly affect the hazard at one site. The approach used to generate alternative maps of the recurrence parameters uses a technique known as Markov Chain Monte Carlo (MCMC) (EPRI/DOE/NRC, 2012).

This resulted in eight alternative maps representing the uncertainty in recurrence parameters that result from the limited duration of the catalog. If the smoothing parameters are treated as uncertain and estimated objectively from the data, the eight alternative maps also include the uncertainty about the appropriate values of the smoothing parameters. The eight realizations are equally weighted. For computational efficiency, the mean of the eight realizations was utilized in these calculations.

4.1.4 RLME

The following describes the Wabash Valley and New Madrid fault system RLMEs, which are the most significant RLMEs to the site.

Wabash Valley Fault Zone

The north-northeast-trending Wabash Valley fault system (WVFS) consists of numerous high-angle oblique-slip faults that comprise a broad 80-km-long zone located within the limits of the Grayville graben. The Wabash Valley RLME as defined in the CEUS-SSC model is significantly longer than the WVFS proper and extends north to include the Vincennes, Indiana area (Figures 6 and 11). The Grayville graben formed during Iapetan rifting (Hildenbrand and Ravat, 1997;

EPRI/DOE/NRC, 2012). Direct evidence for neotectonic activity, including exposures of Quaternary displacement, was documented along the WVFS by Woolery (2005). He interpreted offset of a reflector, identified as a late Quaternary (ca 37,000 years old) sand, revealed in high-resolution seismic reflection profiles as due to displacement across the Hovey Lake fault at the south end of the WVFS. More recent work by Counts *et al*. (2009) and Van Arsdale *et al*. (2009) has identified Holocene deformation across the Uniontown scarp, part of the Hovey Lake fault. Van Arsdale *et al*. (2009) excavated a trench exposing 3500-year-old Ohio River alluvium that had been folded in a monocline with a 3-m amplitude, and also observed fractures within a younger unit that indicate possible activity within the last 295 years. For the most part, activity of the WVFS is indicated by historical seismicity and the aforementioned paleoliquefaction features. The historic seismicity includes five slightly damaging earthquakes of body-wave magnitude (mb) 5.0 to 5.8 during 200 years of historical time (Figure 4).

The maximum magnitude estimates adopted from the EPRI/DOE/NRC (2012) CEUS source characterization of the Wabash Valley RLME are based on analysis of paleoliquefaction features in the vicinity of the lower Wabash Valley of southern Illinois and Indiana. The magnitude of the largest paleoearthquake in the lower Wabash Valley (the Vincennes-Bridgeport earthquake), which occurred 6,011 ± 200 yr BP, was estimated to be ≥ **M** 7.5 using the magnitude-bound method (Obermeier, 1998). Use of a more recently developed magnitude-bound curve for the CEUS gives a lower estimate of **M** 7.1 to 7.3 (Olsen *et al*. (2005). The lower-bound relationship developed by Castilla and Audermard (2007) from a worldwide database gives a range of **M** 7.0 to 7.3. Estimates based on a suite of geotechnical analyses (cyclic stress and energy stress methods) range from **M** 7.5 to 7.8 (summarized in Obermeier *et al*., 1993). The next largest earthquake, the Skelton paleoearthquake, occurred 12,000 ± 1,000 yr BP (Obermeier, 1998). Lower and upperbound magnitude range from **M** 6.3 to 7.3 based on estimates by Munson *et al*. 1997, Olsen *et al*., 2005 and Castilla and Audemard (2007). The magnitude distribution of the EPRI/DOE/NRC (2012) CEUS source model (Table 3) incorporates the range of estimated sizes of the Vincennes-Bridgeport and Skelton paleoearthquakes as representative of both the aleatory variability in the size of individual Wabash Valley RLMEs and the epistemic uncertainty in the approaches and data used to estimate the magnitudes of prehistoric earthquakes.

The recurrence rates for the Wabash Valley RLME (Table 3) are based on the estimated ages for the Vincennes-Bridgeport and Skeleton paleoearthquakes using a Poisson model (EPRI/DOE/NRC, 2012).

New Madrid Fault System (NMFS) RLME

The New Madrid Seismic Zone (NMSZ) is the most likely site of the 1811-1812 New Madrid earthquake sequence, which includes three of the largest earthquakes to have occurred within the North American plate in historical times (Johnston and Shedlock, 1992) (Figure 6). The pattern of seismicity and surface uplift is generally interpreted as delineating a left-stepping, right-lateral, strike-slip fault system (Cox *et al*., 2001; Johnston and Schweig, 1996). Johnston and Schweig (1996) developed faulting models for the 1811-1812 sequence based on geological, geophysical, seismological, and historical data. They concur with the commonly held assumption that the current seismicity is illuminating the most active faults; i.e., those that ruptured in 1811–1812 and also prior to 1811.

Schweig and Ellis (1994) and Johnston and Schweig (1996) provide summaries of the seismological, geodetic, and paleoseismologic data that have been used to assess the repeat times of large-magnitude events in the New Madrid region. In addition, Wheeler and Perkins (2000) provide additional information from the 2002 USGS National Hazard Maps for the CEUS. Correlation of dated liquefaction features suggest that widespread liquefaction occurred within the zone in A.D. 1811-1812, 1450, 900, 300 as well as about 2350 B.C. (Tuttle *et al*., 2005). Liquefaction deposits can constrain the ages of prehistoric events but not the causative faults. However, several of the prehistoric liquefaction deposits are composite, indicating they were formed in multiple episodes within a short period and thus may have occurred in a rapid sequence of large earthquakes similar to the 1811-1812 sequence.

The occurrence of two large events in A.D. ~900 and 2500-1400 B.C. is supported by recent studies of Mississippi River channel morphology that suggest that the Mississippi River changed its course in response to a sudden localized change in base level at those times (Holbrook *et al*., 2006). That change in base level is attributed to uplift of the downstream side of the channel across the Reelfoot reverse fault (described below).

These paleoseismic results indicate a recurrence interval of about 500 years for large earthquakes or earthquake sequences in the NMSZ over the past 2,000 years. The absence of paleoseismic evidence for earthquakes between 300 A.D. and 2200-2350 B.C. has been cited as indicative of temporal clustering of earthquakes in the NMSZ, with large earthquakes or earthquake sequences happening every few hundred years over a period of time followed by a long hiatus in activity (Holbrook *et al*., 2006). However, at this point it remains uncertain if the lack of events documented between A.D. 300 and 2200 B.C. in New Madrid is due to clustering or an incomplete paleoseismic record.

The possibly clustered behavior in the NMSZ, coupled with the discovery of paleoliquefaction features in the Reelfoot Rift southwest of the New Madrid zone (indicative of large earthquakes between about 5,000 and 7,000 years ago but not during the New Madrid cycles), has led to the suggestion that the locus of earthquake activity moves around the Reelfoot Rift on time scales of 5 to 15 kyr. In this model, the New Madrid region is the current, or most recent, locus of activity, but other areas have been so in the past, and the locus may shift again.

In the seismic source model, the elevated seismicity in the NMSZ is included in the RR seismotectonic zone, whereas large historical and paleoseismic events that likely occurred on the structures that ruptured in 1811-1812 are modeled as part of the NMFS RLME, in keeping with the CEUS-SSC model. The source zone accommodates the hazard from background seismicity; the NMFS contributes an additional hazard (Tables 1 and 2). In the seismic source model, the NMFS comprises three distinct fault zones, located within the NMSZ source zone (Figure 6). The three NMFS faults, defined after the models of Van Arsdale (2000) and Johnston and Schwieg (1996), include: 1) the southern section (NMS), comprising the Blytheville arch (BA), extending into the Blytheville fault zone (BFZ) and Bootheel lineament (BL) area, 2) the central section, comprising the Reelfoot reverse fault (RFT), and 3) the northern section, comprising the New Madrid North fault and the Northwestern Seismicity Arm (NMN) (Figure 6; Table 2). Each of these sections ruptured to produce the 1811 and 1812 earthquakes.

The faults of the NMFS are defined primarily based on concentrations of seismicity as geomorphic expression of faulting is poor; only the Reelfoot reverse fault is well expressed as a

definitively tectonic feature. Several different geologic faults have been postulated as the source of the events but there remains considerable uncertainty in defining the causative faults. The southern and northern sections of the fault system are northeast-striking features that are probably ancient faults related to rifting that have been reactivated in the modern stress regime as primarily right-lateral strike-slip faults. Focal mechanisms from these areas are consistent with predominantly dextral motion. The Reelfoot reverse fault strikes northwest and dips southwest; earthquakes associated with it have a variety of focal mechanisms. The fault has been described as a cross-structure in a compressional left step between right-lateral strike-slip faults.

Van Arsdale (2000) reports that the first of the 1811 and 1812 earthquakes, the NM1 event in December 1811, occurred on the southern section (NMS), which extends about 110 km (69 mi) from northeastern Arkansas to the southeastern bootheel of Missouri (EOI, 2008). The rupture occurred along the Blytheville arch, a 10 to 15-km wide northeast-trending Paleozoic upwarp that lies along the axis of the Reelfoot Rift, and extended northeast of the arch proper. Van Arsdale (2000) considers that the event may have resulted from rupture of the 65-km long, steeply dipping to vertical, dextral-oblique Cottonwood Grove-Ridgely fault. Johnston and Schweig (1996) assign the northern extension of the rupture to the Blytheville fault, a 55-km long structure that continues on trend with the Blytheville arch and lies about 4 km east of the Cottonwood Grove fault. However, they suggest the Blytheville fault and the Cottonwood Grove fault may be essentially the same structure.

Johnston and Schweig (1996) propose two alternative rupture scenarios for the December earthquake: (1) the Blytheville Arch region ruptured along with its extension to the northeast, the Blytheville fault (NMS: BA-BFZ) and (2) the Blytheville Arch ruptured, but the rupture branched onto the Bootheel lineament and ruptured the northernmost 70 km of that structure (NMS: BA-BL) (Figure 6). In each scenario, the structure that did not rupture in the main event was the source of one of more of the large aftershocks, which have been proposed as smaller mainshocks (Johnston and Schweig, 1996). In other words, the Bootheel lineament and Blytheville fault sustained the aftershocks in the first and second scenarios, respectively.

The second mainshock of the New Madrid 1811-1812 sequence was the NM2 earthquake, in January 1812, on the northern margin of the fault system (NMN; Figure 6). The source of this event is also uncertain. The region is delineated by a line of seismicity, the Northwestern Seismicity Arm. Concentrated seismicity extends about 40 km, with more sparse seismicity extending another 20 km to near the Illinois border. This seismicity has been postulated to be correlated with the New Madrid North fault (sometimes the East Prairie fault), which has been seen in the subsurface, geomorphically, and in trench exposures (Baldwin *et al*., 2005; Johnston and Schweig, 1996). That fault is at least 30 km long; the seismicity extends beyond the known fault. Wheeler (1997) postulated that the structure continued still farther north to merge with the Rough Creek graben in western Kentucky; he considered this extent, about 100 km, to be the maximum extent of Reelfoot Rift faults. There is little in the sparse distribution of seismicity and lack of significant Quaternary faulting in the northern extent to support that assertion, and based on surface and subsurface expression as well as focal mechanisms, this fault is likely a steeply dipping dextral fault (DTEE, 2011).

The last of the three 1811-1812 mainshocks, NM3, occurred in February 1812, on the central section, the Reelfoot reverse fault (RFT), the proposed cross-structure in a compressional step-over between the dextral southern and northern sections of the system (Figure 6). The Reelfoot

fault is a south-dipping blind reverse fault that has a dip that varies laterally and down dip. The dip can be as steep as 45°-75° in the upper few kilometers and as shallow as 25°-30° at depth (Mueller and Pujol 2001; Csontos and Van Arsdale, 2008). This fault is well-expressed geomorphically with a pronounced scarp, but its extent is also uncertain because seismicity extends beyond the scarp in both directions, beyond the strike-slip faults of the postulated stepover. Johnston and Schweig (1996) define three distinct fault segments: (1) the central Reelfoot fault, defined by its mapped surface extent of about 32 km (Van Arsdale *et al*., 1995); (2) the Reelfoot South seismicity trend, extending 35 km east of the Reelfoot fault; and (3) the New Madrid West seismicity trend, extending about 40 km west of the Reelfoot fault. Their proposed rupture scenarios include rupture of the Reelfoot fault with one or the other of the flanking seismicity trends in the NM3 mainshock.

The third event may have served to accommodate the strain produced by the previous two bounding events (Van Arsdale, 2000). Van Arsdale (2000) also suggests that this sequence of multiple, temporally-clustered events may not be unusual for the NMFS. He cites evidence from subsurface analyses that suggests that these three faults may have identical displacement histories since the Late Cretaceous. Thus, he suggests that the paleoseismic history for the Reelfoot reverse fault can serve as a proxy for the other two faults. Trench exposures of the Reelfoot reverse fault indicate that deformation occurs primarily as folding rather than faulting at the surface and that the structure has experienced at least three earthquakes in the past 2400 years at times consistent with those determined from regional paleoliquefaction studies (Kelson *et al*., 1996). This interpretation is supported by paleoliquefaction studies, which indicate that large magnitude earthquakes on the faults of the New Madrid system have occurred in clusters like those of 1811-1812 (e.g., Tuttle *et al*., 2002; 2005).

There is significant uncertainty regarding the exact identification and geometry of the faults that ruptured in the 1811-1812 and earlier earthquakes, and some models of rupture (e.g., EPRI/DOE/NRC, 2012; STNOC 2011; USNRC, 2006) include weighted alternative geometries for each of the three faults. We adopt the characterization of EPRI/DOE/NRC (2012; Table 2). We include two alternative geometries for the northern extent of the southern section, the Blytheville fault zone (NMS: BA-BL), weighted 0.4, and the Bootheel Lineament (NMS: BA-BFZ), weighted 0.6. For the central and northern sections, we include two alternatives: short and long (RFT-S, RFT-L, NMN-S, NMN-L). The short central section (RFT-S) includes only that part of the Reelfoot reverse fault that is defined by the Reelfoot scarp and extends from the Blytheville fault to the New Madrid North fault; the long alternative (RFT-L) extends both east and west, based on continued seismicity. The short alternative for the New Madrid north fault (NMN-S) is the fault as defined by Johnston and Schweig (1996); the long alternative (NMN-L) extends the source along northward continuations of seismicity identified by Wheeler (1997). Because the causative faults are not well understood, the dips are not well constrained. The northern and southern sections of the system are modeled as vertical. The Reelfoot reverse fault is modeled with a 40-degree southwest dip.

The EPRI/DOE/NRC (2012) characterization also addresses the apparent clustering of activity along the NMFS faults using the approach of Toro and Silva (2001). The rate of earthquakes and geomorphic expression of faulting on the RFT in the late Holocene suggests that the system is or has recently been in a cluster. However, geodetic data gathered over the last decade or so suggest that little or no interseismic deformation is occurring across the NMSZ, which some researchers

have interpreted as evidence that the system is shutting down and entering an inter-cluster period of quiescence (e.g., Calais *et al*., 2005; Calais and Stein, 2009). The EPRI/DOE/NRC model strongly favors the interpretation that the system is currently in a cluster (0.9), based on the recent history of activity and the unlikelihood that we have just happened upon the exact moment the system is shutting down. However, they, and we, give some weight to two alternative models: 1) only the RFT is currently in a cluster, and the other faults are quiescent (0.5), and 2) the entire system is out of a cluster (0.5) (Table 3). In the former case, the RFT is active, but at a lower rate than the in-cluster case; in the latter case, no faults are active and the system defaults to the RR background zone characterization.

Considerable debate has gone on over the past several years regarding the magnitude of the 1811-1812 earthquakes and thus maximum magnitude estimates for source characterization. Most of the studies in which magnitudes have been inferred depend on assessments of intensities derived from felt reports documented in archival material. Since much of the area was lightly populated, there is considerable uncertainty in these estimations. These uncertainties are complicated by a lack of data for constraining attenuation relations for large magnitude earthquakes, which have not been instrumentally recorded in the central and eastern U.S., and poorly known site response effects. Early estimates by Nuttli (1973, 1979) included values of mb 7.2, 7.1 and 7.4 for the southern (NM1), northern (NM2), and central (NM3) earthquakes, respectively. Johnston (1996), using isoseismal area regression, estimated magnitudes of **M** 8.1, 7.8, and 8.0 for these events. Reexamining felt reports, Hough *et al*. (2000) estimated noticeably lower magnitudes of **M** 7.2 to 7.3, **M** 7.0, and **M** 7.4 to 7.5 for the NM1, NM2, and NM3 events, respectively. Bakun and Hopper (2004b) modeled intensities and determined magnitudes of **M** 7.6, 7.5, and 7.8 for the three earthquakes. More recently, Hough and Page (2011) have reduced estimates even further using intensities and consideration of low regional strain rates with a model of postglacial rebound. Their preferred magnitudes are **M** 6.7 to 6.9, **M** 6.8 to 7.0, and **M** 7.1 to 7.3 for NM1, NM2, and NM3, respectively, with the different values dependent on models of earthquake recurrence and strain accumulation and release. However, these low magnitudes are not universally accepted. Holzer *et al*. (2011) argue that magnitudes must be mid-**M** 7s, not less than **M** 7, based on magnitude and extent of liquefaction deposits. Cramer and Boyd (2011) compare the earthquake intensities in New Madrid with those of the 1929 **M** 7.2 Grand Banks earthquake and argue that NM1 and NM3 must be larger than Grand Banks and NM2 comparable in size. They conclude that the New Madrid earthquakes are best fit with magnitudes between **M** 7 and 8. Cramer also used the 2001 Bhuj earthquake to compare to New Madrid; those comparisons yield preferred values for the New Madrid magnitudes of about **M** 7.6, 7.2 to 7.6, and about **M** 7.6 (NEPEC, 2011).

Several recent hazard analyses have developed source characterizations for the New Madrid faults. The USGS National Seismic Hazard Maps (Petersen *et al*., 2008) compiled recent data to develop a model with lower weighted mean magnitudes for the faults than in previous models, and with a recurrence model reflecting possibly clustered timing of events. Their magnitudes range from **M** 7.3 to 8.0 for the southern and central sections, with a preferred magnitude of **M** 7.7 and weighted mean of **M** 7.6, and from **M** 7.1 to 7.8 for the northern section, with a preferred value of **M** 7.5 and weighted mean of **M** 7.4. Models developed for the Site Safety Analysis for Exelon Generation Company in Illinois (USNRC, 2006) include a lower magnitude distribution, with **M** 7.2 to 7.9 (weighted mean **M** 7.5), **M** 7.4 to 7.8 (weighted mean of **M** 7.6), and **M** 7.0 to 7.6 (weighted mean of **M** 7.3) for the southern, central, and northern faults, respectively.

EPRI/DOE/NRC (2012) include distributions for the NMS, RFT, and NMN sections of the NMFS of **M** 6.7 to 7.9, **M** 7.1 to 7.8, and **M** 6.8 to 7.6, respectively. In our model, we adopt the EPRI/DOE/NRC distribution of maximum magnitudes. The preferred values and weighted means are similar to those developed in the nuclear studies described above.

4.2 EPRI GROUND MOTION PREDICTION MODELS

Several factors control the level and character of earthquake ground shaking. These factors are in general: (1) rupture dimensions, geometry, and orientation of the causative fault; (2) distance from the causative fault; (3) magnitude of the earthquake; (4) the rate of attenuation of the seismic waves along the propagation path from the source to site; and (5) site factors, including the effects of near-surface geology, particularly from soils and unconsolidated sediments. Other factors, which vary in their significance depending on specific conditions, include slip distribution along the fault, rupture process, footwall/hanging-wall effects, and the effects of crustal structure such as basin effects.

Several parameters may be used to characterize earthquake ground motions. The common parameters include: peak ground acceleration, velocity, and displacement; response spectral accelerations or velocities, duration, and time histories in acceleration, velocity, or displacement. In this analysis, we have estimated peak horizontal ground acceleration (PGA) and horizontal spectral accelerations (SA) at 0.04, 0.1, 0.2, 0.4, 1.0, and 2.0 sec.

Crustal ground motion prediction models for tectonically active regions like the western U.S. are empirical in nature and derived from strong motion data from such areas as California, Taiwan, Japan, and Italy. In contrast, few useable strong motion records exist for earthquakes in the Central and Eastern North America (CENA). Thus ground motion prediction models for the CENA have been developed, in large part, using seismological-based numerical models. During the past decade, ground motion models for the CENA have been derived using three different approaches: the stochastic method, the Green's function method, and the complex/empirical source method.

Recent efforts have been made to update the ground motion models for the CENA. One project is called the Next Generation of Attenuation (NGA) – East sponsored by Pacific Earthquake Engineering Research (PEER) Center. The objective of the project is to develop a new suite of ground motion prediction model for the CENA. The median ground motion models were just released but no standard deviations for the models were specified. There are 20 new NGA-East models and we expect it will be several months before the models become vetted.

In a second project, EPRI (2013) updated the 2004/2006 EPRI models in the near-term so that preliminary Ground Motion Response Spectra (GMRS) could be developed for existing nuclear power plant sites as required by the NRC's Recommendation 2.1 pending completion of the NGA East Project. The models were used in this study. The EPRI Ground-Motion Model (GMM) Review Project (EPRI, 2013), an enhanced SSHAC Level 2 assessment process, established a methodology to evaluate the existing 2004 EPRI GMM and determine if it should be updated. After reviewing the current literature and conducting interviews and convening a workshop with ground-motion experts and seismologists it was decided to update the 2004 GMM because (1) seven of the thirteen developers of the 2004 EPRI GMM recommended that their models be replaced; (2) three new models have been developed for the CENA by ground-

motion experts; (3) 80% of the earthquake records in a new ground-motion database provided by the NGA-East Project are from earthquakes that occurred after the development of the 2004 EPRI GMM; (4) comparisons to the updated CENA database indicate the 2004 EPRI GMM overpredicts ground motions at some magnitude-distance and structural frequency ranges that are important to nuclear power plant PSHA; and (5) the models used to develop the aleatory portion of the 2006 EPRI GMM have been superseded.

The 2013 EPRI GMM retains the structure of the 2004 EPRI GMM, grouping the candidate individual models into four clusters according to their seismological characteristics, weighting the models within each cluster according to their consistency with the data, representing each cluster by three fitted relationships (5th percentile, median, and 95th percentile), and assessing cluster weights based on consistency with observed data and seismological attributes of the models within each cluster. The GMM Review Project identified new candidate models for the updated GMM clusters, models and weights, as shown in Table 4; a summary of the overall elements of the model are listed in Table 5.

For reference, the ground motion prediction models used by the USGS to develop the 2014 National Seismic Hazard Maps include Toro *et al.* (1997), Frankel *et al.* (1996), Silva *et al.* (2002), Atkinson and Boore (2006), Atkinson (2008), Campbell (2003), Tavakoli and Pezeshk (2005), Pezeshk *et al.* (2011), and Somerville *et al*. (2001). The versions of Atkinson and Boore (2006) and Atkinson (2008) in the EPRI study have been updated with Atkinson and Boore (2011). All the ground motion prediction models are for hard rock characterized by a time-averaged shear-wave (V_S) in the top 30 m (V_S30) of 2,800 m/sec. There are no vetted CENA GMMs for soil at present.

Comparisons indicate that the 2013 GMM is somewhat lower than 2004 EPRI GMM when the two models are taken as a whole, but these differences are moderate, given the broad uncertainty range spanned by both GMMs. The greater differences occur at low frequencies. For PGA the bulk of the curves are consistent between the two GMMs. In addition, there is a substantial overlap in the 10 to 200 km range indicating that the updated GMM does not represent a radical departure from the 2004 EPRI GMM. The observed differences are the result of possessing and using substantially more data and having acquired additional insights from other regions over a period of nearly 10 years.

The 2006 EPRI model for aleatory uncertainty (sigma) was based on preliminary NGA-West1 models for sigma from active tectonic regions, adjusted to account for differences in properties of the earth's crust between active (western North America [WNA]) and stable tectonic regions (i.e., CENA) (EPRI, 2006). The EPRI GMM Review Project updated the model to incorporate the nearly final NGA-West 2 aleatory models, with the same adjustments for differences between WNA and CENA. The updated sigma model is frequency and magnitude dependent, with inter-event and intra-event components. There is additional aleatory variability for distances of R_{JB} < 20 km. The updated aleatory variability model has higher values of total sigma than the 2006 EPRI model for **M** 5 earthquakes, and lower values for **M** 6 and 7 earthquakes for motions at 2.5 Hz and higher. At 1 Hz, the values of sigma are comparable in the two models and at 0.5 Hz, the updated GMM has slightly higher sigma than the 2006 EPRI model.

Table 4

EPRI (2013) GMM Clusters and Models

Cluster	Model Types and Cluster Weights (repeated large-magnitude earthquake sources/area earthquake sources)	Models
1	Single-corner Brune source (0.15/0.185)	Silva *et al*. (2002) – SC-CS-Sat[1] Silva *et al*. (2002) – SC-VS[1] Toro *et al*. (1997) Frankel et al. (1996)
2	Complex/Empirical Source $\sim R^{-1}$ geometrical spreading (0.31/0.383)	Silva *et al*. (2002) – DC-Sat Atkinson (2008) with 2011 modifications (A08′)
3	Complex/Empirical Source $\sim R^{-1.3}$ geometrical spreading (0.35/0.432)	Atkinson-Boore (2006) with 2011 modifications (AB06′) Pezeshk *et al*. (2011)
4	Finite-source /Green's function (0.19/0)	Somerville *et al*. (2001); slightly different models for rifted and nonrifted (not used for distributed seismicity sources with large contribution from **M** < 6)

SC = single-corner; DC = double-corner; CS = constant stress; VS = variable stress; Sat = saturation.
[1] Treated as one model for calculation of weights.

Table 5

Elements of the CENA Ground Motion Models

Feature	Attribute
Ground Motion Measure	Peak ground acceleration Spectral acceleration at frequencies of 0.5, 1, 2.5, 5, 10, 25 Hz
Site Conditions	Hard rock (V_S 2.8 km/sec, 9200 ft/sec)
Regions	Midcontinent (includes east coast) Gulf Coast
Ground Motion Model Types	Four types included: • Single-corner Brune source • Complex/empirical source ~R^{-1} geometrical spreading • Complex/empirical source ~$R^{-1.3}$ geometrical spreading • Finite-source/Green's function
Aleatory Variability	Magnitude and frequency dependent Includes additional variability for distances of R_{JB} < 20 km

4.3 SITE CONDITIONS

Subsurface investigations for the site have been limited to shallow soil borings in the upper Quaternary soils. Stratigraphic profiles for bedrock at the site were developed by researching available information which included data provided by Dynegy, geologic and mining reports, and various structural, isopach, lithofacies, and bedrock geology maps collected from the Illinois Geologic Survey (ISGS).

Specifically, the thickness of overlying soil (overburden) was determined from geotechnical soil borings completed by AECOM in 2015 and others (Dominion, 2010), drilled water well logs, and the nearest referenced 7.5 minute geologic quad maps (Meyers, 2007; USGS), when available. Bedrock stratigraphy was developed primarily using detailed cross-sections compiled by the ISGS utilizing data from drilled oil exploration wells (Treworgy and Whitaker, 1990; Treworgy *et al*., 1994). Based on the cross-sections, structural contours identified using the compiled topography of the Mt. Simon Sandstone (MGSC, 2005) were projected to the Kincaid site. The nearest oil exploration test hole along the contour interval was used to measure the thicknesses of bedrock units and the proper scaled thicknesses of bedrock units were then projected to the site. These thicknesses and projections were cross-checked using known depths to specific coal seams in Pennsylvanian bedrock, particularly the Herrin Coal, and matching the depth(s) to the information in the cross sections (Treworgy and Whitaker, 1990; Treworgy *et al*., 1994). Errors in estimates of bedrock thickness due to structural variations and map projection are likely in the range of 100 to 200 feet, and may compound with increasing depth or in areas of greater subsurface topography.

Site response analysis requires detailed information on subsurface stratigraphy and accurate representation of V_S characteristics for rock and soil. *In situ* measurements of V_S and deep exploration of bedrock at the Kincaid site were not within the scope of this project. A summary of V_S data from the Clinton Nuclear Power Station (130 km to the north) (Exelon, 2014) was used to correlate V_S for bedrock units at the site. Measurements at the Clinton site consisted of refraction, uphole, and downhole surveys as well as recent ESP measurements of unspecified proximity to the site. The measured velocities for lithofacies reported from the Clinton site were assigned to the same rock and soil units at the Kincaid site with thicknesses developed using the methods described above. Table 6 illustrates a set of estimated bedrock thicknesses and V_S for specific rock types at the site used to develop the V_S profile.

Based on Table 6, the mean basecase V_S profile used in the site response analysis (Section 6) was developed by combining layers of identical V_S (Figure 13). The mean value in the V_S ranges given in Table 6 were adopted in the mean basecase profile and the variability about that mean value was considered in developing the lower-range and upper-range basecase models.

Classification for site stratigraphy was based on the Clinton Nuclear Power Station report (Exelon, 2014), where rock groups were aggregated and classified according to geologic systems that each contain various rock types with thicknesses. Ranges for V_S are given to reflect the range of rocks included in each geologic system. In cases where weaker rock is thought to have an appreciable thickness that could affect the site response model, the layer was reported separately in the geologic system and assigned the lower range of values for V_S.

Table 6
V_S Profile

Formation Bottom Depth at Site* (ft)	Thickness of Unit/Formation at Site* (ft)	Age- System	Soil/Rock Description	Estimated V_S (ft/sec)[1]
± 20	± 20	**Quaternary**	EMBANKMENT FILL	600-1,200[2]
20-60	39		Undifferentiated Illinoian TILL (Glasford and Banner Fm)[4]	1100-3300
60-775	715	**Pennsylvanian**	limestone, shale, sandstone, coal, and siltstone	3250-5700
716-1300	584	**Mississippian**	limestone, with lesser siltstone and shale	4500-6500
1300-1425	125	**Devonian**	shale and limestone	4500-8500
1425-1900	475	**Silurian**	carbonates	4500-8500
1900-2150	250	**Ordovician**	shale, clacareous shales, and interbedded limestone	6500[3]
2150-2600	450		dolomite, sandstone, limestone and shales	6500-10500
2600-6600	4,000	**Cambrian**	siltstone, shale, sandstone and dolomite	6500-10500
> 6600		**Precambrian**	igneous rocks, dominantly granite with associated granodiorite, rhyolite	> 9200

***** Depths and thicknesses of bedrock statigraphic units are estimated from structural maps and cross-sections for the Illinois Basin (ISGS) and considered accurate within 200-400 ft

[1] V_S taken from Sesmic Hazard Screening Report data Clinton Station

[2] V_S estimated from SPT blow count information in 2015 borings

[3] V_S estimated to be the lower bound limit of recorded velocity at Clinton Station

[4] Insufficient Data to differentiate Tills at this site

The results of the PSHA are presented in terms of ground motion for hard rock site conditions as a function of annual frequency of exceedance (AFE). AFE is the reciprocal of the average return period. Figure 14 shows the mean, median (50th percentile), 5th, 15th, 85th, and 95th percentile hazard curves for PGA. (PGA is defined as the 0.01 sec spectral acceleration.) These fractiles indicate the range of epistemic uncertainties about the mean hazard. The uncertainties are large due to both the large uncertainties in the ground motion prediction models and the source parameters of the controlling seismic source. The 1.0 sec horizontal spectral acceleration (SA) hazard is shown in Figure 15. The 2,500 year return period mean PGA is 0.12 g (Table 7).

The contributions of the various seismic sources to the mean PGA hazard are shown on Figure 16. The major contributors to the hazard at the site for a return period of 2,500 years are the IBEB zone in which the site is located and the NMFS RLME. The NMFS RLME contributes up to 27 percent of the PGA hazard at 2,500-year return period with the background seismicity contributing 69 percent (Figure 17). At 1.0 sec SA, the NMFS RLME relative contribution increases up to 71 percent of the hazard at 2,500 years (Figures 18 and 19).

By deaggregating the PGA and 1.0 sec SA hazard by magnitude, distance and epsilon bins, we can illustrate the contributions by events at a return period of 2,500 years (Figures 20 and 21). Epsilon is the difference between the logarithm of the ground motion amplitude and the mean logarithm of ground motion (for that M and R) measured in units of the standard deviation (σ) of the logarithm of the ground motion. As shown on Figure 20, a majority of the PGA hazard at the site is coming from background events (**M** 5.0 to 6.0 within 50 km) and to a lesser extent the RLME (**M** 7.25 to 8.0 at 175 to 400 km). As shown on Figure 21, a majority of the 1.0 sec SA hazard at the site is coming from the NMFS RLME (**M** 7.0 to 8.25 at 250 to 400 km). There is a small contribution to the PGA and 1.0 sec SA hazard from the Wabash Valley RLME (Figures 20 and 21).

The deaggregation shown in Figures 20 and 21 also provides the modal magnitude M*, modal distance D*, and modal epsilon ε*, which represent the largest contributor to the hazard at the defined return period. The M* and D* for the 2,500-year return period for PGA and 1.0 sec horizontal SA are listed in Table 8.

A horizontal Uniform Hazard Spectrum (UHS) on hard rock computed at 7 spectral periods for the 2,500-year return period is shown on Figure 22. A UHS shows the hazard across all periods for the same annual exceedance probability or return period. The SA hazard has been calculated at 0.01 (PGA), 0.04, 0.1, 0.2, 0.4, 1.0 and 2.0 sec. These are the spectral periods specified in the EPRI (2013) ground motion models.

Table 7

2,500-Year Return Period Mean UHS for Hard Rock

Period (sec)	SA (g)
0.01 (PGA)	0.117
0.04	0.239
0.10	0.214
0.20	0.156
0.40	0.107
1.00	0.056
2.00	0.034

Table 8

Modal M* and D* at 2,500-year Return Period

	M*	D*
PGA	5.1	12.5
1.0 Sec SA	7.6	275

The PSHA results are for hard rock and so we performed a site response analysis to adjust the ground motions to the ground surface. Traditionally in the estimation of site-specific probabilistic ground motions for a soil site, a rock ground motion is calculated and modified by deterministic site response analyses derived for the soil column to arrive at the ground motions at the soil surface. In doing so, the annual exceedance probability of that soil motion is generally unknown, varies with period, and may be of a higher probability than the control (rock) motion. If a risk analysis is desired, the surface motions must be hazard consistent, i.e., the annual exceedance probability of the soil ground motion should be the same as the rock ground motion.

In NUREG/CR-6728 (McGuire *et al.*, 2001), several site response approaches are recommended to produce soil motions consistent with the rock outcrop hazard. The approaches also incorporate the aleatory variabilities in the soil properties into the soil motions. McGuire *et al.* (2001) identified four basic approaches for determining the ground motions at a soil site. The approaches range from a PSHA using ground motion prediction models for the specific site (or location) of interest (Approach 4) to scaling the rock motion on the basis of a site response analysis using a broadband input motion (Approach 1). Conceptually, Approach 4 is the ideal approach and other approaches are approximations to it. However, Approach 4 is seldom used because rarely are data sufficient to develop site-specific ground motion models.

To compute the ground motions for the Kincaid Station site, we implemented Approach 3 as it is called (McGuire *et al.*, 2001; Bazzurro and Cornell, 2004). Approach 3 is a fully probabilistic analysis procedure which moves the site response, in an approximate way, into the hazard integral. The approach is described by Bazzurro and Cornell (2004) and NUREG/CR-6769 (McGuire *et al*., 2002). In this approach, the hazard at the surface is computed by integrating the site-specific hazard curve at generic rock or soil level with the probability distribution of the amplification factors (Lee *et al*., 1998; 1999). The site-specific amplification, relative to a reference rock, in this case hard rock, is characterized by a suite of frequency-dependent amplification factors that can account for nonlinearity in soil/rock response. Approach 3 involves approximations to the hazard integration using suites of transfer functions, which result in complete hazard curves at the ground surface for specific ground motion parameters (e.g., spectral accelerations) and a range of frequencies.

The basis for Approach 3 is a modification of the standard PSHA integration:

$$P[A_S>z] = \int\int\int P\left[AF > \frac{z}{a} \middle| m,r,a \right] f_{M,R|A}\ (m,r;a) f_A(a) dm dr da \qquad (6\text{-}1)$$

where A_S is the random ground-motion amplitude on soil at a certain natural frequency; z is a specific level of A_S; m is earthquake magnitude; r is distance; a is an amplitude level of the random rock ground motion, A, at the same frequency as A_S; $f_A(a)$ is derived from the rock hazard curve for this same frequency (namely it is the absolute value of its derivative); and $f_{M,R|A}$ is the deaggregated hazard (i.e., the joint distribution of M and R, given that the rock amplitude is level a). AF is an amplification factor defined as:

$$AF = A_S/a \qquad (6\text{-}2)$$

where AF is a random variable with a distribution that can be a function of m, r, and a. To accommodate epistemic uncertainties in site dynamic material properties, multiple suites of AF

may be used and the resulting hazard curves combined with weights to properly reflect mean hazard and fractiles.

The ground surface response is controlled primarily by the level of rock motion and m, so Equation 6-1 can be approximated by:

$$P[A_S>z] = \int\int P[AF > \frac{z}{a}(m,a)]f_{M|A}(m;a)f_A(a)dmda \quad (6\text{-}3)$$

where r is dropped because it has an insignificant effect in most applications (McGuire *et al.*, 2001). To implement Equation 6-3, only the conditional magnitude distribution for relevant amplitudes of a is needed. $f_{M|A}(m;a)$ can be represented (with successively less accuracy) by a continuous function, with three discrete values or with a single point, (e.g., $m^1(a)$, the mean magnitude given a). With the latter, Equation 6-3 can be simplified to:

$$P[A>z] = \int\int P[AF > \frac{z}{a}|a,m^1(a)]f_A(a)da \quad (6\text{-}4)$$

where, $f_{M|A}(m;a)$ has been replaced with m^1 derived from deaggregation. With this equation, one can integrate over the rock acceleration, a, to calculate $P[A_S>z]$ for a range of surface amplitudes, z.

6.1 IMPLEMENTATION OF APPROACH 3

In Approach 3, the following steps were performed:

- Randomization of base case site-dynamic material properties to produce a suite of velocity profiles as well as G/Gmax and hysteretic damping curves that incorporate site randomness.
- Computation of transfer functions (hereafter termed amplification factors) as characterized by a mean and distribution for each set of base case site properties using the RVT-based equivalent-linear site response model.
- Full integration of the fractile and mean hazard curves for the generic site condition in this case hard rock and amplification factors to arrive at a distribution of site-specific hazard curves.

Specifically, the suites of rock hazard curves are first combined into a single suite and site-specific amplification factors applied using Approach 3. Combining the empirical hazard curves, rather than applying Approach 3 to each suite independently, results in the same mean hazard—the desired product—but does not properly preserve the full epistemic variability in the fractile estimates. As a result, the range in probability reflected in the resulting fractiles is likely somewhat underestimated. Although the fractiles are likely not significantly in error since the differences in hazard fractiles between the empirical relations are not large, the site-specific hazard fractiles should not be used for hazard or risk assessment.

Approach 3 is implemented through a number of computer programs, which are described below. The computation of the amplification factors is the first phase of the calculations and is similar to what is done in other site-response approaches.

6.1.1 RVT-Based Equivalent-Linear Site Response Approach

The conventional site response approach in quantifying the effects of soil and other unconsolidated sediments on strong ground motions involves the use of time histories compatible with the specified outcrop response spectra to serve as control (input) motions. The control motions are then used to drive a nonlinear computational formulation to transmit the motions through the profile.

The computational formulation that has been most widely employed to evaluate 1D site response assumes vertically-propagating plane S-waves. Departures of soil response from a linear constitutive relation are treated in an approximate manner through the use of the equivalent-linear formulation. The equivalent-linear formulation, in its present form, was introduced by Idriss and Seed (1968). A stepwise analysis approach was formalized into a 1D, vertically propagating S-wave code called SHAKE (Schnabel *et al*., 1972). Subsequently, this code has become the most widely used and validated analysis package for 1D site response calculations.

The computational scheme employed to compute the amplification factors in this study uses an alternative approach employing RVT (Silva and Lee, 1987). In this approach, as embodied in the computer program RASCALS, the control motion power spectrum is propagated through the 1D soil profile using the plane-wave propagators of Silva (1976). The power spectrum is derived from the uniform hazard spectrum by spectral matching assuming the controlling earthquake. In this formulation only SH waves are considered. Arbitrary angles of incidence may be specified. In this case, vertical incidence was assumed.

Inputs to RASCALS are as follows:

- Location of input and output motions within the site profile.
- Input (control) motions characterized by earthquake power spectra.
- Incidence angles of input motion.
- A vertical profile consisting of homogeneous layers with specified thickness, seismic velocity, and density.
- Dynamic properties of the material at the site, consisting of strain-dependent shear modulus and damping curves for each layer.

Control motions (power spectral density) must be calculated for input into the site response analysis that are representative of the earthquake magnitude and distance dominating the hazard at the desired rate of exceedance. The basis for the control motions are the magnitude and distances specified by the hazard deaggregation.

Evaluation of site-response using the equivalent-linear site response model is based on convolution of appropriate control motions through randomized velocity profiles combined with randomized G/Gmax and hysteretic damping curves. The randomized profiles and curves are generated from base case velocity and nonlinear dynamic properties. The convolutions yield amplification factors for 5%-damped response spectra and peak ground velocity (PGV).

6.1.2 Inputs and Analysis

To perform the site response analysis, representative V_S profiles of the site and shear modulus (G/Gmax) reduction and damping curves are required.

For the computation of spectra for a site with uncertain properties and exhibiting a degree of lateral variability, a best-estimate (mean) basecase velocity profile (or profiles) (Table 10; Figure 13) is developed and used to simulate a number of V_S profiles. To address the epistemic uncertainty in the basecase V_S profile, upper-range and lower-range basecase profiles were computed by using a factor of 1.57 (Figure 13). This factor was adopted from EPRI (2013) for sites where there are no site-specific V_S data (Figure 13). The upper-range basecase V_S profile was constrained to not exceed 2,800 m/sec (hard rock). Additionally, strain-dependent shear modulus and hysteretic damping are also randomized about best-estimate basecases. A large number of simulations can be required to achieve stable statistics on the response. To achieve statistical stability, 30 randomizations were produced using the velocity correlation models for each basecase velocity profile and each basecase nonlinear dynamic property curve. In order to randomly vary the V_S profile, a profile randomization scheme has been developed which varies both layer velocity and thickness. The randomization is based on a correlation model developed from an analysis of variance on about 500 measured V_S velocity profiles (EPRI, 1993; Silva *et al.*, 1996). Profile depth (depth to competent material) is also varied on a site specific basis using a uniform distribution. The depth range is generally selected to reflect expected variability over the structural foundation as well as uncertainty in the estimation of depth to competent material.

Associated with each of the 30 randomized profiles was also a set of randomized dynamic material property curves. For the dynamic material properties, the EPRI (1993) and Peninsular Range curves for cohesionless soils (Silva *et al.*, 1996) were used to approximate a nonlinear response over the top 250 ft, with linear response below (Silva *et al*., 1996). To accommodate the large uncertainty in nonlinear dynamic material properties, two sets of curves were used in the site-specific analyses. In addition to the EPRI (1993) curves, a subset of the EPRI (1993) curves was also used for each profile to account for the possibility that the site may behave more linearly. The second set, termed Peninsular Range curves, use the EPRI (1993) 51 to 120 ft curves for 0 to 50 ft and the 501 to 1,000 ft curves for deeper materials and reflect much more linear response than the EPRI curves. The two sets of curves were given equal weights and are considered to cover the range in nonlinear dynamic material properties.

Based on the RASCALS runs for the 30 V_S profiles for the two base case profiles, a probability distribution of amplification factors was calculated. Input control motions are computed using RASCALS for each set of 30 V_S profiles and dynamic property curves. RASCALS is used for horizontal spectra using normally-incident and inclined SH-waves. For each control motion, mean and standard deviation are computed from the 30 response spectra (from 30 randomized profiles). Thirty realizations result in stable estimates. The mean response spectrum from the 30 convolutions is divided by the mean (log) spectrum for hard rock spectrum to produce the amplification factors. The amplification factors include the effects of the inherent aleatory variability (randomness) of the site properties about each base case and any possible effects of magnitude of the control motions. Epistemic variability (uncertainty) is captured in consideration of alternate base case (mean) profiles and properties.

Table 10
Simplified V_S Profile Used in Analysis

Depth (ft)	Lithology	V_S (ft/sec)
0 – 40	Quaternary till	2,200
40 – 755	Pennsylvanian limestone, shale, sandstone	4,500
755 – 1,340	Mississippian limestone	5,500
1,340 – 2,190	Devonian, Silurian, Ordovician shale, limestone	6,500
2,190 – 6,640	Cambrian dolomite, sandstone, limestone	8,500
> 6,640	Precambrian basement	> 9,200

RASCALS was used to generate control motions and acceleration power response spectra for two earthquakes, **M** 5.5 and 7.5, which approximately represents the range of magnitudes for events contributing to the hazard at the site at short- and long-period ground motions. The events were placed at a suite of distances to produce expected median rock peak accelerations of 0.01, 0.05, 0.10, 0.20, 0.30, 0.40, 0.50, 0.75, 1.00, 1.25 and 1.50 g. The amplification factors (the ratios of the response spectra at the top of the site profiles to the hard rock profiles) are a function of the reference (hard rock) peak acceleration (or SA), spectral frequency, and nonlinear soil response.

6.2 SITE-SPECIFIC HORIZONTAL RESULTS

The hard rock hazard curves derived from the PSHA and the amplification factors relative to hard rock were multiplied to arrive at site-specific amplified hazard curves. The hazard curves calculated using the amplification factors from the **M** 5.5 and 7.5 earthquakes were weighted based on their contributions to the hazard at each spectral frequency. The uncertainty or epistemic variability in seismic hazard is typically represented by a set of weighted hazard curves. Using these sets of curves as discrete probability distributions, they can be sorted by the frequency of exceedance at each ground-motion level and summed into a cumulative probability mass function. When the cumulative probability mass function for a particular exceedance frequency equals or exceeds fractile y, then the exceedance frequency represents the yth fractile. The weighted-mean hazard curve is the weighted average of the exceedance frequency values. This approach is a standard practice in PSHA.

Figure 23 shows the SEE UHS for the return period of 2,500 years at the ground surface (assumed to be the top of till) resulting from the site response analysis (Table 9). Also shown is the input hard rock UHS for the same return period. The amplification is significant at spectral periods greater than about 0.07 seconds.

6.3 COMPARISON WITH USGS NATIONAL HAZARD MAPS

In 1996, the USGS released a "landmark" set of NSHMs for earthquake ground shaking, which was a significant improvement from previous maps they had developed (Frankel *et al.*, 1996). These maps were the result of the most comprehensive analyses of seismic sources and ground motion prediction ever undertaken on a national scale. The maps are the basis for the NEHRP Maximum Considered Earthquake (MCE_R) maps, which are used in the International Building Code. The maps are for NEHRP site class B/C (firm rock) (V_S30 760 m/sec).

For a 2,500-year return period, the 2014 NSHMs indicate firm rock (site class B/C) PGA, 0.2 sec SA and 1.0 sec SA values of 0.11, 0.23, and 0.10 g, respectively (USGS website). The site-specific ground surface values of 0.12, 0.16, and 0.06 g for PGA, 0.2 and 1.0 sec SA, respectively, are comparable. The site-specific values are higher at short periods and lower at long periods. These minor differences are likely due to the differences in the site conditions.

Table 9

2,500-Year Return Period Mean SEE UHS for the Ground Surface

Period (sec)	SA (g)
0.01 (PGA)	0.11
0.02	0.15
0.03	0.17
0.04	0.18
0.10	0.25
0.20	0.21
0.40	0.13
1.0	0.10
2.0	0.06
3.0	0.04
4.0	0.03
5.0	0.03

Three sets of two-component time histories were spectrally-matched to a 2,500-year return period ground surface SEE UHS. At short periods the 2,500-year hazard is primarily from background events, and at long periods hazard is primarily from large events from the New Madrid fault system RLME (Figures 20 and 21). Hence, three sets of time histories were selected: one to represent a $\mathbf{M} \leq 6.5$ event at distances less than 50 km and two sets to represent a large NMFS event at greater distances (Table 11).

Because the response spectrum of a time history has peaks and valleys that deviate from the design response spectrum (target spectrum), it is necessary to modify the motion to improve its response spectrum compatibility. The procedure proposed by Lilhanand and Tseng (1988), as modified by Al Atik and Abrahamson (2010) and contained in the computer code RSPMatch09 (Fouad and Rathje, 2012), was used to develop the acceleration time histories through spectral matching to the target (seed) spectrum. This time-domain procedure has been shown to be superior to previous frequency-domain approaches because the adjustments to the time history are only done at the time at which the spectral response occurs resulting in only localized perturbations on both the time history and the spectra (Lilhanand and Tseng, 1988).

To match the design (target) spectrum, seed time histories should be from events of similar magnitude and distance (for duration) and most importantly, spectral shape as the earthquake dominating the spectrum. Figure 24 shows the spectra from the seed time histories scaled to the target spectrum at PGA. The seed acceleration time history series are shown on Figures 25 to 27. The spectral matches and resulting SEE time histories are shown on Figures 28 to 39. Arias intensities and durations of the SEE time histories are provided in Table 12.

Table 11

Seed Time Histories

Record Sequence Number	Year	Earthquake Name	Station Name	Earthquake Magnitude (M)	ClstD (km)	V_S30 (m/sec)	Comp	PGA(g)	PGV (cm/sec)	PGD (cm)	5-95% AI (m/sec)	5-95% Dur (sec)
172	1979	Imperial Valley	El Centro Array #1	6.5	21.7	237.3	140	0.141	16.06	9.82	0.287	15.02
							230	0.136	10.98	7.10	0.224	19.53
1404	1999	Chi-Chi, Taiwan	PNG	7.6	110.3	465.9	E	0.029	1.52	0.47	0.030	31.99
							N	0.034	2.27	0.66	0.033	28.10
2112	2002	Denali, Alaska	TAPS Pump Station #08	7.9	104.9	424.9	049	0.046	4.62	2.15	0.049	30.78
							319	0.036	4.22	2.52	0.043	36.28

ClstD Closest distance
Comp Component
PGA peak horizontal ground acceleration
PGV peak horizontal ground velocity
PGD peak horizontal ground displacement
AI Arias intensity
Dur Duration

Table 12

Spectrally-Matched Time Histories

Record Sequence Number	Year	Earthquake Name	Station Name	Earthquake Magnitude (M)	ClstD (km)	V_S30 (m/sec)	Comp	PGA(g)	PGV (cm/sec)	PGD (cm)	5-95% AI (m/sec)	5-95% Dur (sec)
172	1979	Imperial Valley	El Centro Array #1	6.5	21.7	237.3	140	0.114	13.15	7.41	0.149	20.39
							230	0.111	13.57	13.30	0.148	20.54
1404	1999	Chi-Chi, Taiwan	PNG	7.6	110.3	465.9	E	0.111	7.74	3.38	0.346	33.60
							N	0.111	8.72	5.41	0.284	29.96
2112	2002	Denali, Alaska	TAPS Pump Station #08	7.9	104.9	424.9	049	0.114	11.51	10.05	0.208	36.71
							319	0.109	12.76	9.96	0.294	39.66

ClstD Closest distance
Comp Component
PGA peak horizontal ground acceleration
PGV peak horizontal ground velocity
PGD peak horizontal ground displacement
AI Arias intensity
Dur Duration

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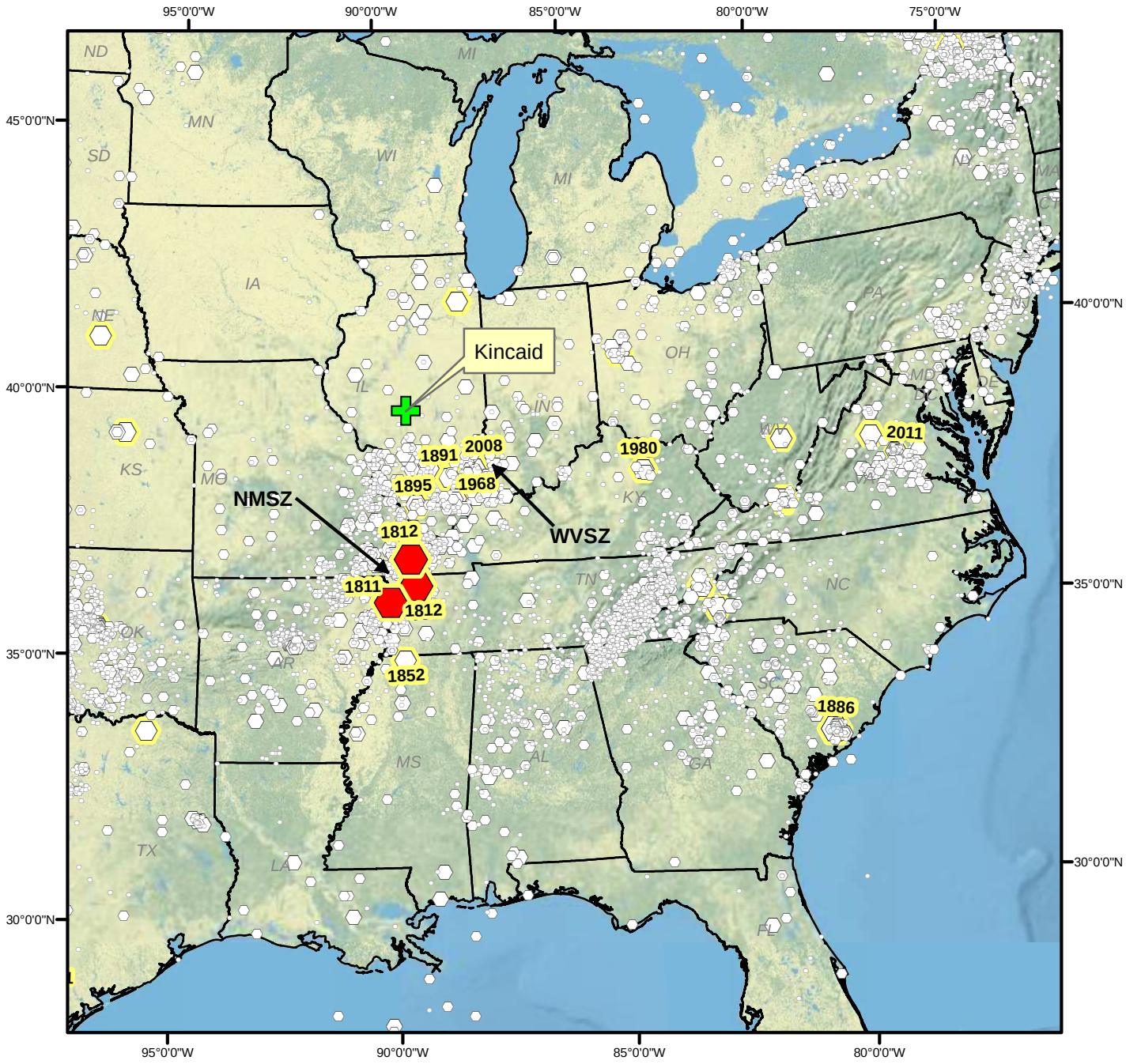


Magnitude Mw

- <= 3.0
- 3.0 - 4.0
- 4.1 - 5.0
- 5.1 - 6.0
- 6.1 - 7.0
- > 7.0

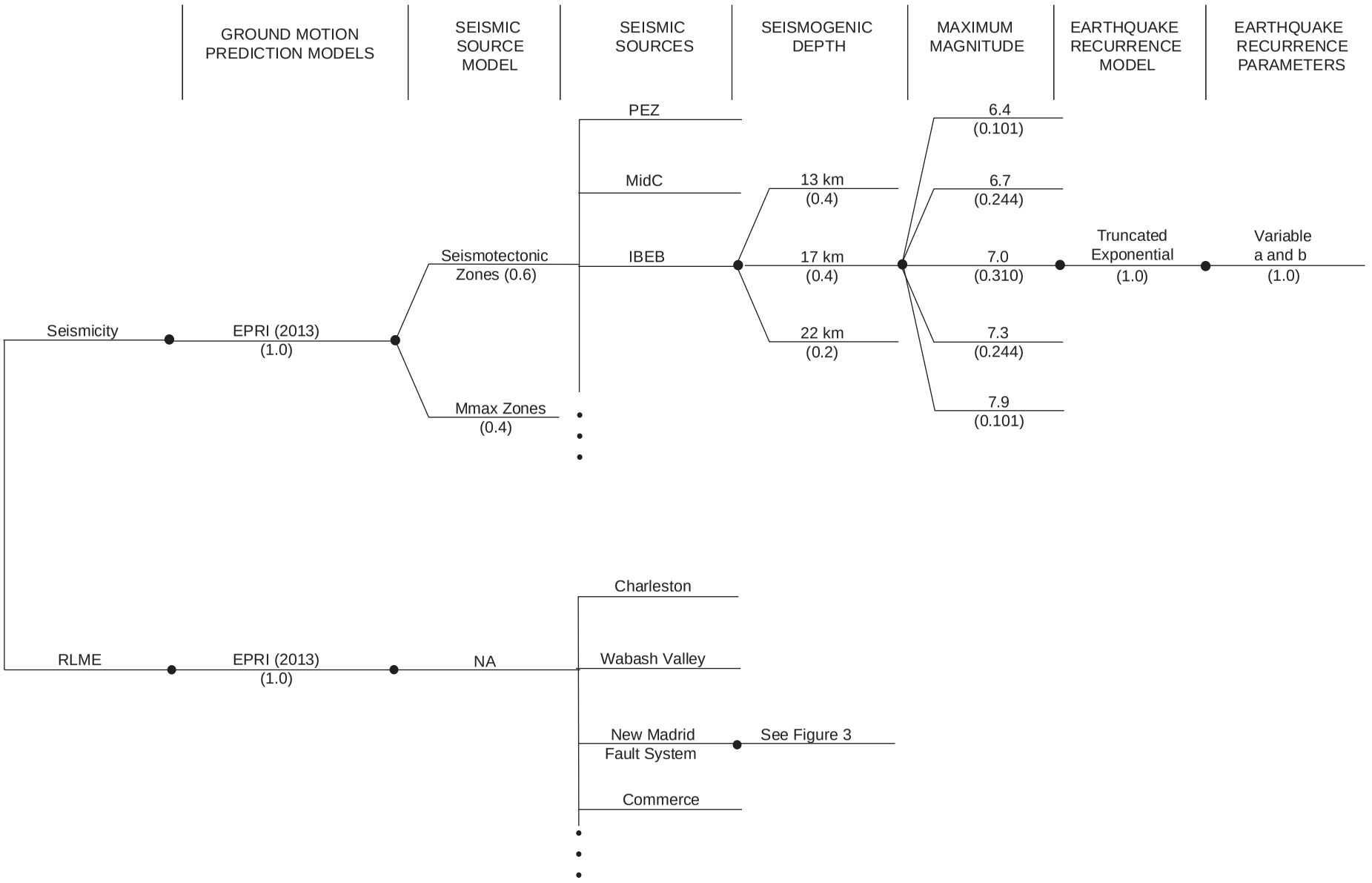
Data Sources: 1699 to 2008 from EPRI/DOE/NRC (2012)
2009 to May 2015 from ANSS

0 70 140 280 420 560 Kilometers

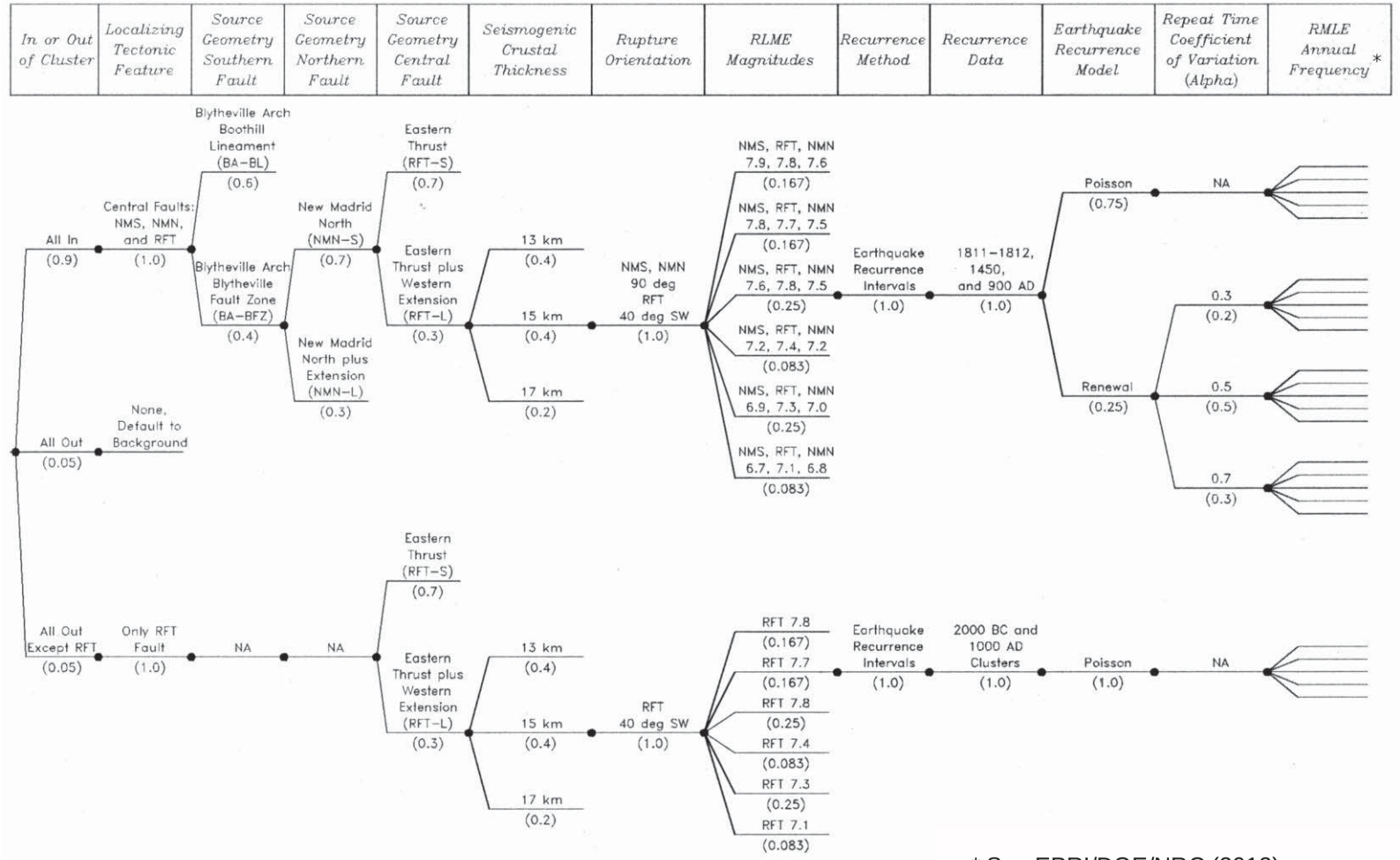
0 50 100 200 300 400 Miles

N

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	HISTORICAL SEISMICITY OF THE CENTRAL AND EASTERN UNITED STATES (1699 - 2015)	Figure 1

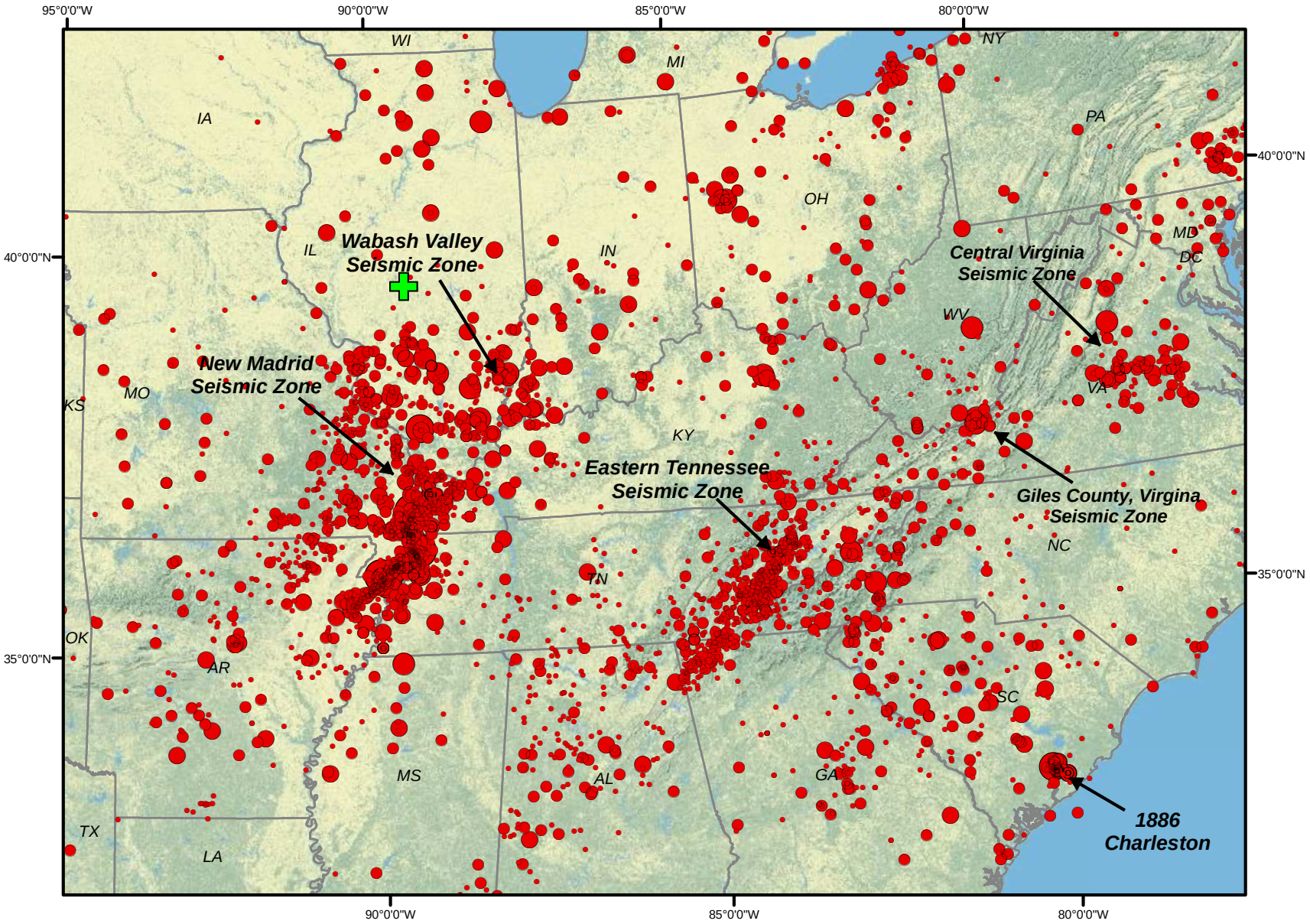


AECOM	Project No. 60440697 Kincaid Power Station Dynegy	EXAMPLE SEISMIC HAZARD MODEL LOGIC TREE	Figure 2



* See EPRI/DOE/NRC (2012)

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	NEW MADRID RLME LOGIC TREE	Figure 3



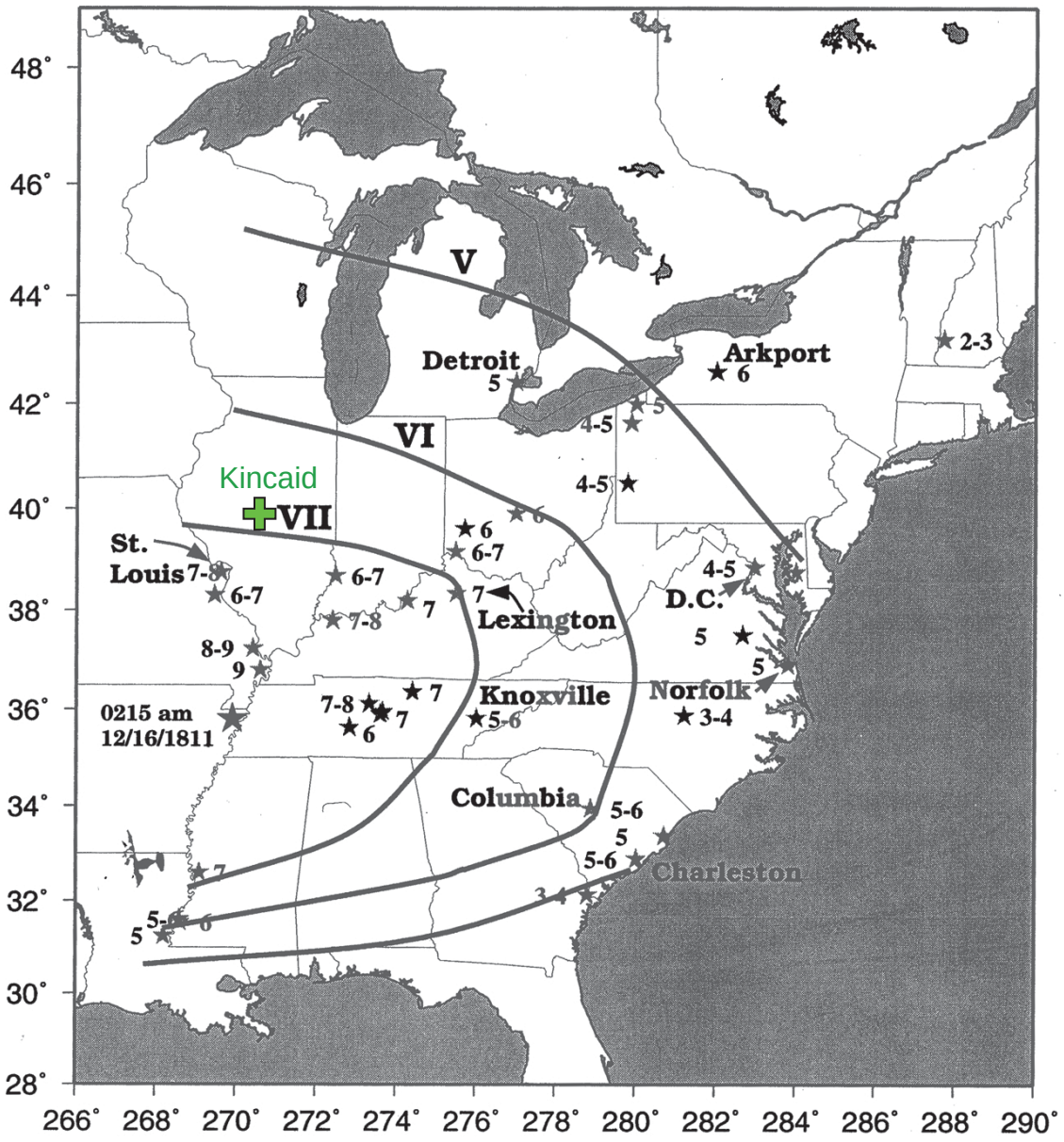
Project Site

Earthquake Epicenters

Seismicity from:
EPRI/DOE/NRC (2012)

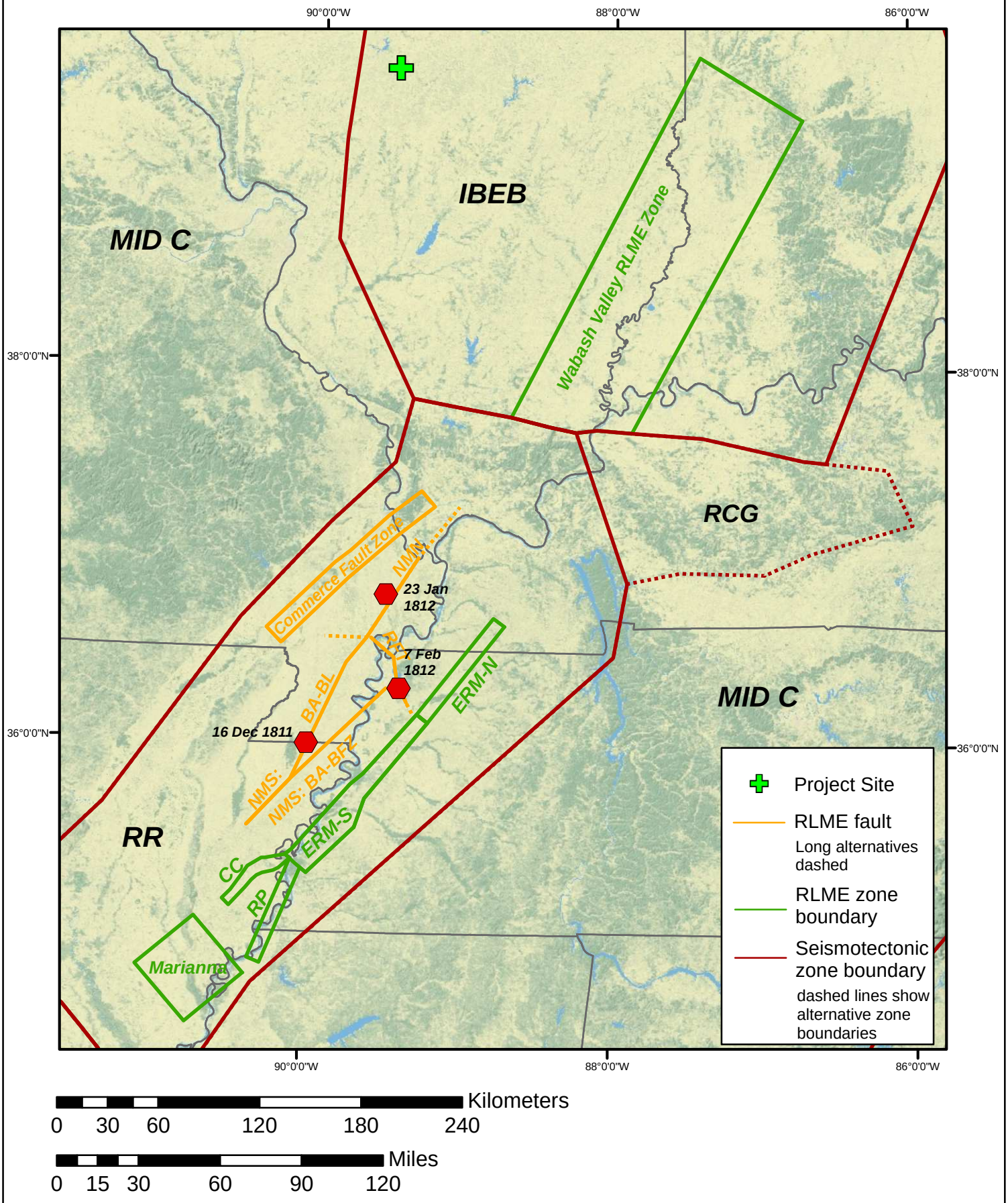
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	HISTORICAL SEISMICITY AND SEISMIC ZONES IN THE CENTRAL AND EASTERN U.S.

Figure 4

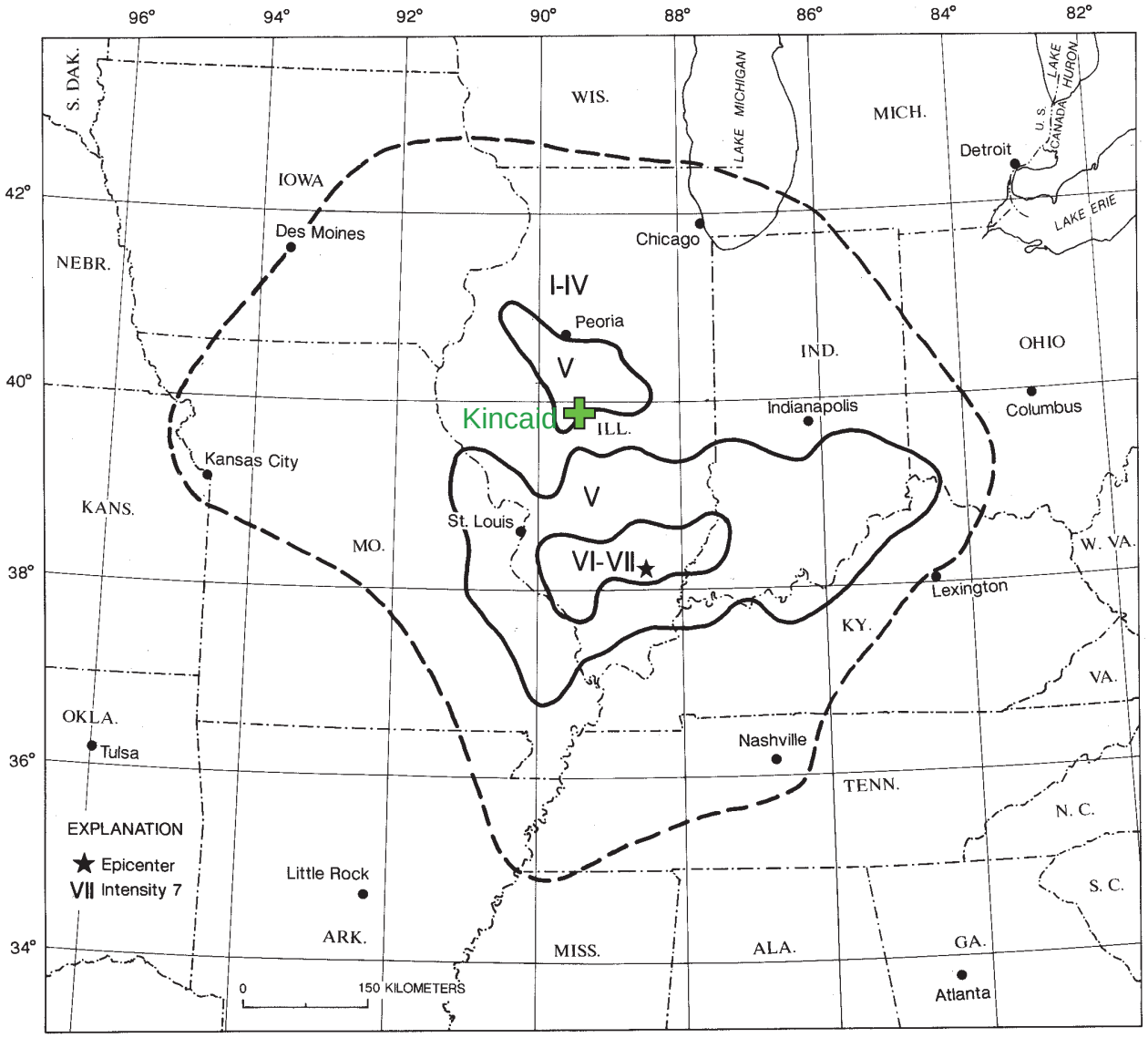


Source: Hough *et al*. (2000)

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	ISOSEISMAL MAP OF THE 16 DECEMBER 1811 **M** 7.2-7.3 NEW MADRID EARTHQUAKE	Figure 5

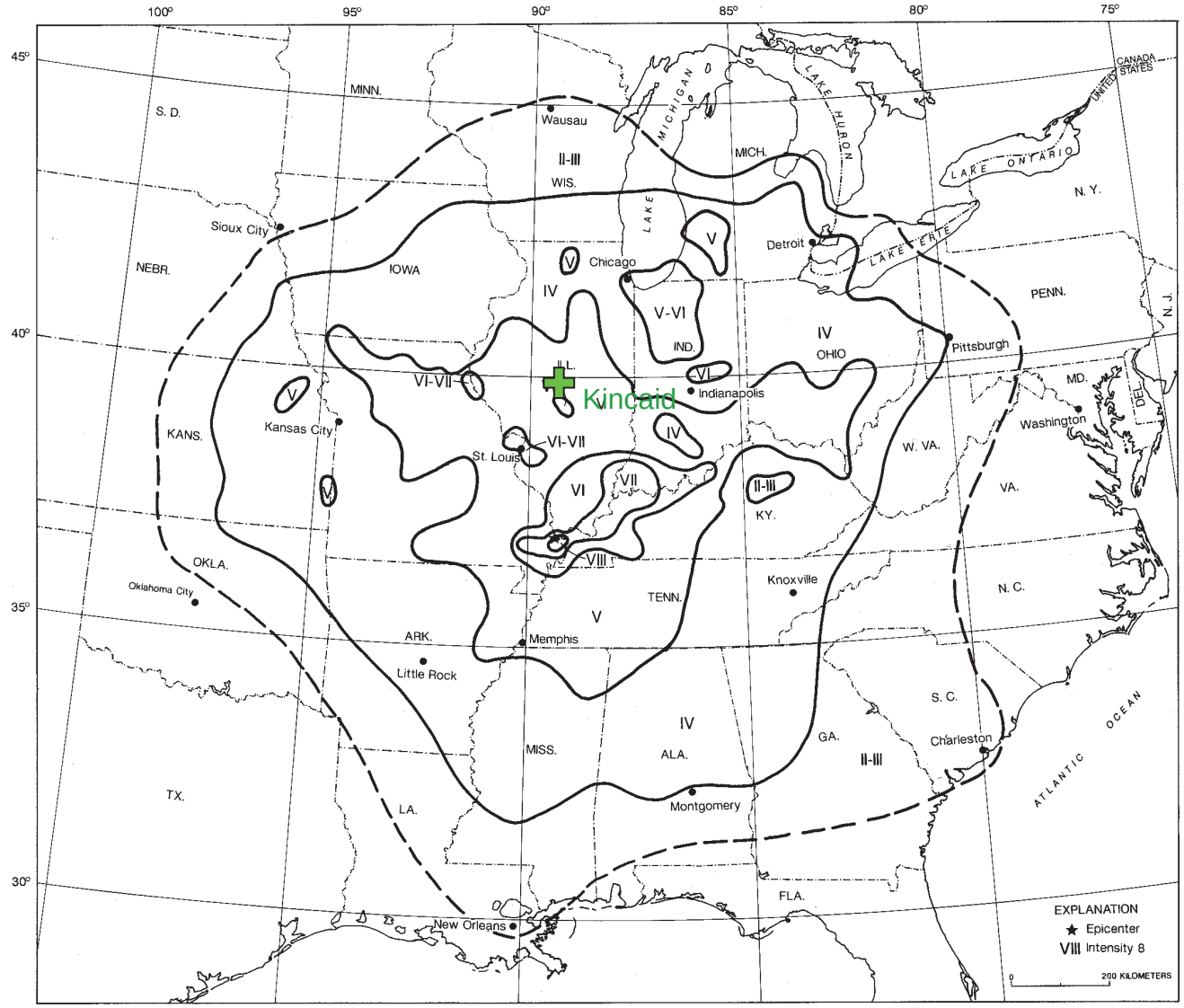


AECOM	Project No. 60440697 Kincaid Power Station Dynegy	NEW MADRID FAULT SYSTEM, 1811-1812 NMFS EARTHQUAKES, AND NEIGHBORING RLMEs	Figure 6



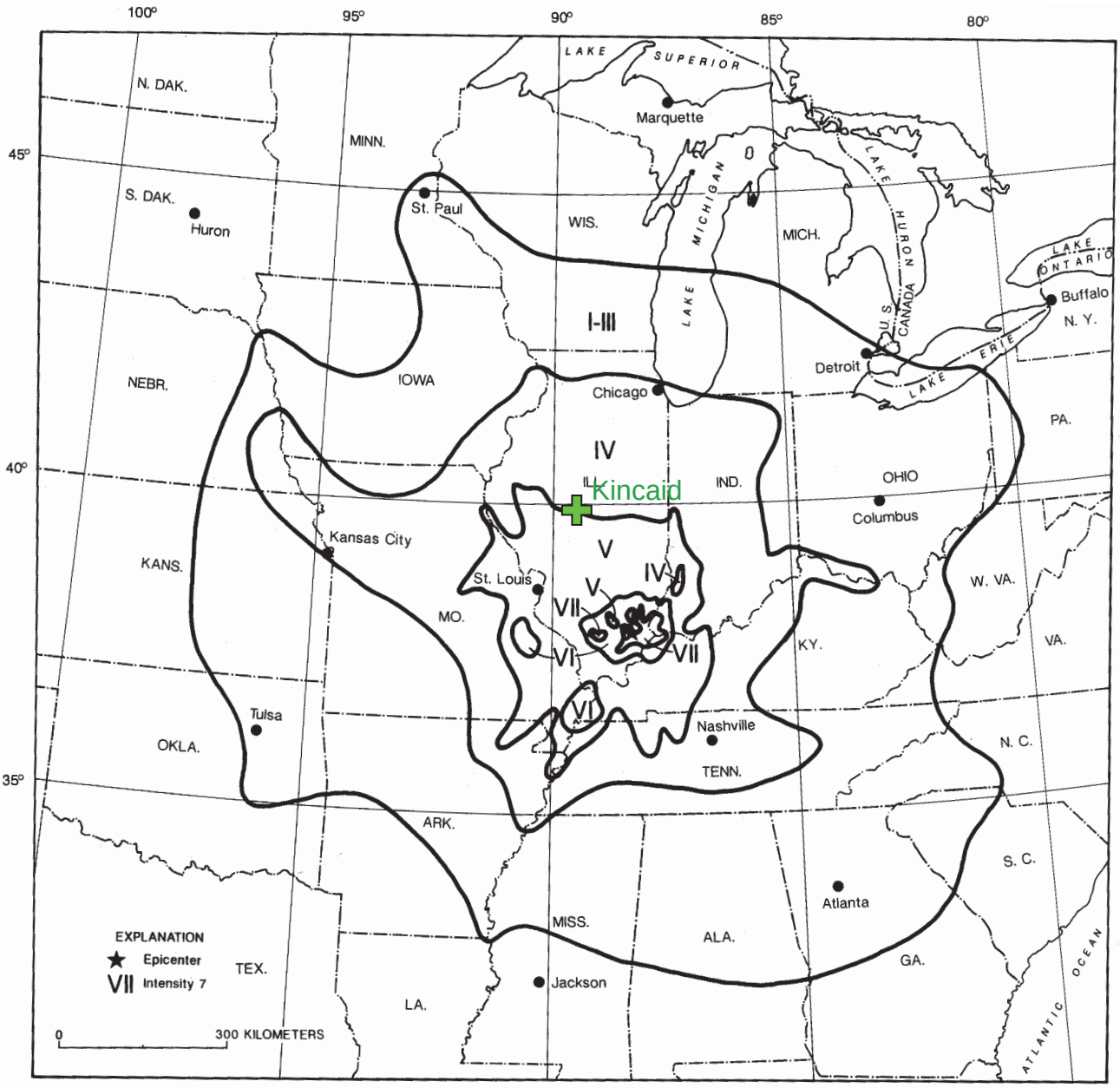
Source: Stover and Coffman (1993)

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	ISOSEISMAL MAP OF THE 27 SEPTEMBER 1891 m_b 5.8 SOUTHERN ILLINOIS EARTHQUAKE	Figure 7



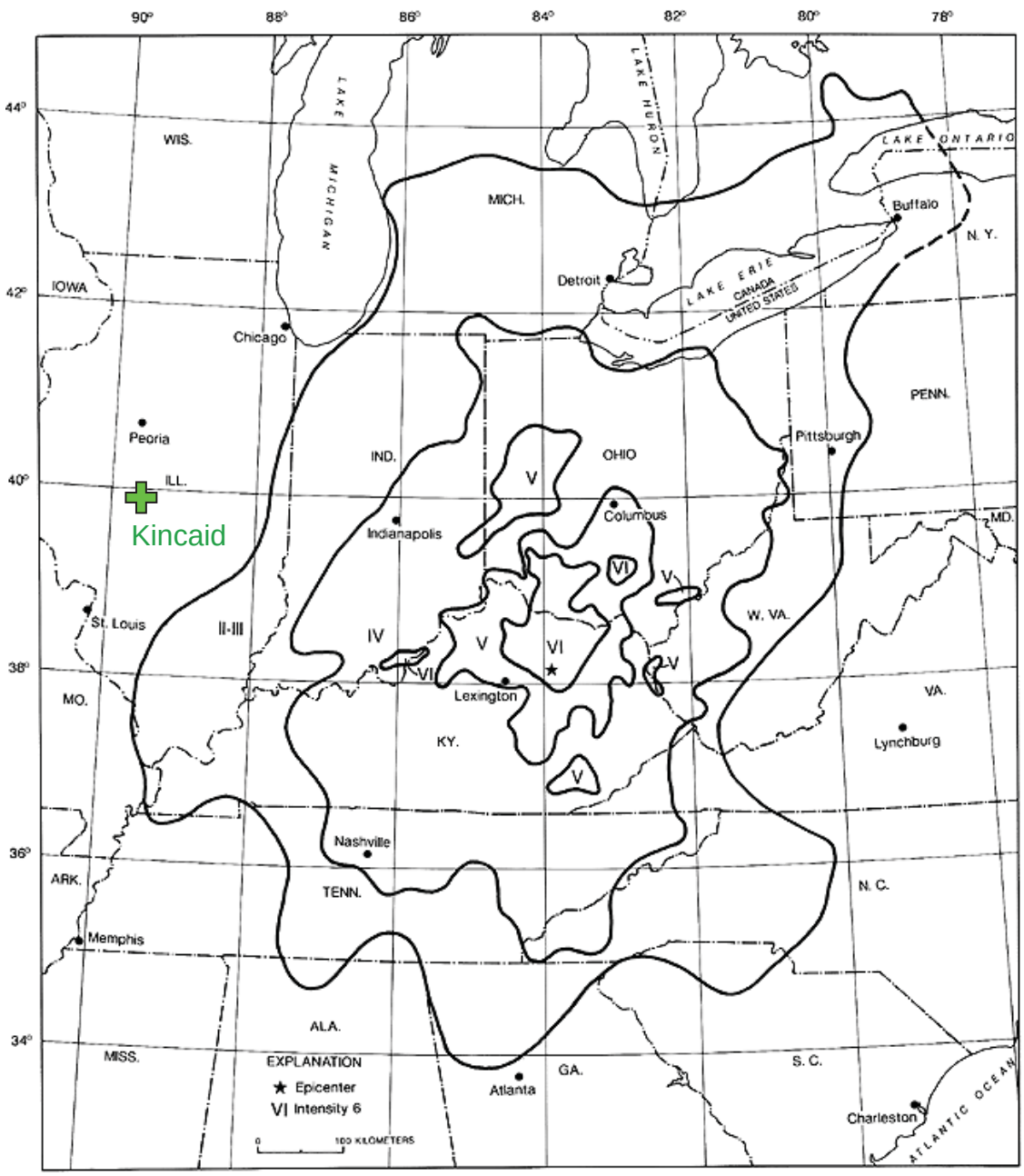
Source: Stover and Coffman (1993)

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	ISOSEISMAL MAP OF THE 31 OCTOBER 1895 M_S 6.7 CHARLESTON, MISSOURI EARTHQUAKE	Figure 8



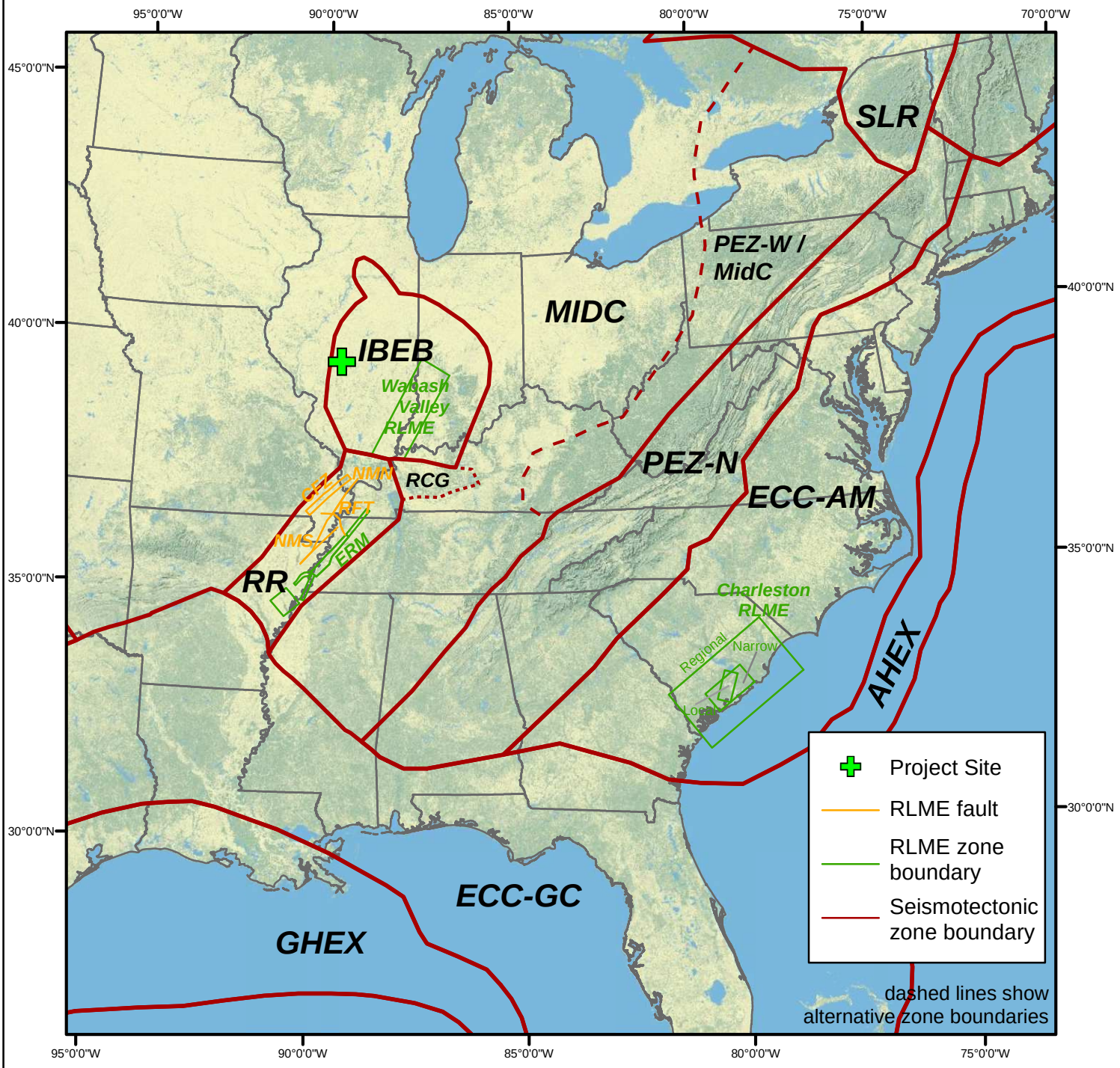
Source: Stover and Coffman (1993)

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	ISOSEISMAL MAP OF THE 9 NOVEMBER 1968 m_b 5.5 SOUTHERN ILLINOIS EARTHQUAKE	Figure 9



Source: Stover and Coffman (1993)

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	ISOSEISMAL MAP FOR THE 27 JULY 1980 M 5.1 SHARPSBURG, KENTUCKY EARTHQUAKE	Figure 10

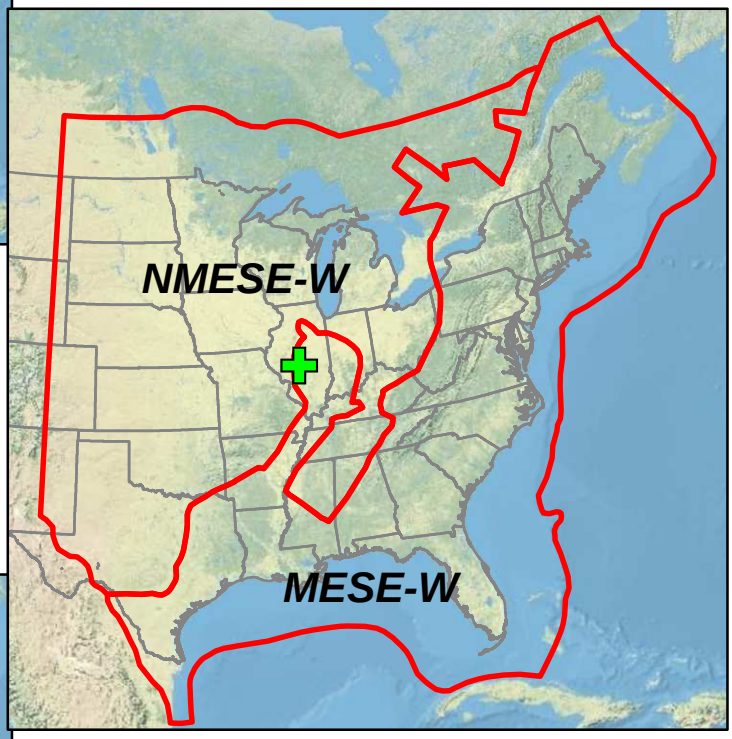


Kilometers
0 125 250 500 750 1,000

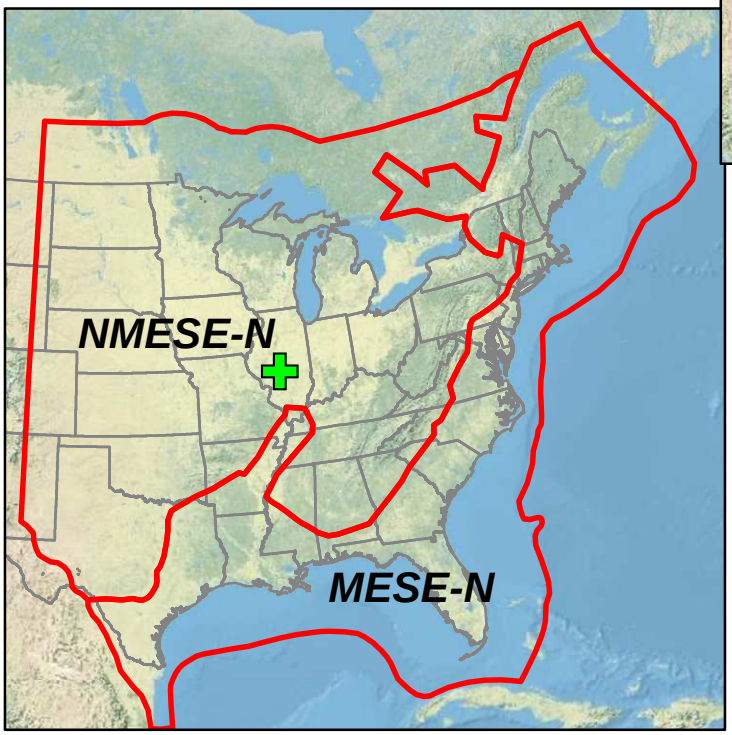
Miles
0 87.5 175 350 525 700

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMOTECTONIC ZONES AND RLMES	Figure 11

1-Zone Mode

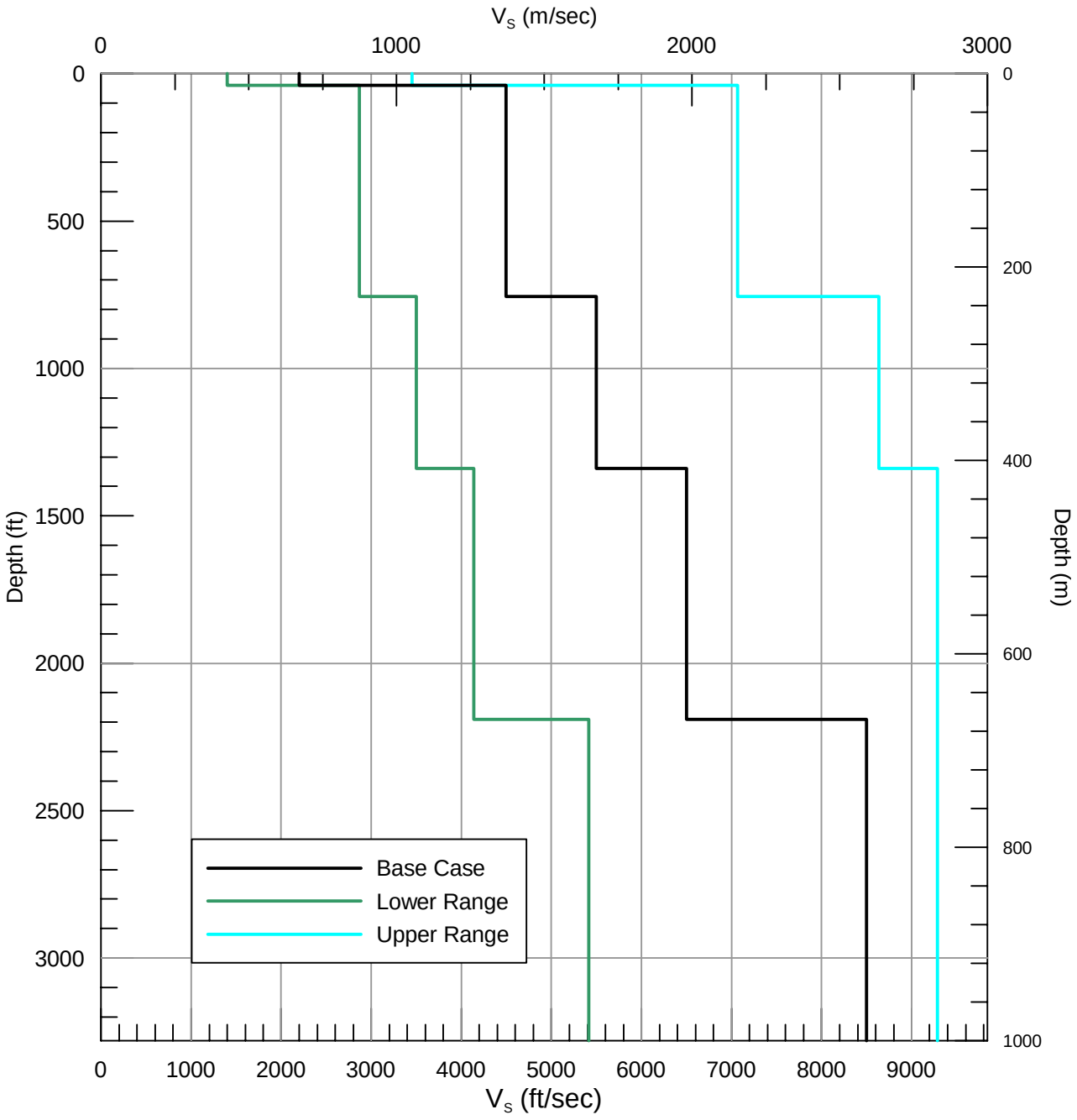


2-Zone Model
MESE-Wide

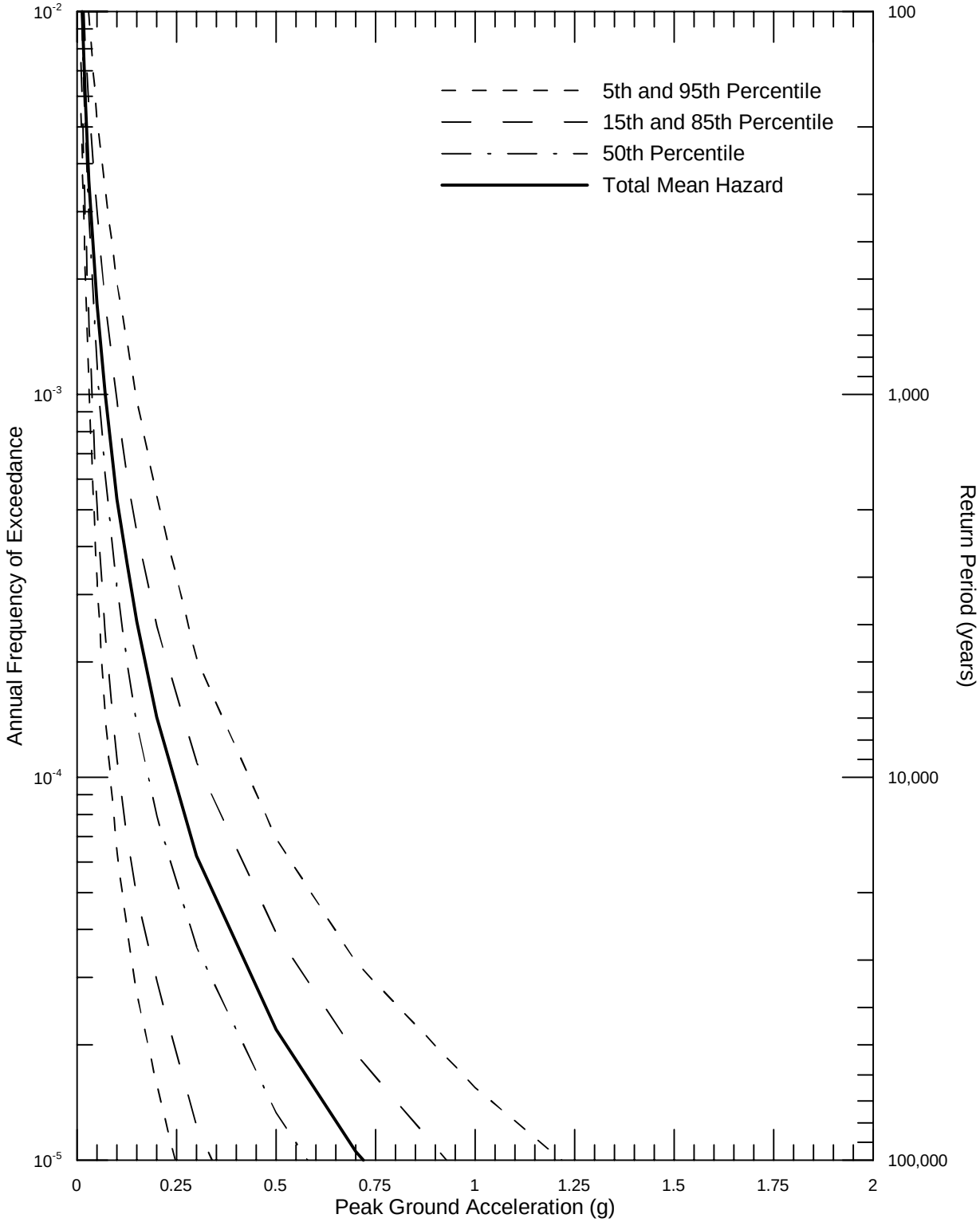


2-Zone Model
MESE-Narrow

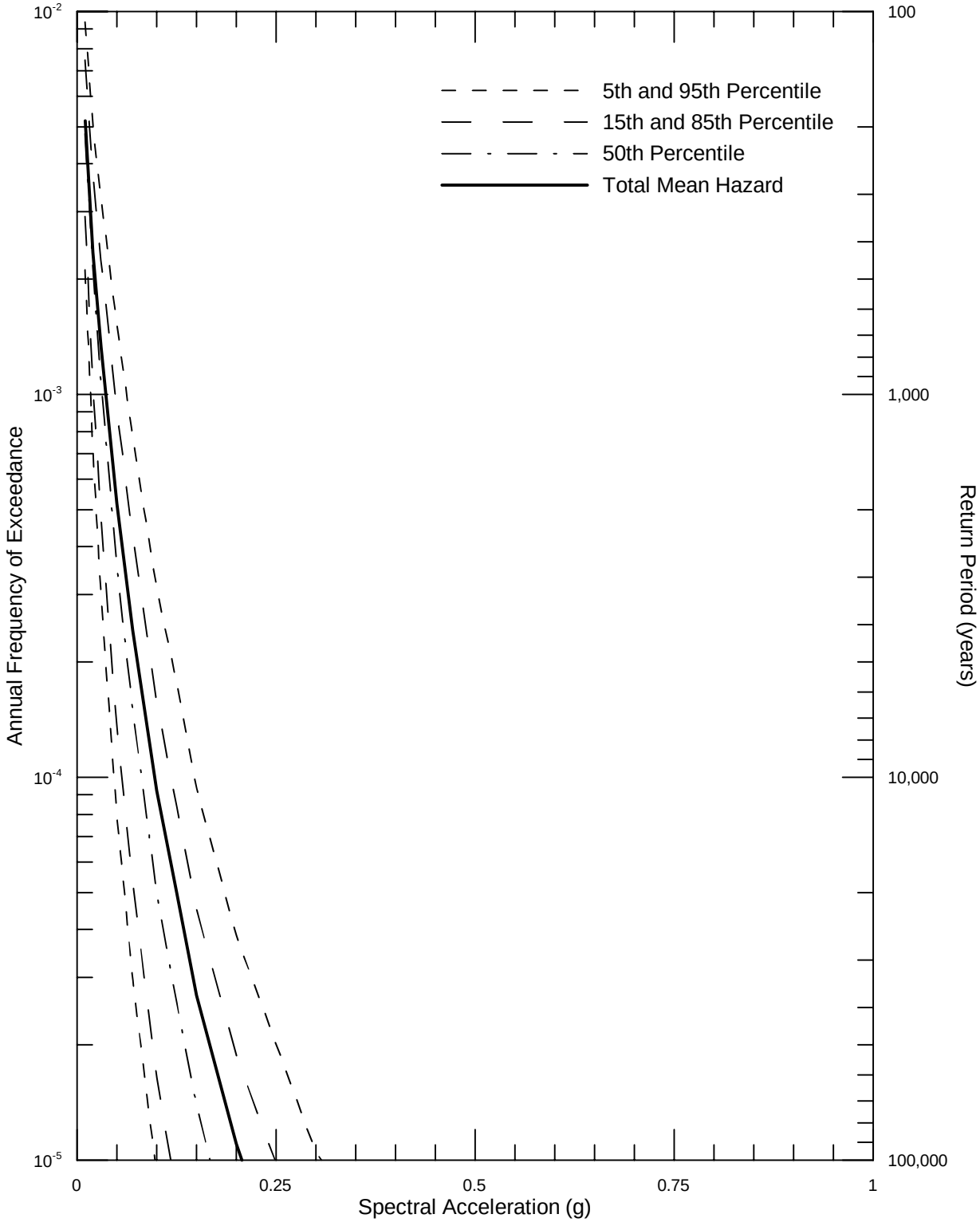
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	Mmax ZONES	Figure 12



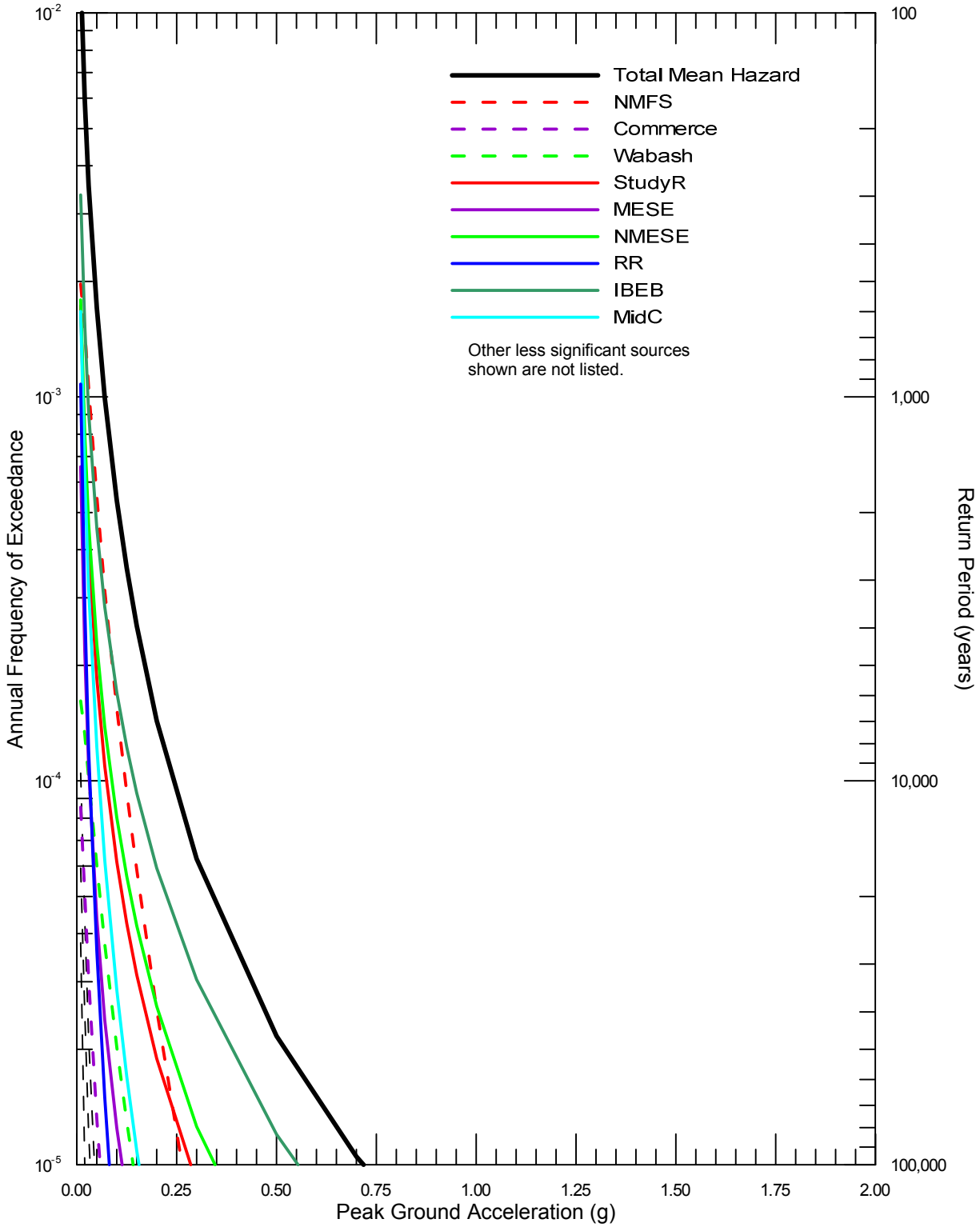
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SITE RESPONSE VELOCITY PROFILES	Figure 13



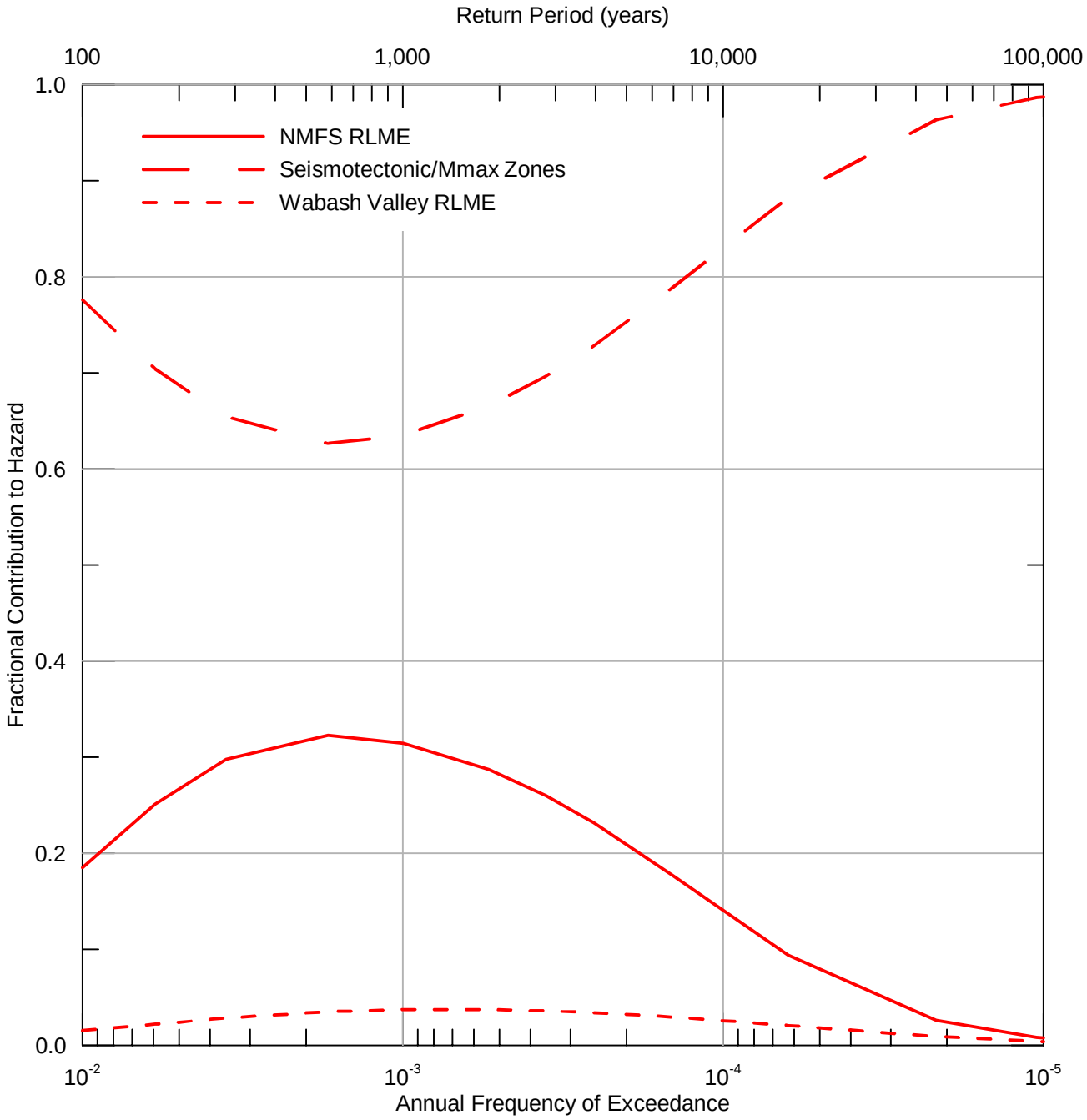
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMIC HAZARD CURVES FOR PEAK HORIZONTAL ACCELERATION ON HARD ROCK	Figure 14



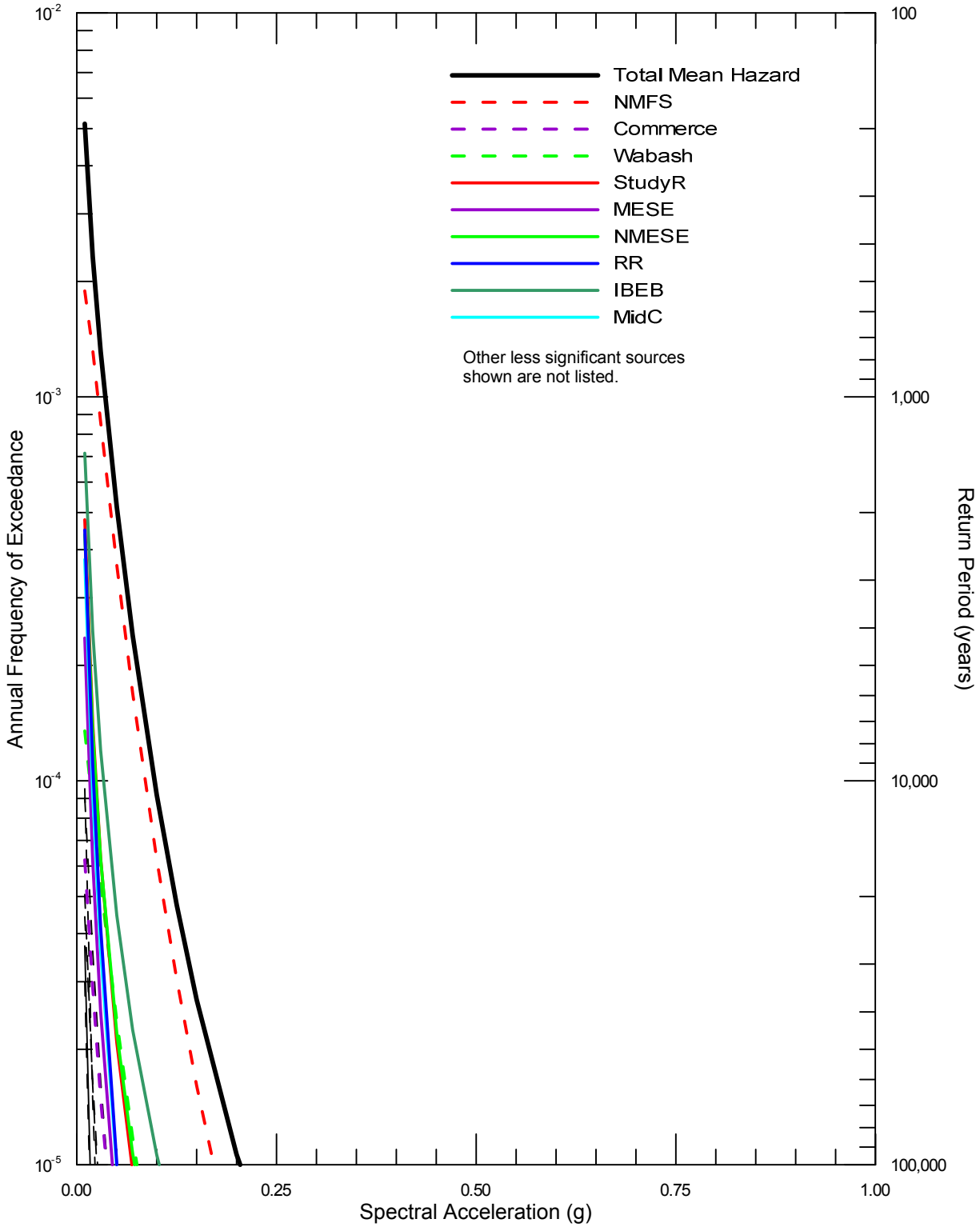
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMIC HAZARD CURVES FOR 1.0 SEC HORIZONTAL SPECTRAL ACCELERATION ON HARD ROCK	Figure 15



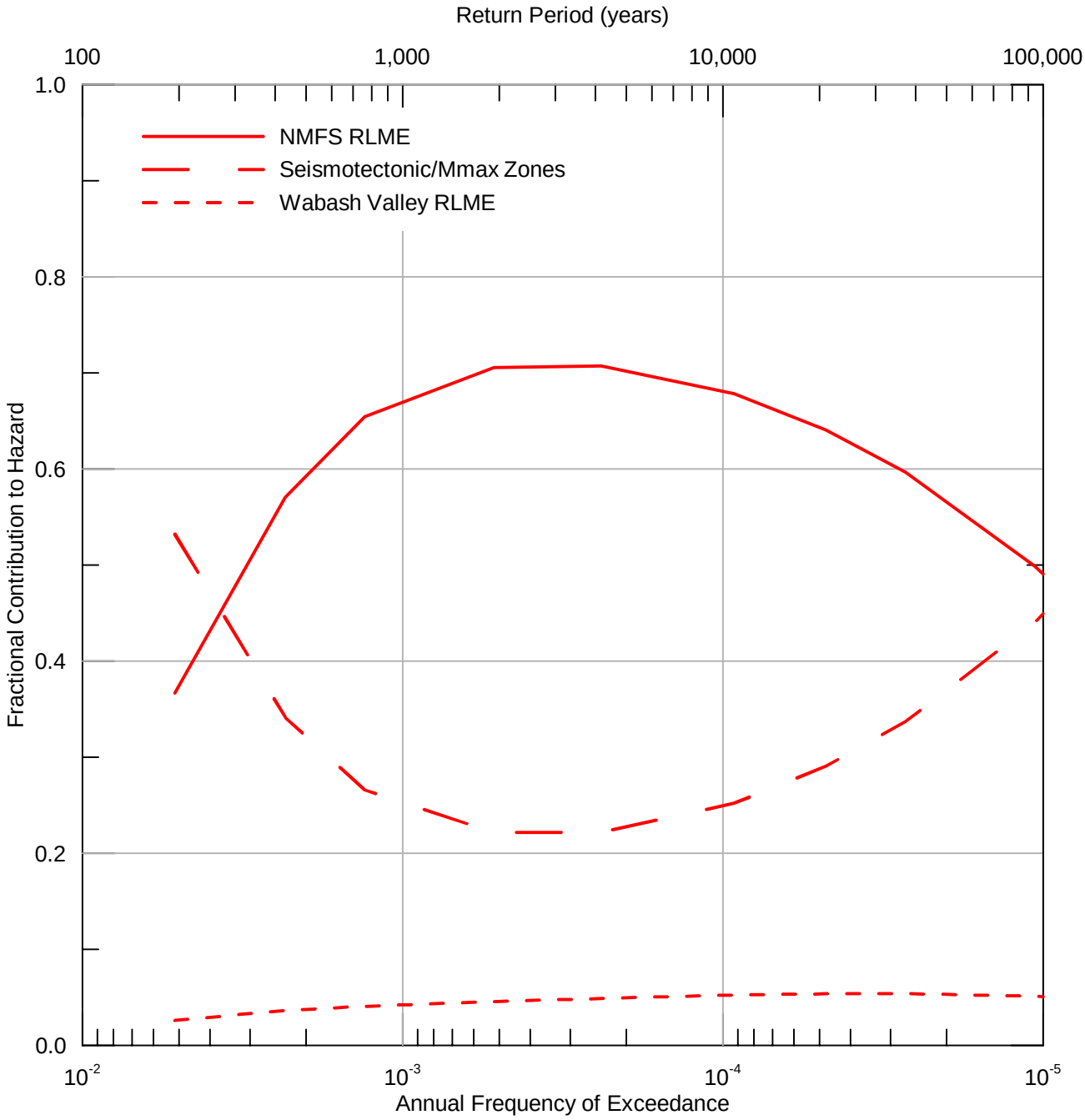
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMIC SOURCE CONTRIBUTIONS TO MEAN PEAK HORIZONTAL ACCELERATION HAZARD ON HARD ROCK	Figure 16



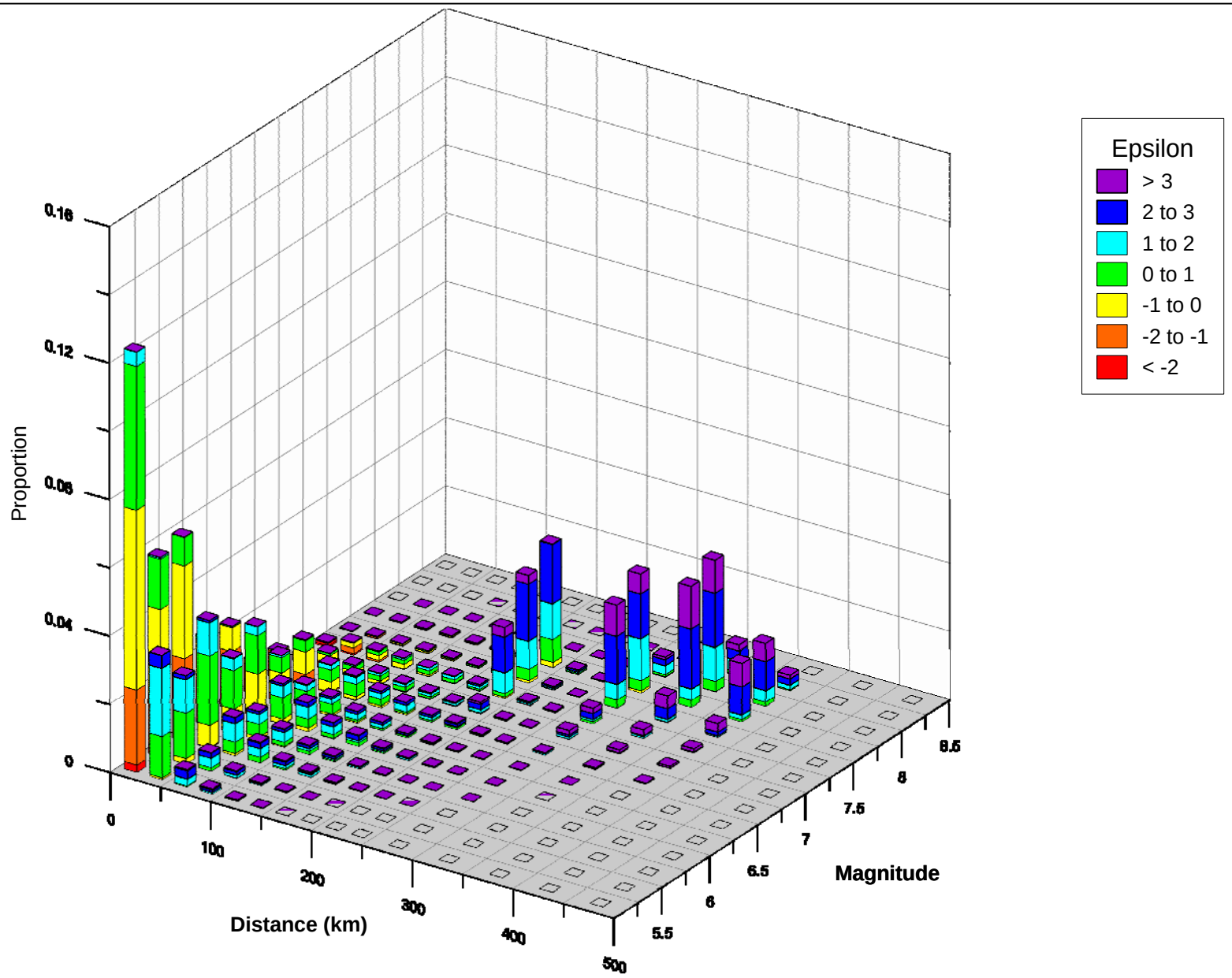
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMIC SOURCE FRACTIONAL CONTRIBUTION TO MEAN PEAK HORIZONTAL ACCELERATION HAZARD ON HARD ROCK	Figure 17



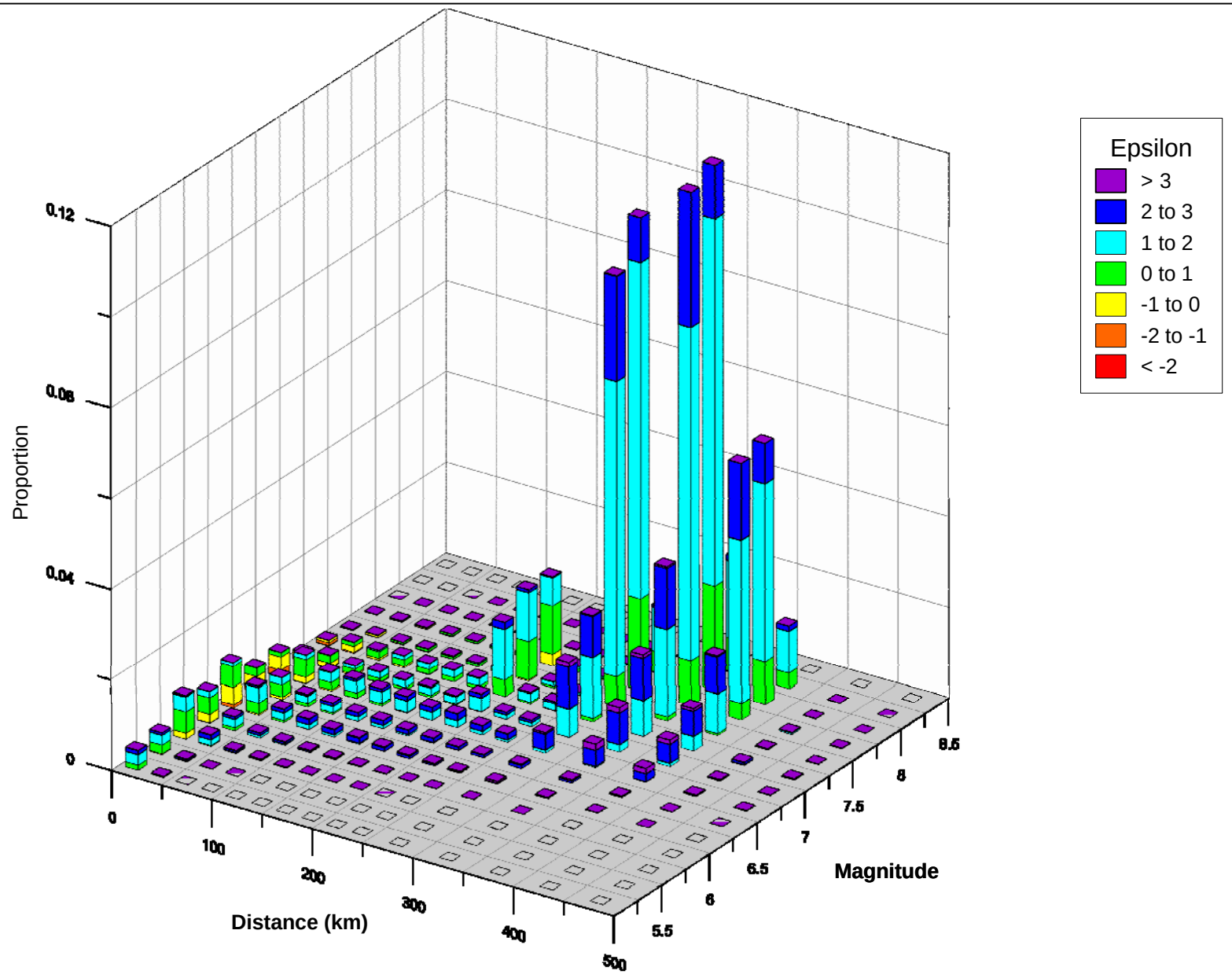
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMIC SOURCE CONTRIBUTIONS TO MEAN 1.0 SEC HORIZONTAL SPECTRAL ACCELERATION HAZARD ON HARD ROCK	Figure 18



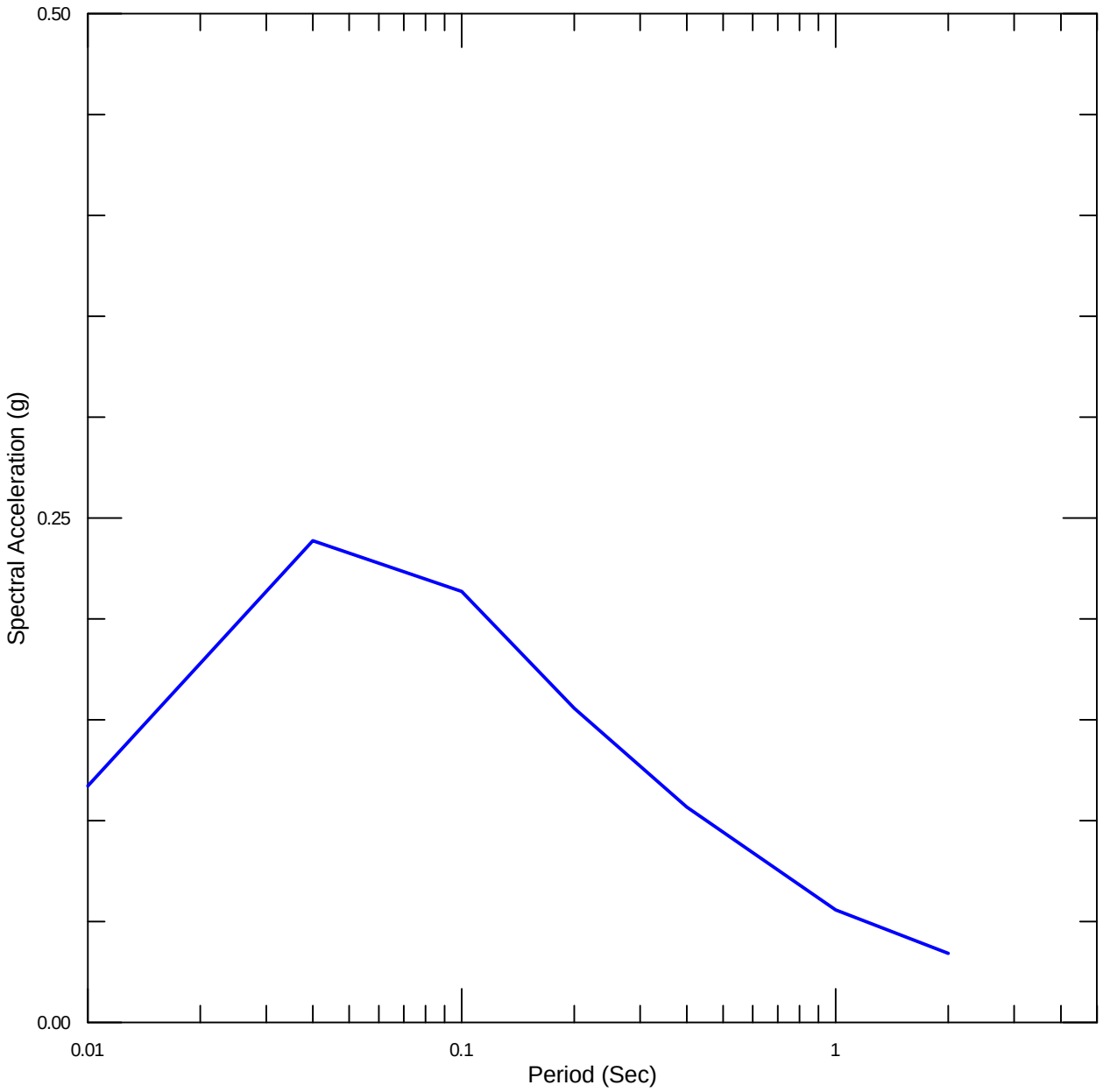
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEISMIC SOURCE FRACTIONAL CONTRIBUTION TO MEAN 1.0 SEC HORIZONTAL SPECTRAL ACCELERATION HAZARD ON HARD ROCK	Figure 19



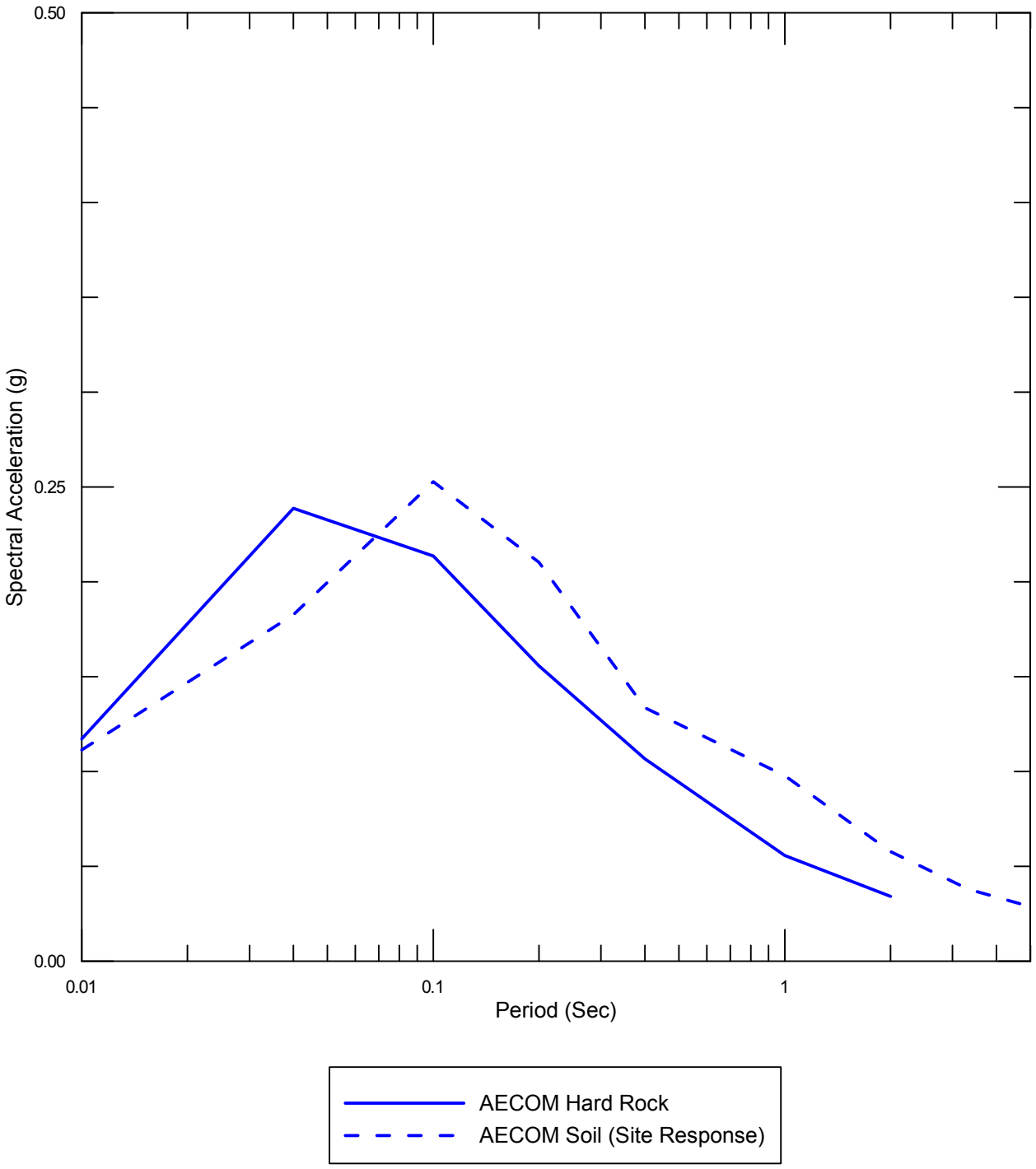
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	MAGNITUDE, DISTANCE AND EPSILON CONTRIBUTIONS TO THE MEAN PEAK HORIZONTAL ACCELERATIONHAZARD AT 2,500-YEAR RETURN PERIOD ON HARD ROCK	Figure 20



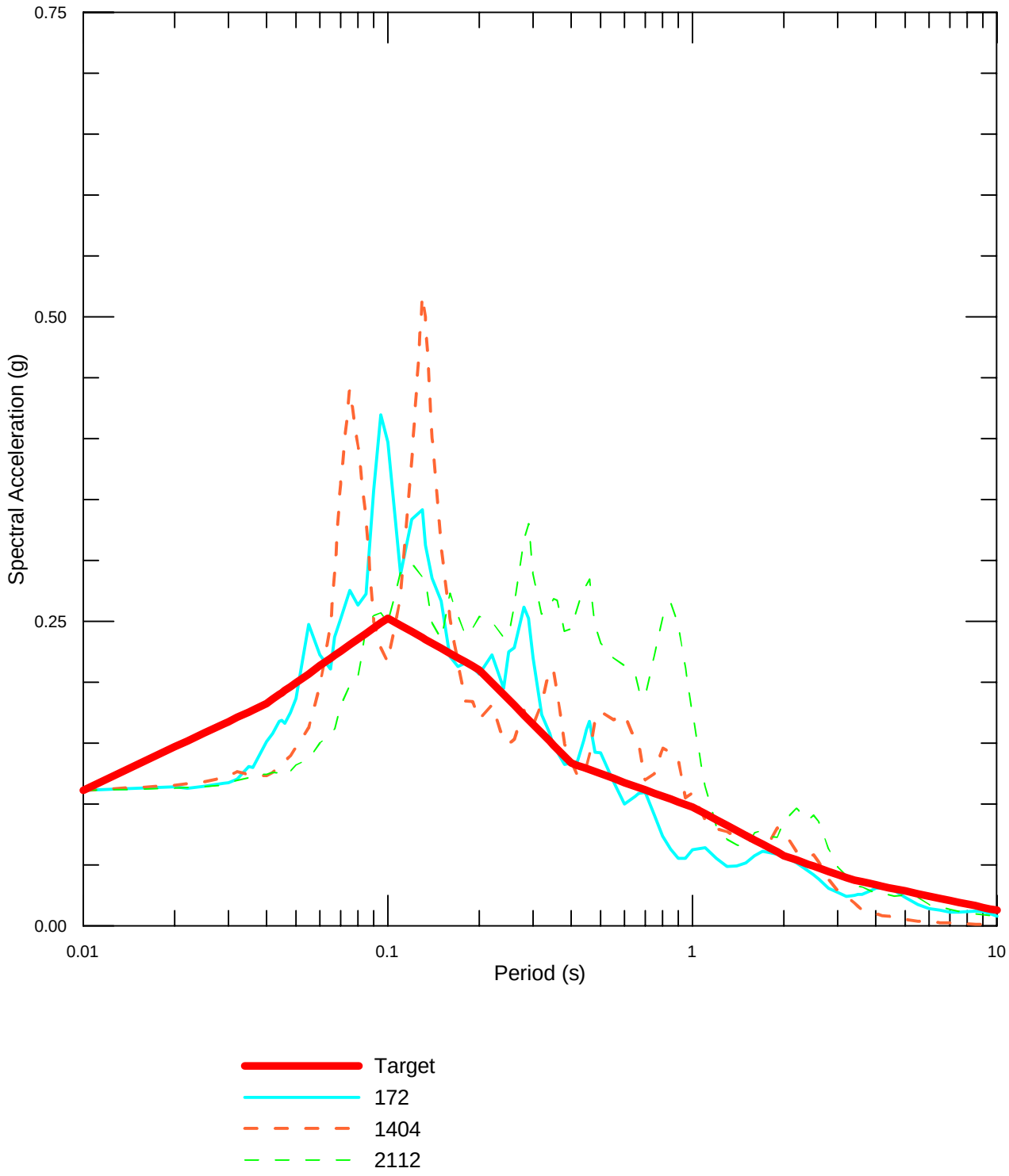
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	MAGNITUDE, DISTANCE AND EPSILON CONTRIBUTIONS TO THE MEAN 1.0 SEC HORIZONTAL SPECTRAL ACCELERATIONHAZARD AT 2,500-YEAR RETURN PERIOD ON HARD ROCK	Figure 21



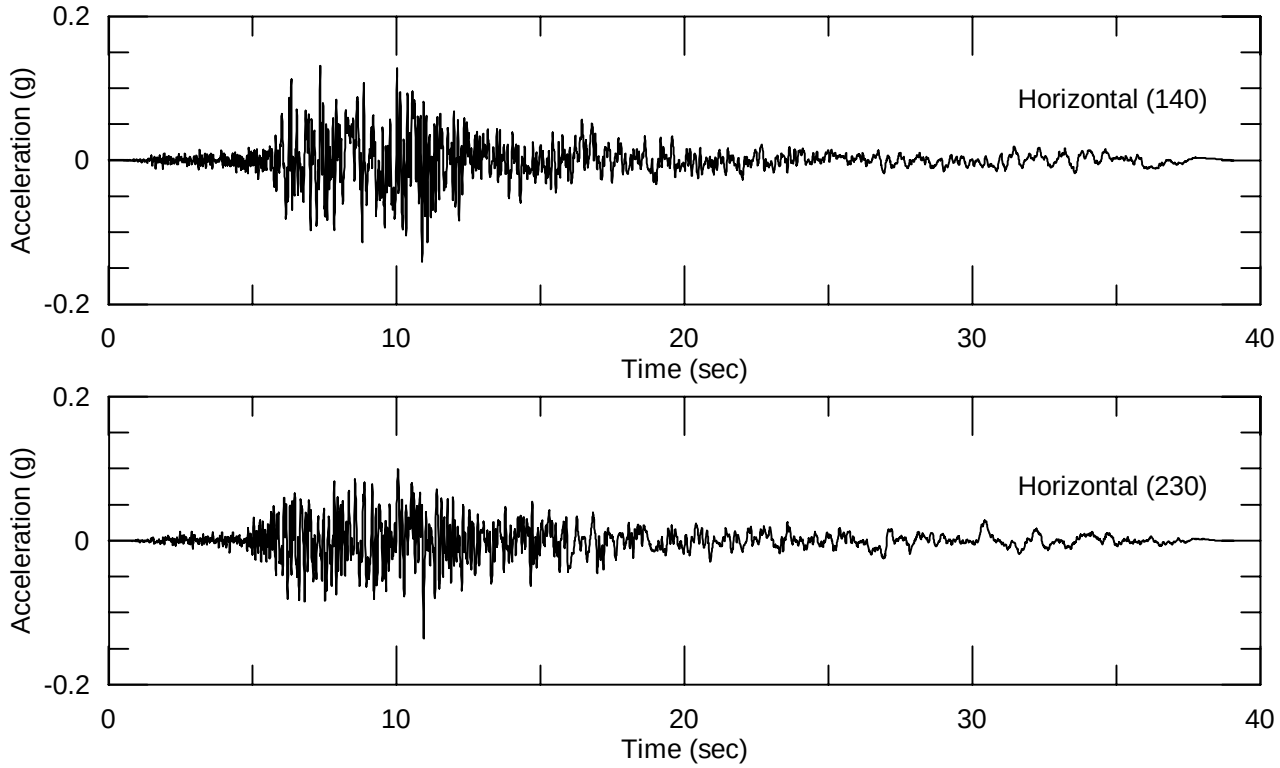
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	HORIZONTAL 5%-DAMPED MEAN UNIFORM HAZARD RESPONSE SPECTRA AT 2,500-YEAR RETURN PERIOD	Figure 22



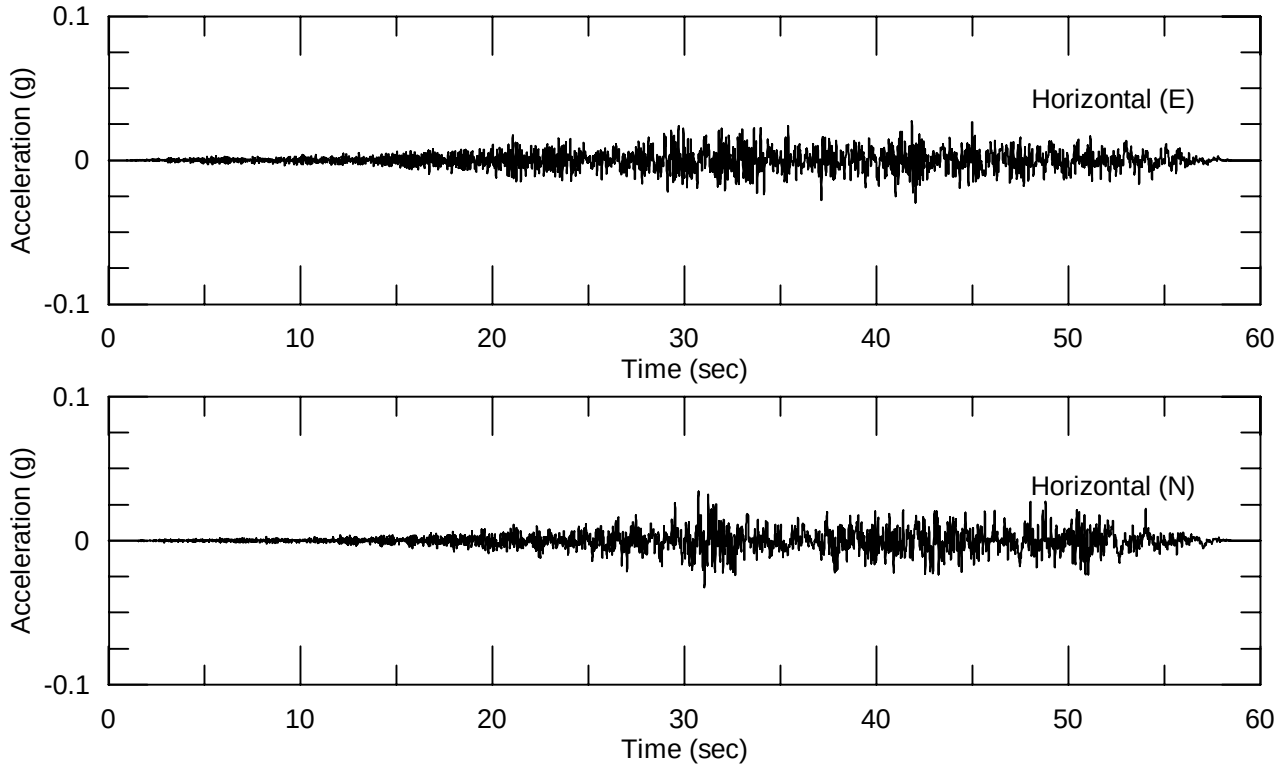
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	HORIZONTAL 5%-DAMPED MEAN UNIFORM HAZARD RESPONSE SPECTRA AT 2,500-YEAR RETURN PERIOD	Figure 23



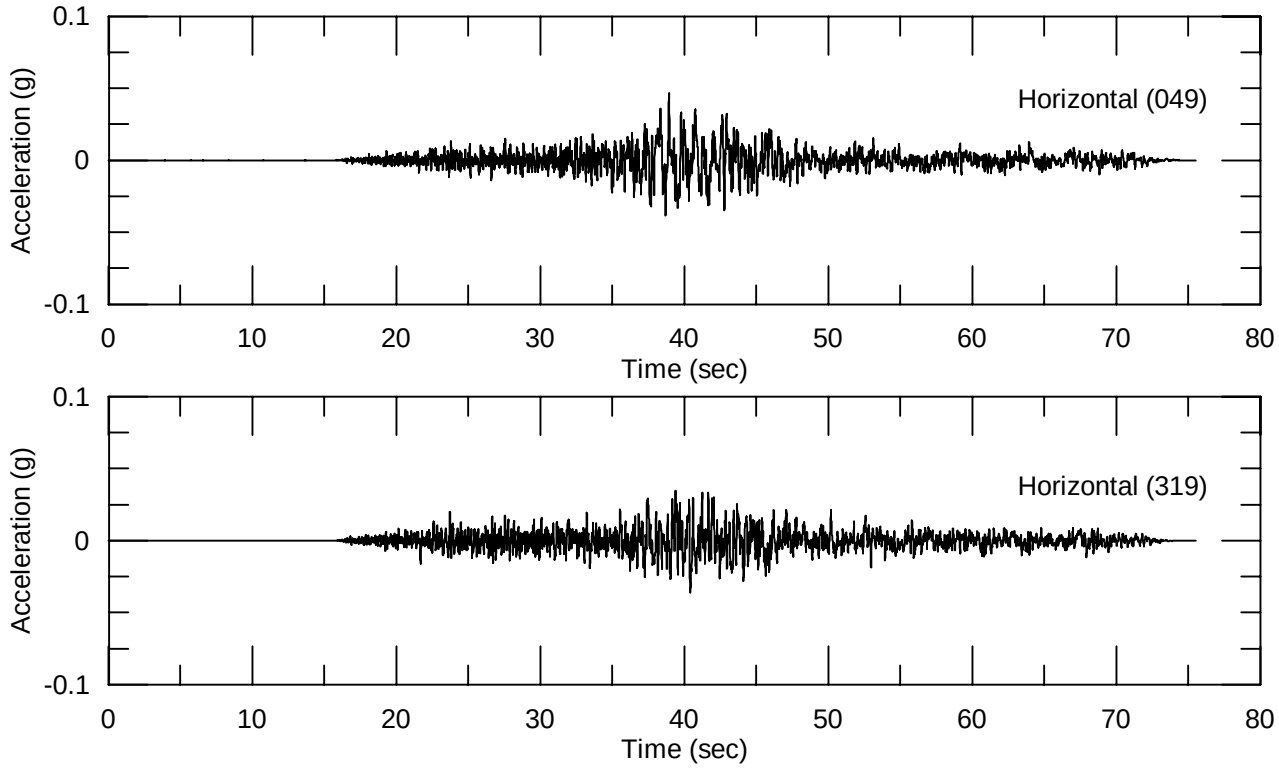
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	HORIZONTAL TARGET AND SELECTED SEED RESPONSE SPECTRA	Figure 24



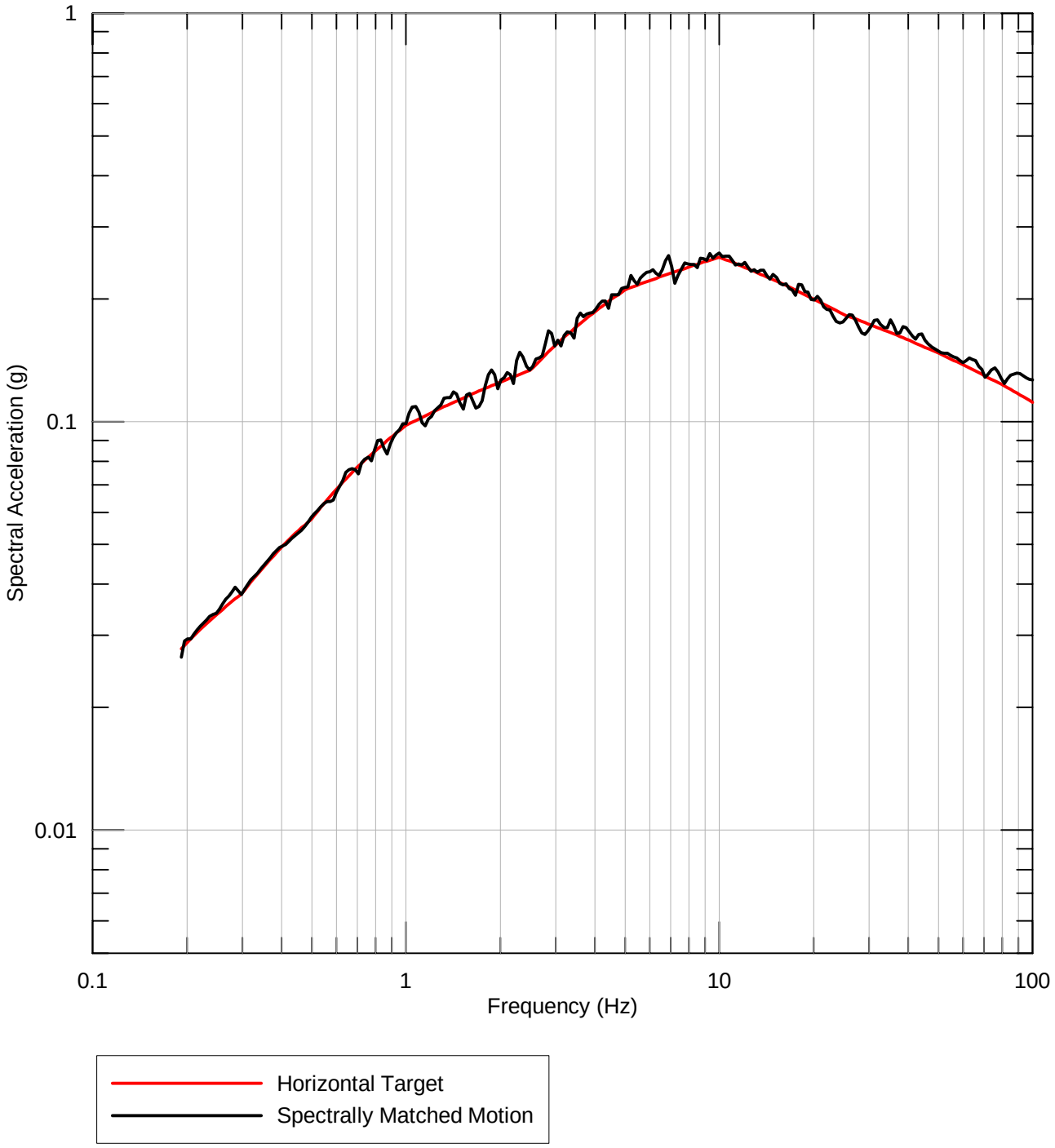
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEED TIME HISTORIES RSN0172 - 1979 IMPERIAL VALLEY EL CENTRO ARRAY #1	Figure 25



AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEED TIME HISTORIES RSN1404 - 1999 CHI CHI PNG	Figure 26

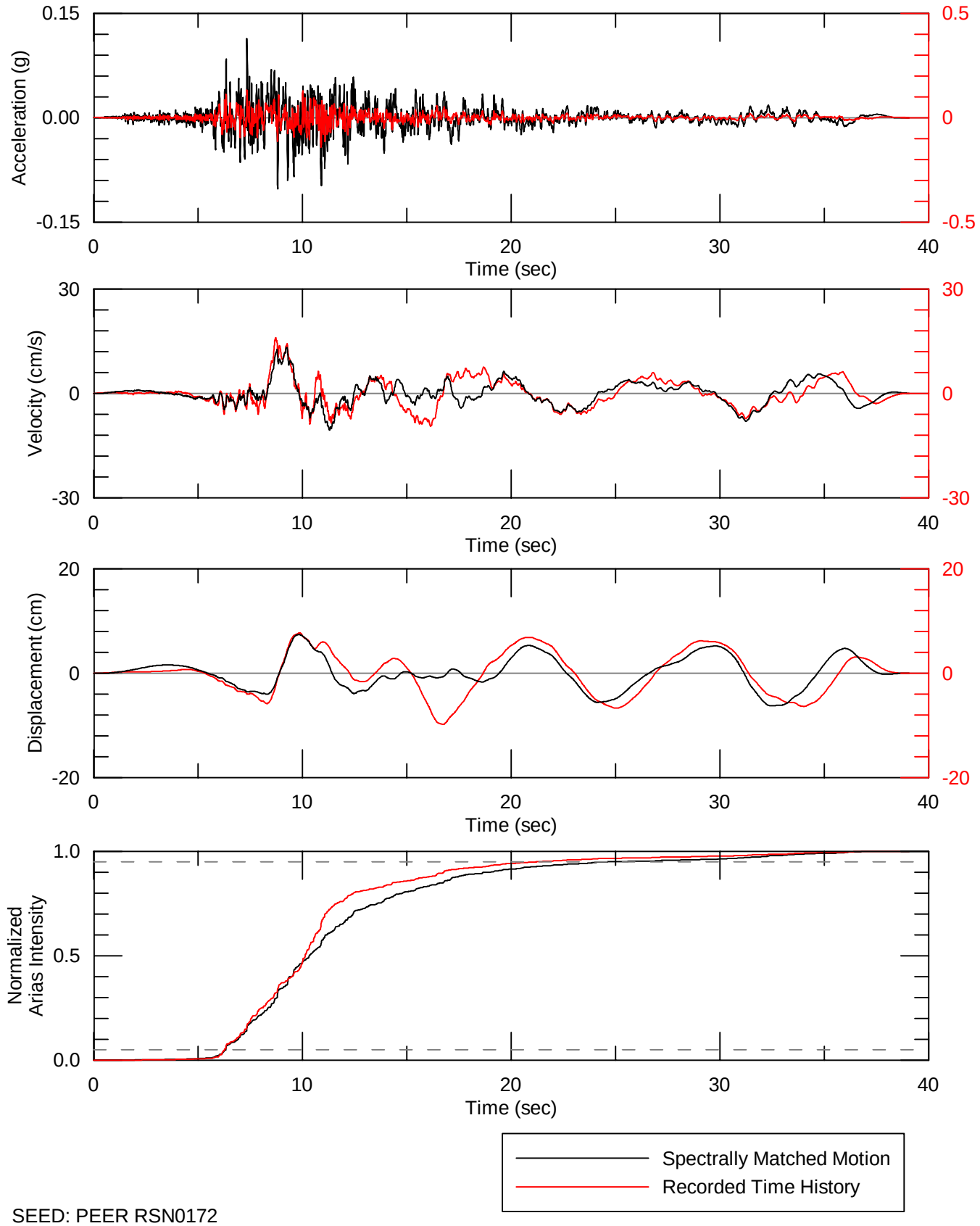


AECOM	Project No. 60440697 Kincaid Power Station Dynegy	SEED TIME HISTORIES RSN2112 - 2002 DENALI TAPS PUMP STATION #08	Figure 27



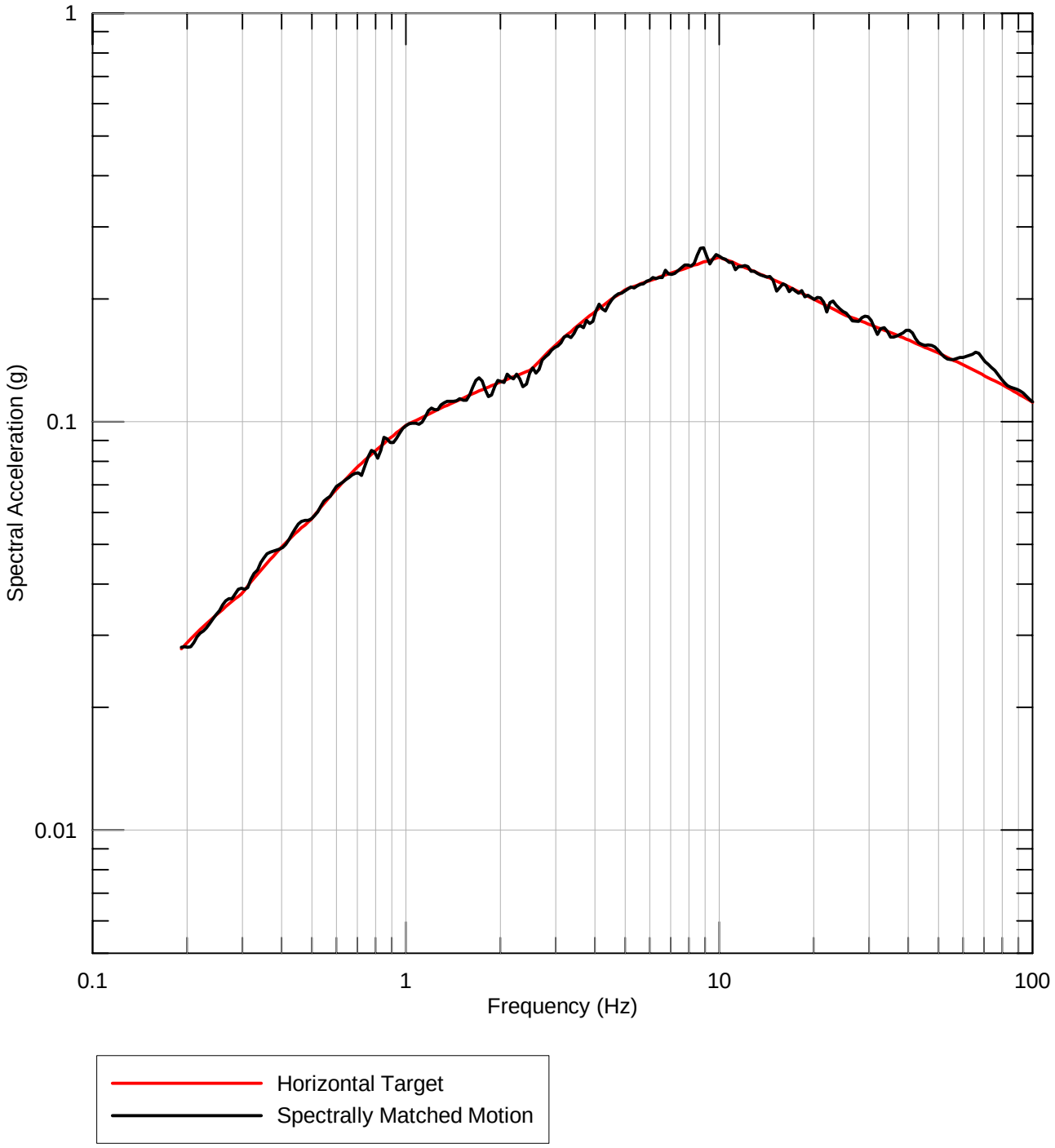
SEED: PEER RSN0172

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	RESPONSE SPECTRA FOR TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1979 IMPERIAL VALLEY - ECA #1 (140) SEED	Figure 28



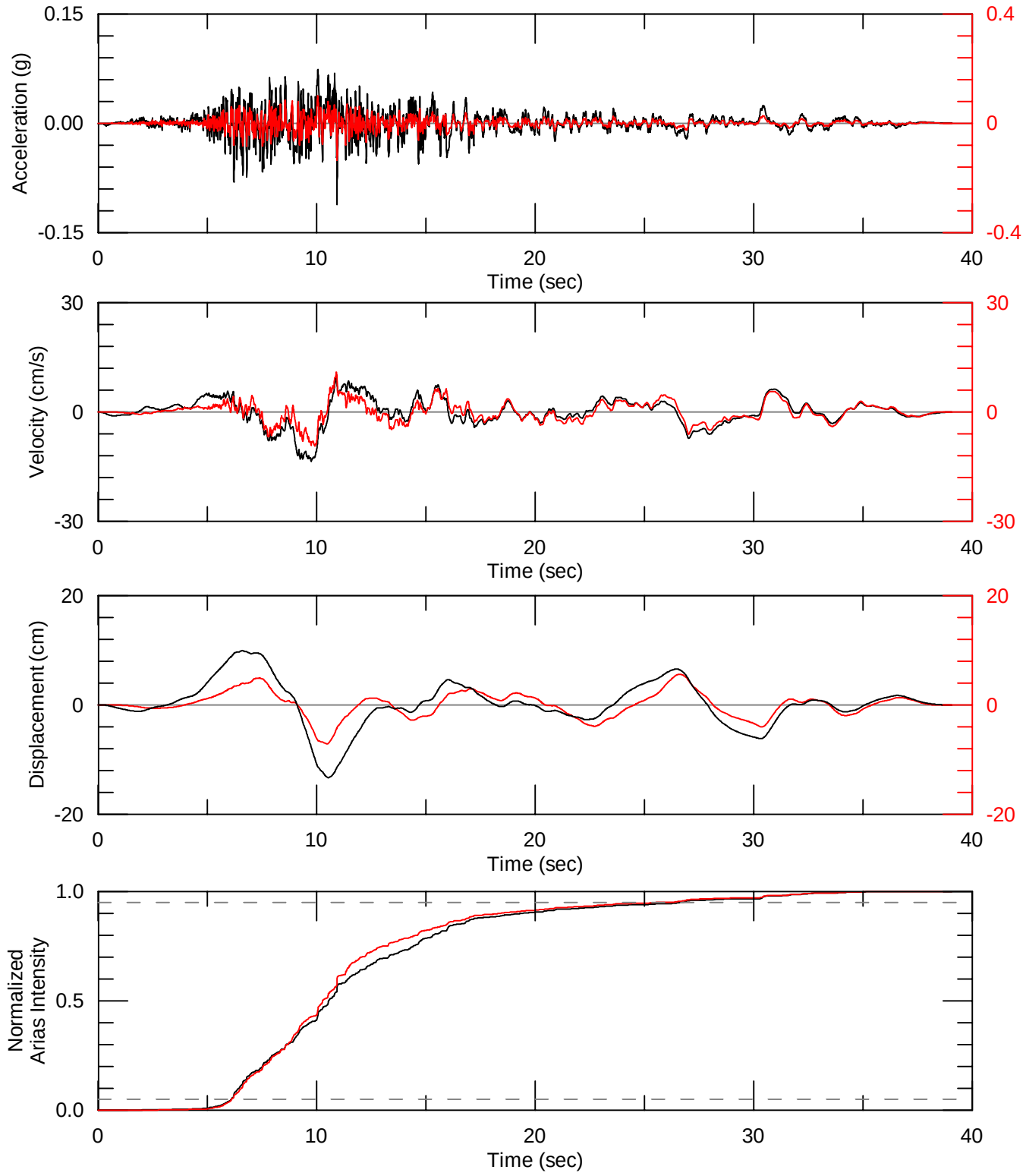
SEED: PEER RSN0172

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1979 IMPERIAL VALLEY - ECA #1 (140) SEED	Figure 29



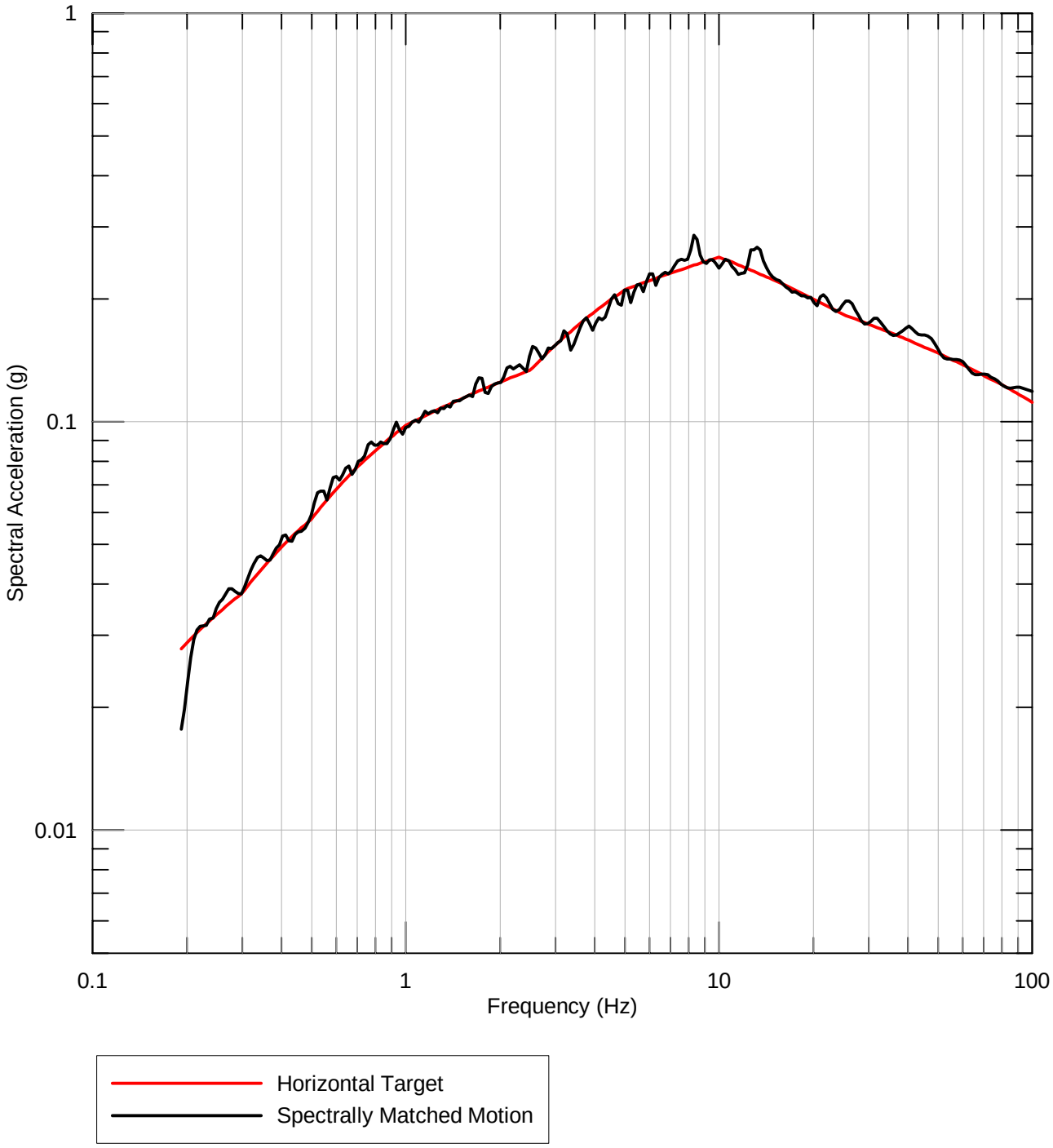
SEED: PEER RSN0172

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	RESPONSE SPECTRA FOR TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1979 IMPERIAL VALLEY - ECA #1 (230) SEED	Figure 30



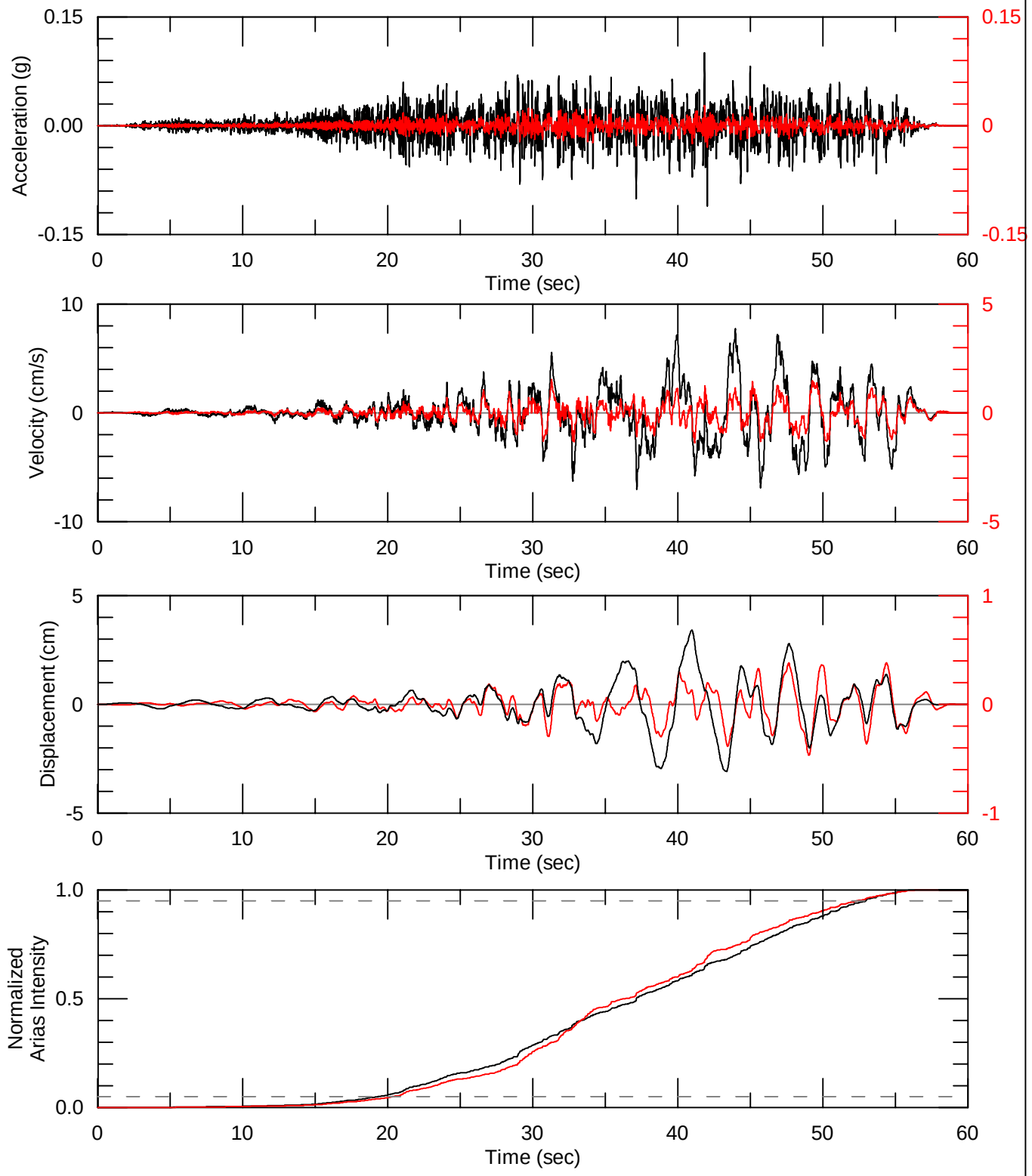
SEED: PEER RSN0172

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1979 IMPERIAL VALLEY - ECA #1 (230) SEED	Figure 31



SEED: PEER RSN1404

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	RESPONSE SPECTRA FOR TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1999 CHI CHI - PNG (E) SEED	Figure 32

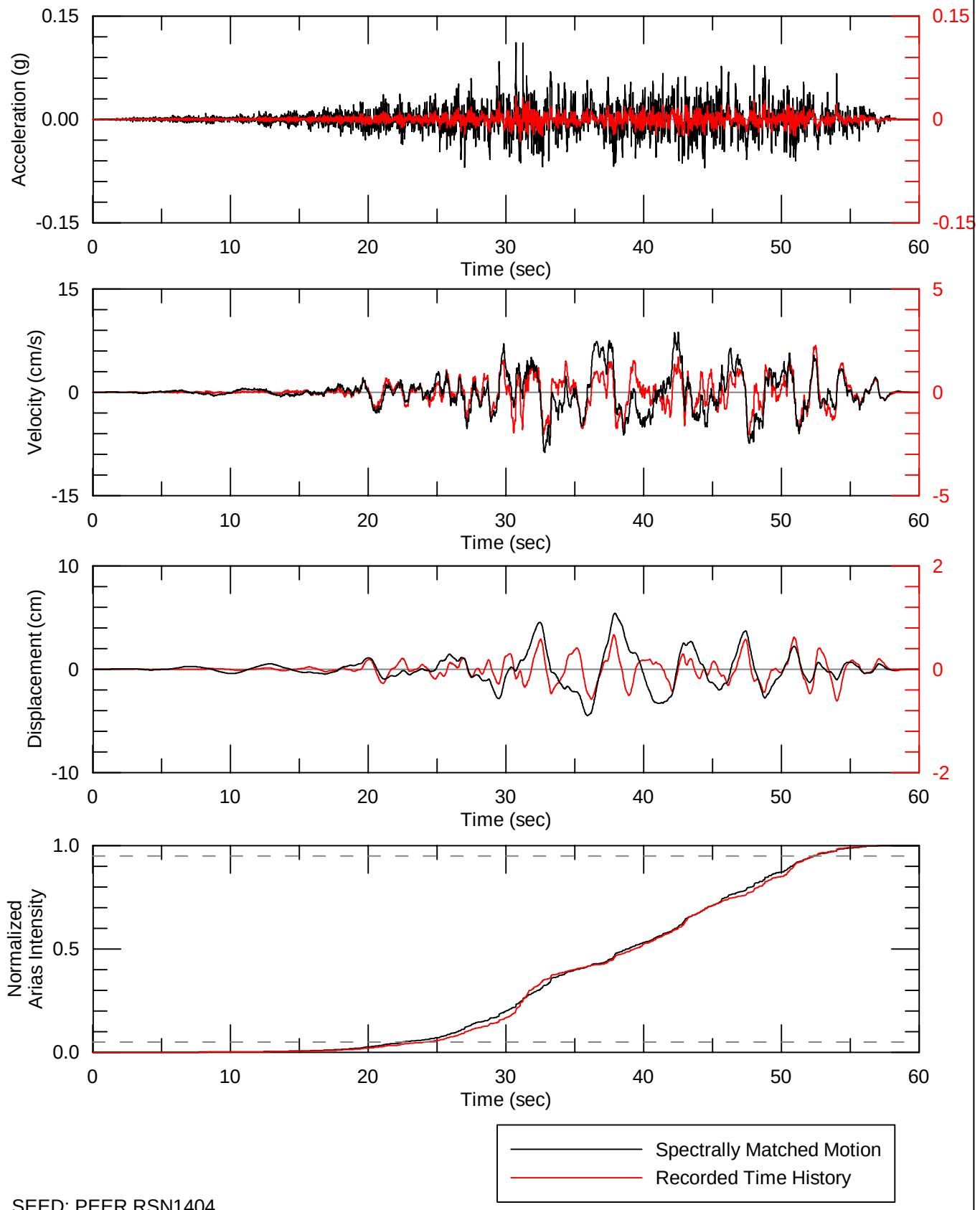


SEED: PEER RSN1404

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1999 CHI CHI - PNG (E) SEED	Figure 33

SEED: PEER RSN1404

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	RESPONSE SPECTRA FOR TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1999 CHI CHI - PNG (N) SEED	Figure 34



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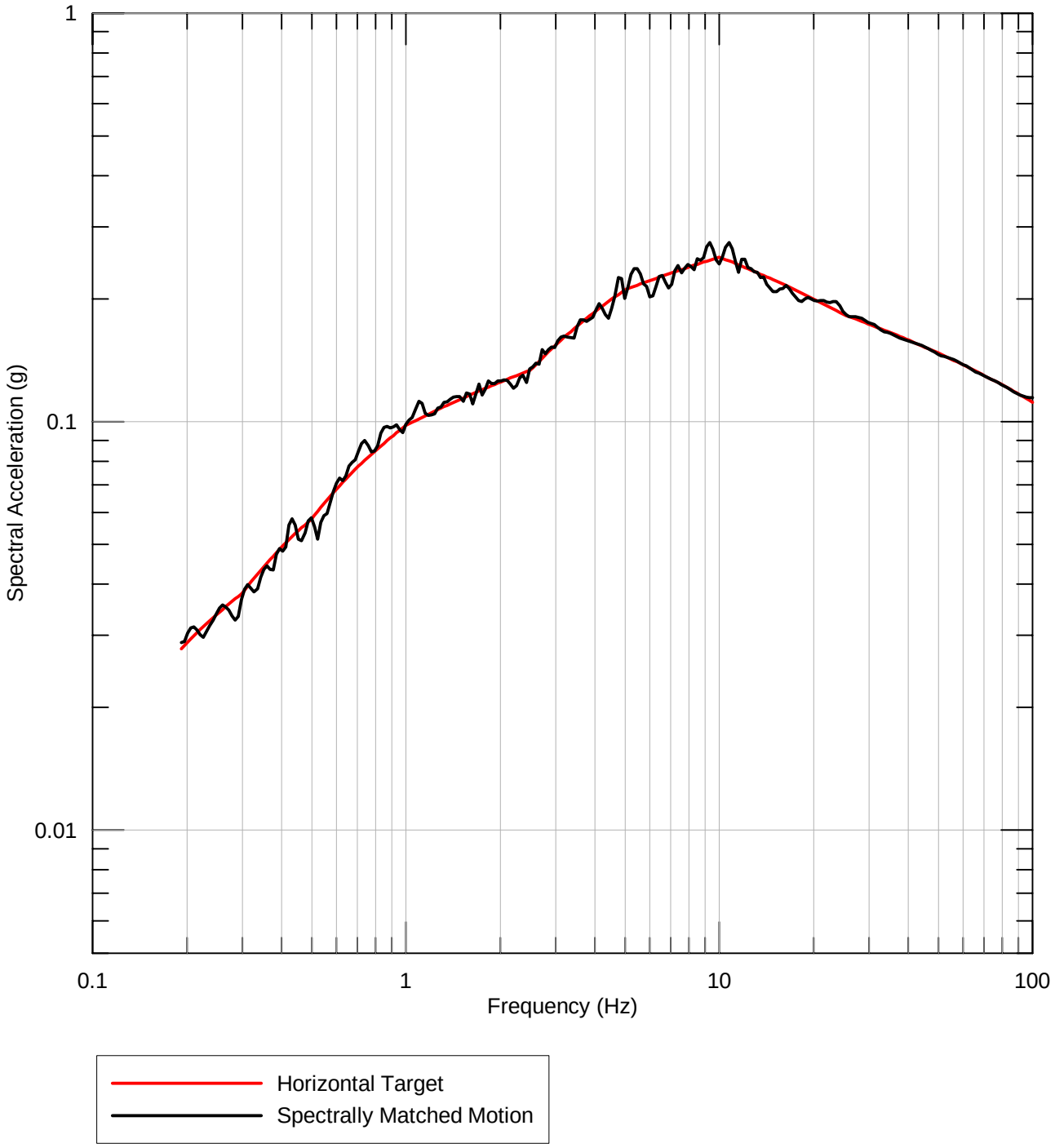
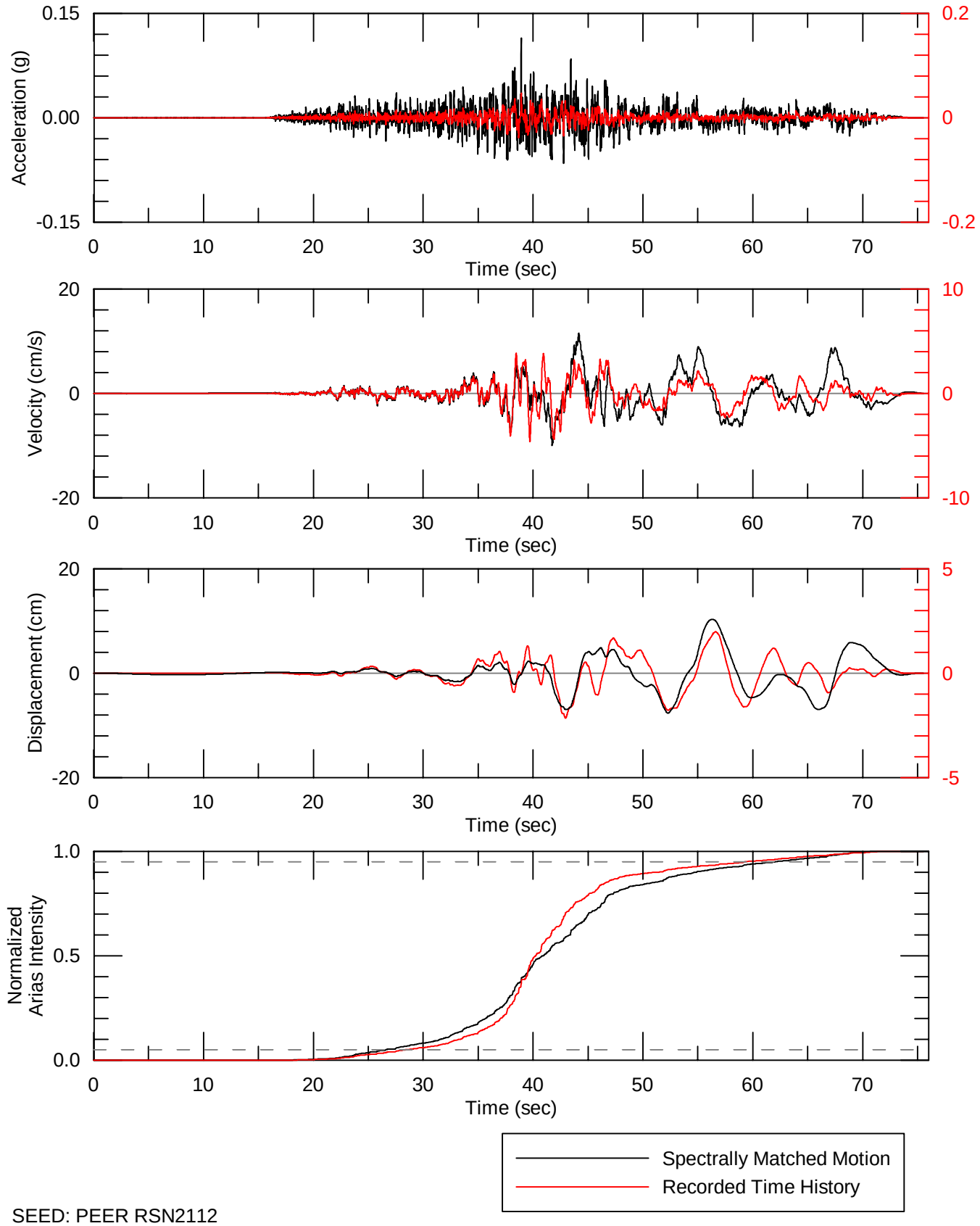
AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1999 CHI CHI - PNG (N) SEED	Figure 35



SEED: PEER RSN2112

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	RESPONSE SPECTRA FOR TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 2002 DENALI - TAPS PUMP STATION #8 (049) SEED	Figure 36

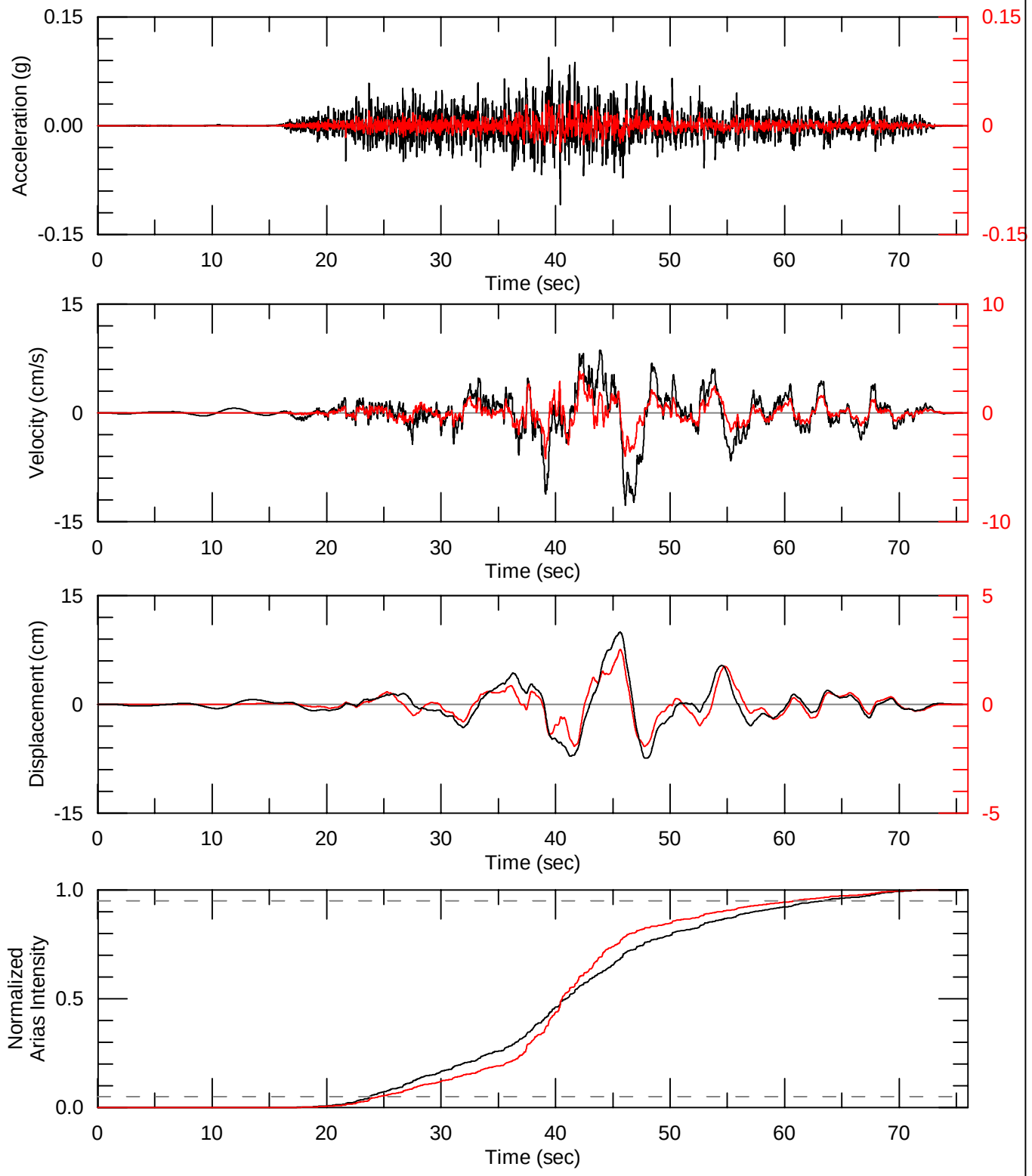


SEED: PEER RSN2112

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 2002 DENALI - TAPS PUMP STATION #8 (049) SEED	Figure 37

SEED: PEER RSN2112

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	RESPONSE SPECTRA FOR TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 2002 DENALI - TAPS PUMP STATION #8 (319) SEED	Figure 38



SEED: PEER RSN2112

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 2002 DENALI - TAPS PUMP STATION #8 (319) SEED	Figure 39

Attachment K. Dynamic Response Analysis Calculations

AECOM

QMS Form 3-3 (MM)
Rev. 2013 QMS
Date: 28 Feb 2013

IE QMS - Americas | **Detail Check - Calculations**

Project Name	Dynegy CCR Management Program	**Client**	Dynegy, Inc.
Project Location	Kincaid, Christian County, Illinois	**PM**	Eric Glazier
Project Number	60480698	**PIC**	Vic Modeer

IDENTIFYING INFORMATION

(This section is to be completed by the Originator.)

Calculation Medium: *(Select as appropriate)*
☒ Electronic
☒ Hard-copy

File Name: Kincaid Dynamic Response.docx
Unique Identification: N/A
Number of pages *(including cover sheet)*: 6 plus attachments

Discipline:	Geotechnical
Title of Calculation:	Kincaid Dynamic Response Analysis
Calculation Originator:	Tiffany Adams
Calculation Contributors:	
Calculation Checker:	Masood Kafash

DESCRIPTION & PURPOSE

See attached.

BASIS / REFERENCE / ASSUMPTIONS

See attached.

ISSUE / REVISION RECORD

Checker comments, if any, provided on: ☐ hard-copy ☐ electronic file ☐ Form 3-5

No.	Description	P	S	F	Originator Initials	Date	Checker Initials	Date
0	Initial Issue	☐	☐	☑	TEA	1/28/16	MHK	1/28/16
1	Revised elevations	☐	☑	☐	TEA	2/5/16	KR	2/10/16
2		☐	☐	☐				
3		☐	☐	☐				

For a given Revision, indicate either P (Preliminary), S (Superseding) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

APPROVAL and DISTRIBUTION

☐ The below individuals assert that the Detail Check – Calculations is complete.

Originator Signature	Date: 1/28/16
Checker Signature	Date: 1/28/16 / 2/10/16
Project Manager (or Designee) Signature	Date: January 28, 2016

Distribution:

Project Central File – Quality File Folder
Other – Specify: Enter names here.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Dynamic Response Analysis | Project Name: Dynegy CCR

By: Tiffany Adams Date: 01/28/2016 | Project No: 60480698

Checked By: Masood Kafash Date: 01/28/2016 | Task No.: 01

Objective

The purpose of this calculation is to perform 2-D site response analyses using the QUAD4M software program to estimate the seismic loads under the design, 2,500-year event.

Given:

- QUAD4TB, QUAD4MU, "A computer Program to Evaluate Seismic Response of Soil Structures Using Finite Element Procedures Incorporating a Compliant Base." Hudson, M., Idriss, I.M., and Beikae, M.
- Model geometry and material densities for Stations 48+50, 63+00, 94+50
- Shear wave velocity testing from the CPT investigations
- Earthquake motions developed through seismic hazard analysis

APPROACH AND ASSUMPTIONS:

The goal of this study is to estimate the peak ground surface accelerations (PGA) at the dam crest and the dam toe at the Kincaid Ash Pond. These PGA values will be used as inputs to define the seismic load for the simplified liquefaction triggering evaluation and to estimate a site-specific seismic coefficient for use in the seismic stability analyses (presented under separate cover) . In addition, the earthquake induced cyclic stress ratios at Station 48+50 were estimated to allow for a more refined assessment of the liquefaction triggering potential at this section. Analyses were performed by using QUAD4M software program for the cross-sections at Station 48+50, 63+00, and 94+50 . Figure 1 provides an approximate location of each section. The general geometry of each of above mentioned cross sections are provided in Attachment A.

Earthquake motions have been developed for the Kincaid Ash Pond as part of the 2016 seismic hazard analysis for the top of the glacial till layer underneath the dam (Vs = 2,200 ft/sec). Appendix B provides a summary and a comparison of the characteristics of above mentioned time histories. Cross sections, material properties and pore pressures used in analysis are mainly based and selected from slope stability analysis.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Dynamic Response Analysis

Project Name: Dynegy CCR

By: Tiffany Adams Date: 01/28/2016

Project No: 60480698

Checked By: Masood Kafash Date: 01/28/2016

Task No.: 01

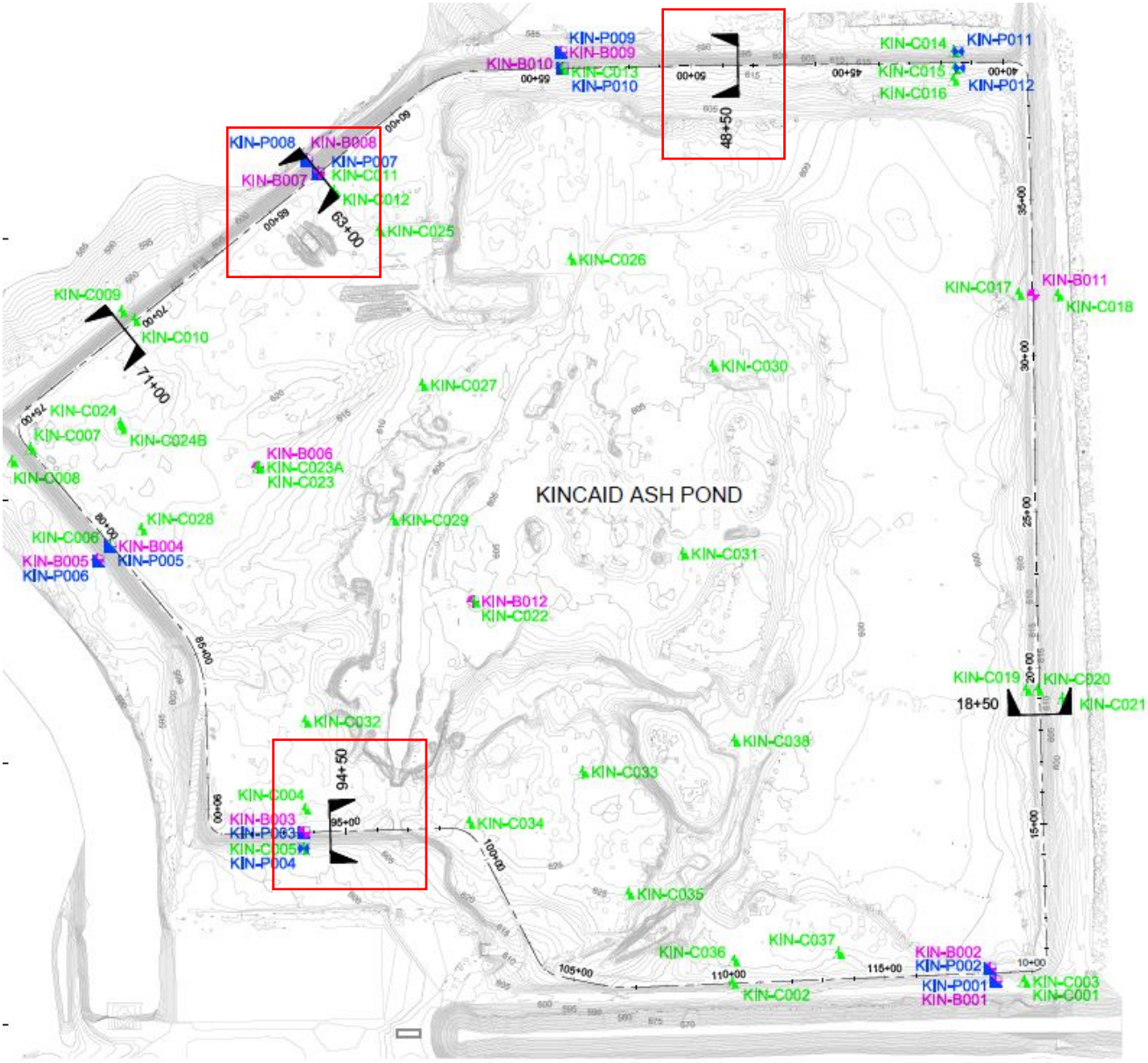


Figure 1. Location of QUAD4 Analysis Sections

Methodology

Due to the size and complexity of the section model, it is not practical to create a model mesh by hand. For time and practicality sake we used the FLAC program to develop the mesh and input properties under gravity at an elastic condition. A FLAC model

for each section was developed and used. FISH and utility functions were used to convert the FLAC Model mesh and properties to the correct format for input into QUAD4.

Cross section

As discussed before, three cross sections developed in limit equilibrium slope stability analysis were used in site response analysis. In general cross sections have been developed based on the,2015 CPT soundings as discussed in the analysis section development calculation package. The QUAD4 model geometry was extended slightly into the glacial till layer, (Vs of 22000 ft/sec), as the earthquake motions have been developed as outcrop motion for the top of till.

Material Properties:

Elastic material properties including shear and bulk modulus of material are needed for QUAD4 analyses. The following provides a summary of parameters used in the analysis.

Shear stiffness parameters

Maximum shear modulus (Gmax) represents the stiffness of a material at very small strain levels. Shear modulus equation proposed in this table are based on a fit to the shear wave velocities obtained from CPT soundings.

Average shear wave velocities for the embankment, foundation clay, and upper till were calculated based on the shear wave velocity tests in the CPT sounding, and are listed in Table 1. The shear wave velocity in the ash was estimated based on experience with similar bottom ash materials and the shear wave velocity of the soft clay layer was estimated to be the same as the overlying foundation clay layer, consistent with the material characterization for density and drained strength.

.

Shear Modulus and Damping Variations with Strains

As strains increase in the soil mass as a result of the intensity of earthquake shaking, the soils progressively start behaving nonlinearly and show a decrease in shear modulus and an increase in intergranular material damping. The reduction in shear modulus with increasing shear strains are typically normalized with respect to Gmax and expressed as a normalized modulus (G/Gmax) reduction versus strain relationship, which is dependent on the material type.

Vucetic and Dobry modulus and damping curves were selected for use with the clay materials at the site. The PI=15 curve was selected for the embankment and foundation clay based on their average PI values of 18 to 21, as determined from the laboratory testing program. The PI=0 curve was selected for the soft clay/silt/sand material based on the description of this material as being more granular and less plastic than the overlying clay. The EPRI sand curve for depths less than 20ft was selected for the bottom ash material, and Schnabel's curve for weathered rock was selected for the glacial till based on the high stiffness and strength of this material.

Table 1. Elastic material properties

Material	Unit Weight (pcf)	Dynamic Properties	
		Shear Wave Velocity (Vs) and Maximum Shear Modulus (Gmax)	Modulus and Damping Curves
Ash	112	*Vs=700 ft/s* Gmax = 1.7 x 10^6 psf	EPRI Sand (0-20ft), Idriss 1999 Modification
Embankment	135	*Vs=760 ft/s* Gmax = 2.4 x 10^6 psf	Vucetic and Dobry (PI=15)
Foundation Clay	125	*Vs=635 ft/s* Gmax = 1.6 x 10^6 psf	Vucetic and Dobry (PI=15)
Glacial Till	135	*Vs=1540 ft/s* Gmax = 9.9 x 10^6 psf	Schnabel Weathered Rock

Time histories

The Chi-Chi east motion was selected as the most critical motion for use in the QUAD 4 analysis based on the Arias Intensity, duration and specific energy of the 6 ground motions provided with the PSHA. The 2500-yr design event has a PGA (at top of till) of 0.19g and Magnitude of 6.5

FILE LOCATIONS

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RESULTS

Crest and toe acceleration time histories for Station 48+50, 63+00 and 94+50 are provided in attachment C. The peak ground acceleration (PGA) for the acceleration time histories at the crest is 0.20g and the PGA for the acceleration time histories at the dam toe is 018g.These site-specific PGAs are appropriate for use in the simplified liquefaction triggering analysis, and the crest PGA is appropriate for use in determining the appropriate seismic coefficient for use in pseudo-static stability analysis.

A plot of the CSR contours at station 48+50 is provided in Attachment C. The plot shows that CSR values in the potentially liquefiable foundation clay approach 0.3 to 0.4 directly underneath the embankment toe, but fall to less than 0.14 within about 50 upstream and 20ft downstream of the embankment toe.

REFERENCES:

Fast Lagrangian Analysis of Continua (FLAC). Version 7.0 Finite Difference Software, Itasca, 2011.

Vucetic, M. and Dobry, r., 1991, "Effect of Soil Plasticity on Cyclic Response," Journal of Geotechnical Engineering, 117(no. 1): 89-107 .

Electric Power Research Institute (1993). Guidelines for determining design basis ground motions. Palo Alto, California: Electric Power Research Institute, vol. 1-5, EPRI TR-102293.

Schnabel, P. B., Lysmer, J., and Seed, H. B. (1972) " SHAKE: A Computer Program for Earthquake Response Analysis of Horizontally Layered Sites", Report No. UCB/EERC-72/12, Earthquake Engineering Research Center, University of California, Berkeley, December, 102p.

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ATTACHMENTS:

- Attachment A –Cross sections
- Attachment B – time histories
- Attachment C- results.

Calculation Notes

Subject: Kincaid Ash Pond Dynamic Response Analysis

Project Name: Dynegy CCR

By: Tiffany Adams Date: 01/28/2016

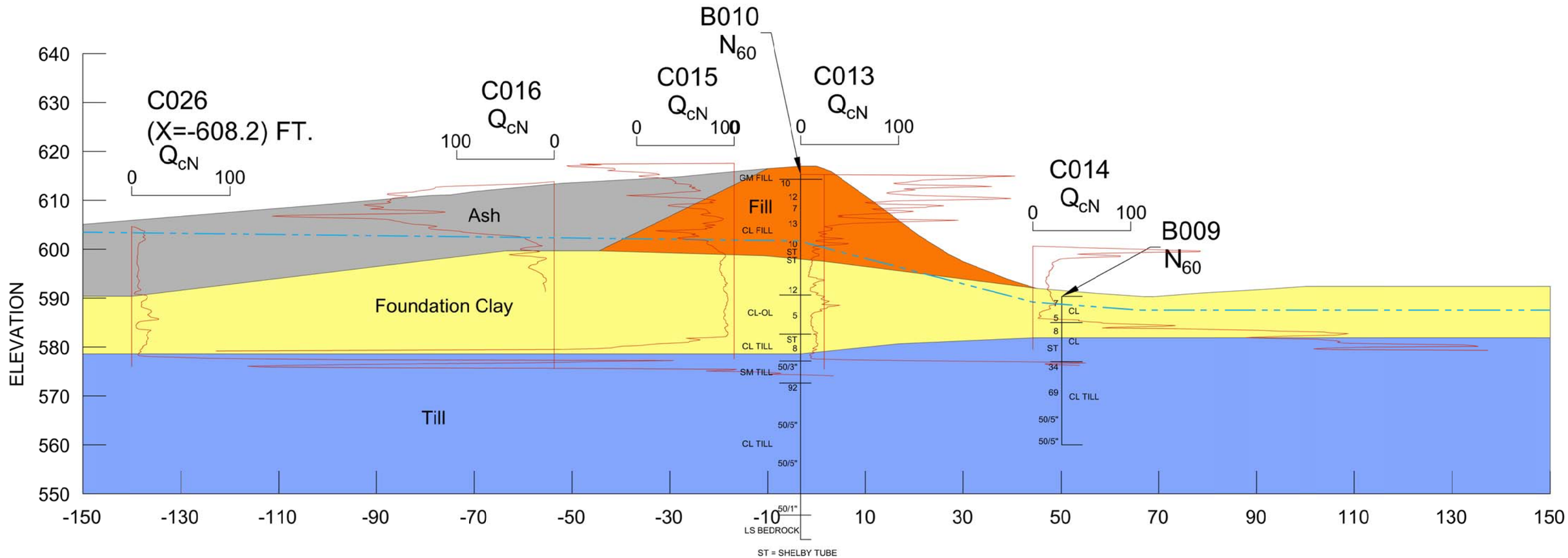
Project No: 60480698

Checked By: Masood Kafash Date: 01/28/2016

Task No.: 01

APPENDIX A

Cross Sections



PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 48+50	FIGURE 5-2
AECOM			

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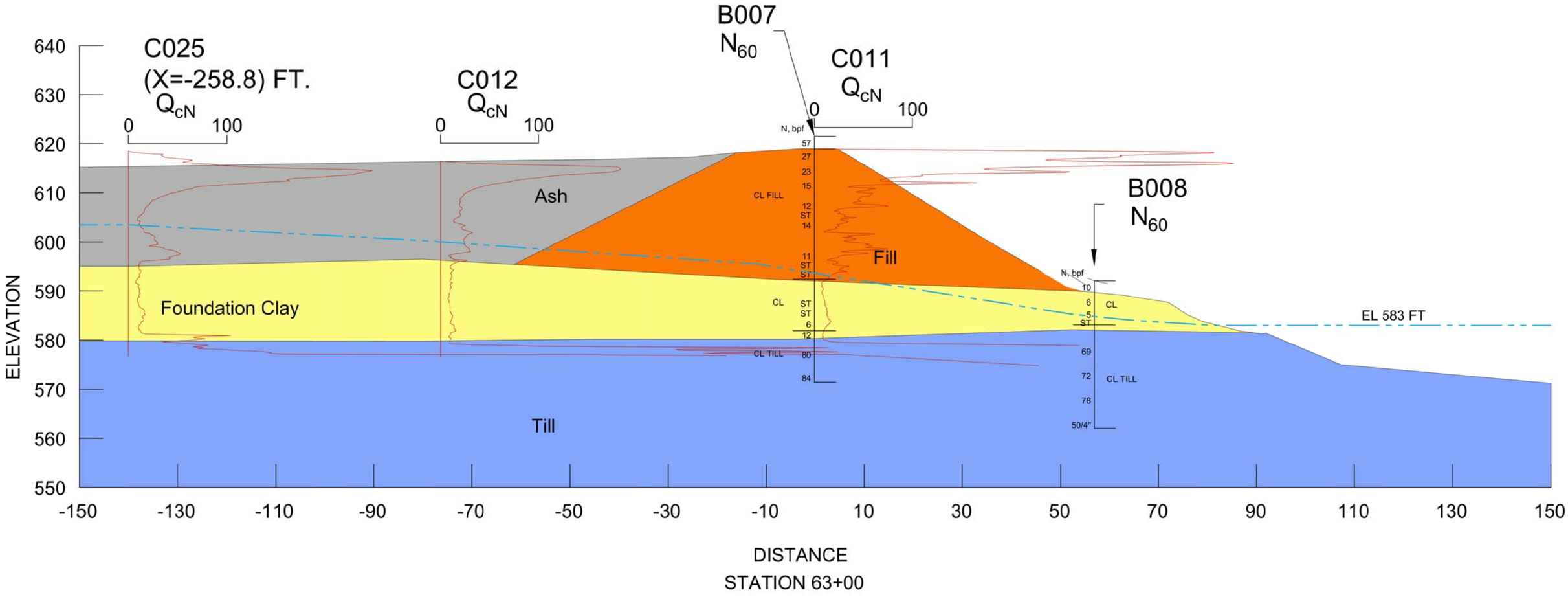

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 63+00	FIGURE 5-3
AECOM			

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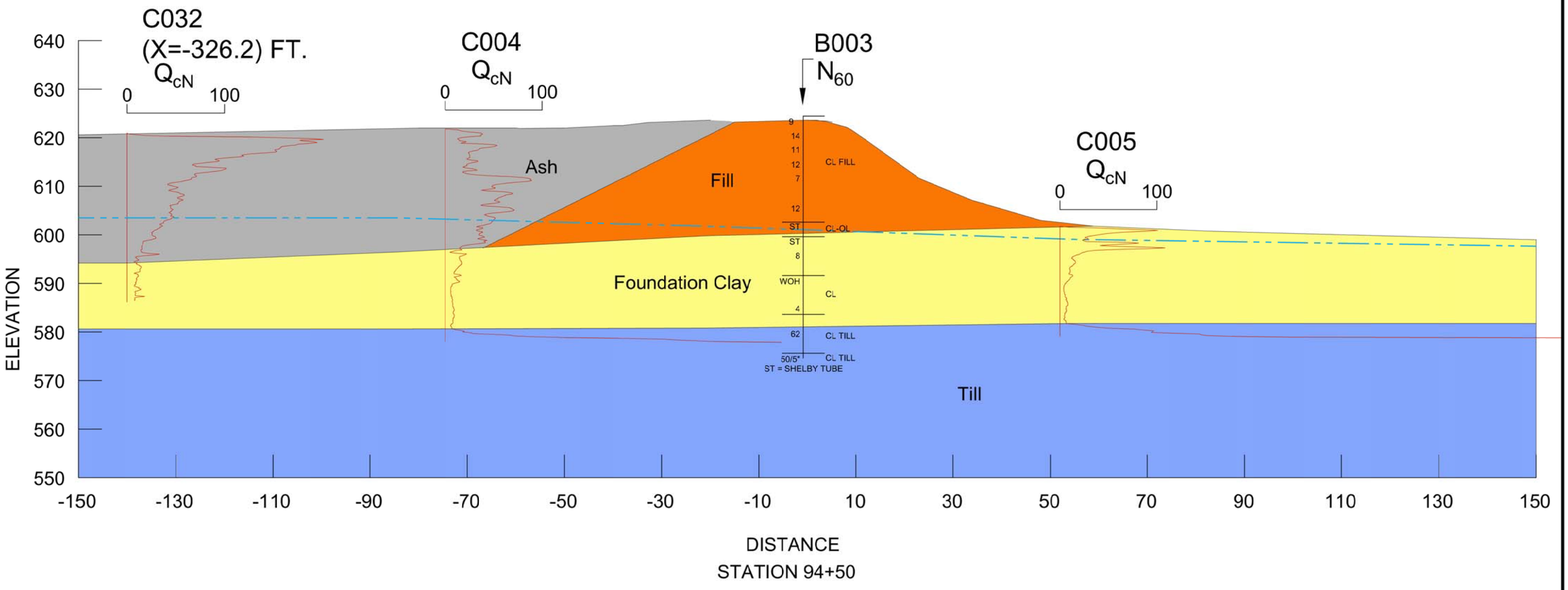

PROJECT NO. 60480698	DYNEGY CCR KINCAID ASH POND	SECTION STATION 94+50	FIGURE 5-5
	AECOM		

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Calculation Notes

Subject: Kincaid Ash Pond Dynamic Response Analysis

Project Name: Dynegy CCR

By: Tiffany Adams Date: 01/28/2016

Project No: 60480698

Checked By: Masood Kafash Date: 01/28/2016

Task No.: 01

APPENDIX B

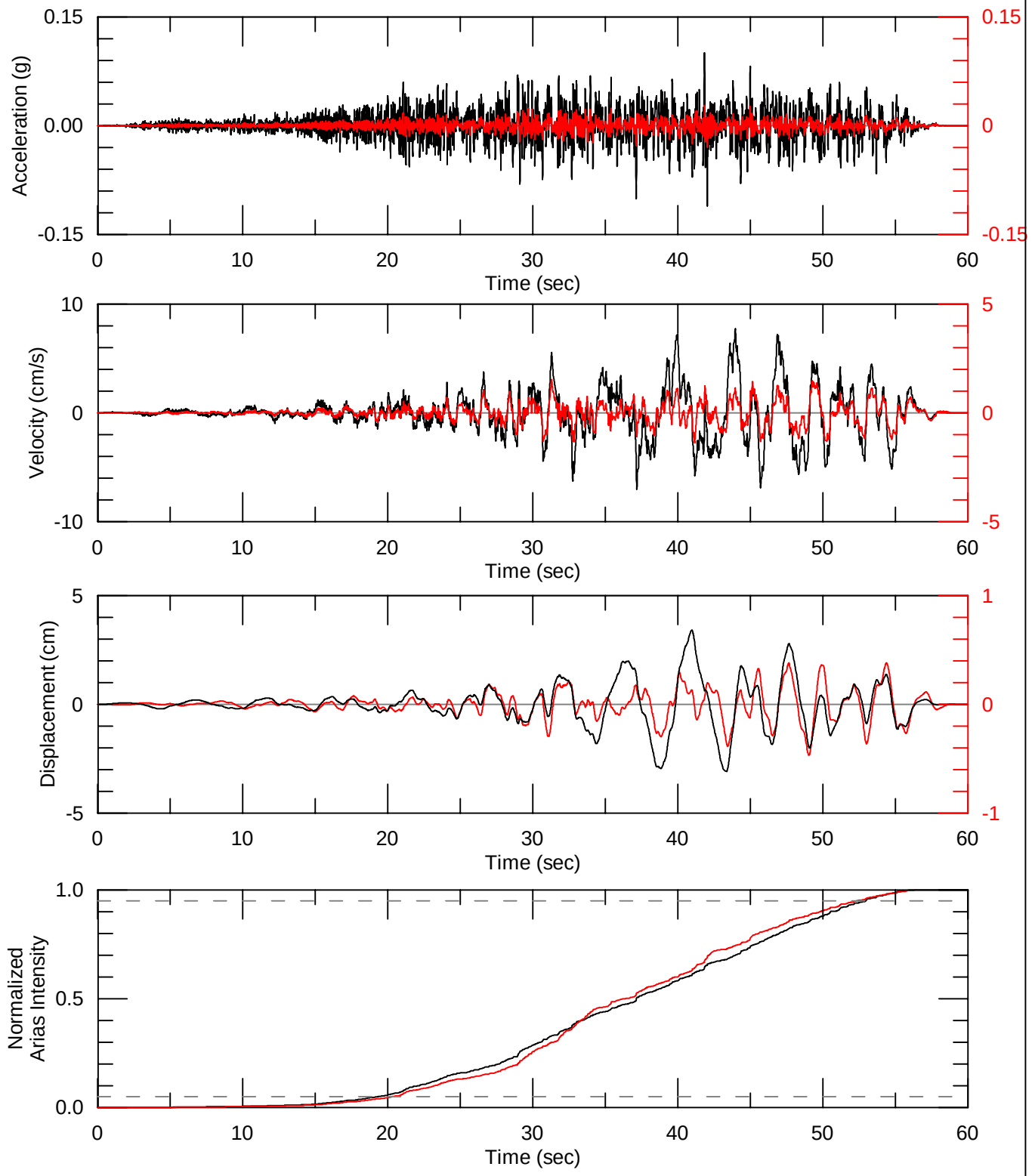
Time Histories

Table 12

Spectrally-Matched Time Histories

Record Sequence Number	Year	Earthquake Name	Station Name	Earthquake Magnitude (M)	ClstD (km)	V_S30 (m/sec)	Comp	PGA(g)	PGV (cm/sec)	PGD (cm)	5-95% AI (m/sec)	5-95% Dur (sec)
172	1979	Imperial Valley	El Centro Array #1	6.5	21.7	237.3	140	0.114	13.15	7.41	0.149	20.39
							230	0.111	13.57	13.30	0.148	20.54
1404	1999	Chi-Chi, Taiwan	PNG	7.6	110.3	465.9	E	0.111	7.74	3.38	0.346	33.60
							N	0.111	8.72	5.41	0.284	29.96
2112	2002	Denali, Alaska	TAPS Pump Station #08	7.9	104.9	424.9	049	0.114	11.51	10.05	0.208	36.71
							319	0.109	12.76	9.96	0.294	39.66

ClstD Closest distance
Comp Component
PGA peak horizontal ground acceleration
PGV peak horizontal ground velocity
PGD peak horizontal ground displacement
AI Arias intensity
Dur Duration



SEED: PEER RSN1404

AECOM	Project No. 60440697 Kincaid Power Station Dynegy	TIME HISTORY SPECTRALLY MATCHED TO 2,500-YEAR RETURN PERIOD UHS HORIZONTAL TARGET 1999 CHI CHI - PNG (E) SEED	Figure 33

Calculation Notes

Subject: Kincaid Ash Pond Dynamic Response Analysis

Project Name: Dynegy CCR

By: Tiffany Adams Date: 01/28/2016

Project No: 60480698

Checked By: Masood Kafash Date: 01/28/2016

Task No.: 01

APPENDIX C

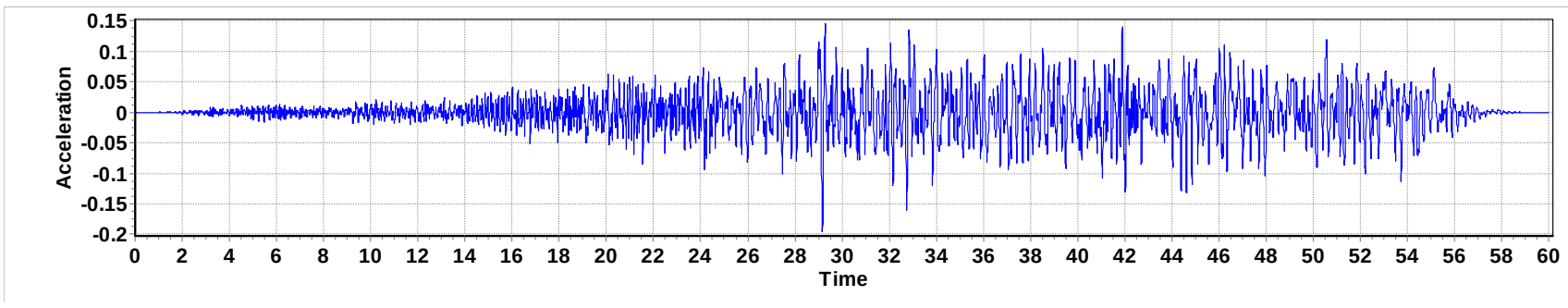
Results

QUAD4 RESULTS – ACCELERATION TIME HISTORIES

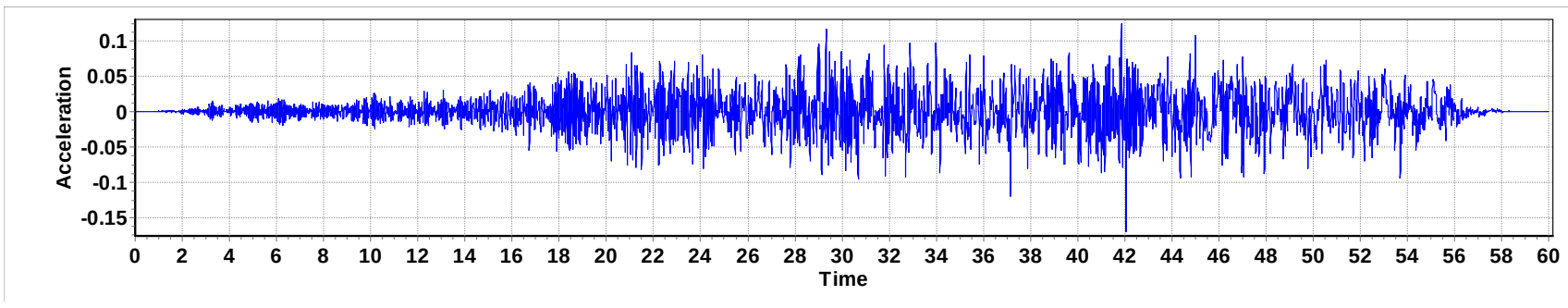
Input Motion: Chi Chi E spectrally matched to 2,500-year event (PGA=0.19g, M=6.5), top of Glacial Till

Station 48+50

Acceleration Time History at the Crest (PGA = 0.20g)

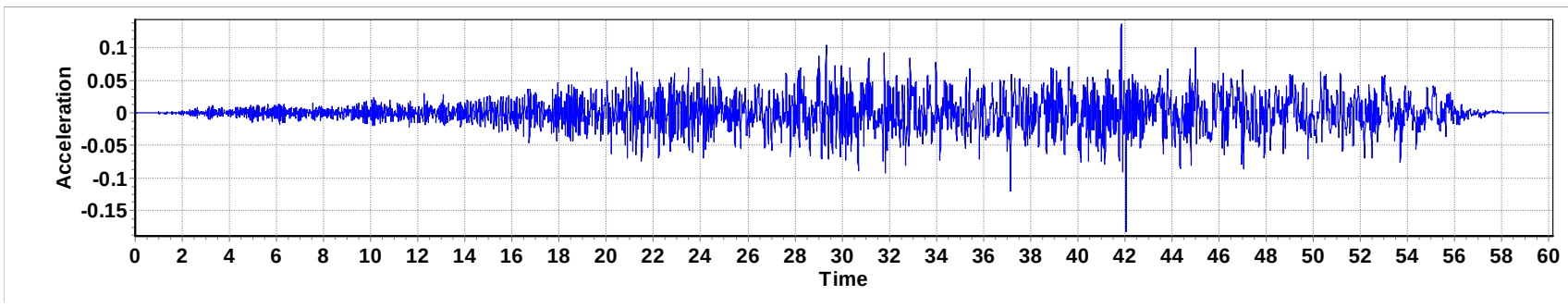


Acceleration Time History at the Toe(PGA = 0.17g)

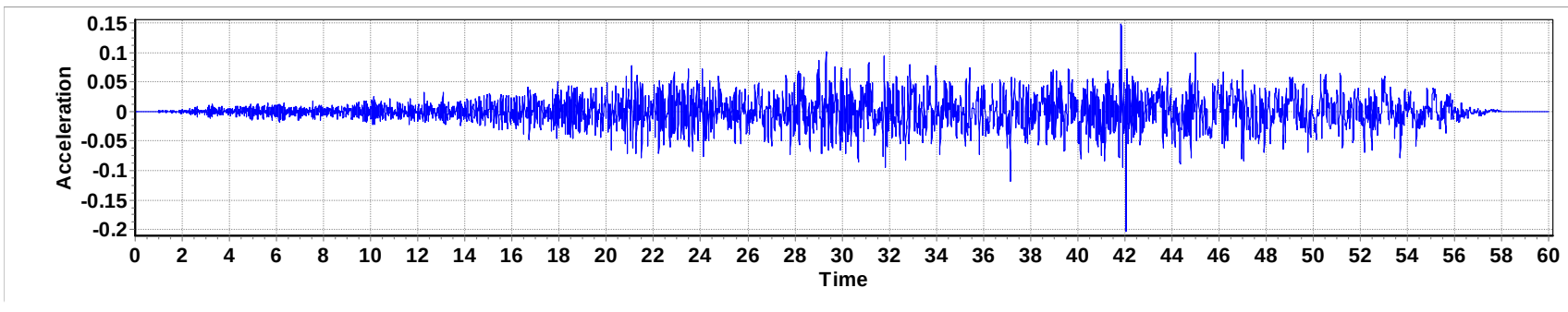


Station 63+00

Acceleration Time History at the Crest (PGA = 0.18g)

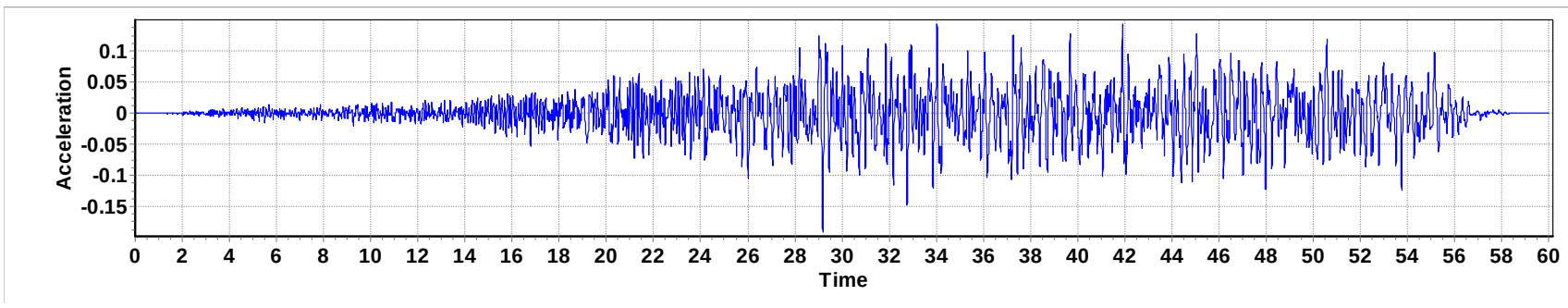


Acceleration Time History at the Toe (PGA = 0.20g)

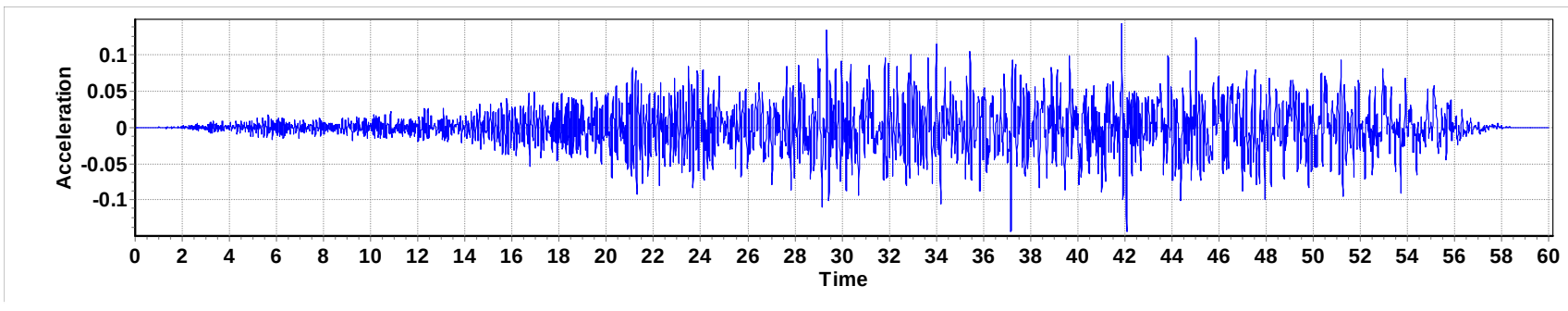


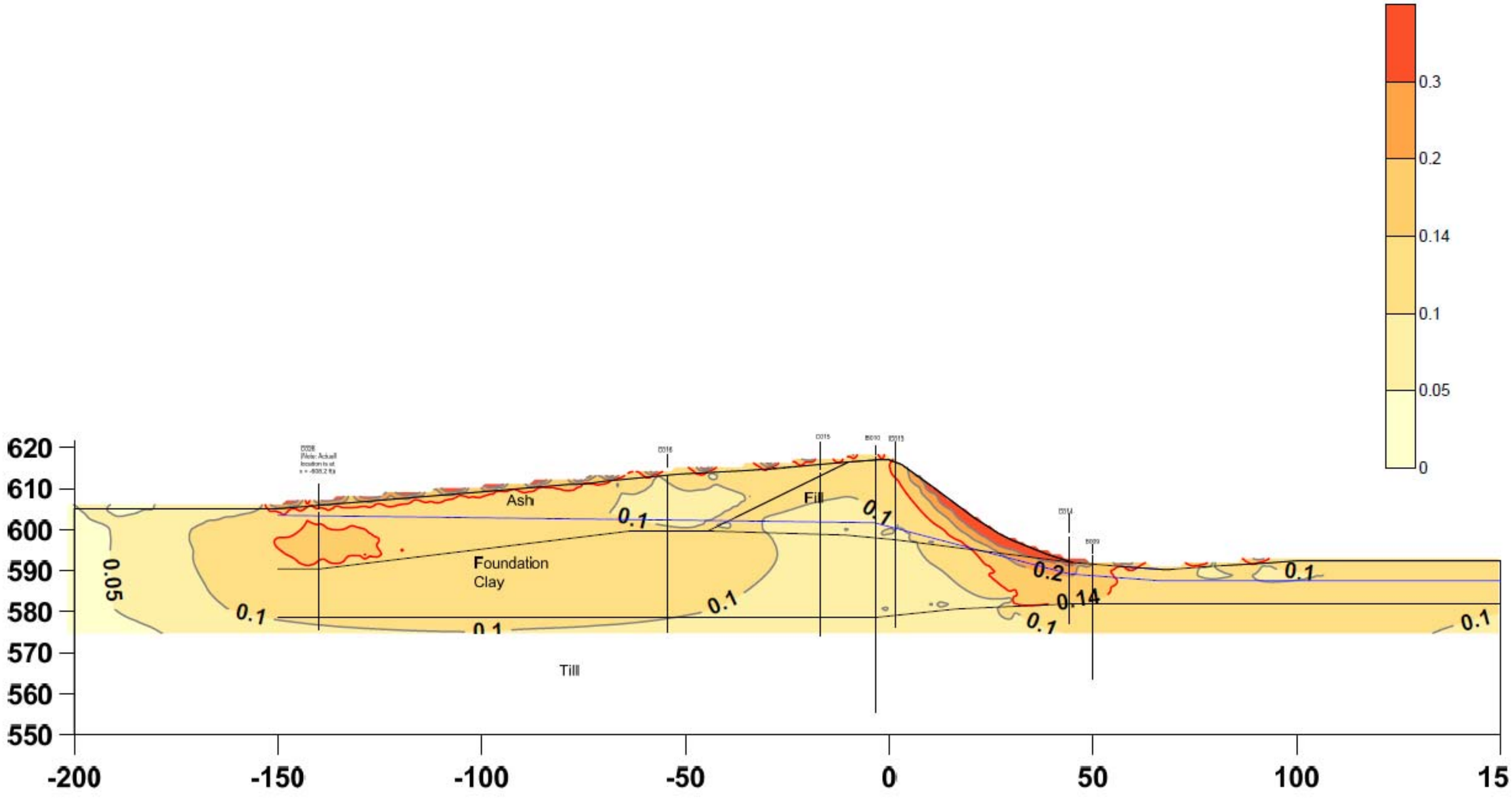
Station 94+50

Acceleration Time History at the Crest (PGA = 0.19g)



Acceleration Time History at the Toe (PGA = 0.14g)





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Project No. 60428794	Dynenergy Seismic Study	Site Response Analysis Kincaid 48+50	Figure
	AECOM		

Attachment L. Liquefaction Analysis Calculations

AECOM

QMS Form 3-3 (MM)
Rev. 2013 QMS
Date: 28 Feb 2013

IE QMS - Americas

Detail Check - Calculations

Project Name	Dynegy CCR Management Program	Client	Dynegy, Inc.
Project Location	Kincaid, Christian County, Illinois	PM	Eric Glazier
Project Number	60480698	PIC	Vic Modeer

IDENTIFYING INFORMATION

(This section is to be completed by the Originator.)

Calculation Medium: *(Select as appropriate)*
☒ Electronic
☒ Hard-copy

File Name: Kincaid Ash Pond Liquefaction Analysis Calc Package.docx
Unique Identification: N/A
Number of pages *(including cover sheet)*: 6 plus attachments

Discipline:	Geotechnical
Title of Calculation:	Kincaid Ash Pond Liquefaction Analysis
Calculation Originator:	Brian Gomez
Calculation Contributors:	Meaghan Kenna
Calculation Checker:	Julie Heitland

DESCRIPTION & PURPOSE

See attached.

BASIS / REFERENCE / ASSUMPTIONS

See attached.

ISSUE / REVISION RECORD

Checker comments, if any, provided on: ☐ hard-copy ☐ electronic file ☐ Form 3-5

No.	Description	P	S	F	Originator Initials	Date	Checker Initials	Date
0	Initial Issue	☐	☐	☒	BWG	1/29/16	JAH	1/29/16
1	Revised elevations	☐	☑	☐	BWG	2/10/16	JAH	2/10/16
2		☐	☐	☐				
3		☐	☐	☐				

For a given Revision, indicate either P (Preliminary), S (Superseding) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

APPROVAL and DISTRIBUTION

☒ The below individuals assert that the Detail Check – Calculations is complete.

Brian Gomez — Originator Signature — 1/29/16 — Date

Julie Heitland — Checker Signature — 1/29/16 — Date

Eric J. Glazier — Project Manager (or Designee) Signature — January 29, 2016 — Date

Distribution:

Project Central File – Quality File Folder

Other – Specify: Enter names here.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Liquefaction Analysis | Project Name: Dynegy CCR

By: Brian Gomez / Meaghan Kenna Date: 01/29/2016 | Project No: 60480698

Checked By: Julie Heitland Date: 01/29/2016 | Task No.: 01

Objective

Determine the liquefaction potential of the Kincaid Ash Pond impoundment using CPT-based triggering assessment. Liquefaction triggering analyses were evaluated using Idriss and Boulanger (2008).

Subsurface Conditions

A subsurface investigation was conducted at Kincaid Ash Pond in August 2015 by AECOM. The investigation included 12 soil borings and 37 Cone Penetration Test (CPT) soundings. Borings and CPTs were drilled or pushed through the ash deposit and along the crest and toe of the existing embankments. CPT soundings used in the liquefaction triggering analysis are included in the Kincaid Ash Pond Material Characterization calculation package.

Based on results of the investigation, four stratigraphic materials were identified at the site:

- **Impounded Ash**: Fine- to coarse-grained SAND (cinders) with clayey silt, organics or clay, very loose to very dense, moist to very wet, and dark brown to black.
- **Embankment Fill**: Low to medium plasticity sandy CLAY or CLAY with sand (CL), or high plasticity clay (CH). The CL and CH soils had occasional occurrences of trace levels of fine gravel, were medium stiff to very stiff with occasional soft zones, moist to very moist, and brown to gray.
- **Foundation Clay**: Native clay of alluvial origin with occasional layers of coarse-grained soil. The fine-grained soils (clays) were generally classified as low to medium plasticity silty CLAY, sandy CLAY, CLAY with sand, or CLAY (CL) with trace amounts of sand or gravel; or high plasticity CLAY (CH). The CL and CH soils were soft to very stiff with a CPT profile indicative of a somewhat over-consolidated crust near the top of the layer, very moist to very wet, and brown to gray with some occurrence of reddish brown silt seams. The coarse-grained soil encountered in the borings was classified as clayey SAND (SC), with a trace amount of gravel, very loose, low plasticity, very wet, and brown to gray.
- **Till**: Predominantly classified as sandy CLAY (CL) with some occurrences of clayey SAND (SC) or silty SAND (SM), usually with a trace amount of fine gravel, generally hard, low to medium plasticity, slightly moist to very wet, and brown to gray.

ANALYSIS

The evaluation of liquefaction susceptibility of soils included a conventional triggering analysis calculating the factor of safety against liquefaction and a CPT-based liquefaction evaluation. The liquefaction triggering analysis is further described below.

CPT-Based Liquefaction Evaluation

The CPT-based state characterization of the soundings advanced at Kincaid Ash Pond provides an independent "first principles" approach to soils material behavior under dynamic and static loading conditions. The characterization provides an independent state assessment of whether the materials would behave in a dilative or contractive manner during loading. Materials that exhibit dilative behavior are typically denser, have a lower dynamic pore pressure response, and are less susceptible to liquefaction while materials that show contractive behavior are typically looser, have a higher dynamic pore pressure response, and are more susceptible to liquefaction.

The CPT-based state characterization included four different methods to evaluate the state of the embankment and foundation soils. The four methods include:

- Comparison between recorded static and dynamic pore pressures;
- Development of a normalized pore pressure parameter (P-value);
- Development of normalized CPT plots with state parameter lines; and
- Development of state parameter difference plots.

Each method is described in more detail below.

Static and Dynamic Pore Pressures

The static pore pressures in the CPT soundings obtained from the pore pressure dissipation tests were compared to the dynamic pore pressures recorded during cone advancement to evaluate potentially contractive or dilative material behavior as follows:

- Materials that show dynamic pore pressures greater than the static pore pressures indicate potentially contractive behavior during shearing; and
- Materials that show dynamic pore pressures less than static pore pressures indicate potentially dilative behavior during shearing.

Normalized Pore Pressure Parameter

The pore pressure difference value (P-value) was calculated by subtracting the static from the dynamic pore pressures (u_{dyn}-u_{static}) and normalizing the difference to the vertical effective stress, reflecting the effects of depth. If the P-value is negative, the dynamic pore pressures are less than the static pore pressures and the material shows potentially dilative behavior during shearing. If the P-value is positive, the dynamic pore pressures are greater than the static pore pressures and the material shows potentially contractive behavior during shearing.

Normalized Material Properties and State Parameter

Normalized CPT soil behavior type charts (SBTn chart) were created for the CPT soundings following the Robertson (2010) method to evaluate material behavior. The normalized CPT data were plotted as normalized tip resistance (Q_{tn}) versus normalized friction ratio (F_r). The approximate boundary between dilative and contractive material behavior is provided by the state parameter Ψ = -0.05 line plotted on the SBTn charts. The state parameter, Ψ, is the difference between the initial void ratio and the critical void ratio line.

The SBTn chart and data from liquefaction case histories (Robertson, 2010) is shown in Figure 1. The data shows that most flow liquefaction failures have CPT data that plots in zones 4 and 5 below the $Q_{tn,cs}$ = 70 line. The $Q_{tn,cs}$ = 70 line is similar to the state parameter Ψ = -0.05 line. The state parameter line for Ψ = 0.00 and Ψ = -0.10 were also shown on the charts to evaluate the sensitivity of the state parameter. The CPT soundings were normalized based on the phreatic surface at the time of sounding advancement.

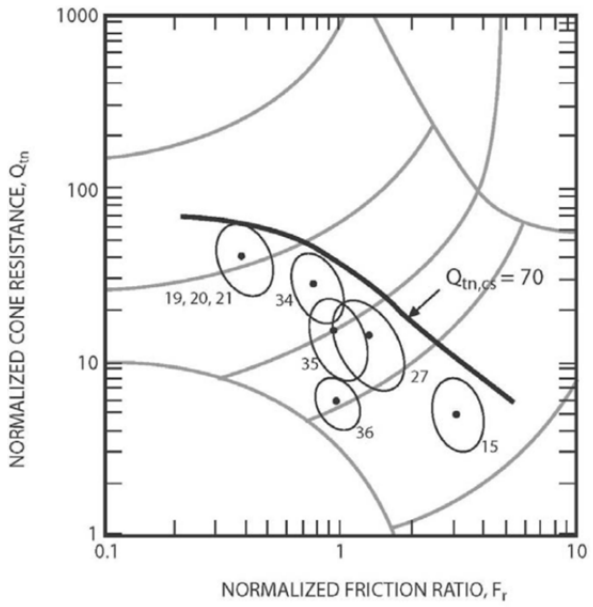


Figure 1: Robertson (2010) Liquefaction Case Histories

Generally, zones of dilative soils plot above the state parameter Ψ = -0.05 line of the SBTn chart and contractive soils plot below the state parameter Ψ = -0.05 line. Materials that plot in zones 2 and 3 of the SBTn chart generally indicate plastic or clay-like behavior and may not be susceptible to liquefaction.

State Parameter Difference

The state parameter difference plot combines the evaluation of the normalized pore pressure difference (P-value) and the normalized CPT data soil behavior plots to provide an additional tool to help characterize the material as potentially contractive or dilative.

Negative P-values indicate potentially dilative behavior and positive values indicate potentially contractive behavior, as described above, and are plotted on the y-axis on the state parameter difference plot. The perpendicular distance from the state parameter Ψ = -0.05 line for each data point was calculated and plotted on the x-axis on this plot. Recognizing that data plotting above the state parameter Ψ = -0.05 line on the normalized CPT soil behavior plot indicate dilative behavior, the horizontal distance calculated to a point above this line was given a negative value to remain consistent with the convention that negative values indicate dilative behavior. Therefore, a point that plots below the state parameter Ψ = -0.05 line on the normalized CPT soil behavior plot is positive, indicating contractive behavior.

The state parameter difference plot was broken into quadrants, with quadrant number one in the upper right corner progressing counterclockwise to quadrant number four in the lower right corner. Material that showed dilative behavior on both the normalized pore pressure difference plot and normalized CPT soil behavior plot can be found in quadrant three. Material that showed potentially contractive behavior in both the normalized pore pressure difference plot and on the normalized CPT soil behavior plot will plot in quadrant one.

Results

The CPT-based state characterization analysis is typically used to evaluate the liquefaction potential of sands. Since the soils at Kincaid Ash Pond are clay-like, they are not susceptible to liquefaction. Therefore, the CPT-based state characterization does not provide indication of potential for strength loss in these materials. However, the trend toward more dilative response in the upper portion of the soundings is consistent with the compacted clay embankment and the upper over-consolidated portion of the foundation clay.

Several CPT soundings were advanced through the ash material. The CPT-based state characterization analysis on the CPTs indicates the saturated sand-like material is primarily dilative. A liquefaction triggering analysis was performed to assess the liquefaction potential of this material. However, the dilative behavior of this material is consistent with cyclic mobility and therefore may not behave as a liquefaction flow failure.

Liquefaction Triggering Analysis

An earthquake triggering analysis is used to assess the liquefaction potential of saturated soils under a design event. The analysis consists of comparing the calculated cyclic resistance ratio (CRR) from the CPT soundings to the cyclic stress ratio (CSR) calculated from a simplified site response analysis as described in Idriss and Boulanger (2008). All the CPT soundings performed were evaluated for liquefaction triggering potential.

The factor of safety against liquefaction is computed as:

$$FS = \frac{CRR}{CSR}$$

If the calculated factor of safety is less than 1.2, the material is considered to be potentially liquefiable. If the calculated factor of safety is greater than 1.2, the material is considered to be not susceptible to liquefaction. A detailed description of the procedure can be found in Idriss and Boulanger (2008).

Based on the 2016 PSHA, the design event for the Kincaid Ash Pond site is a 2,500-year, 6.0 magnitude event with a PGA of 0.11g. A dynamic response analysis was performed (discussed in a separate calculation package) using QUAD4 to determine the PGA at the crest and toe of the embankment. For this site, the PGA_{crest} = 0.20g and the PGA_{toe} = 0.18g.

Results

The CPT liquefaction triggering plots generally show factors of safety greater than 1.2, except for ash material and the foundation clay layer above the till.

Factors of safety were less than 1.2 in some portions of the soundings through the embankment materials where the I_c index values were less than 2.6. While the I_c index for the embankment at the Kincaid Ash Pond site vary from somewhat above (clay-like) and below (sand-like) the 2.6 index value, the materials encountered during the field investigation all classify as clay. To illustrate how this affects the liquefaction triggering factor of safety, CPT KIN-C015 was reinterpreted using the Idriss and Boulanger cyclic softening evaluation criteria for clay-like materials (Figure 2 below), and results in factors of safety well above 1.2. Therefore, the triggering analysis indicates that the embankment does not have a potential for cyclic softening during the design earthquake event.

Based on the simplified liquefaction analyses performed on CPTs pushed within the ash material, the saturated sand-like material indicates factors of safety against liquefaction less than 1.2, and thus the potential for liquefaction. However, as mentioned previously, the saturated sand-like material is

primarily dilative, which is consistent with cyclic mobility and therefore may not behave as a liquefaction flow failure.

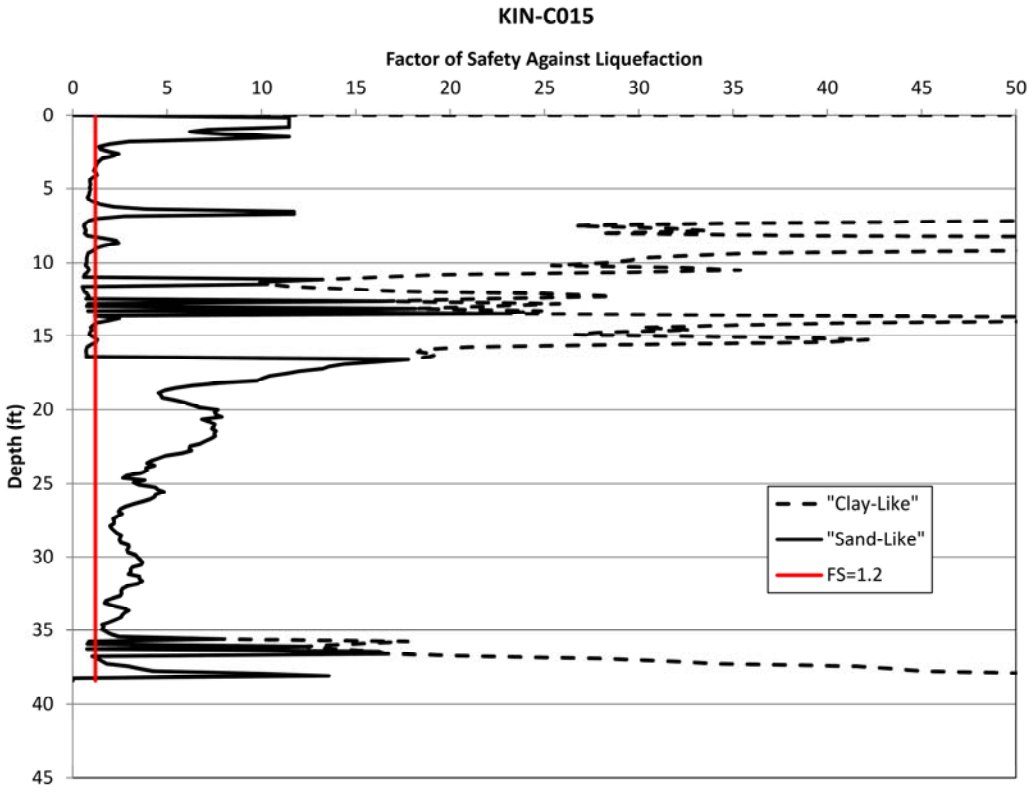


Figure 2: CPT KIN-C015 Factors of Safety for Sand-Like and Clay-Like Evaluations

Correlated values of peak and residual undrained strength from CPT results in the foundation clay indicate a potential for strain softening of this material. Because of this (as well as triggering FOS<1.20), cyclic and post-cyclic DSS strength tests were performed on two undisturbed tube samples collected within the foundation clay to estimate a residual undrained shear strength for this material under the post-earthquake loading condition. Both samples were subjected to a cyclic stress ratio (CSR) of about 0.14 and did not experience strain softening. The CSR was then increased to 0.28 in one sample and 0.23 in the second sample. The sample tested under a CSR of 0.23 experienced strain softening while the sample tested under a CSR of 0.28 did not experience strain softening. It can be assumed that no triggering will occur in the foundation clay material at CSR values less than or equal to 0.14.

Calculation Notes

Subject: Kincaid Ash Pond Liquefaction Analysis

Project Name: Dynegy CCR

By: Brian Gomez / Meaghan Kenna Date: 01/29/2016

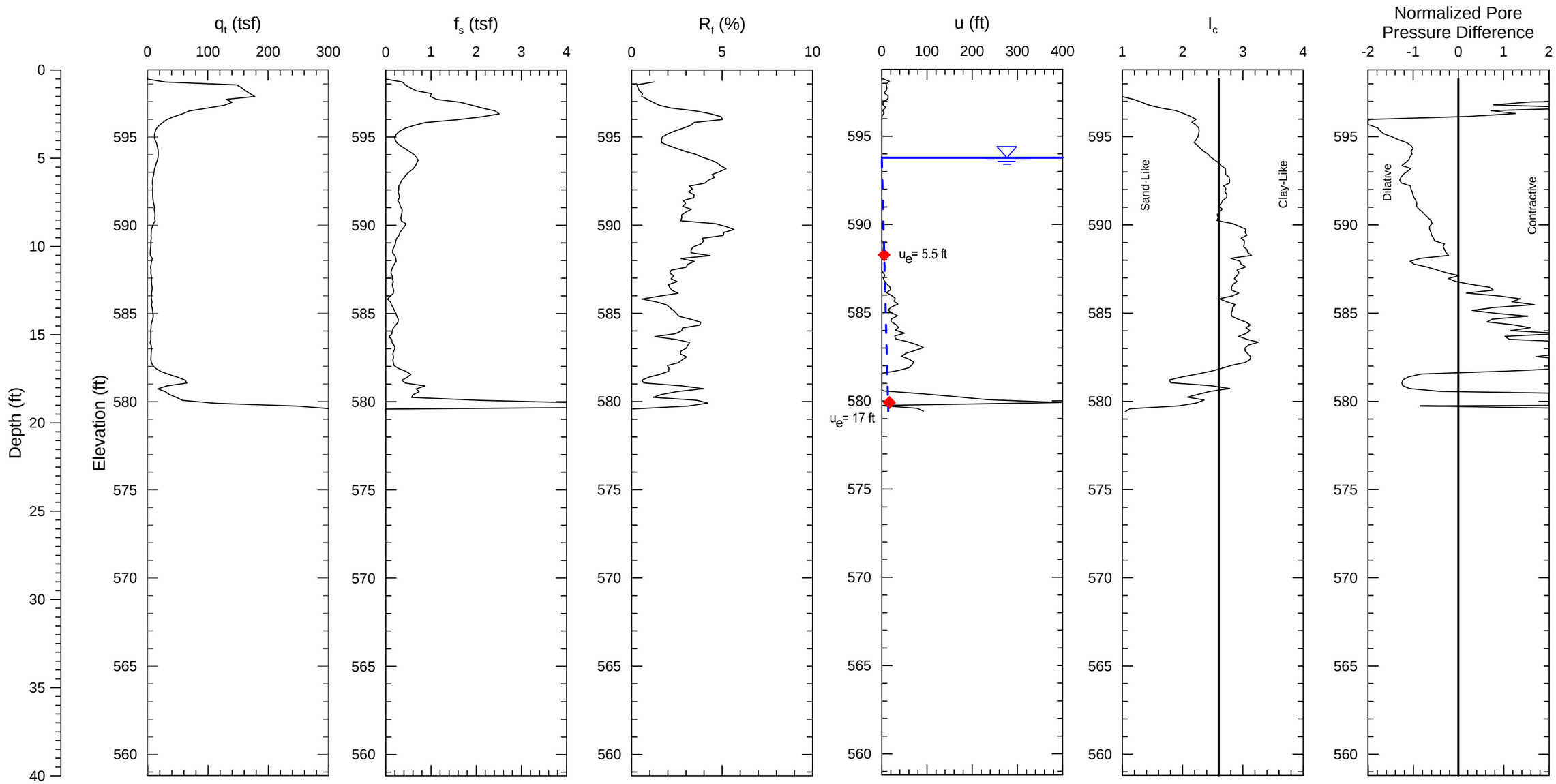
Project No: 60480698

Checked By: Julie Heitland Date: 01/29/2016

Task No.: 01

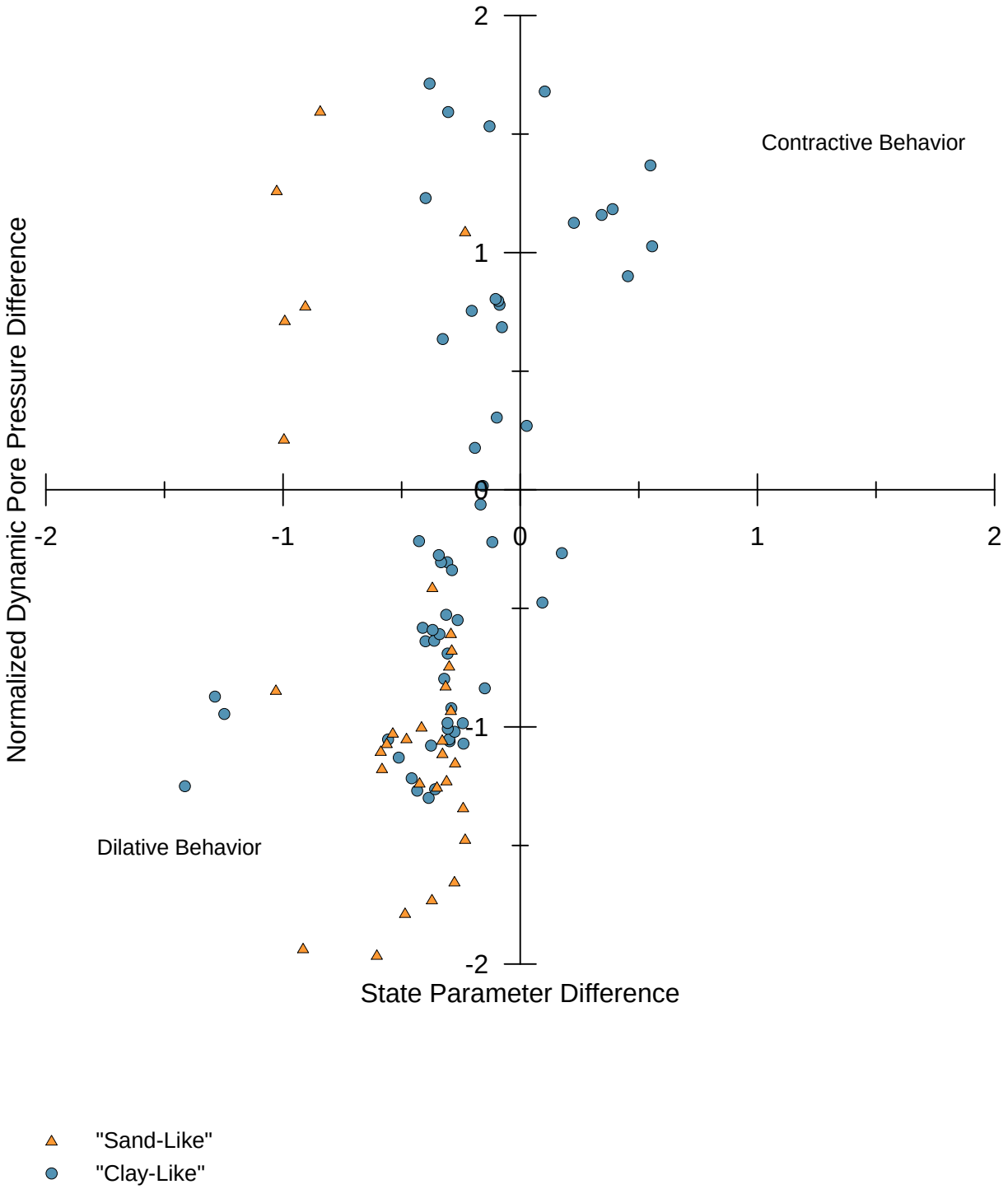
APPENDIX A

CPT-Based State Characterization Plots



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C001 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C001 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

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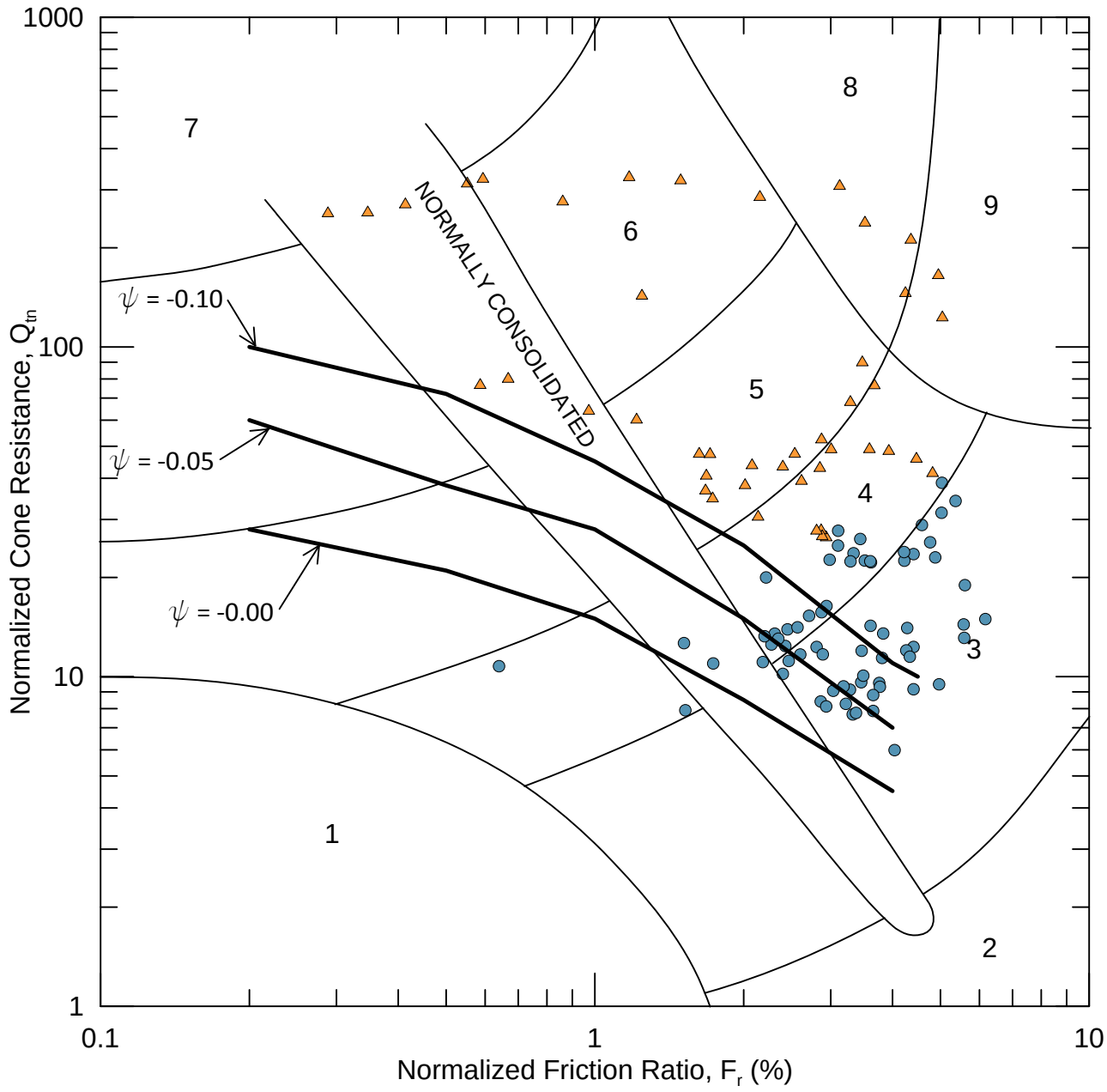


"Sand-Like"

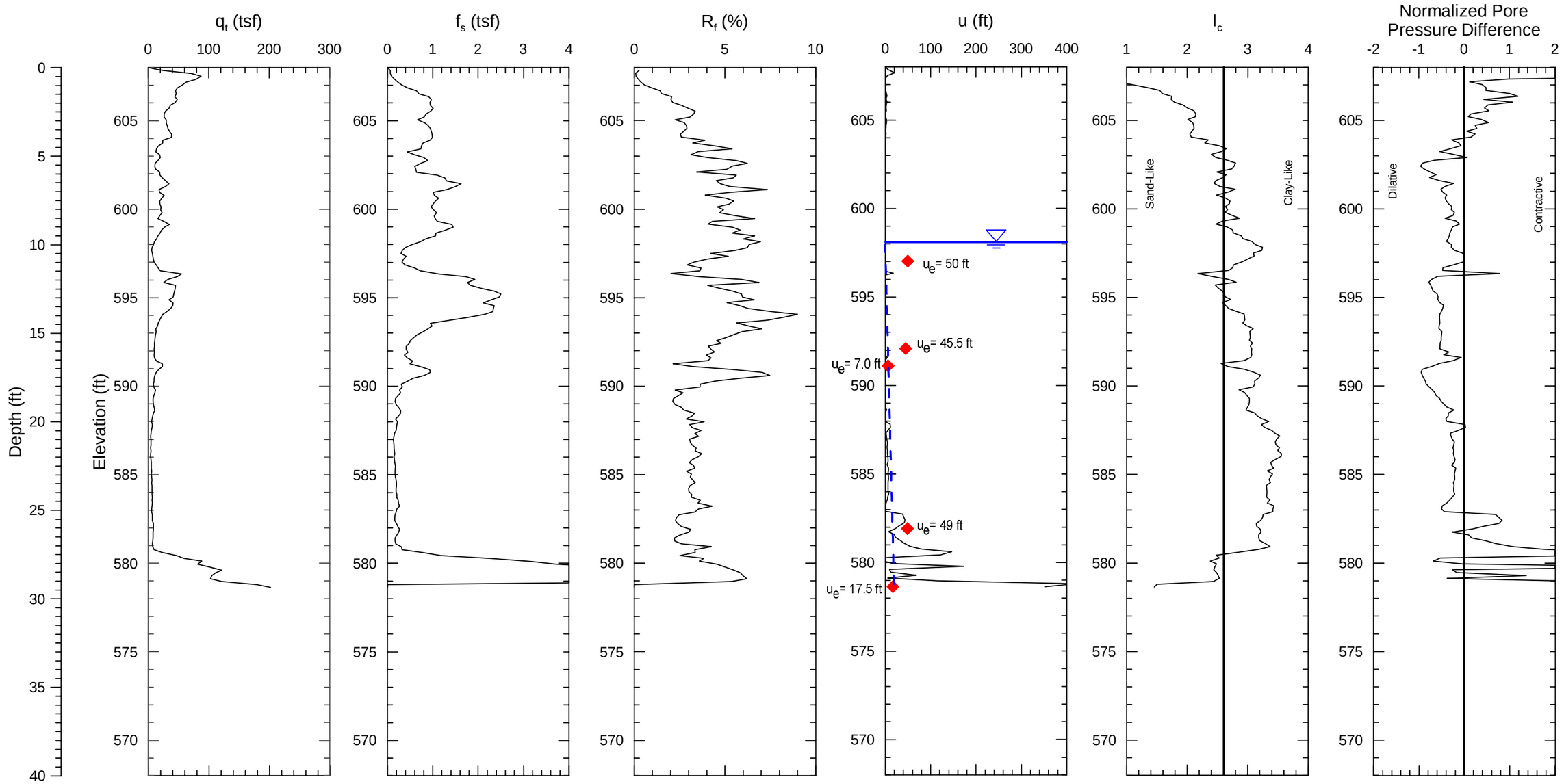
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

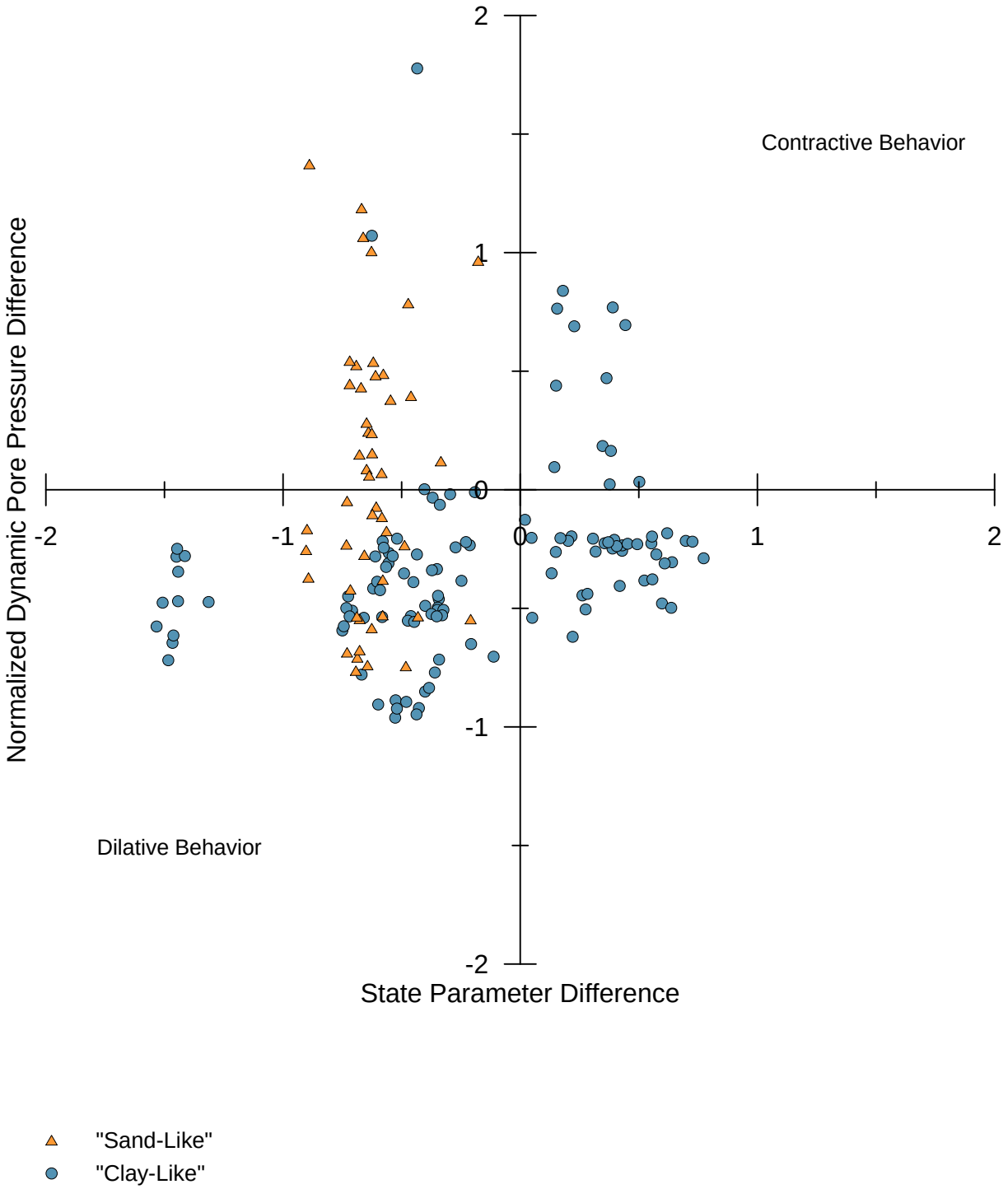
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C001 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-001_DC_Normalized State.grf



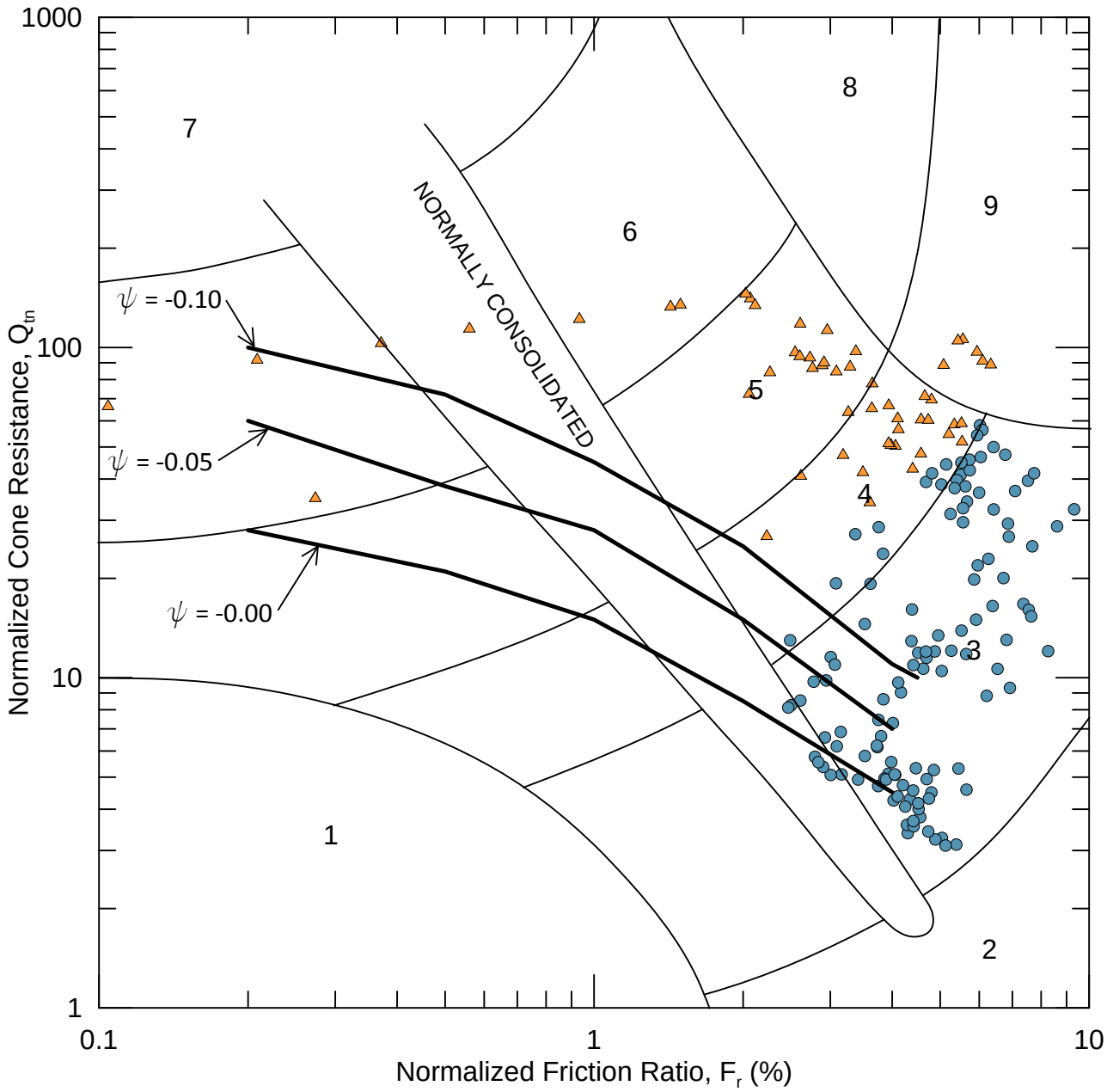
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C002 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C002 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-002_DC_ State Parameter Difference.grf



"Sand-Like"

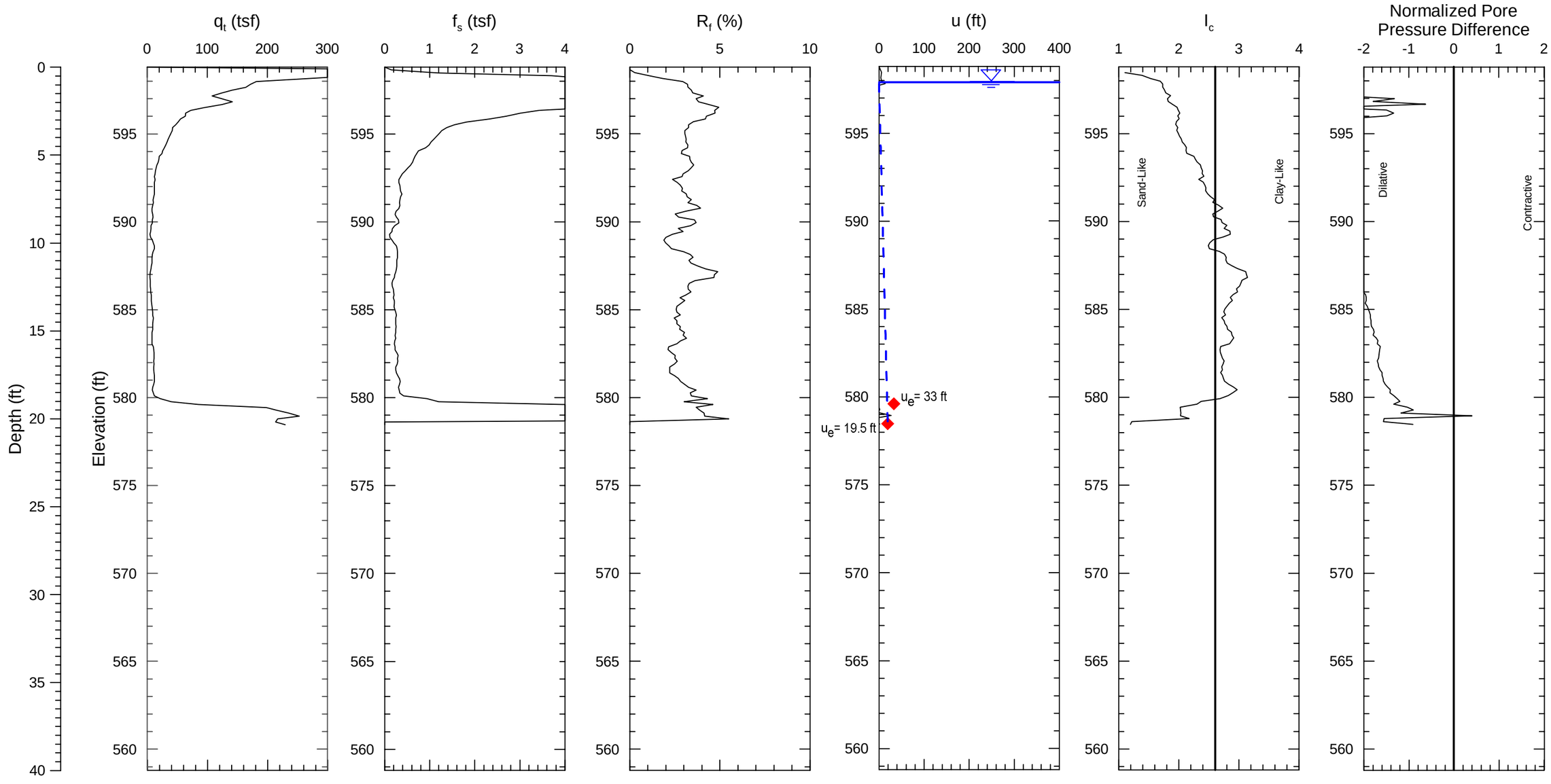
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

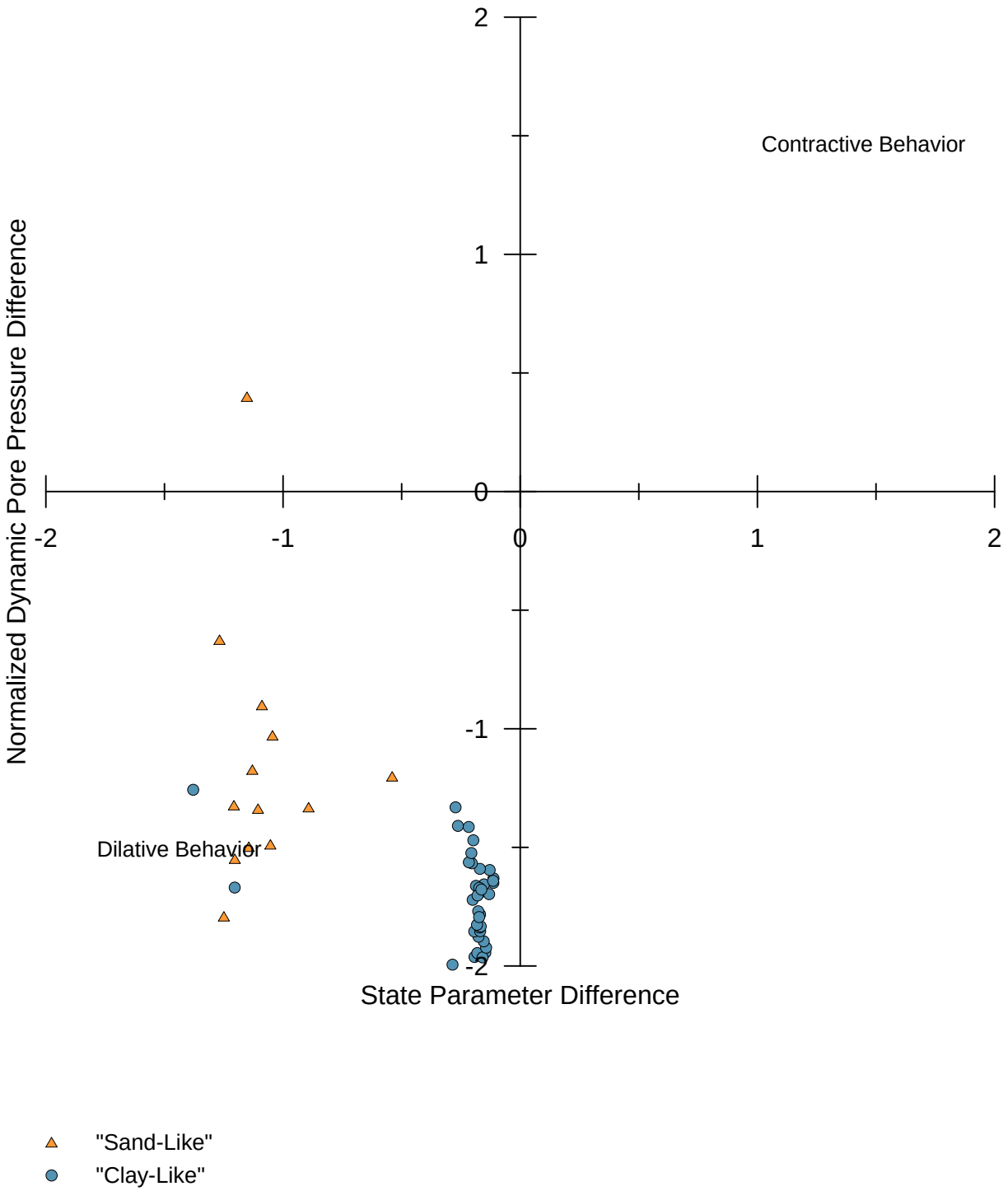
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C002 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-002_DC_Normalized State.grf



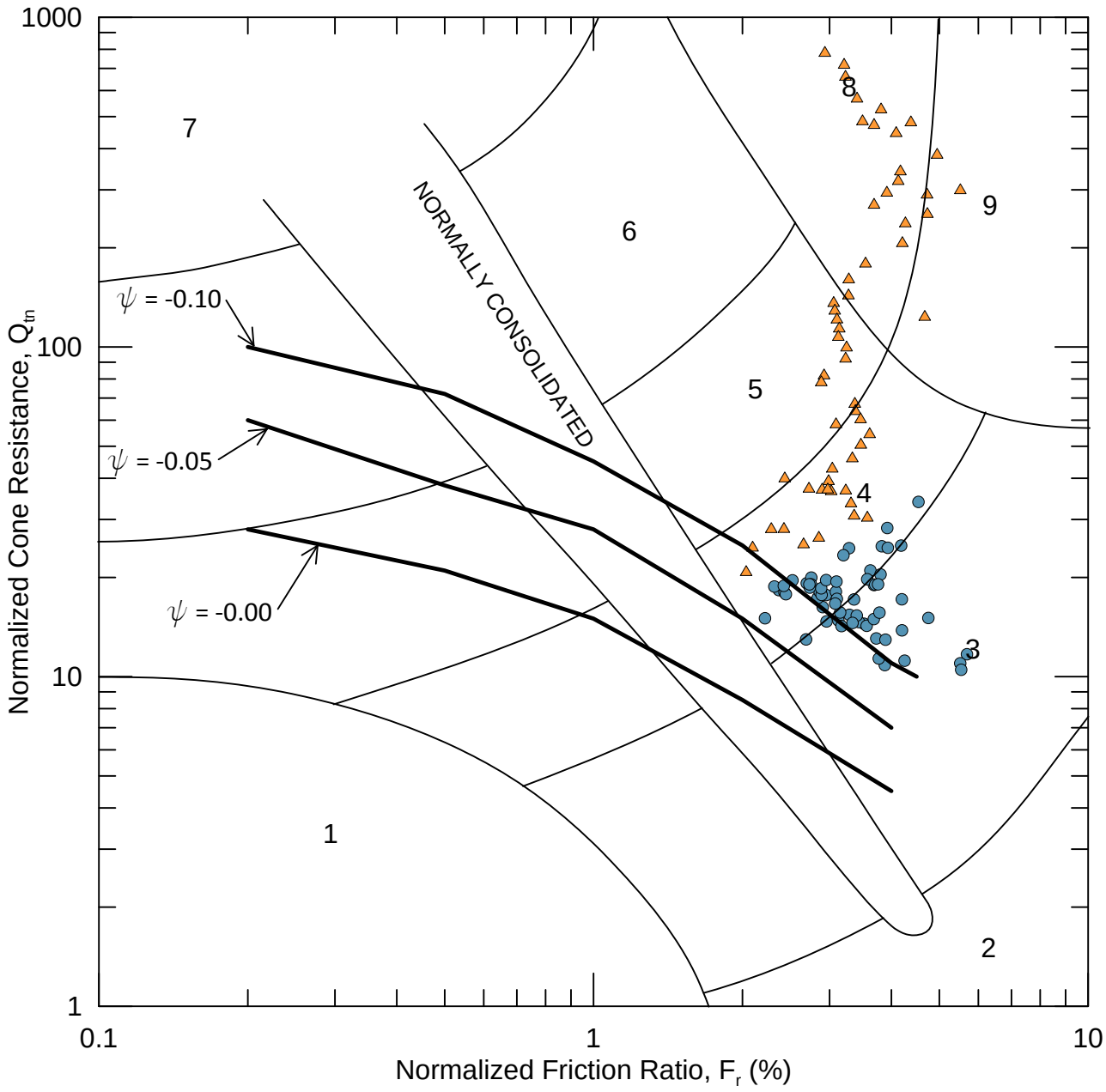
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C003 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C003 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_001\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-003_DC_ State Parameter Difference.grf



"Sand-Like"

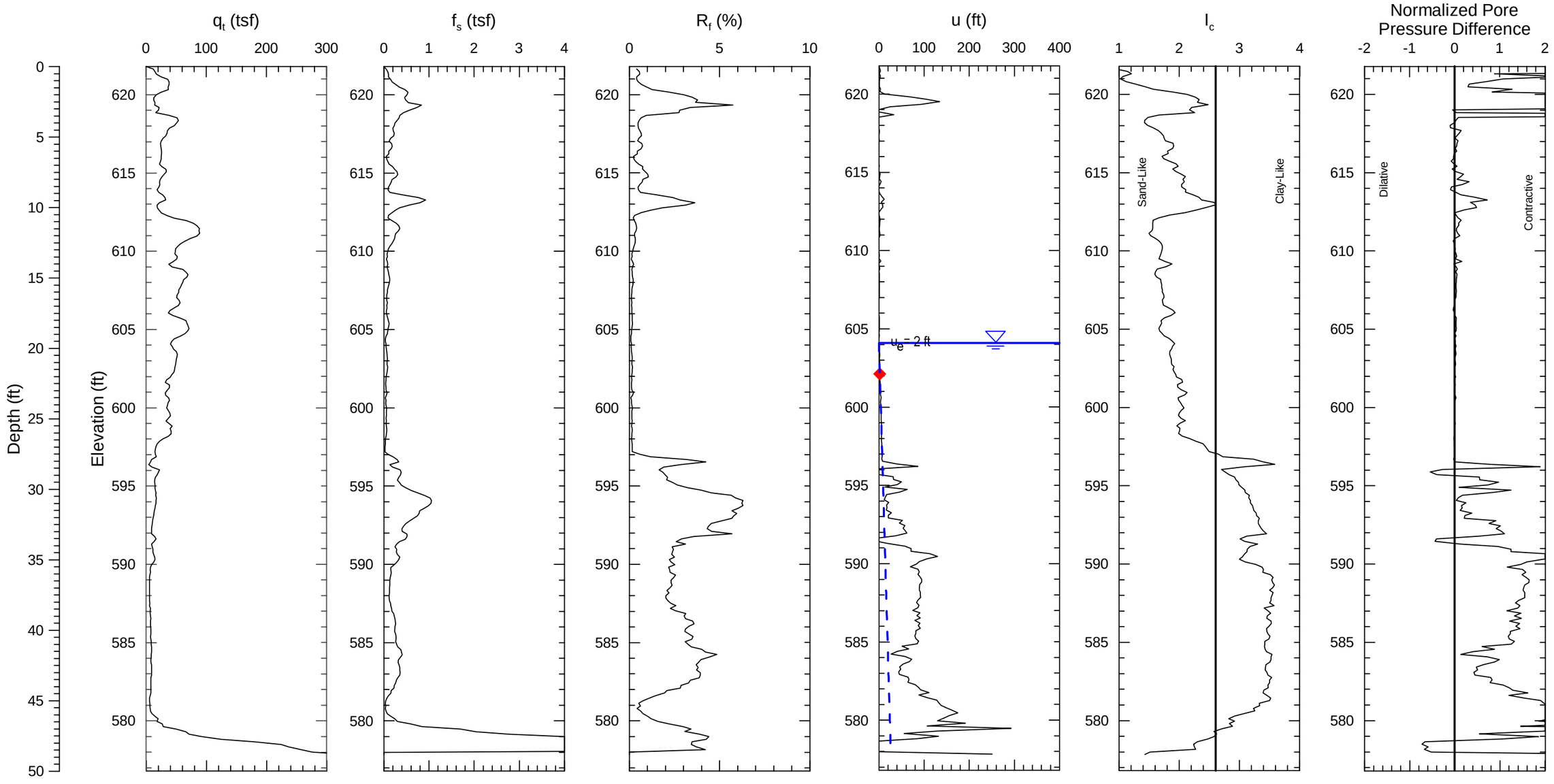
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

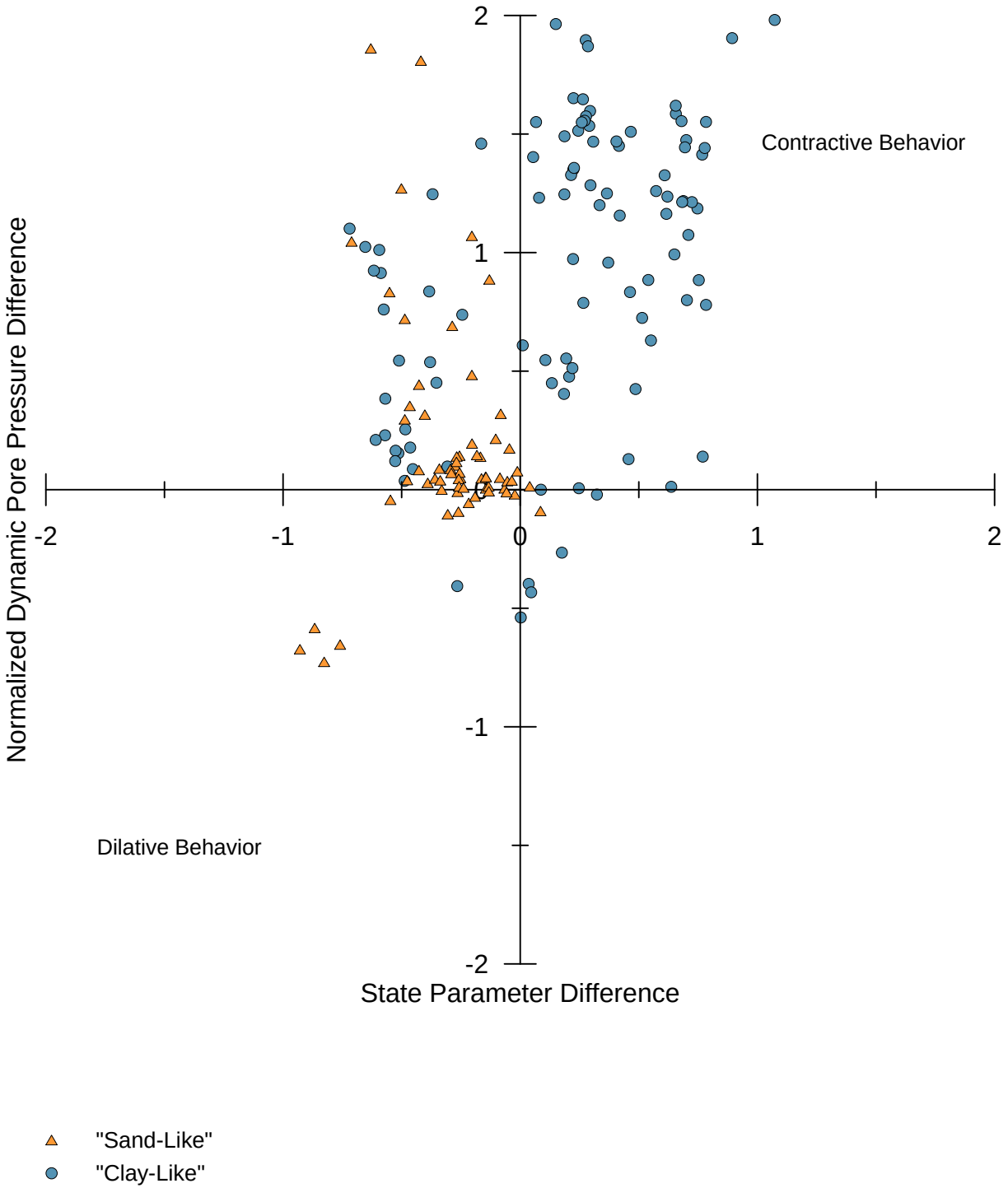
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C003 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-003_DC_Normalized State.grf



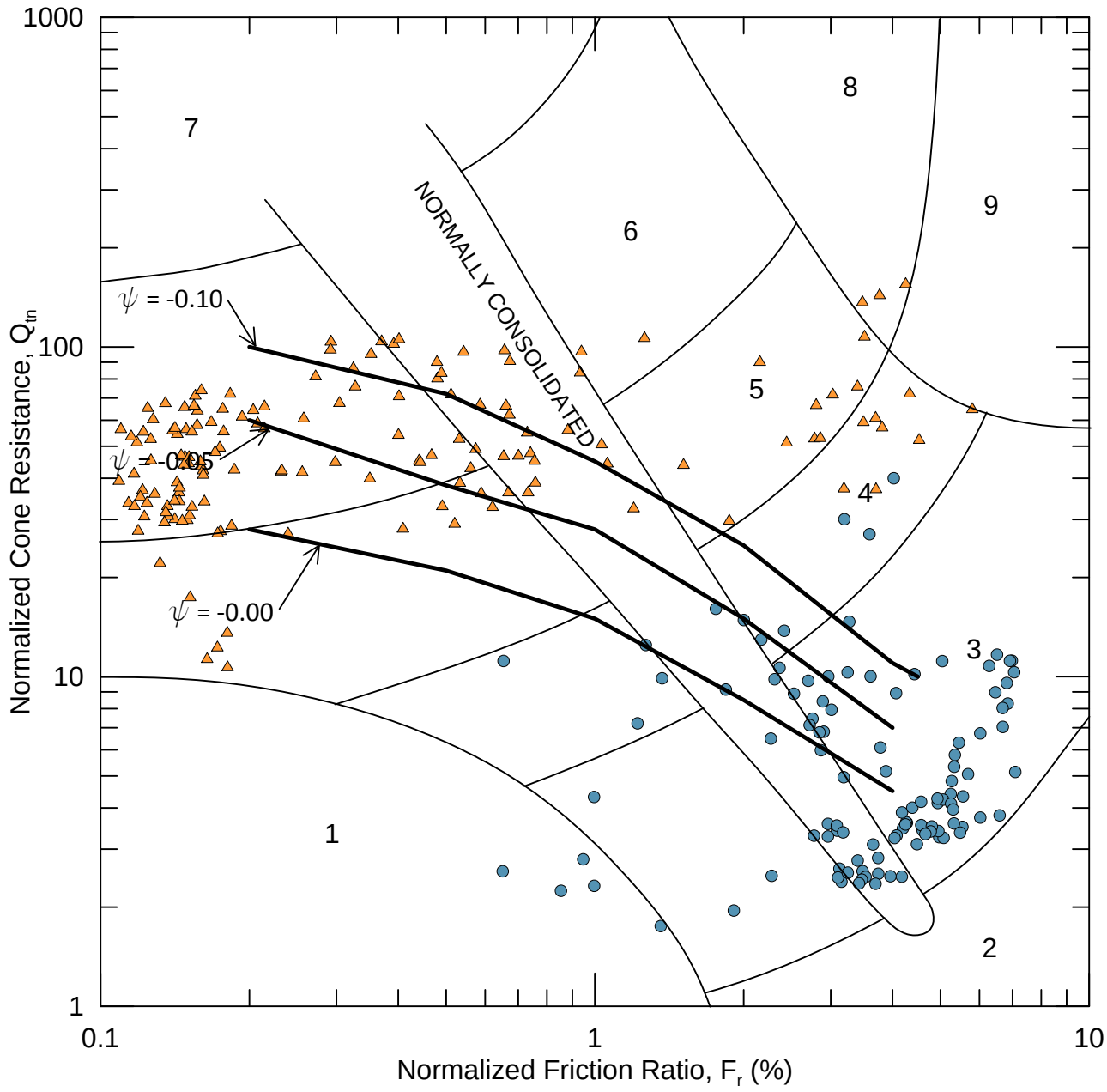
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C004 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C004 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-004_DC_ State Parameter Difference.grf



"Sand-Like"

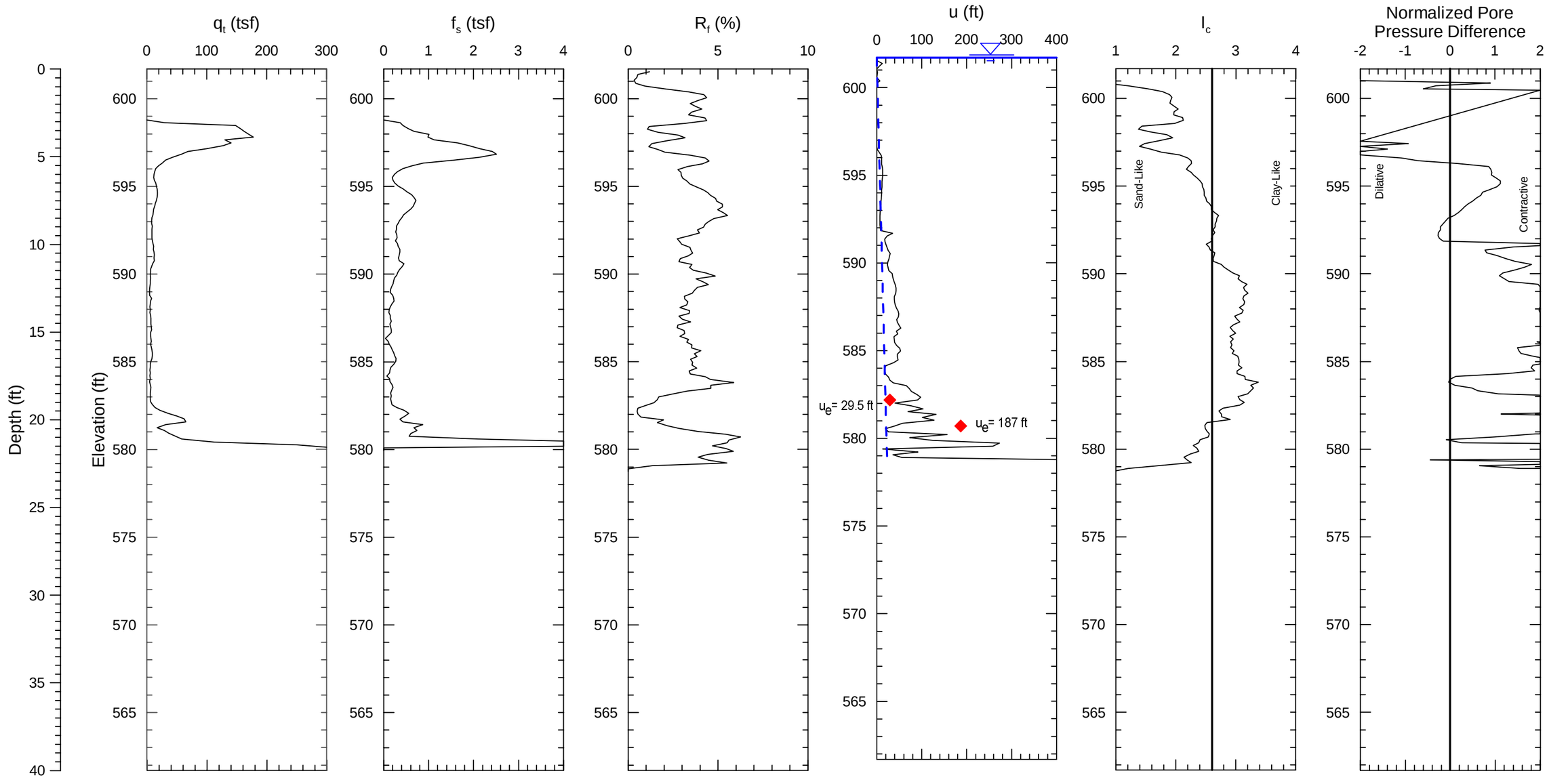
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

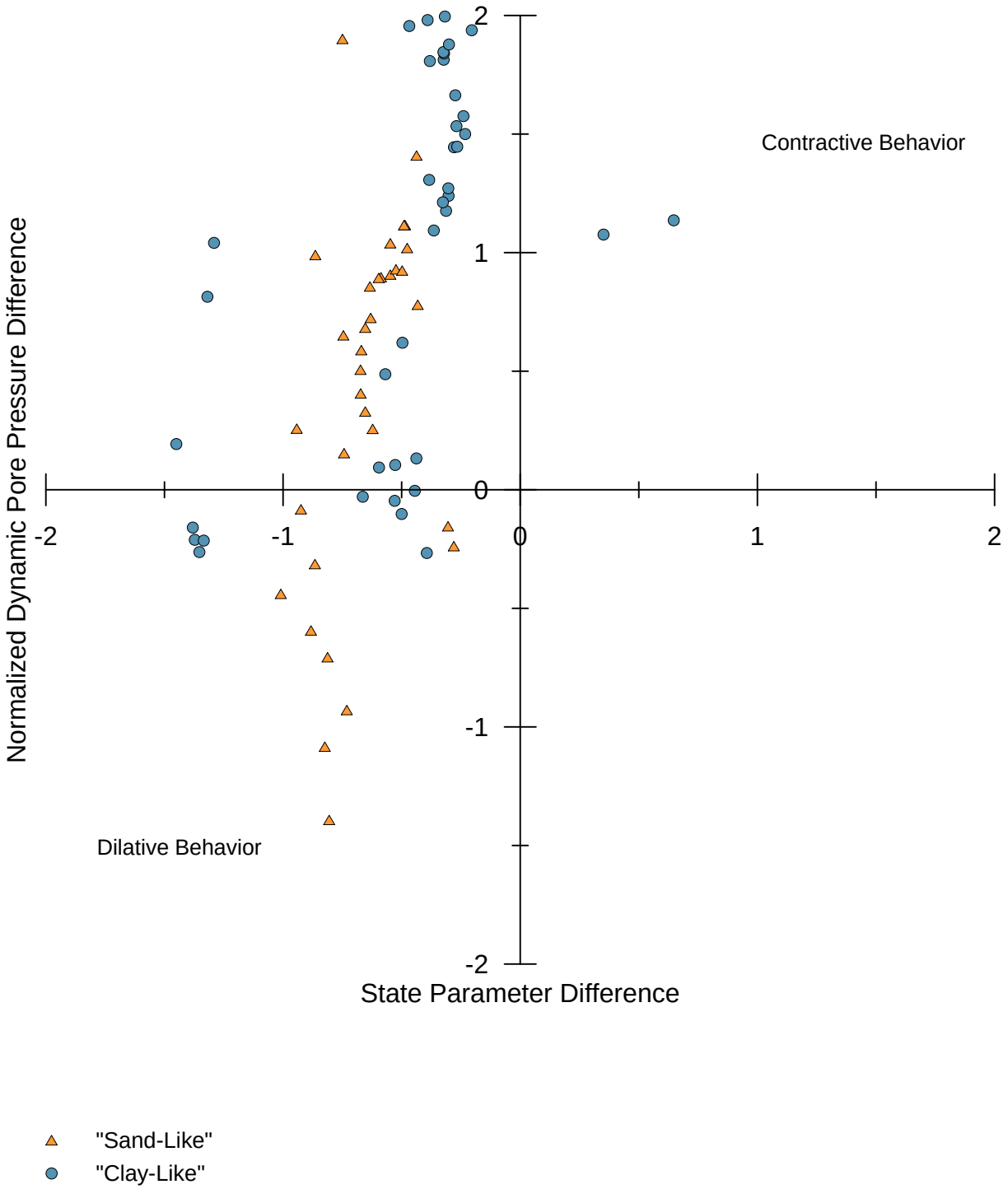
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C004 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-004_DC_Normalized State.grf



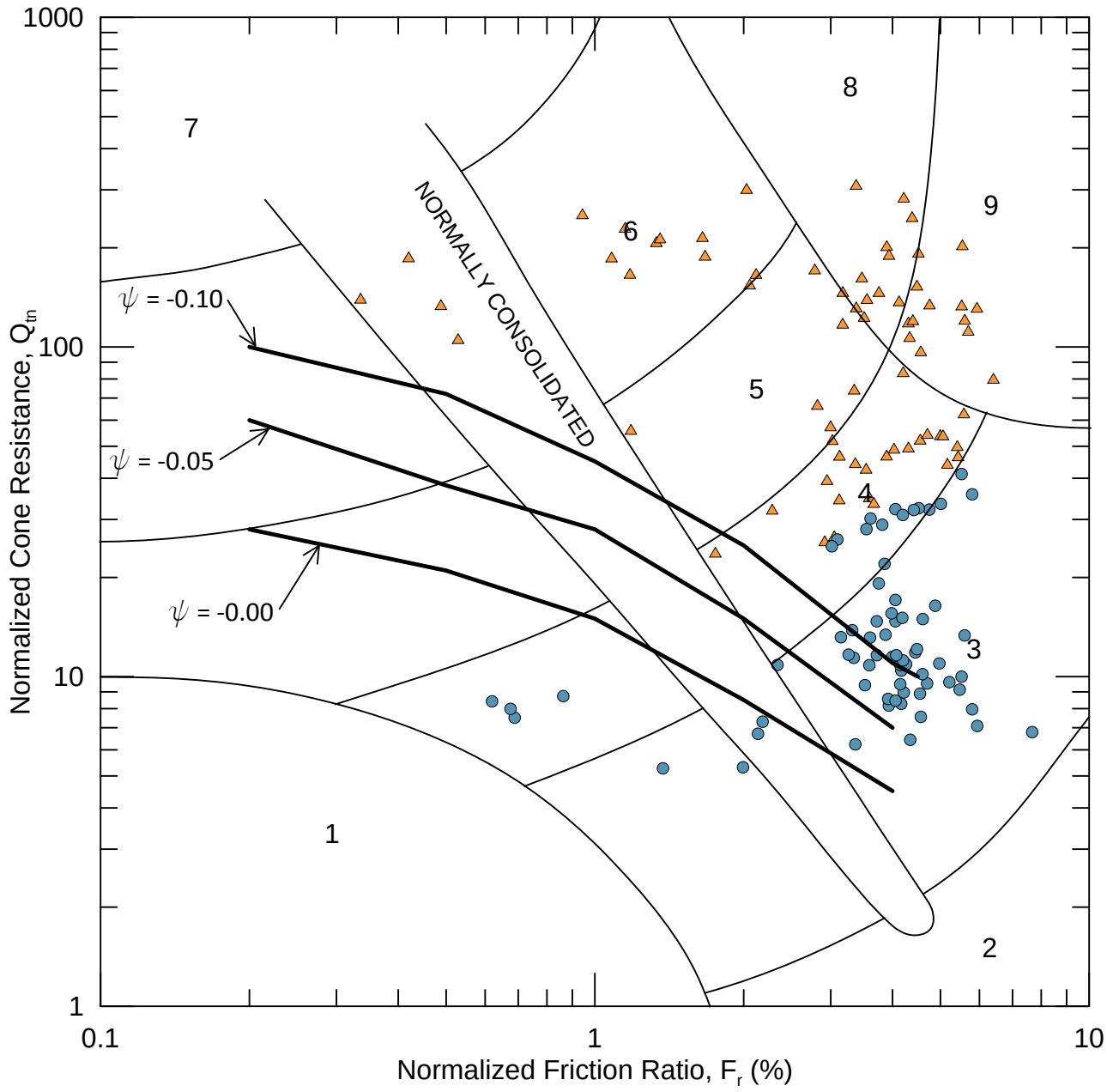
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C005 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C005 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-005_DC_ State Parameter Difference.grf



"Sand-Like"

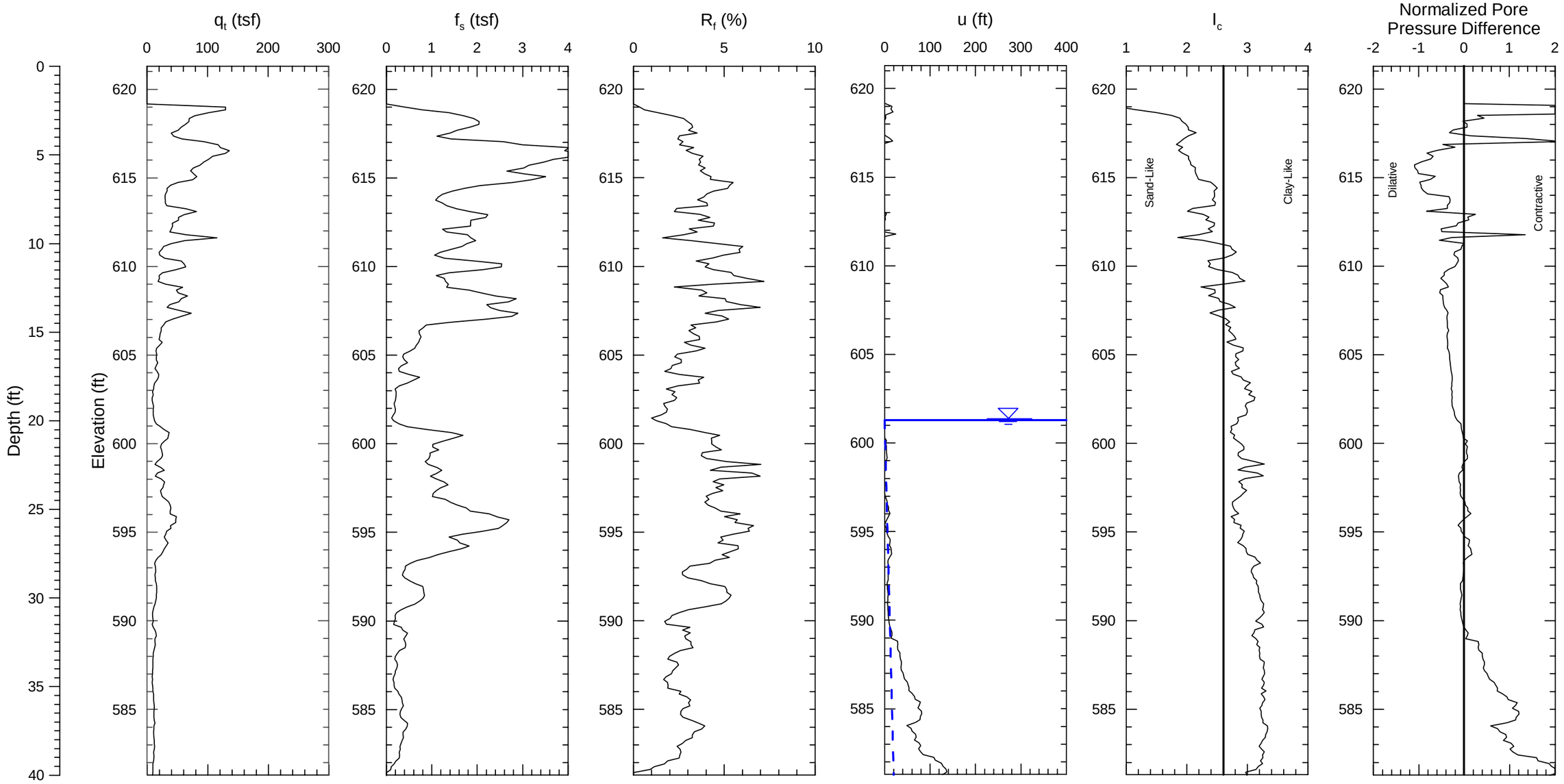
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

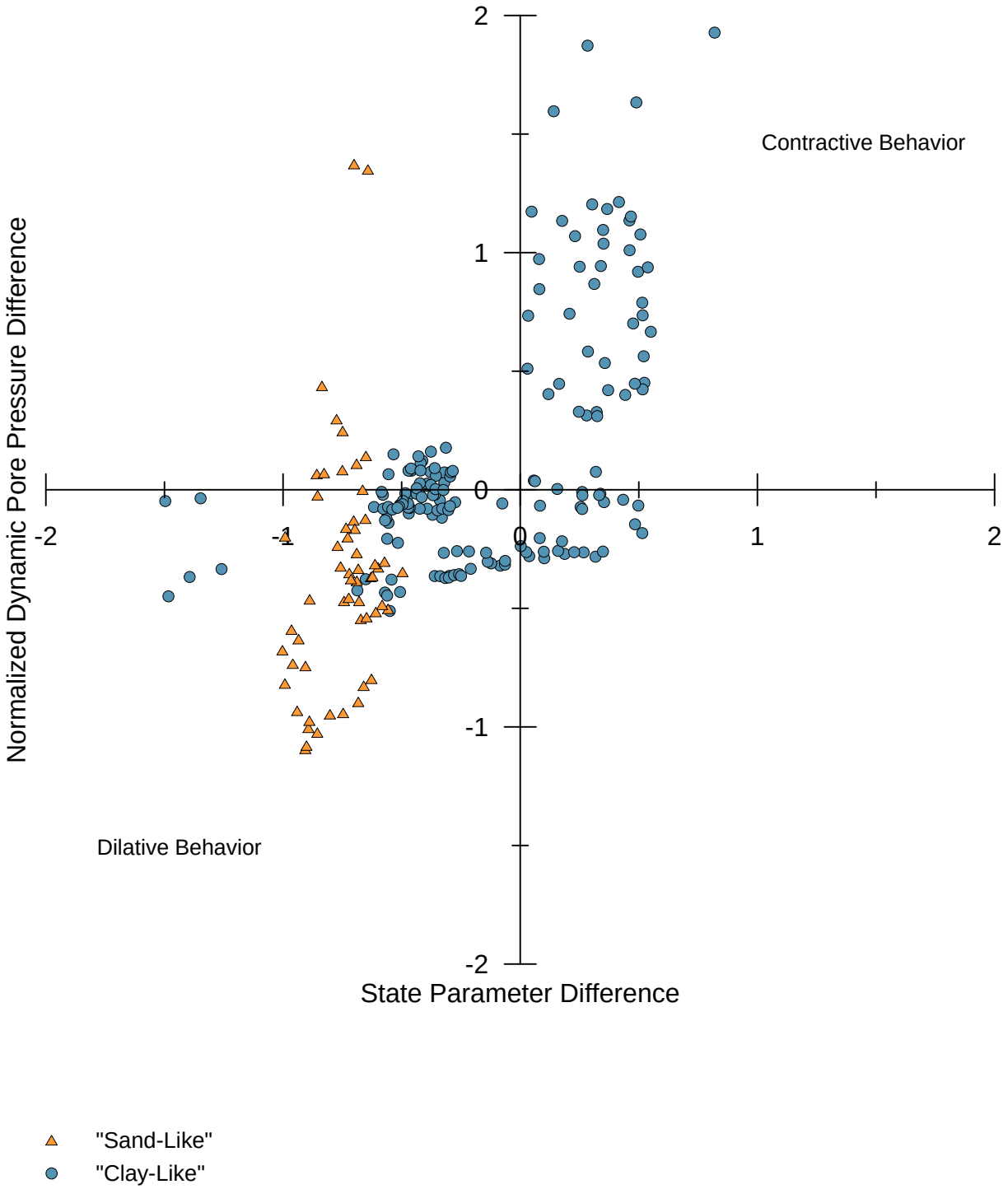
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C005 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-005_DC_Normalized State.grf



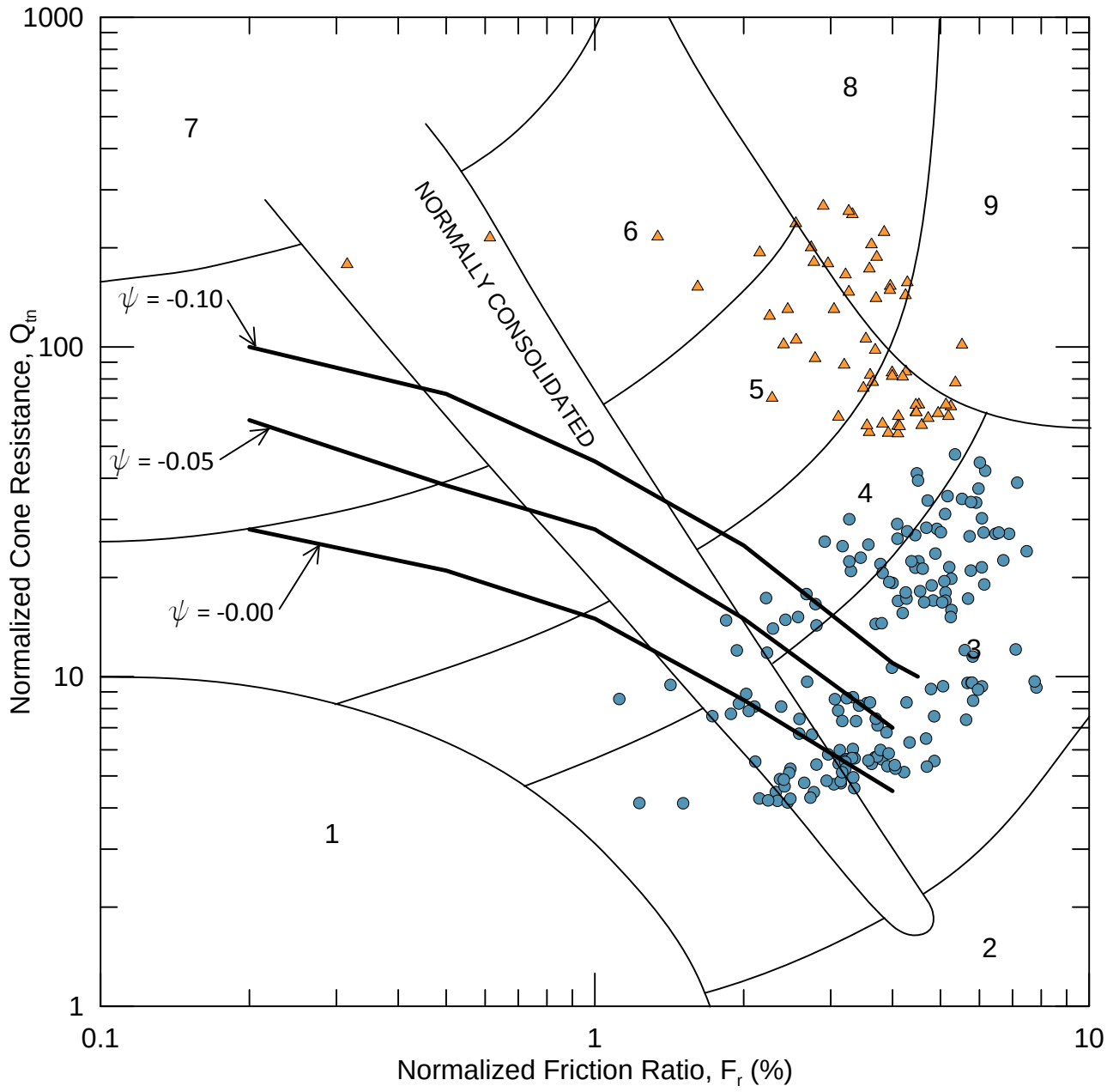
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C006 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C006 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-006_DC_ State Parameter Difference.grf



"Sand-Like"

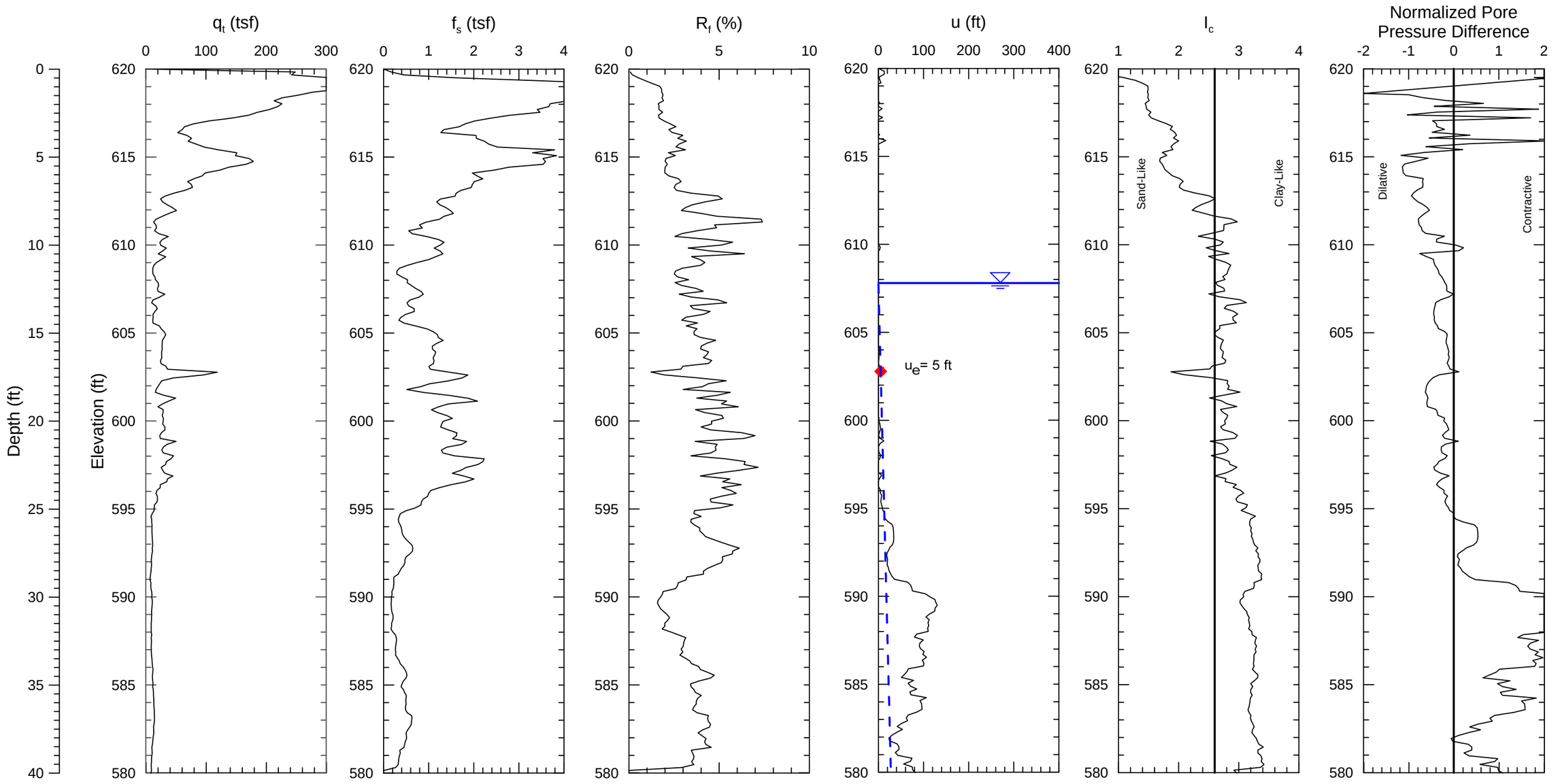
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

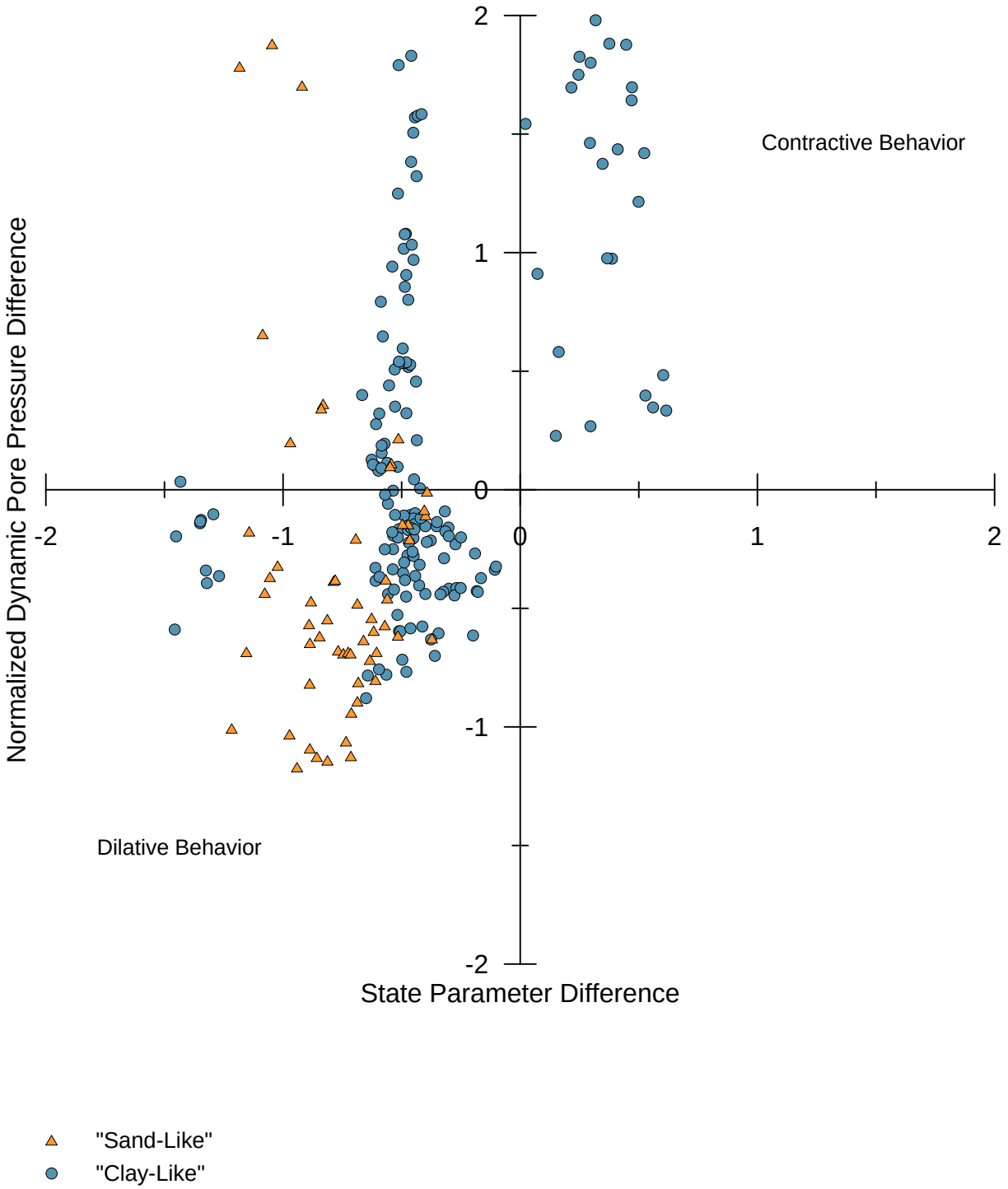
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C006 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-006_DC_Normalized State.grf



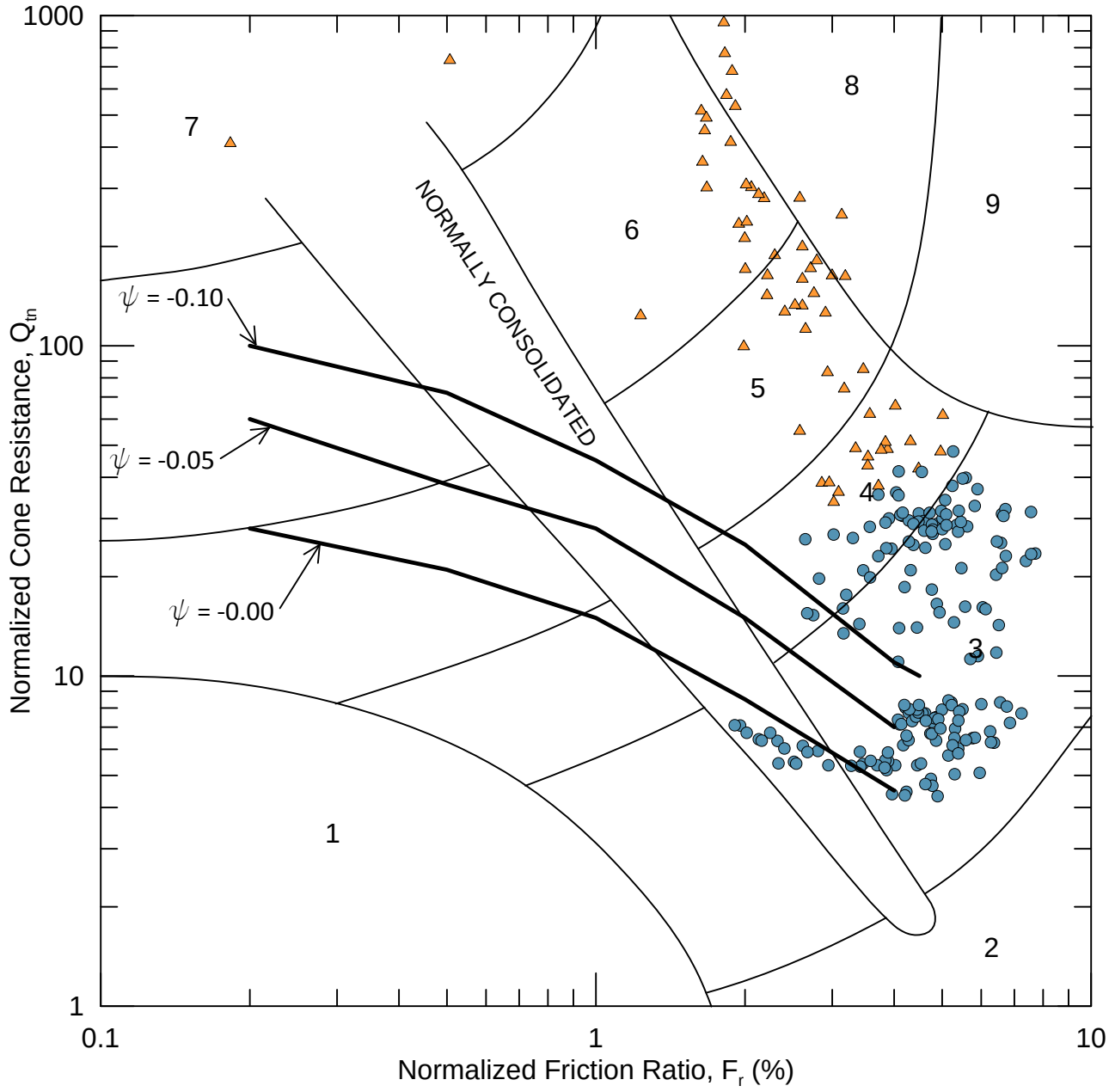
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C007 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C007 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-007_DC_ State Parameter Difference.grf



"Sand-Like"

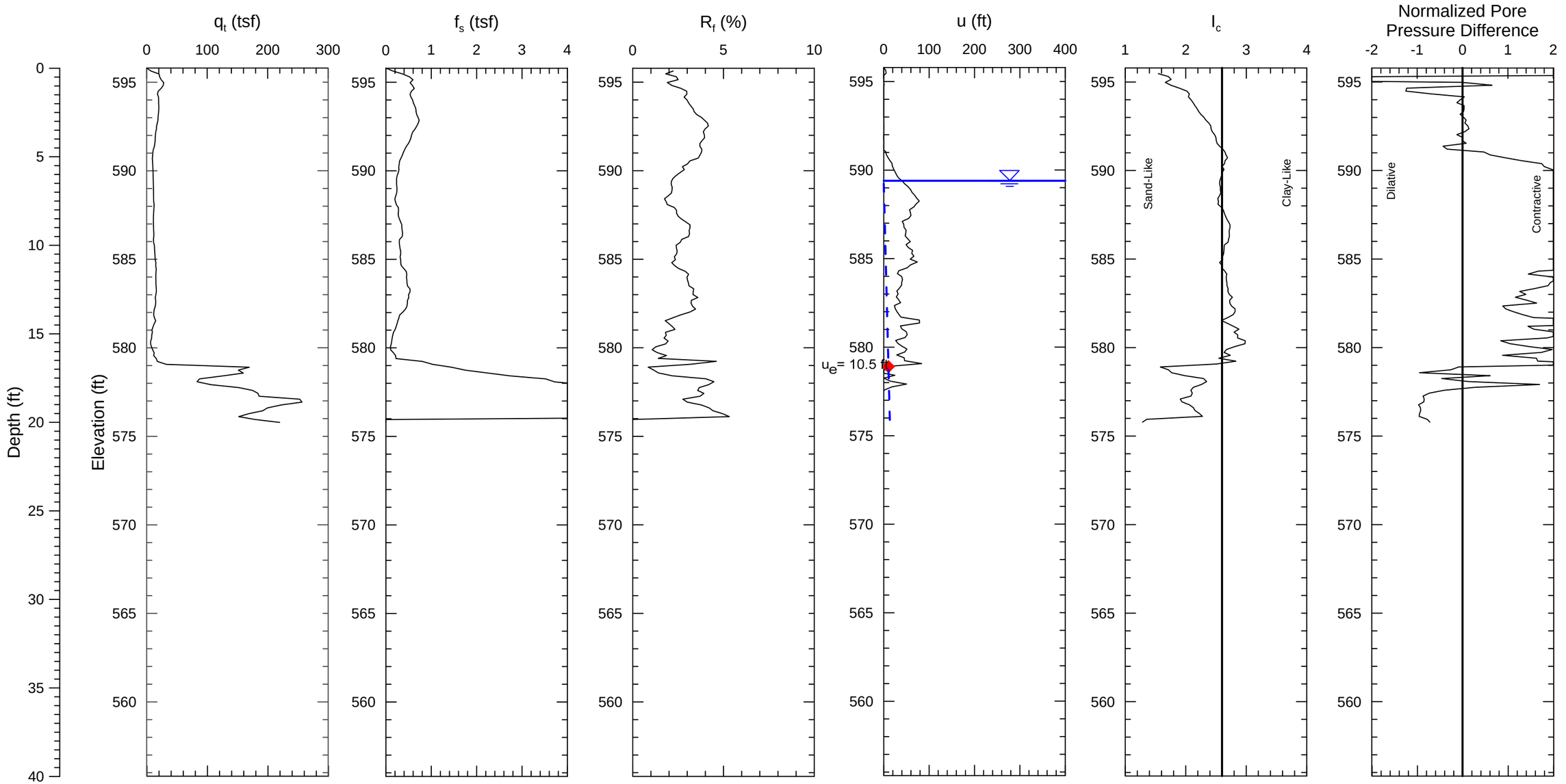
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C007 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-007_DC_Normalized State.grf



◆ Pore Pressure Dissipation Test

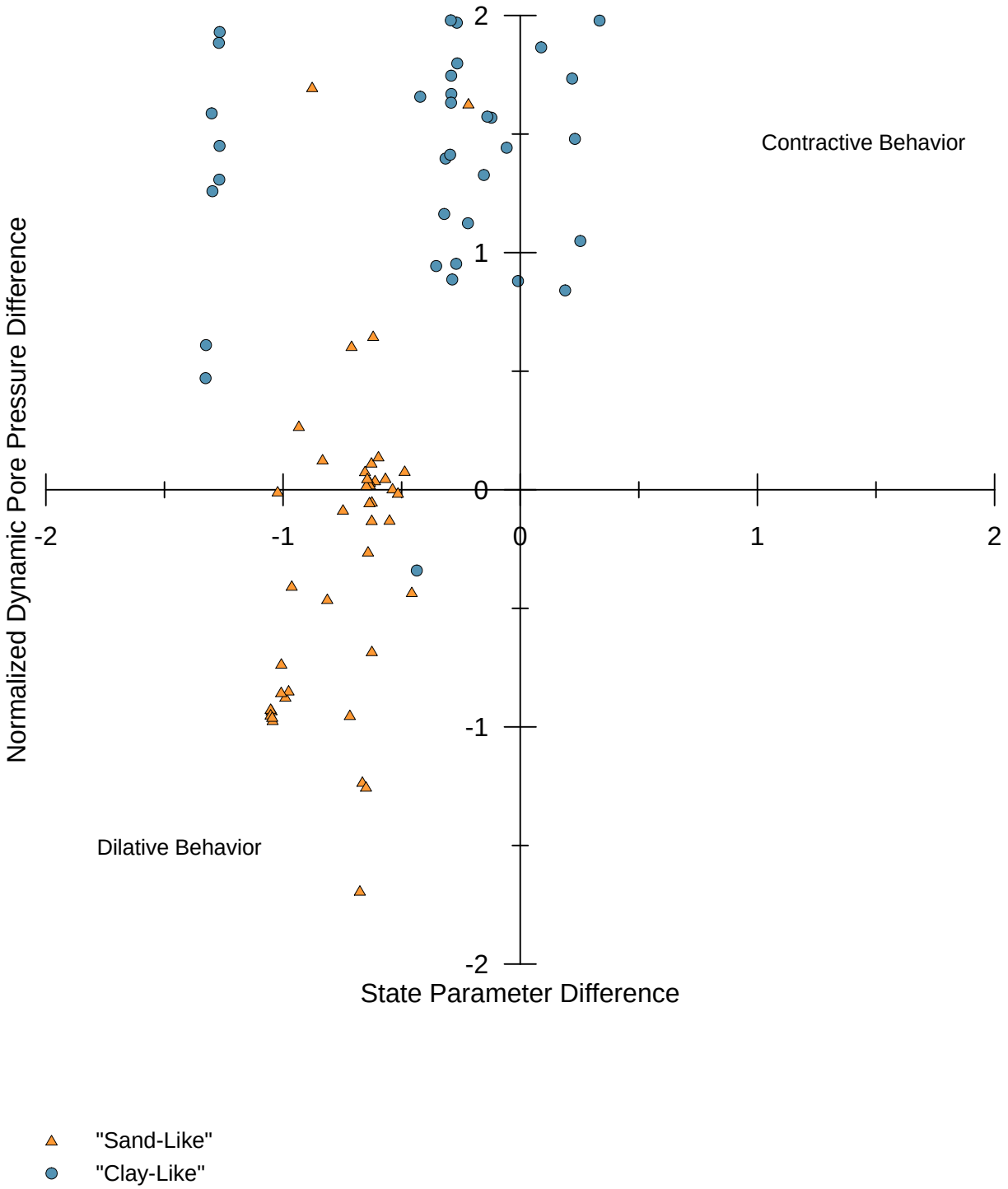
– – – – – 100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

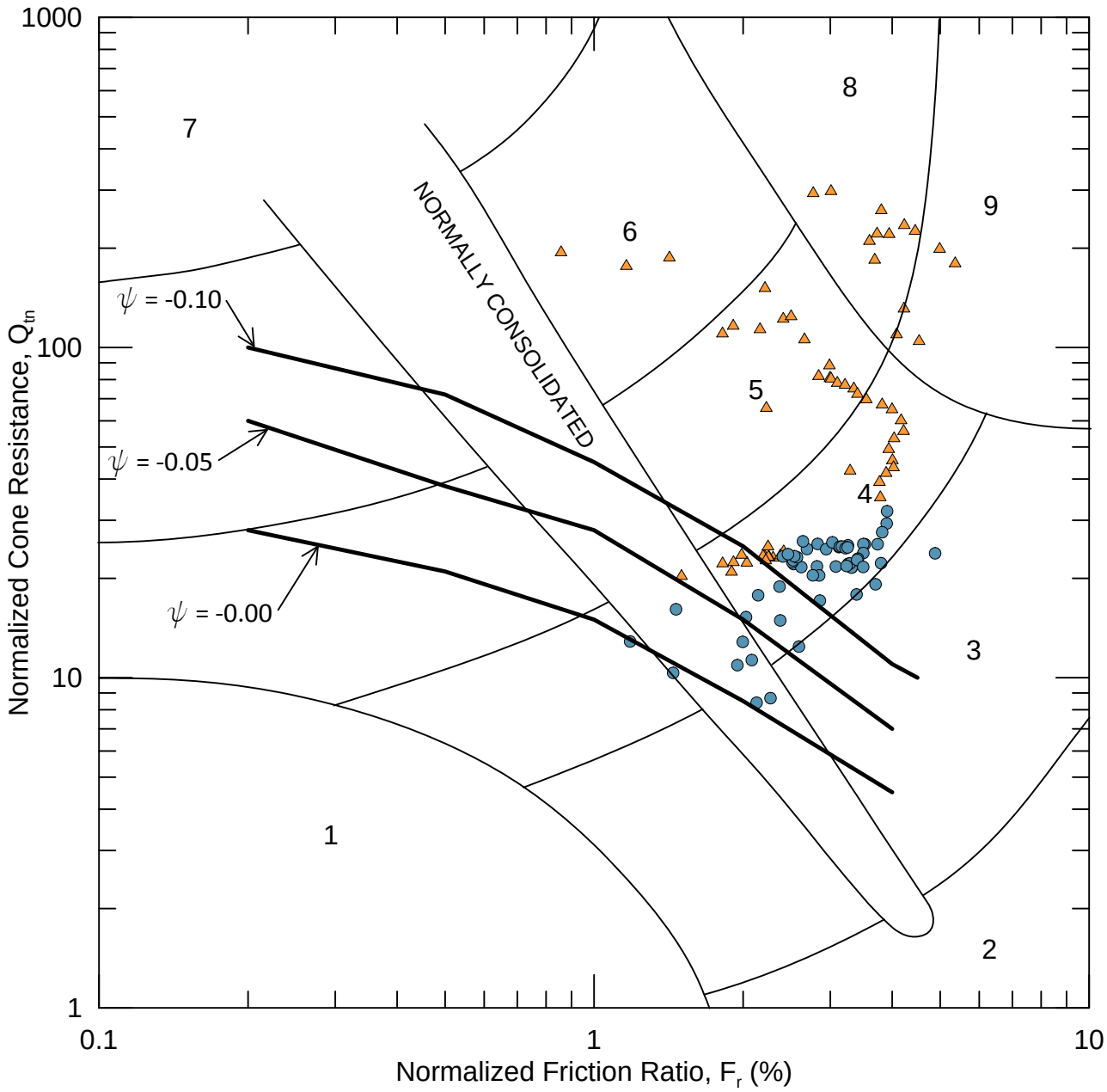
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C008 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C008 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-008_DC_ State Parameter Difference.grf



"Sand-Like"

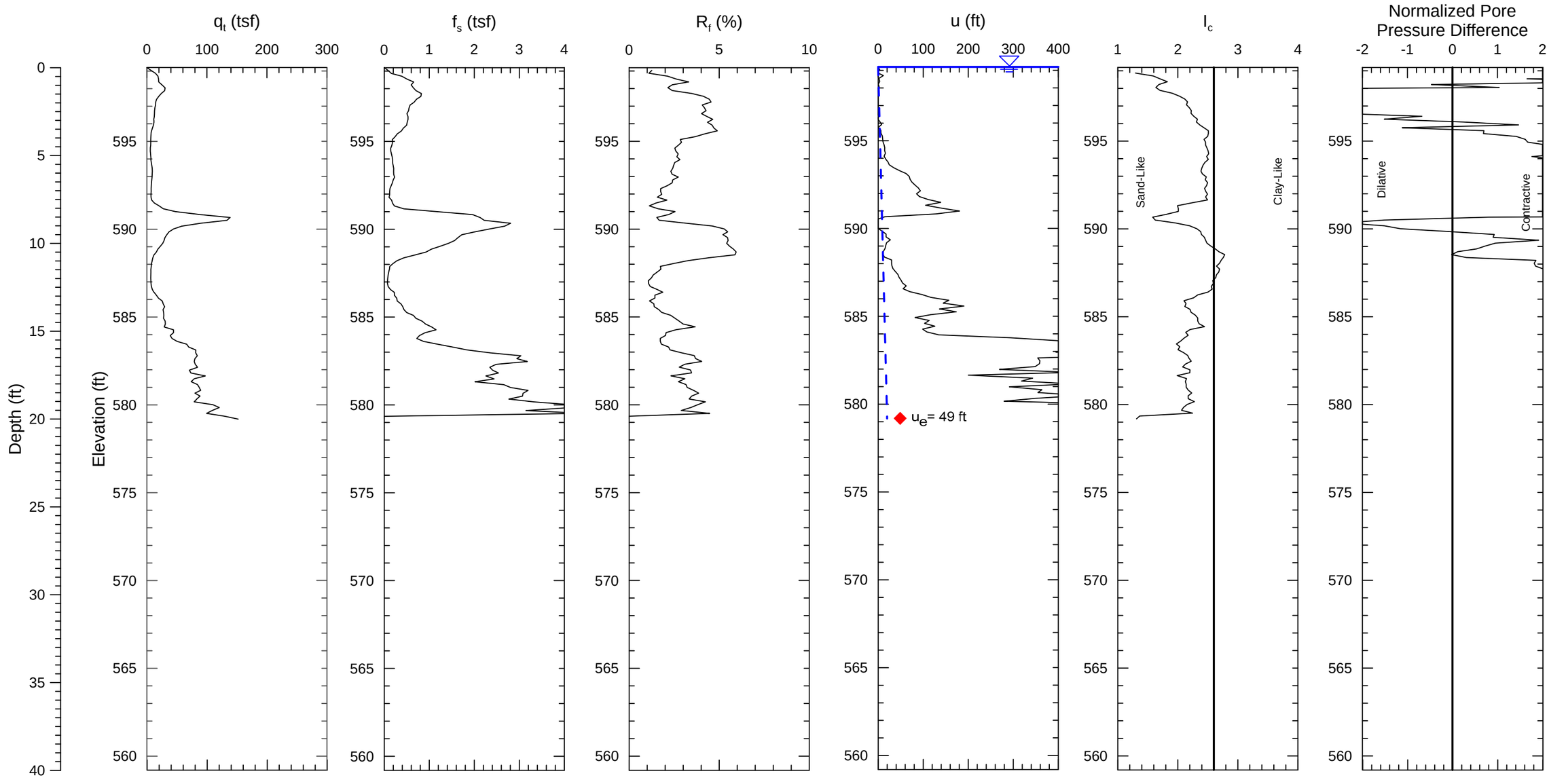
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C008 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-008_DC_Normalized State.grf



Pore Pressure Dissipation Test

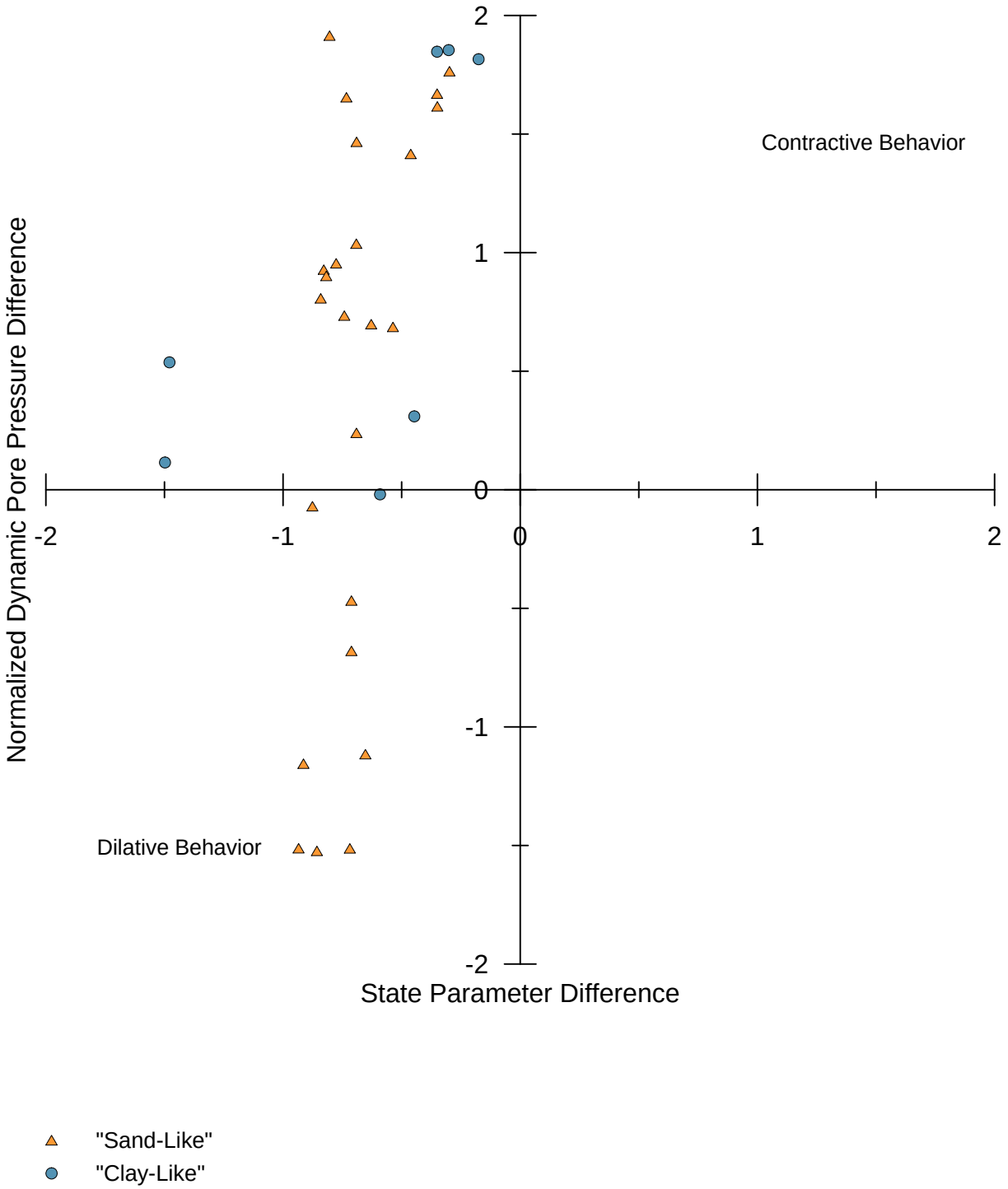
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

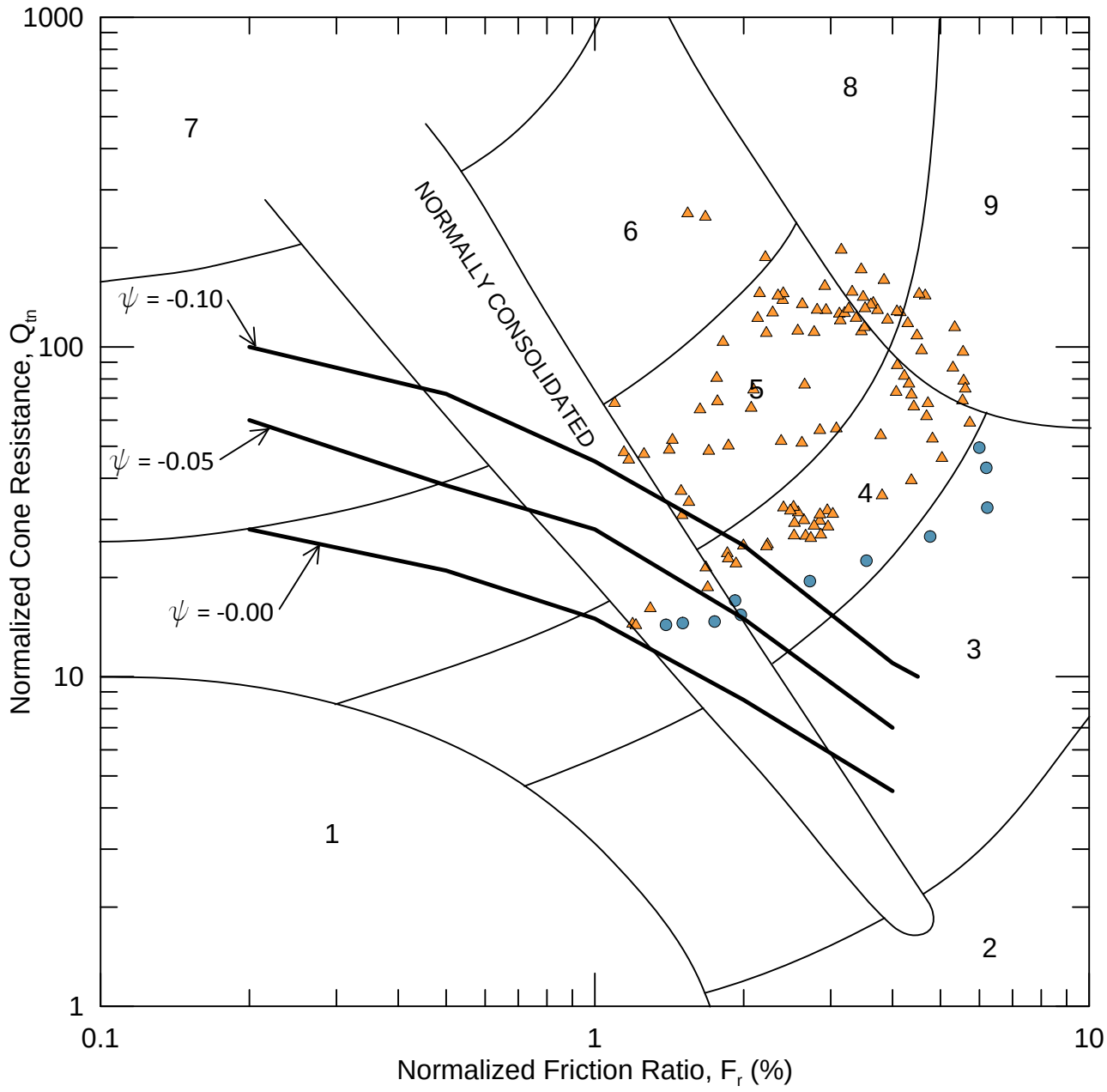
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C009 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C009 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-009_DC_ State Parameter Difference.grf



"Sand-Like"

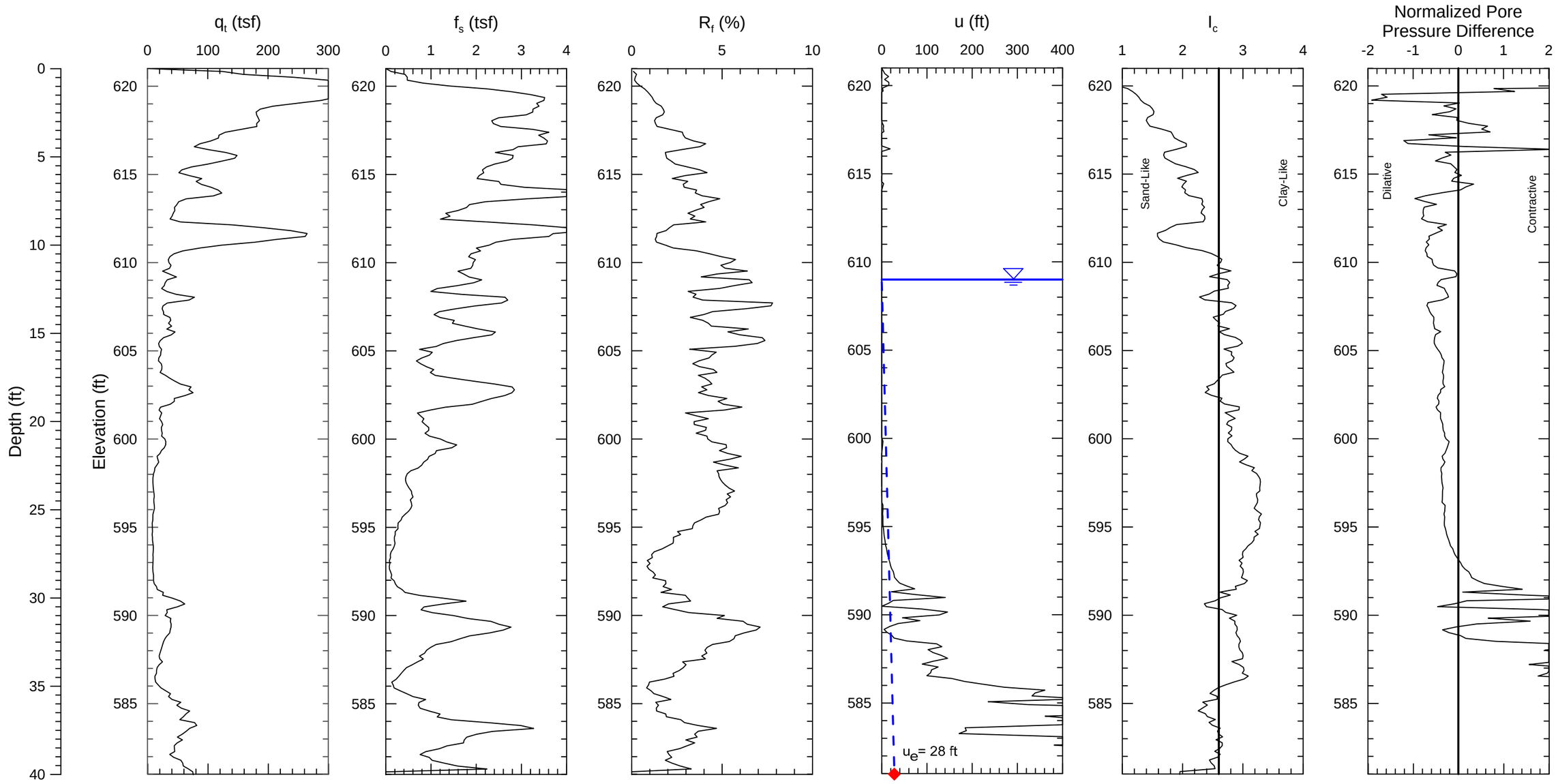
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

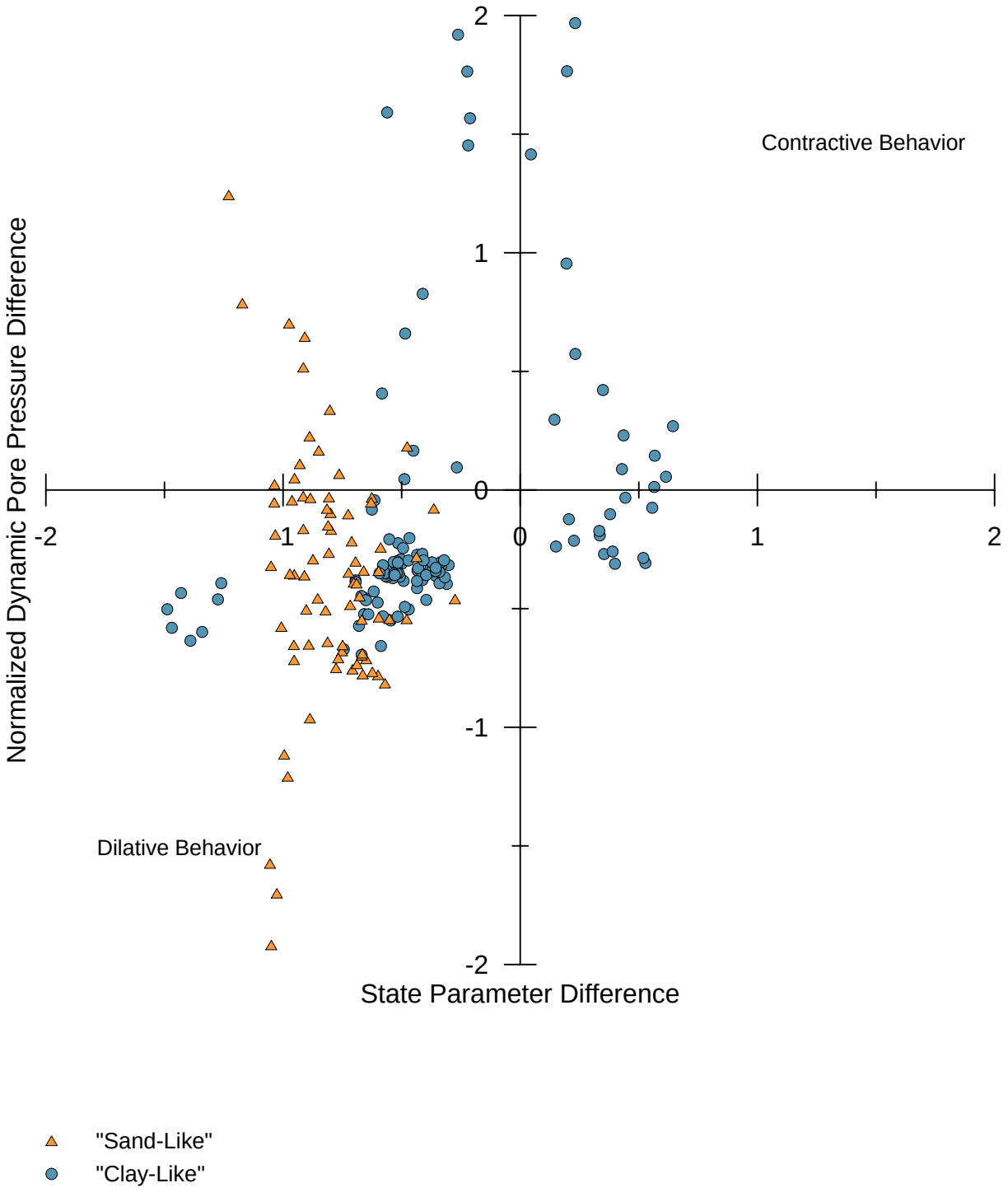
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C009 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-009_DC_Normalized State.grf



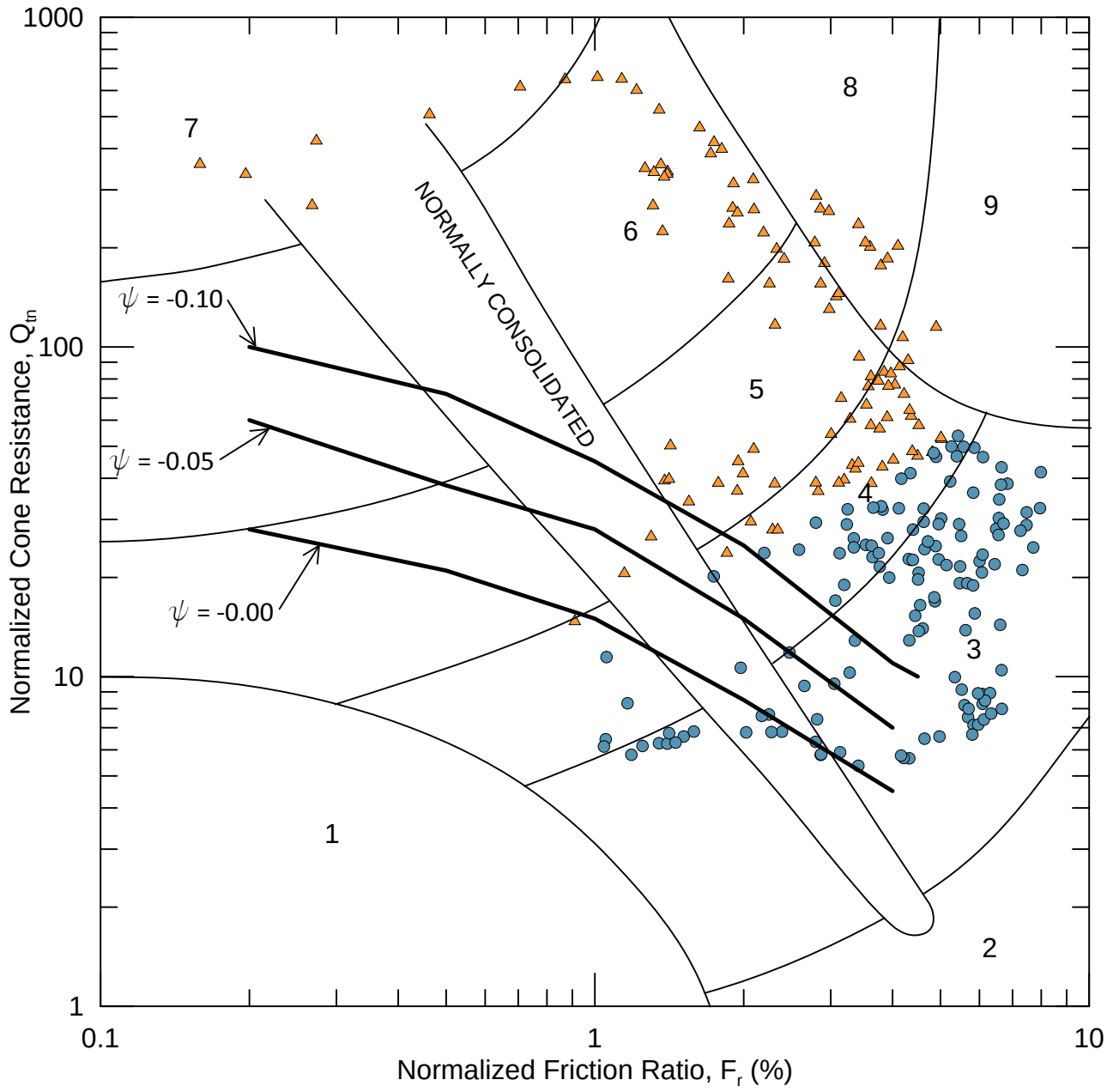
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C010 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C010 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-010DC_ State Parameter Difference.grf



"Sand-Like"

"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C010 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

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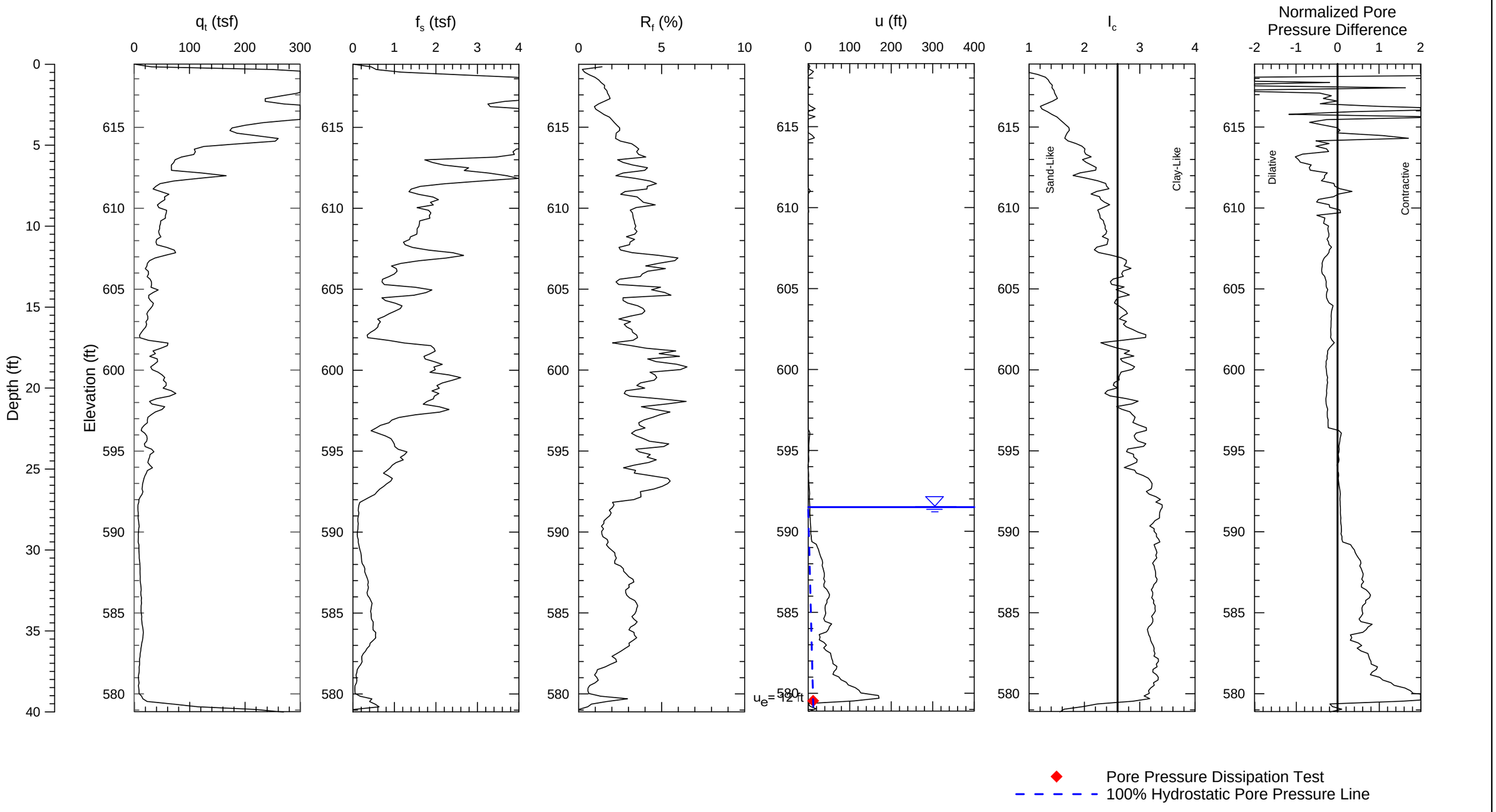
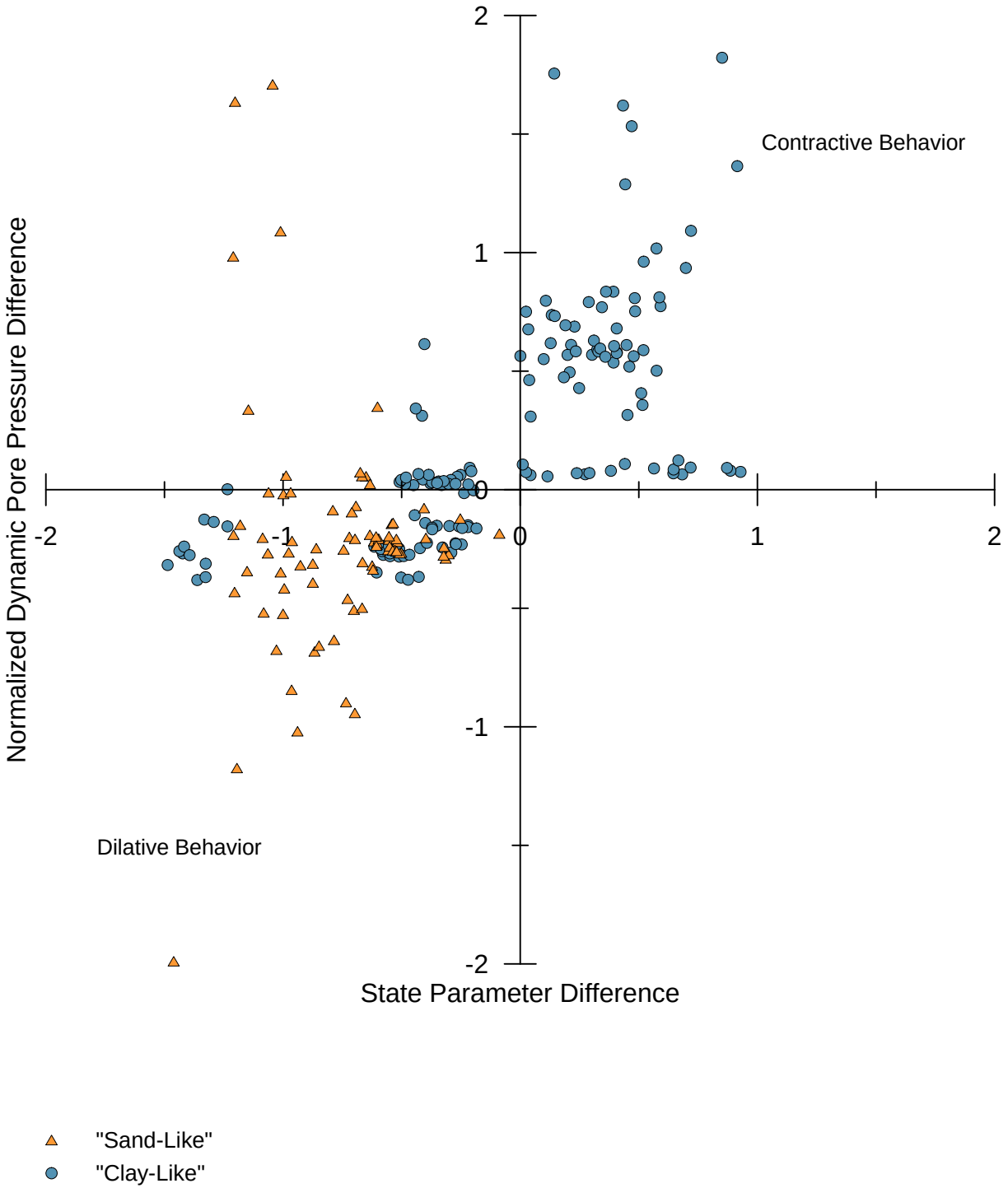


Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C011 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C011 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

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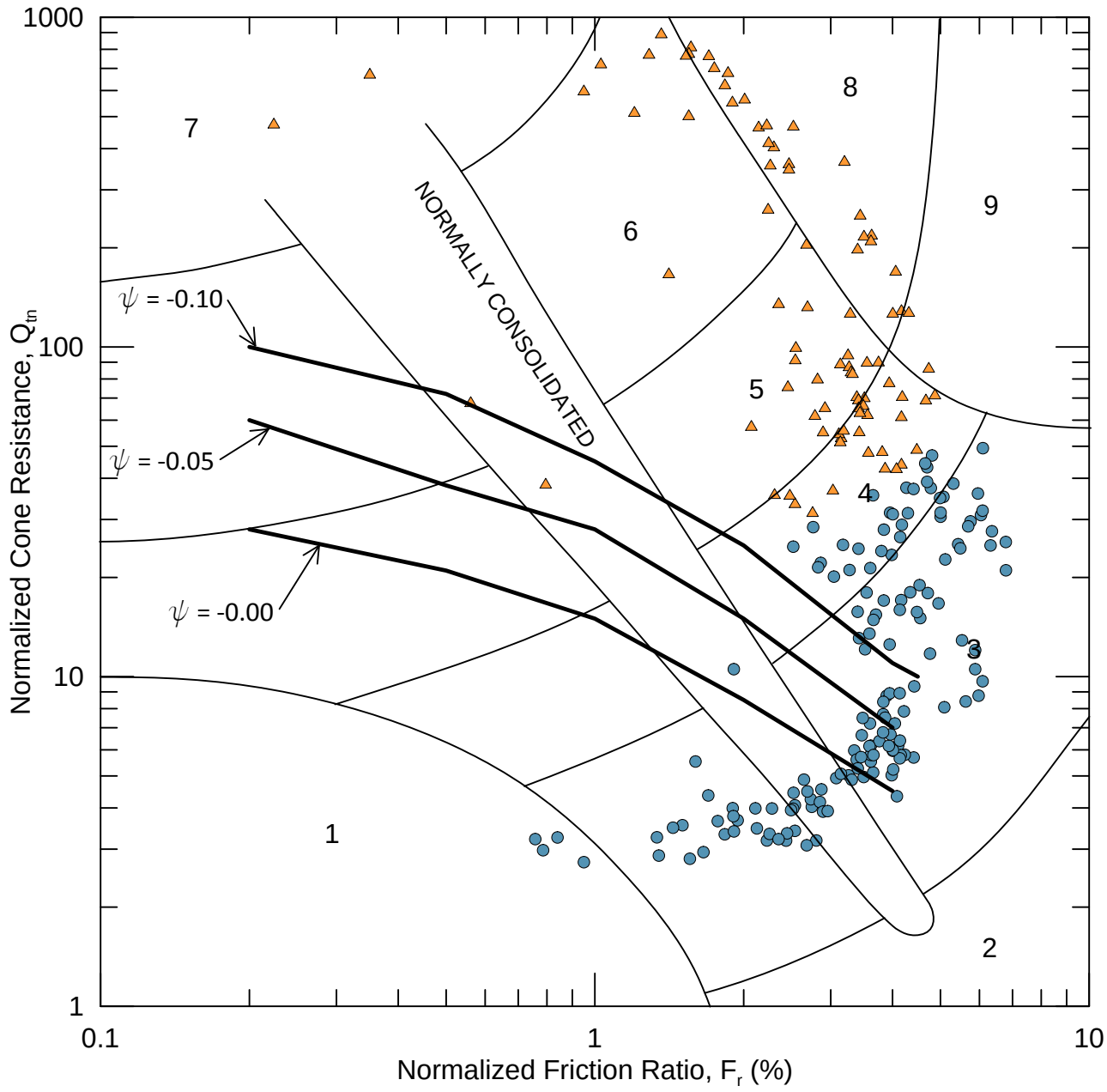

"Sand-Like"

"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C011 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

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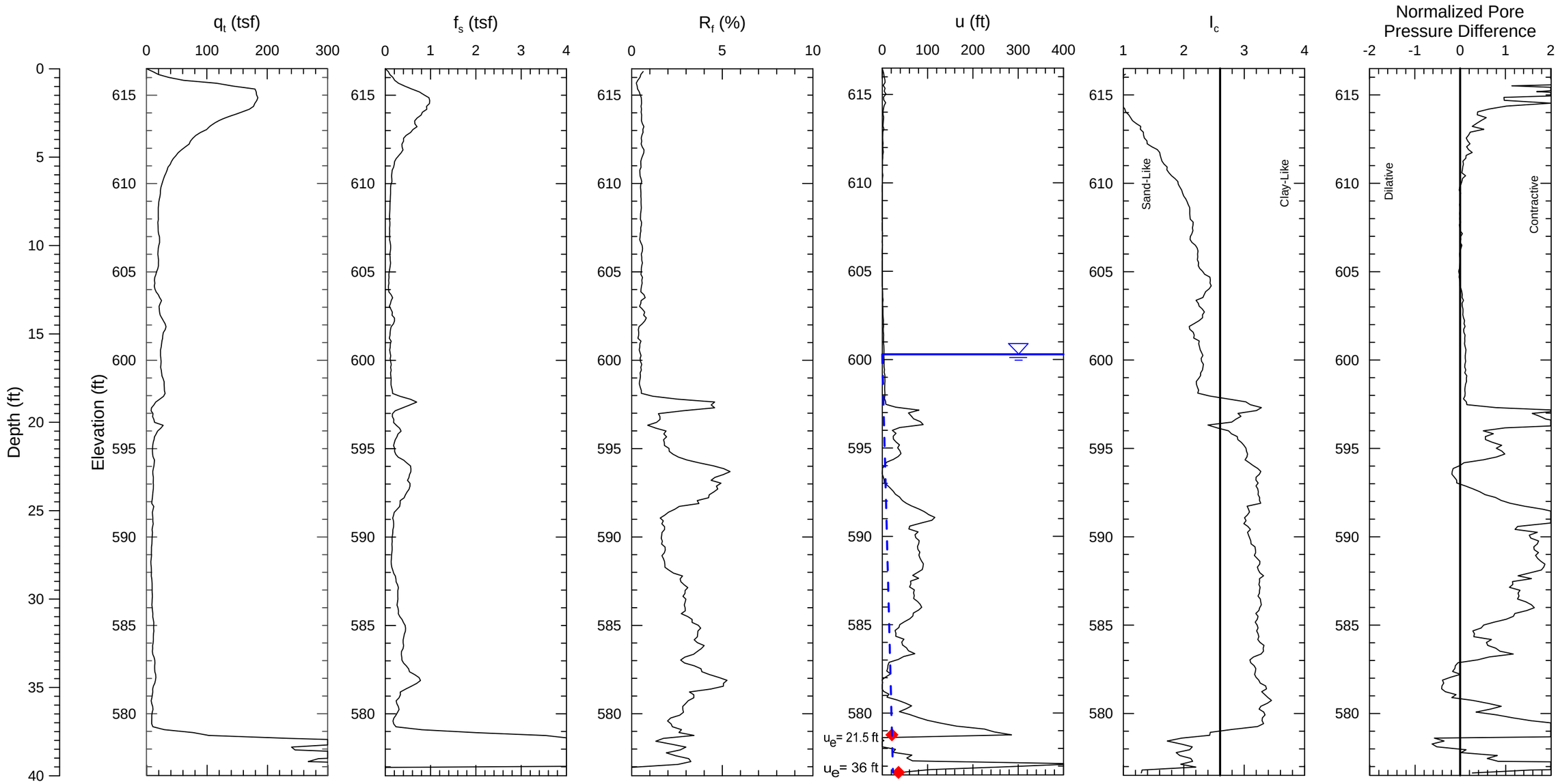
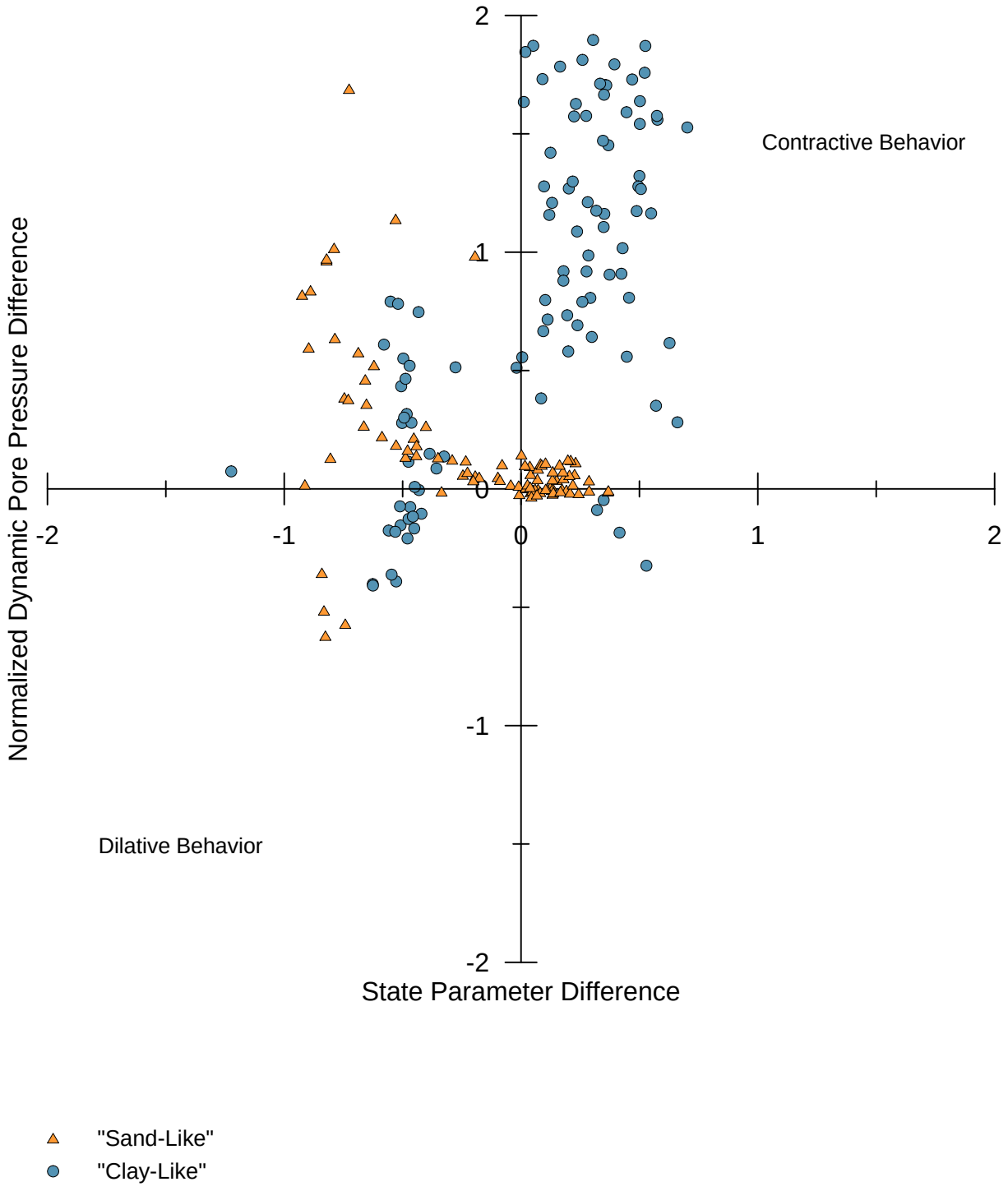


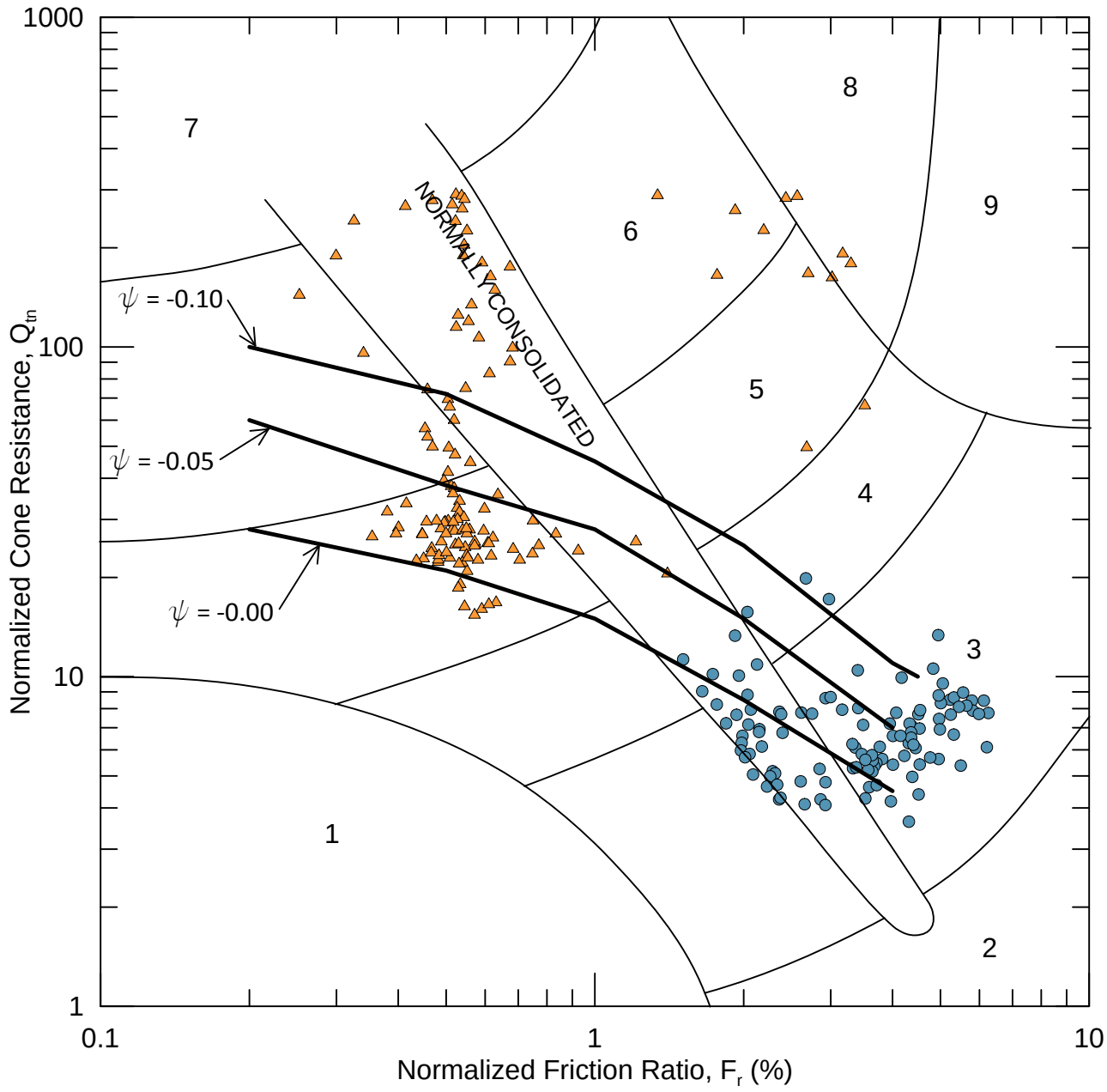
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C012 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C012 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-012_DC_ State Parameter Difference.grf



"Sand-Like"

"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C012 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

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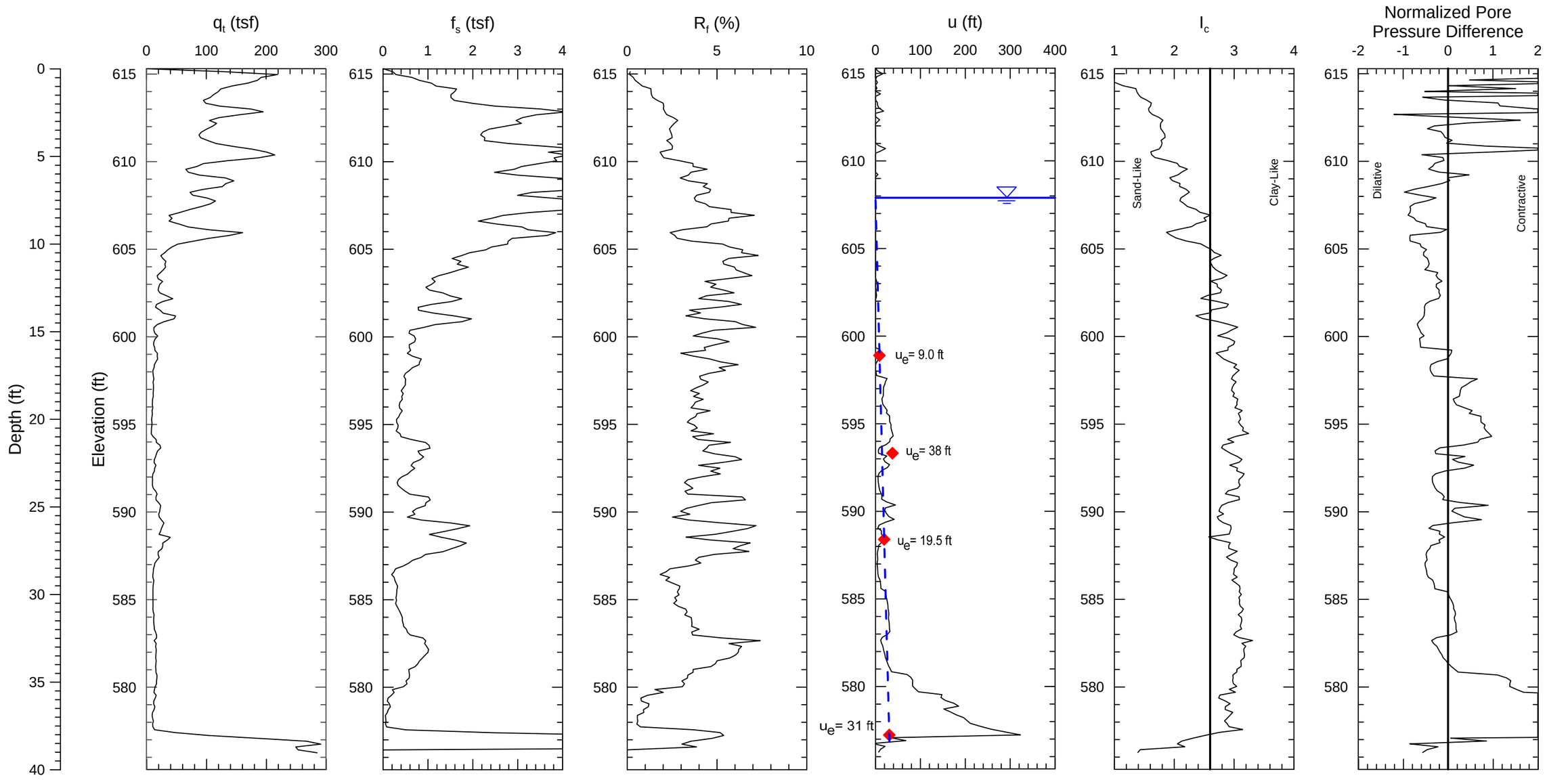
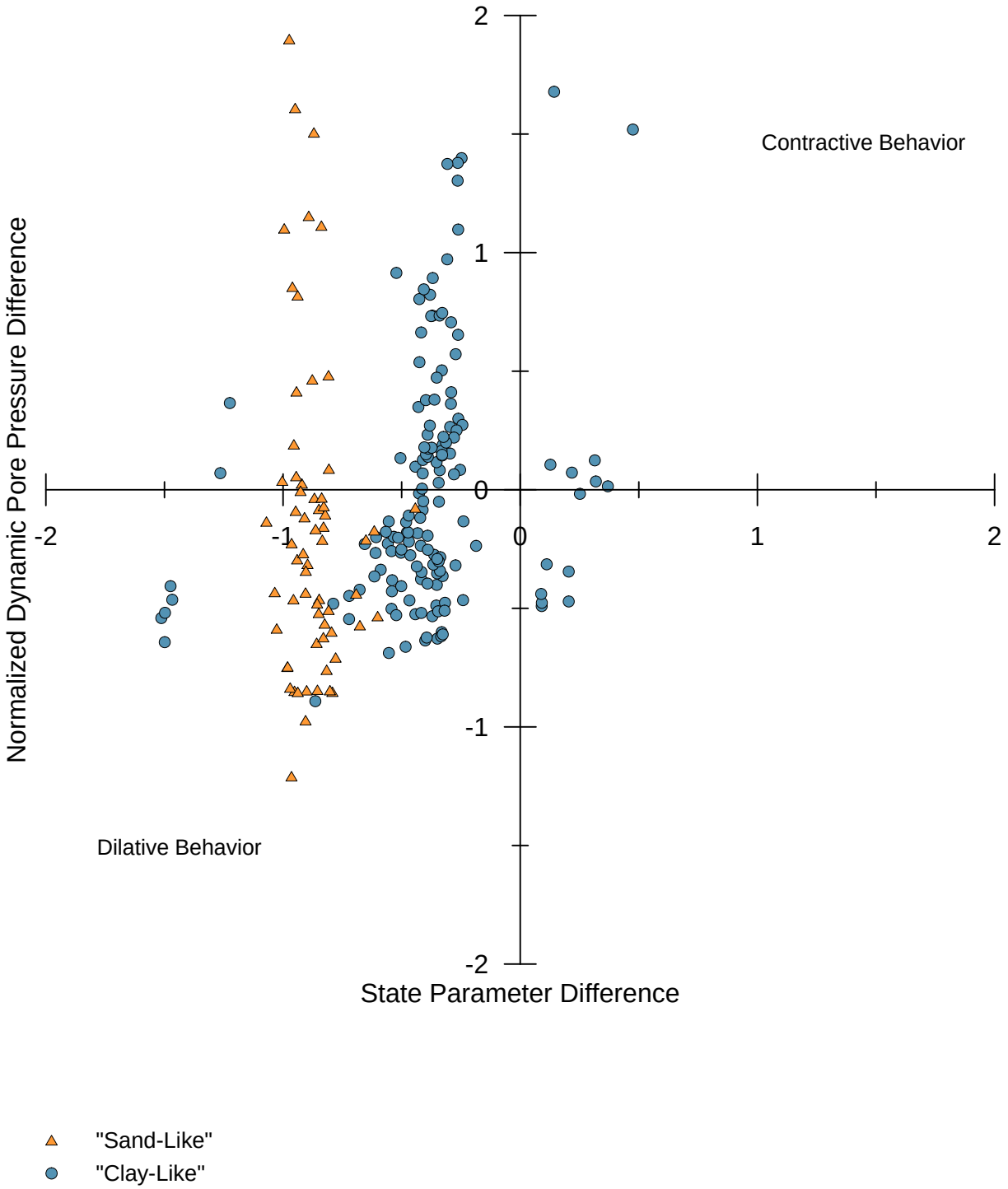


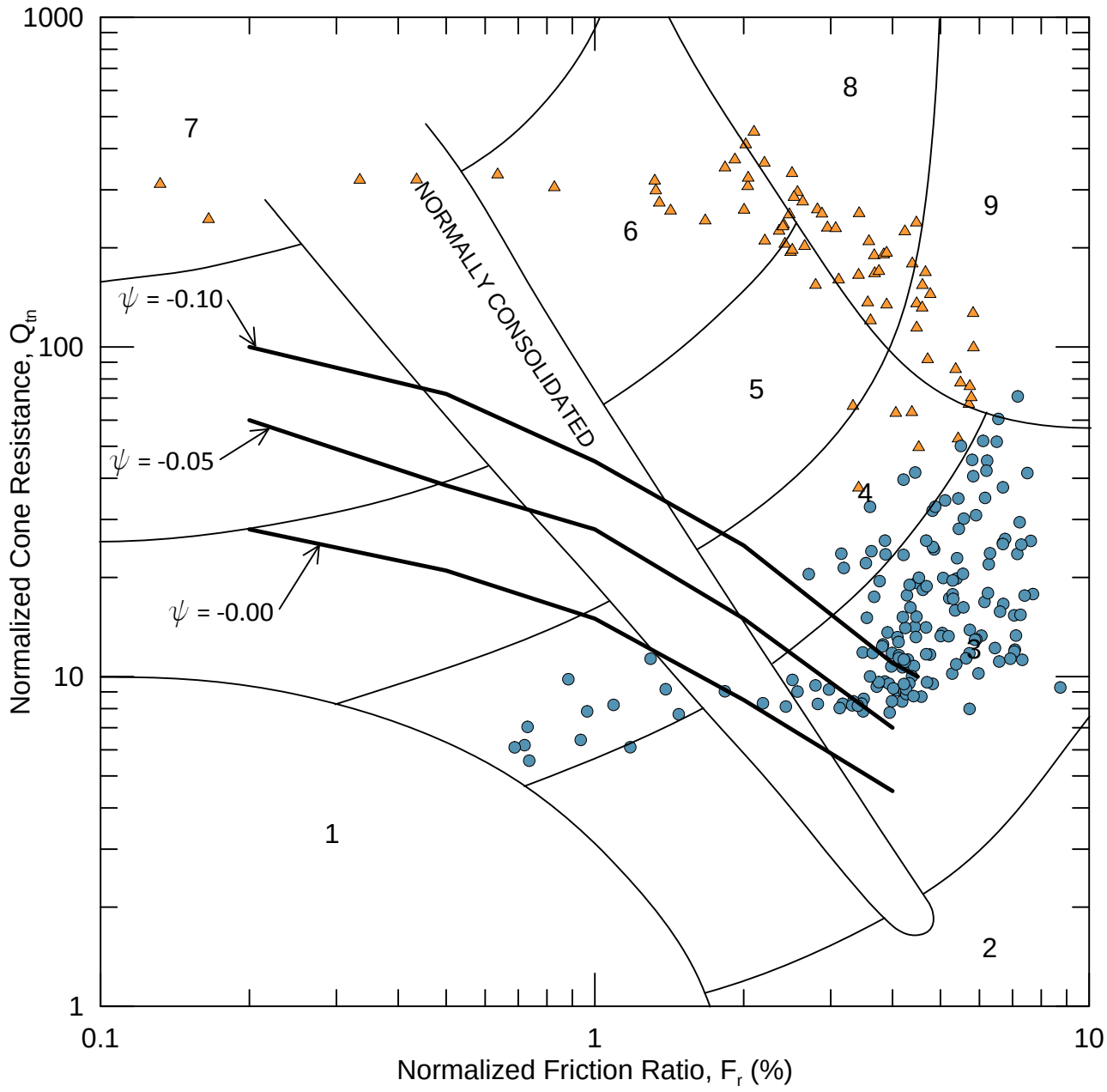
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C013 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C013 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-013_DC_ State Parameter Difference.grf



"Sand-Like"

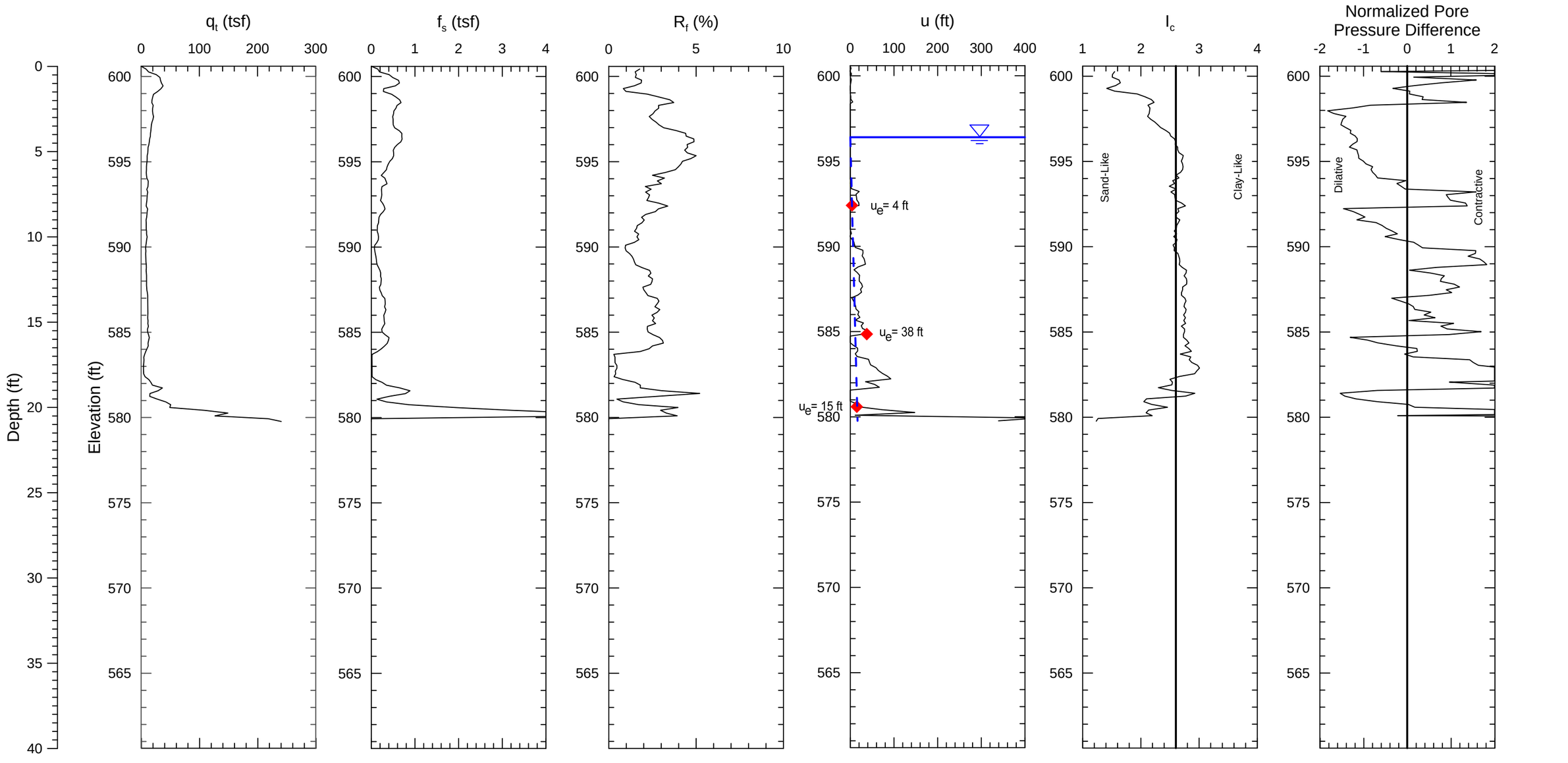
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

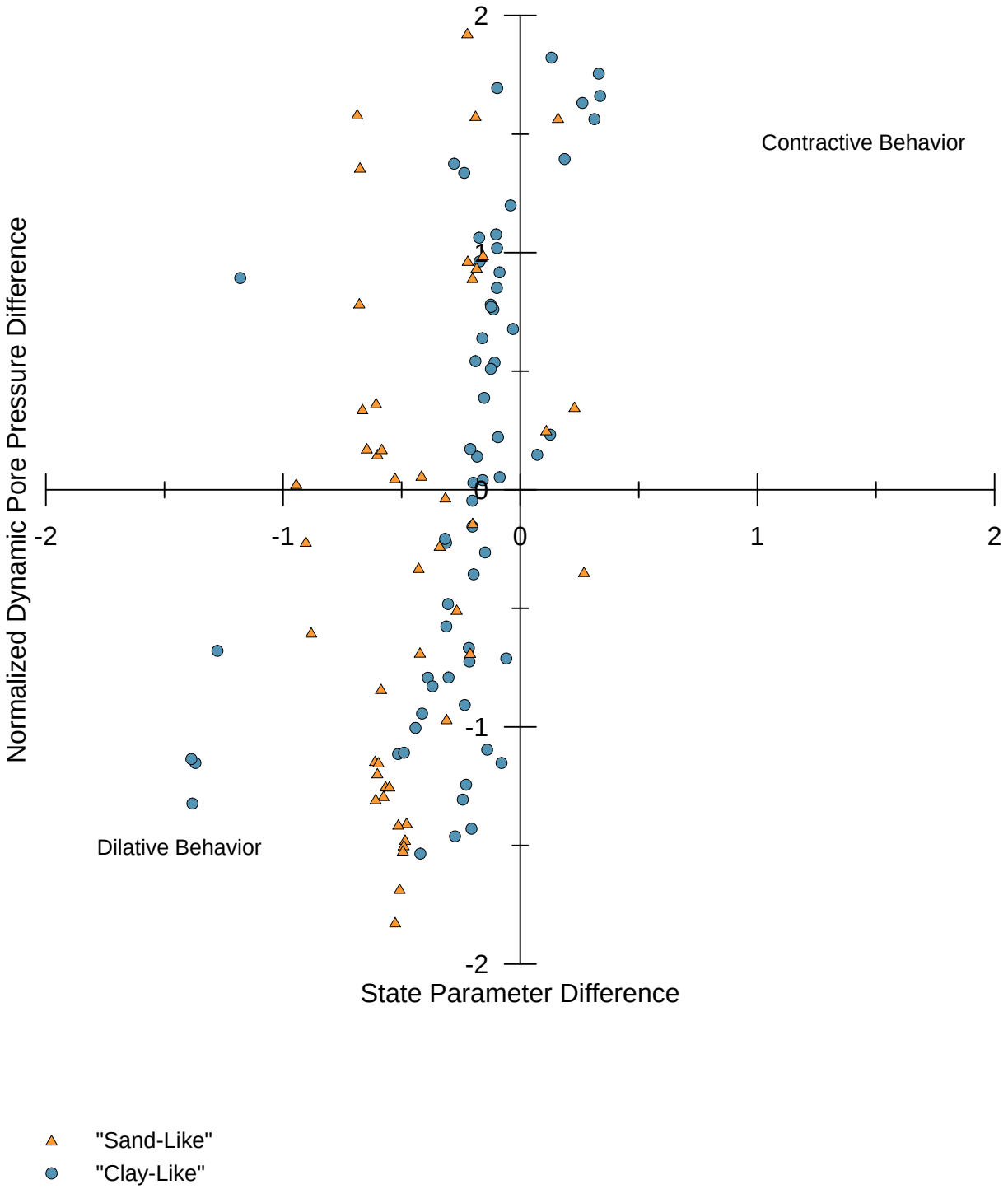
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C013 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-013_DC_Normalized State.grf



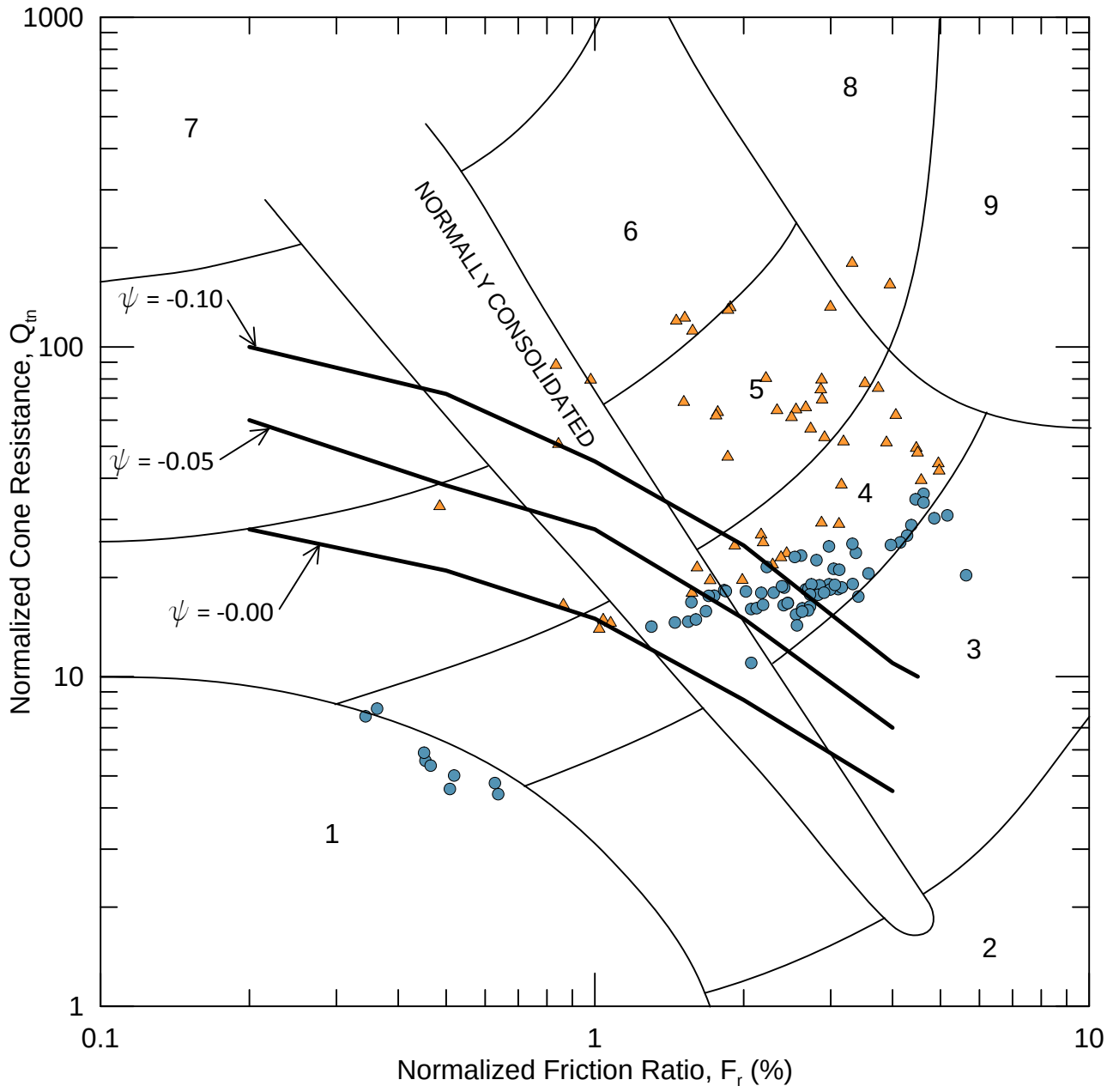
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C014 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C014 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-014_DC_ State Parameter Difference.grf



"Sand-Like"

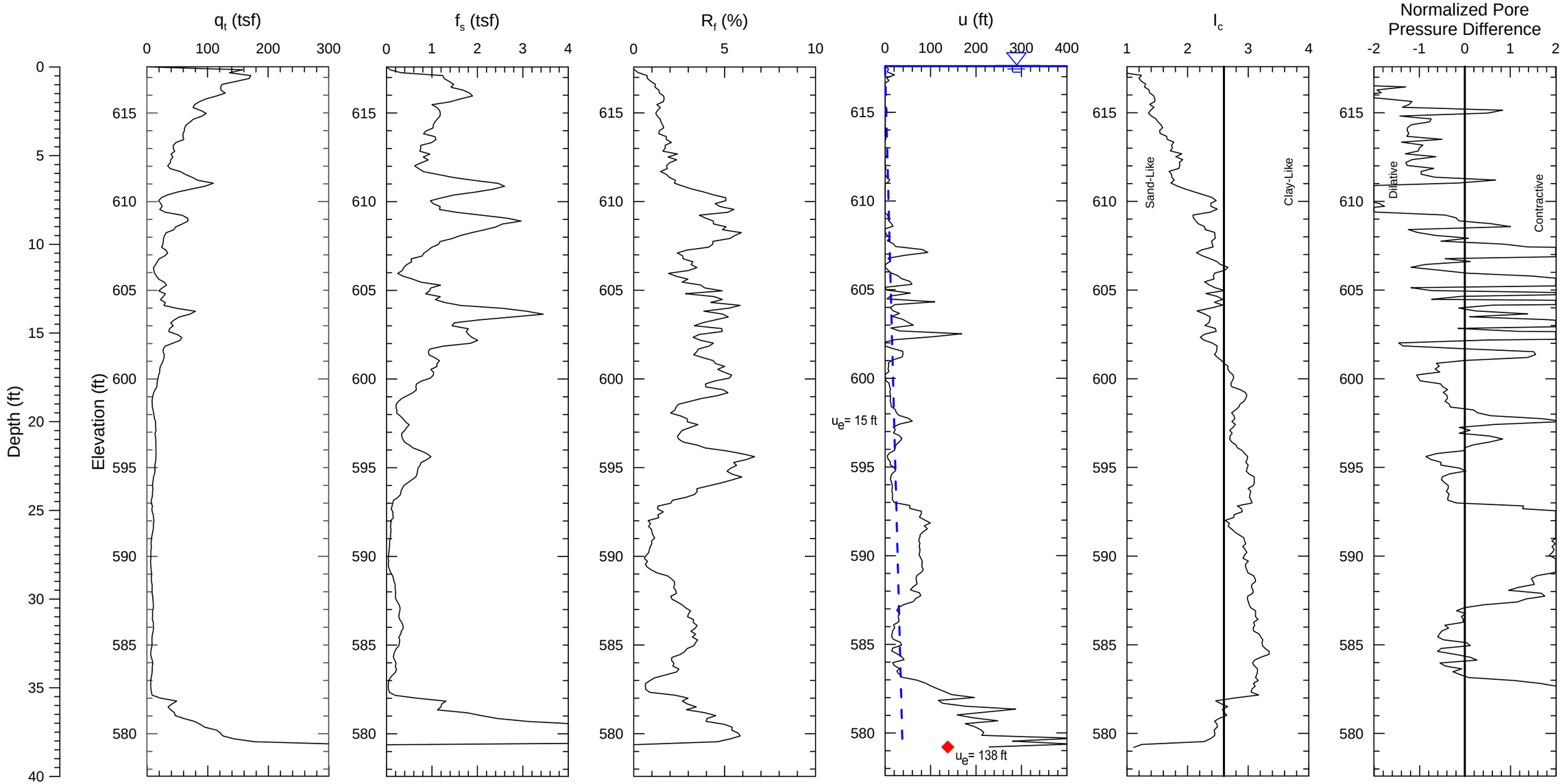
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

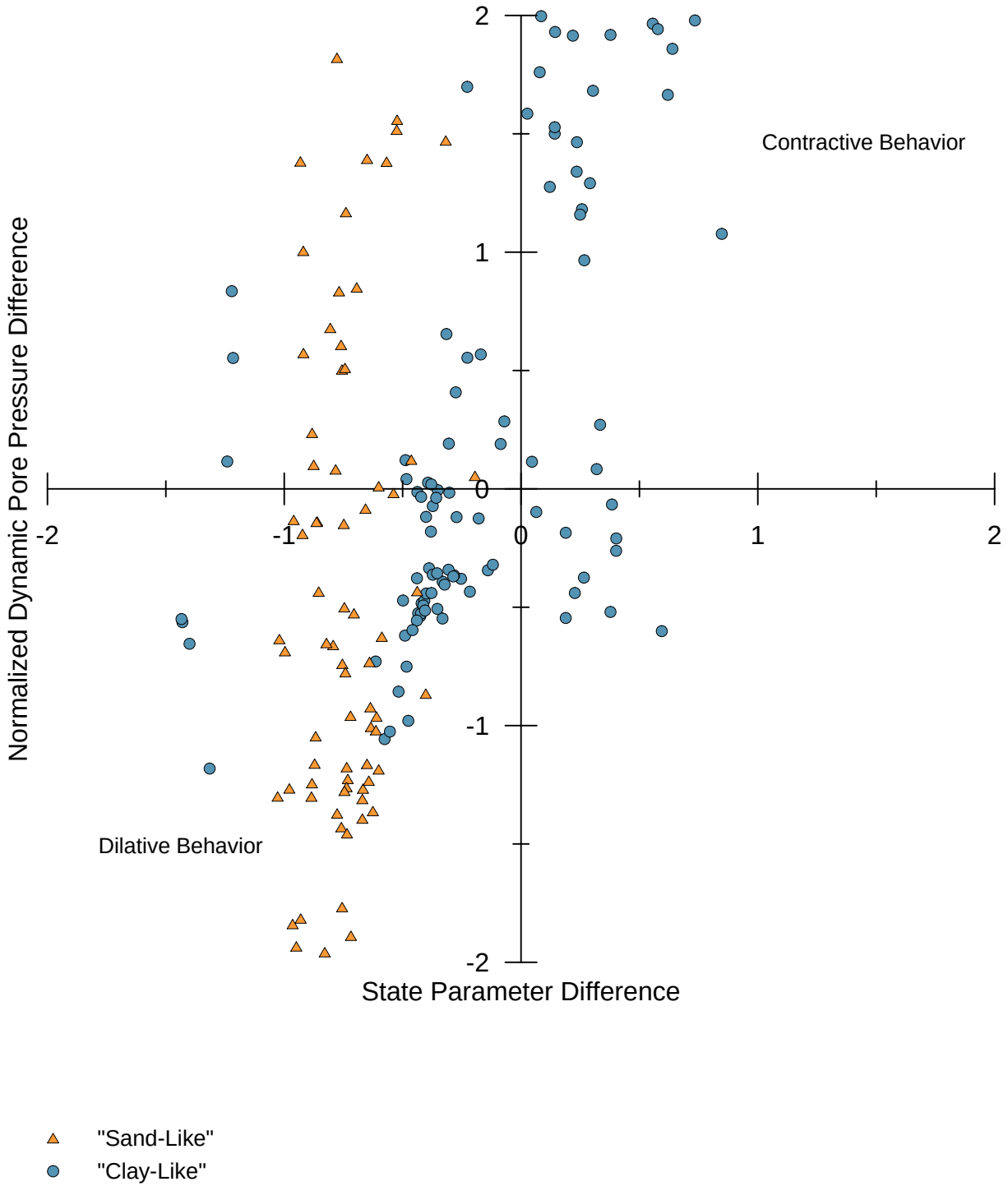
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C014 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-014_DC_Normalized State.grf



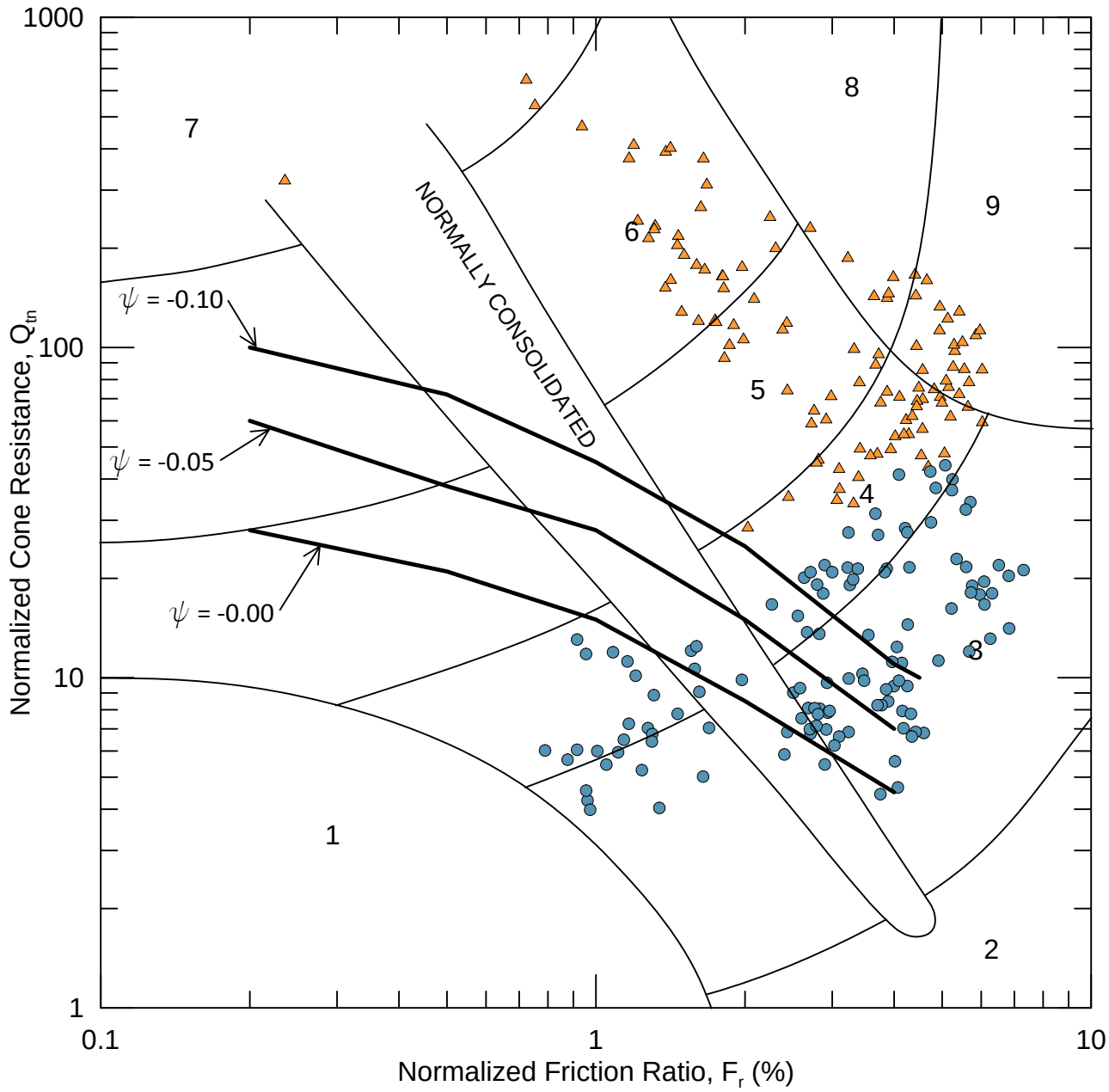
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C015 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C015 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-015_DC_ State Parameter Difference.grf



"Sand-Like"

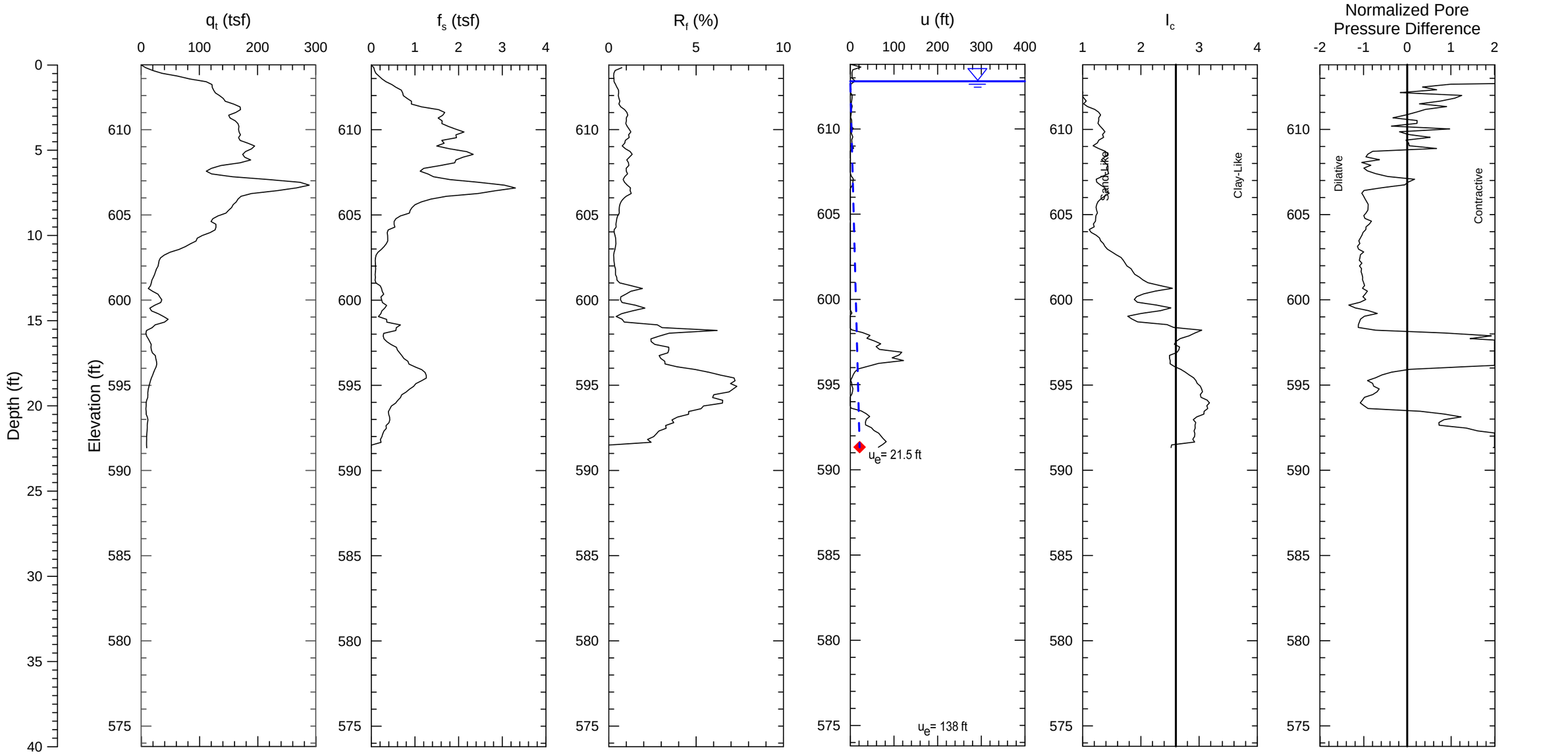
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

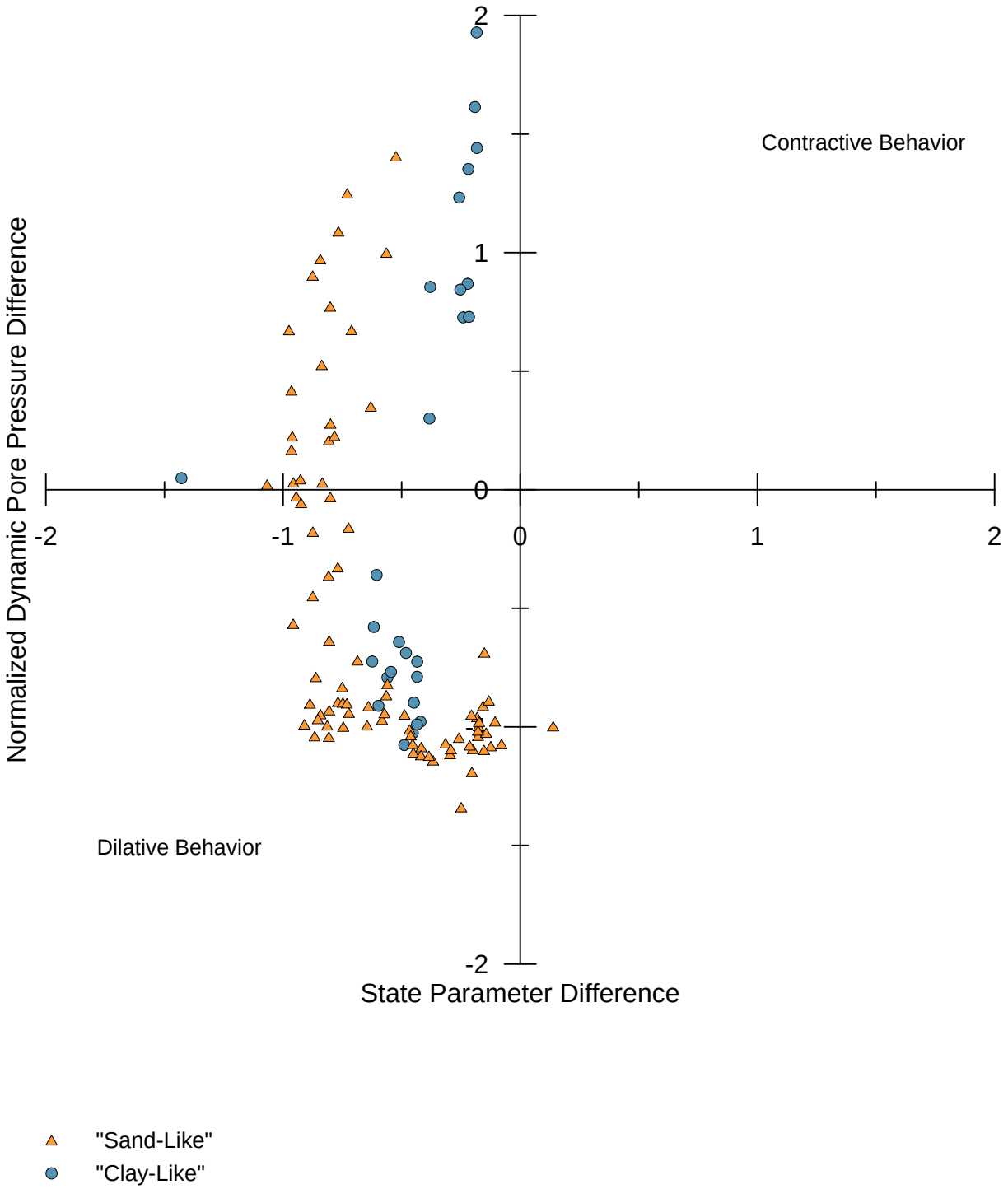
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C015 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-015_DC_Normalized State.grf



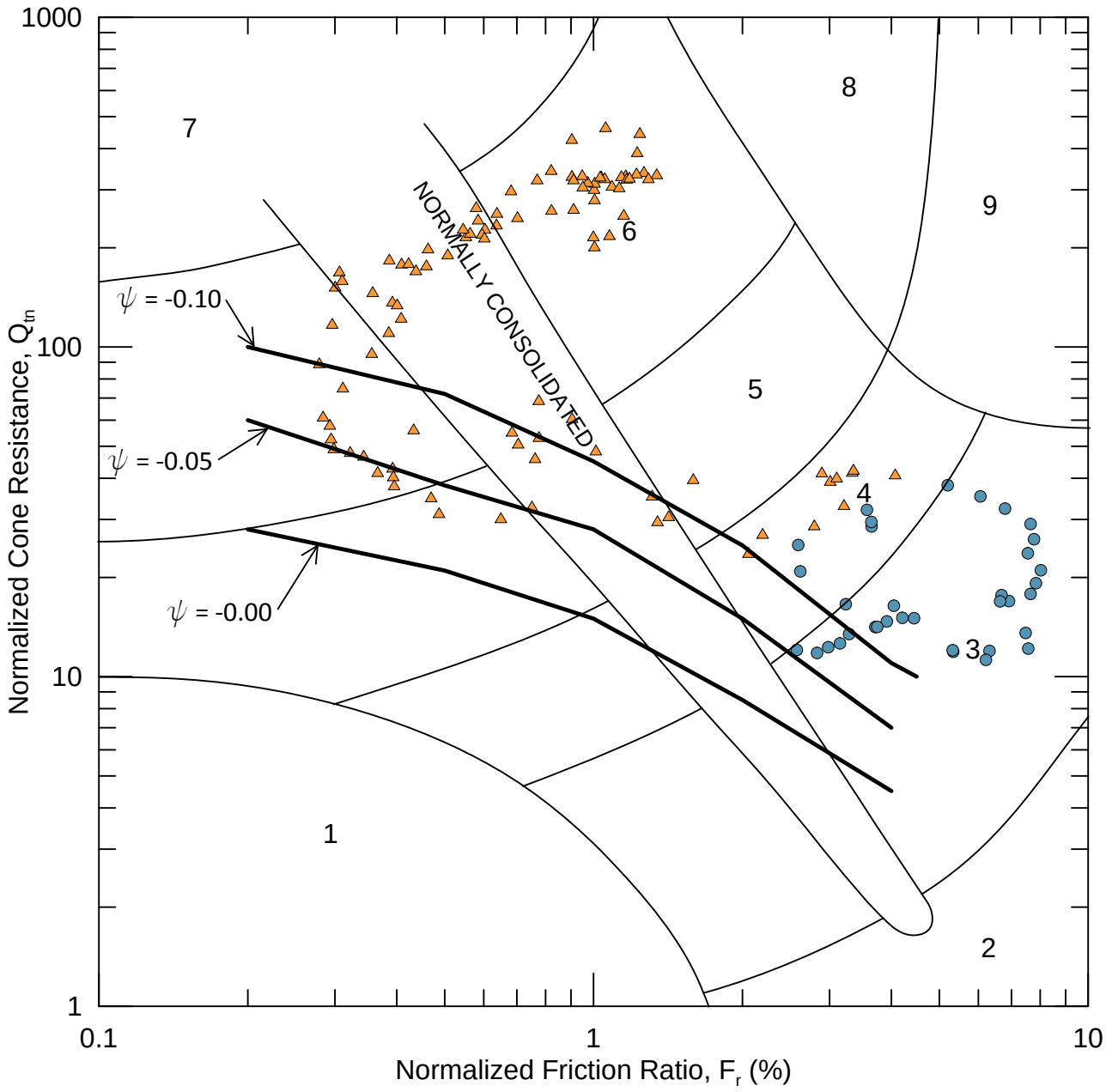
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C016 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C016 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-016_DC_ State Parameter Difference.grf



"Sand-Like"

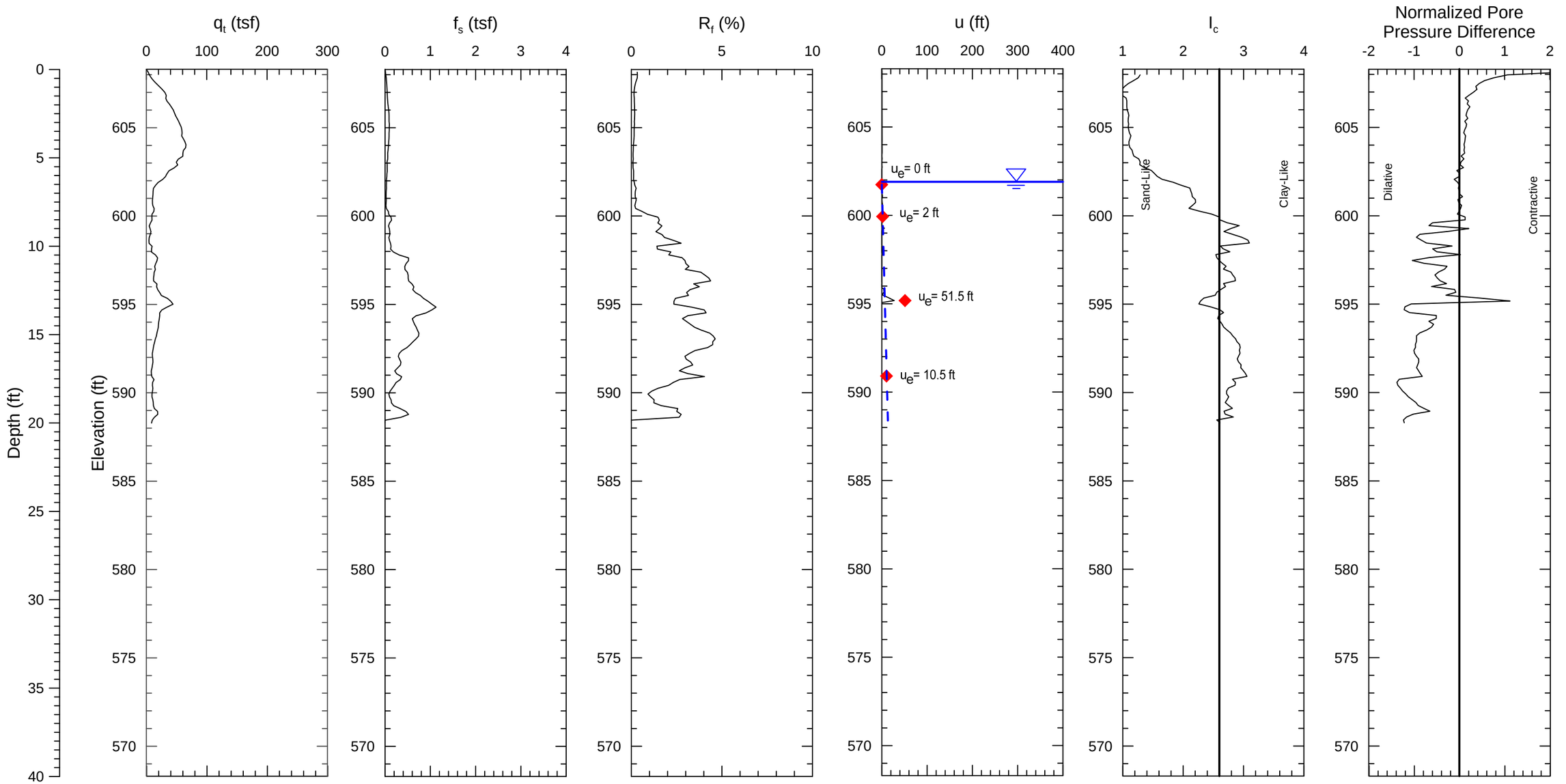
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

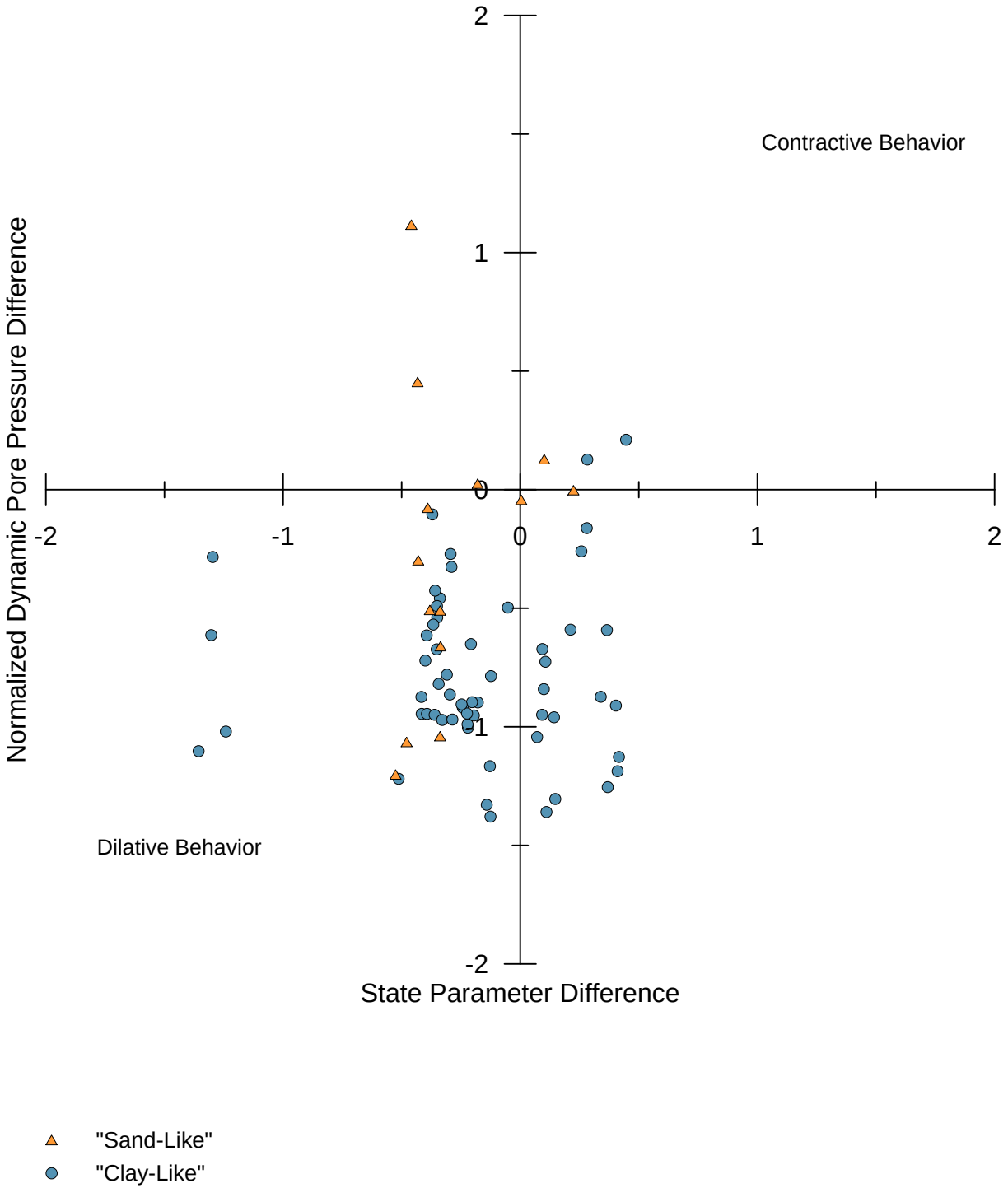
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C016 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-016_DC_Normalized State.grf



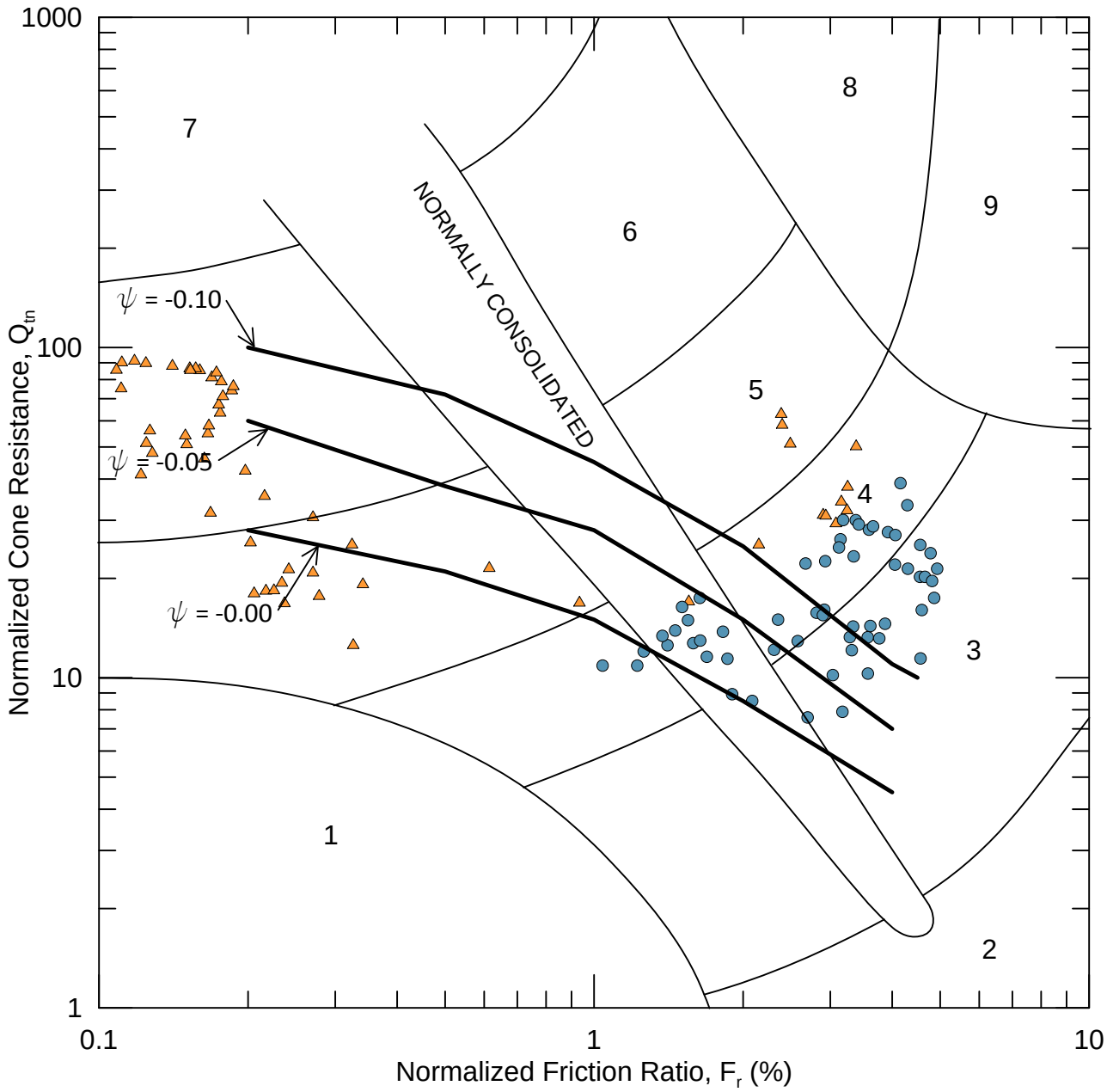
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C017 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C017 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-017_DC_ State Parameter Difference.grf



"Sand-Like"

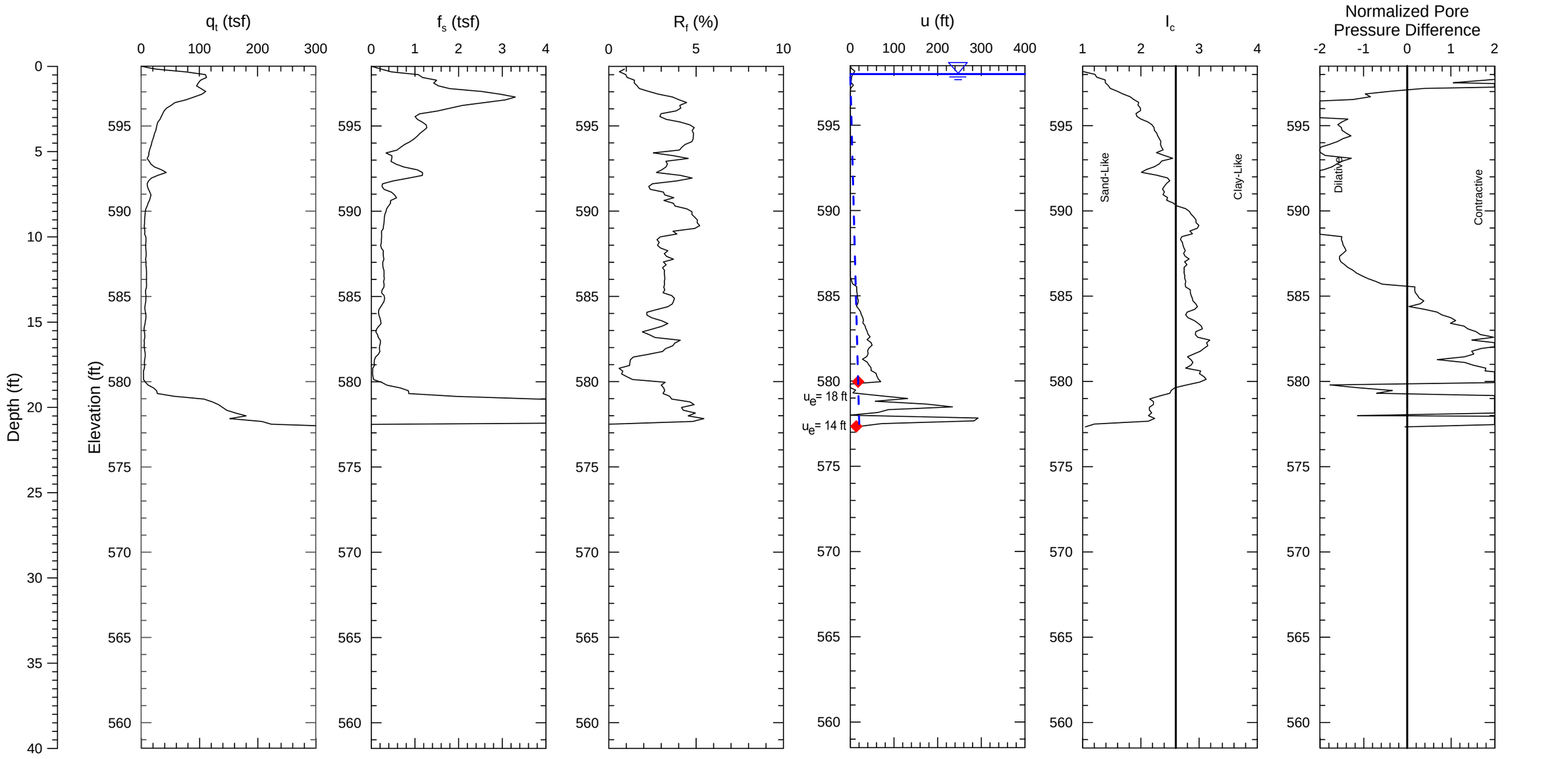
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

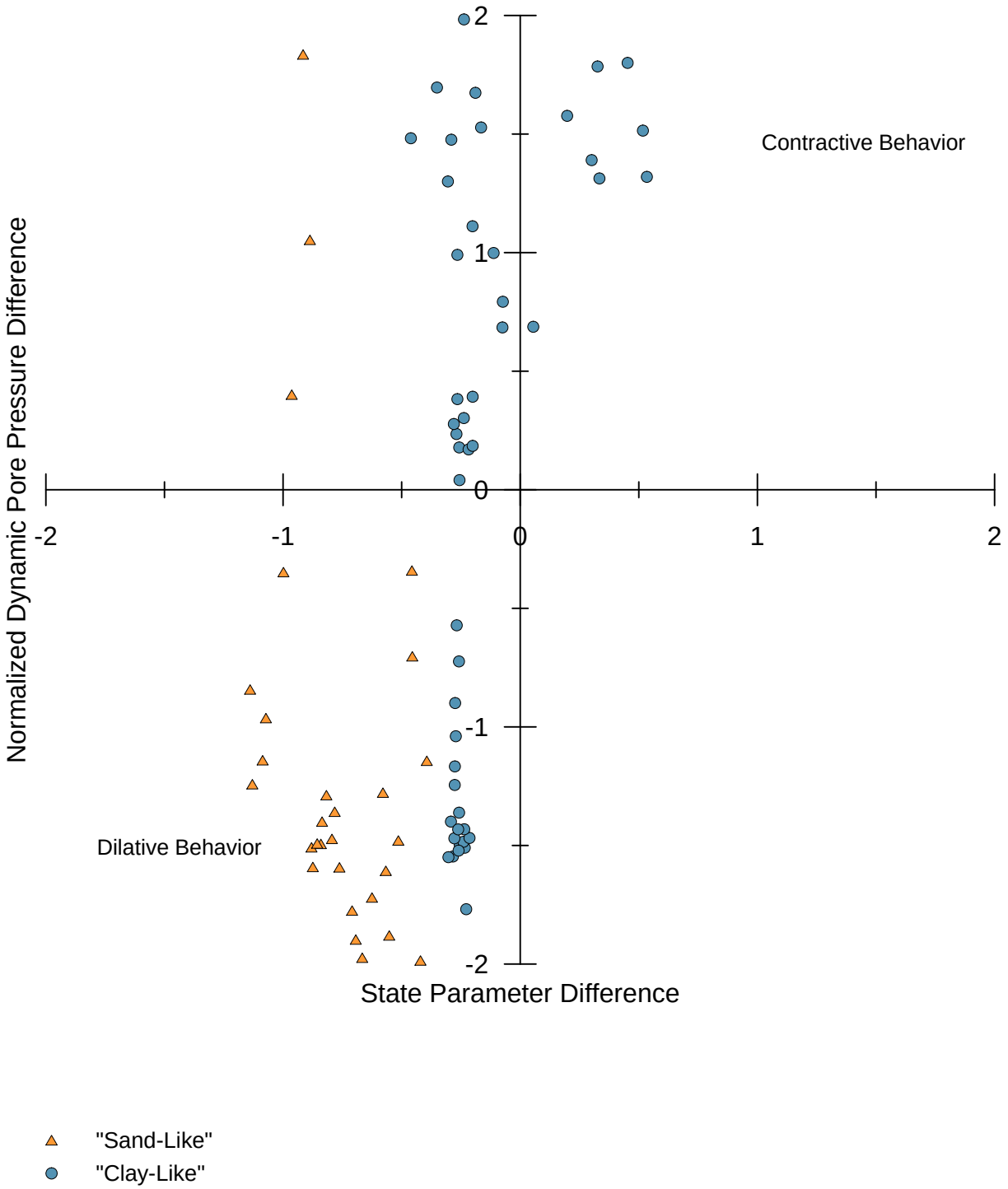
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C017 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-017_DC_Normalized State.grf



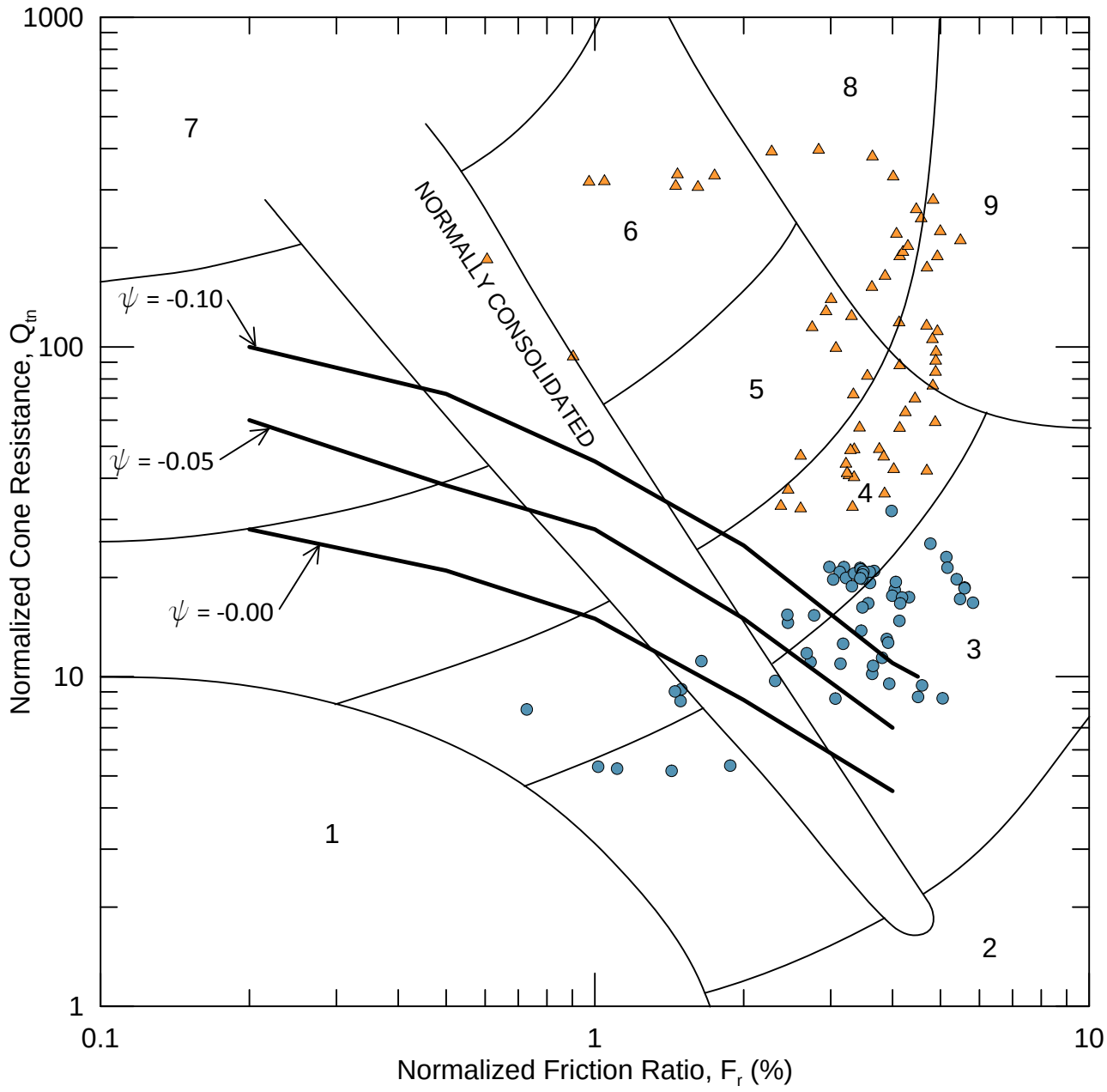
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C018 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C018 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-018_DC_ State Parameter Difference.grf



"Sand-Like"

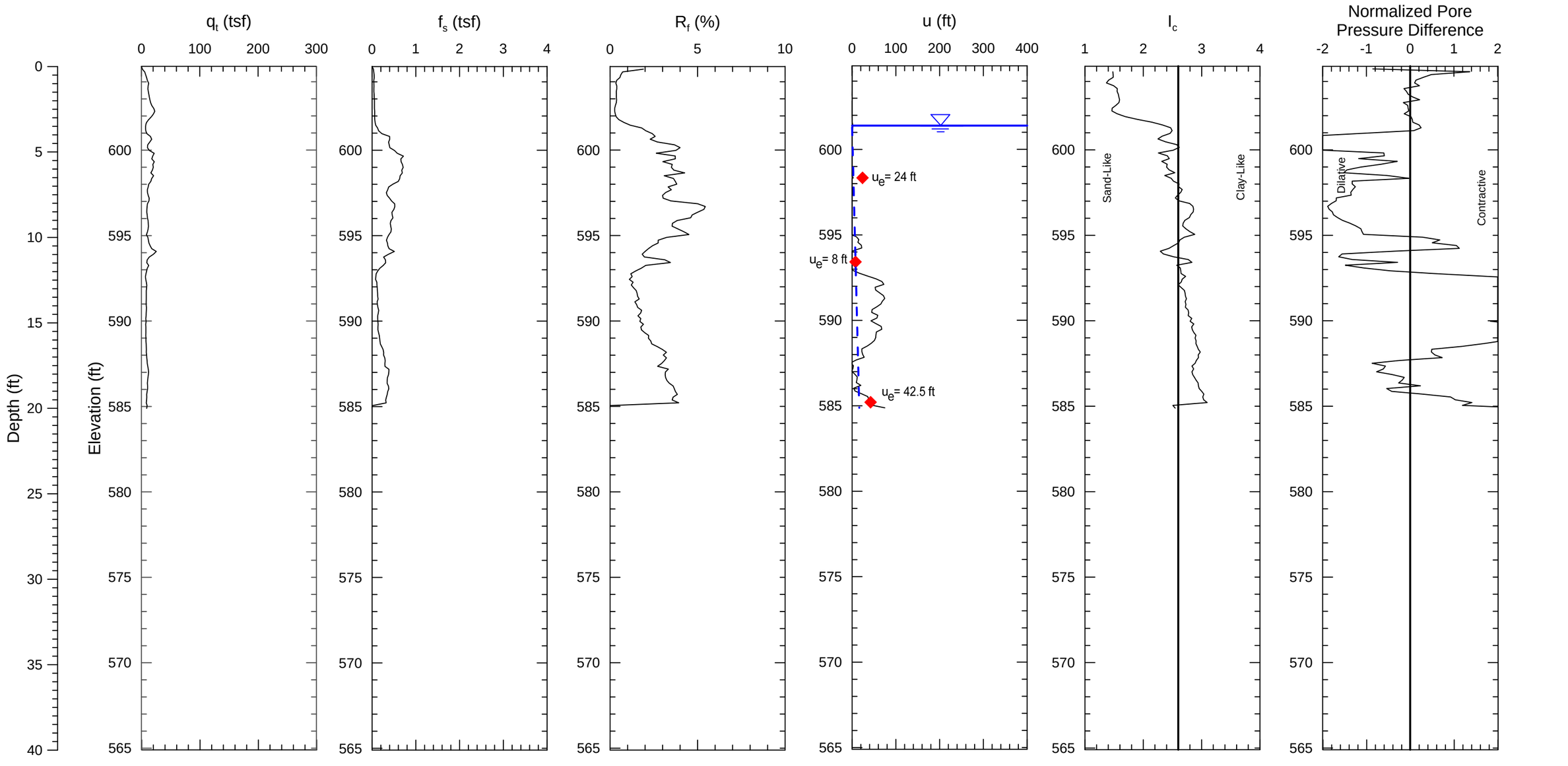
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

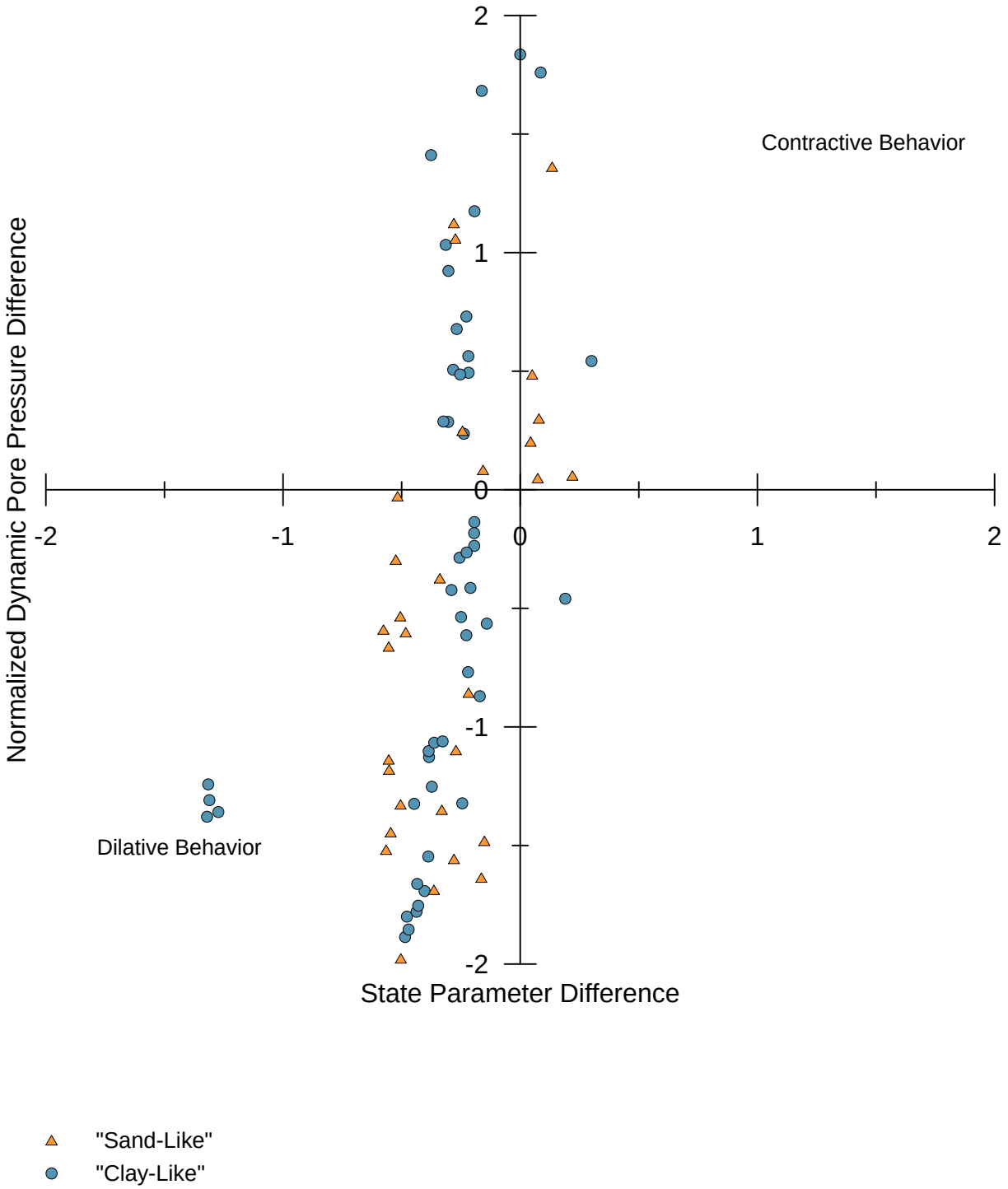
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C018 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-018_DC_Normalized State.grf



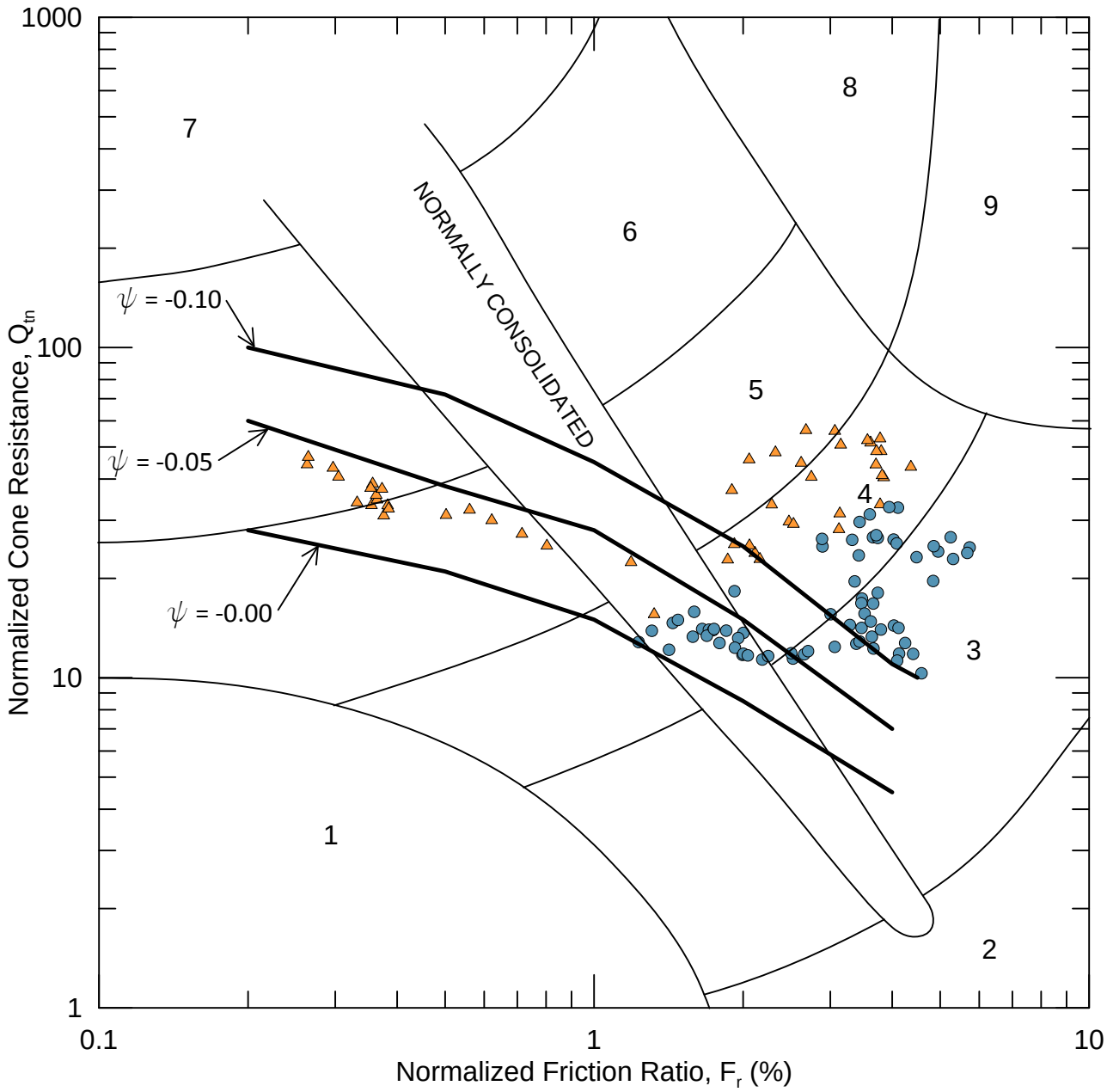
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C019 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C019 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-019_DC_ State Parameter Difference.grf



"Sand-Like"

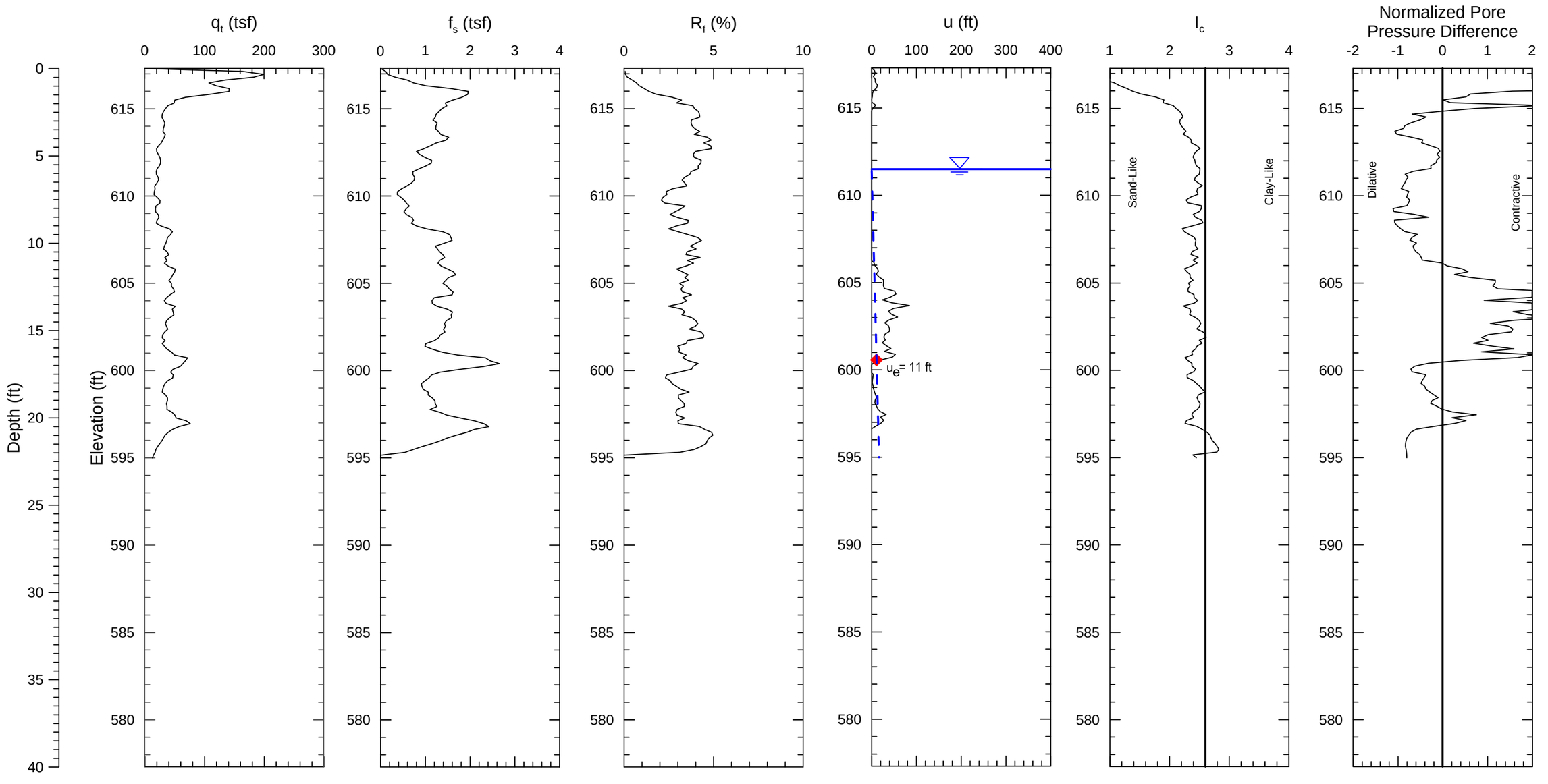
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

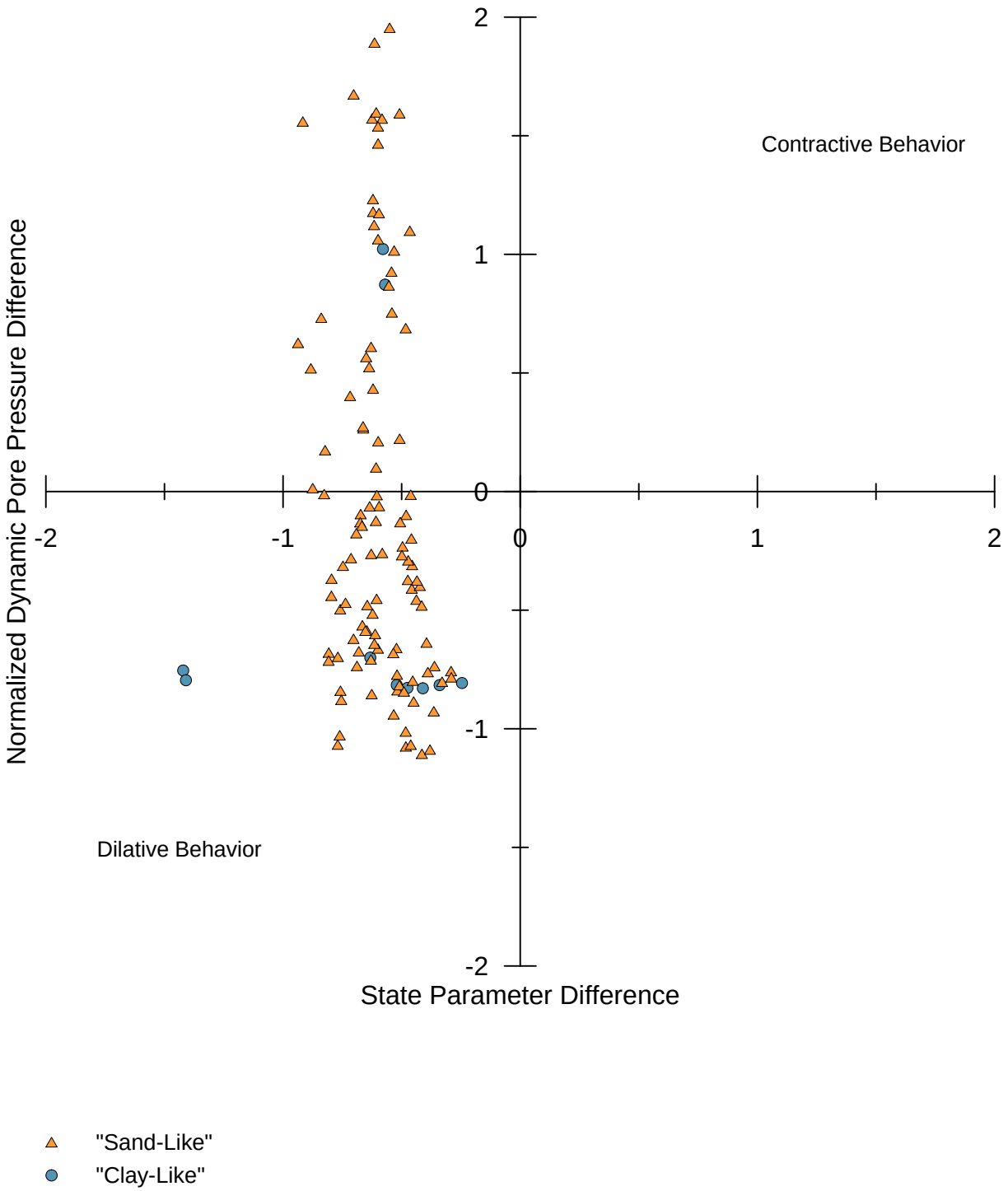
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C019 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-019_DC_Normalized State.grf



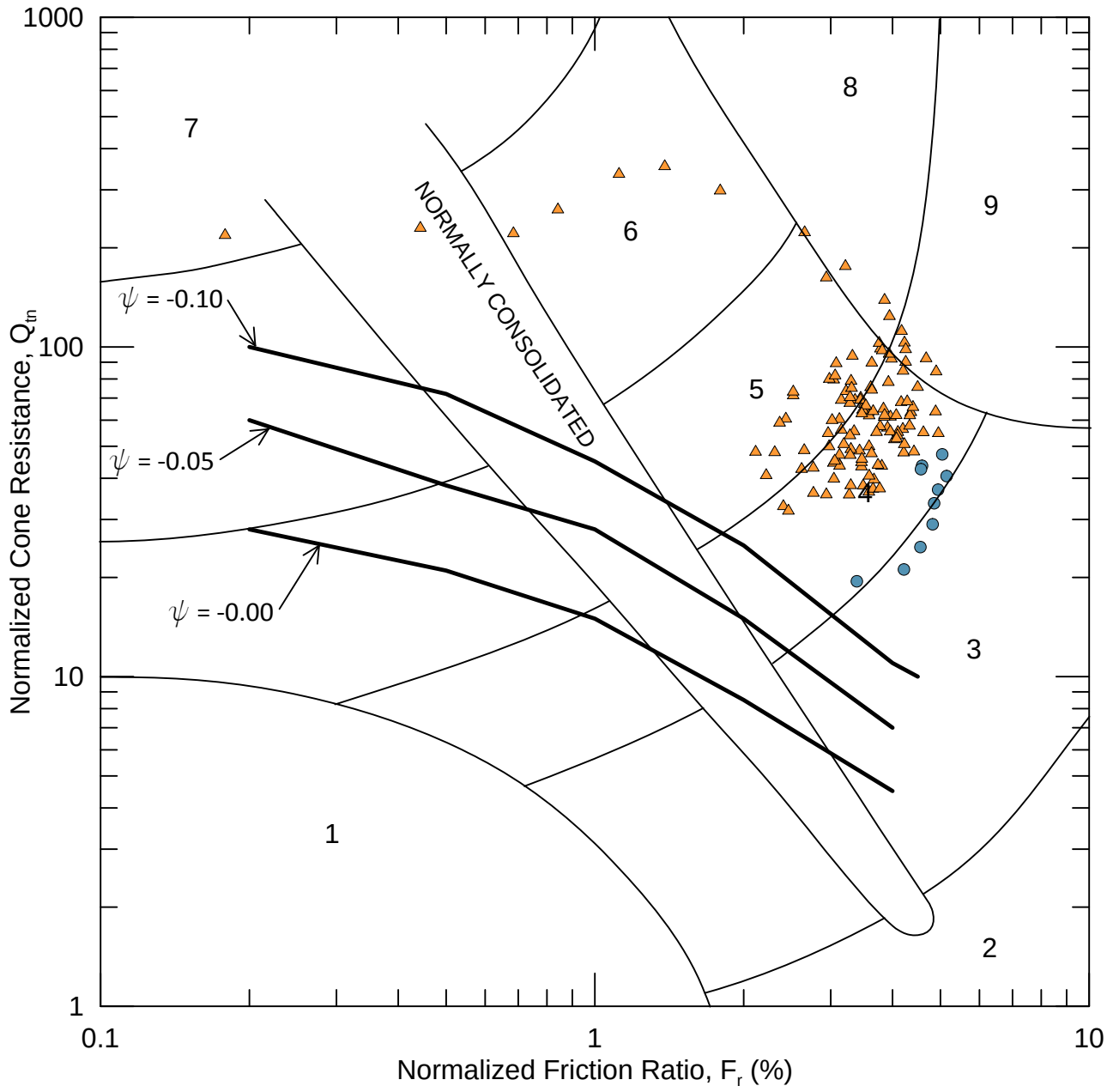
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C020 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C020 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-020_DC_ State Parameter Difference.grf



"Sand-Like"

"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C020 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

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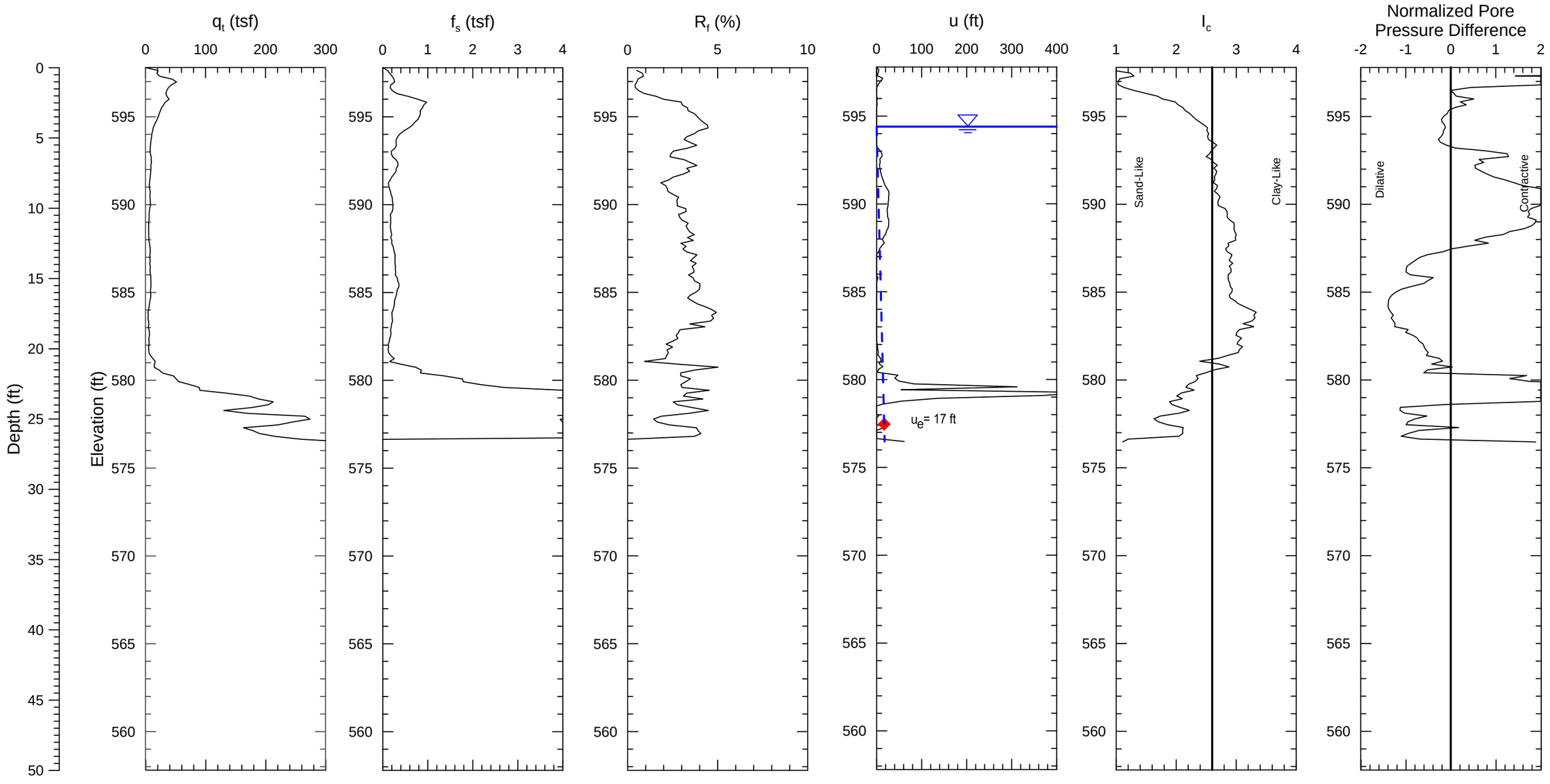


Pore Pressure Dissipation Test

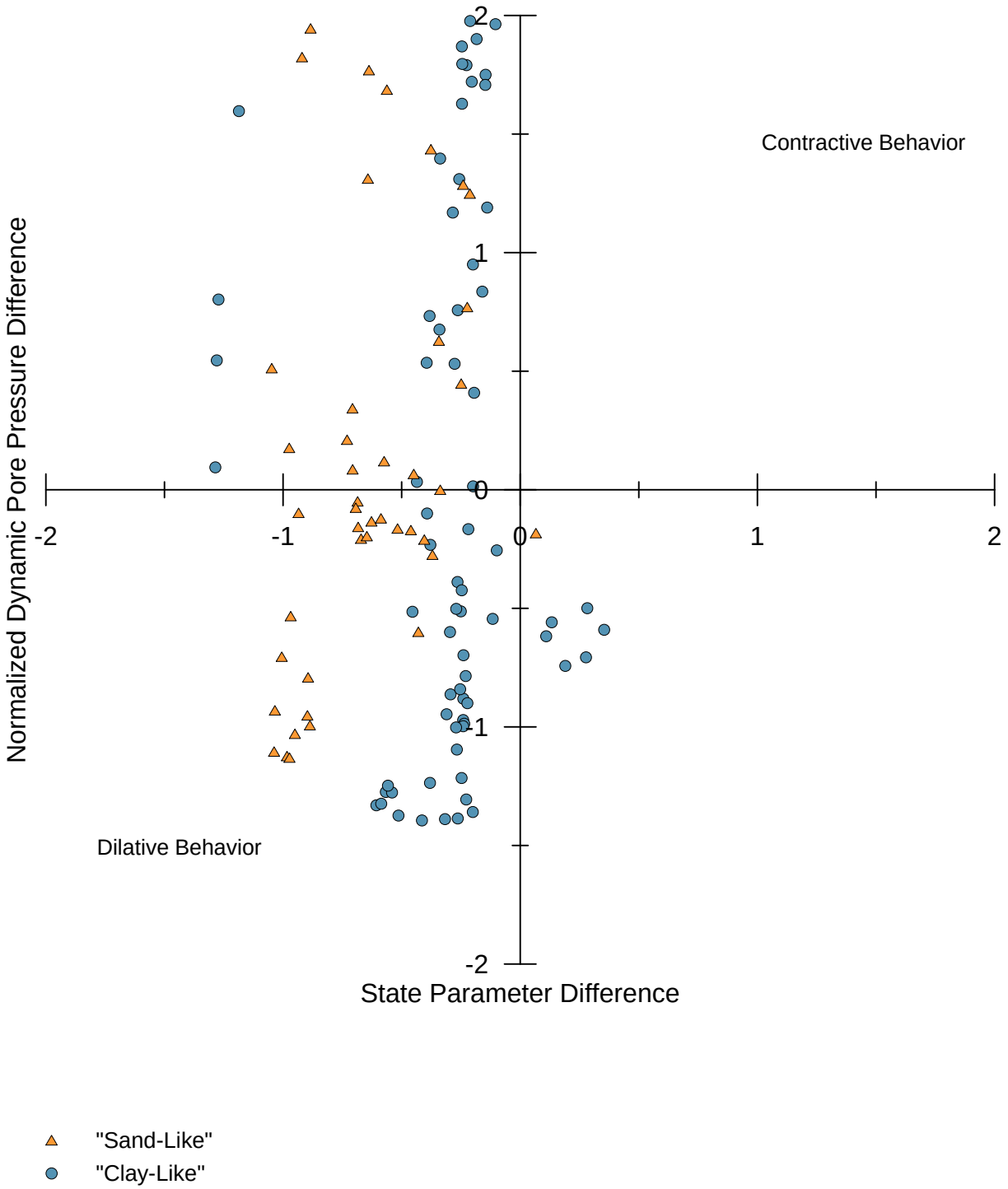
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

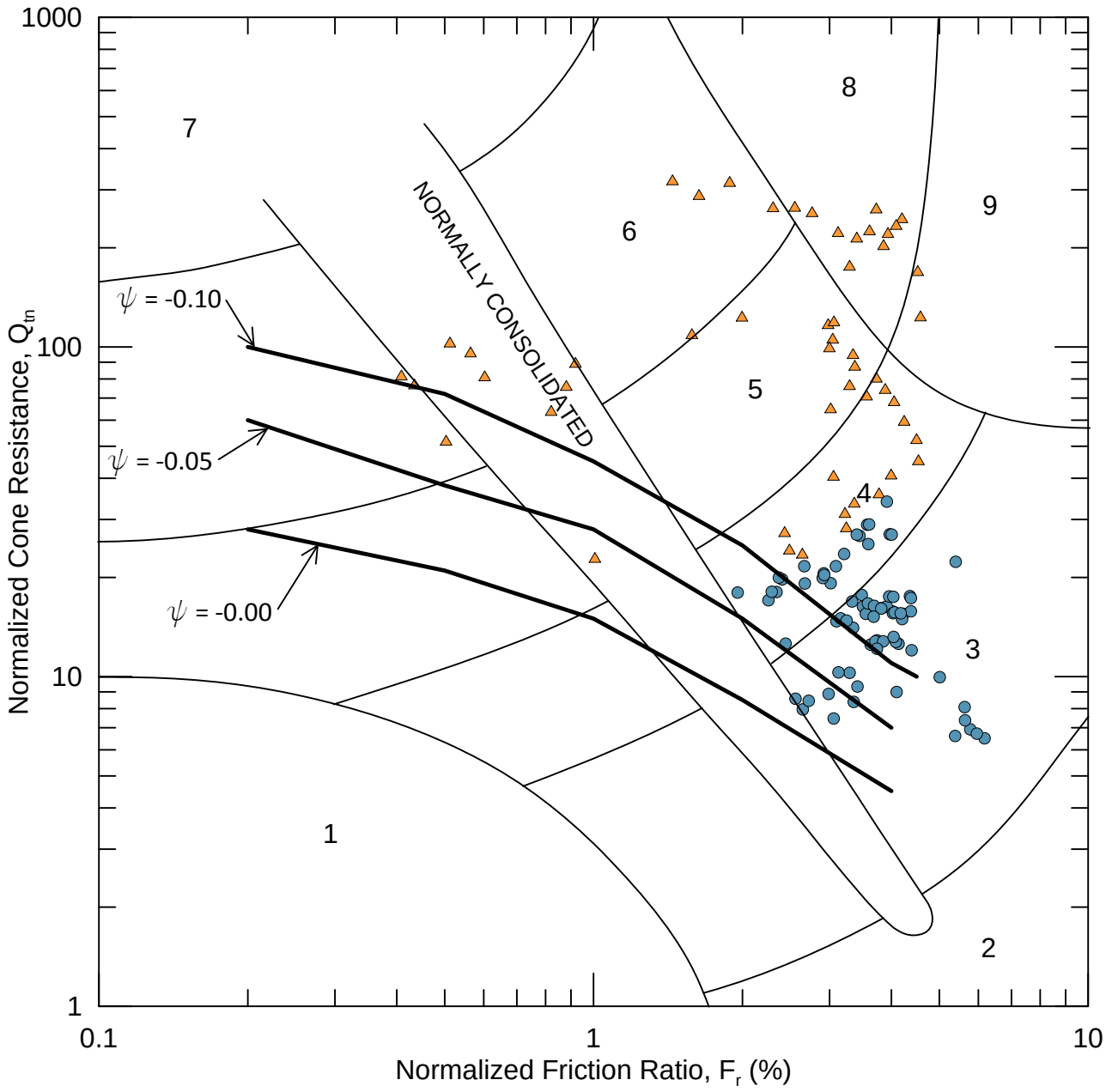
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C021 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C021 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-021_DC_ State Parameter Difference.grf



"Sand-Like"

"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C021 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

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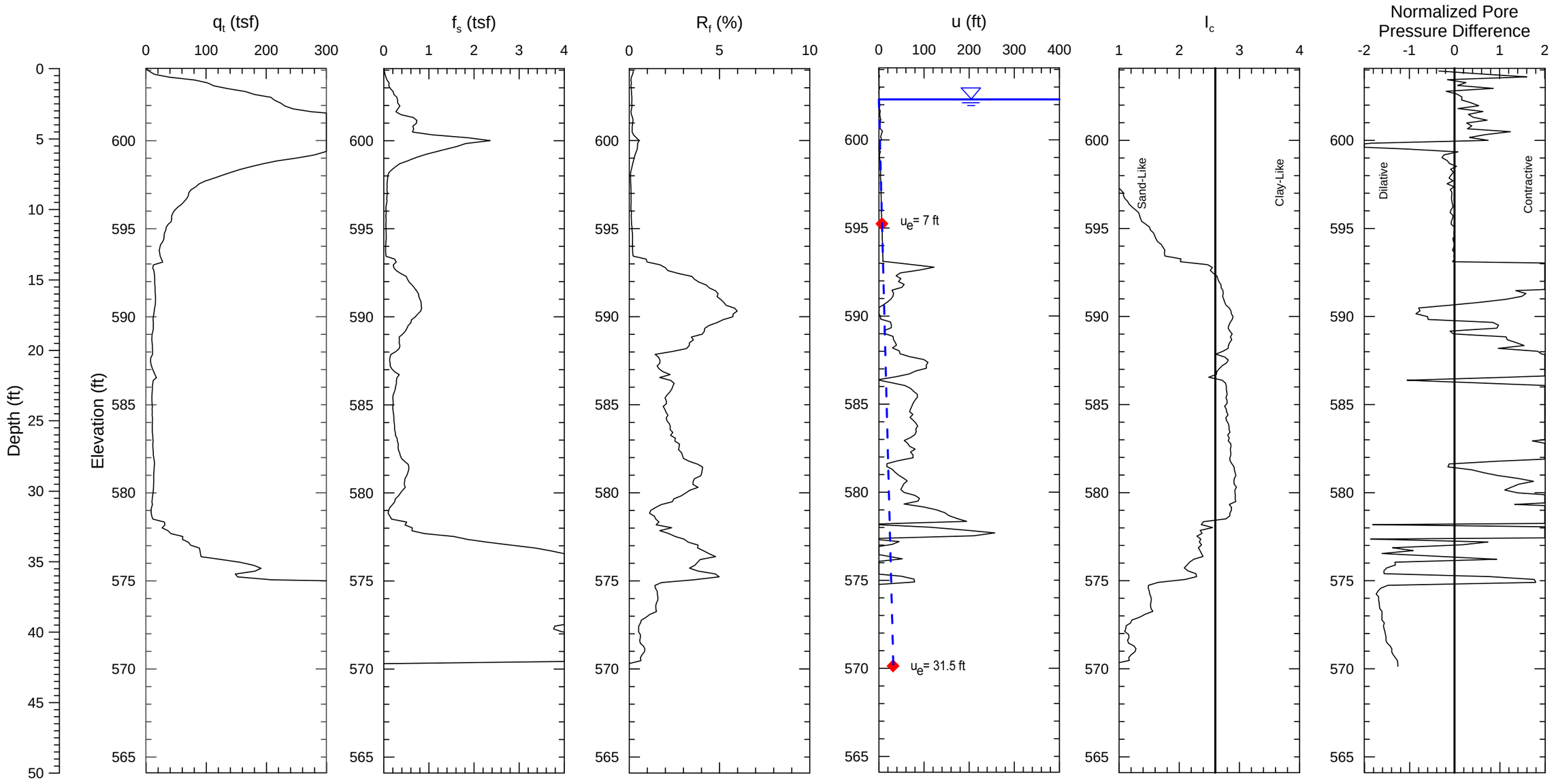
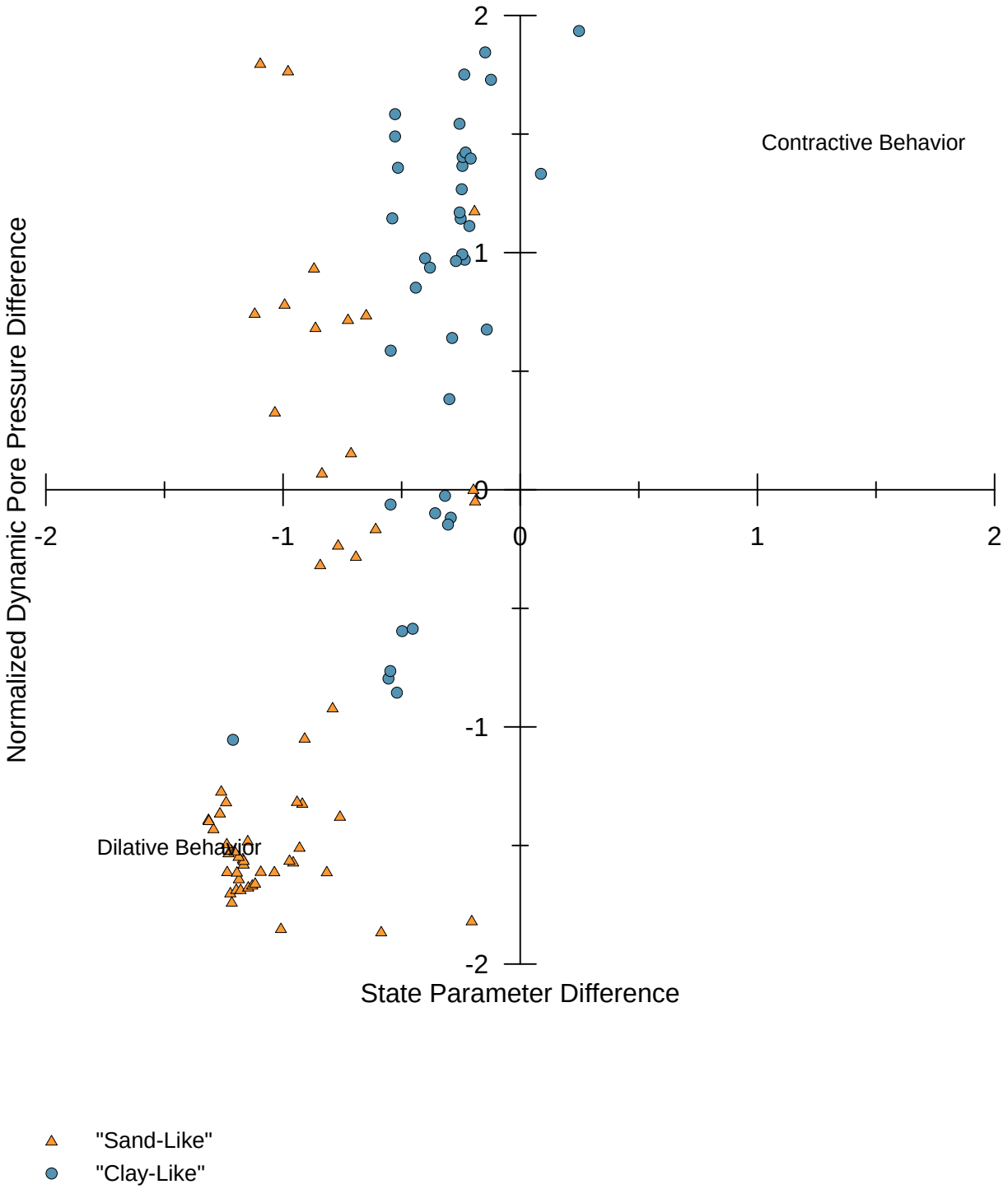


Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C022 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C022 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

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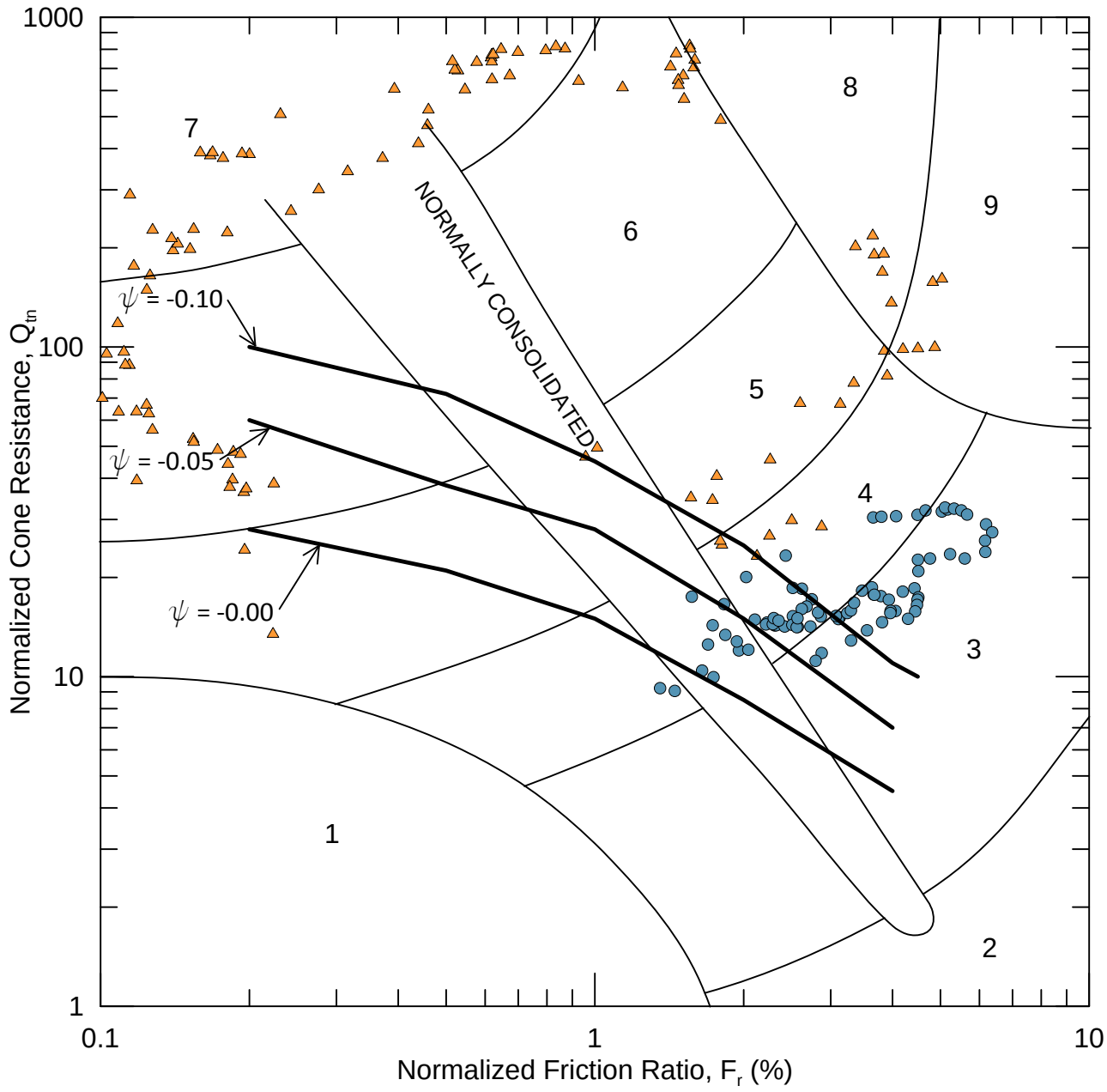


"Sand-Like"

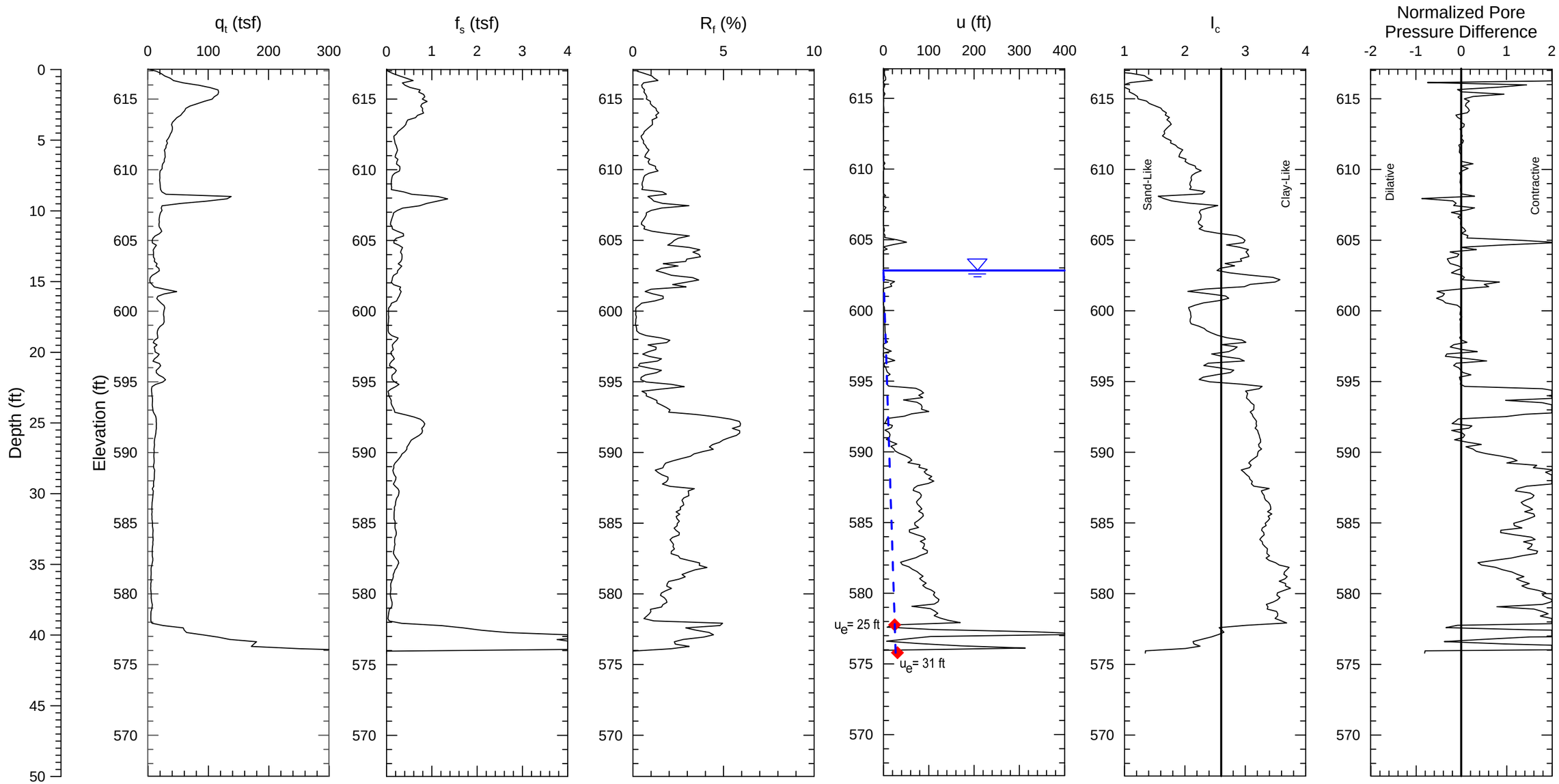
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

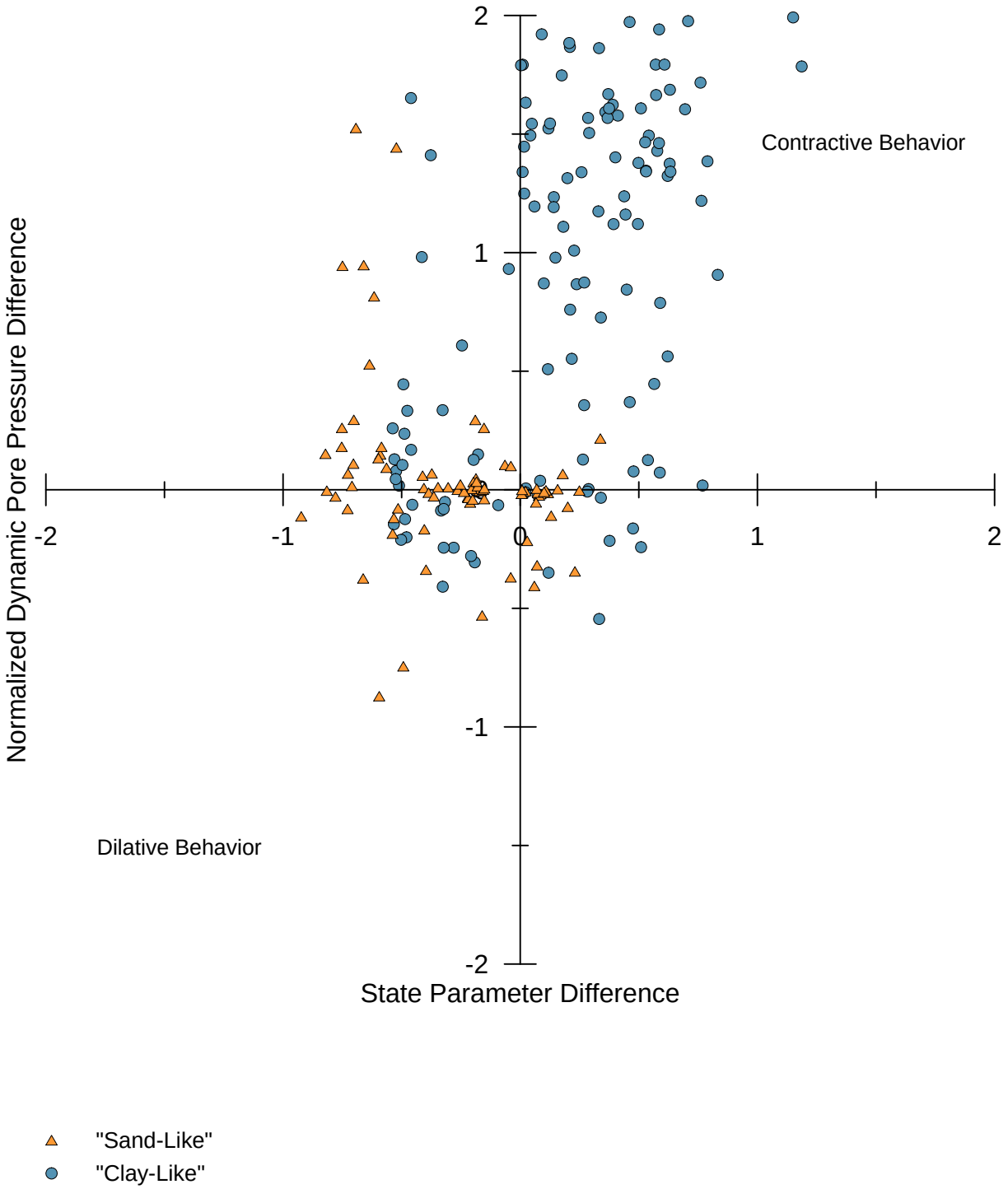
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C022 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-022_DC_Normalized State.grf



Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C023 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C023 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

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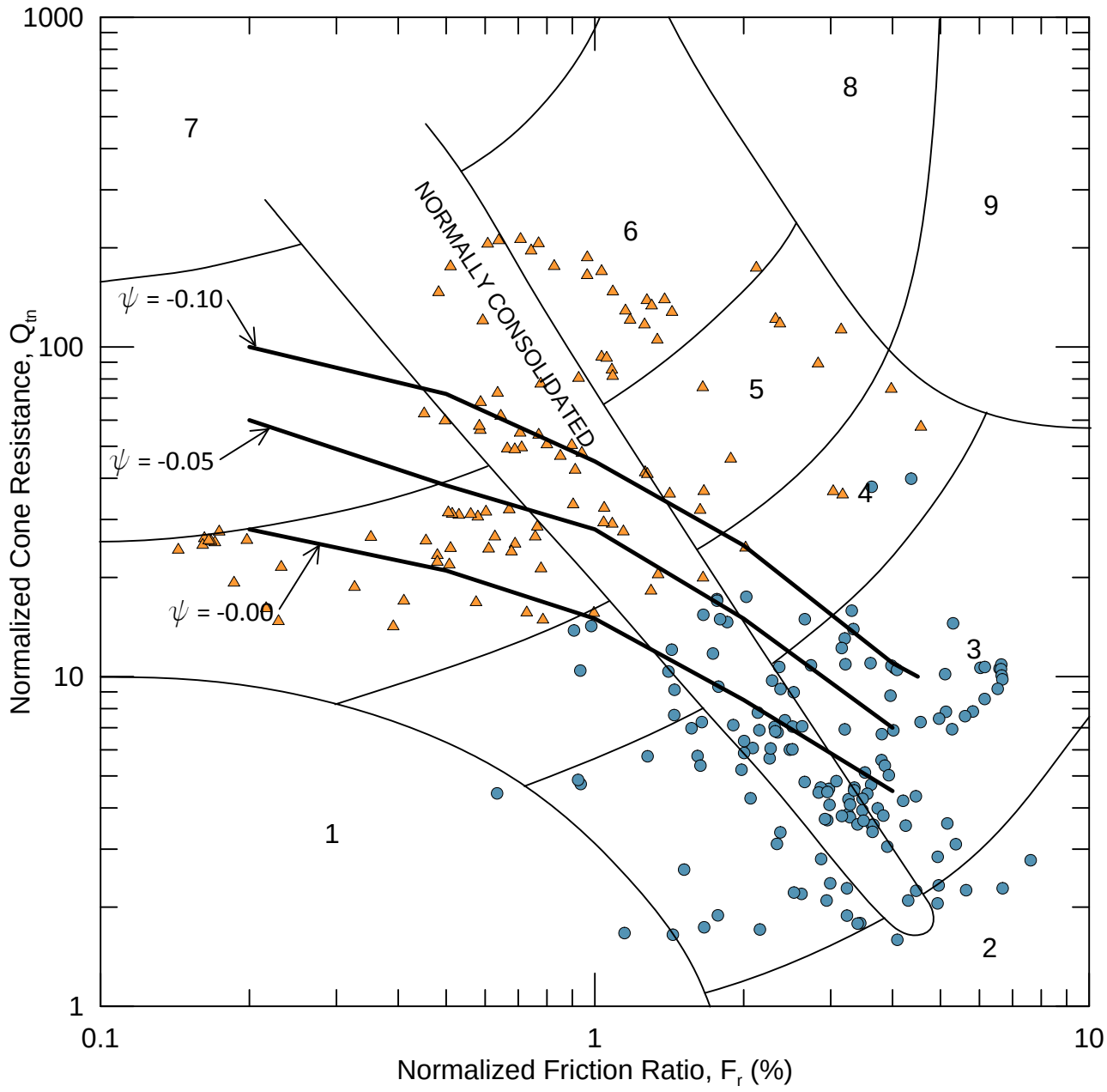


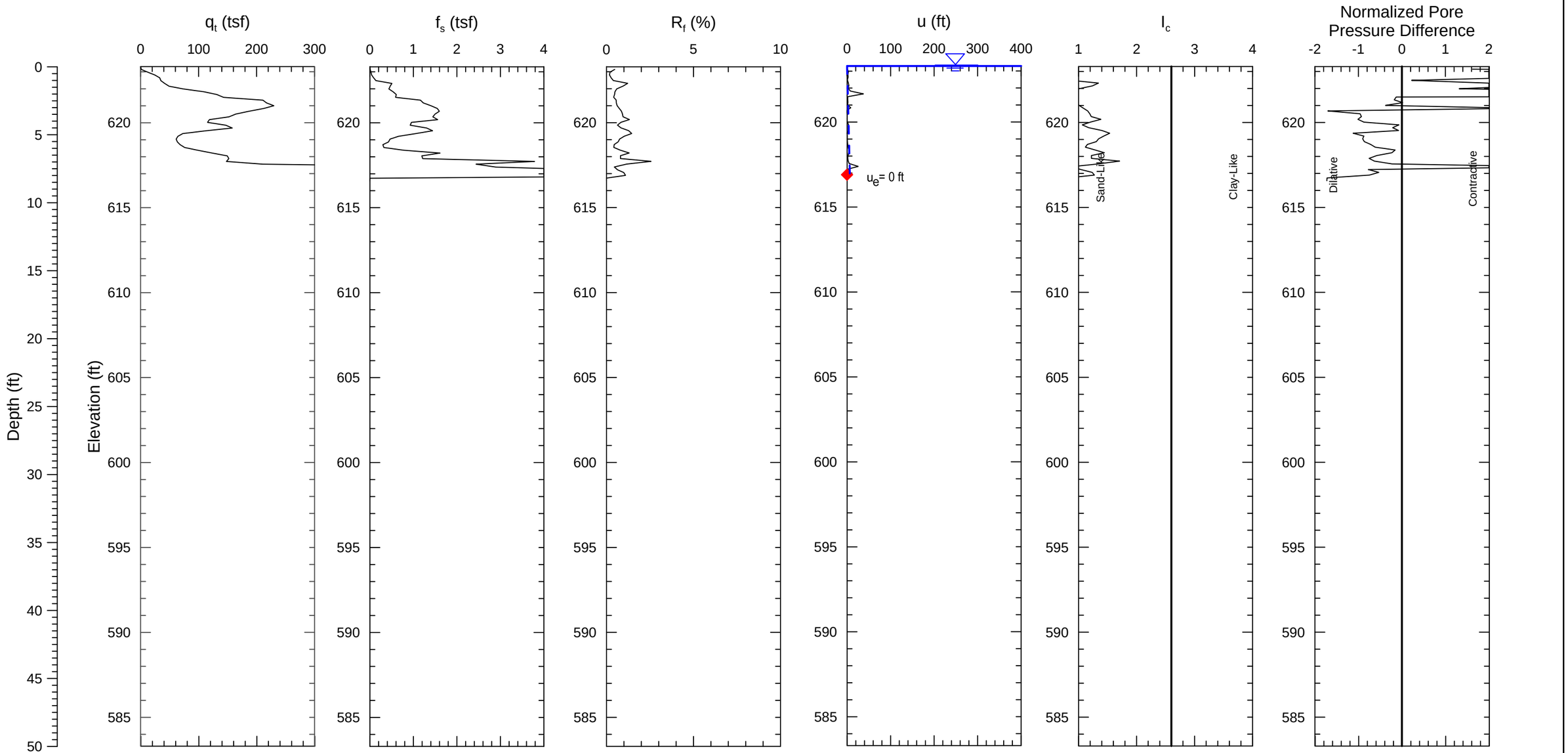
"Sand-Like"
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

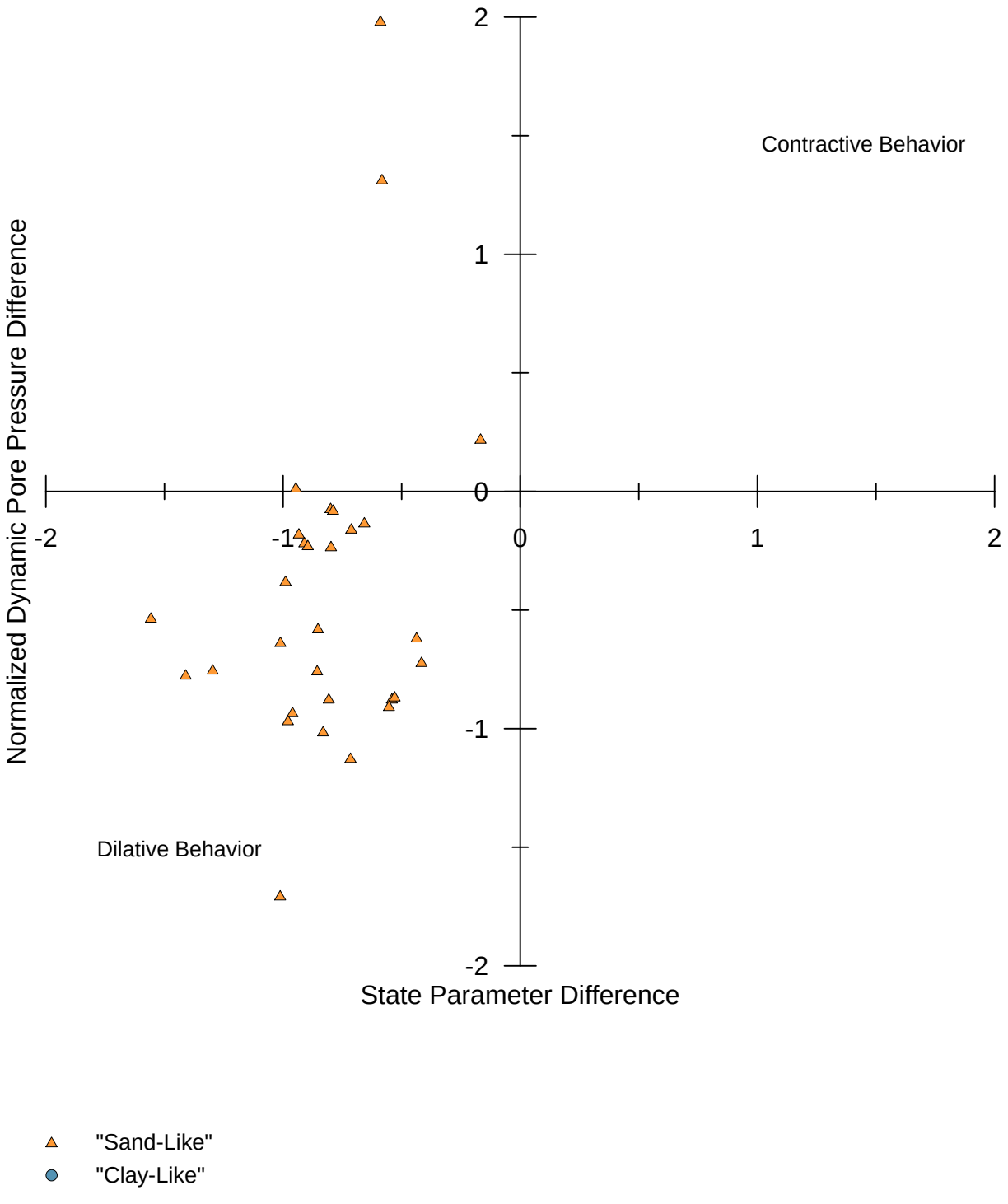
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C023 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-023_DC_Normalized State.grf



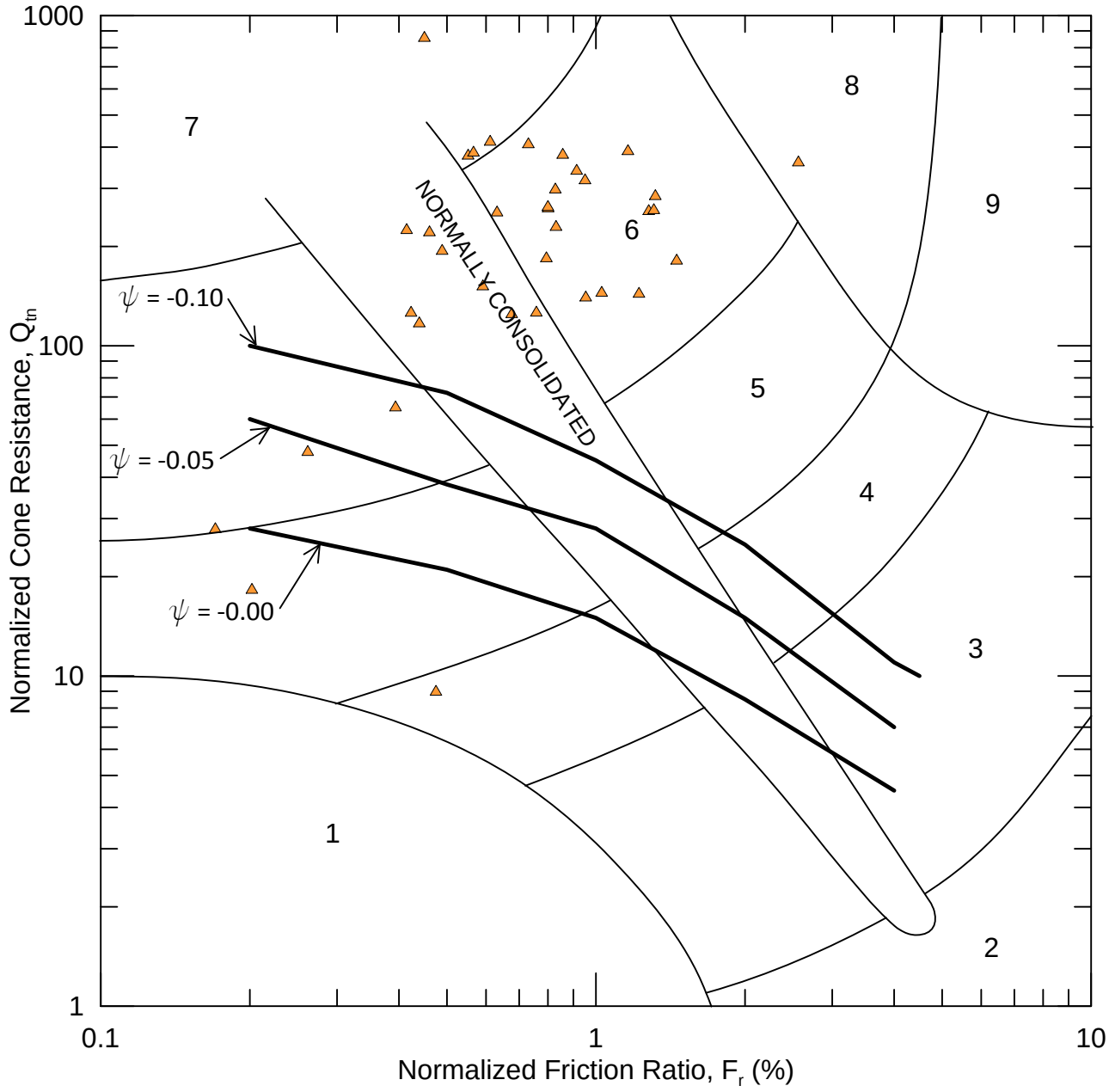
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C024 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C024 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-024_DC_ State Parameter Difference.grf



"Sand-Like"

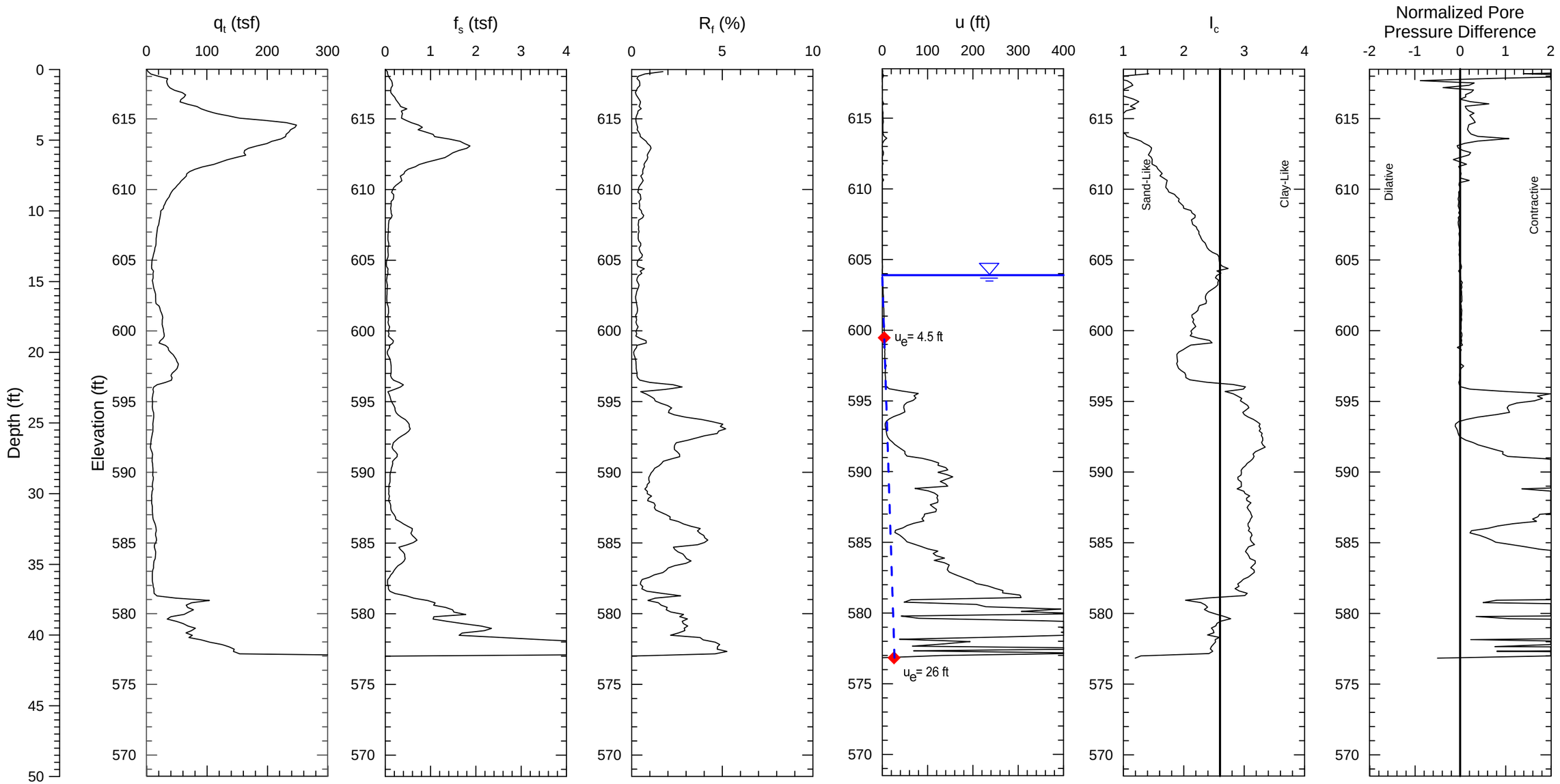
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

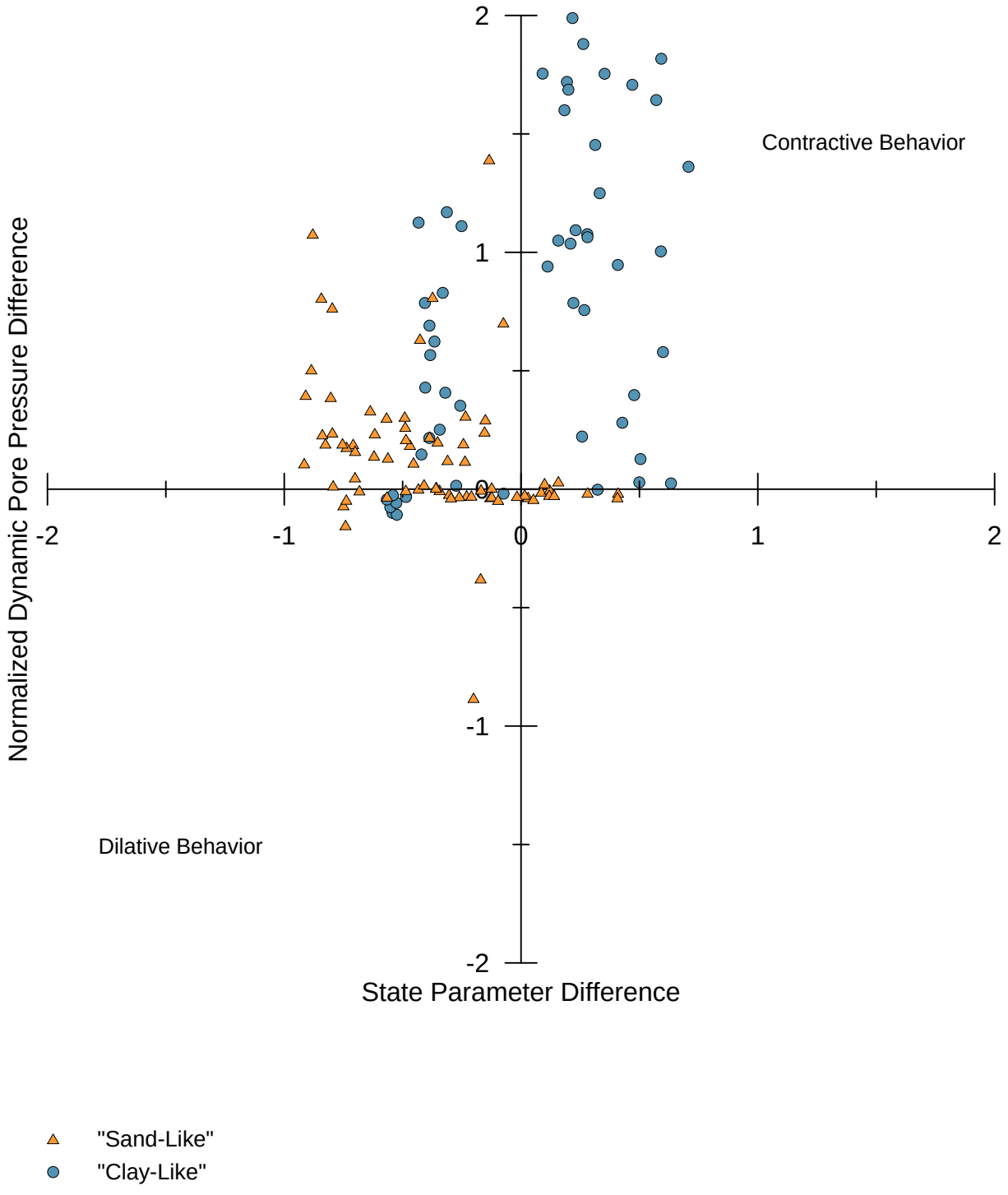
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C024 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-024_DC_Normalized State.grf



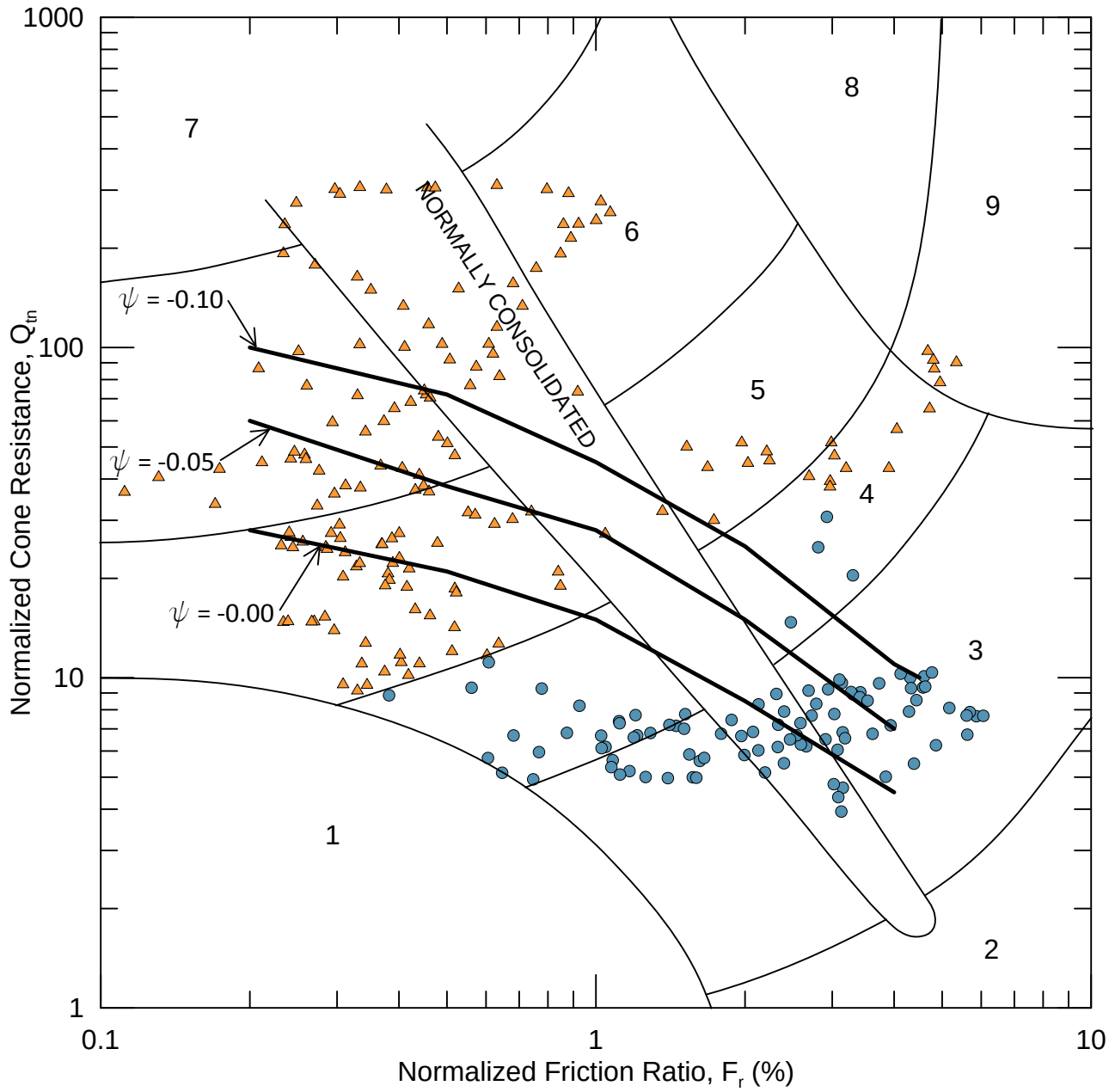
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C025 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C025 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-025_DC_ State Parameter Difference.grf



"Sand-Like"

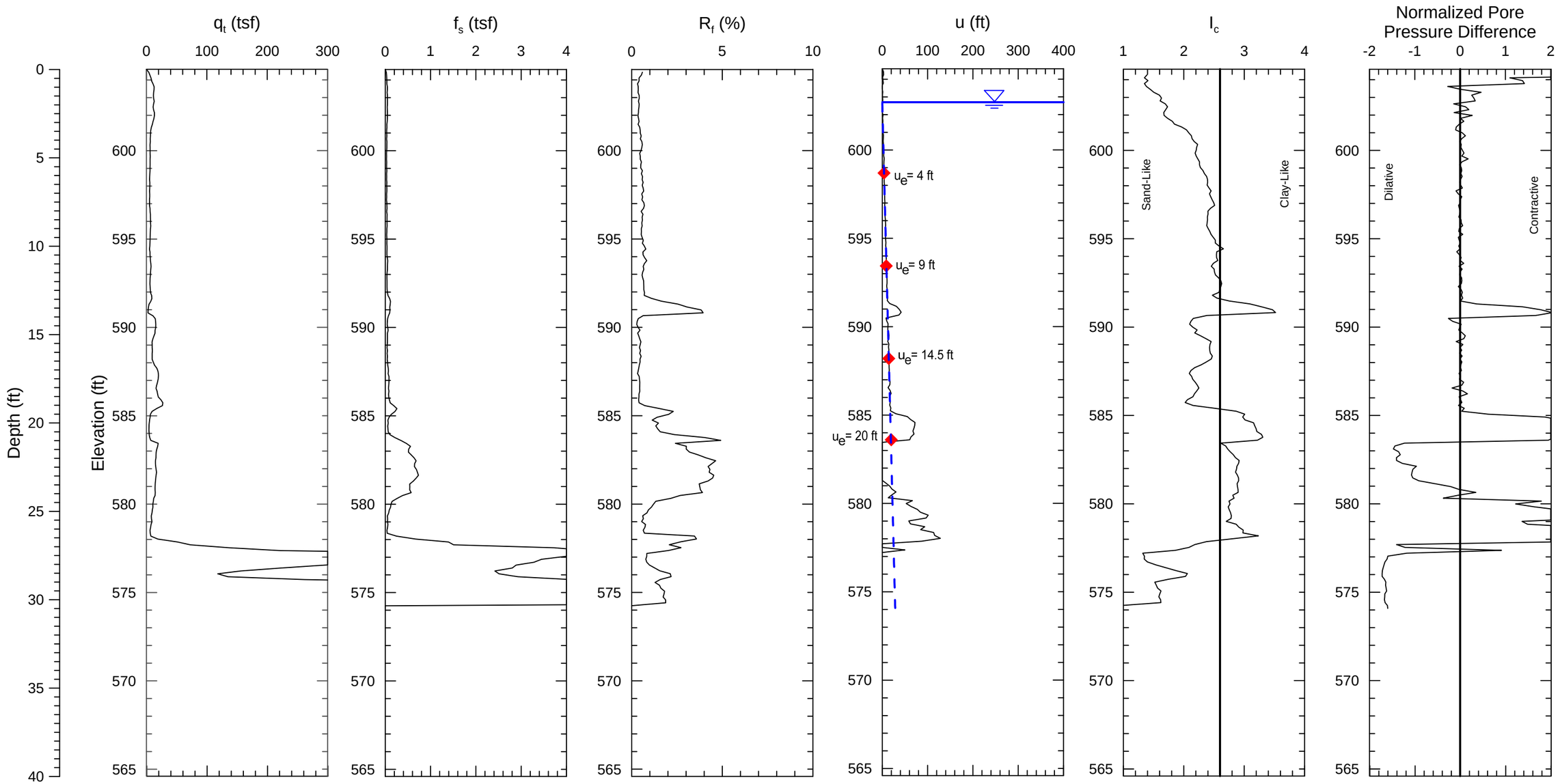
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

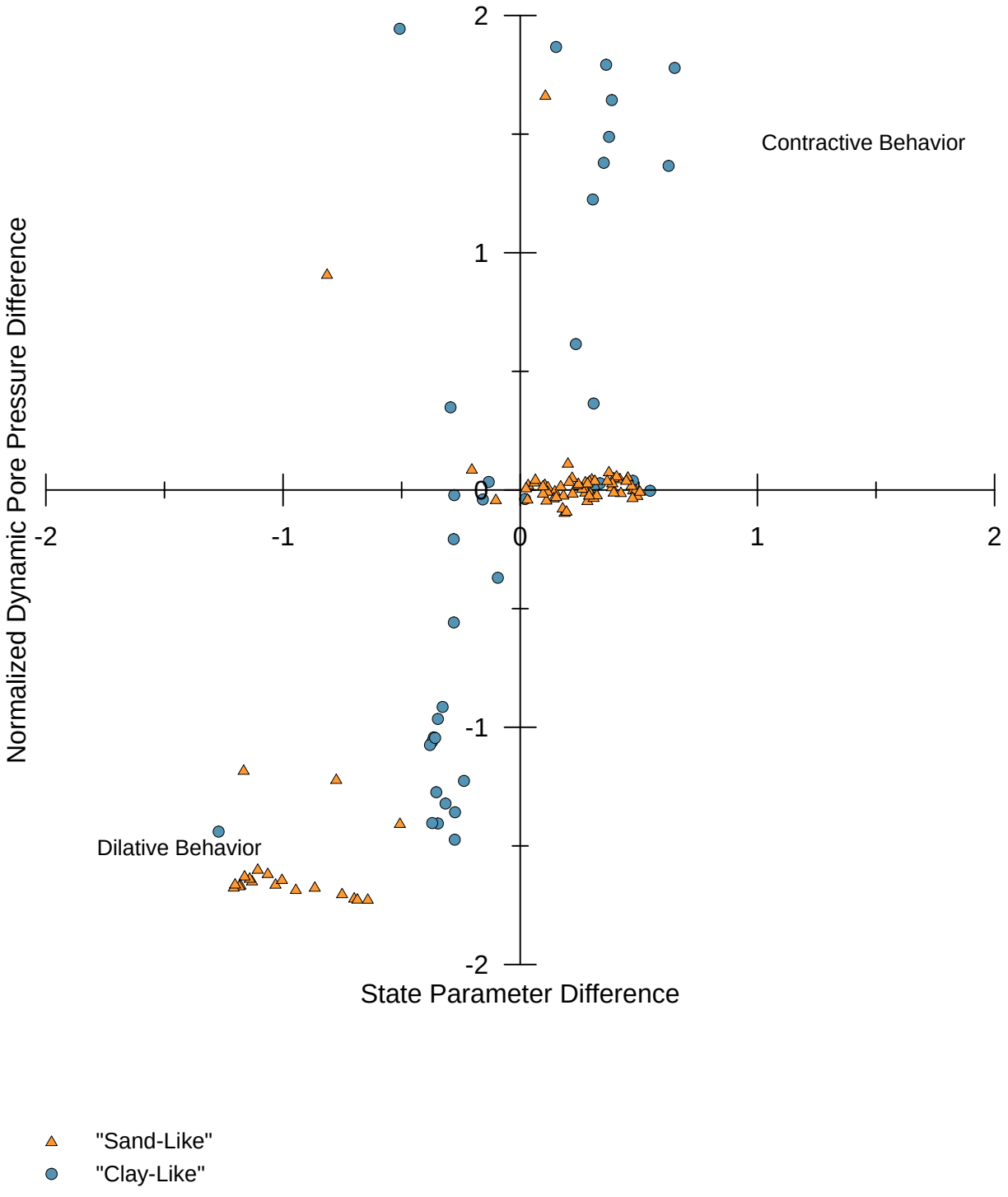
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C025 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-025_DC_Normalized State.grf



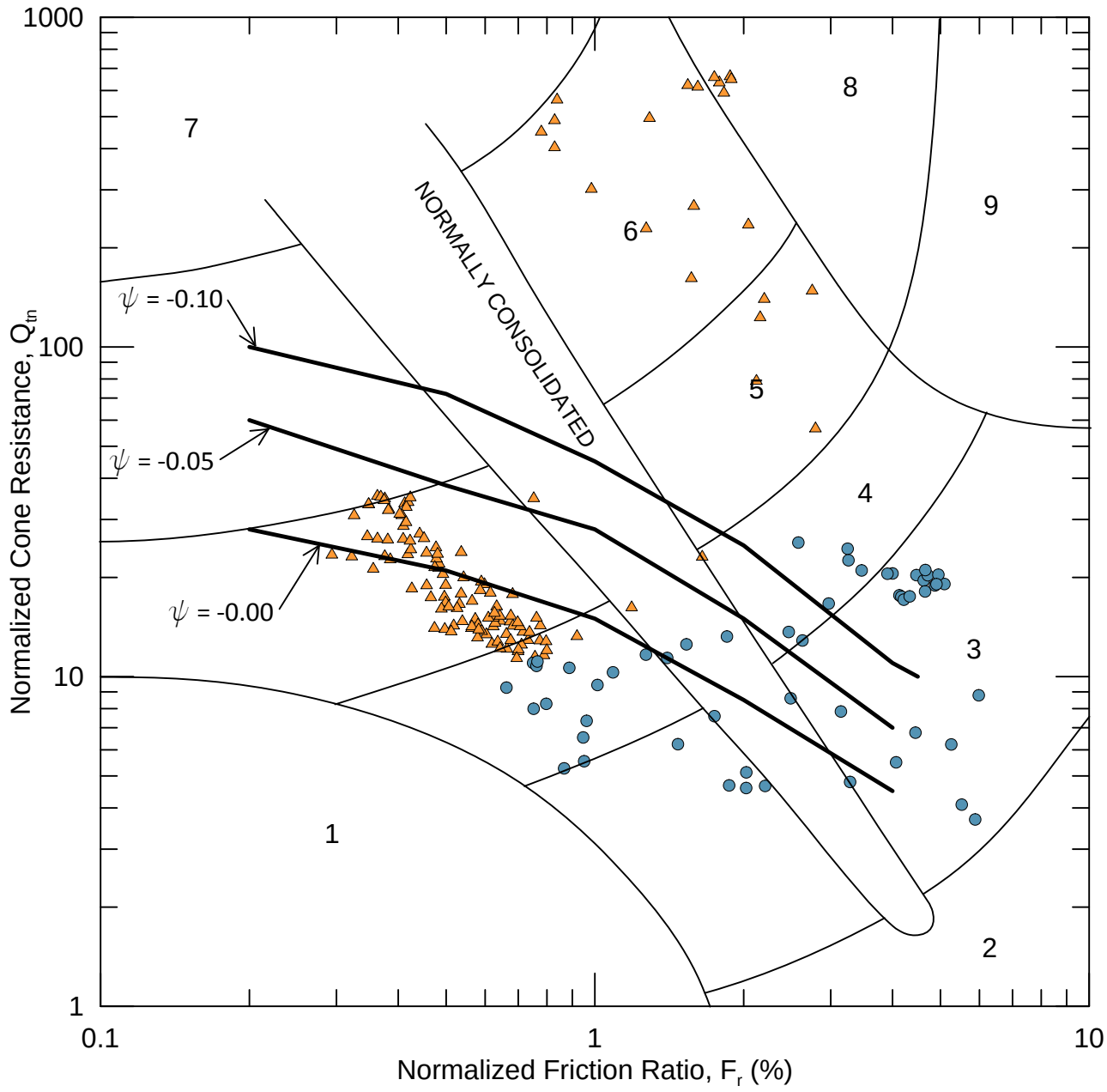
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C026 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C026 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-026_DC_ State Parameter Difference.grf



"Sand-Like"

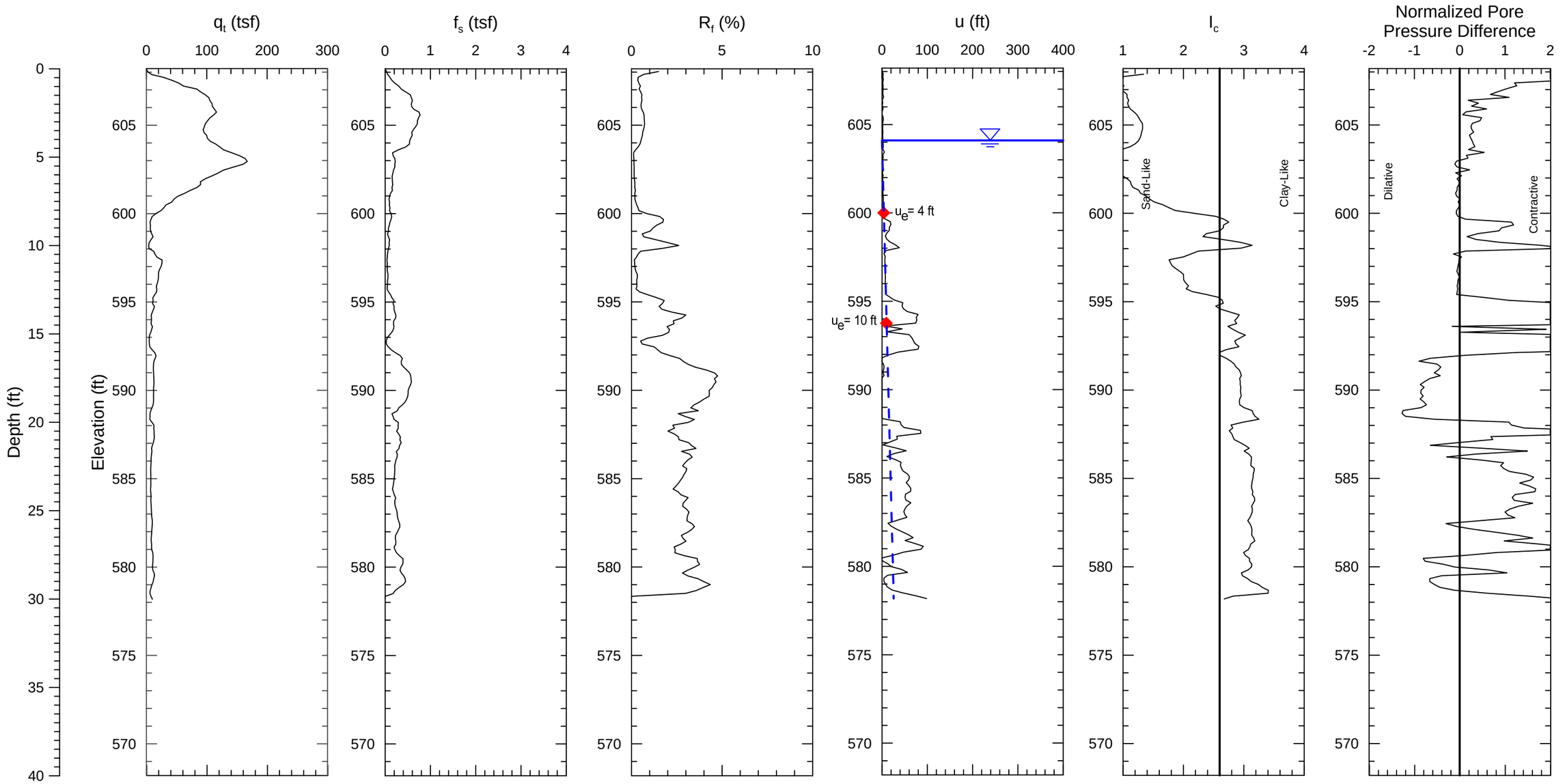
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

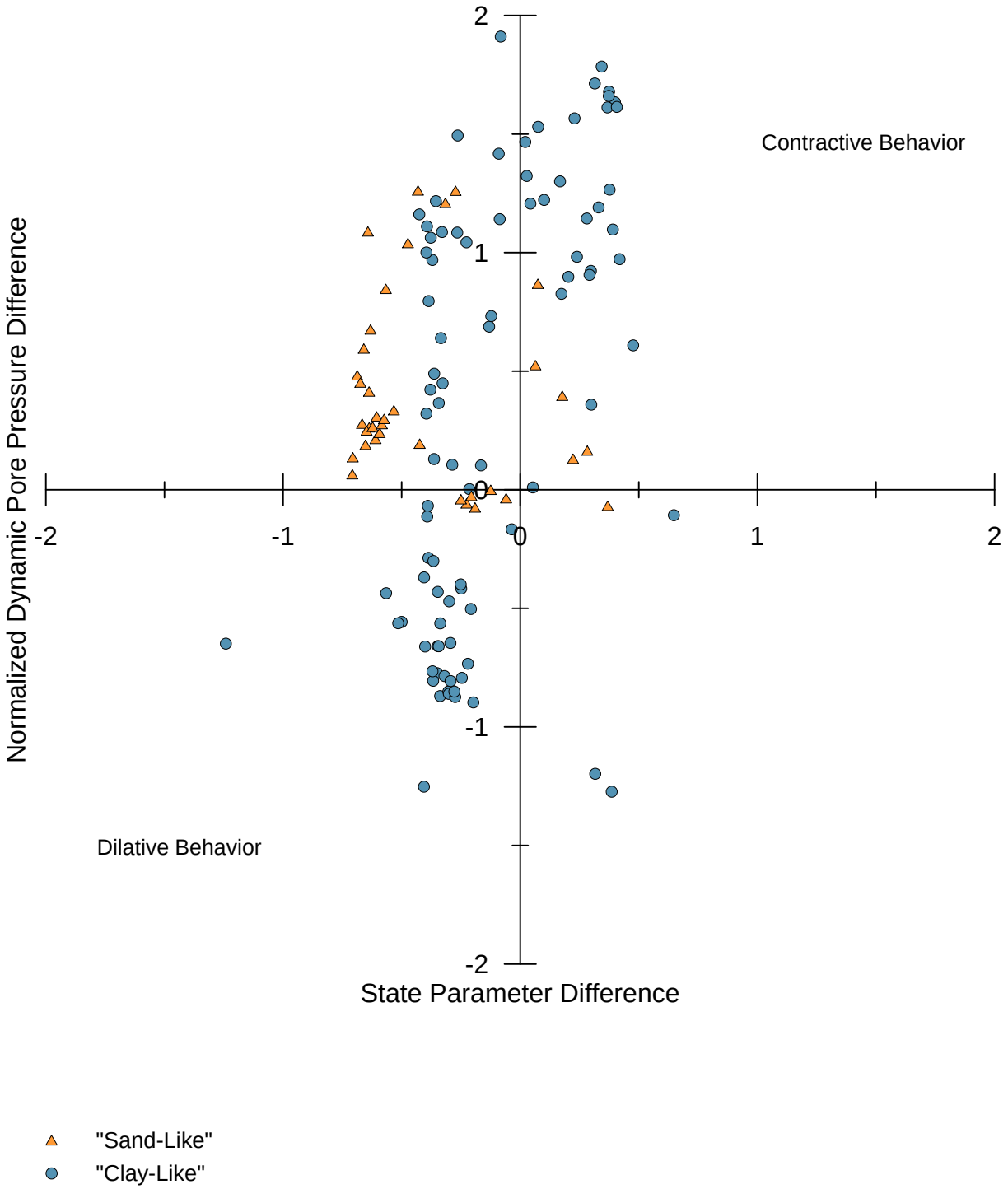
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C026 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-026_DC_Normalized State.grf



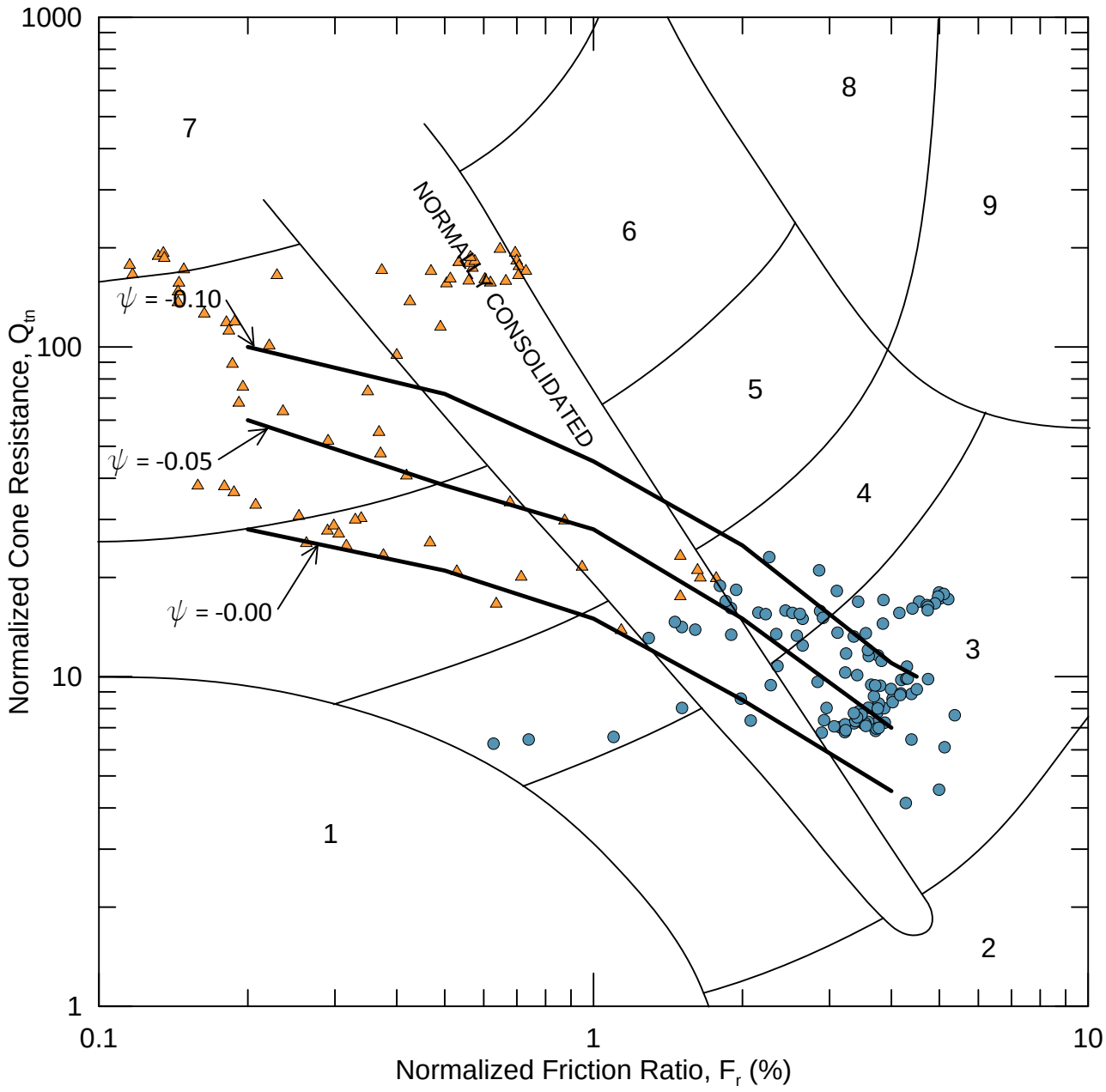
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C027 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C027 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-027_DC_ State Parameter Difference.grf



"Sand-Like"

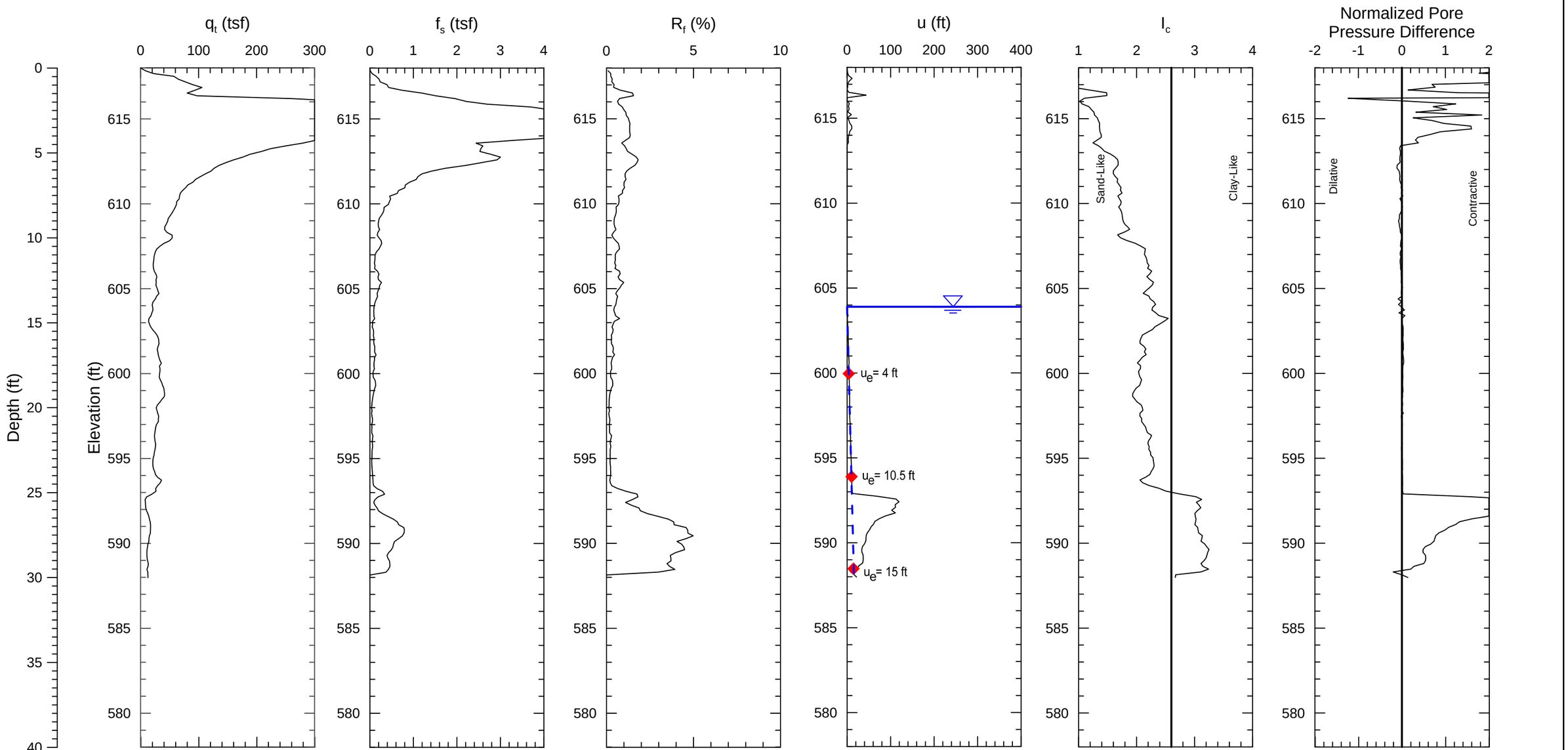
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

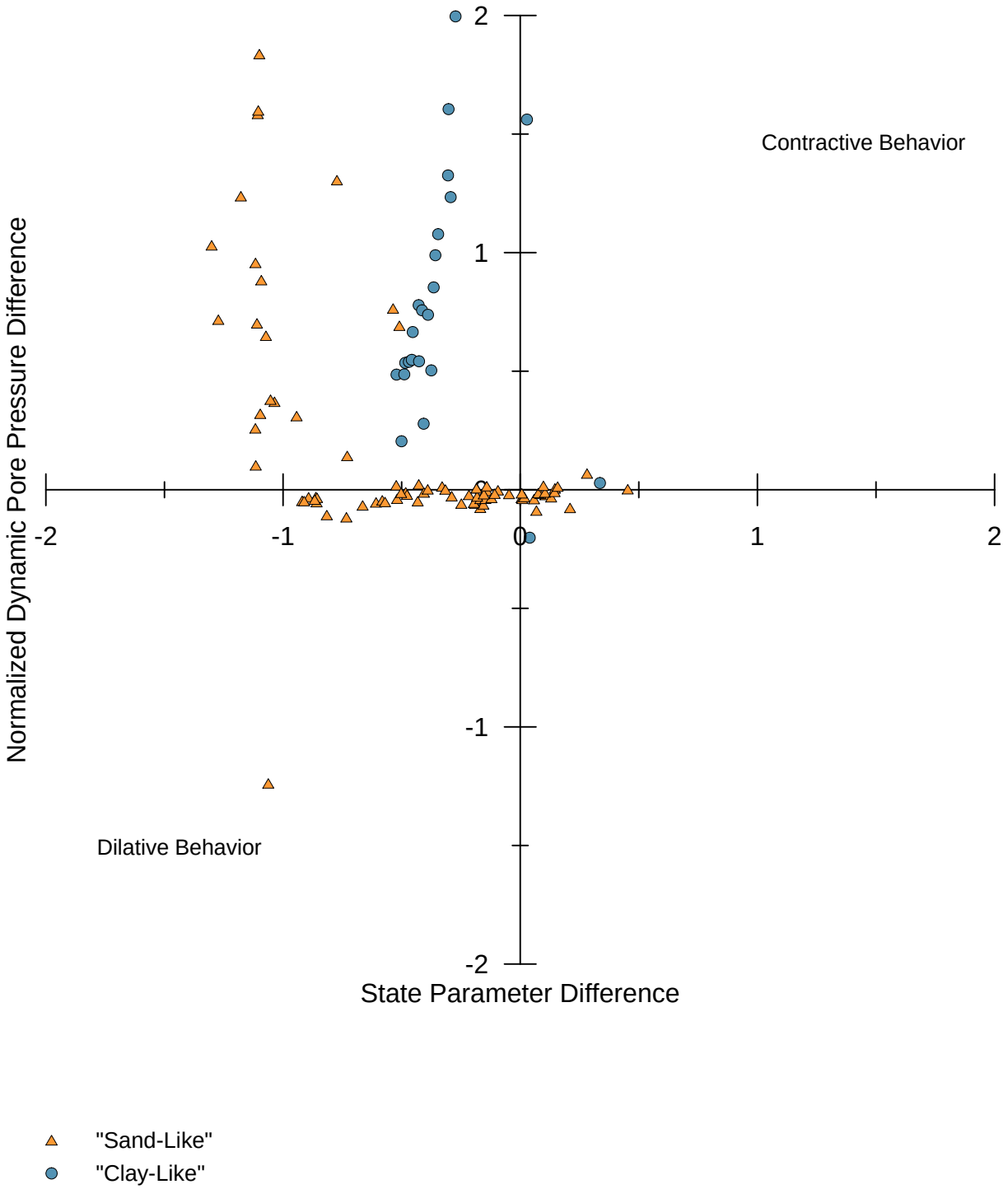
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C027 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-027_DC_Normalized State.grf



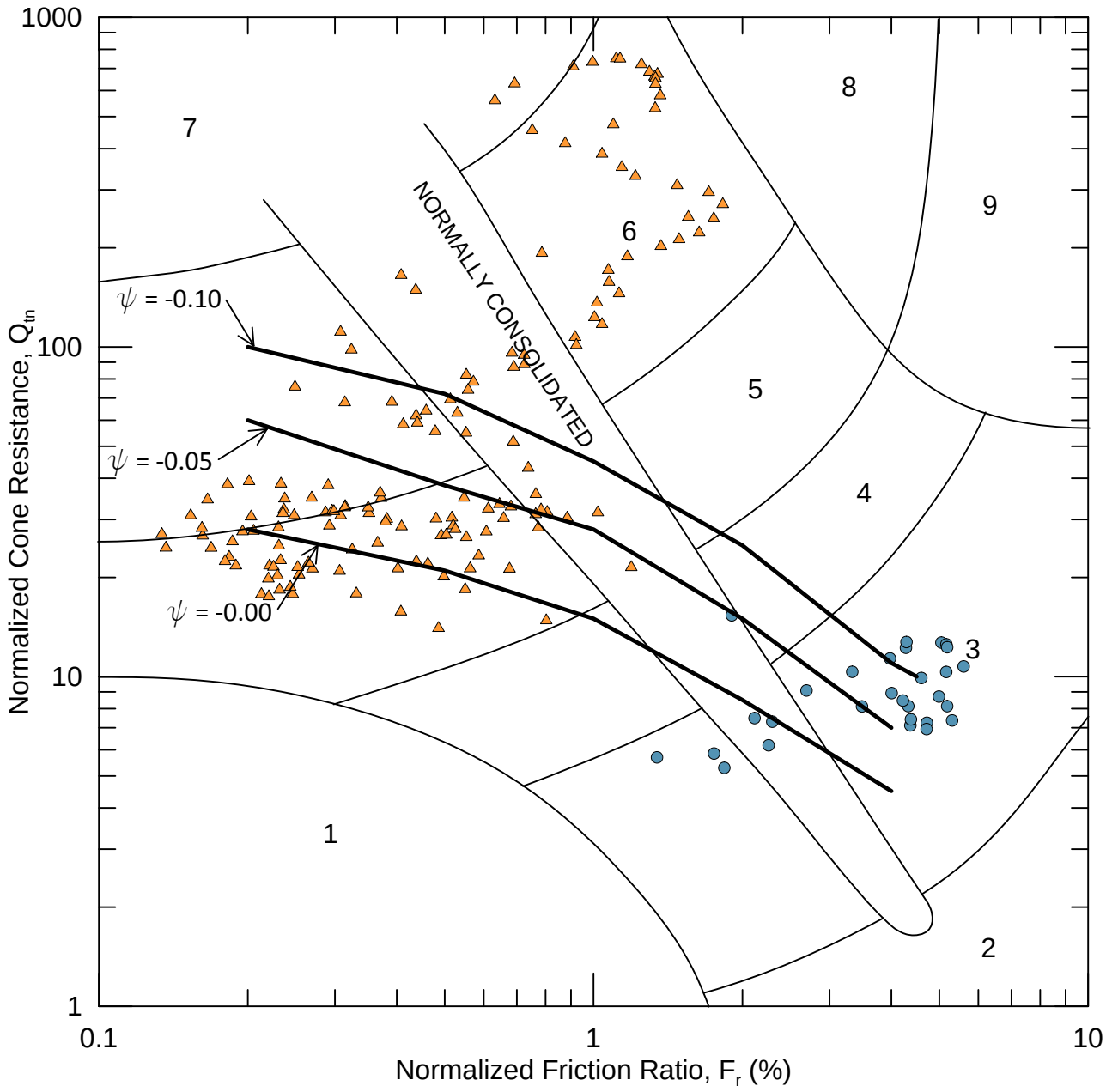
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C028 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C028 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-028_DC_ State Parameter Difference.grf



"Sand-Like"

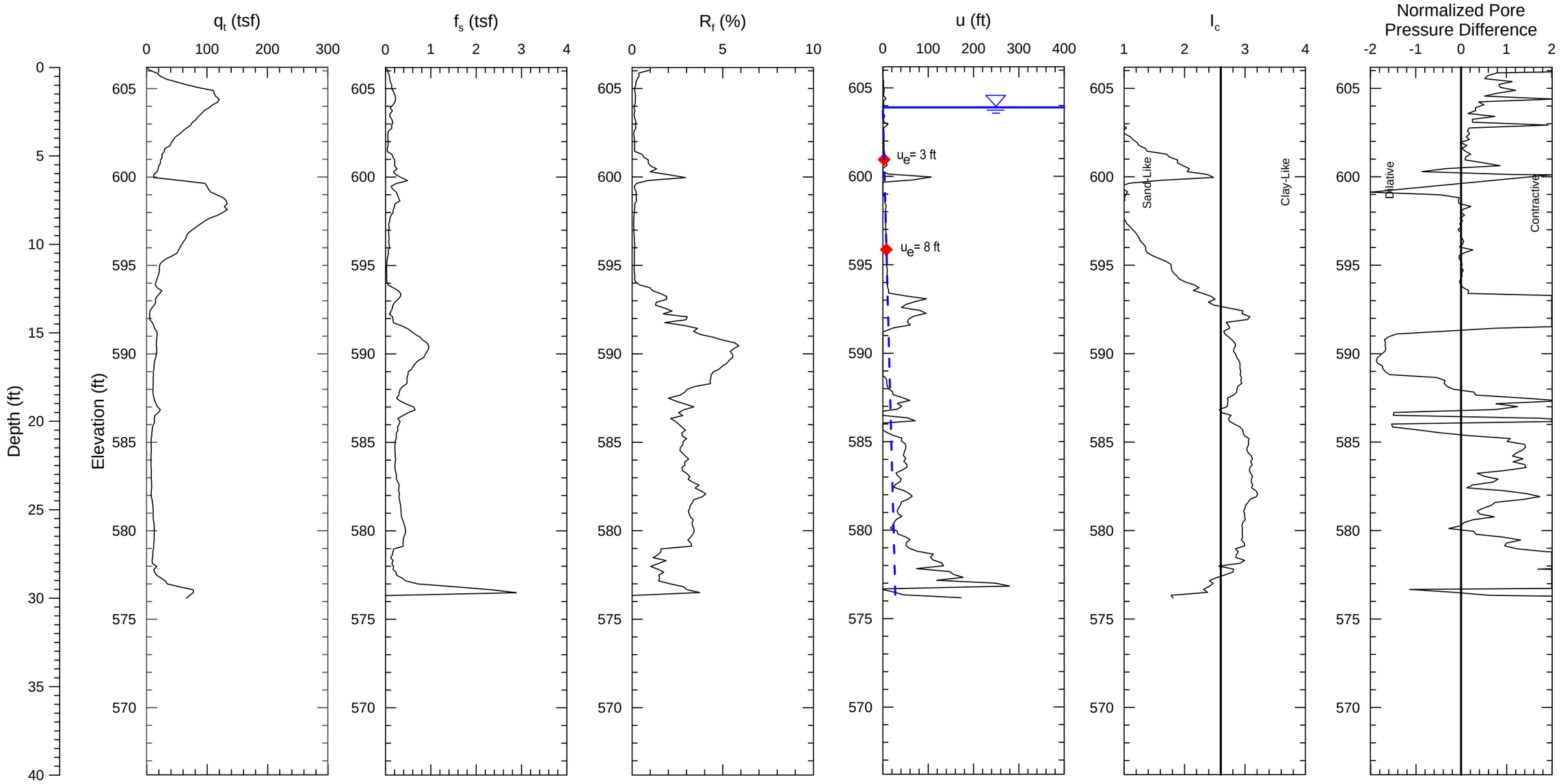
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

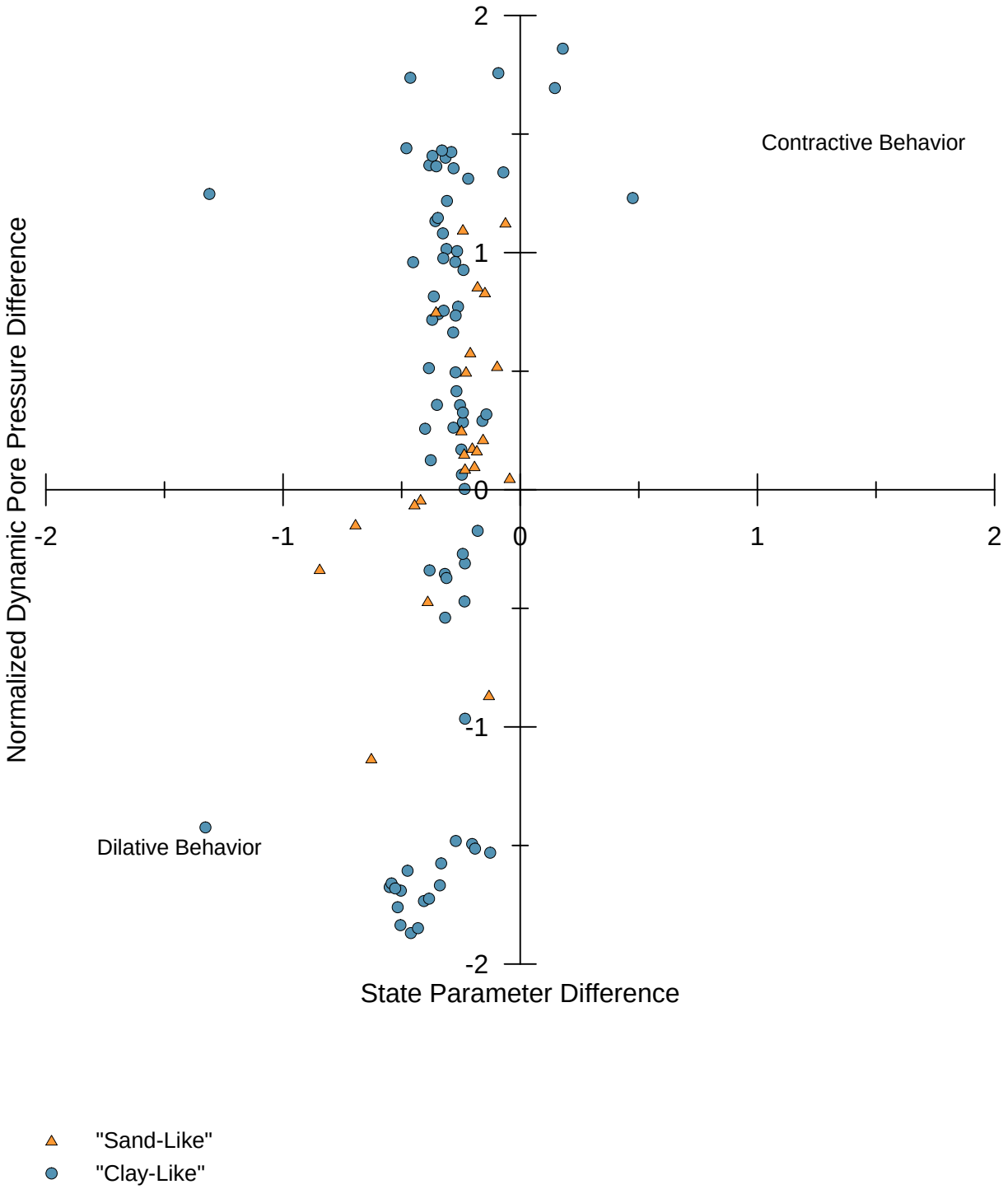
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C028 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-028_DC_Normalized State.grf



Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C029 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C029 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

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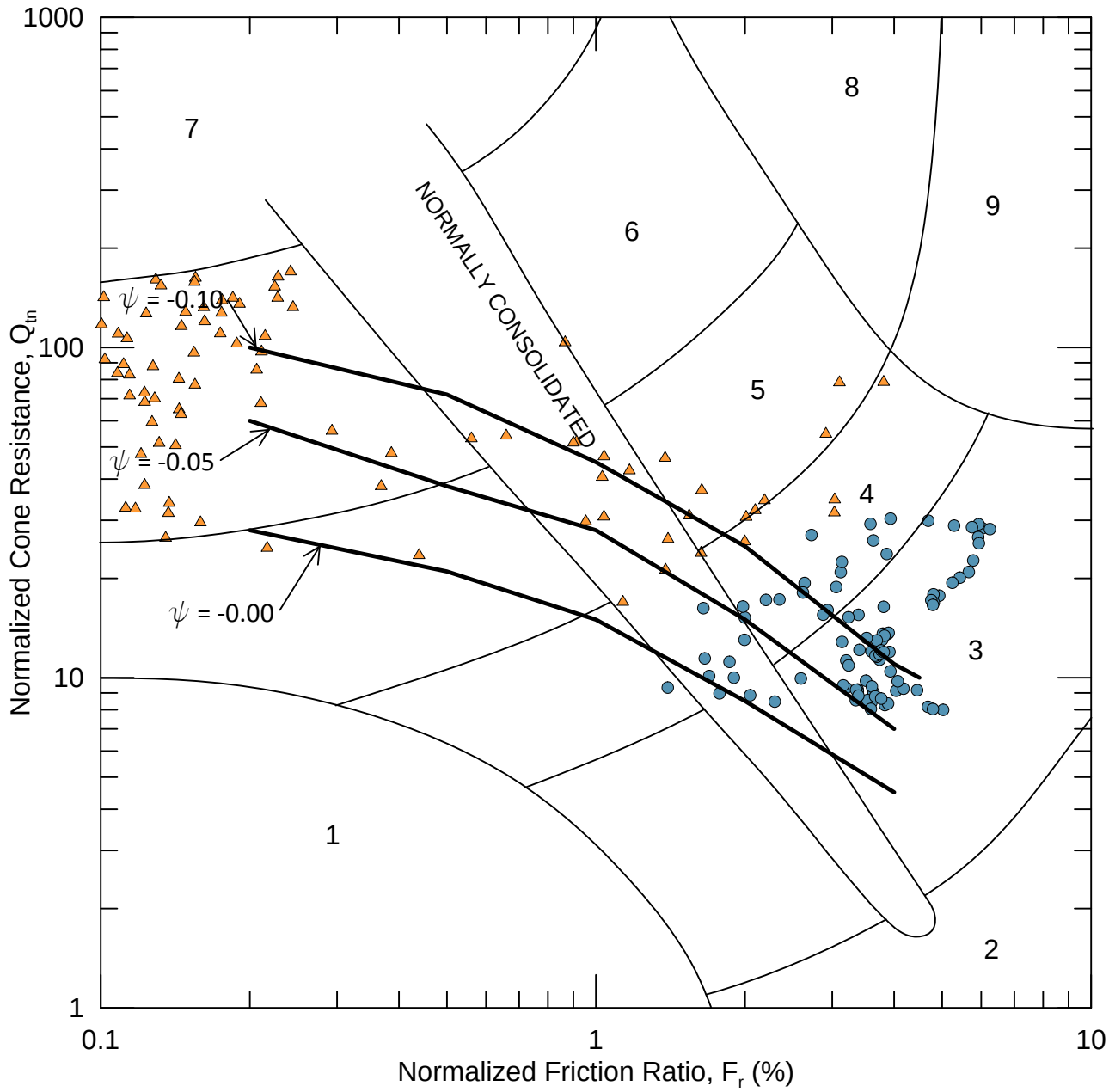


"Sand-Like"

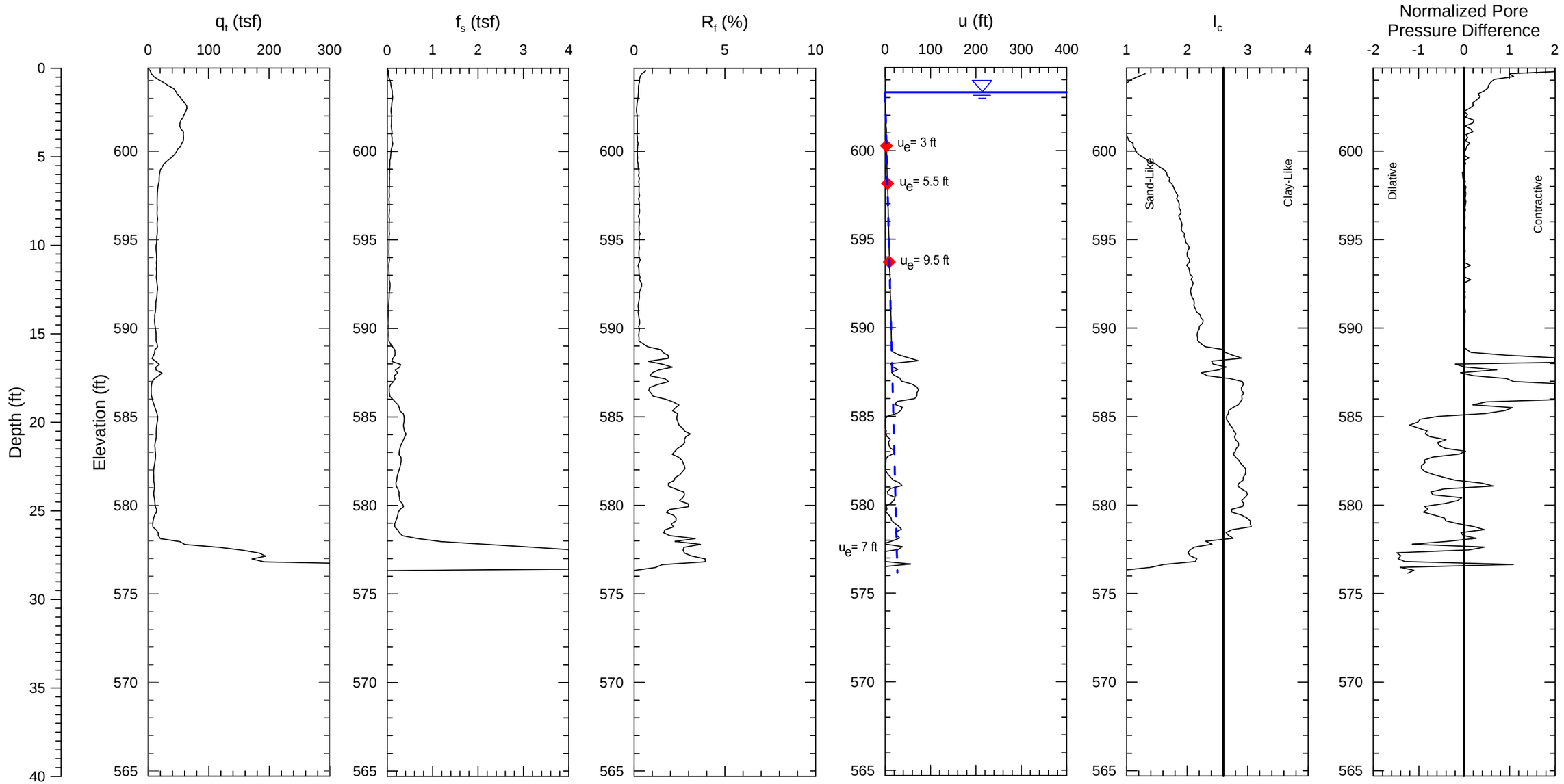
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

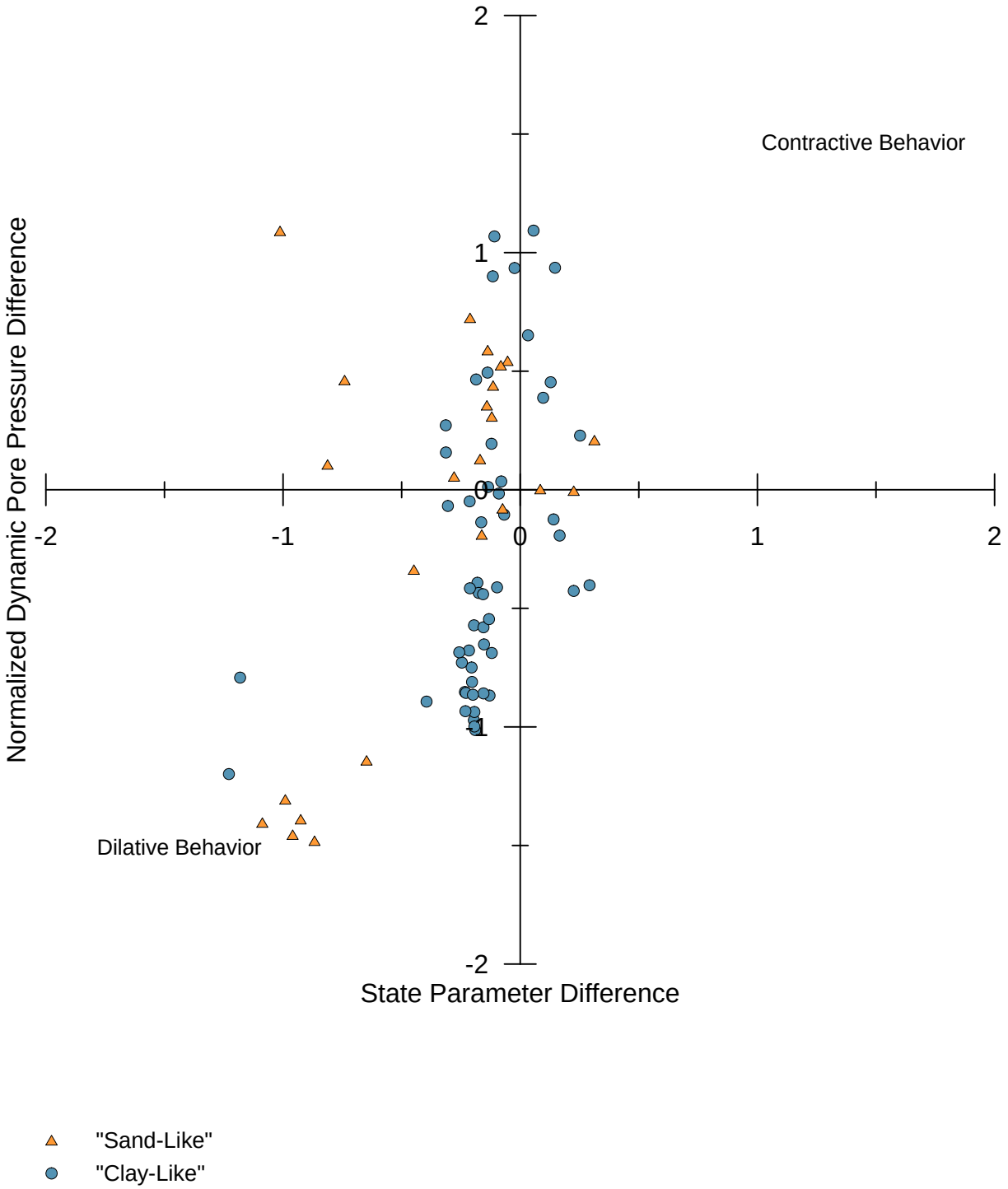
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C029 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-029_DC_Normalized State.grf



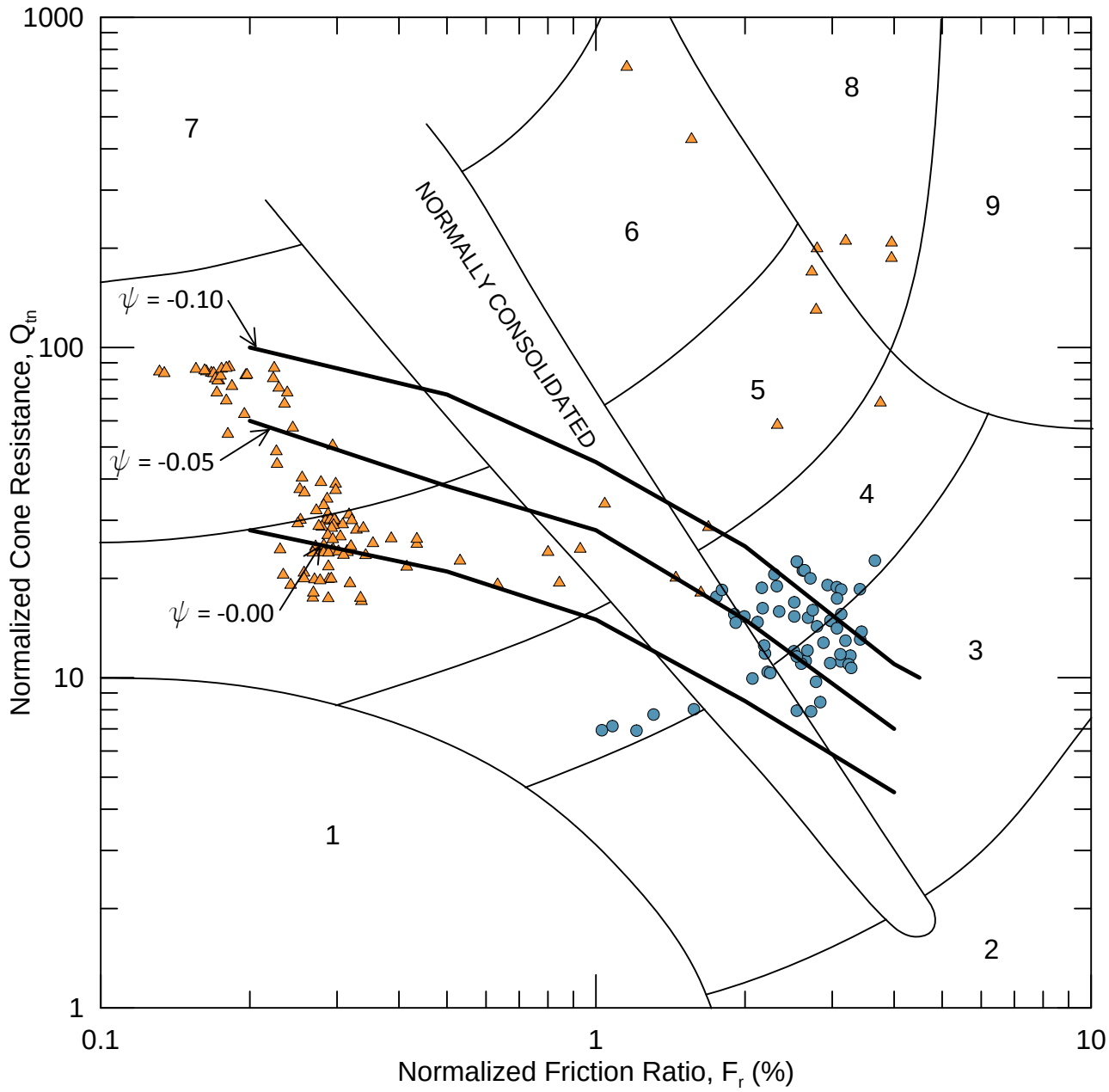
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C030 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C030 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-030_DC_ State Parameter Difference.grf



"Sand-Like"
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C030 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

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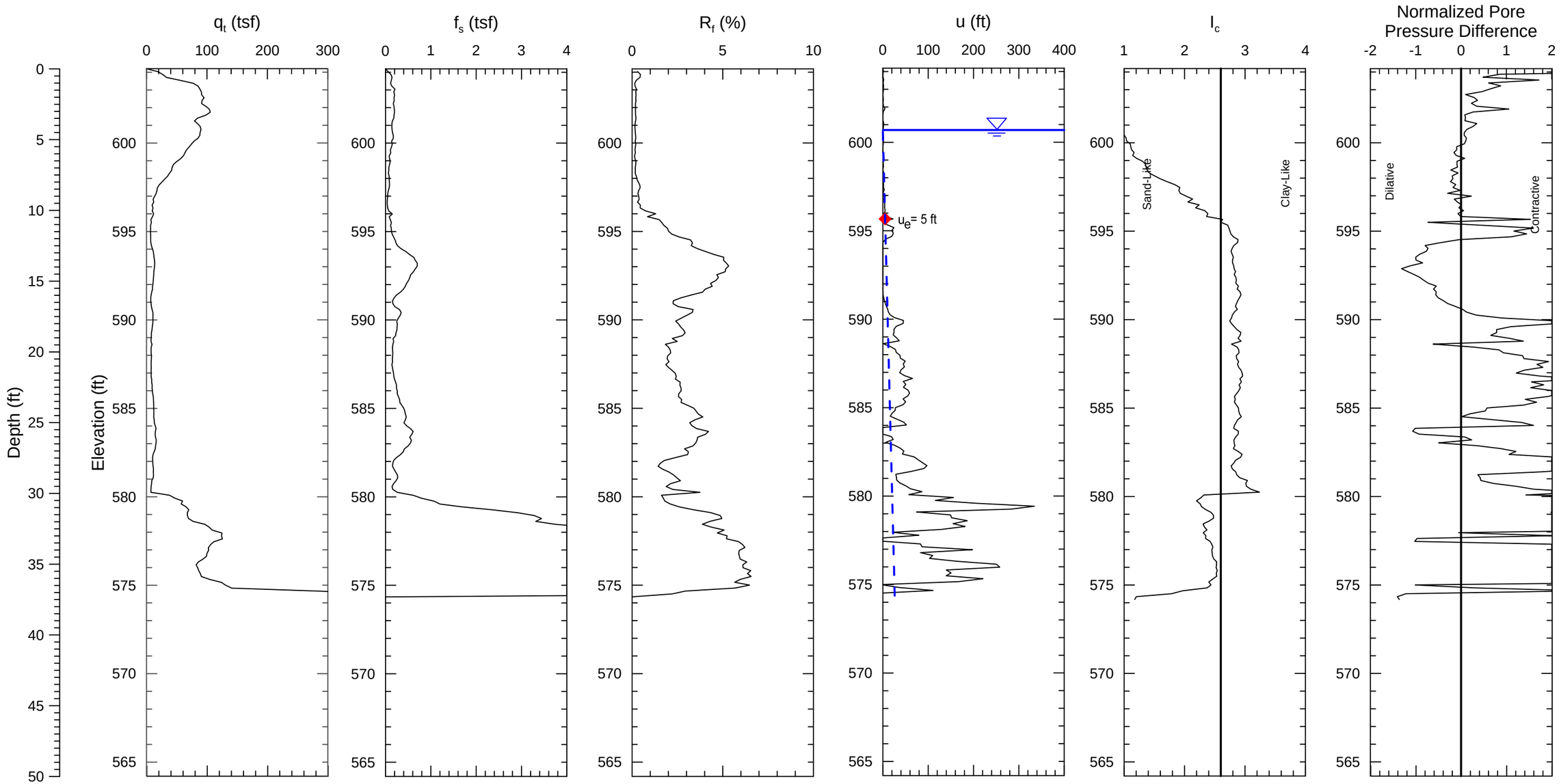


Pore Pressure Dissipation Test

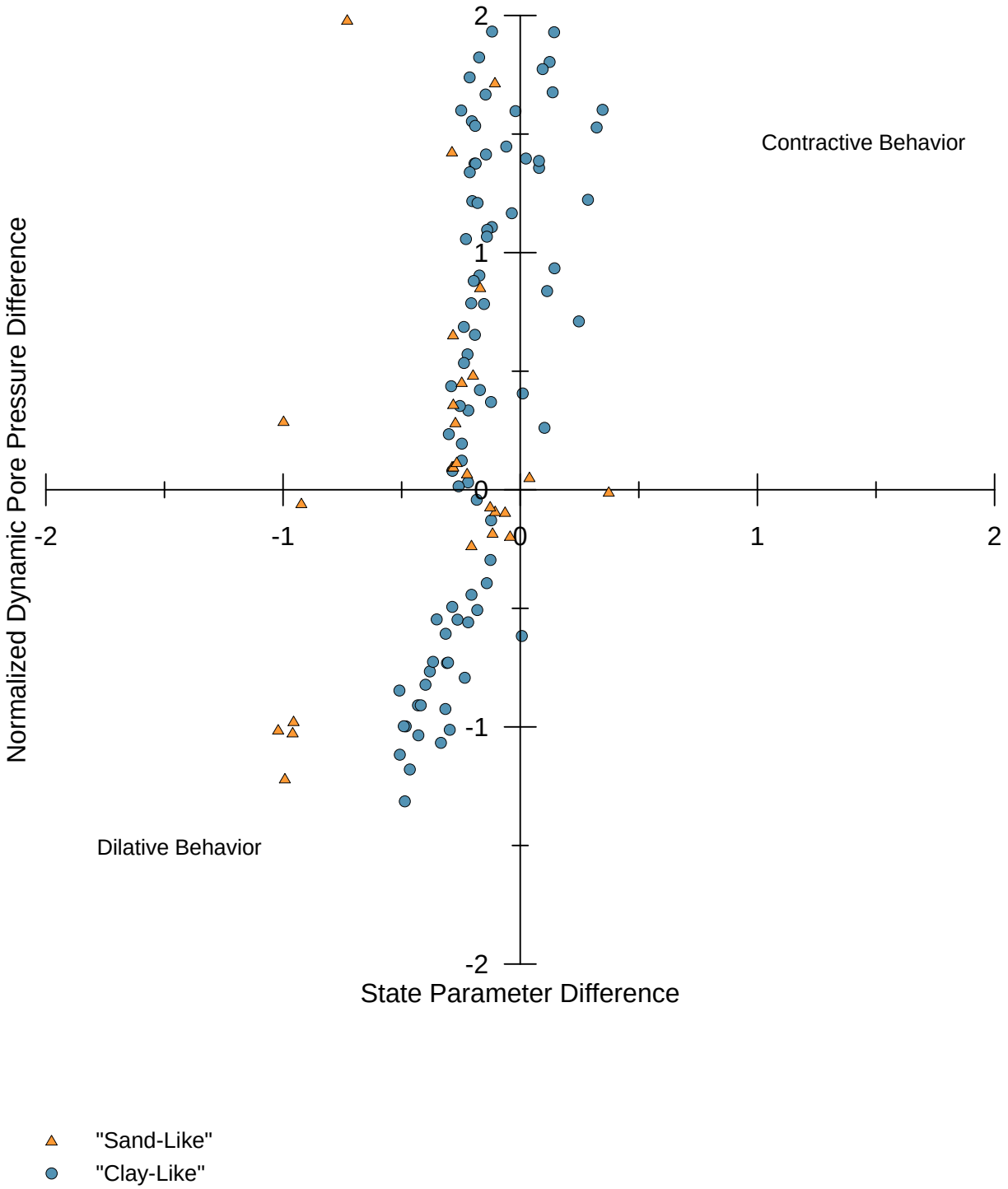
100% Hydrostatic Pore Pressure Line

Notes:

1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).

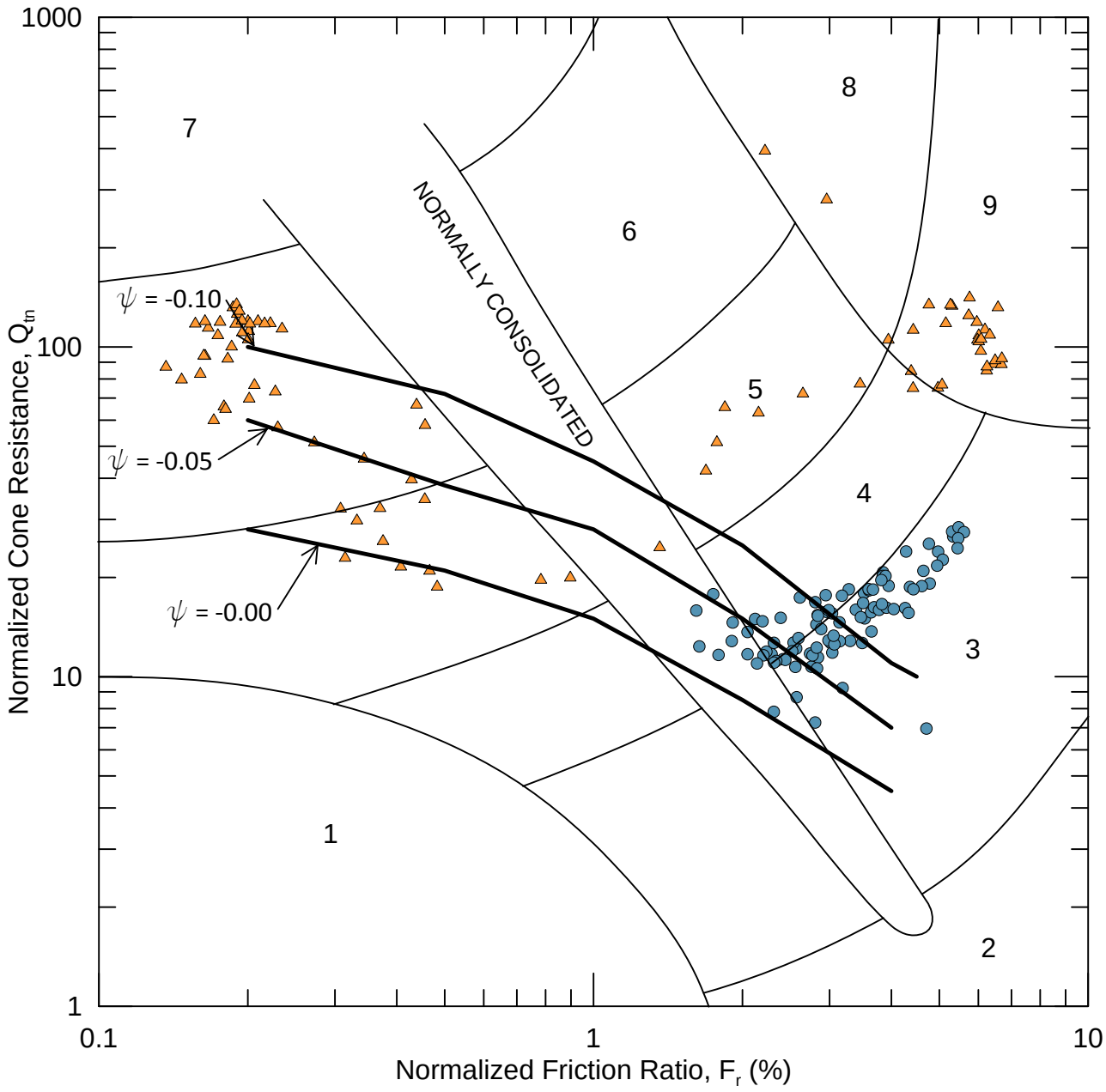
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C031 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C031 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-031_DC_ State Parameter Difference.grf



"Sand-Like"

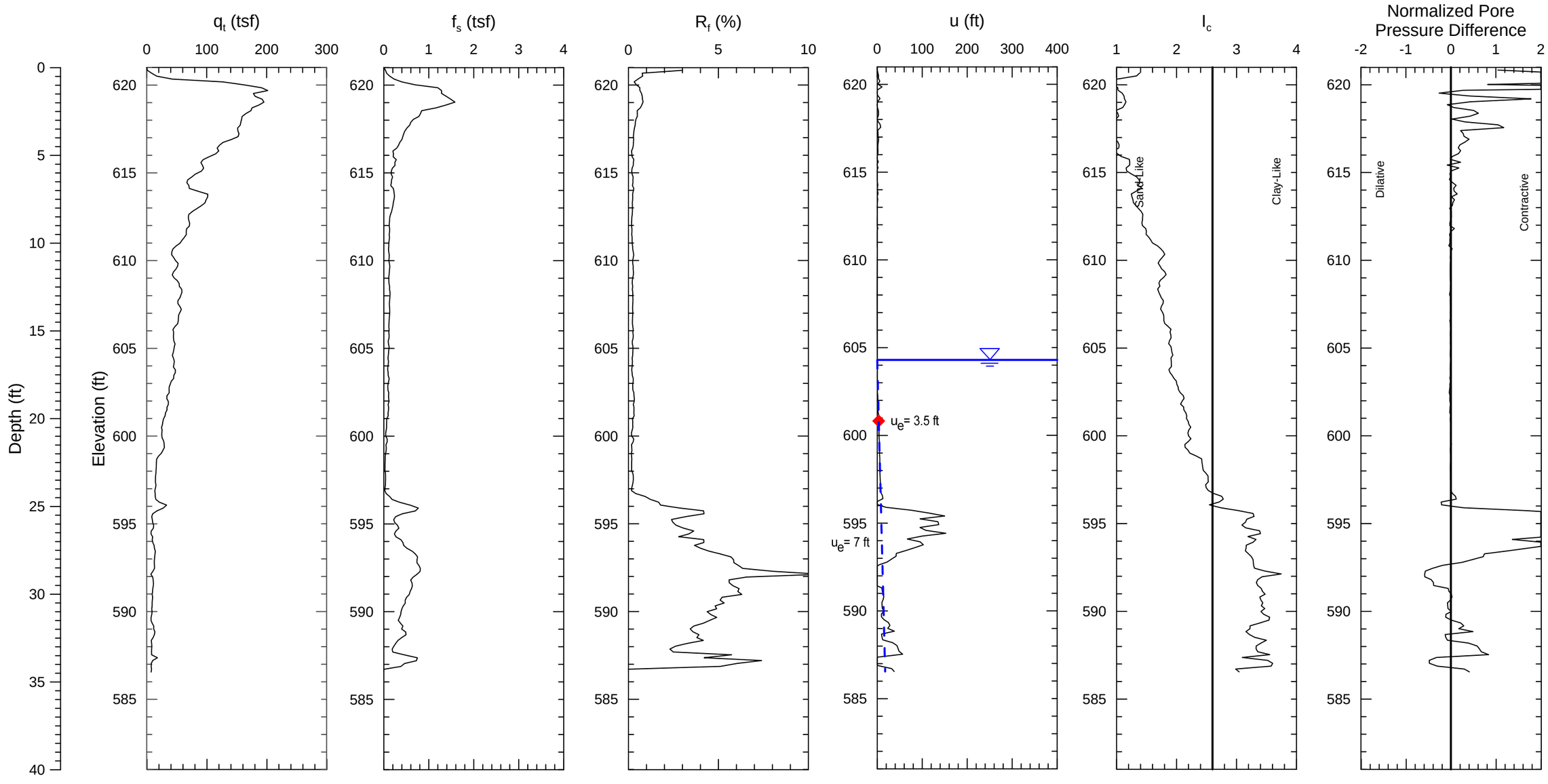
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

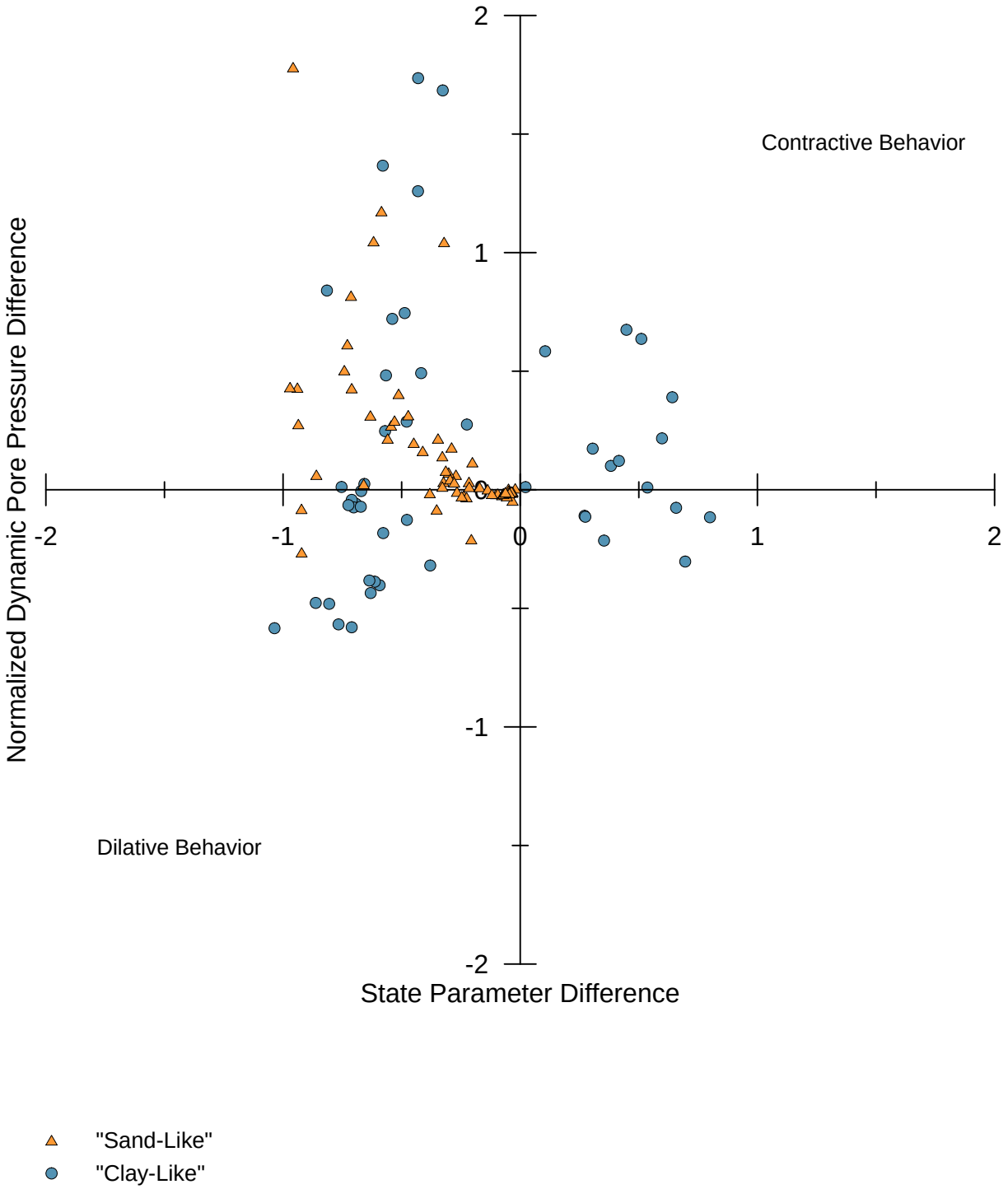
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C031 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-031_DC_Normalized State.grf



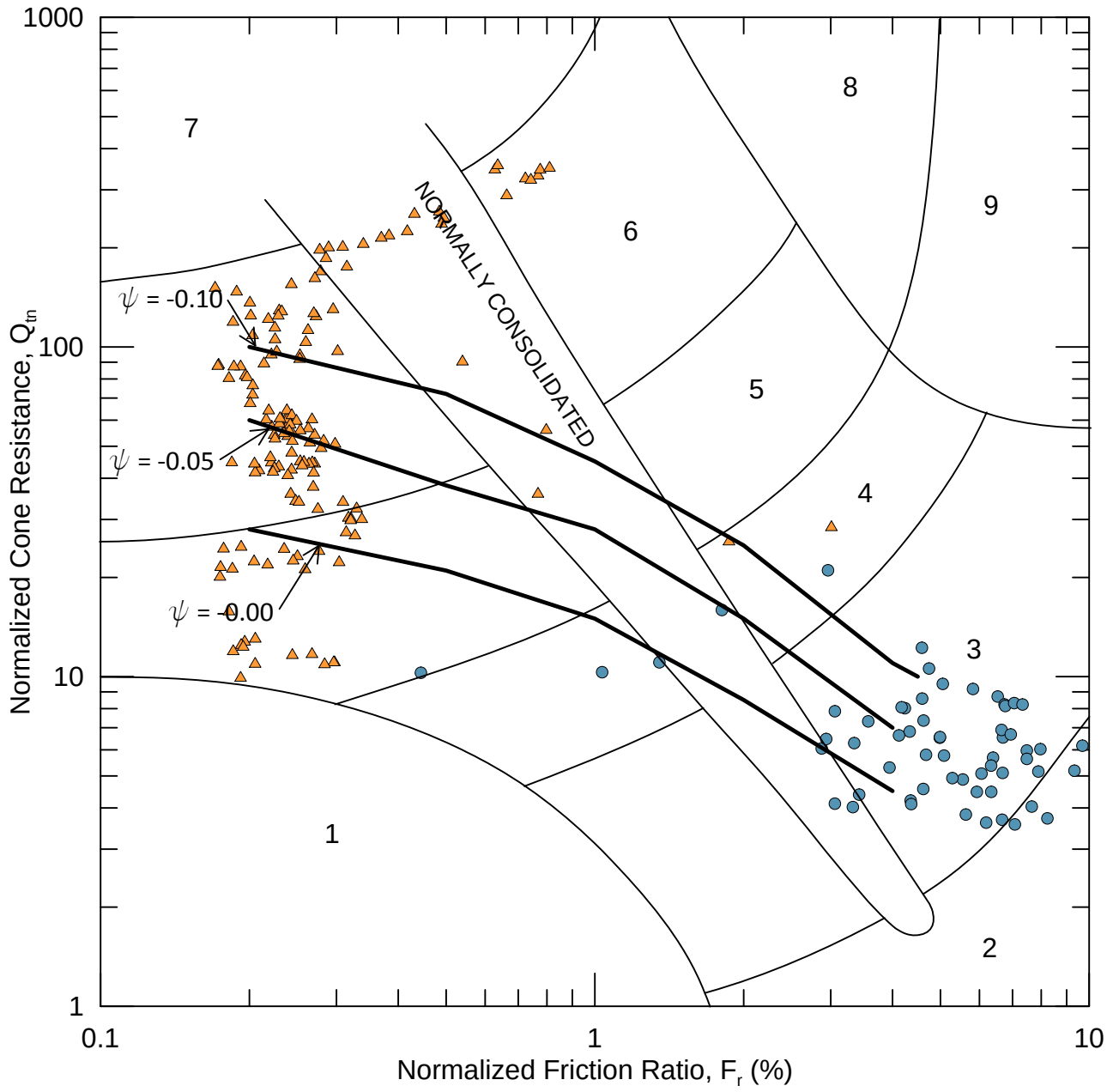
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C032 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C032 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-032_DC_ State Parameter Difference.grf



"Sand-Like"

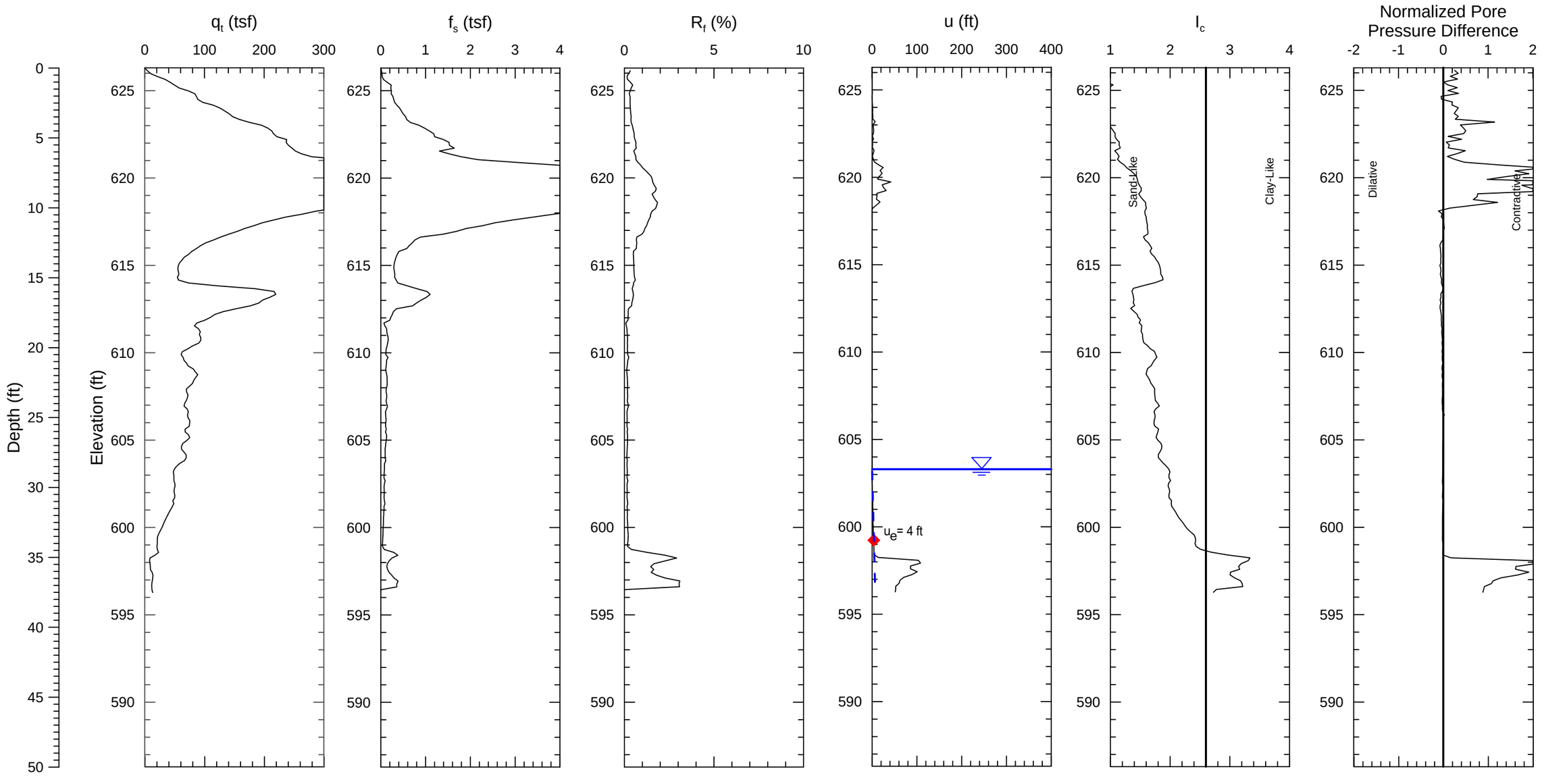
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

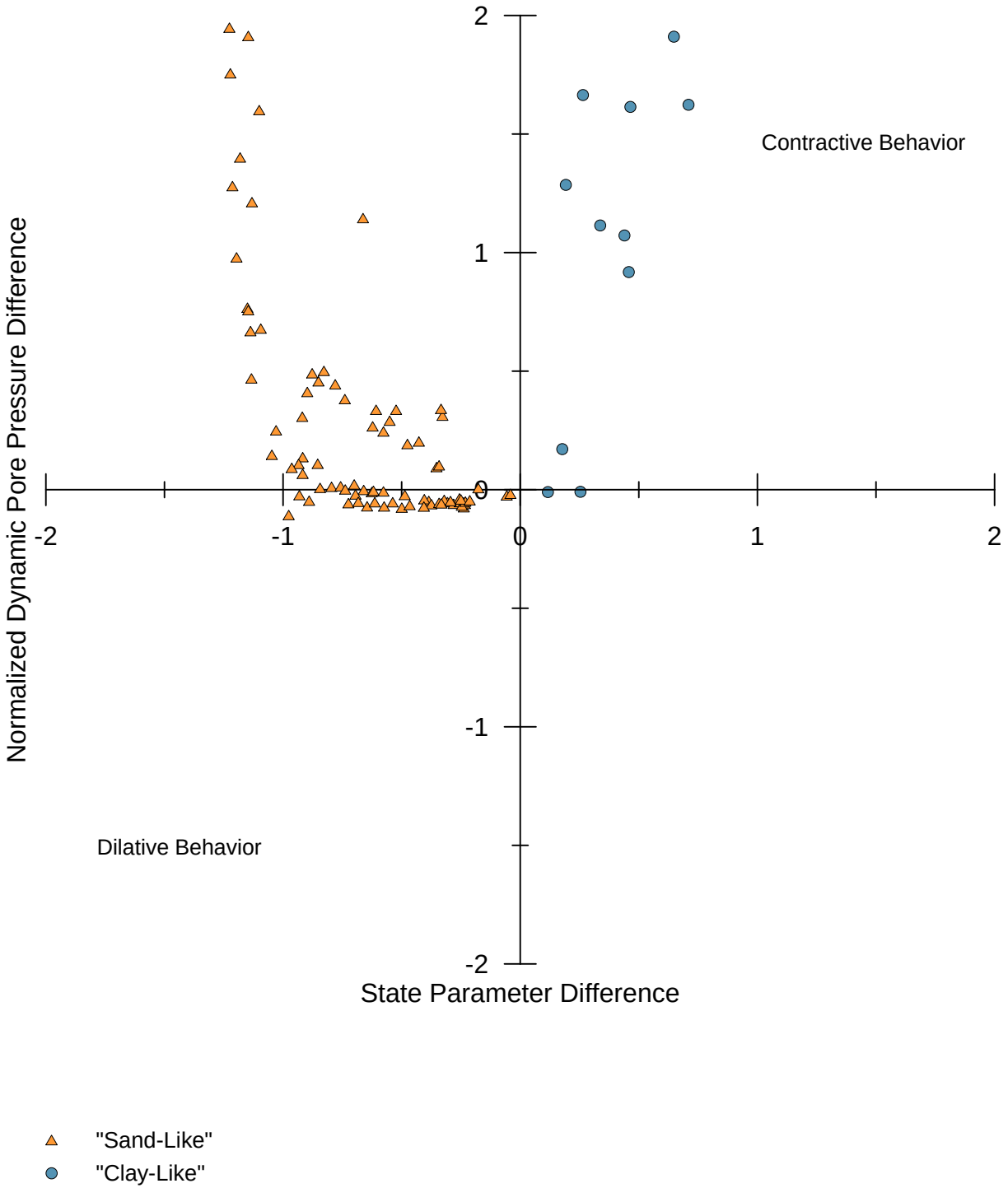
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C032 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-032_DC_Normalized State.grf



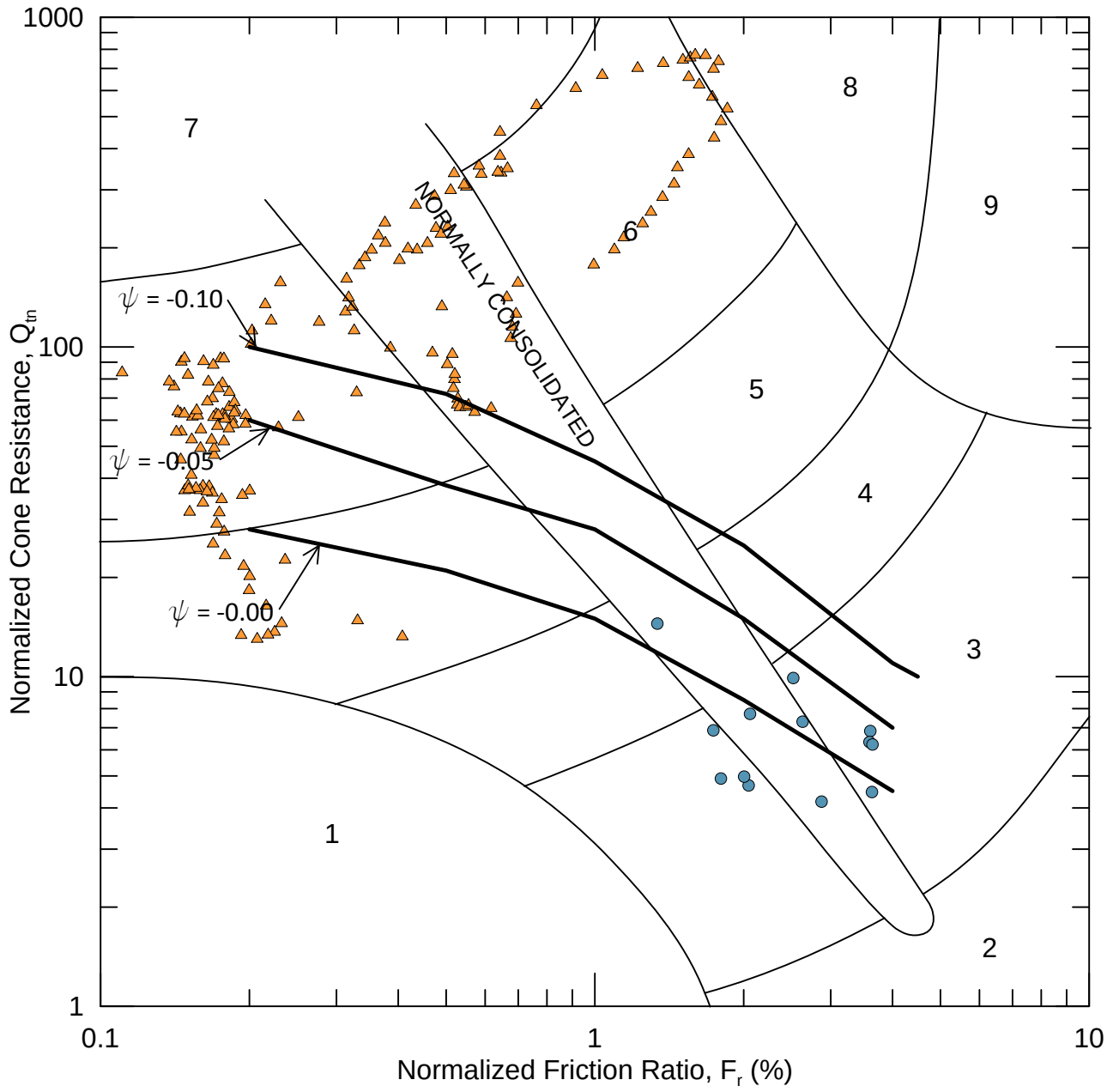
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C033 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C033 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-033_DC_ State Parameter Difference.grf

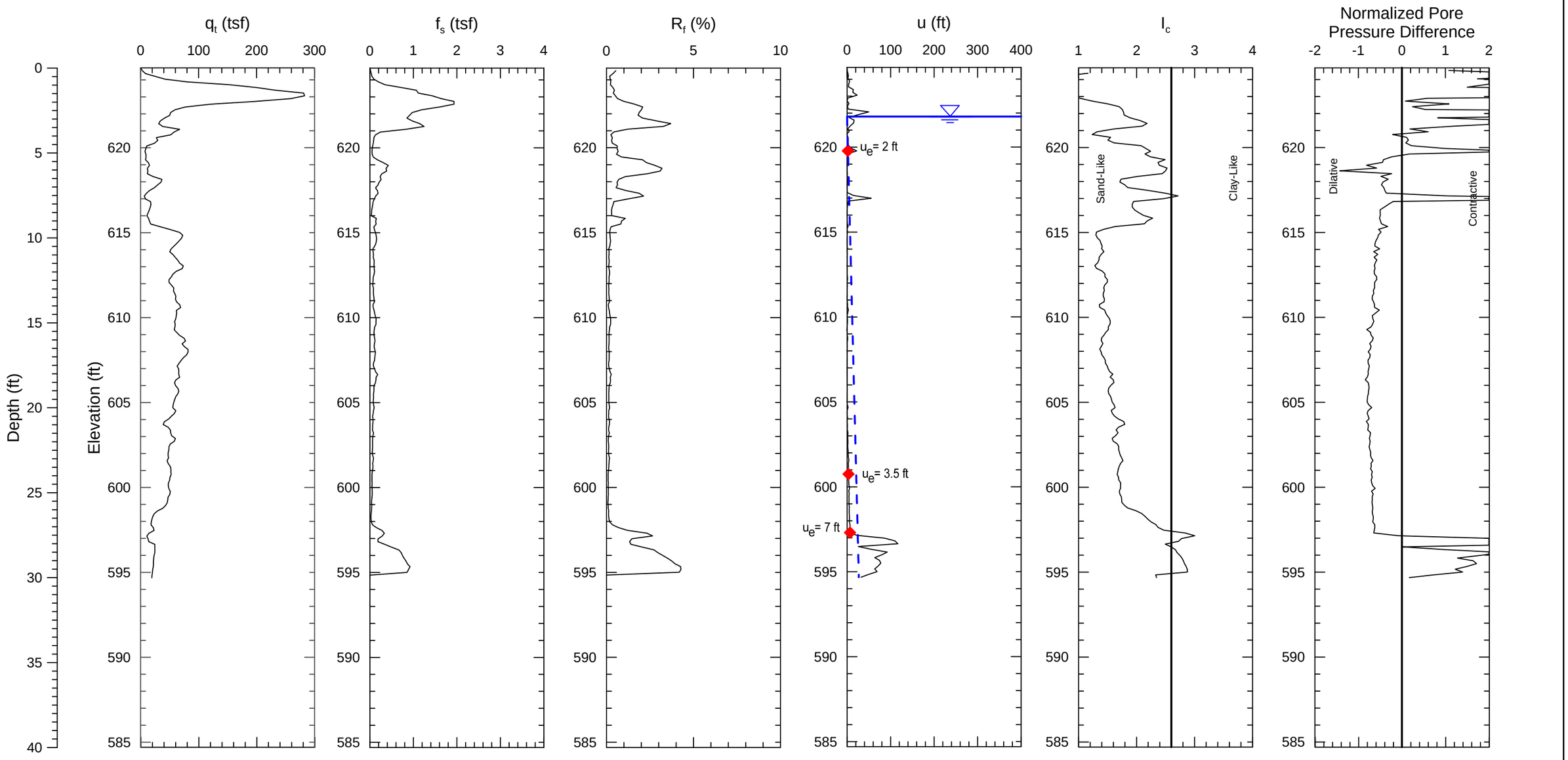


Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

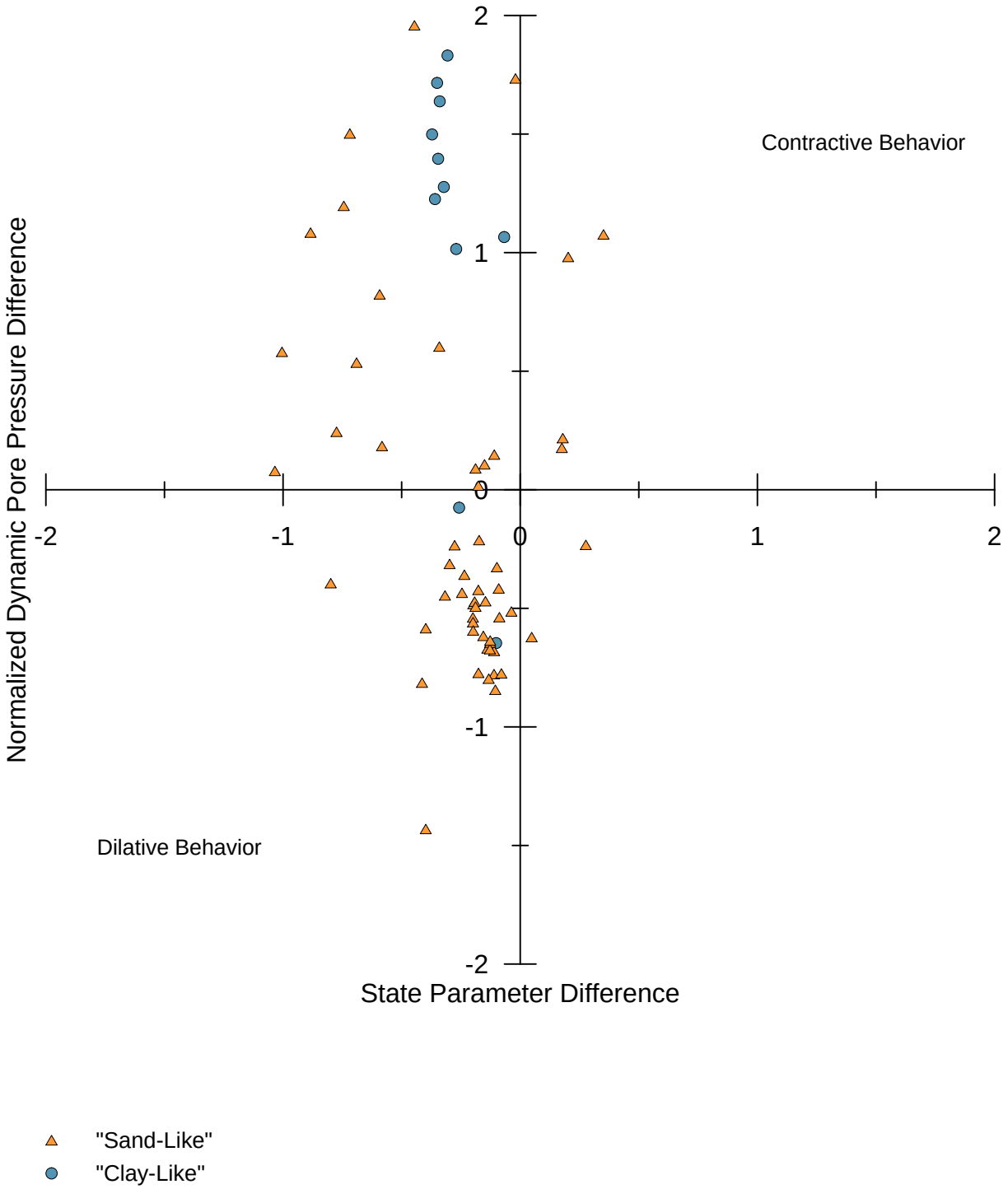
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C033 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-033_DC_Normalized State.grf



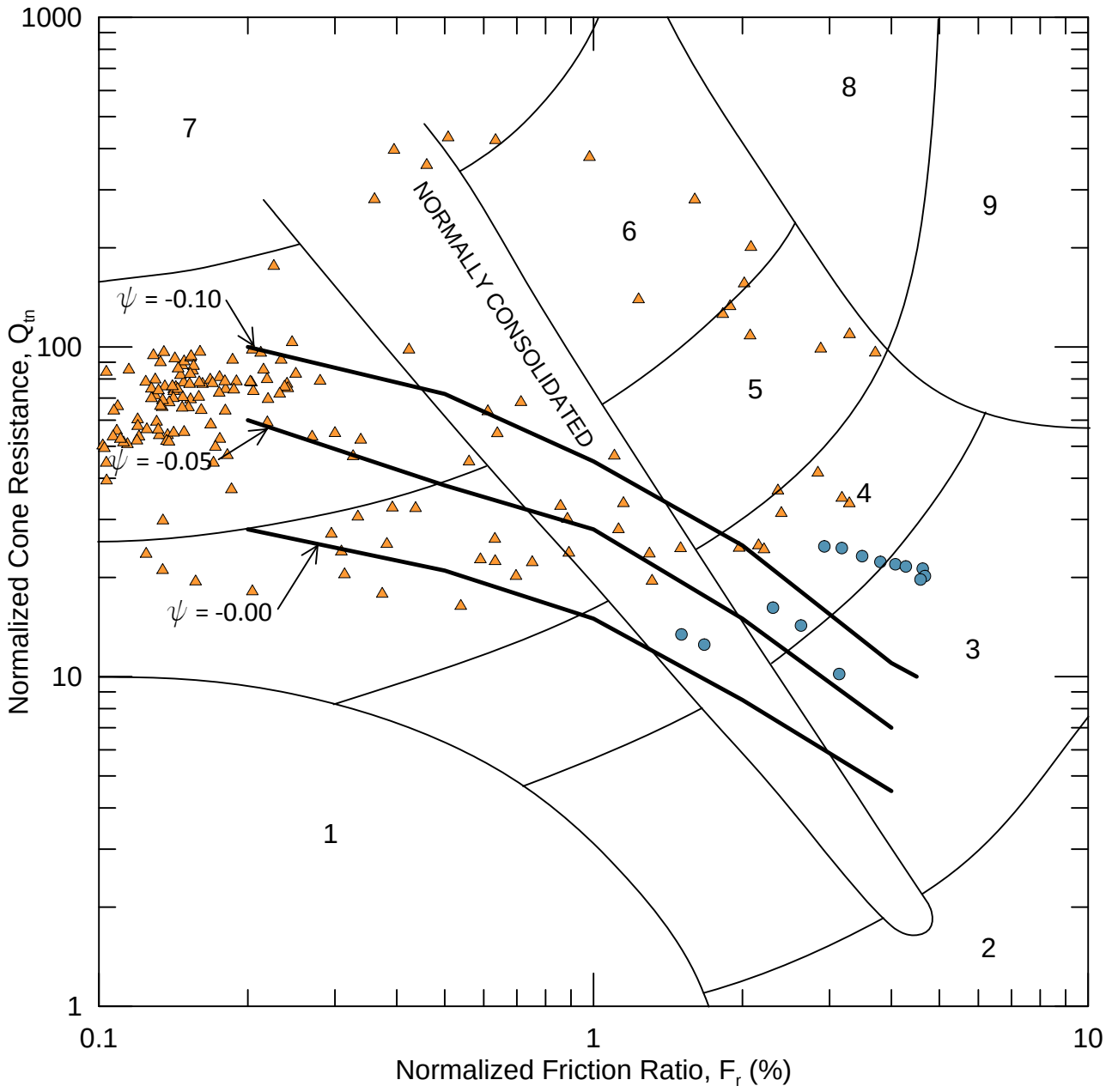
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C034 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C034 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-034_DC_ State Parameter Difference.grf



"Sand-Like"

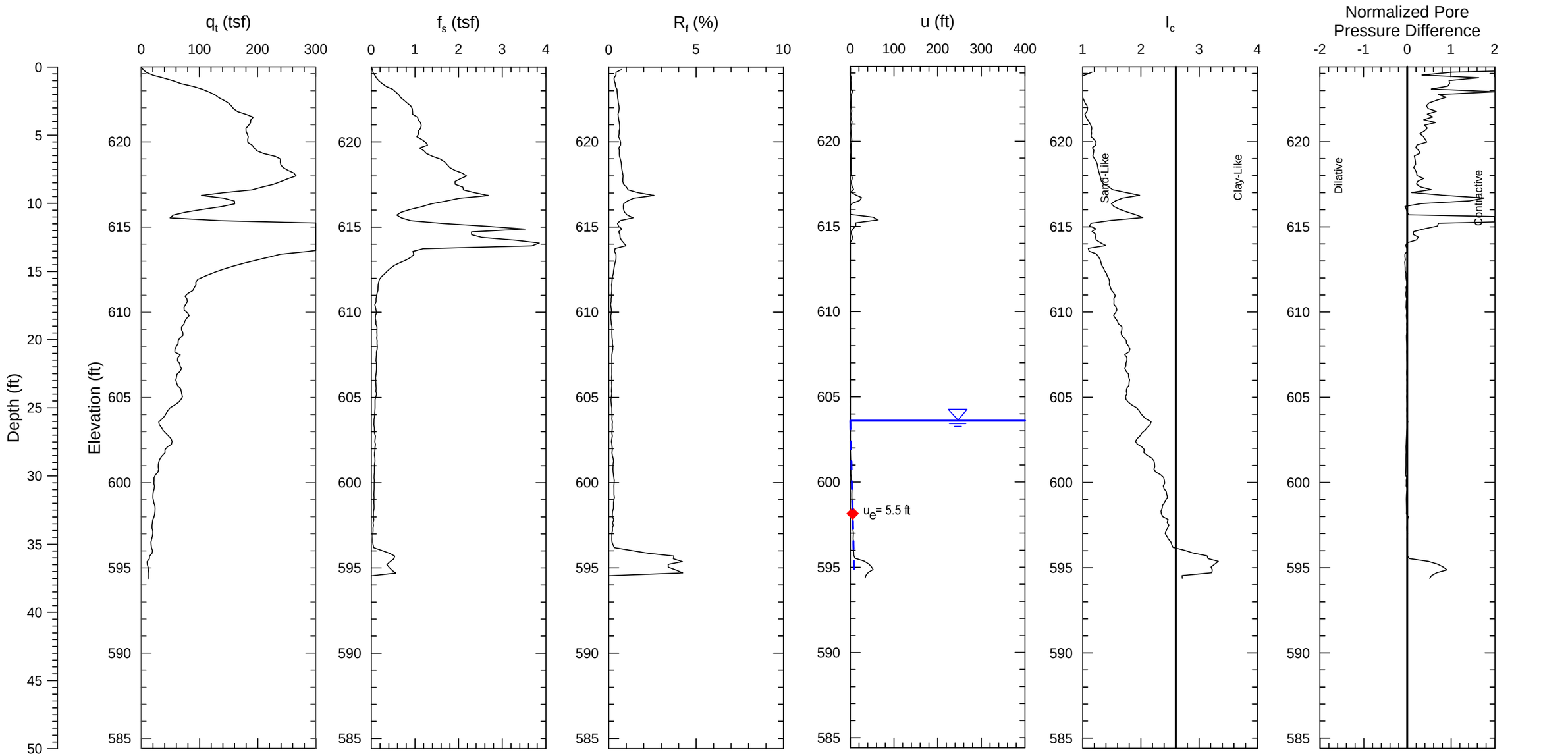
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

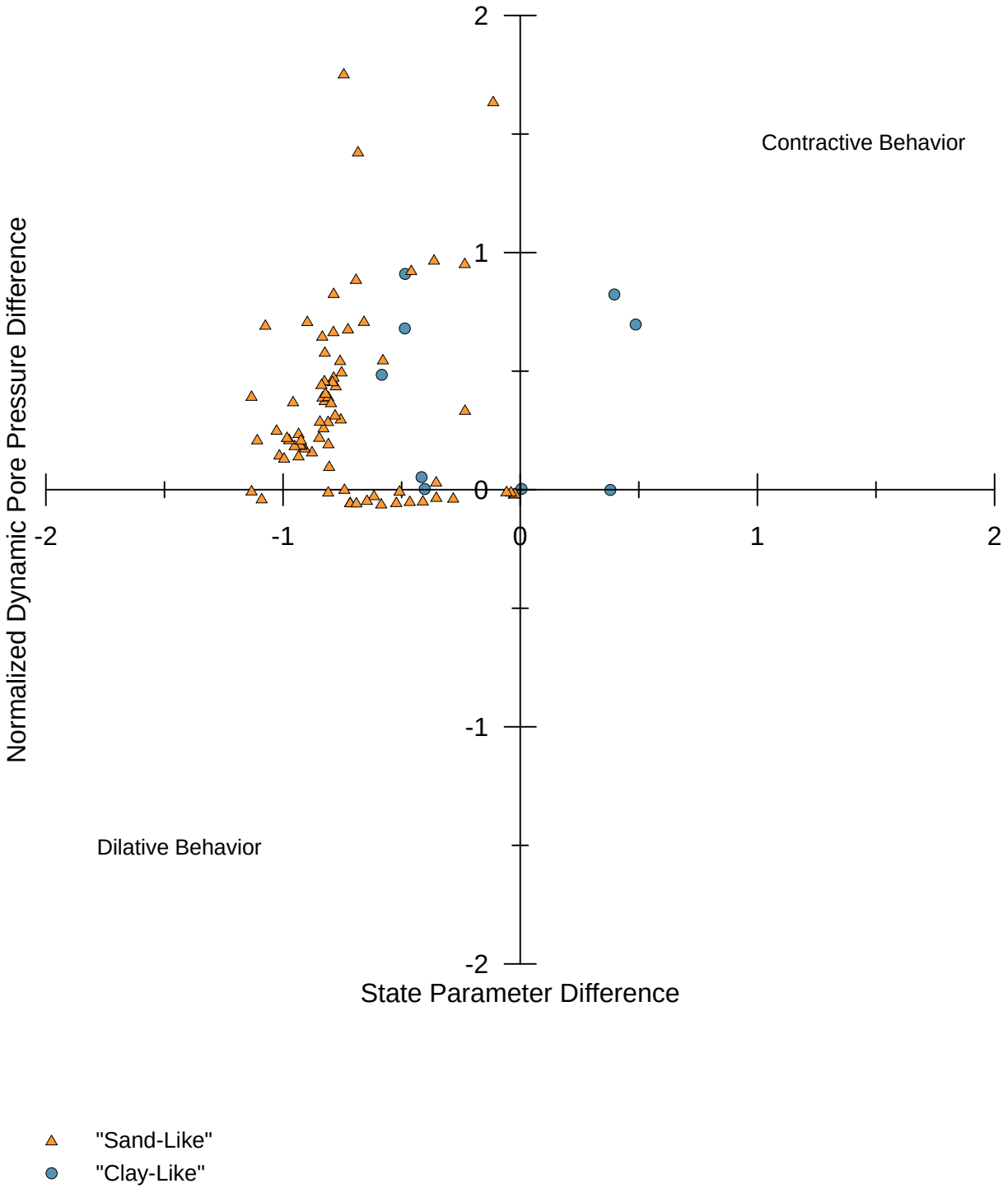
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C034 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-034_DC_Normalized State.grf



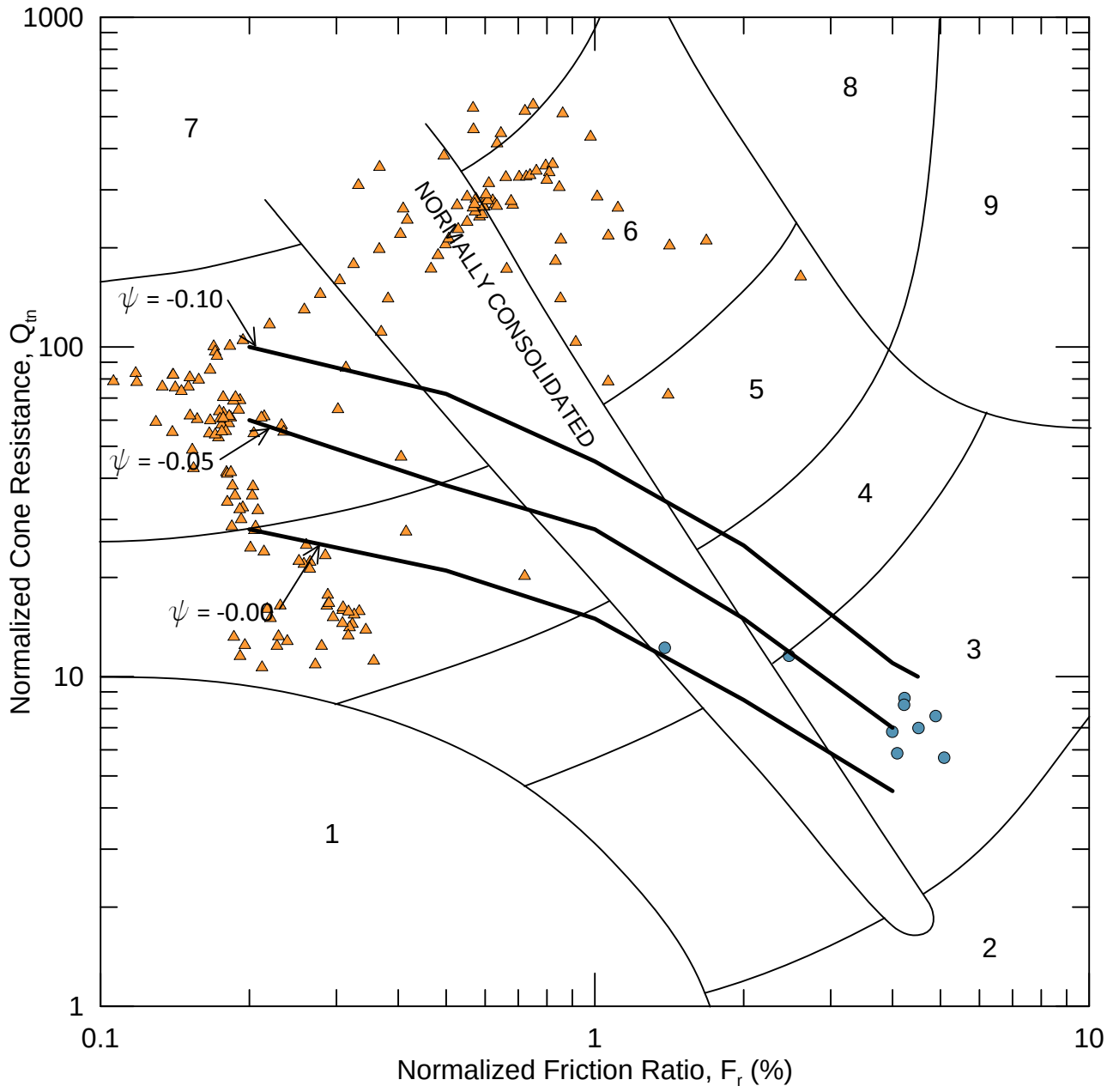
Notes:
1) Soil behavior type index, I_c, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C035 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C035 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-035_DC_ State Parameter Difference.grf



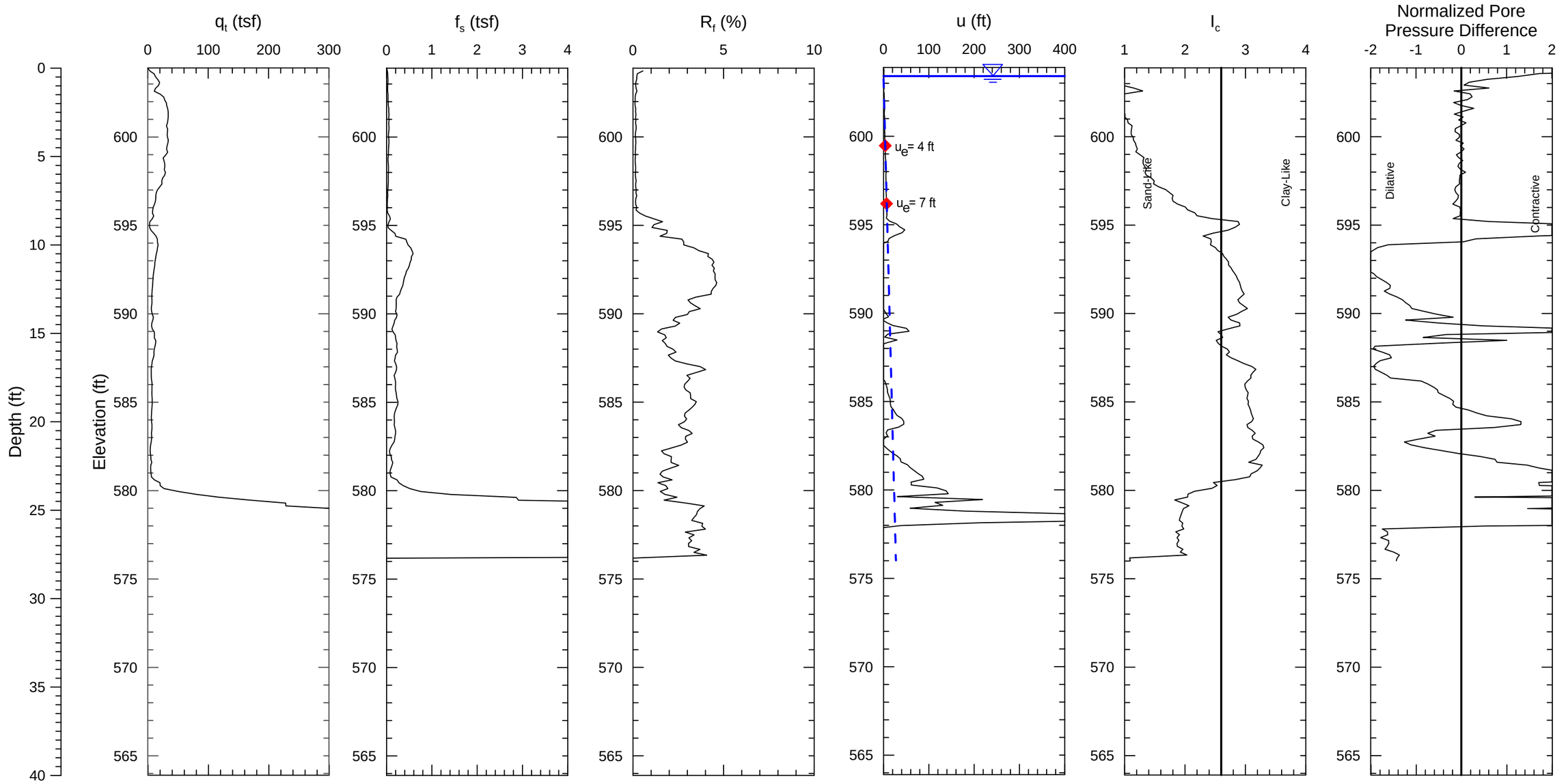
"Sand-Like"
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

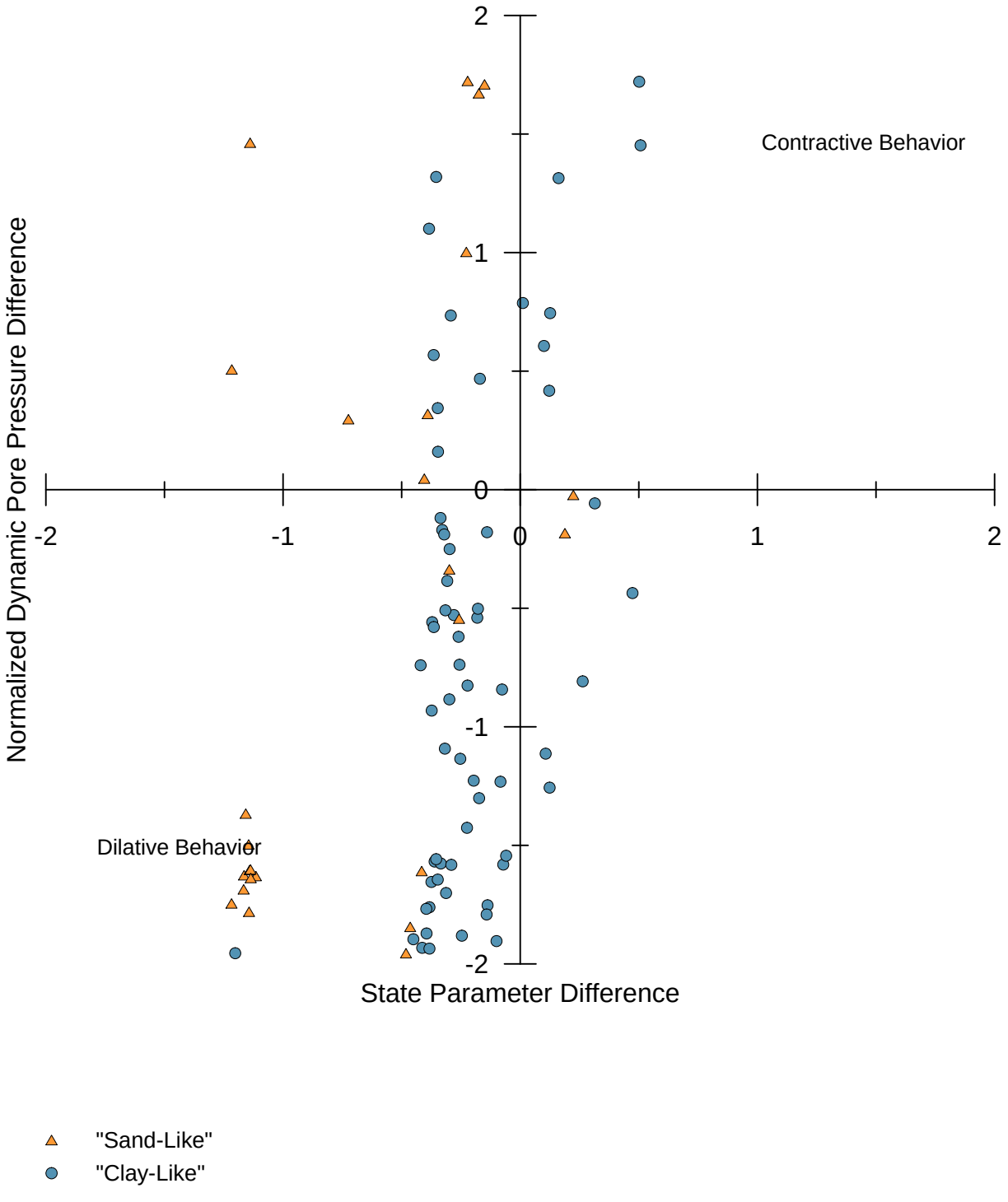
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C035 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-035_DC_Normalized State.grf



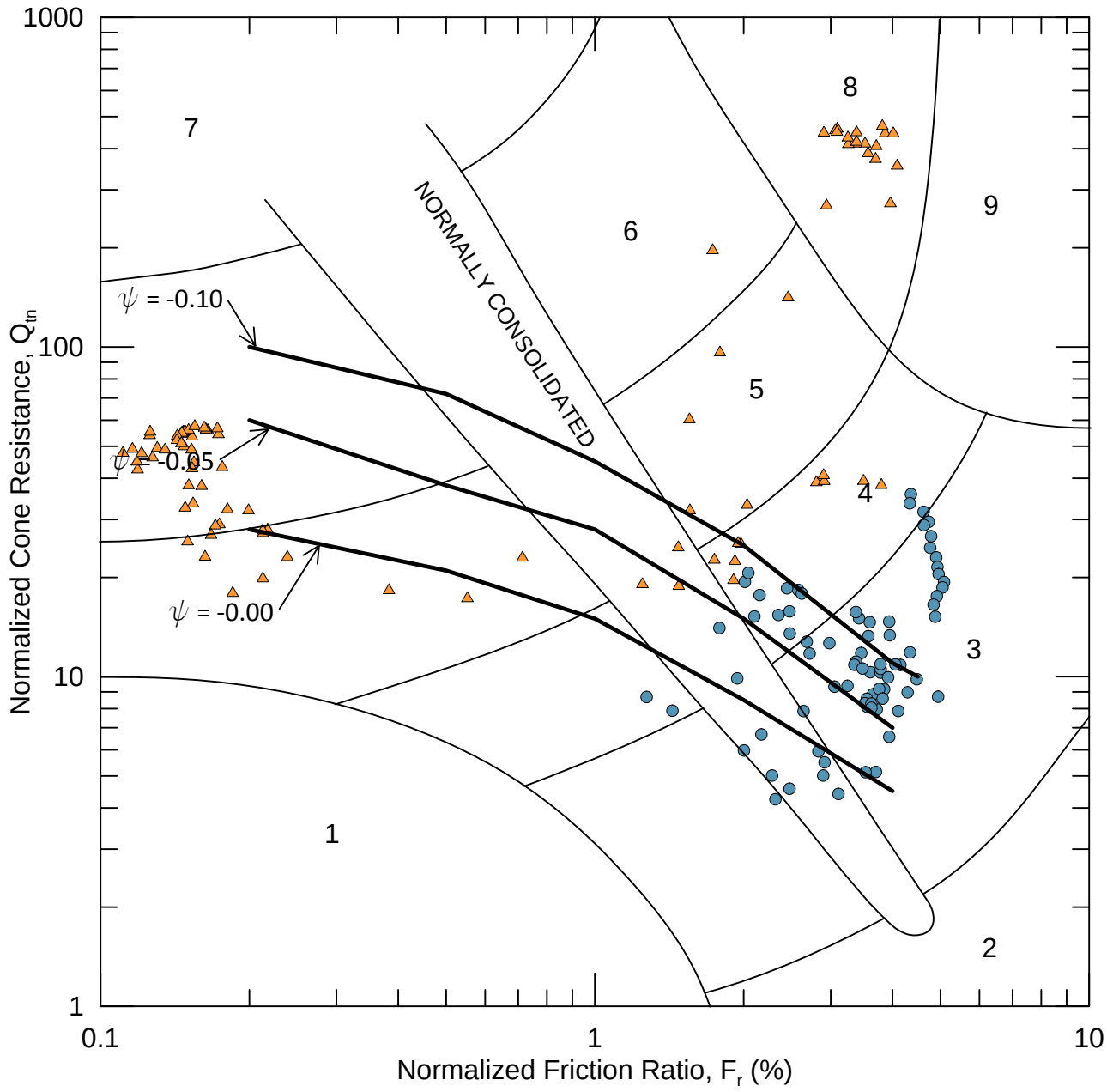
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C036 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C036 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-036_DC_ State Parameter Difference.grf



"Sand-Like"

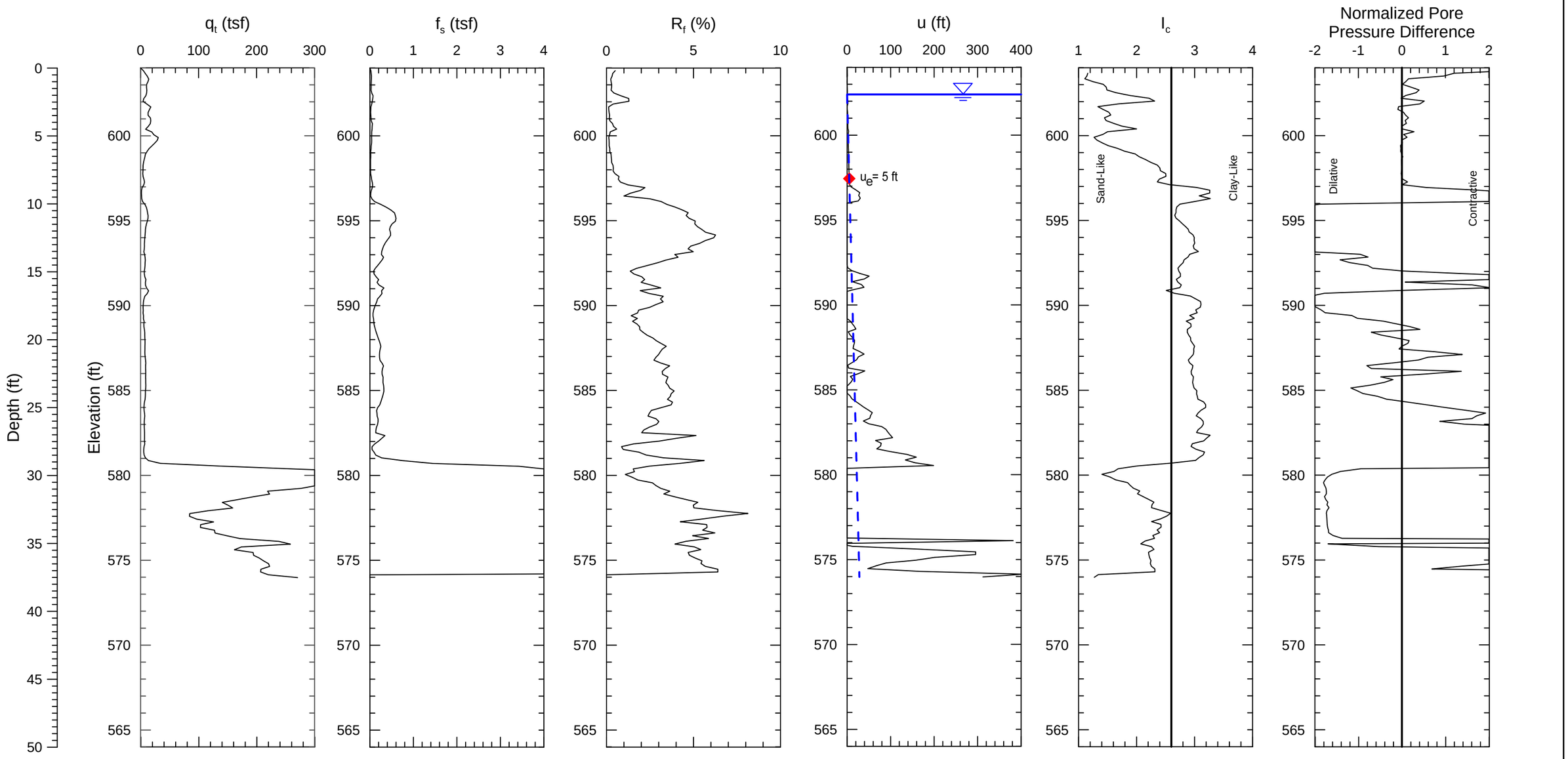
"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

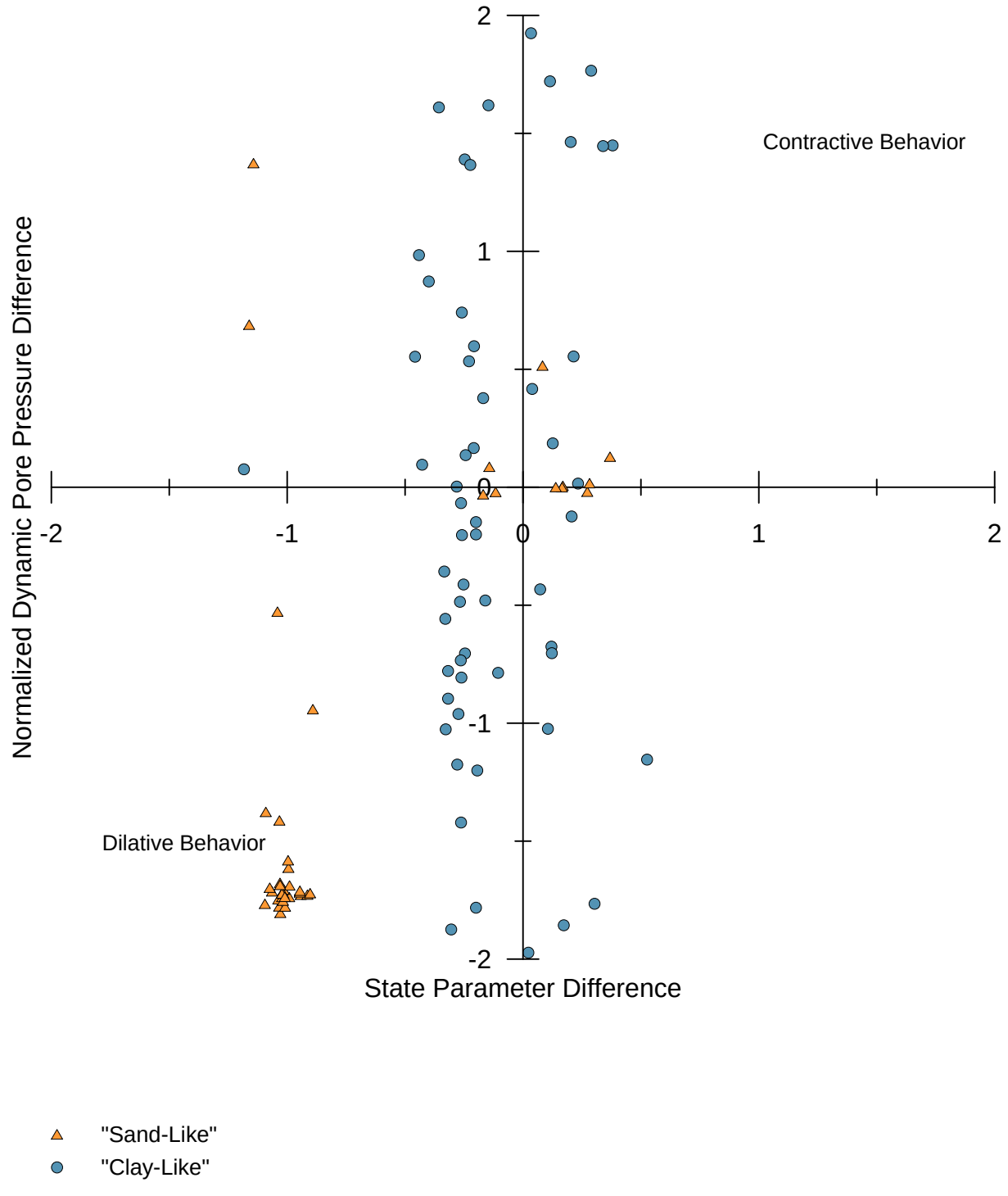
PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C036 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmtSub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-036_DC_Normalized State.grf



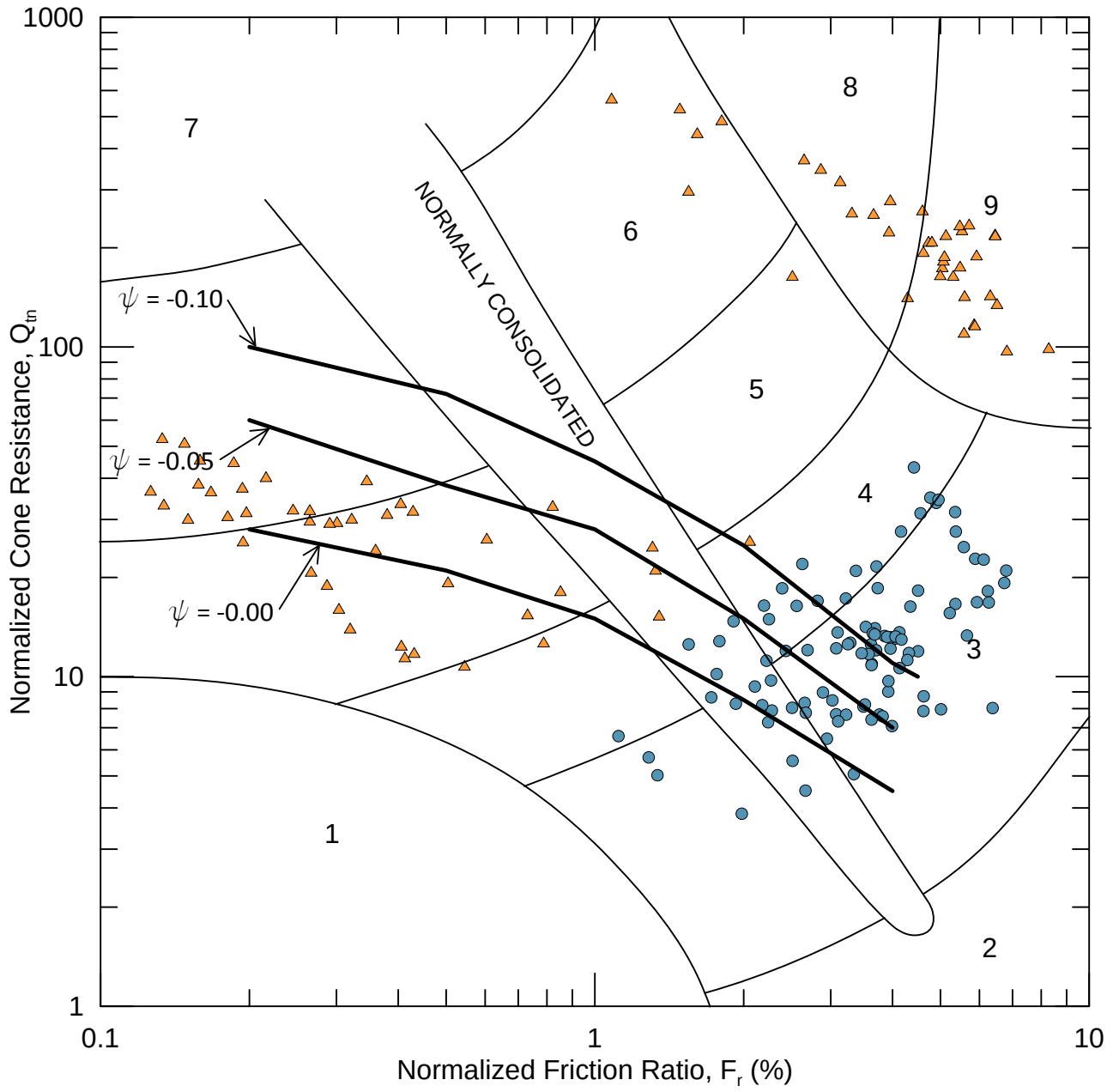
Notes:
1) Soil behavior type index, I_C, values based on correlations in Guide to Cone Penetration Testing for Geotechnical Engineering (Robertson, 2012).
2) CPT soundings performed by ConeTec, Inc. in August 2015.

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C037 Kincaid Ash Pond	FIGURE
AECOM			



PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C037 Normalized Dynamic Pore Pressure Difference vs State Parameter Difference	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-037_DC_ State Parameter Difference.grf



"Sand-Like"

"Clay-Like"

Zone	Soil Behavior Type	Ic
1	*Sensitive, fine grained*	N/A
2	*Organic soils-peats*	>3.6
3	*Clays-silty clay to clay*	2.95-3.6
4	*Silt mixtures-clayey silt to silty clay*	2.6-2.95
5	*Sand mixtures-silty sand to sandy silt*	2.05-2.6
6	*Sands-clean sand to silty sand*	1.31-2.05
7	*Gravelly sand to dense sand*	<1.31
8	*Very stiff sand to clayey sand**	N/A
9	*Very stiff, fine grained**	N/A

**Heavily overconsolidated or cemented*

PROJECT NO. 60480698	Dynegy - Kincaid Site	KIN-C037 Approximate Boundary Between Dilative and Contractive Soil Response Using Normalized CPT and Pore Pressure Parameters	FIGURE
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\GeotechnicalCPT Characterization\Kincaid Ash Pond\KIN-037_DC_Normalized State.grf

Calculation Notes

Subject: Kincaid Ash Pond Liquefaction Analysis

Project Name: Dynegy CCR

By: Brian Gomez / Meaghan Kenna Date: 01/29/2016

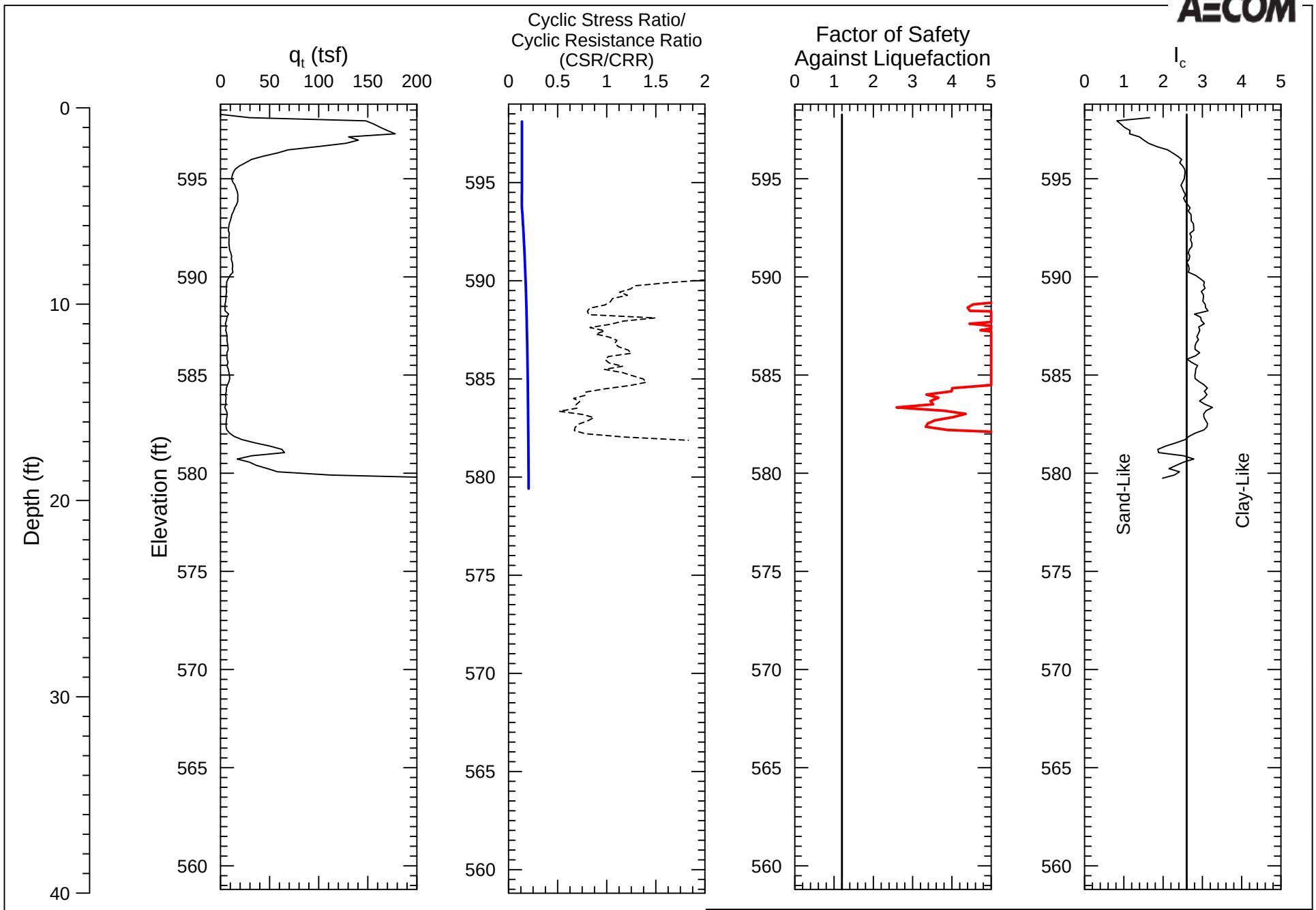
Project No: 60480698

Checked By: Julie Heitland Date: 01/29/2016

Task No.: 01

APPENDIX B

Liquefaction Triggering Plots


AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
595 590 585 580 575 570 565 560
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 598.8 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C001
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-001 Triggering.grf

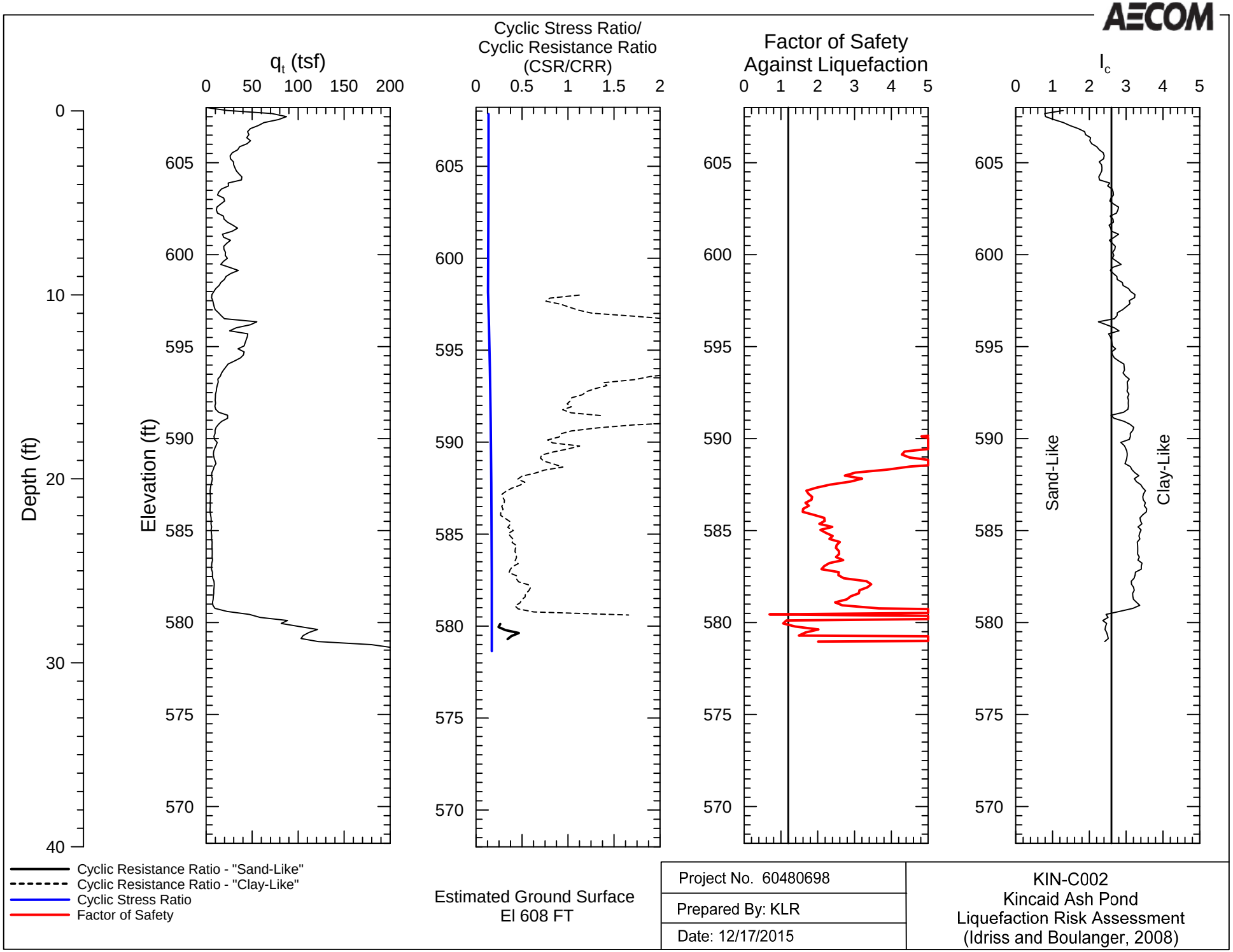

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
605 600 595 590 585 580 575 570
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 608 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C002
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-002 Triggering.grf

FIG. XXXX

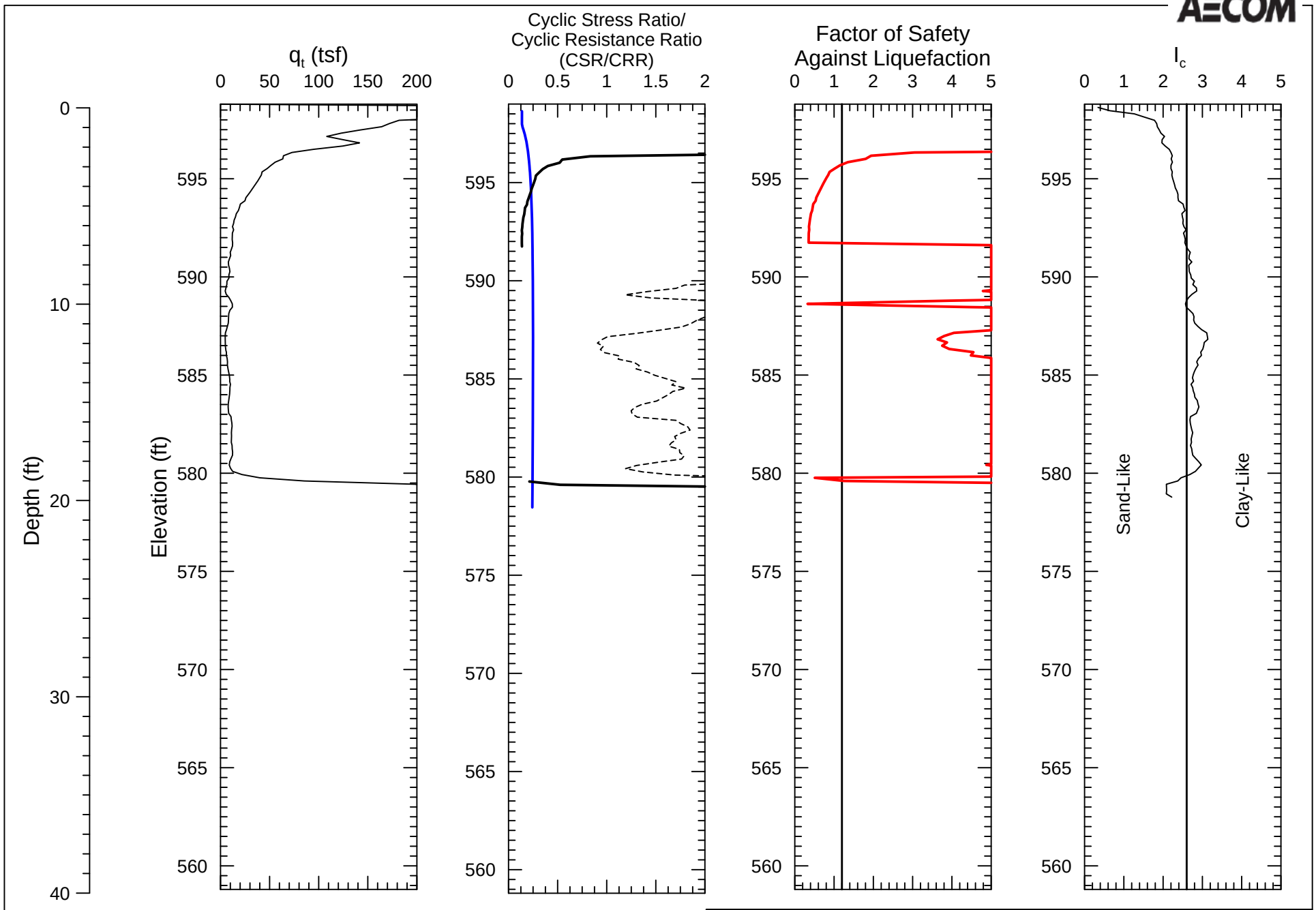

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
595 590 585 580 575 570 565 560
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 598.8 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C003
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-003 Triggering.grf

FIG. XXXX

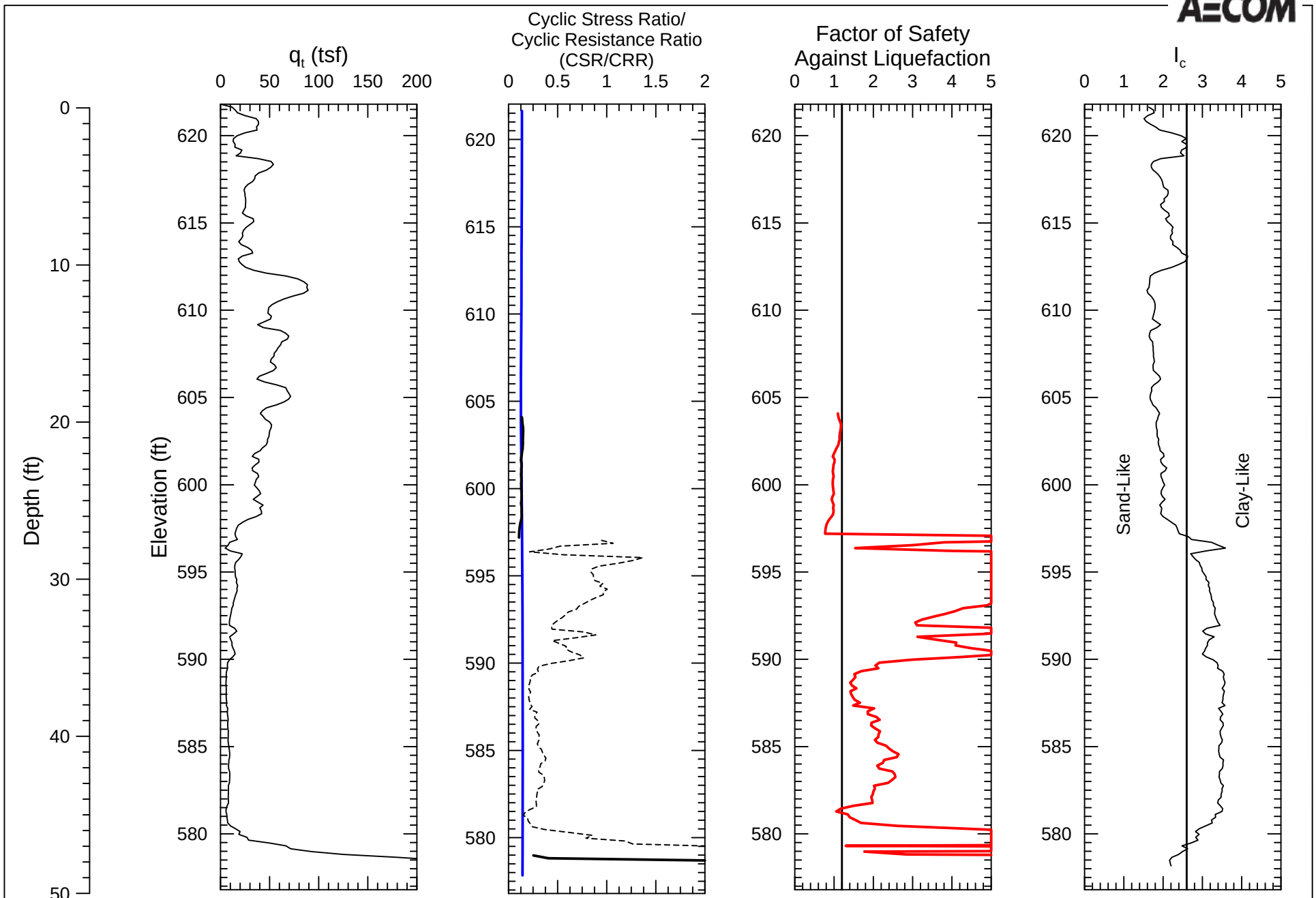
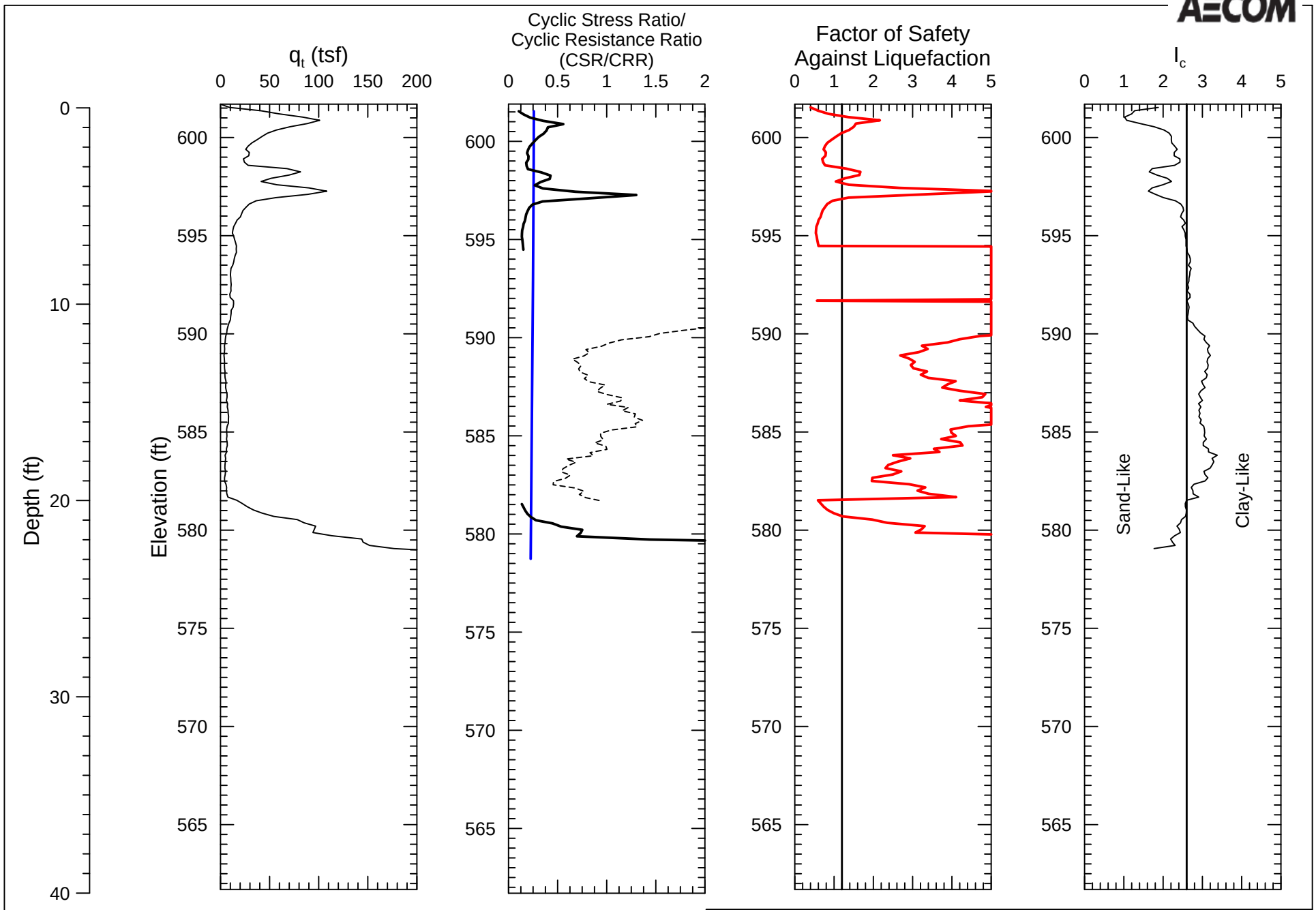

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40 50
Elevation (ft)
620 615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 621.8 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C004
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-004 Triggering.grf

FIG. XXXX


AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 601.7 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C005
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-005 Triggering.grf

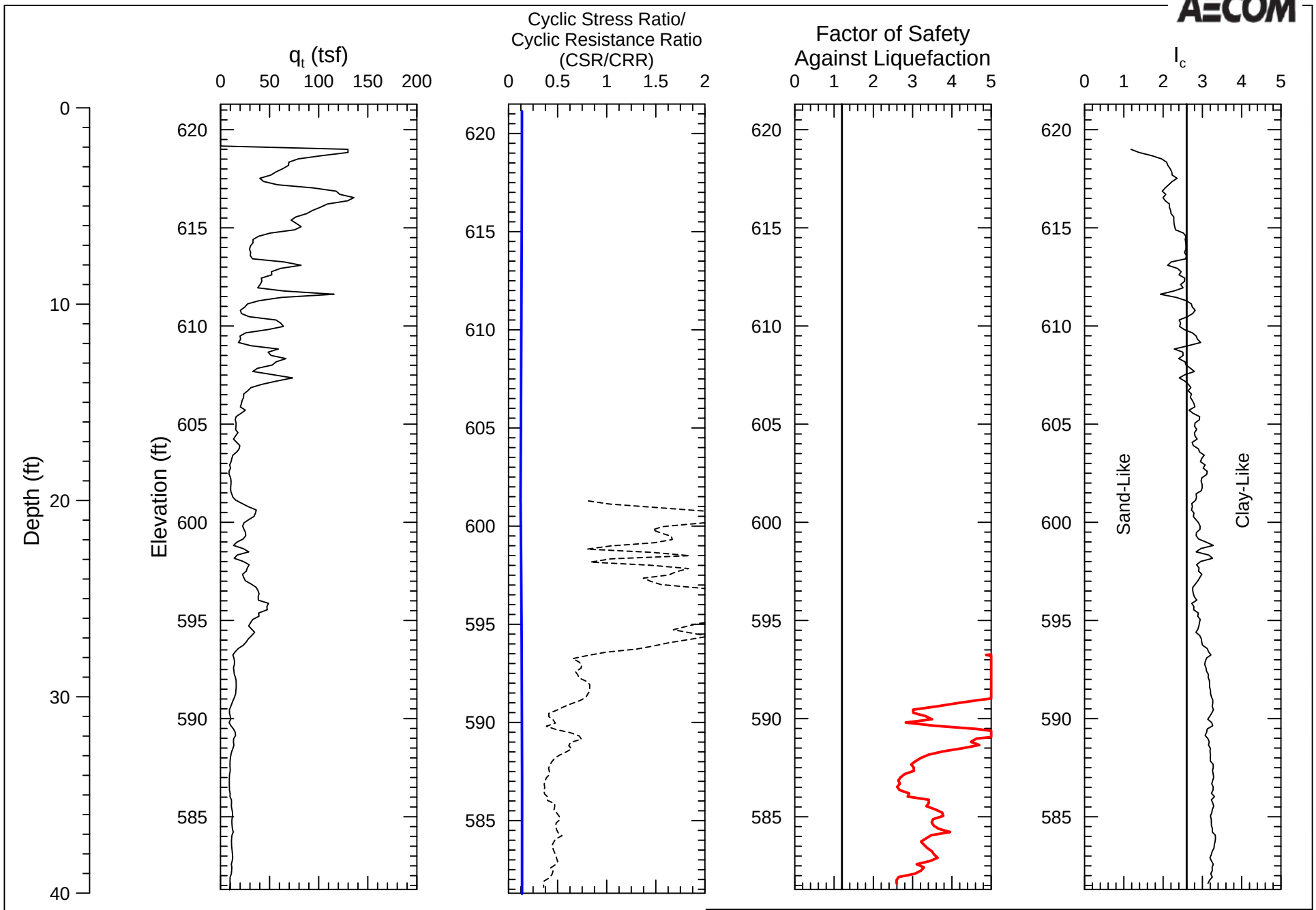


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FIG. XXXX

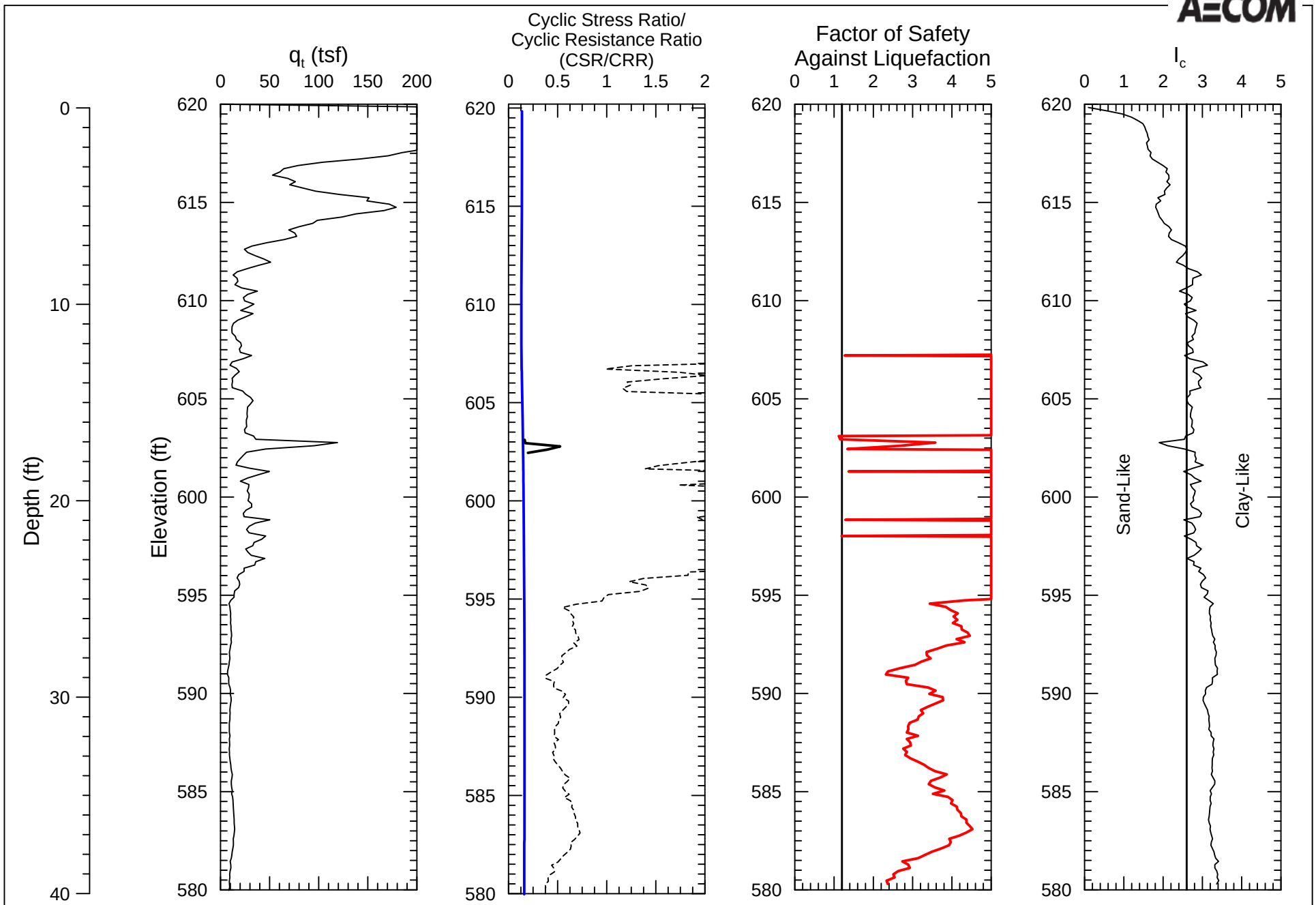
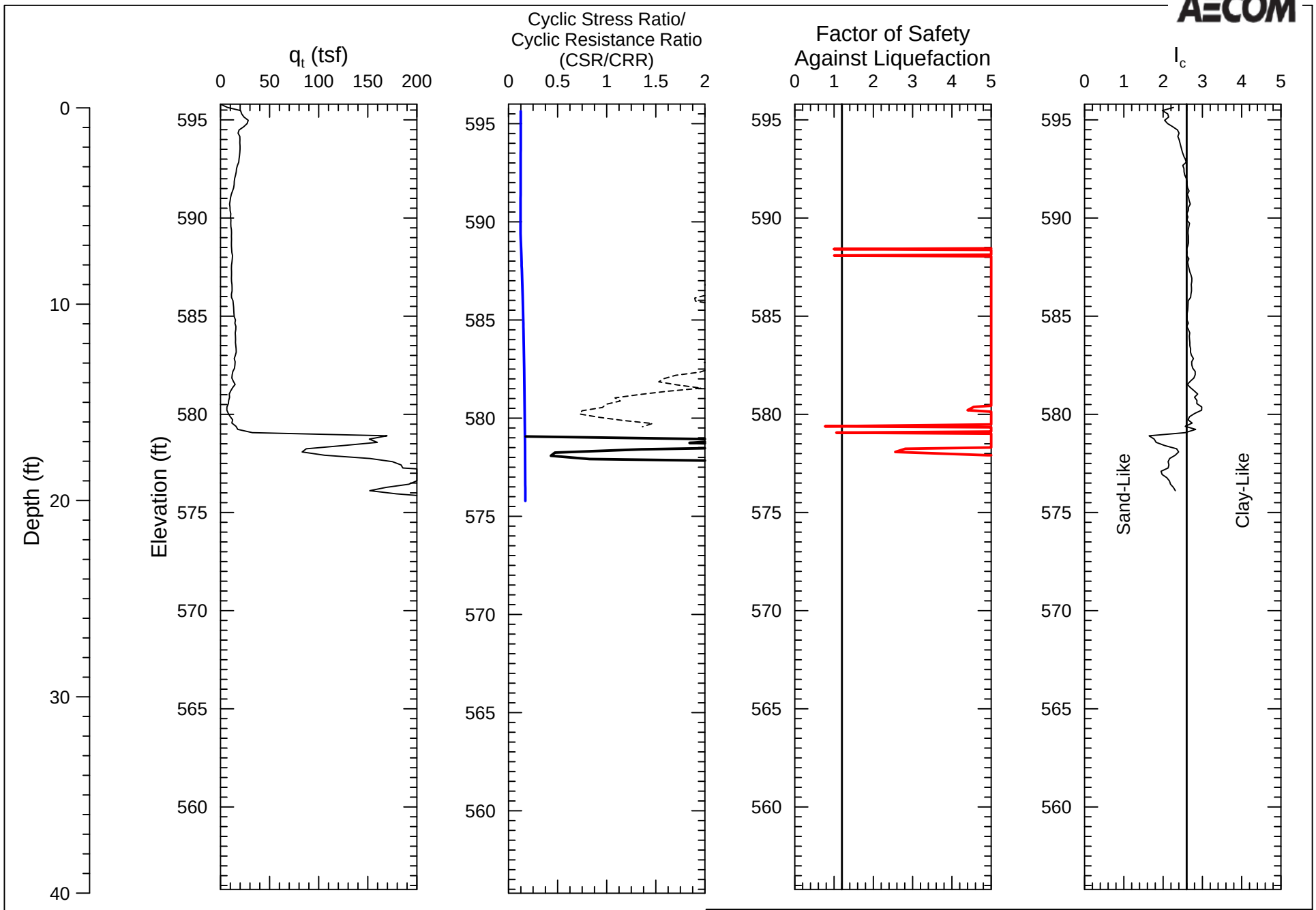

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
620 615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 620 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C007
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-007 Triggering.grf

FIG. XXXX


AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
595 590 585 580 575 570 565 560
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 595.8 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C008
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-008 Triggering.grf

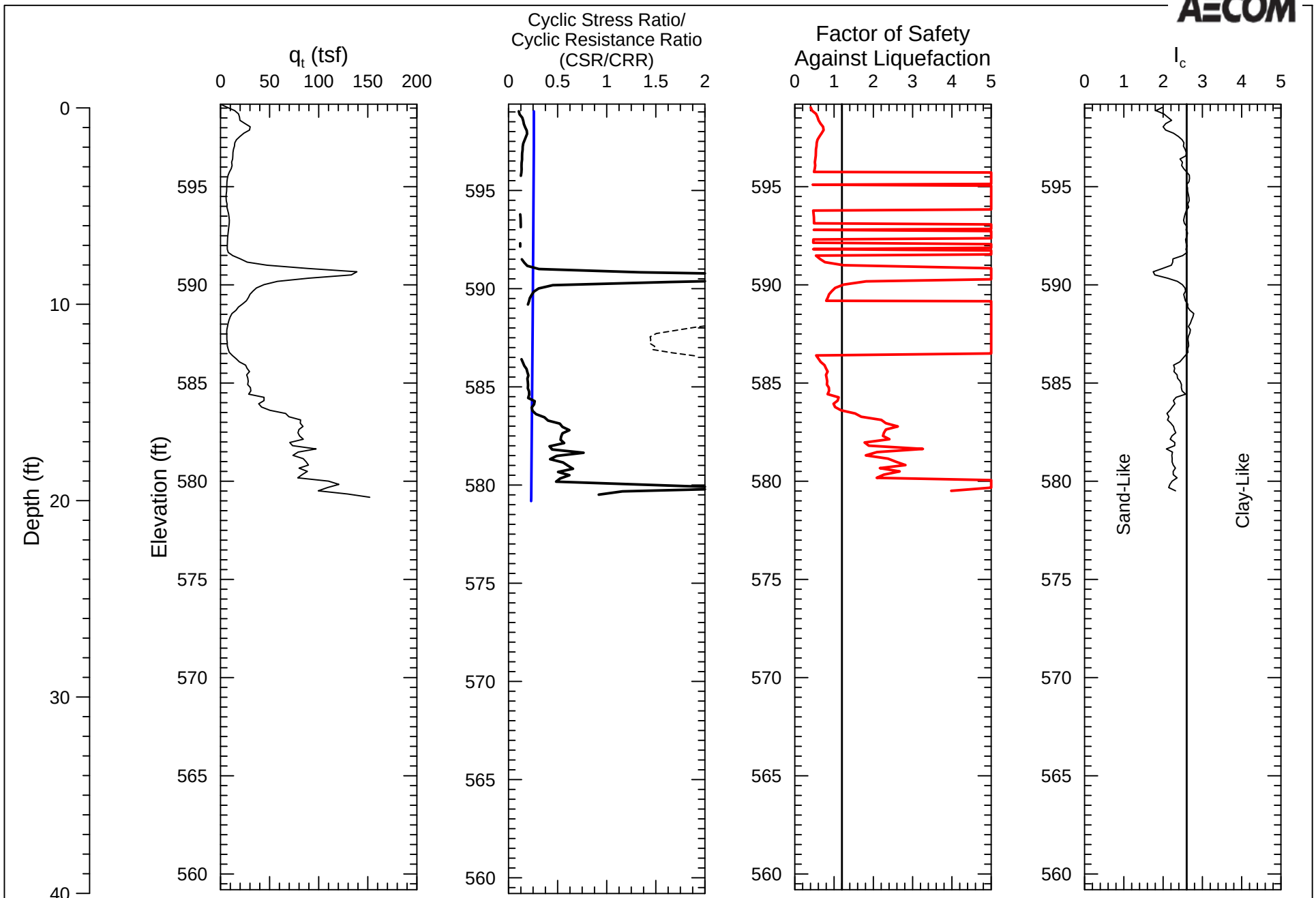

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
595 590 585 580 575 570 565 560
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 599.2 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C009
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-009 Triggering.grf

FIG. XXXX

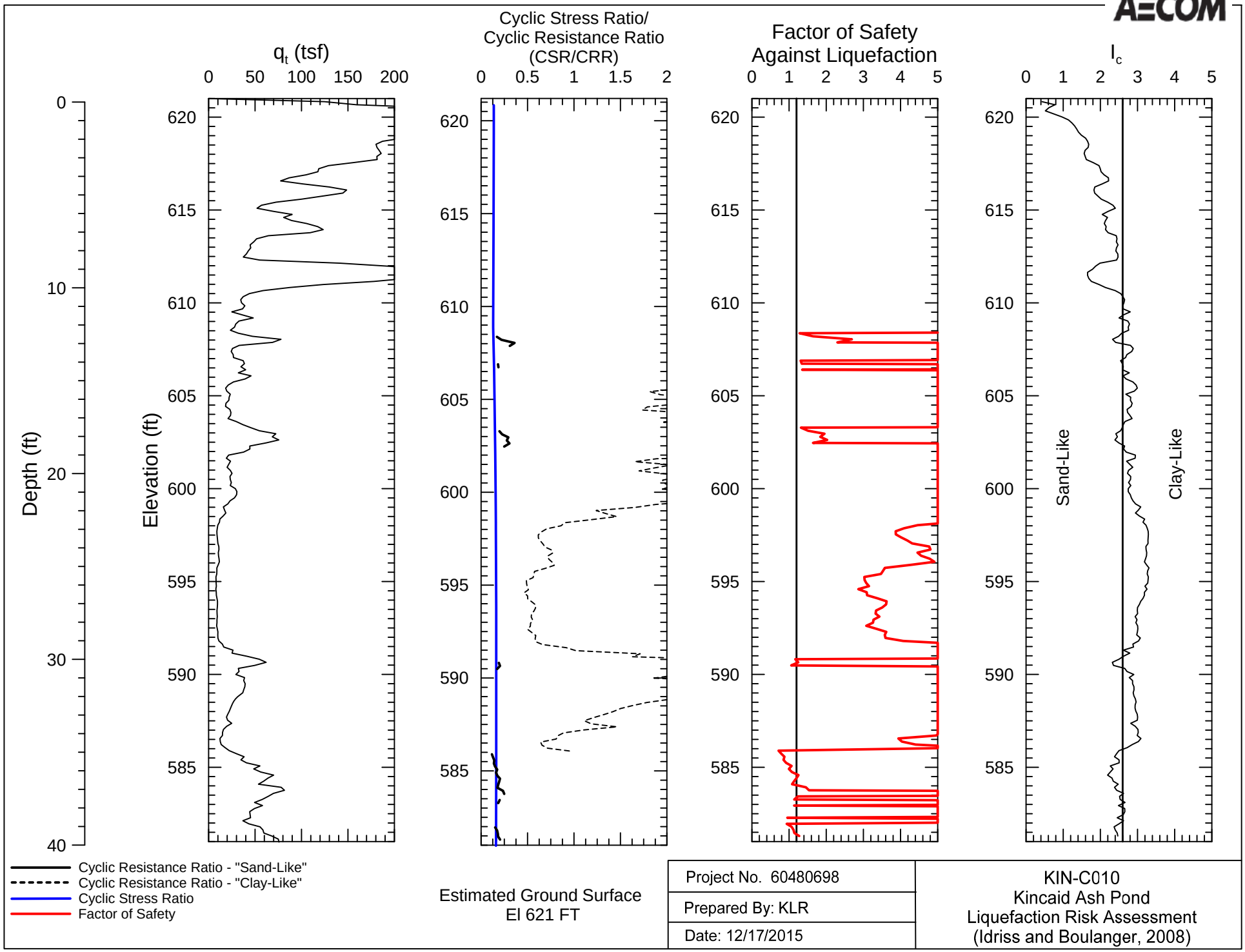

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
620 615 610 605 600 595 590 585
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 621 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C010
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00110.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-010 Triggering.grf

FIG. XXXX

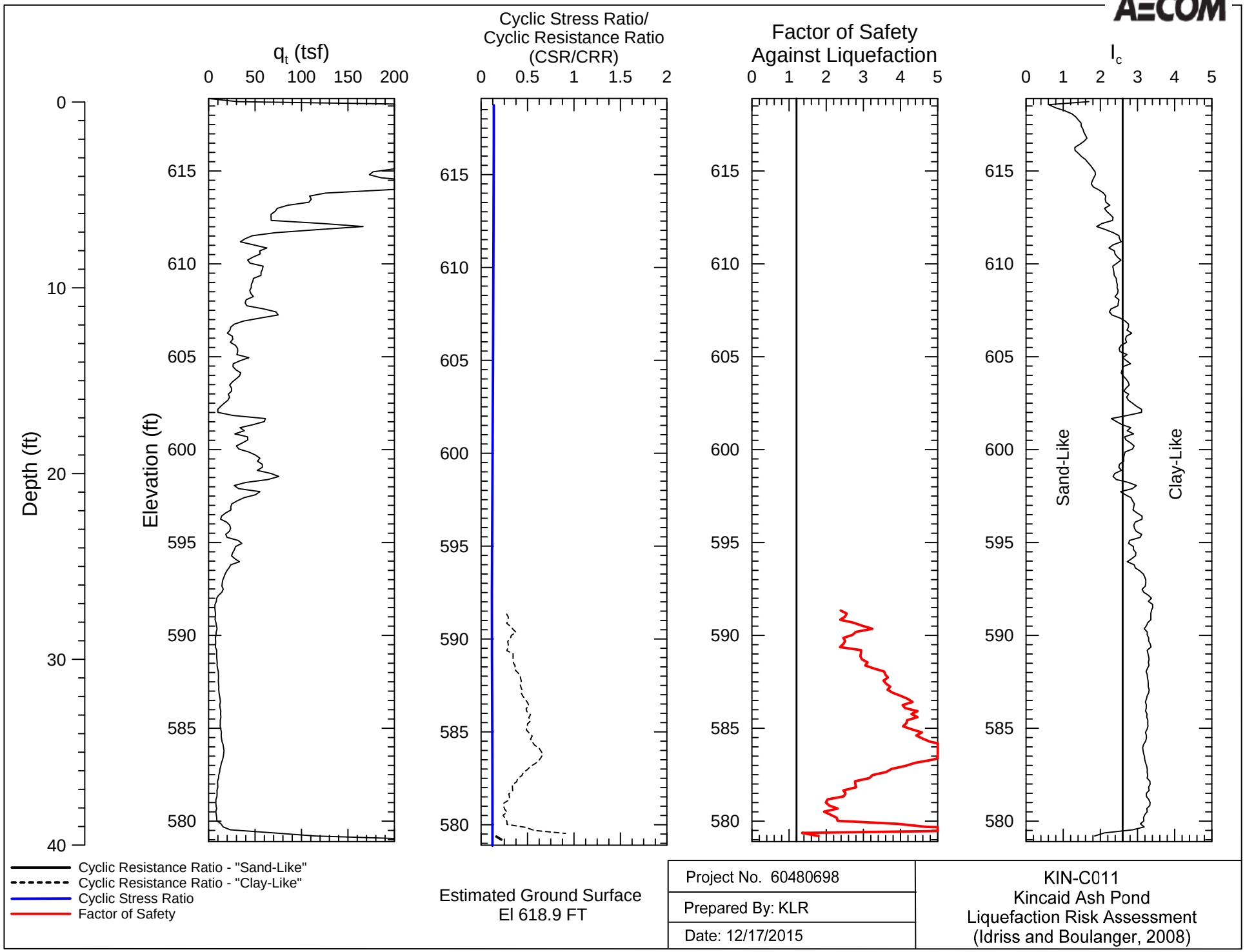

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 618.9 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C011
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-011 Triggering.grf

FIG. XXXX

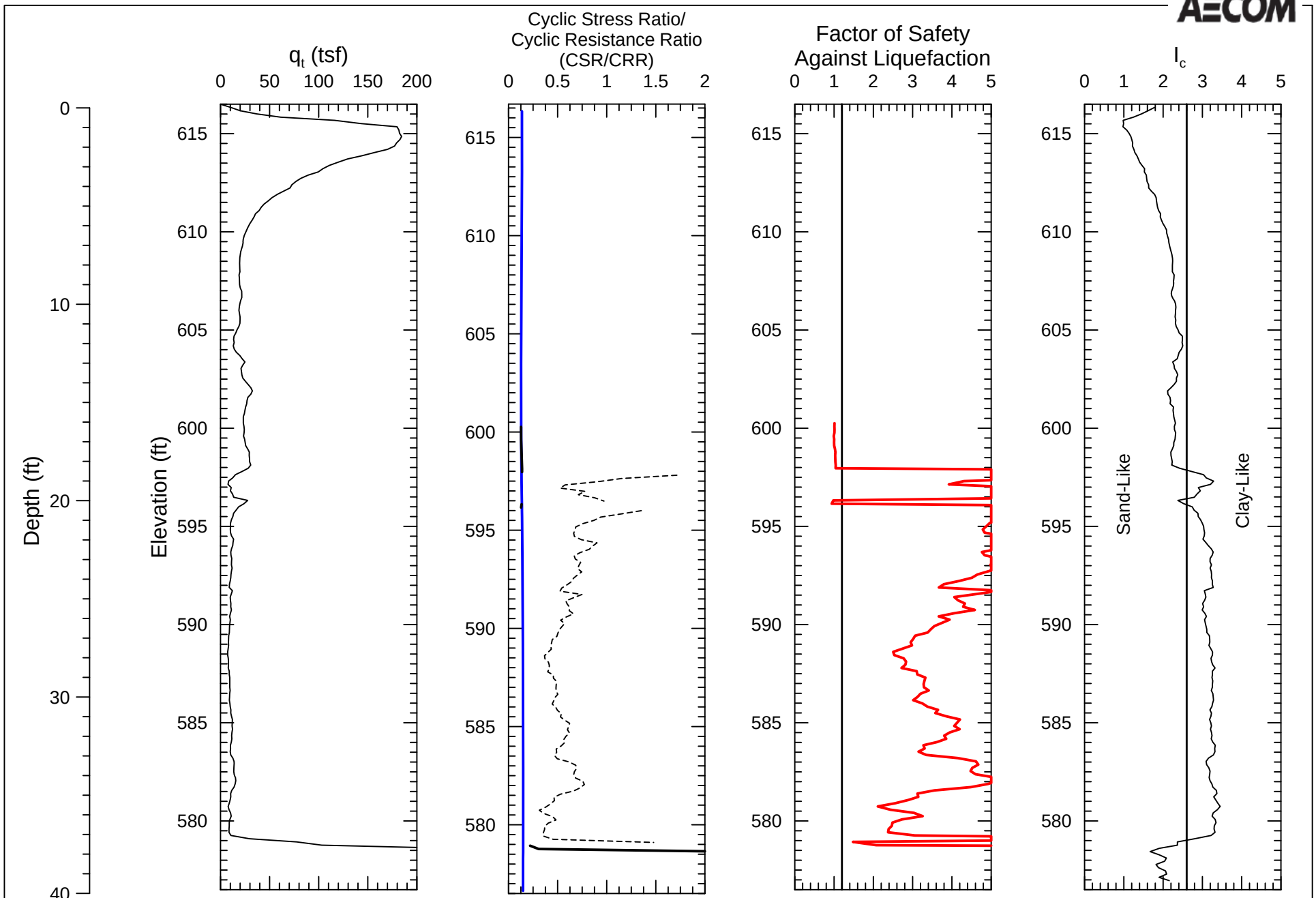

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 616.5 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C012
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-012 Triggering.grf

FIG. XXXX

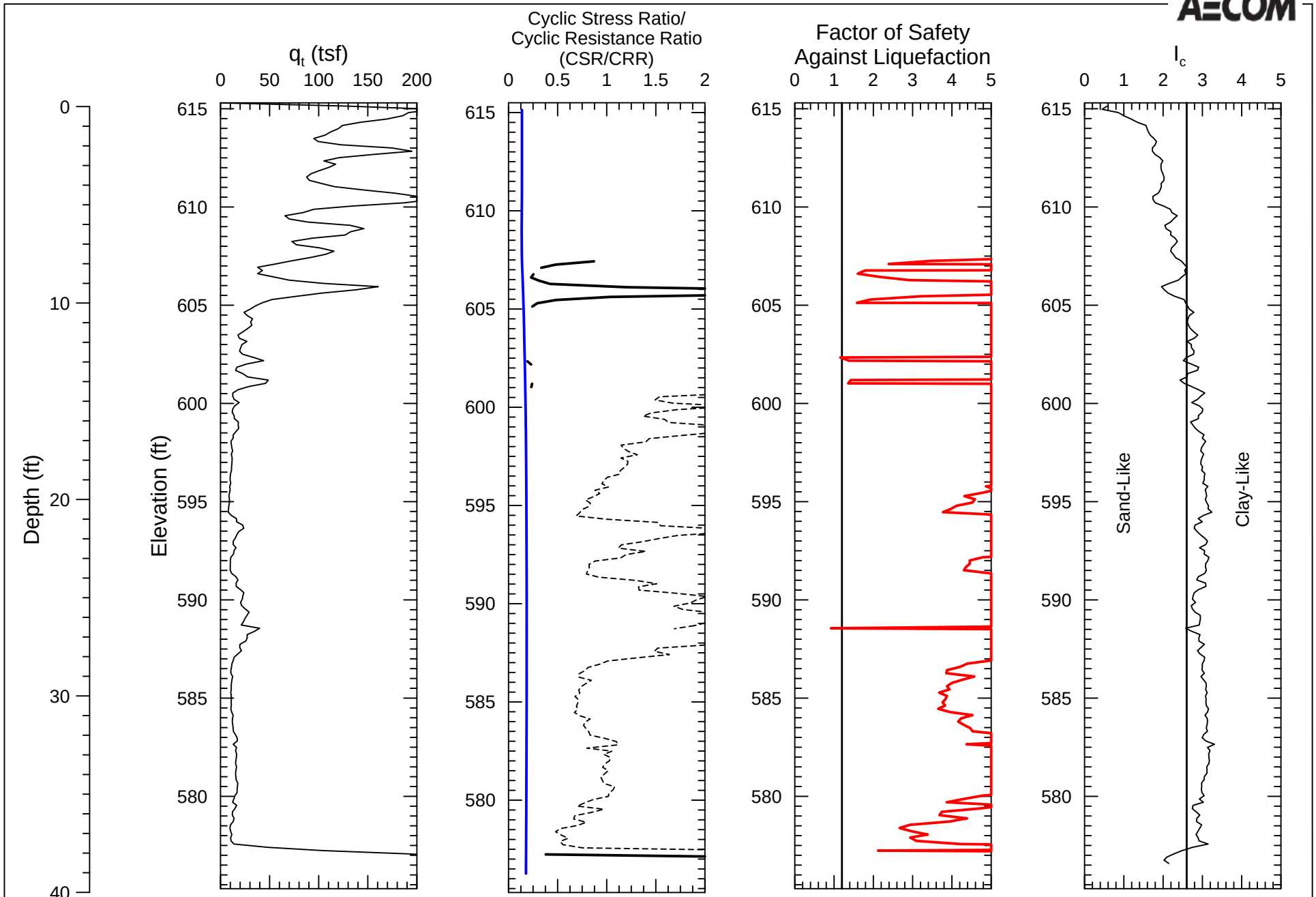

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 615.3 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C013
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-013 Triggering.grf

FIG. XXXX

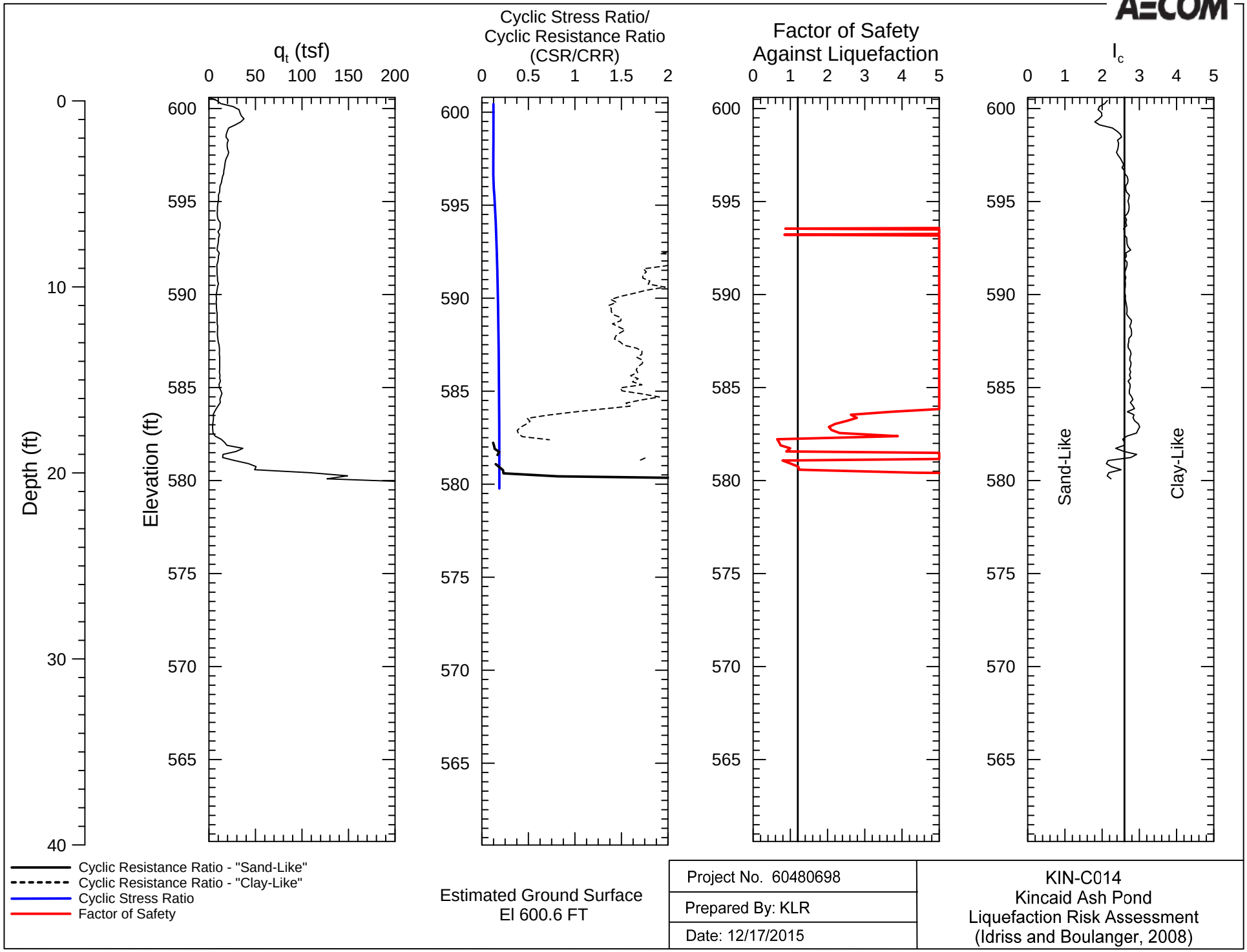

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 600.6 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C014
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00110.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-014 Triggering.grf

FIG. XXXX

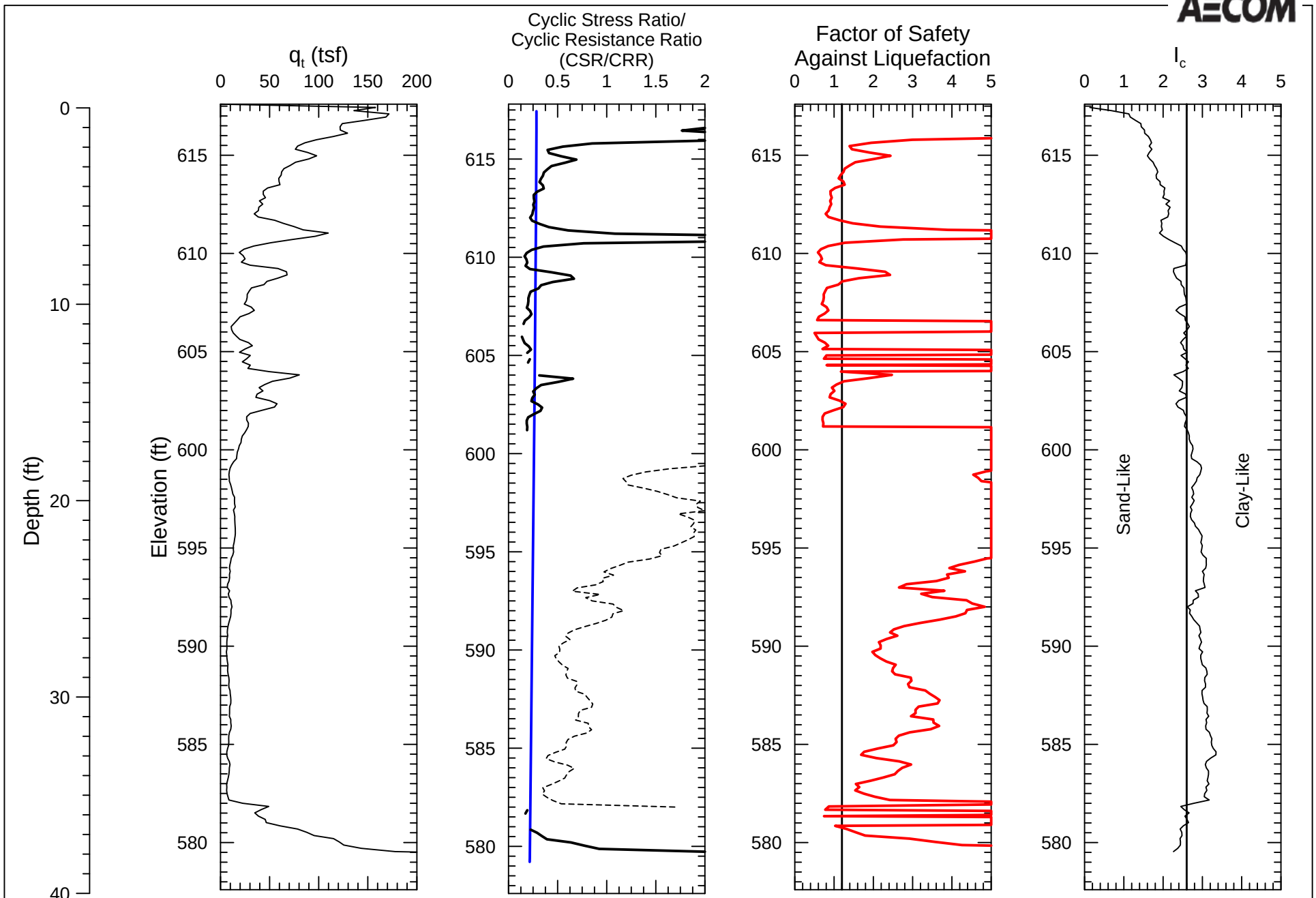

AECOM
Depth (ft)
Elevation (ft)
q_t (tsf)
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
Factor of Safety
Against Liquefaction
I_c
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 617.6 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C015
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-015 Triggering.grf

FIG. XXXX

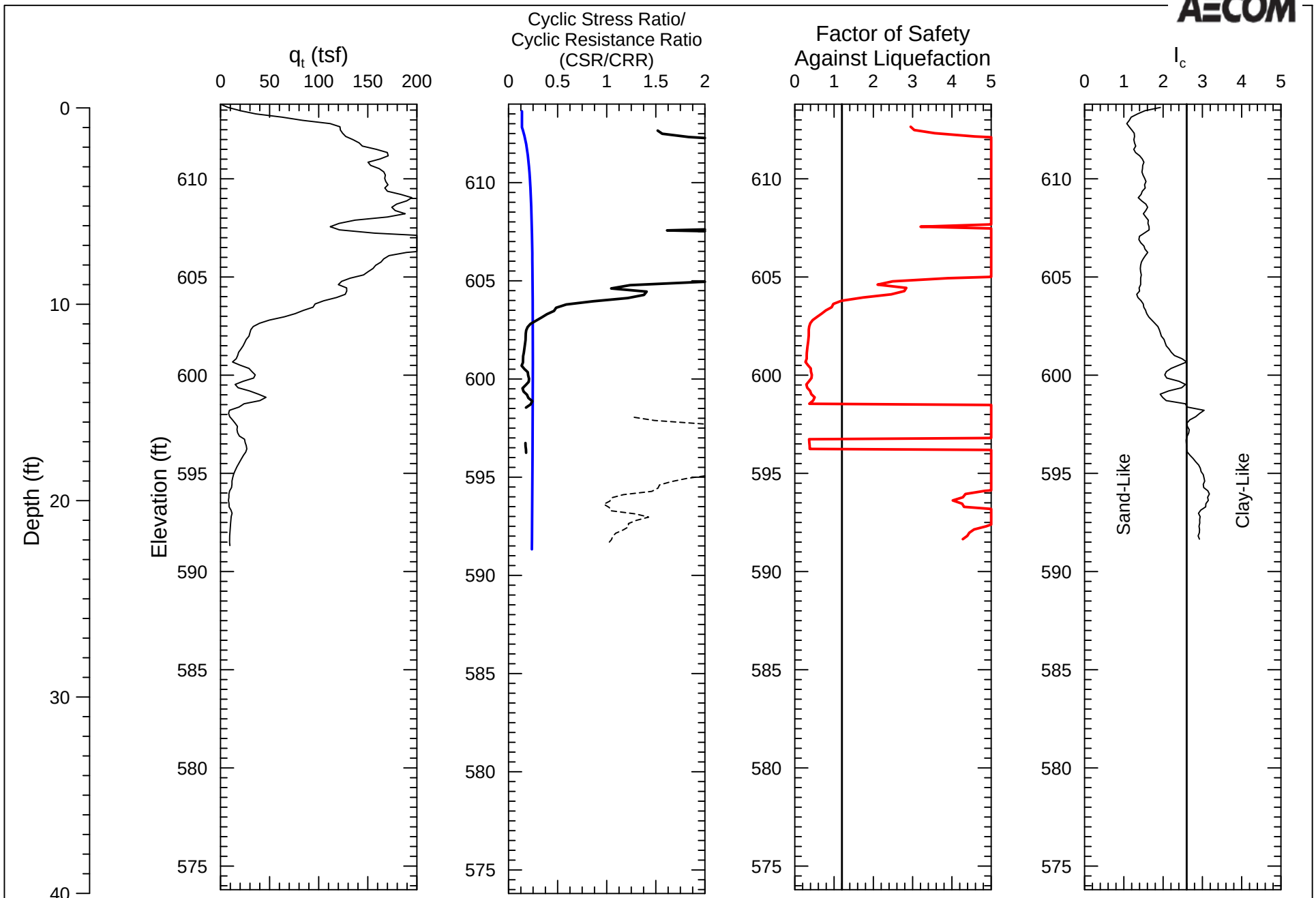

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
610 605 600 595 590 585 580 575
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 613.8 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C016
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-016 Triggering.grf

FIG. XXXX

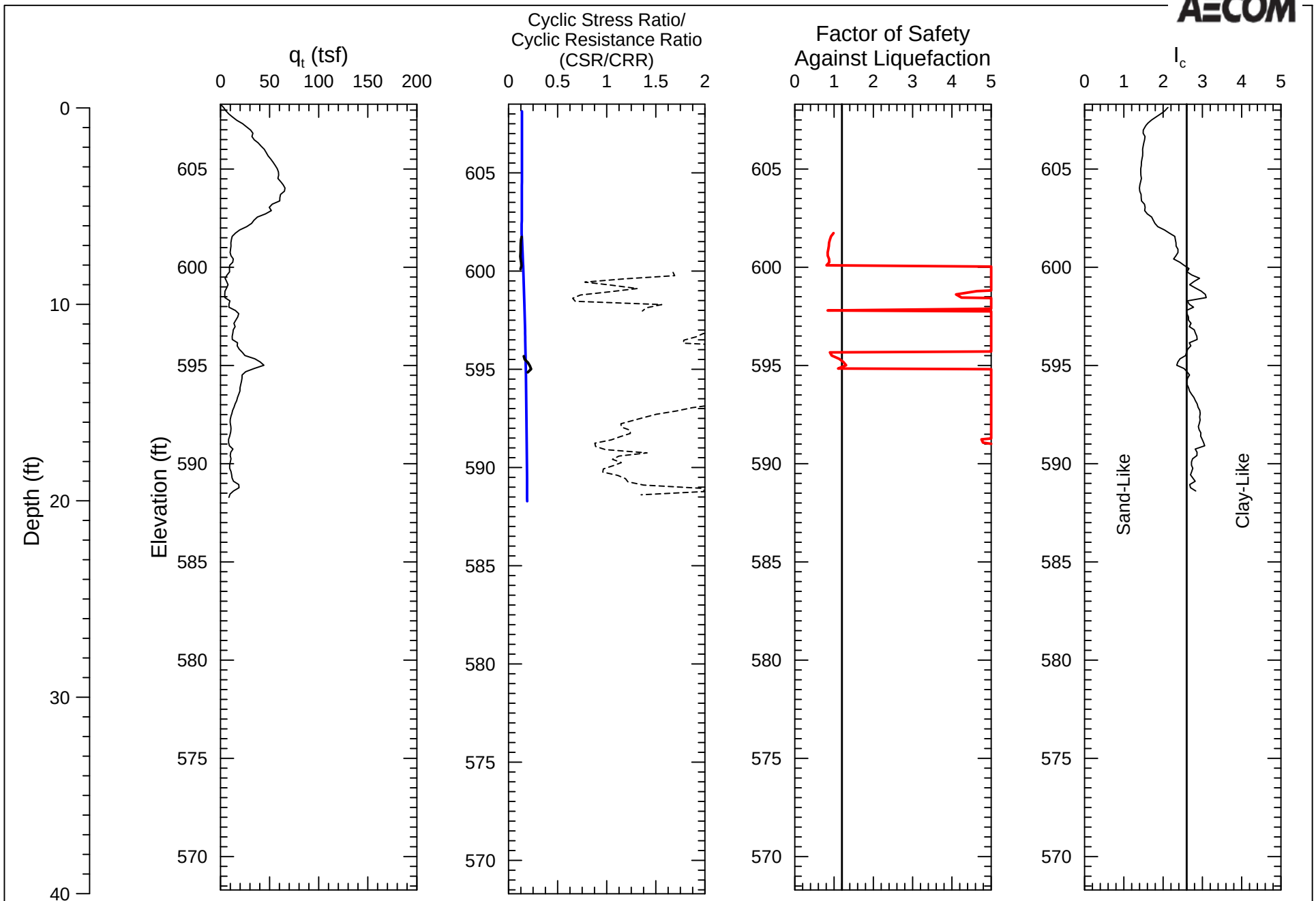

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
605 600 595 590 585 580 575 570
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 608.3 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C017
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-017 Triggering.grf

FIG. XXXX

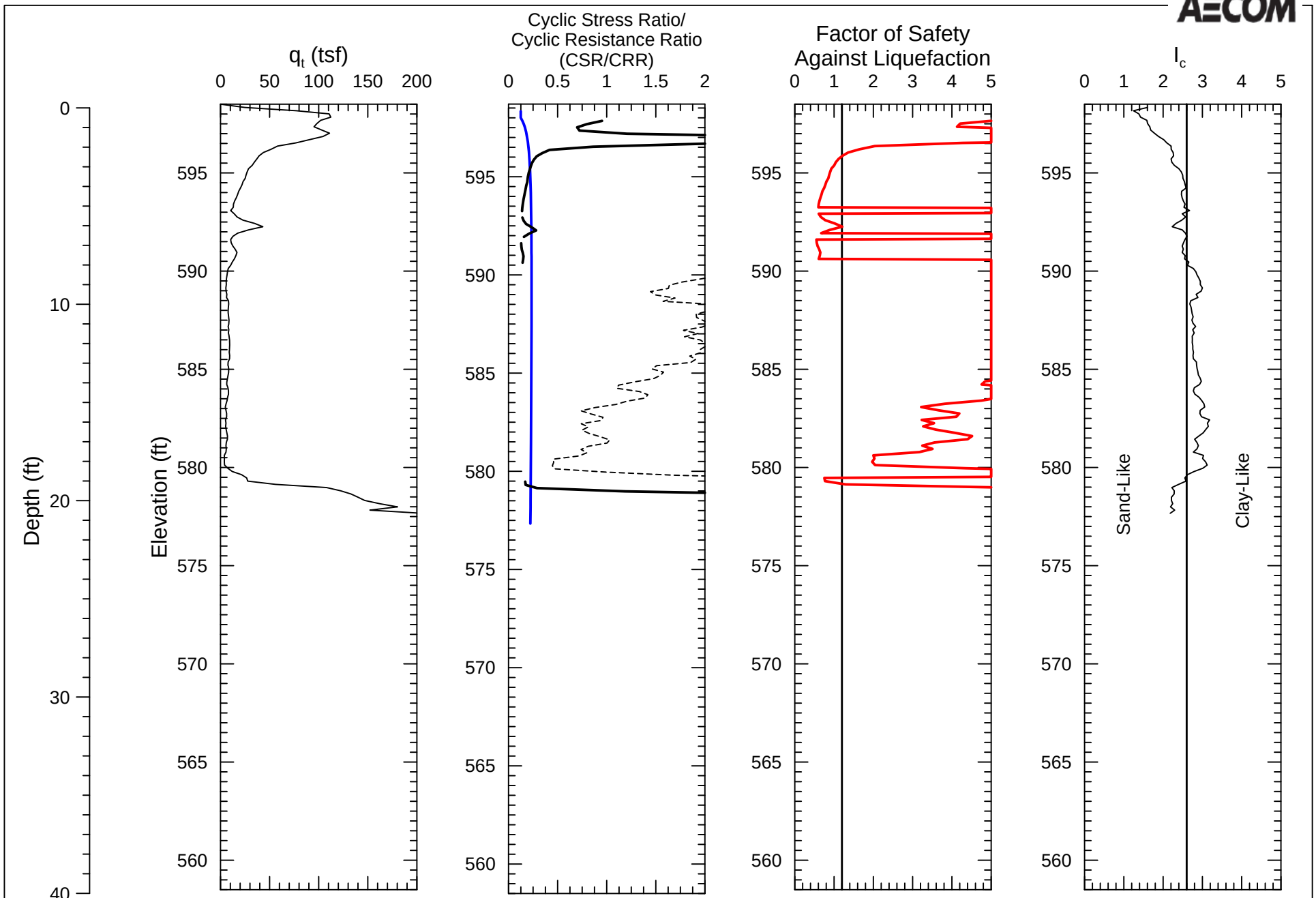

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
595 590 585 580 575 570 565 560
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 598.5 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C018
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-018 Triggering.grf

FIG. XXXX

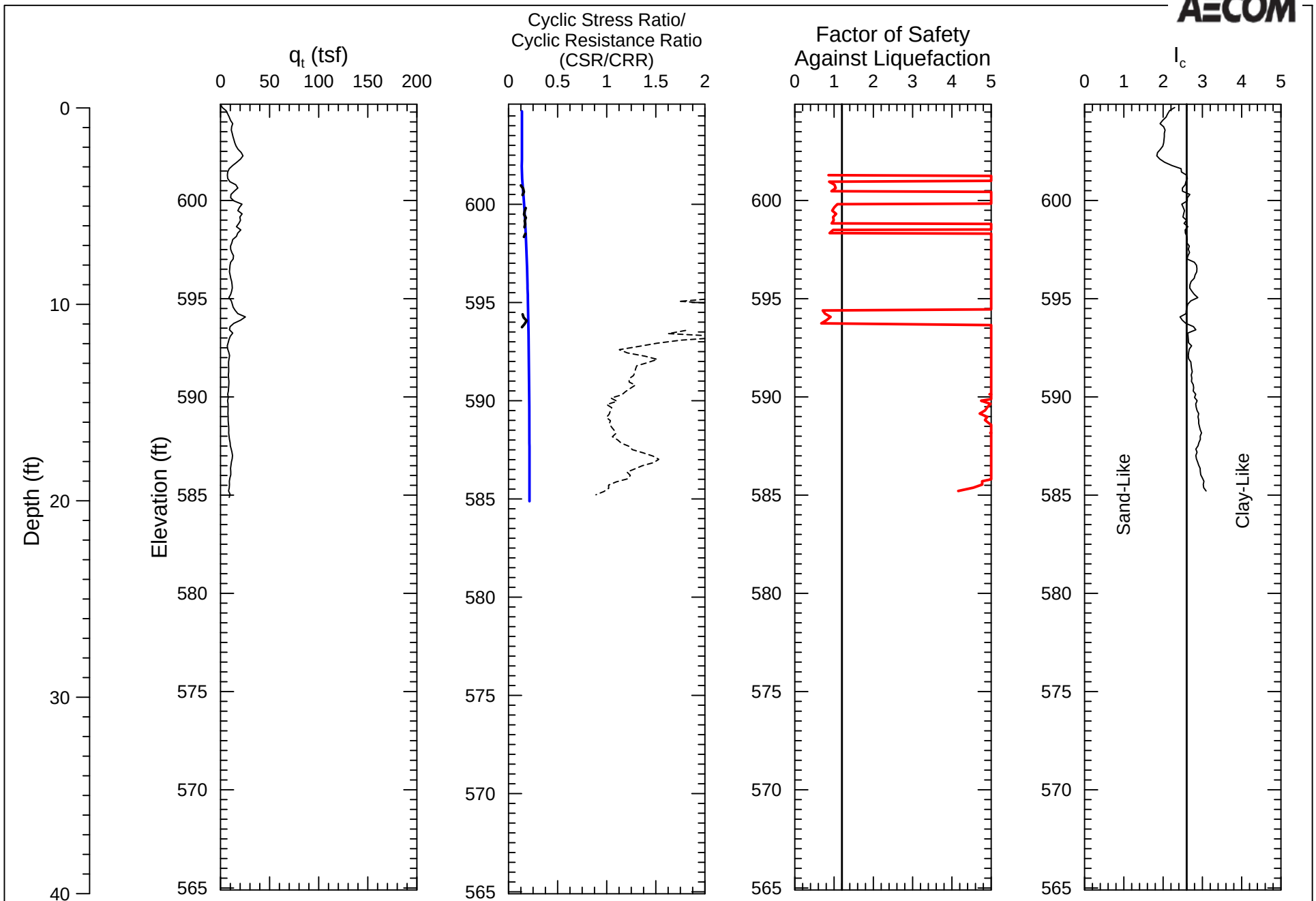

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 604.9 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C019
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-019 Triggering.grf

FIG. XXXX

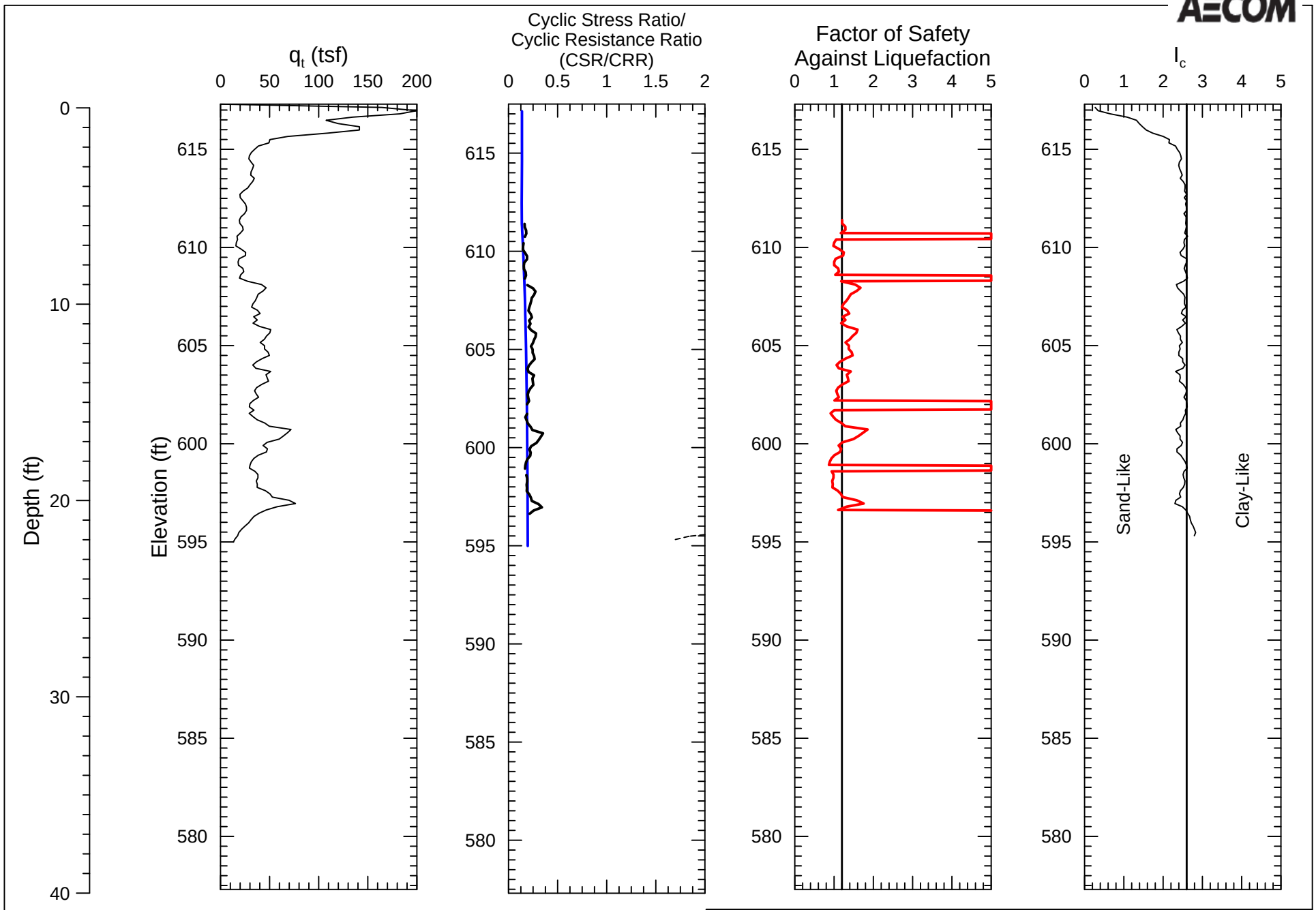
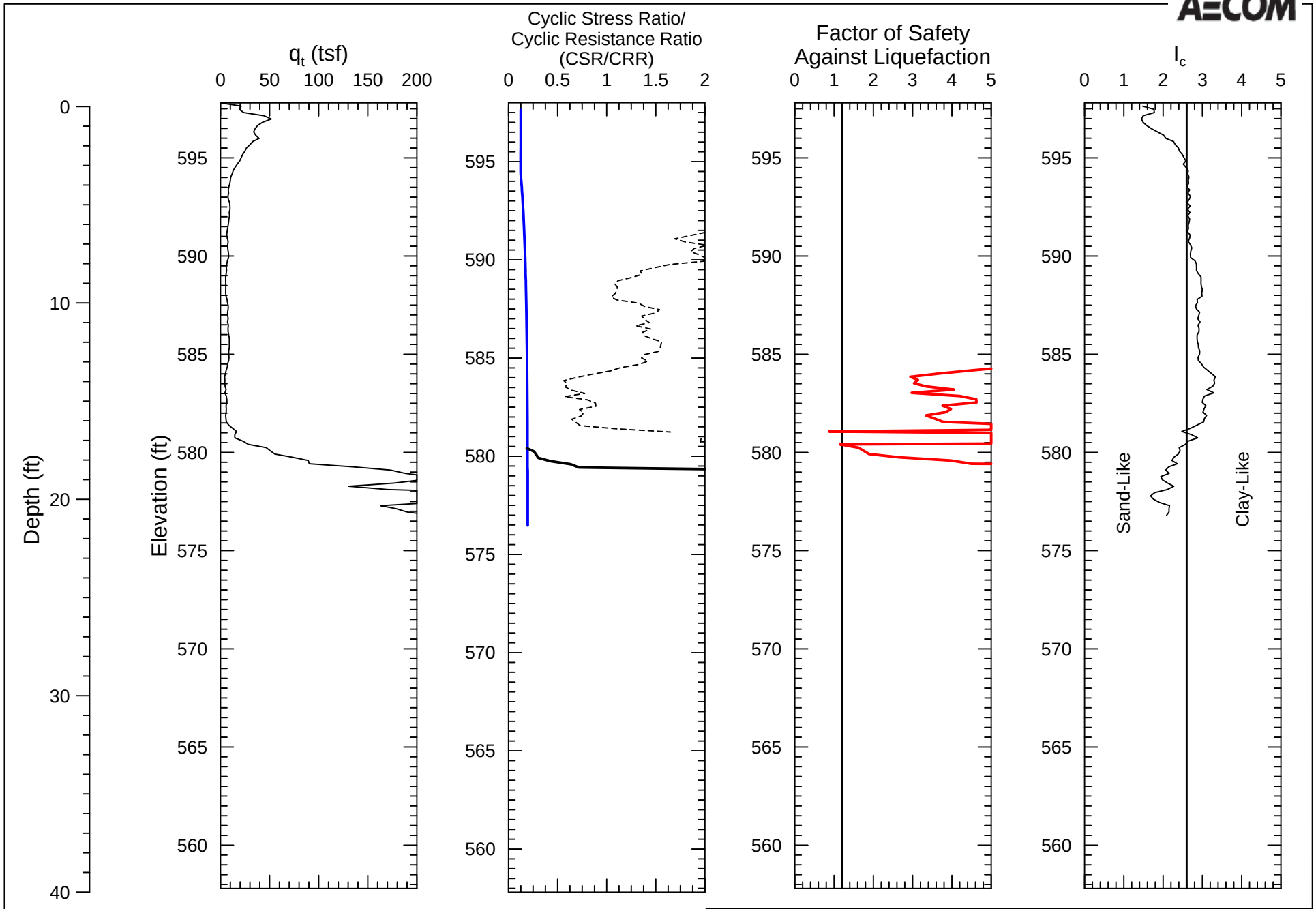

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 617.3 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C020
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-020 Triggering.grf

FIG. XXXX



\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-021 Triggering.grf

FIG. XXXX

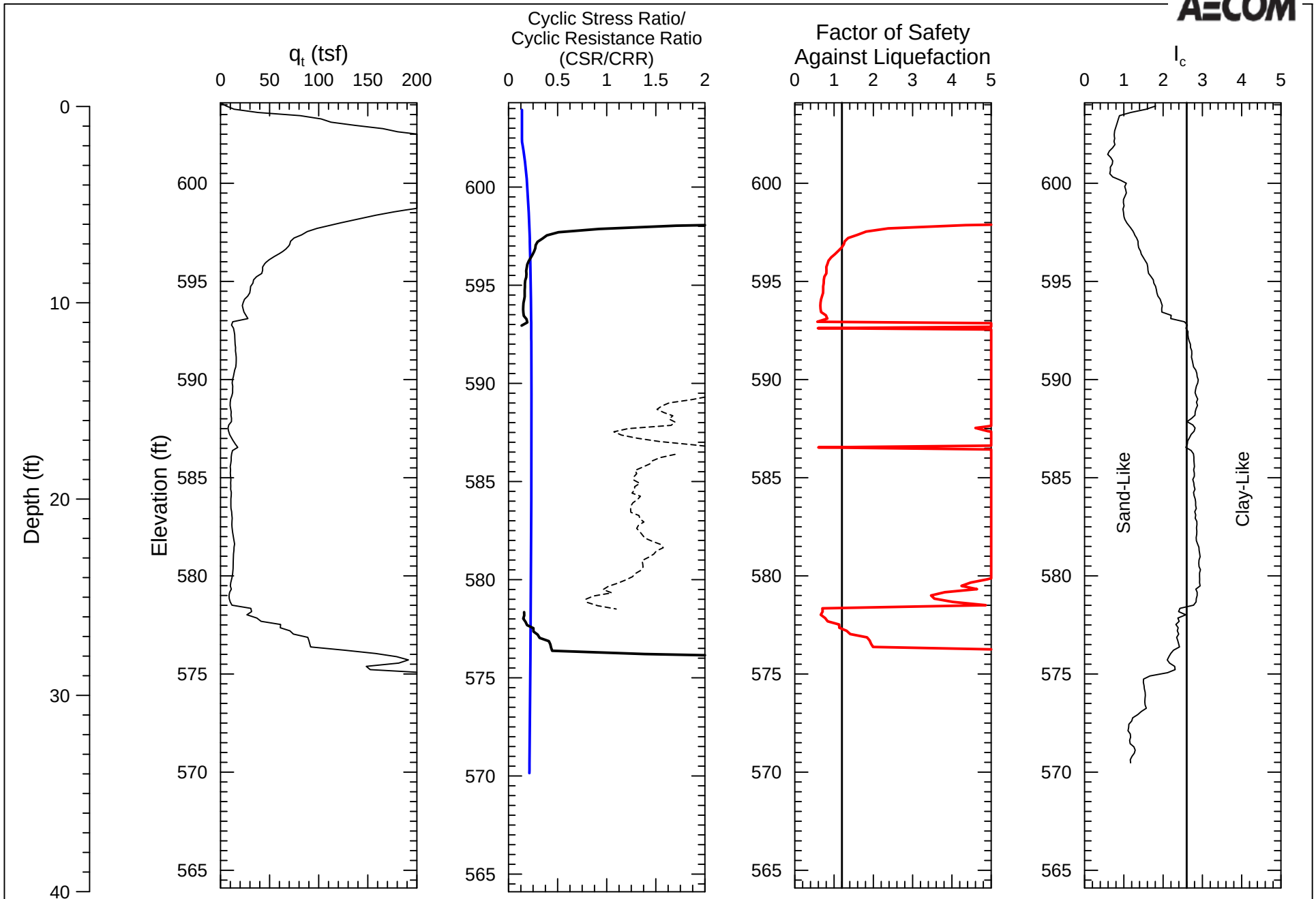

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 604.1 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C022
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-022 Triggering.grf

FIG. XXXX

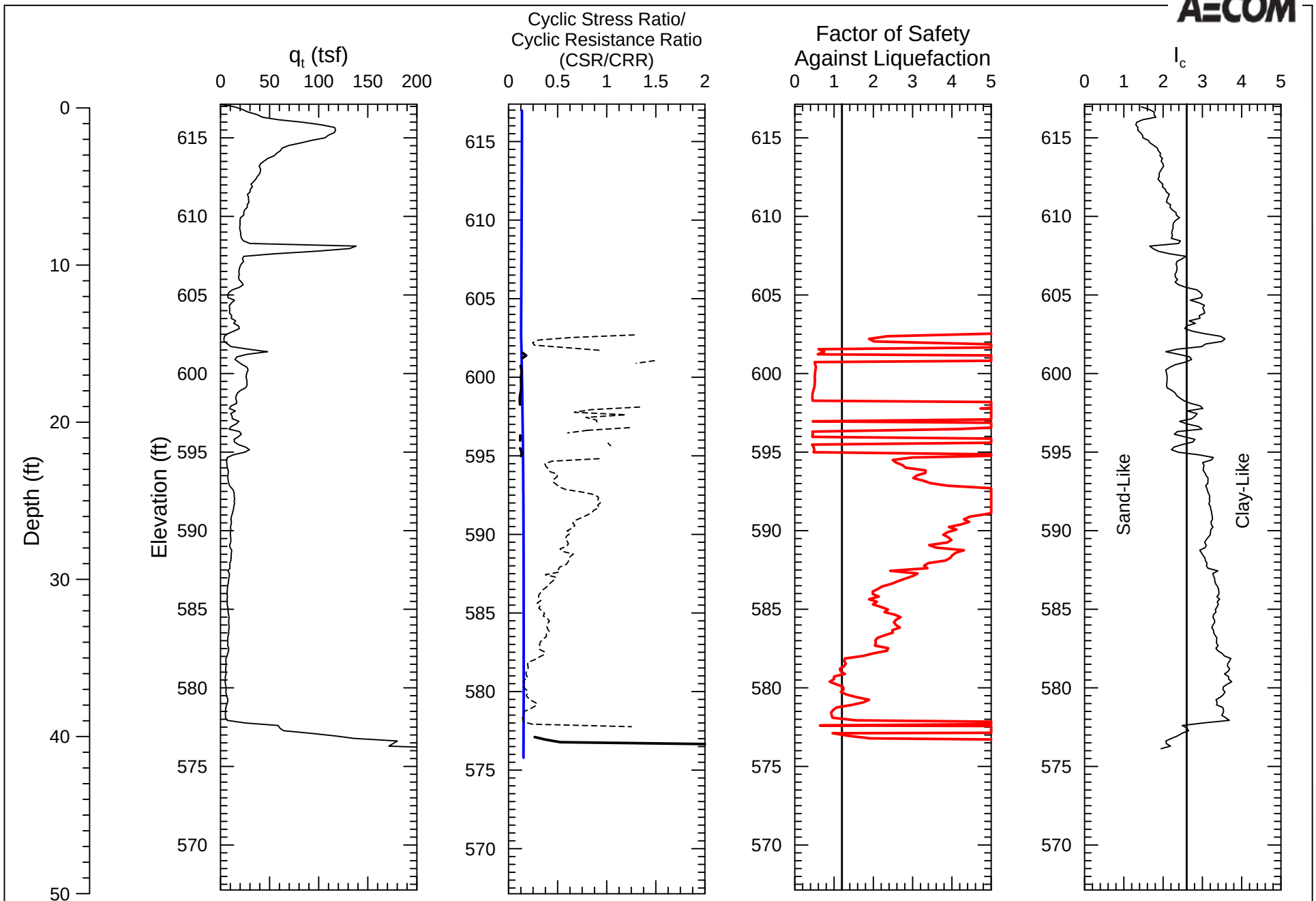
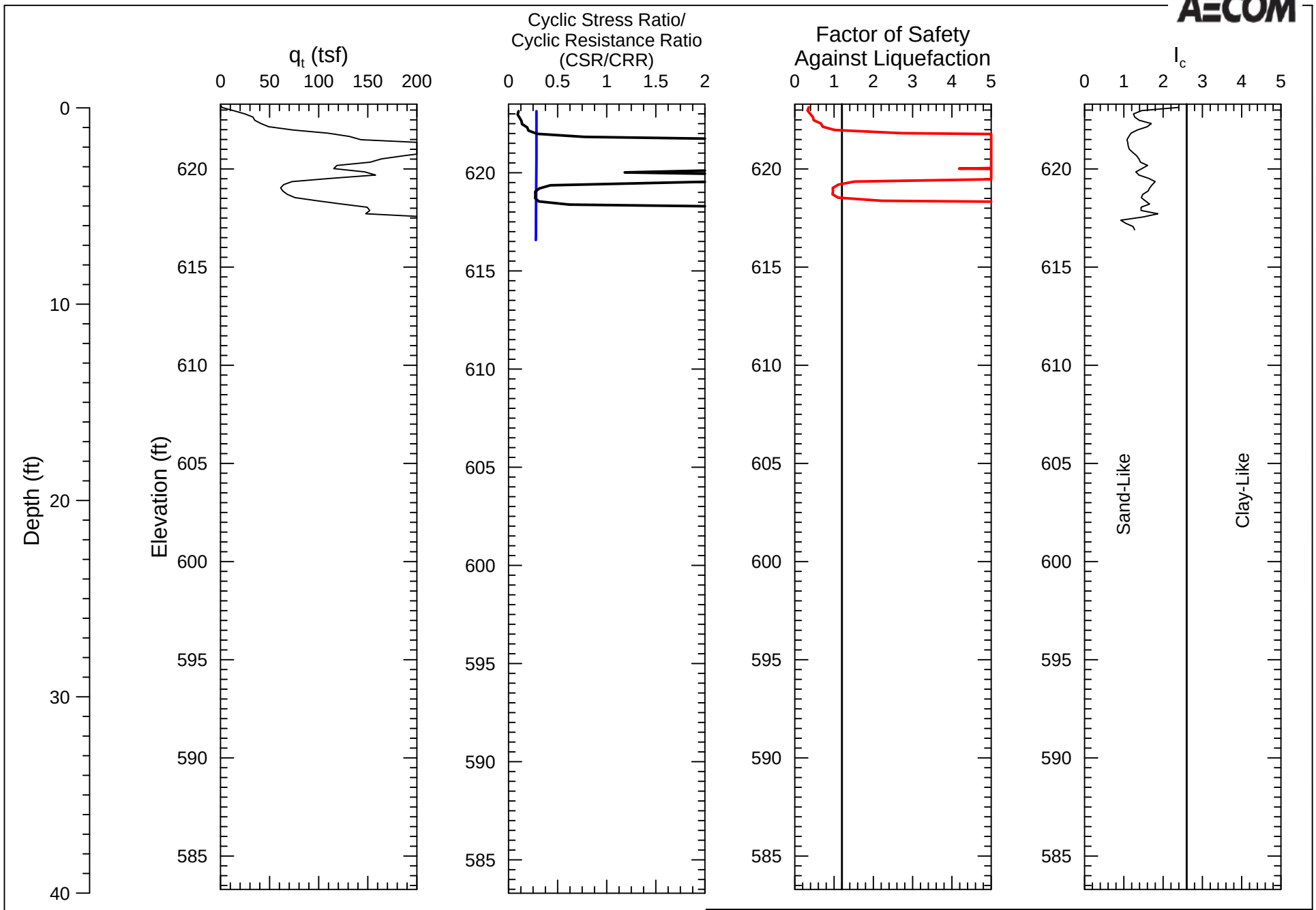

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40 50
Elevation (ft)
615 610 605 600 595 590 585 580 575 570
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 617.13 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C023
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-023 Triggering.grf

FIG. XXXX


AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
620 615 610 605 600 595 590 585
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 623.3 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C024
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-024 Triggering.grf

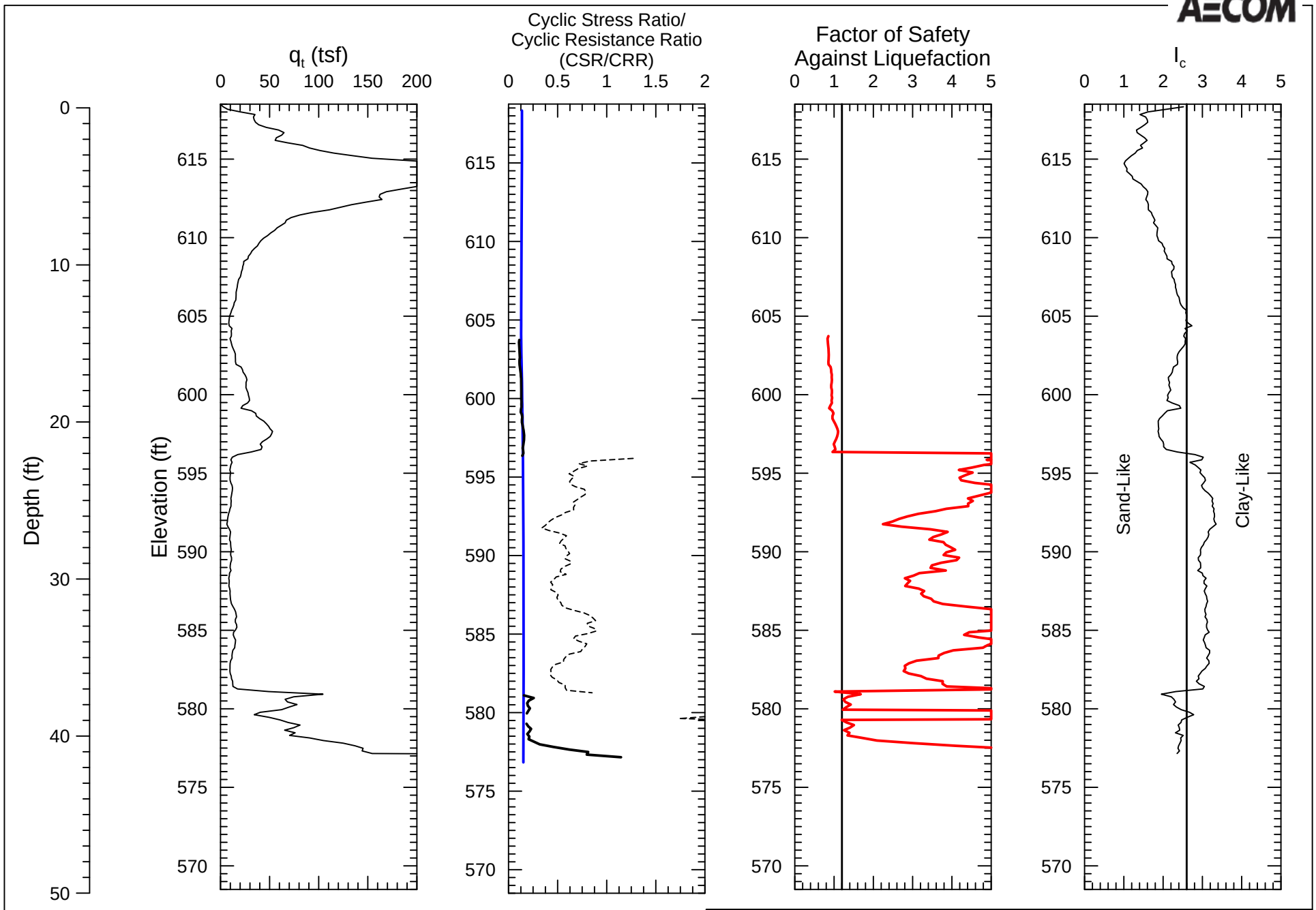

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40 50
Elevation (ft)
615 610 605 600 595 590 585 580 575 570
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 618.5 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C025
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-025 Triggering.grf

FIG. XXXX

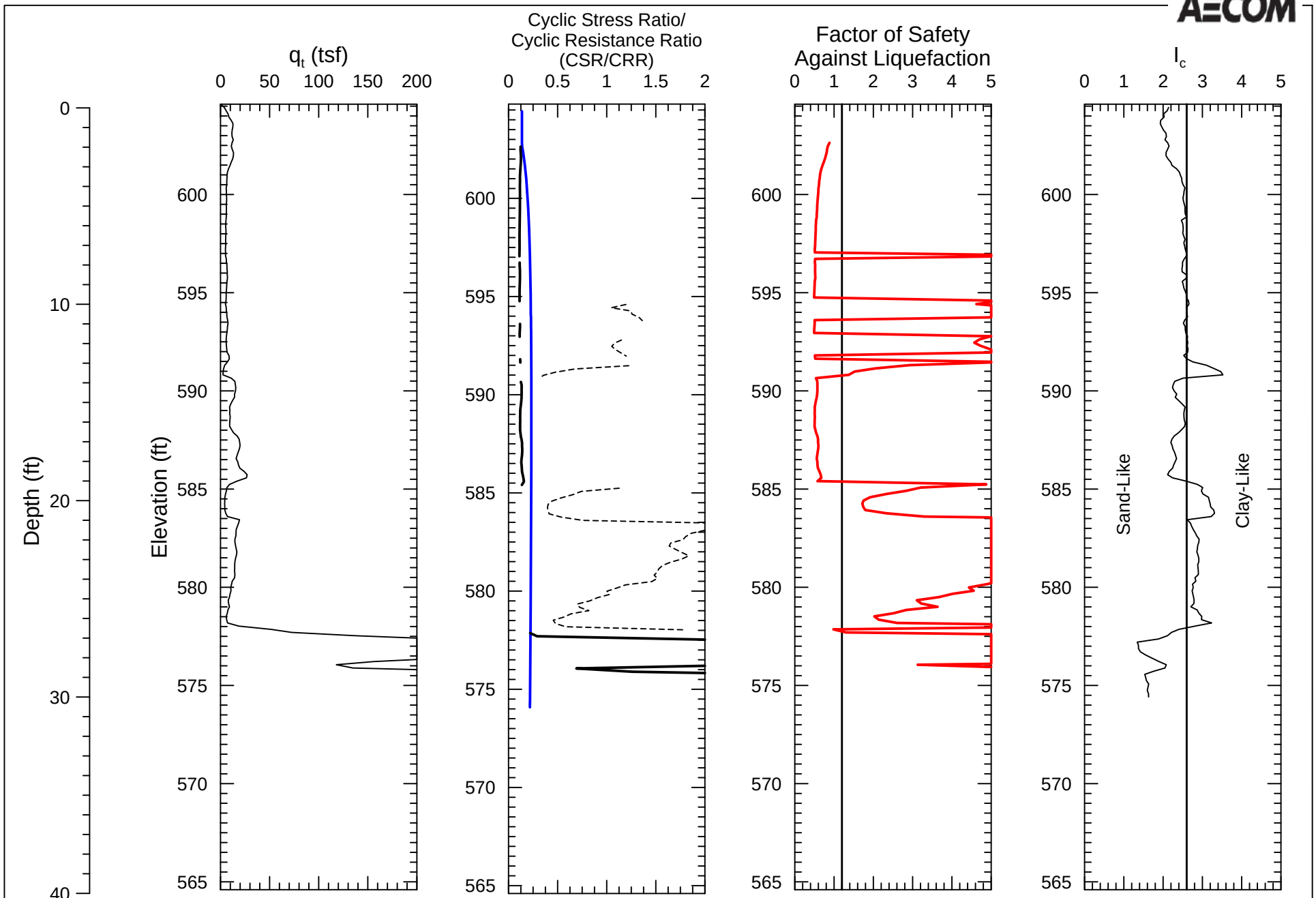
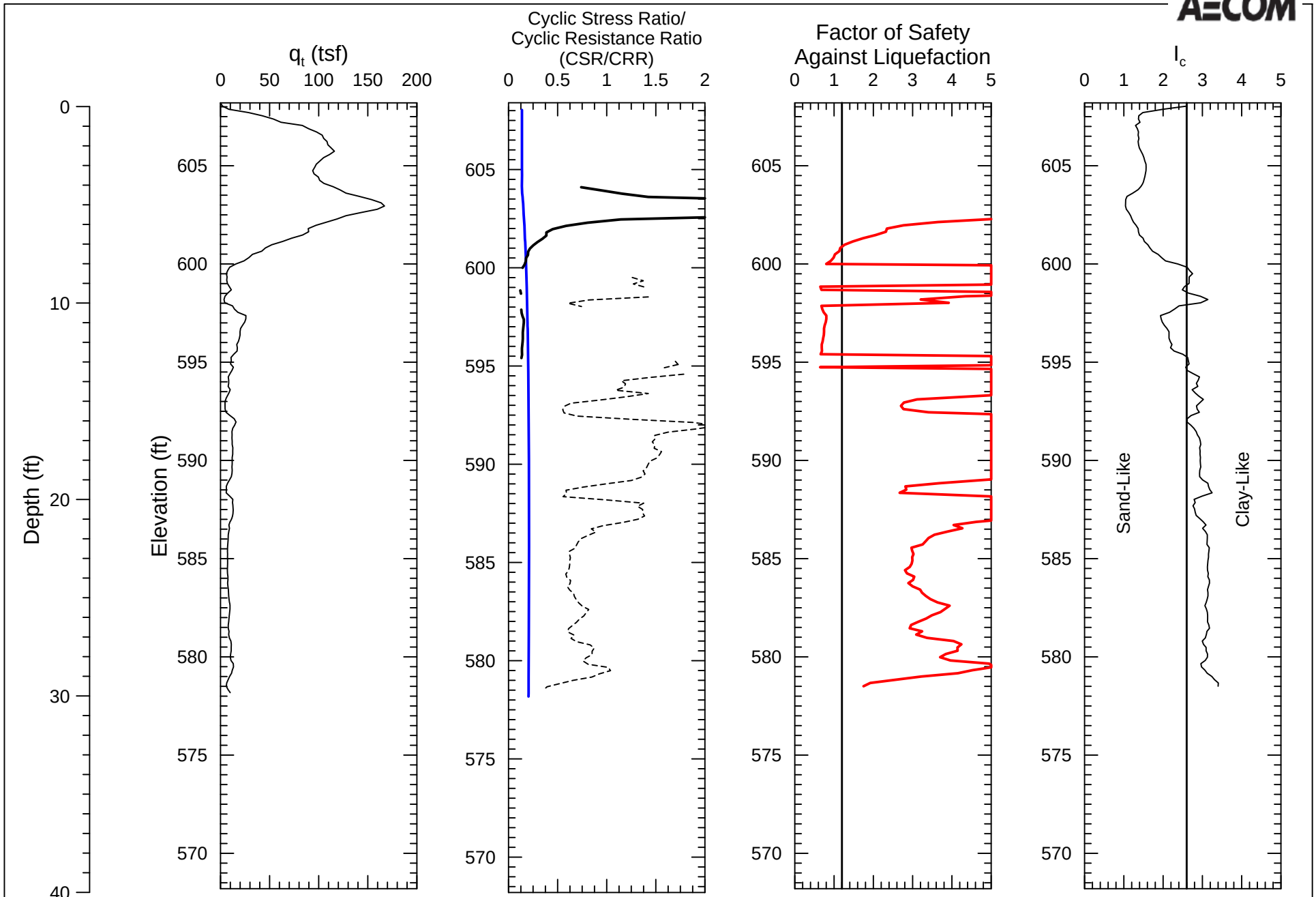

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 604.6 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C026
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geocivil$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-026 Triggering.grf

FIG. XXXX


AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
605 600 595 590 585 580 575 570
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 608.2 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C027
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-027 Triggering.grf

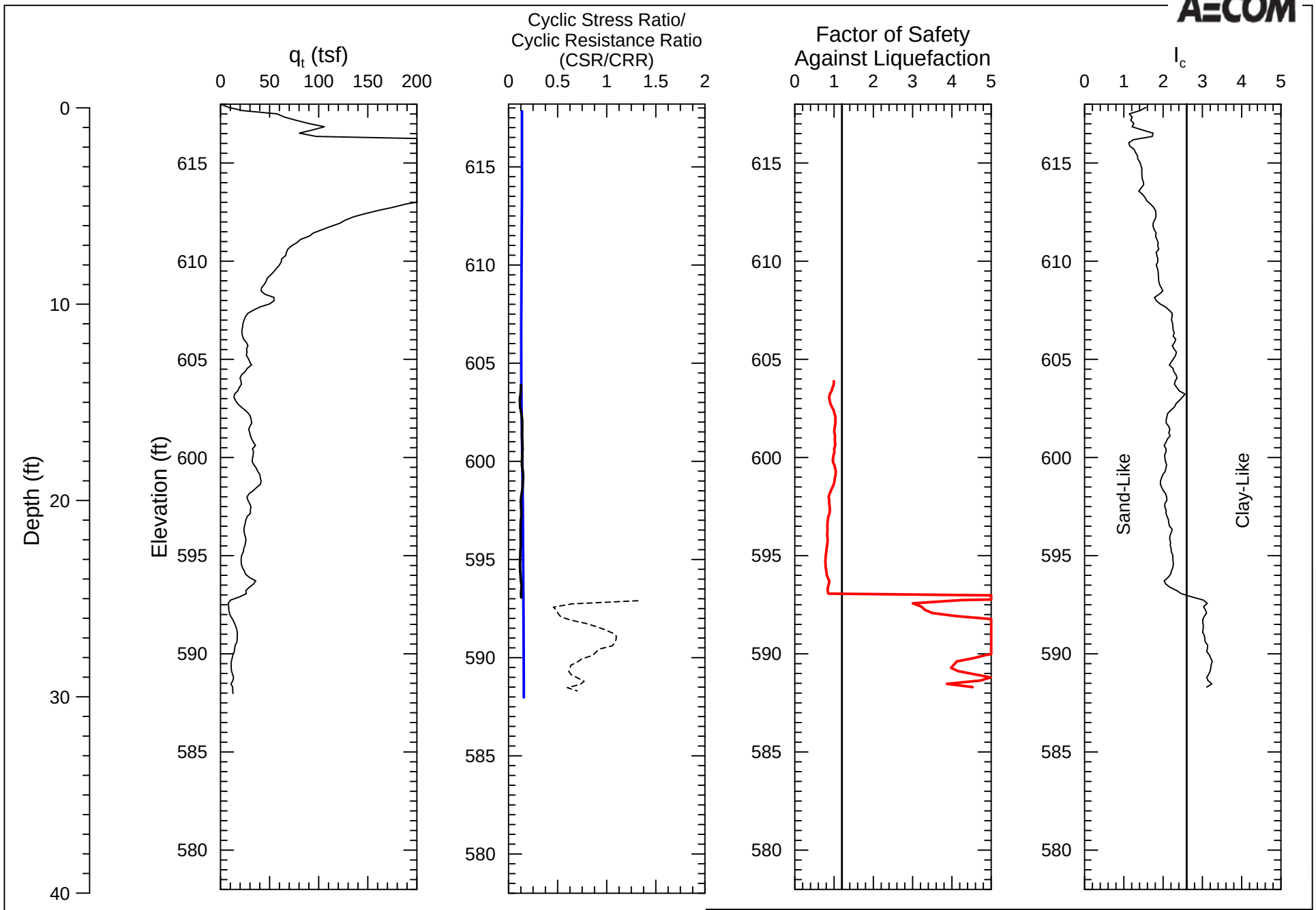
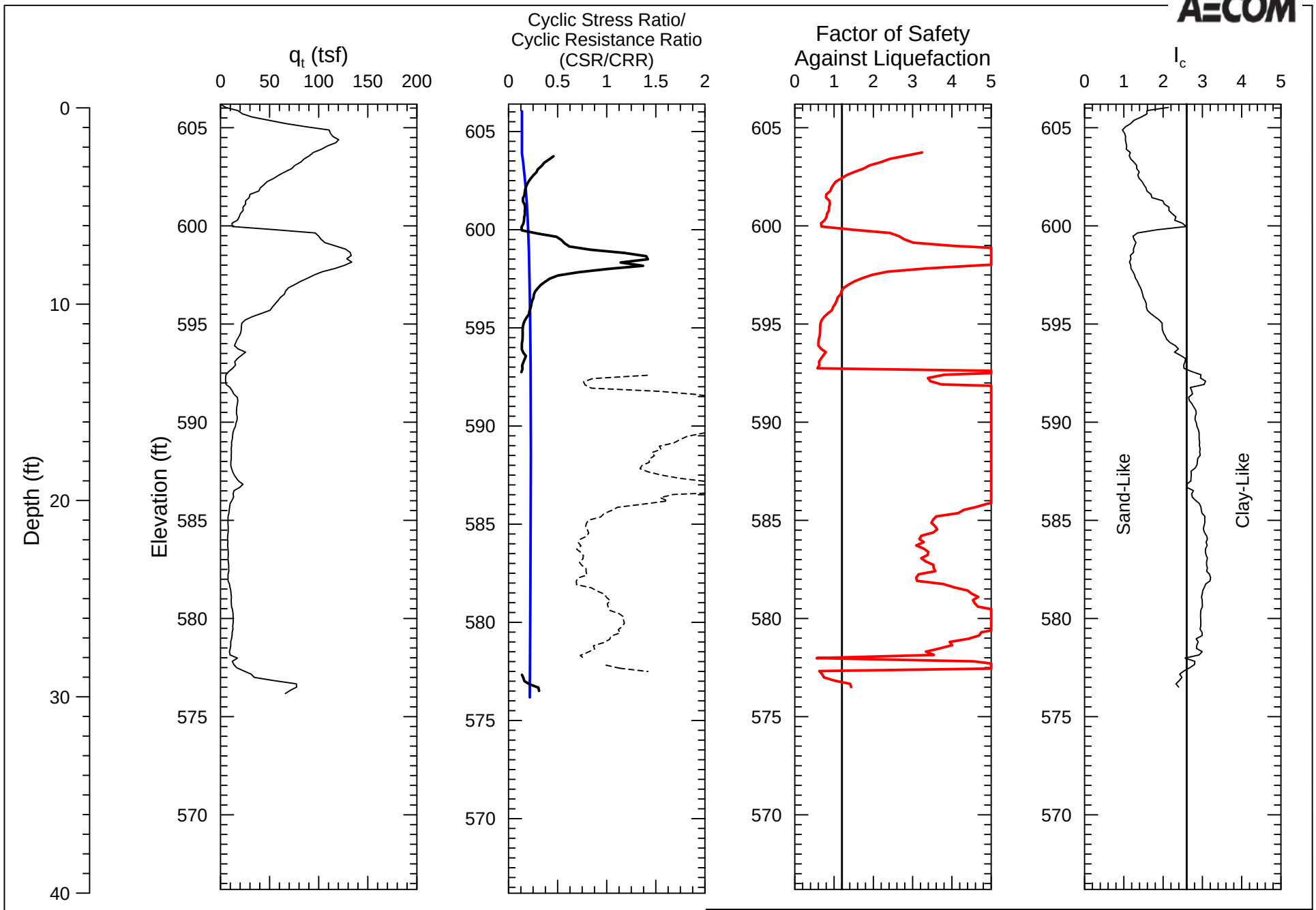

AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
615 610 605 600 595 590 585 580
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 618 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C028
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
\\USDEN5FP0001\geociv\$\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\CPT Characterization\Kincaid Ash Pond\KIN-028 Triggering.grf

FIG. XXXX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q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
605 600 595 590 585 580 575 570
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 606.2 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C029
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
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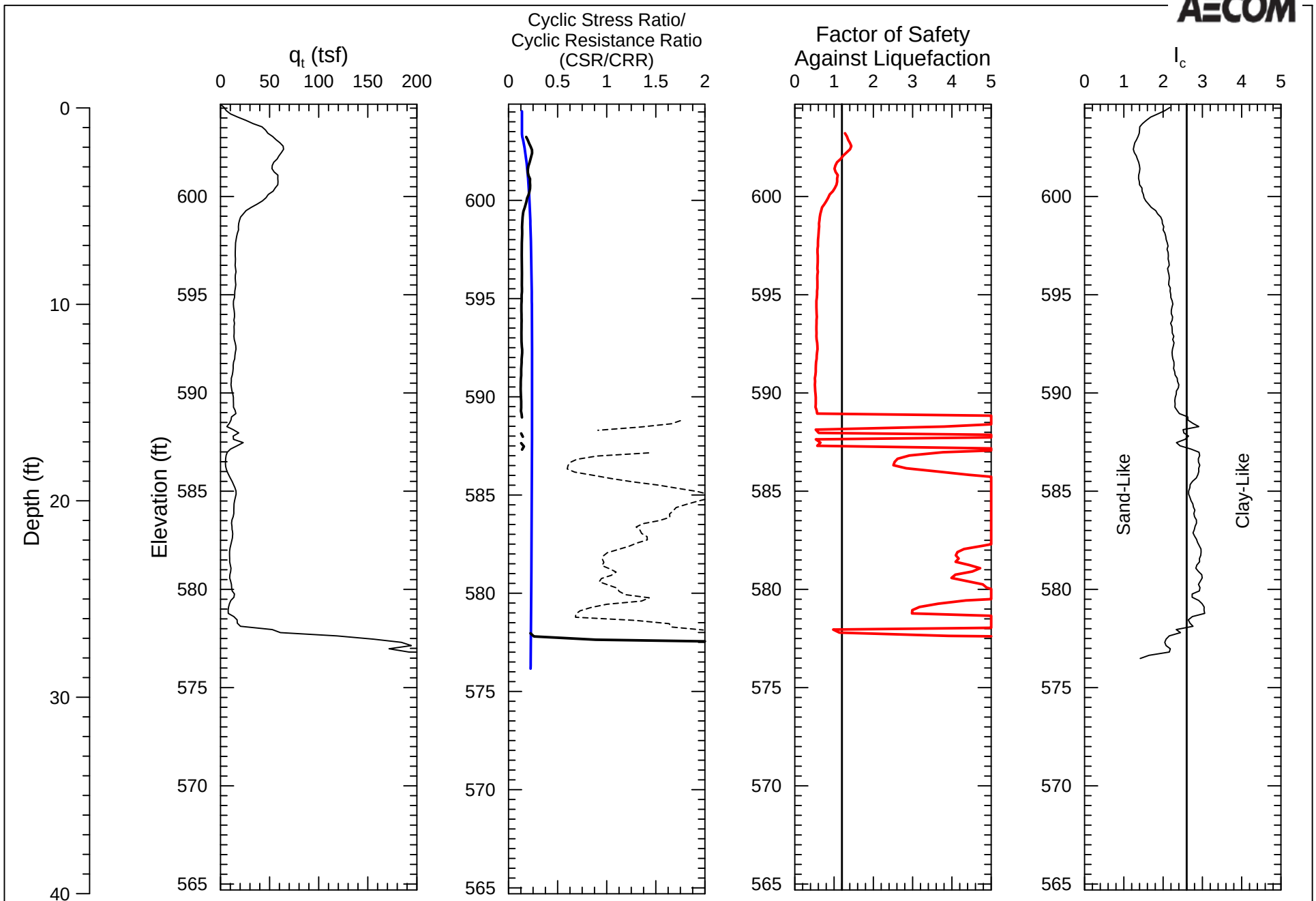
FIG. XXXX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Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 604.7 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C030
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
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FIG. XXXX

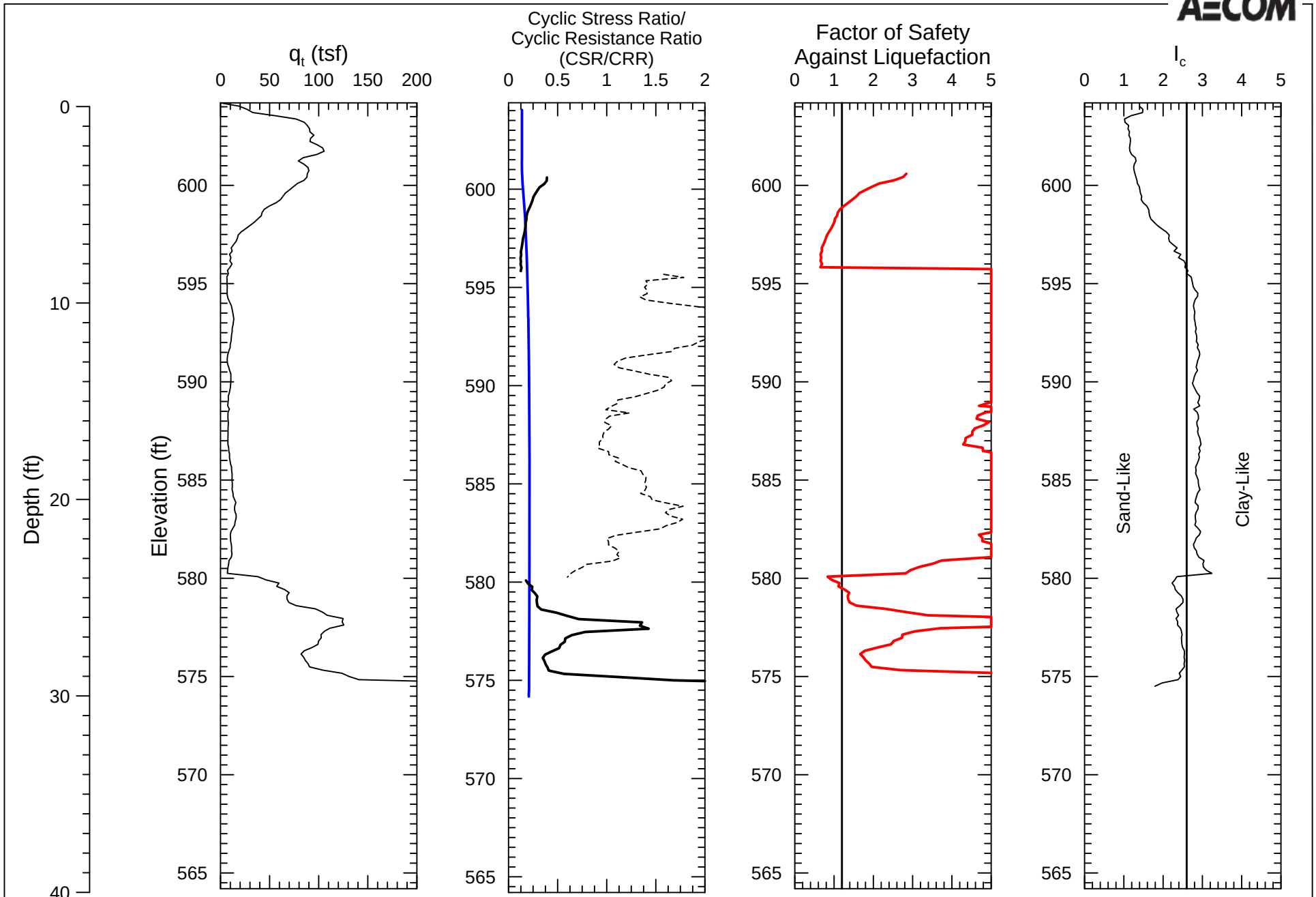

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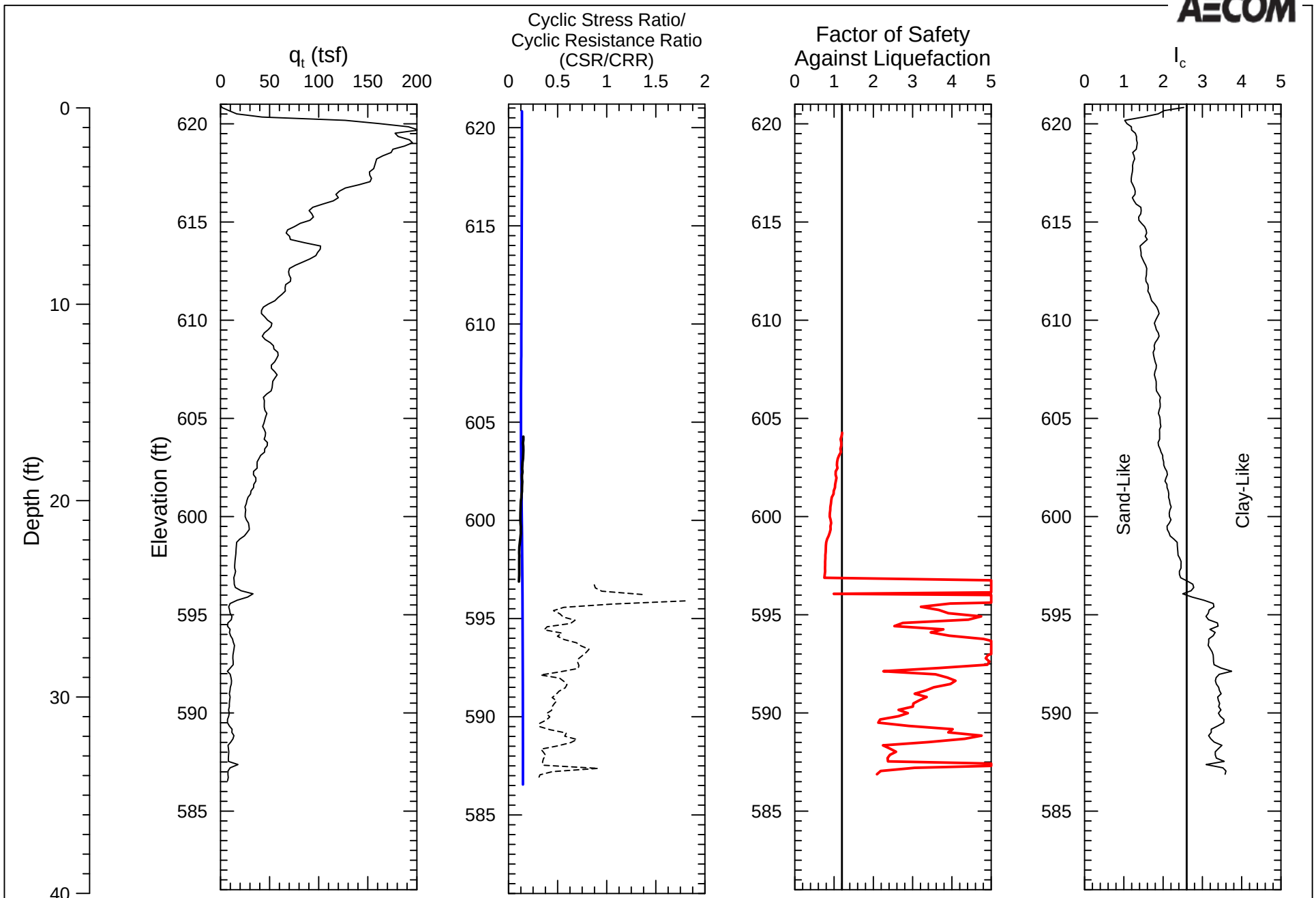
FIG. XXXX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Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
620 615 610 605 600 595 590 585
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 621 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C032
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
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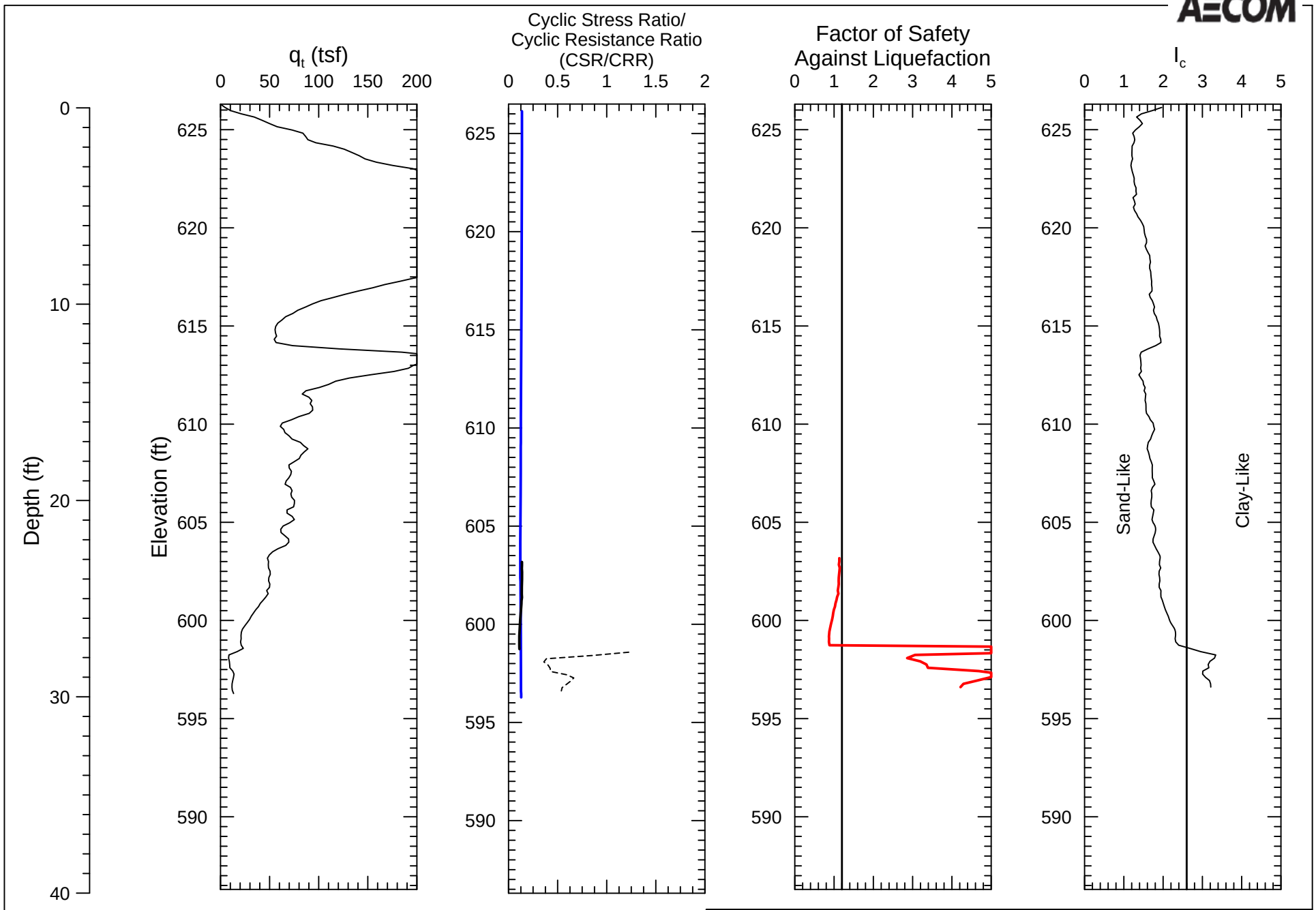
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Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
625 620 615 610 605 600 595 590
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 626.3 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C033
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
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FIG. XXXX

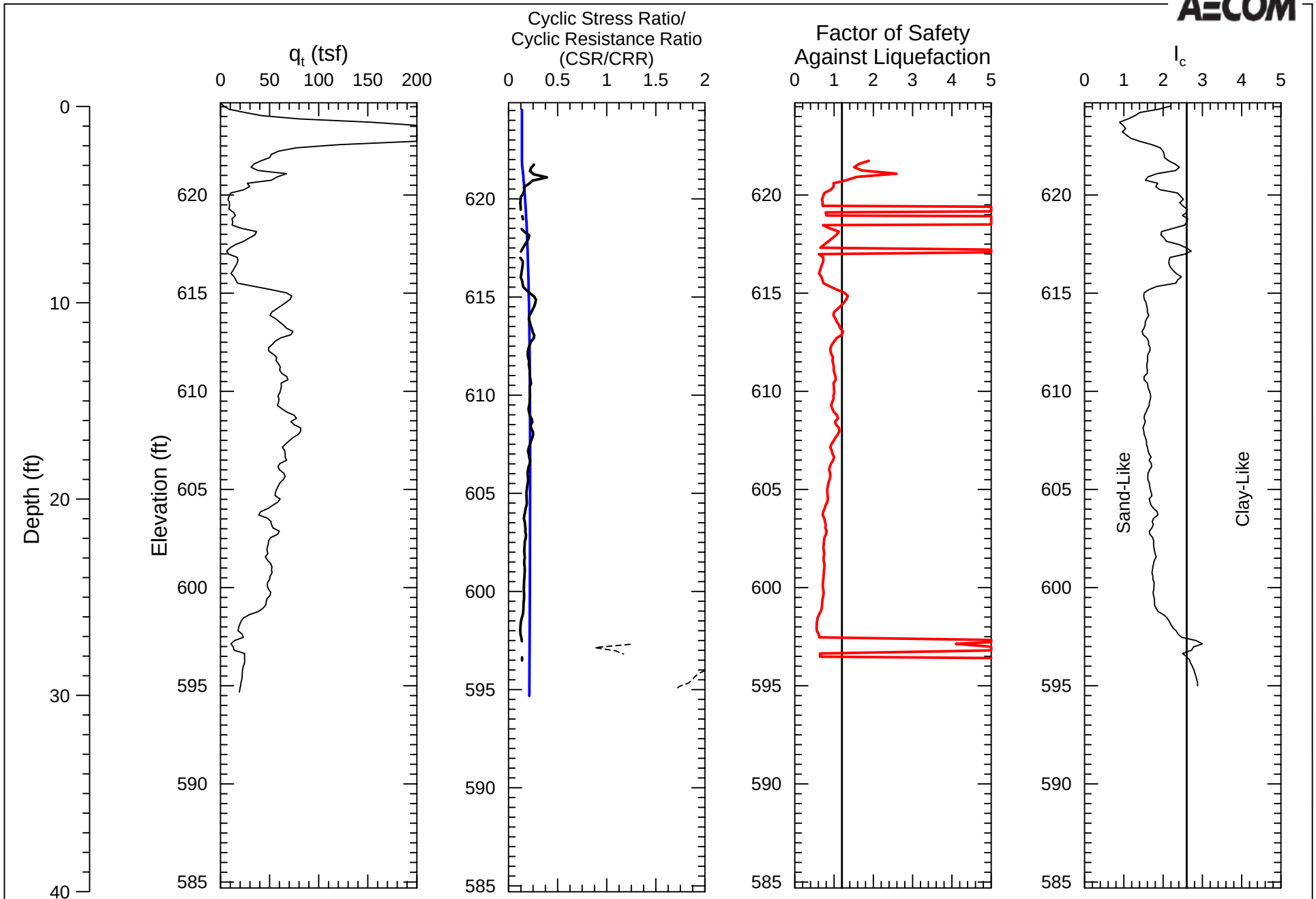

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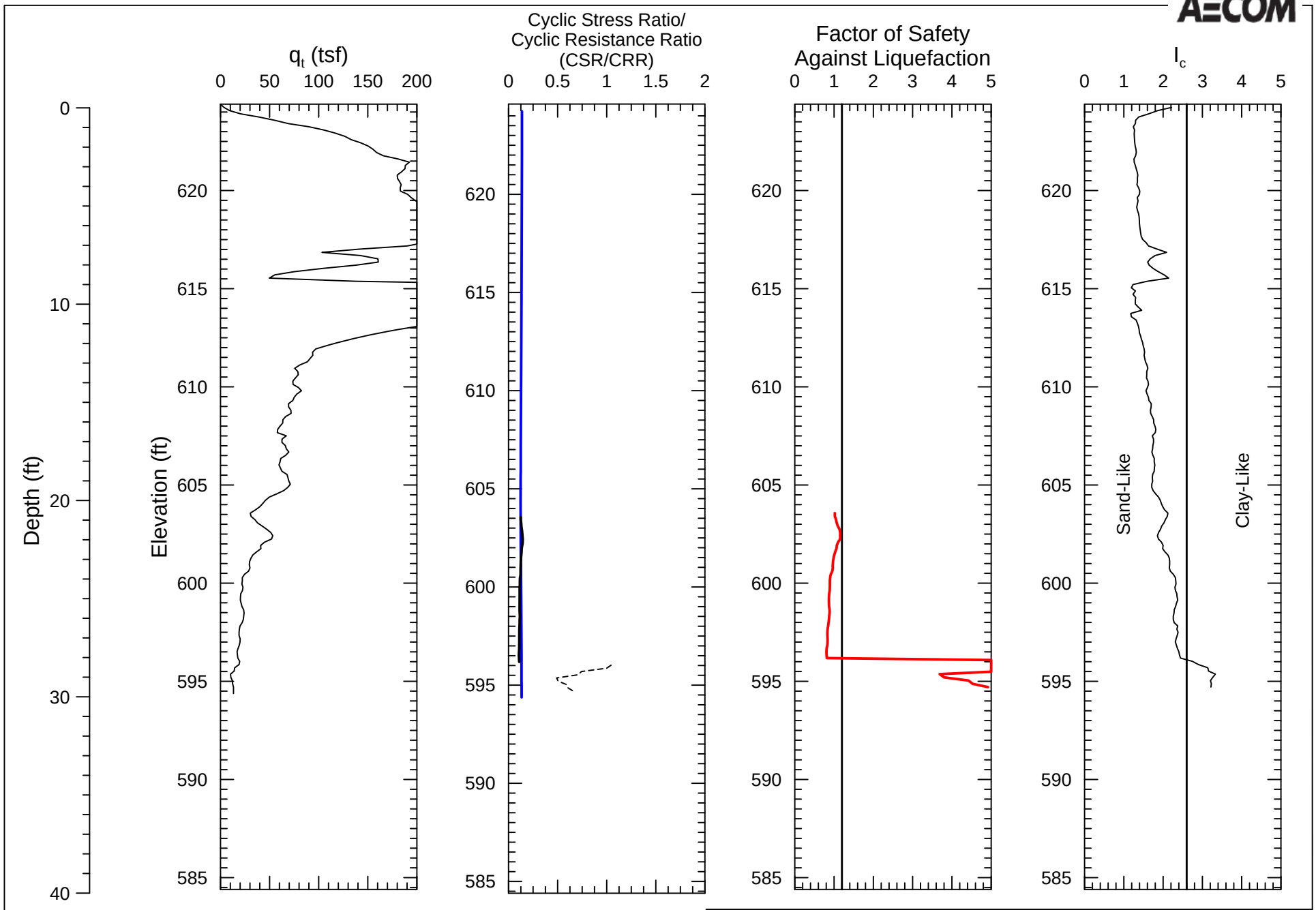
FIG. XXXX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q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
620 615 610 605 600 595 590 585
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 624.4 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C035
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
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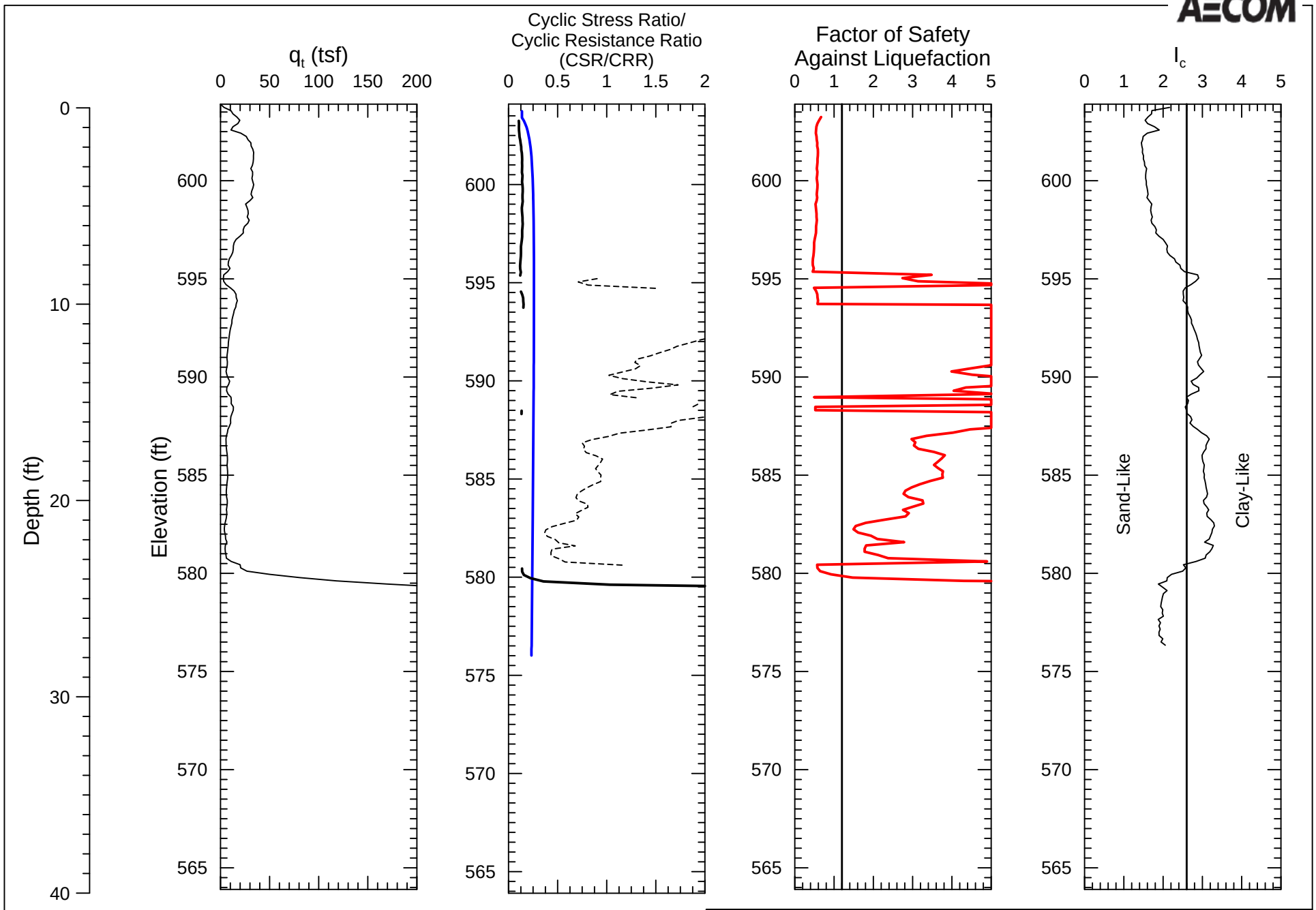
AECOM
q_t (tsf)
0 50 100 150 200
Cyclic Stress Ratio/
Cyclic Resistance Ratio
(CSR/CRR)
0 0.5 1 1.5 2
Factor of Safety
Against Liquefaction
0 1 2 3 4 5
I_c
0 1 2 3 4 5
Depth (ft)
0 10 20 30 40
Elevation (ft)
600 595 590 585 580 575 570 565
Sand-Like
Clay-Like
Cyclic Resistance Ratio - "Sand-Like"
Cyclic Resistance Ratio - "Clay-Like"
Cyclic Stress Ratio
Factor of Safety
Estimated Ground Surface
El 603.9 FT
Project No. 60480698
Prepared By: KLR
Date: 12/17/2015
KIN-C036
Kincaid Ash Pond
Liquefaction Risk Assessment
(Idriss and Boulanger, 2008)
FIG. XXXX
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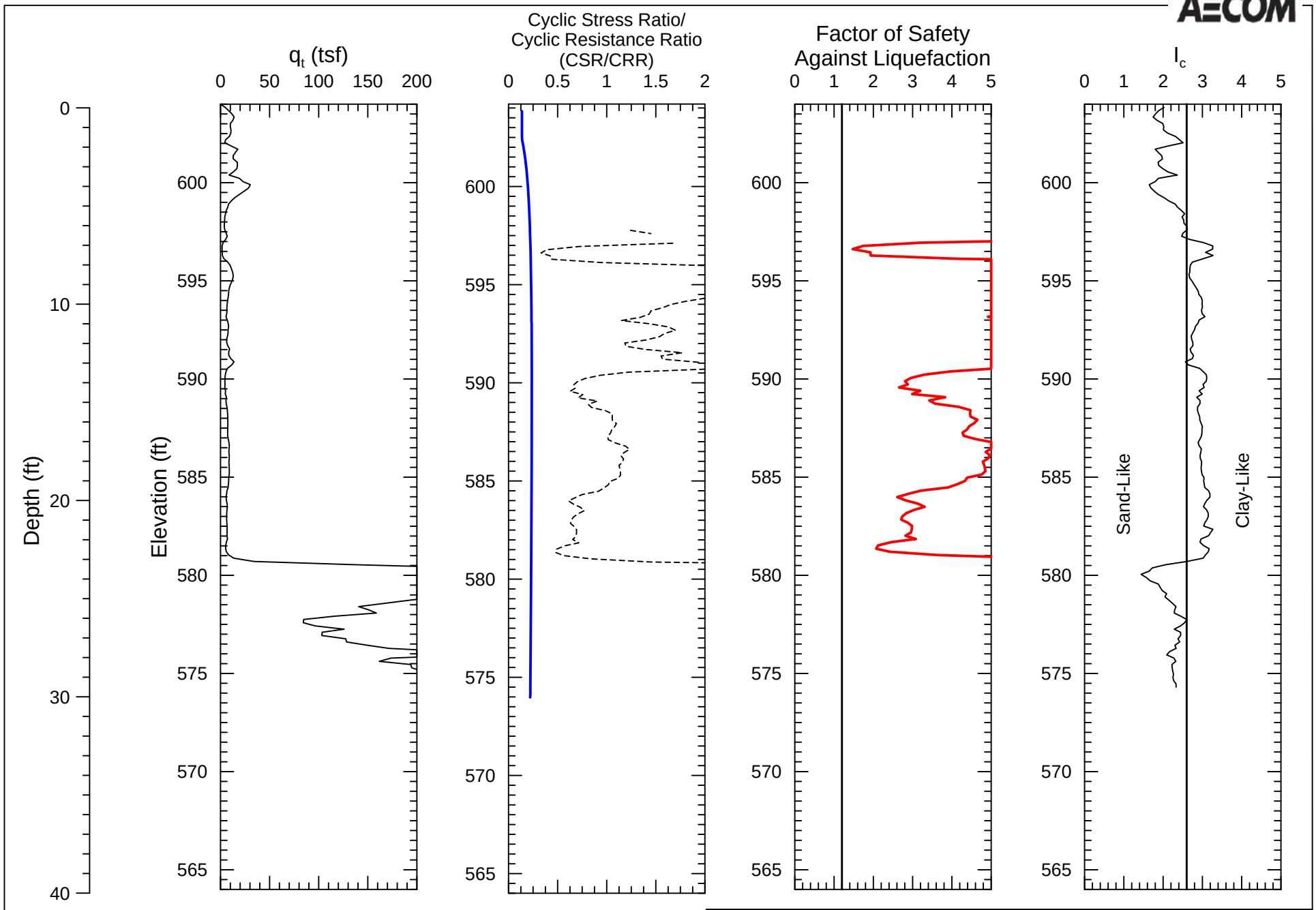

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FIG. XXXX

Attachment M. Sudden Drawdown Slope Stability Calculations

AECOM

QMS Form 3-3 (MM)
Rev. 2013 QMS
Date: 28 Feb 2013

IE QMS - Americas

Detail Check - Calculations

Project Name	Dynegy CCR Management Program	**Client**	Dynegy Midwest Generation, LLC
Project Location	Kincaid, Illinois	**PM**	Ron Hager
Project Number	60480698	**PIC**	Ron Hager

IDENTIFYING INFORMATION

(This section is to be completed by the Originator.)

Calculation Medium: *(Select as appropriate)*
☒ Electronic
☒ Hard-copy

File Name: Kincaid_Ash_Pond_RDD_LPC_20160620v0.pdf
Unique Identification: N/A
Number of pages *(including cover sheet)*:

Discipline:	Geotechnical
Title of Calculation:	Kincaid Ash Pond Rapid Drawdown Stability Analysis
Calculation Originator:	Lucas P. Carr
Calculation Contributors:	
Calculation Checker:	Betty Tesfu

DESCRIPTION & PURPOSE

See attached.

BASIS / REFERENCE / ASSUMPTIONS

See attached.

ISSUE / REVISION RECORD

Checker comments, if any, provided on: ☐ hard-copy ☐ electronic file ☐ Form 3-5

No.	Description	P	S	F	Originator Initials	Date	Checker Initials	Date
0	Version 1	☐	☐	☒	LPC	6/20/16	BT	6/20/16
1		☐	☐	☐				
2		☐	☐	☐				
3		☐	☐	☐				

For a given Revision, indicate either P (Preliminary), S (Superseding) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

APPROVAL and DISTRIBUTION

☒ The below individuals assert that the Detail Check – Calculations is complete.

Originator Signature	June 20, 2016 **Date**
Bethelehem Tesfu **Checker Signature**	June 20, 2016 **Date**
Eric J Glazer **Project Manager (or Designee) Signature**	June 22,2016 **Date**

Distribution:

Project Central File – Quality File Folder

Other – Specify: Enter names here.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Rapid Drawdown Stability Analysis

Project Name: Dynegy CCR

By: Lucas Carr Date: 2016-06-20

Project No: 60480698

Checked By: Betty Tesfu Date: 2016-06-20

Task No.: 01

Objective

A rapid drawdown (also known as "sudden drawdown") slope stability analysis was performed to calculate factors of safety (FoS) under sudden drawdown conditions of Sangchris Lake for the Kincaid Ash Pond embankment. The factor of safety for this case has been compared to USACE Slope Stability Manual factor of safety criteria for sudden drawdown conditions, as minimum rapid drawdown factors of safety are not expressly stated in the USEPA CCR Rule.

The methodology used to perform the sudden drawdown analysis is summarized in the following sections.

Development of Sections for Analysis

The sudden drawdown stability analysis was performed for Station 63+00, where the Kincaid Ash Pond slopes into adjacent Sangchris Lake. Additional information on the development of this cross-section, including the subsurface stratigraphy and other pertinent information can be found in the *Slope Stability Analysis Calculations* (Attachment I).

It should be noted that Sangchris Lake is also adjacent to the toe of the dike near Sta. 52+00, on the north side of the Kincaid Ash Pond. This section was not analyzed due to the higher toe elevation relative to Sta. 63+00 (approximately El. 595 ft vs. 590 ft) and the presence of a rock buttress at the toe of the embankment at Sta. 52+00. Both of these factors are, by inspection, likely to result in a higher sudden drawdown factor of safety for Sta. 52+00. Therefore, Sta. 63+00 is the critical section by inspection, and was selected for analysis.

Analysis Methodology

The slope stability analysis evaluated the sudden drawdown loading condition. Although not expressly required by the USEPA CCR Rule, §257.73(d)(1)(vii) states: *CCR unit designed, constructed, operated and maintained with, for CCR units with downstream slopes which can be inundated by the pool of an adjacent water body, such as a river, stream or lake, downstream slopes that maintain structural stability during low pool of the adjacent water body or sudden drawdown of the adjacent water body.* Therefore, the sudden drawdown slope stability analysis was performed to evaluate the structural stability of the Kincaid Ash Pond during sudden drawdown of adjacent Kincaid Lake, as Kincaid Lake comprises an adjacent waterbody to the Kincaid Ash Pond.

The clause in the EPA CCR Rule above is concerned with drawdown from a normal pool scenario to low pool therefore, drawdown of Sangchris Lake from normal pool to an empty pool condition was considered.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Rapid Drawdown Stability Analysis Project Name: Dynegy CCR

By: Lucas Carr Date: 2016-06-20 Project No: 60480698

Checked By: Betty Tesfu Date: 2016-06-20 Task No.: 01

Material Properties

The analysis was performed using the staged Duncan et al (1990) approach within SLOPE/W. This approach uses combined drained and undrained soil properties to evaluate soil shear strength during drawdown. For the embankment fill, foundation clay, and till, the drained soil properties were assumed to be the same as the drained friction angles discussed in the *Material Characterization Calculations*. However, the design drained strengths for the embankment fill and foundation clay materials rely on nonlinear curved failure envelopes to account for overconsolidation in the soil. As SLOPE/W cannot account for nonlinear envelopes during soil drawdown, a simplified straight-line linear envelope was used for drained strength, neglecting higher strengths at lower effective stresses due to overconsolidation. This is a conservative assumption.

Drained-undrained (R-envelope) soil strengths were taken from the design Su/p' ratio ratios presented in the *Material Characterization Calculations*. R-envelope strengths are used to estimate the available undrained shear strength during sudden drawdown as a function of the vertical effective consolidation stress on the failure plane, prior to undrained loading. As this is a different presentation of the same failure envelope used to develop the Su/p' characterization, the undrained failure envelope was converted to an R-envelope. This was performed by taking the tangent of the Su/p' ratio to determine ϕR. It should be noted that both Su/p' characterizations assumed a minimum undrained shear strength. As SLOPE/W cannot account for nonlinear failure envelopes during sudden drawdown, the minimum shear strength was not used. As each Su/p' ratio failure envelopes were drawn through the origin of the Su-p' plot (therefore effectively being cohesionless when the minimum undrained shear strength is not included), a nominal cohesion of 0.1 psf was assigned to each materials, as SLOPE/W cannot account for a cohesionless R-envelope.

Table 1 – Sudden Drawdown Slope Stability Material Properties

Material	Unit Weight (pcf)	Drained Strength		R-Envelope Strength	
		ϕ' (deg)	c' (psf)	ϕR (deg)	cR (psf)
Embankment	135	40	0	34	0.1
Foundation Clay – CIU	125	32	0	26	0.1
Foundation Clay - DSS	125	30	0	17	0.1
Till	135	40	0	33	0.1

It should be noted that drained strengths were used for the ash material. This is because the ash is located inside the embankment, and drawdown of the exterior water body is unlikely to change the effective stress or stresses on slip surfaces that pass through the ash as it is isolated form Sangchris Lake by the clay embankment.

Calculation Notes AECOM

Subject: Kincaid Ash Pond Rapid Drawdown Stability Analysis Project Name: Dynegy CCR

By: Lucas Carr Date: 2016-06-20 Project No: 60480698

Checked By: Betty Tesfu Date: 2016-06-20 Task No.: 01

Stability Analysis Approach

The slope stability analysis was conducted using SLOPE/W within the GeoStudio 2012 software package (Version 8.15.1.11236). The following approach was used to conduct the analysis:

- Analysis Method: Spencer
- Slip Surface Definition: Entry and exit. Slip surfaces were allowed to enter the ground surface upstream of the middle of the embankment crest and downstream of the embankment toe
- Minimum Slip Surface Depth: 10 ft
- Optimization: Critical slip surfaces were optimized.
- Tension Cracks: Added if necessary to reduce interslice tensile forces. The tension crack was assumed to be full of water.
- Pore Pressures: From piezometric line. Two piezometric lines were used, including one normal pool piezometric line (representing existing phreatic conditions under normal pool elevations of the Kincaid Ash Pond and Sangchris Lake) and a drawdown piezometric line (similar to the normal pool line, but modeling an empty condition in Sangchris Lake where the piezometric line follows the ground surface to the downstream edge of the model).

Results

The resulting factor of safety is **1.41**. Per USACE EM 1110-2-1902, minimum rapid drawdown slope stability factors of safety of 1.3 applies from drawdown from maximum storage pool. Therefore, the calculated factor of safety of 1.41 meets USACE criteria for sudden drawdown stability, and the Kincaid Ash Pond embankment is expected to maintain structural stability during sudden drawdown of Sangchris Lake.

References

United States Army Corps of Engineers (2003). *Slope Stability*. EM 1110-2-1902, October 31, 2003.

Dynegy Kincaid
Station 63+00
Slope Stability - Sudden Drawdown

Design by: Lucas Carr
Checked by:
Date: 6/20/2016

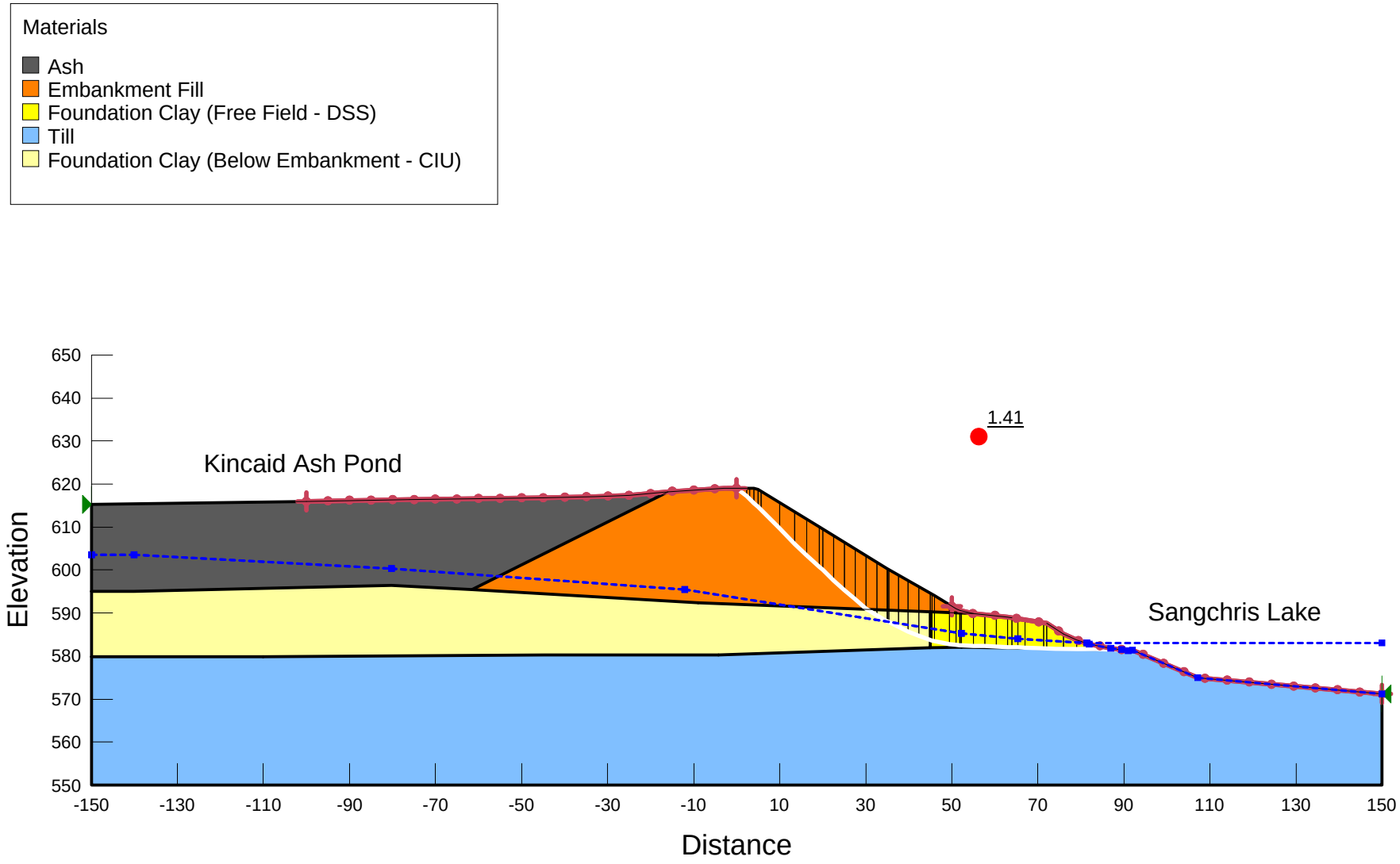
Name: Ash Model: Mohr-Coulomb Unit Weight: 112 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Cohesion R: 0 psf Phi R: 0 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

Name: Embankment Fill Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Cohesion R: 0.1 psf Phi R: 34 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

Name: Foundation Clay (Free Field - DSS) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Phi-B: 0 ° Cohesion R: 0.1 psf Phi R: 17 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

Name: Till Model: Mohr-Coulomb Unit Weight: 135 pcf Cohesion': 0 psf Phi': 40 ° Phi-B: 0 ° Cohesion R: 0.1 psf Phi R: 33 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

Name: Foundation Clay (Below Embankment - CIU) Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 32 ° Phi-B: 0 ° Cohesion R: 0.1 psf Phi R: 26 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2



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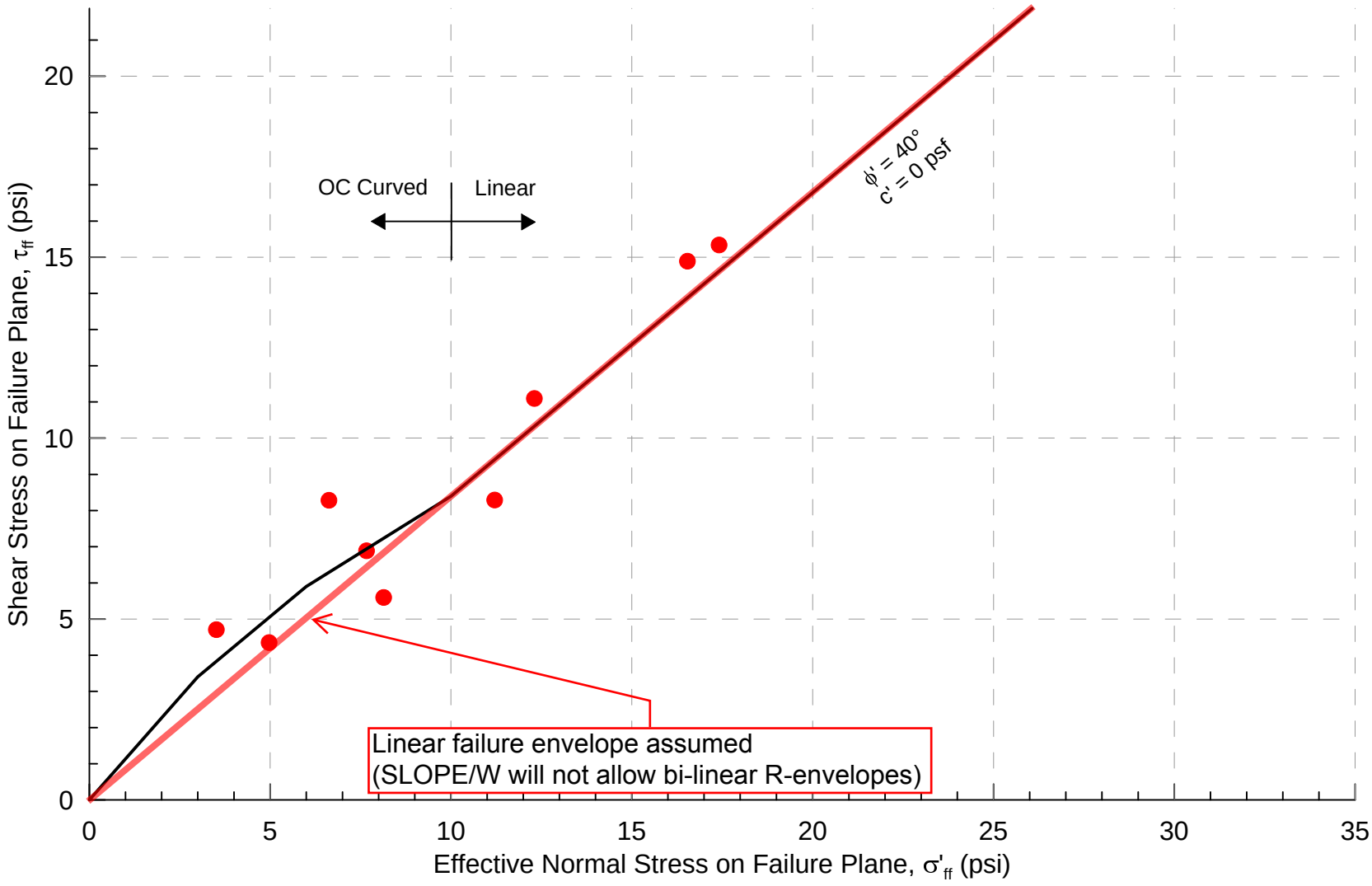

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** Drained Shear Strength Characterization	Figure B.1
AECOM			

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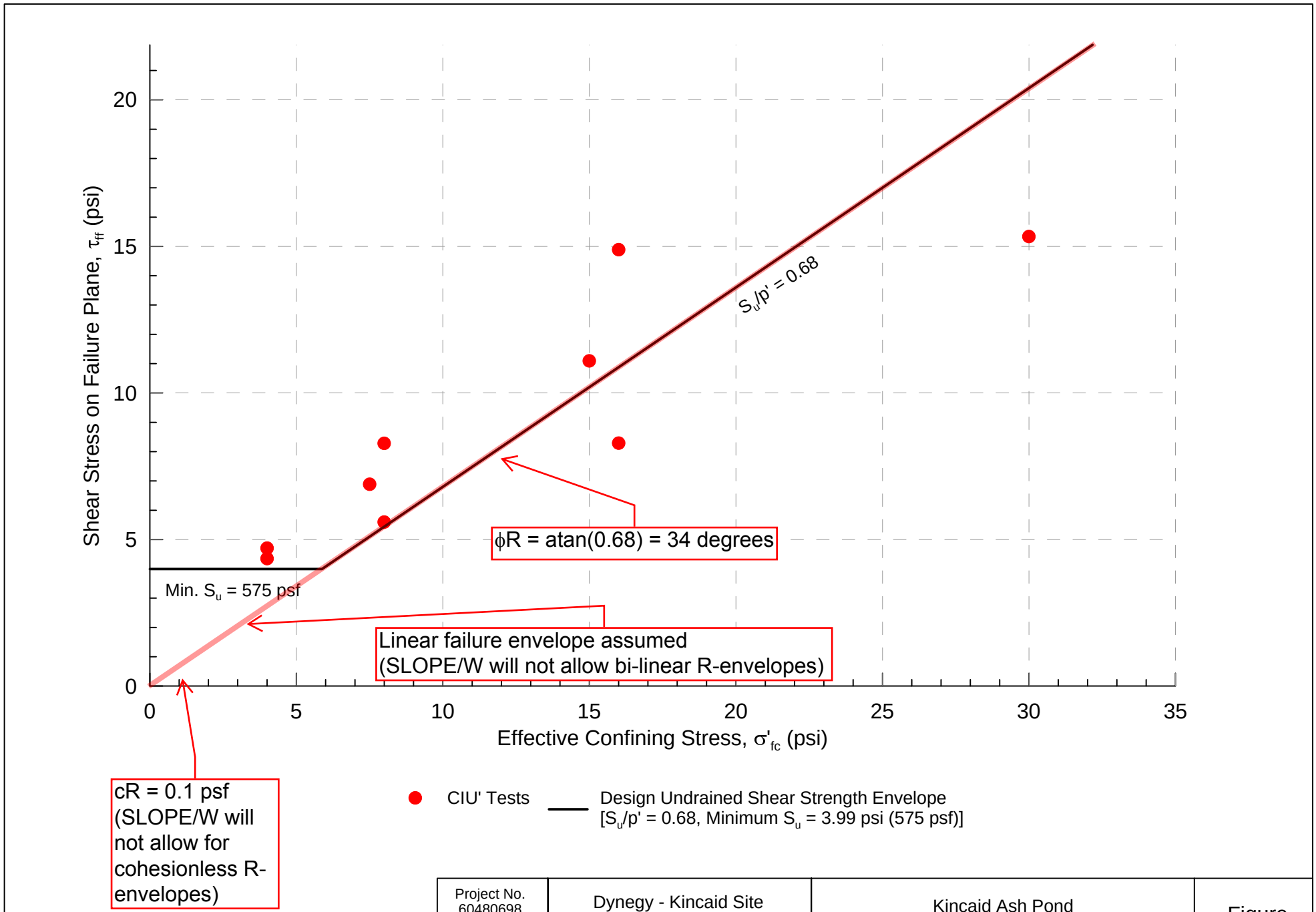

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Embankment** Undrained Shear Strength Characterization	Figure B.2
AECOM			

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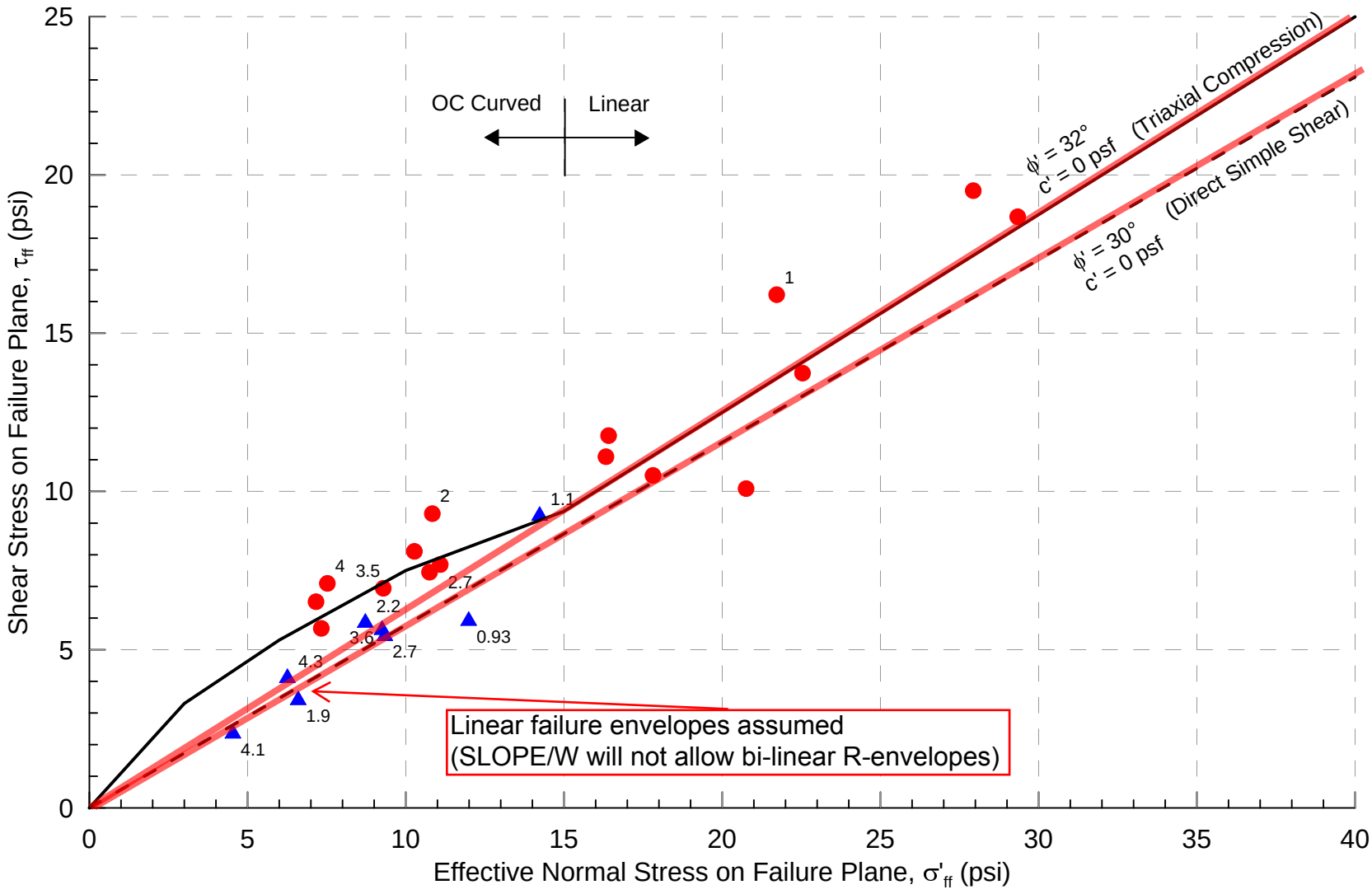


CIU' Tests

DSS Tests

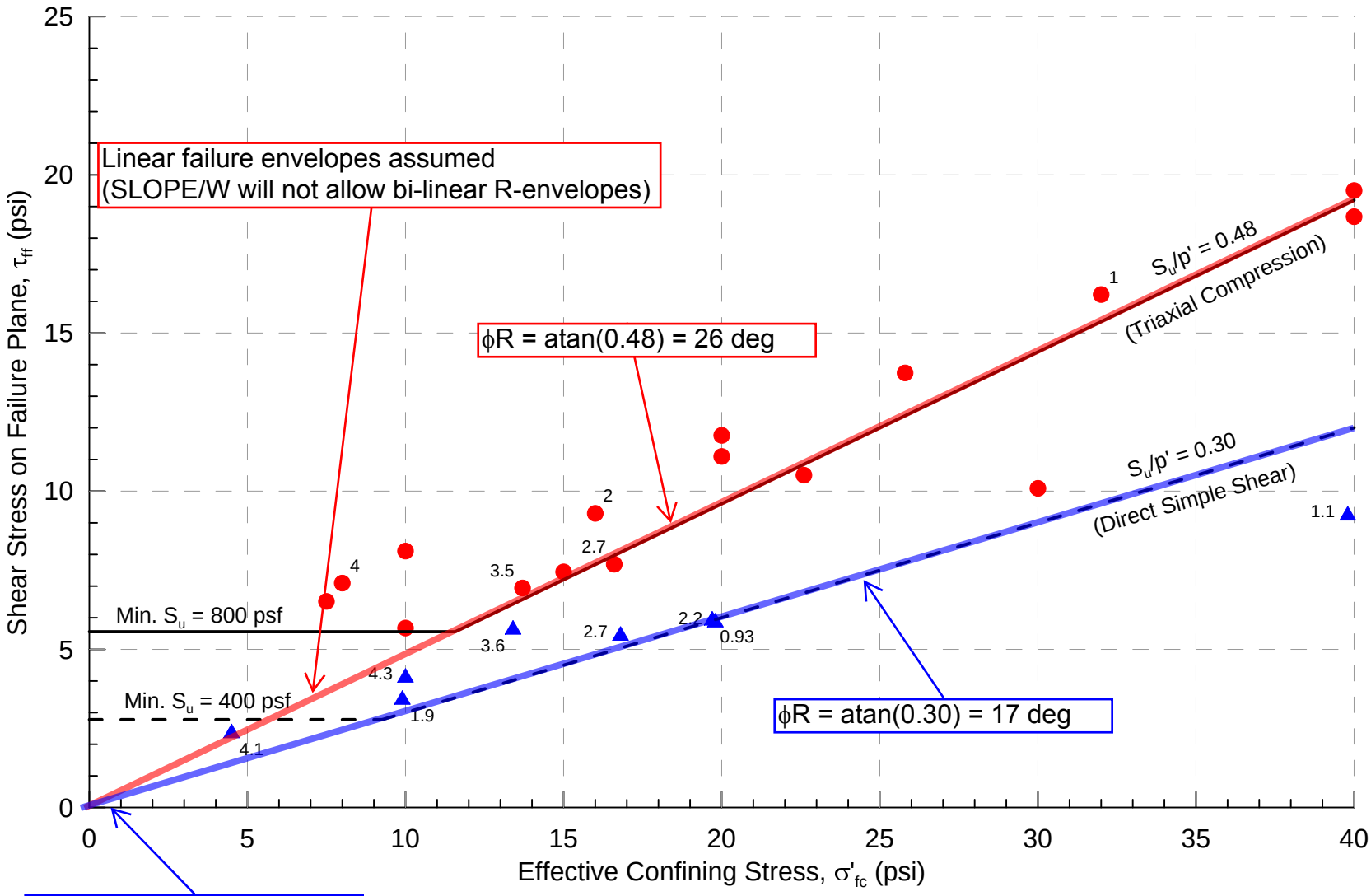
Design Drained Shear Strength Envelope - Below Embankment
[ϕ' = 32°, c' = 0 psf with curved envelope for σ'_{ff} < 15 psi (2160 psf)]

Design Drained Shear Strength Envelope - Free Field
[ϕ' = 30°, c' = 0 psf]

Notes:
1. Number next to point is OCR of sample tested.
2. Strength based on orientation of failure plane below the embankment and in the free field. Strength below embankment based on triaxial compression (CIU' tests), and strength in free field based on direct simple shear (DSS tests).

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Drained Shear Strength Characterization	Figure C.1
AECOM			

N:\Projects\60428794_Dynegy_CCR_RuleAsmt\Sub_00\10.0_Calculations_Analysis_Data\Geotechnical\Material Characterization_Final\Kincaid\Lab Characterization\Foundation Clay Plots\2015 Kincaid Foundation Clay Drained Strength Chara



Notes:
1. Number next to point is OCR of sample tested.
2. Strength based on orientation of failure plane below the embankment and in the free field. Strength below embankment based on triaxial compression (CIU' tests), and strength in free field based on direct simple shear (DSS tests).

Project No. 60480698	Dynegy - Kincaid Site	Kincaid Ash Pond **Foundation Clay** Undrained Shear Strength Characterization	Figure C.2
AECOM			

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Appendix C. Hydrologic and Hydraulic Report

AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110-1337
www.aecom.com

314.429.0100 tel
314.429.0462 fax

July 1, 2016

Mr. Matt Ballance, PE
Senior Project Engineer
Dynegy Inc.
1500 Eastport Plaza Drive
Collinsville, Illinois 62234

RE: DRAFT Hydrologic and Hydraulic Summary Report for Certification of CCR Surface Impoundments, Kincaid Station, Kincaid Ash Pond CCR Unit

Dear Mr. Ballance:

AECOM is pleased to provide this Draft Summary Report of Hydrologic and Hydraulic Modeling for the Dynegy Coal Combustion Residual (CCR) Kincaid Station Ash Pond CCR Unit. This analysis was performed to document that the facility meets the requirements of 40 CFR § 257.82 with regard to the Inflow Design Flood Control Plan.

Please review the attached materials and forward any comments you may have.

AECOM looks forward to providing continued support to Dynegy and working together on this important program. Please do not hesitate to call Vic Modeer at 314-743-4194 (office) / 618-541-0878 (mobile), if you have any questions.

Sincerely,

AECOM

Ronald Hager
Technical Program Manager
Ronald.hager@aecom.com

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cc Mark Rokoff, PE – AECOM

Attachments:

A. Location Map and Site Plan
B. Hydrologic and Hydraulic Calculations

1. INTRODUCTION

1.1. *Purpose of This Memorandum*

This report presents the results of the hydrologic and hydraulic analysis prepared by AECOM for the Dynegy Coal Combustion Residuals (CCR) Ash Pond unit at the Kincaid Station, located approximately 4.4 miles west of Kincaid, Illinois in Christian County (See Attachment A for Location Map). This analysis was completed in response to the Environmental Protection Agency (EPA) adopting the Federal Register 40 CFR Parts 257 and 261 to regulate the disposal of coal combustion residuals (CCR) as solid waste in April of 2015. As required by 257.82, within 18 months of the published date (October 17, 2016) owners and operators of existing or new CCR surface impoundments must develop an Inflow Design Flood Control Plan in accordance with the following:

- *(40 CFR 257.82, paragraph (a)(1)* - The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood.

- *(40 CFR 257.82, paragraph (a)(2)* - The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood.

The results of this analysis will be used by AECOM to confirm that the Kincaid Ash Pond meets the hydrologic and hydraulic capacity requirements of the rules referenced above for CCR surface impoundments. The Kincaid Ash Pond has been categorized as a “Significant Hazard Potential CCR Impoundment”, which indicates that the inflow design flood is the 1,000-year return frequency design storm event.

1.2. *Brief Description of Impoundments*

The site is situated in a primarily rural area and is bordered to the north and west by Sangchris Lake, to the south by Route 104 and to the east and northeast by agricultural land owned by others. The impoundment was commissioned in 1967 and operates as an unlined CCR impoundment. Bottom ash is currently sluiced from the plant into the impoundment. Currently, a third party recycling company recovers newly placed ash for beneficial reuse, and unacceptable material is returned to the impoundment. The storage capacity of the impoundment does therefore not significantly change from year to year.

The Ash Pond impoundment is operated as a zero-discharge facility during normal conditions and receives and impounds sluiced ash from the plant as well as providing recycle water necessary for sluicing ash back into the pond. The Ash Pond is operated such that the outflow from pond is essentially equal to the inflow from plant processes, as there is virtually no storage capacity between the outflow (recycle intake structure) and the inflow sluice pipes. Therefore, flows into and out of the Ash Pond are balanced during normal conditions.

The surface area of the impoundment is approximately 178 acres. Although the impoundment has not received an official hazard classification, it is judged to be a Significant Hazard structure for the purpose of this design based on input from Dynegy and based on potential for damage to downstream structures and environmental impacts if the impoundment were to fail. Free water impounded in the east approximate one-third of the impoundment typically fluctuates by no more than about 1.5 feet, with a maximum operating level of El. 603.3 feet (unless otherwise noted, all elevations in this report are in the NAVD88 datum) and a minimum operating level of El. 601.8 feet. The normal operating level varies seasonally, with the higher operating level of El. 603.3 feet typically used during winter months to account for the effects of freezing.

Normal outflow from the Kincaid Ash Pond is conveyed into the recycle intake structure (screen house) located at the southeast corner of the embankment. This structure is comprised of a concrete headwall, a fiberglass and steel grating system to control (screen) debris, and a 60-inch recycle pipe with a centerline elevation of 589.45 feet[1] which is used to convey water approximately 2,000 feet westward to the recycle pump house, where it is recycled for use in plant processes. Outflow from the Kincaid Ash Pond into the recycle pipe is controlled by a steel gate valve installed on the pipe inlet, which can be operated from inside the screen house. A concrete weir is also present in front of the recycle pipe, but has a crest elevation of 595.21 feet, which is lower than the maximum operating pool of the Kincaid Ash Pond (El. 603.3 feet). Therefore, the weir is completely submerged during normal operations. The pipe material is reportedly reinforced concrete pipe (RCP), but has not been verified.

An emergency outlet (effluent) structure is also located at the southeast corner of the impoundment, and serves to discharge pond water into the adjacent discharge flume during emergency or upset conditions. The discharge flume transmits plant cooling water back into Lake Sangchris. The emergency outlet structure consists of a square concrete intake structure with an exterior steel 3 foot circular gate valve (invert El. 597.21 feet) and opening discharging into the center of the structure, which leads into an ungated 48-inch corrugated metal pipe (CMP) emergency outlet pipe (approximate invert elevation of 591 feet, based on historic drawings). The gate valve can be operated from an access walkway leading to the emergency outlet structure. The top of the emergency outflow structure is open to the Kincaid Ash Pond on three sides at El. 604.3 feet, with open dimensions of 3 foot square. The opening effectively acts as a 9 foot wide overflow weir that is activated when the pool level in the Kincaid Ash pond exceeds El. 604.3 feet. As the 48-inch CMP is ungated, flow is transmitted freely into the emergency outlet structure when the pond level exceeds El. 604.3 feet and is transmitted to the discharge flume via the 48-inch CMP, without needing to manually operate the exterior gate valve. Reportedly, the 48-inch CMP failed after opening of the gate valve during high rainfall conditions in 2006, resulting in near breaching of the embankment. The 48-inch CMP was replaced after the 2006 failure and has not been used since, which leaves the operability of the gate valve questionable, as it has not been opened in approximately 10 years.

Bathymetry data from October 2015 indicate that the pond bottom (likely ash) is currently at or above the elevation of the emergency outlet gate valve, such that if the gate were opened, ash could be discharged into the discharge flume and Sangchris Lake, which could be considered a release of ash. This precludes testing of the gate valve for the emergency outflow structure without some other means to prevent ash from migrating into the discharge flume. Remote video inspection of the pipe was performed in November 2015; portions of the pipe and joints appeared to have some minor bulging and deterioration, but was free of significant deterioration, deformation, distortions, bedding deficiencies, sedimentation, or debris.

Seven connected embankment segments totaling a length of approximately 11,000 feet form a complete perimeter embankment around the Kincaid Ash Pond. Design crest elevations are 607.0 ft. for a 400-ft long section of the south embankment, and 620.0 ft. for all other embankments. Survey data from 2015 found a minimum crest elevation of 605.2 feet near the emergency outfall and recycles intake structures. The original design intent for the south embankment was that it would function as an overflow emergency spillway. However, it is not armored and therefore does not meet current standard of practice for emergency overflow spillways.

[1] Elevations from historic 1977 design drawings were assumed to be in the NGVD29 datum, due to the date of the drawings. These elevations were adjusted by -0.295 feet for conversion to the NAVD88 datum. Recent survey data of dike crest and spillway elevations provided by Dynegy is in the NAVD88 datum, and was not adjusted.

2. POND CAPACITY / IMPOUNDMENT COMPUTATIONS

2.1. ***Primary Ash Pond***

The elevation/areas for the Kincaid Ash Pond were determined using a computer-aided design (CAD) analysis of topographic surveys completed in 2012 and 2015. Please refer to Attachment B for further details.

3. HYDROLOGIC AND HYDRAULIC ANALYSIS

3.1. ***Rainfall Data***

The Rainfall totals for the 1000-year return frequency storm event were ascertained from NOAA Atlas 14, Volume 2, Version 3. The 24-hour rainfall total was estimated to be **8.80** inches.

A Soil Conservation Service (SCS) Type II rainfall distribution was used to model the peak storm event.

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3.2. ***Runoff Computations***

The HydroCAD Version 10.0 computer software was used to model pond and outlet structure capacities during peak discharges.

The analyzed scenario assumes the starting water surface elevation is maximum operating pool elevation of 603.3 ft. Process water inflow and outflow from the recycle intake structure is not included in the analysis due to the balanced inflows and outflows, as discussed in Section 2. This approach is also valid for conditions when the plant is not operating. As the operating condition of the gate valve on the emergency outflow structures is unknown, it was assumed that no flow would pass through the gate valve. Therefore, all outflow from the Ash Pond is transmitted to 48-inch CMP and ultimately the discharge flume through the open top of the emergency outflow structure at El. 604.3 feet. In this case, the impoundment was determined to reach a peak elevation of 605.1 ft., providing essentially zero freeboard but without overtopping the embankment.

4. CONCLUSIONS

- The inflow design flood control system of the Kincaid Ash Pond appears to adequately manage flow into the CCR unit during and following the peak discharge of the 1,000-year frequency storm event inflow design flood.

- The inflow design flood control system of the Kincaid Ash Pond appears to adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the 1,000-year frequency storm event inflow design flood.

- Dynegy should institute operational controls to prevent the normal pool elevation in the Kincaid Ash Pond from exceeding El. 603.3 feet. Although this is the reported maximum operating pool for the Kincaid Ash Pond, due to the low amount of freeboard during the design storm event, operating the pond any higher than El. 603.3 ft may result in overtopping during the 1,000-year storm.

- However, due to the relatively low freeboard of 0.1 feet, the potential for wave overtopping at the south embankment exists. Wave overtopping was not evaluated as part of this hydrologic and hydraulic analysis, as it is not a requirement of the USEPA CCR Rule. The potential for wave overtopping could be reduced by placing Jersey

barriers or other temporary measures along the approximately 400-ft long lowered section of south embankment.

- Video inspection of the 48-inch CMP emergency outfall pipe identified some deterioration and deformation. While this level of deterioration and deformation is unlikely to reduce the hydraulic capacity of the pipe during the design storm, it should be regularly monitored and repaired if the deterioration and deformation begins to worsen.

5. LIMITATIONS

Background information, design basis, and other data have been furnished to AECOM by Dynegy, which AECOM has used in preparing this report. AECOM has relied on this information as furnished, and is not responsible for the accuracy of this information. Our recommendations are based on available information from previous and current investigations. These recommendations may be updated as future investigations are performed.

The conclusions presented in this report are intended only for the purpose, site location, and project indicated. The recommendations presented in this report should not be used for other projects or purposes. Conclusions or recommendations made from these data by others are their responsibility. The conclusions and recommendations are based on AECOM's understanding of current plant operations, maintenance, stormwater handling, and ash handling procedures at the station, as provided by Dynegy. Changes in any of these operations or procedures may invalidate the findings in this report until AECOM has had the opportunity to review the findings, and revise the report if necessary.

This hydrologic and hydraulic analysis was performed in accordance with the standard of care commonly used as state-of-practice in our profession. Specifically, our services have been performed in accordance with accepted principles and practices of the geological and geotechnical engineering profession. The conclusions presented in this report are professional opinions based on the indicated project criteria and data available at the time this report was prepared. Our services were provided in a manner consistent with the level of care and skill ordinarily exercised by other professional consultants under similar circumstances. No other representation is intended.

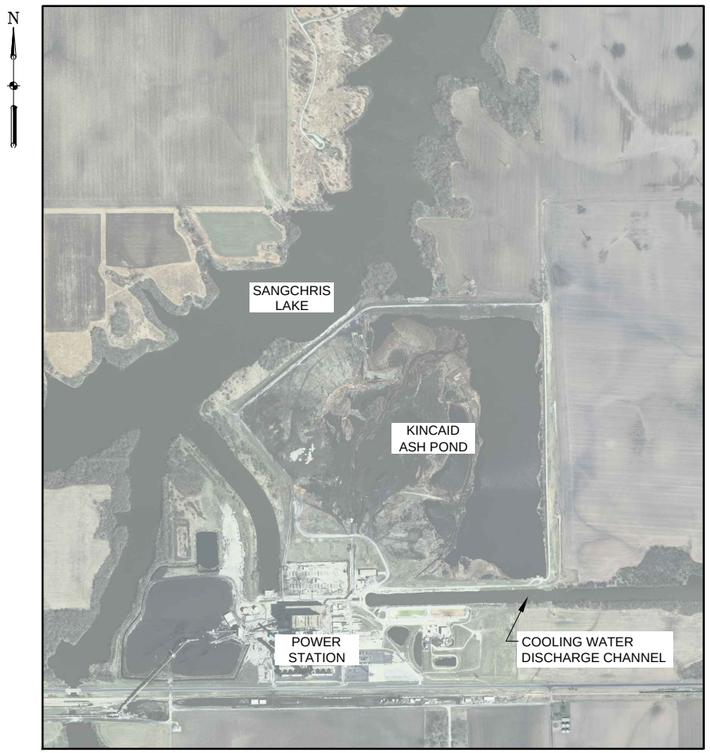
6. REFERENCES

NOAA (2014). NOAA Atlas 14 Point Precipitation Frequency Estimates, Volume 1, Version 3, http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html?bkmrk=il.

U.S. Environmental Protection Agency [USEPA]. (2015). *Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments*. 40 CFR §257. Federal Register 80, Subpart D, April 17, 2015.

Attachment A
Location Map and Site Plan

LOCATION MAP
NOT TO SCALE



VICINITY MAP
NOT TO SCALE

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

DYNEGY
Dynegy Inc.
1500 East Port Plaza Drive
Collinsville, IL 62234

CCR RULE ASSESSMENT OF PLANTS

KINCAID POWER PLANT
KINCAID, ILLINOIS

HYDROLOGIC AND HYDRUALIC REPORT
ASH POND

ISSUED FOR BIDDING — DATE BY

ISSUED FOR CONSTRUCTION — DATE BY

REVISIONS

NO.	DESCRIPTION	DATE
△		
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△		
△		
△		

AECOM PROJECT NO:	
DRAWN BY:	GJH
DESIGNED BY:	EJV
CHECKED BY:	MCR
DATE CREATED:	12/23/2015
PLOT DATE:	2/9/2016
SCALE:	AS SHOWN
ACAD VER:	2014

SHEET TITLE

LOCATION MAP &
SITE VICINITY MAP

1-1
SHEET 1 OF 4

SMITH, CURT, 2/9/2016 11:38 AM
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Attachment B
Hydrologic and Hydraulic Calculations

AECOM

QMS Form 3-3 (MM)

Date: September 2014

Dynegy CCR Program Quality Management — Calculation Check and Review Record

Project Name	Draft HH Analysis, Kincaid Ash Pond	**Client Name**	Dynegy
Project Location	Kincaid Power Station, Kincaid, IL	**PM Name**	Ron Hager, PE
Project Number / Office Code		**PIC Name**	Ron Hager, PE

This form may be used instead of Form 3-4 – Check and Review Record for Detail Checks of calculations. If the calculation is a standalone deliverable, an Independent Technical Review (ITR) may be required, and this form can be used for that purpose as well.

Type	☒ Calculation Detail Check	☒ Calculation ITR

IDENTIFYING INFORMATION

(This section is to be completed by the PM, PM's Designee, or Originator.)

Calculation Medium: *(Select as appropriate)*

☒ Electronic — File Name:

☐ Hard-copy — Unique Identification:

Number of pages *(including cover sheet)*:

Discipline:	Civil / Water Resources
Title of Calculation:	Draft HH Analysis, Kincaid Power Station, Kincaid Ash Pond
Calculation Originator Name:	Richard Wilburn, PE
Calculation Contributor Names:	
Calculation Checker Names:	Michael Caruso, PE
Calculation Reviewer Names:	Alex Nice, PE

DESCRIPTION & PURPOSE

Hydrologic and hydraulic analysis for CCR certification of Kincaid Power Station Ash Pond

BASIS / REFERENCE / ASSUMPTIONS

Dynegy Programmatic Documents

ISSUE / REVISION RECORD

For comments, select N (None), HC (Hard Copy), EF (Electronic File), or Form 3-5 from drop-down. For a given Revision, indicate P (Preliminary), S (Superseded) or F (Final). If there are no revisions to the Initial Issue, check F (Final).

Rev. No.	Description	Comments	P	S	F	Originator Initials	Date	Checker Initials	Date	Reviewer Initials	Date
0	Initial Issue	Y	☒	☐	☐	RLW	6/30/16	MJC	7/1/16	AJN	7/1/16
1	Revised Issue	N	☐	☐	☒	RLW	7/1/16	MJC	7/1/16	AJN	7/1/16
2		N	☐	☐	☐						
3		N	☐	☐	☐						

APPROVAL and DISTRIBUTION

☒ The below individuals confirm that the Calculation Check and Review process has been followed.

Originator Signature	1-Jul-16 **Date**
Checker Signature	1-Jul-16 **Date**
Reviewer Signature	1-Jul-16 **Date**
Ronald H. Hager **Project Manager (or Designee) Signature**	7-1-2016 **Date**

AECOM	CALCULATION SHEET	Calculation No. 1
		Project No. 60440697
Project Title: Draft HH Analysis Kincaid Power Station Ash Pond		Sheet No. 1 of 1
Subject/Feature: Hydrological Evaluation of Kincaid Ash Pond		Rev: 0

SUMMARY

The HydroCAD model results indicate that the Kincaid Ash Pond and outlet structure have adequate capacity for the 1,000 year storm event. The CCR Rule (§257.82 (a)) requires the analysis of the 1,000-year flood event (inflow design flood) for a significant hazard potential CCR surface impoundment. This analysis was completed to verify compliance with this rule.

OBJECTIVE

The purpose of the following computations and hydrologic model are to determine peak discharges and water surface elevations from the Kincaid Ash Pond during the 1,000-year, 24-hour recurrence interval flood event.

DESIGN BASIS

The watershed was estimated as the area contained to the top of the pond's berms as no other areas drain directly to the ponds. As the plant draws water from the pond and returns it at approximately the same rate, no net inflow from plant operations was considered in the model.

The area-elevation table was prepared utilizing bathymetric and topographic survey data collected during 2015 field investigations.

The rainfall data for the 1000-year, 24-hour storm event was extrapolated from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Version 3 for the specific site location. The 1,000-year storm event was modeled to comply with the CCR Rule.

The model was created using HydroCAD version 10, and utilizes a Soil Conservation Service (SCS) Type II 24-Hour rainfall distribution.

The analysis assumes that the pond is operating at a typical pool elevation of 603.3 feet.

All elevations are NAVD88 unless otherwise noted.

DATA

Kincaid Ash Pond Design Drawings
NOAA Atlas 14, Volume 2, Version 3
2015 Bathymetric Survey
2015 Structure Survey

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NOAA Atlas 14, Volume 2, Version 3
Location name: Pawnee, Illinois, US*
Latitude: 39.5972°, Longitude: -89.4923°
Elevation: 601 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.401 (0.365-0.442)	0.477 (0.435-0.526)	0.566 (0.517-0.624)	0.638 (0.580-0.702)	0.728 (0.660-0.799)	0.800 (0.721-0.878)	0.870 (0.780-0.954)	0.943 (0.842-1.04)	1.04 (0.924-1.15)	1.12 (0.986-1.23)
10-min	0.623 (0.568-0.686)	0.745 (0.679-0.821)	0.880 (0.803-0.970)	0.984 (0.896-1.08)	1.11 (1.01-1.22)	1.21 (1.09-1.33)	1.31 (1.17-1.44)	1.41 (1.26-1.55)	1.53 (1.36-1.68)	1.63 (1.44-1.79)
15-min	0.763 (0.696-0.841)	0.910 (0.830-1.00)	1.08 (0.986-1.19)	1.21 (1.10-1.33)	1.38 (1.25-1.51)	1.50 (1.35-1.65)	1.63 (1.46-1.78)	1.75 (1.56-1.92)	1.92 (1.70-2.10)	2.04 (1.80-2.24)
30-min	1.01 (0.921-1.11)	1.22 (1.11-1.34)	1.48 (1.35-1.63)	1.68 (1.53-1.85)	1.94 (1.76-2.13)	2.15 (1.94-2.36)	2.35 (2.11-2.58)	2.56 (2.28-2.80)	2.84 (2.51-3.11)	3.06 (2.69-3.36)
60-min	1.23 (1.12-1.36)	1.50 (1.36-1.65)	1.86 (1.70-2.05)	2.14 (1.95-2.36)	2.52 (2.28-2.77)	2.83 (2.55-3.10)	3.14 (2.82-3.44)	3.47 (3.10-3.81)	3.92 (3.48-4.30)	4.29 (3.78-4.71)
2-hr	1.47 (1.33-1.62)	1.77 (1.61-1.96)	2.22 (2.02-2.44)	2.57 (2.33-2.82)	3.05 (2.76-3.35)	3.44 (3.10-3.78)	3.85 (3.45-4.22)	4.29 (3.81-4.69)	4.90 (4.33-5.37)	5.41 (4.74-5.93)
3-hr	1.56 (1.42-1.72)	1.88 (1.71-2.08)	2.36 (2.14-2.61)	2.74 (2.48-3.02)	3.28 (2.95-3.61)	3.72 (3.33-4.08)	4.18 (3.73-4.59)	4.69 (4.15-5.15)	5.41 (4.74-5.94)	6.01 (5.22-6.61)
6-hr	1.83 (1.67-2.01)	2.21 (2.02-2.43)	2.76 (2.52-3.03)	3.21 (2.92-3.52)	3.84 (3.47-4.20)	4.35 (3.92-4.76)	4.91 (4.39-5.37)	5.50 (4.89-6.01)	6.35 (5.58-6.94)	7.07 (6.16-7.72)
12-hr	2.15 (1.98-2.34)	2.59 (2.39-2.83)	3.22 (2.96-3.51)	3.72 (3.42-4.05)	4.43 (4.05-4.82)	5.01 (4.55-5.44)	5.62 (5.08-6.10)	6.27 (5.64-6.81)	7.21 (6.42-7.83)	7.99 (7.05-8.68)
24-hr	2.49 (2.31-2.69)	3.01 (2.80-3.25)	3.76 (3.50-4.06)	4.35 (4.03-4.69)	5.15 (4.76-5.55)	5.78 (5.34-6.22)	6.43 (5.92-6.92)	7.11 (6.53-7.65)	8.05 (7.36-8.66)	8.80 (8.02-9.48)
2-day	2.88 (2.67-3.10)	3.47 (3.23-3.75)	4.32 (4.02-4.67)	4.98 (4.63-5.37)	5.87 (5.44-6.32)	6.57 (6.07-7.08)	7.29 (6.72-7.85)	8.03 (7.39-8.64)	9.06 (8.30-9.74)	9.87 (9.02-10.6)
3-day	3.08 (2.86-3.30)	3.71 (3.46-3.99)	4.61 (4.30-4.96)	5.31 (4.94-5.70)	6.24 (5.79-6.70)	6.97 (6.46-7.48)	7.72 (7.14-8.28)	8.48 (7.82-9.10)	9.52 (8.76-10.2)	10.3 (9.49-11.1)
4-day	3.28 (3.06-3.51)	3.95 (3.69-4.24)	4.90 (4.58-5.26)	5.63 (5.25-6.04)	6.61 (6.15-7.08)	7.37 (6.85-7.89)	8.14 (7.55-8.72)	8.93 (8.26-9.56)	9.99 (9.22-10.7)	10.8 (9.96-11.6)
7-day	3.87 (3.62-4.12)	4.64 (4.36-4.96)	5.69 (5.33-6.08)	6.47 (6.06-6.91)	7.49 (7.00-7.99)	8.28 (7.72-8.83)	9.06 (8.44-9.66)	9.85 (9.18-10.5)	10.9 (10.1-11.6)	11.7 (10.8-12.5)
10-day	4.38 (4.12-4.66)	5.26 (4.95-5.60)	6.40 (6.02-6.82)	7.25 (6.81-7.72)	8.37 (7.84-8.90)	9.22 (8.63-9.80)	10.1 (9.40-10.7)	10.9 (10.2-11.6)	12.0 (11.2-12.8)	12.9 (12.0-13.7)
20-day	5.97 (5.65-6.31)	7.14 (6.75-7.57)	8.61 (8.13-9.11)	9.67 (9.13-10.2)	11.0 (10.4-11.7)	12.1 (11.4-12.8)	13.1 (12.3-13.8)	14.1 (13.2-14.9)	15.4 (14.5-16.3)	16.4 (15.4-17.4)
30-day	7.36 (6.99-7.76)	8.79 (8.35-9.28)	10.5 (9.96-11.1)	11.7 (11.1-12.3)	13.3 (12.5-14.0)	14.4 (13.6-15.2)	15.5 (14.6-16.4)	16.6 (15.6-17.6)	18.1 (17.0-19.1)	19.2 (17.9-20.2)
45-day	9.23 (8.78-9.70)	11.0 (10.5-11.6)	13.0 (12.4-13.7)	14.4 (13.7-15.1)	16.2 (15.4-17.0)	17.5 (16.6-18.4)	18.8 (17.8-19.7)	20.0 (18.9-21.0)	21.6 (20.4-22.7)	22.8 (21.5-24.0)
60-day	10.9 (10.3-11.4)	12.9 (12.3-13.6)	15.2 (14.5-16.0)	16.8 (16.0-17.7)	18.8 (17.9-19.8)	20.3 (19.3-21.3)	21.7 (20.6-22.8)	23.1 (21.9-24.3)	24.9 (23.5-26.2)	26.2 (24.8-27.6)

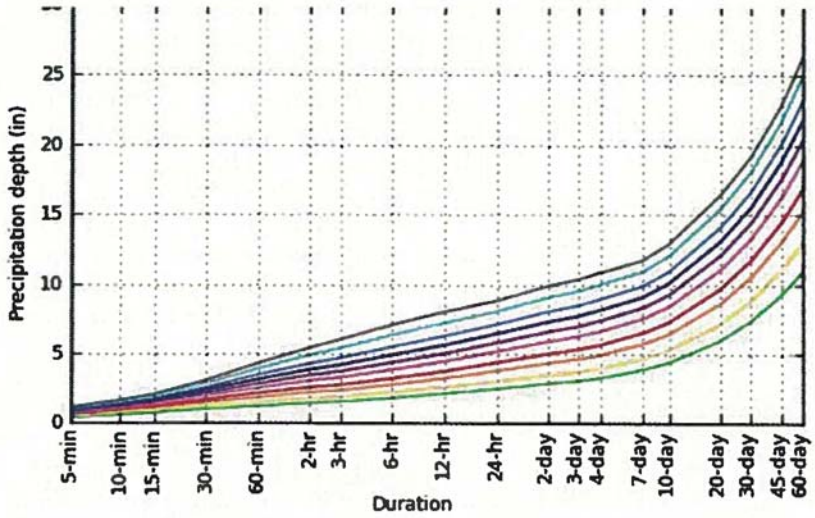
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

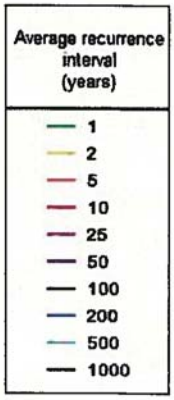
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

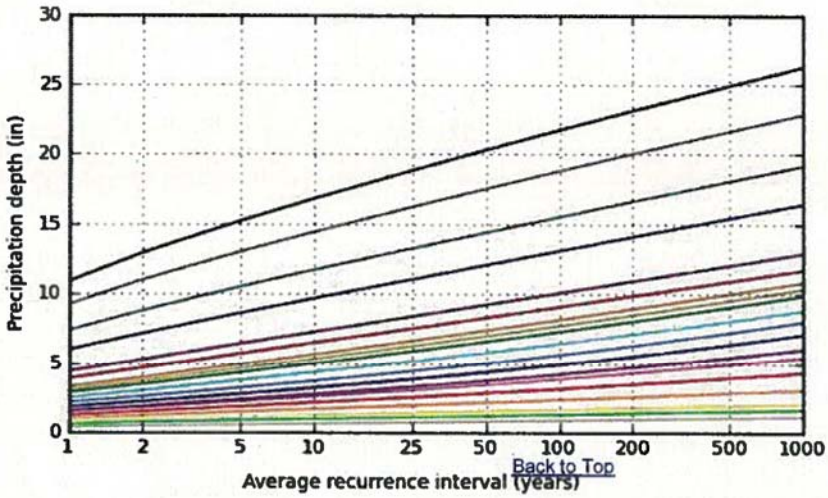
Please refer to NOAA Atlas 14 document for more information.

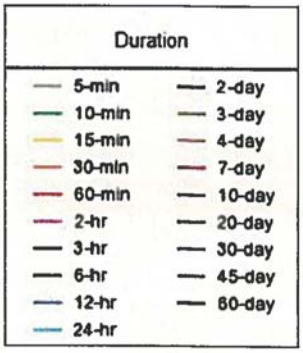
Back to Top

PF graphical









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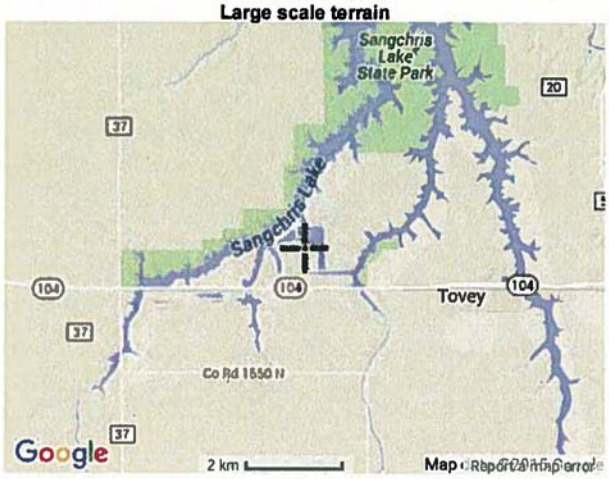
Maps & aerials

NOAA Atlas 14, Volume 2, Version 3

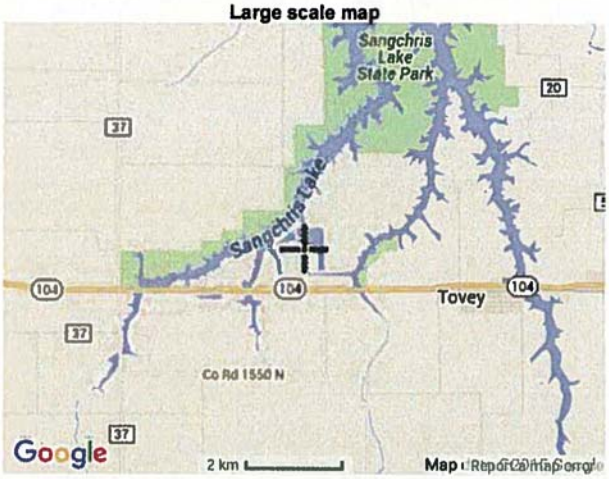
Created (GMT): Mon Oct 19 21:35:30 2015

Small scale terrain

Large scale terrain



Large scale map



Large scale aerial

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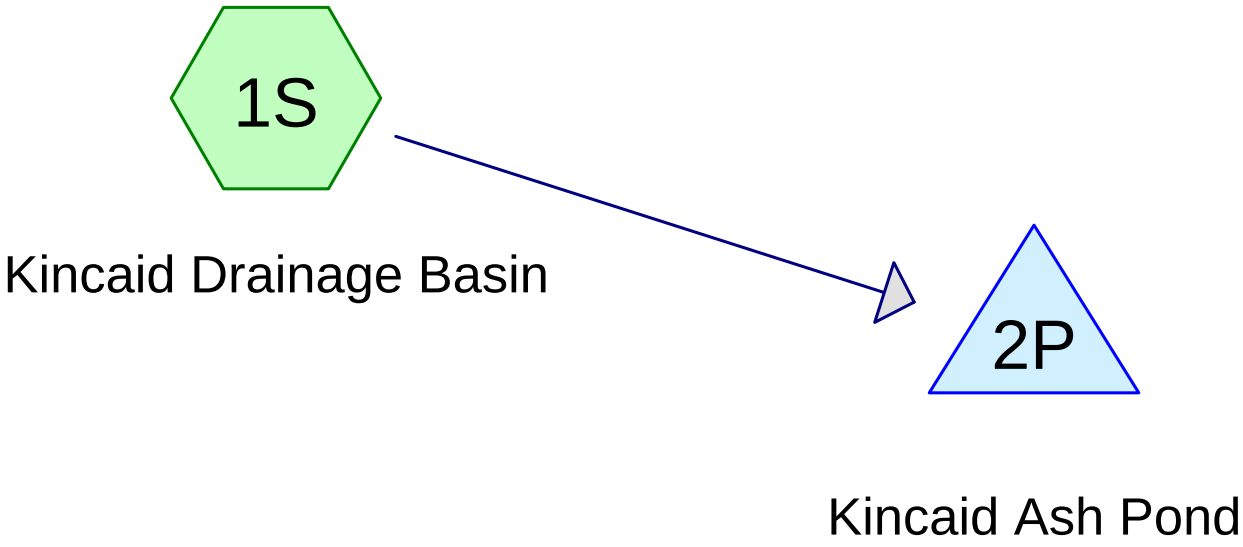
US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910

Name **Project**

Area Capacity Curve

Elevation	Area (ft^2)	Area (acres)	Delta V	Volume (AF)	Depth (ft)
595	445.5523	0.0		-	0
596	14804.621	0.3	0	0	1
597	71053.942	1.6	1	1	2
598	354939.88	8.1	4	6	3
599	595543.96	13.7	11	16	4
600	1639842.7	37.6	25	41	5
601	1818796.6	41.8	40	81	6
602	2048781.8	47.0	44	125	7
603	2314111.2	53.1	50	175	8
604	2579413.9	59.2	56	231	9
605	3252028.6	74.7	67	298	10
606	3998804.1	91.8	83	381	11
607	4238692.6	97.3	95	476	12
608	4434586.5	101.8	100	575	13
609	4618076.5	106.0	104	679	14
610	4841878.6	111.2	109	788	15
611	4947117.9	113.6	112	900	16
612	5039239.5	115.7	115	1,015	17
613	5137502.7	117.9	117	1,131	18
614	5227948	120.0	119	1,250	19
615	5326321.7	122.3	121	1,372	20
616	5443147.2	125.0	124	1,495	21
617	5649239.7	129.7	127	1,622	22
618	6096480.7	140.0	135	1,757	23
619	6413584.6	147.2	144	1,901	24
620	6741204.2	154.8	151	2,052	25

DRAFT-Attorney Client Privileged



Subcat Reach Pond Link

Routing Diagram for Dynegy Kincaid H&H Summary Analysis-Zero Process Outflow-WeirFlow

Prepared by AECOM, Printed 7/1/2016

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Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
178.000	98	Water Surface and Impervious Ash (1S)

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
178.000	Other	1S

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchmer Numbers
0.000	0.000	0.000	0.000	178.000	178.000	Water Surface and Impervious Ash	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	591.96	588.71	2,000.0	0.0016	0.012	60.0	0.0	0.0
2	2P	590.96	590.00	158.0	0.0061	0.025	48.0	0.0	0.0

Summary for Subcatchment 1S: Kincaid Drainage Basin

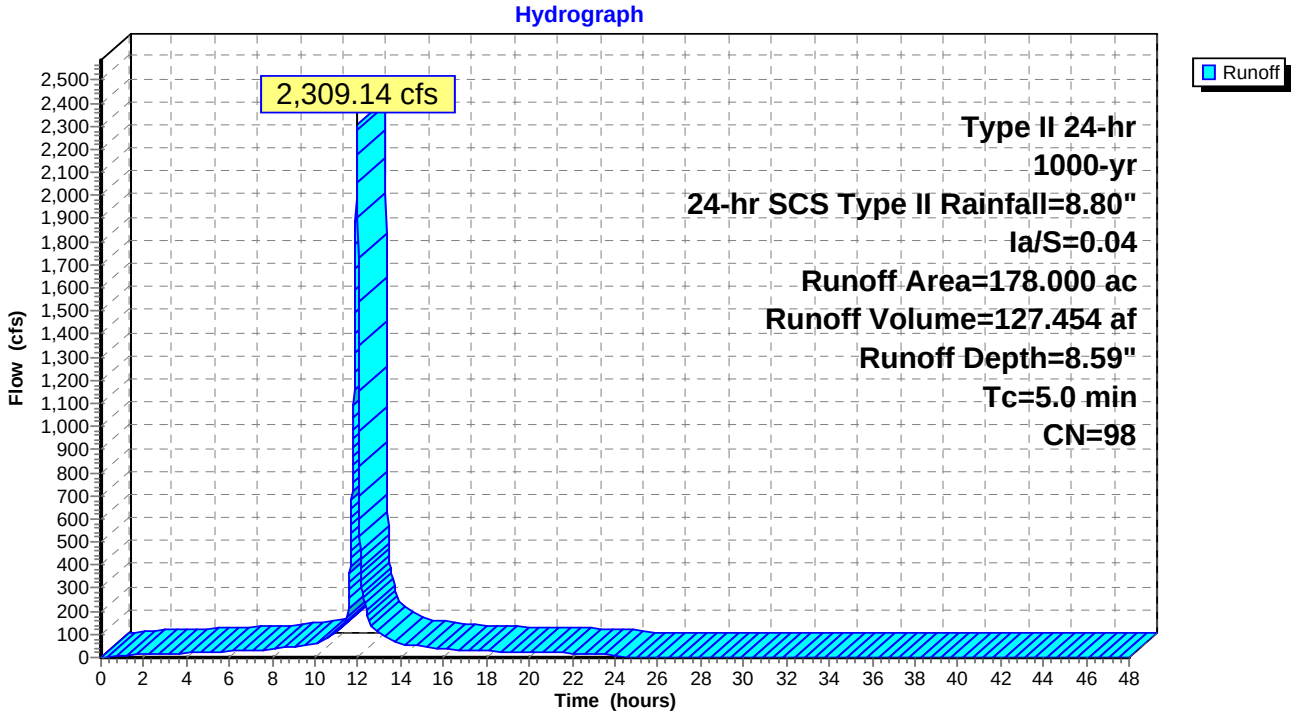
Runoff = 2,309.14 cfs @ 11.96 hrs, Volume= 127.454 af, Depth= 8.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Type II 24-hr 1000-yr, 24-hr SCS Type II Rainfall=8.80", Ia/S=0.04

	Area (ac)	CN	Description
*	178.000	98	Water Surface and Impervious Ash
	178.000		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Rainfall Directly Into Impoundment**

Subcatchment 1S: Kincaid Drainage Basin



Hydrograph for Subcatchment 1S: Kincaid Drainage Basin

Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)	Time (hours)	Precip. (inches)	Excess (inches)	Runoff (cfs)
0.00	0.00	0.00	0.00	26.00	8.80	8.59	0.00
0.50	0.05	0.01	3.92	26.50	8.80	8.59	0.00
1.00	0.09	0.02	8.14	27.00	8.80	8.59	0.00
1.50	0.14	0.05	11.14	27.50	8.80	8.59	0.00
2.00	0.19	0.09	13.44	28.00	8.80	8.59	0.00
2.50	0.25	0.13	15.30	28.50	8.80	8.59	0.00
3.00	0.30	0.17	16.88	29.00	8.80	8.59	0.00
3.50	0.36	0.22	18.27	29.50	8.80	8.59	0.00
4.00	0.42	0.28	19.52	30.00	8.80	8.59	0.00
4.50	0.49	0.34	21.28	30.50	8.80	8.59	0.00
5.00	0.55	0.40	23.12	31.00	8.80	8.59	0.00
5.50	0.63	0.47	24.92	31.50	8.80	8.59	0.00
6.00	0.70	0.54	26.69	32.00	8.80	8.59	0.00
6.50	0.79	0.62	28.44	32.50	8.80	8.59	0.00
7.00	0.87	0.70	30.17	33.00	8.80	8.59	0.00
7.50	0.96	0.79	31.87	33.50	8.80	8.59	0.00
8.00	1.06	0.88	33.56	34.00	8.80	8.59	0.00
8.50	1.16	0.98	40.46	34.50	8.80	8.59	0.00
9.00	1.29	1.11	48.36	35.00	8.80	8.59	0.00
9.50	1.43	1.25	49.72	35.50	8.80	8.59	0.00
10.00	1.59	1.40	60.40	36.00	8.80	8.59	0.00
10.50	1.80	1.60	78.33	36.50	8.80	8.59	0.00
11.00	2.07	1.87	107.91	37.00	8.80	8.59	0.00
11.50	2.49	2.29	**176.71**	37.50	8.80	8.59	0.00
12.00	5.83	5.63	**1,904.61**	38.00	8.80	8.59	0.00
12.50	6.47	6.26	165.07	38.50	8.80	8.59	0.00
13.00	6.79	6.59	102.60	39.00	8.80	8.59	0.00
13.50	7.03	6.82	77.58	39.50	8.80	8.59	0.00
14.00	7.22	7.01	60.83	40.00	8.80	8.59	0.00
14.50	7.37	7.16	53.72	40.50	8.80	8.59	0.00
15.00	7.51	7.30	48.20	41.00	8.80	8.59	0.00
15.50	7.64	7.43	42.68	41.50	8.80	8.59	0.00
16.00	7.74	7.54	37.15	42.00	8.80	8.59	0.00
16.50	7.84	7.64	34.63	42.50	8.80	8.59	0.00
17.00	7.94	7.73	32.66	43.00	8.80	8.59	0.00
17.50	8.02	7.82	30.69	43.50	8.80	8.59	0.00
18.00	8.10	7.90	28.72	44.00	8.80	8.59	0.00
18.50	8.18	7.97	26.74	44.50	8.80	8.59	0.00
19.00	8.25	8.04	24.77	45.00	8.80	8.59	0.00
19.50	8.32	8.11	22.80	45.50	8.80	8.59	0.00
20.00	8.38	8.17	20.82	46.00	8.80	8.59	0.00
20.50	8.43	8.23	20.19	46.50	8.80	8.59	0.00
21.00	8.49	8.28	19.79	47.00	8.80	8.59	0.00
21.50	8.54	8.34	19.40	47.50	8.80	8.59	0.00
22.00	8.60	8.39	19.00	48.00	8.80	8.59	0.00
22.50	8.65	8.44	18.61				
23.00	8.70	8.49	18.21				
23.50	8.75	8.54	17.82				
24.00	**8.80**	**8.59**	17.42				
24.50	8.80	8.59	0.00				
25.00	8.80	8.59	0.00				
25.50	8.80	8.59	0.00				

Summary for Pond 2P: Kincaid Ash Pond

This analysis assumes no water is being drawn from the lake during the 1000-year storm event through the 60-inch recycling pipe. When the recycling pipe is in operation, a matching inflow to the pond of 174.33 cfs offset the outflow from the pipe at normal pool of 603.5.

Inflow Area = 178.000 ac,100.00% Impervious, Inflow Depth = 8.59" for 1000-yr, 24-hr SCS Type II event
Inflow = 2,309.14 cfs @ 11.96 hrs, Volume= 127.454 af
Outflow = 19.07 cfs @ 21.91 hrs, Volume= 40.471 af, Atten= 99%, Lag= 597.5 min
Primary = 19.07 cfs @ 21.91 hrs, Volume= 40.471 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 603.30' Surf.Area= 2,393,702 sf Storage= 8,407,770 cf
Peak Elev= 605.05' @ 21.91 hrs Surf.Area= 3,290,004 sf Storage= 13,230,418 cf (4,822,648 cf above start)

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= 928.2 min (1,660.7 - 732.5)

Volume	Invert	Avail.Storage	Storage Description
#1	592.50'	34,401,196 cf	**Custom Stage Data (Prismatic)**Listed below (Recalc)

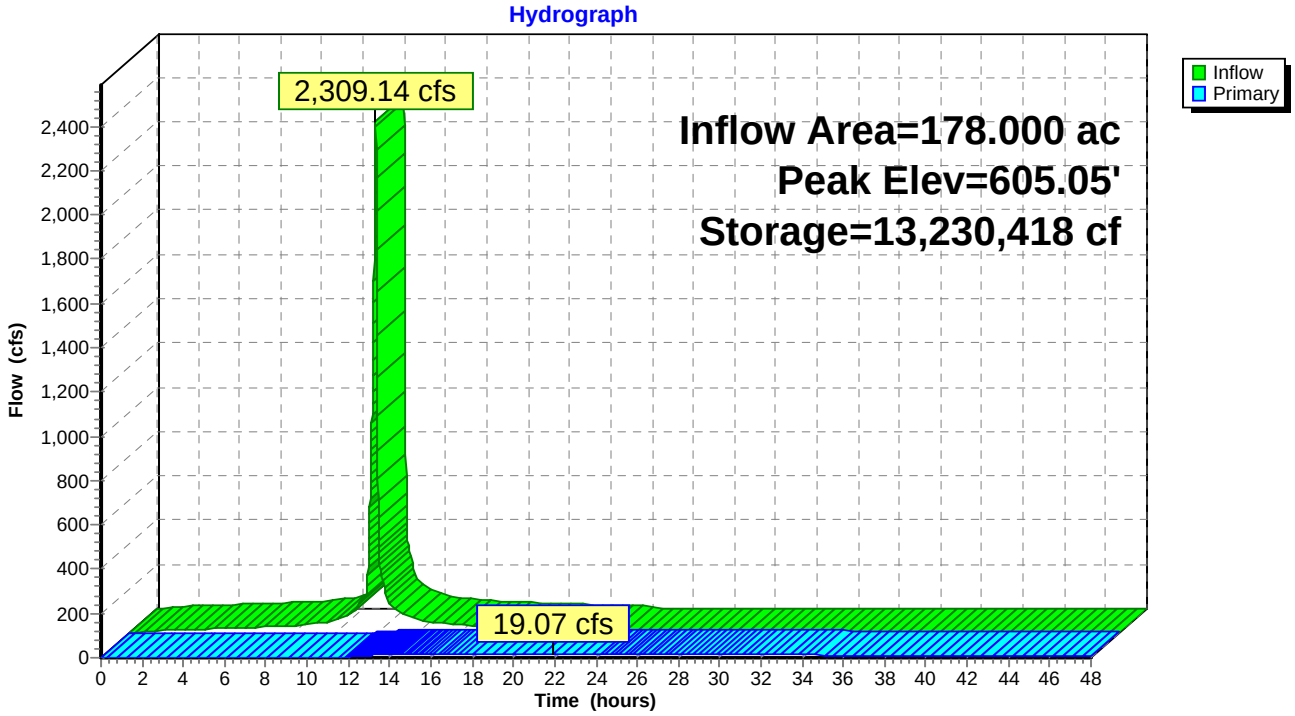
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
592.50	0	0	0
595.00	446	558	558
596.00	14,804	7,625	8,183
597.00	71,053	42,929	51,111
598.00	354,940	212,997	264,108
599.00	595,544	475,242	739,350
600.00	1,639,843	1,117,694	1,857,043
601.00	1,818,797	1,729,320	3,586,363
602.00	2,048,781	1,933,789	5,520,152
603.00	2,314,111	2,181,446	7,701,598
604.00	2,579,413	2,446,762	10,148,360
605.00	3,252,029	2,915,721	13,064,081
606.00	3,998,804	3,625,417	16,689,498
607.00	4,238,693	4,118,749	20,808,246
608.00	4,434,587	4,336,640	25,144,886
609.00	4,618,077	4,526,332	29,671,218
610.00	4,841,879	4,729,978	34,401,196

Device	Routing	Invert	Outlet Devices
#1	Primary	591.96'	**60.0" Round Culvert X 0.00** L= 2,000.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 591.96' / 588.71' S= 0.0016 '/' Cc= 0.900 n= 0.012 Steel, smooth, Flow Area= 19.63 sf
#2	Primary	590.96'	**48.0" Round Culvert** L= 158.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 590.96' / 590.00' S= 0.0061 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 12.57 sf
#3	Device 2	597.21'	**36.0" Vert. Orifice/Grate X 0.00** C= 0.600

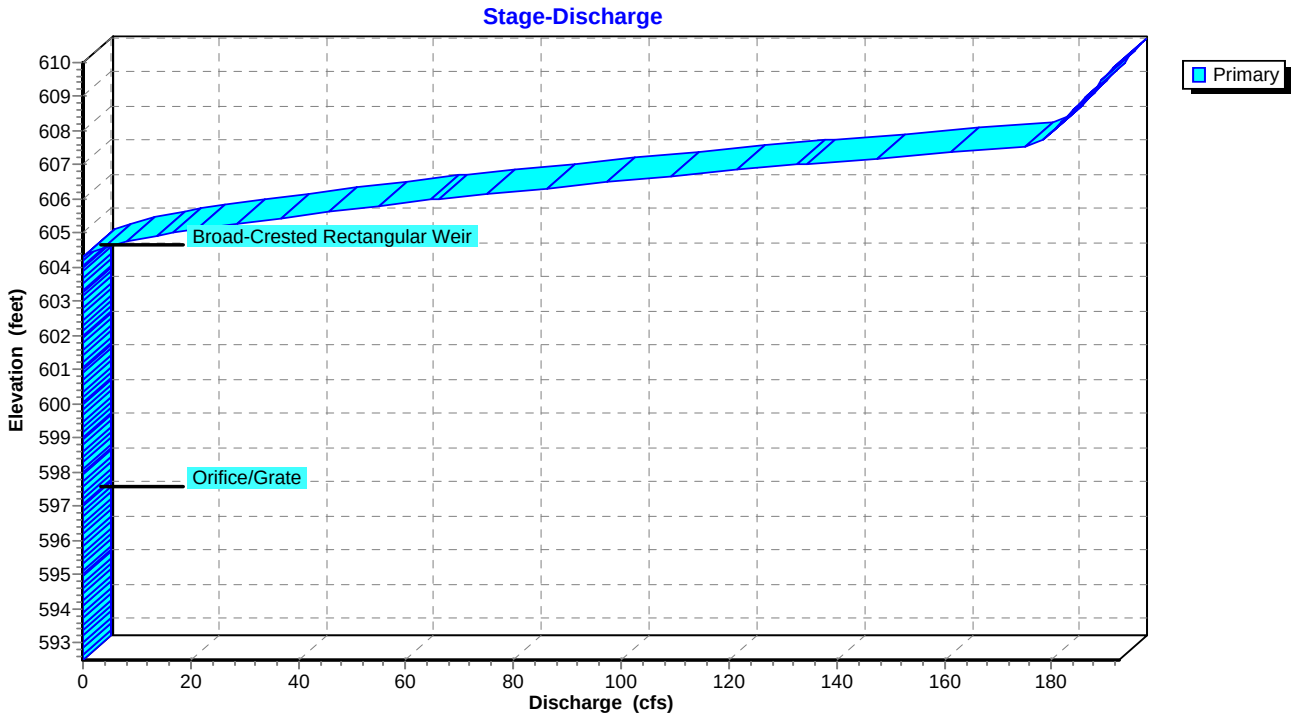
#4 Device 2 604.30' **9.0' long x 0.5' breadth Broad-Crested Rectangular Weir**
Head (feet) 0.20 0.40 0.60 0.80 1.00
Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=19.01 cfs @ 21.91 hrs HW=605.05' (Free Discharge)
- **1=Culvert** (Controls 0.00 cfs)
- **2=Culvert** (Passes 19.01 cfs of 159.99 cfs potential flow)
  - **3=Orifice/Grate** (Controls 0.00 cfs)
  - **4=Broad-Crested Rectangular Weir** (Weir Controls 19.01 cfs @ 2.81 fps)

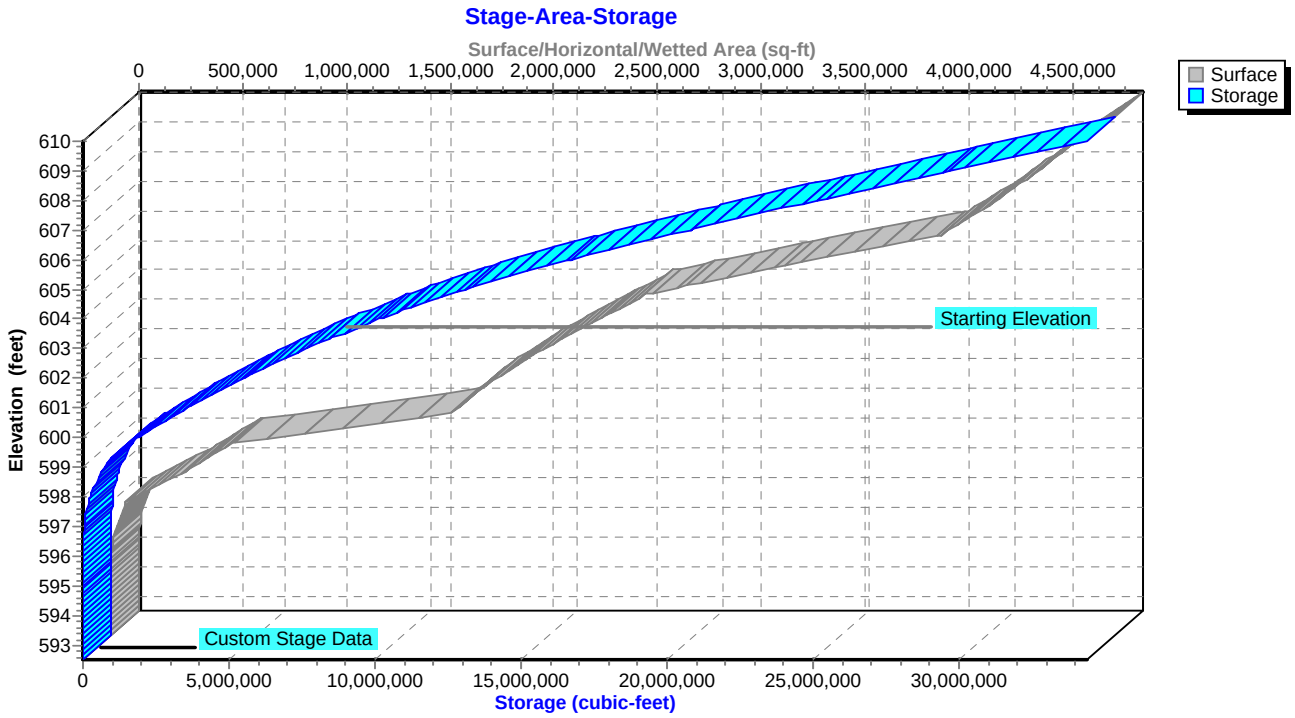
Pond 2P: Kincaid Ash Pond



Pond 2P: Kincaid Ash Pond



Pond 2P: Kincaid Ash Pond



Hydrograph for Pond 2P: Kincaid Ash Pond

Time (hours)	Inflow (cfs)	Storage (cubic-feet)	Elevation (feet)	Primary (cfs)
0.00	0.00	8,407,770	603.30	0.00
1.00	8.14	8,421,351	603.31	0.00
2.00	13.44	8,461,039	603.32	0.00
3.00	16.88	8,515,952	603.35	0.00
4.00	19.52	8,581,633	603.37	0.00
5.00	23.12	8,658,254	603.40	0.00
6.00	26.69	8,747,961	603.44	0.00
7.00	30.17	8,850,344	603.48	0.00
8.00	33.56	8,965,084	603.53	0.00
9.00	48.36	9,110,957	603.59	0.00
10.00	60.40	9,297,834	603.66	0.00
11.00	**107.91**	9,588,192	603.78	0.00
12.00	**1,904.61**	11,669,945	604.55	3.28
13.00	102.60	12,603,603	604.86	11.52
14.00	60.83	12,841,051	604.93	14.05
15.00	48.20	12,980,855	604.97	15.78
16.00	37.15	13,075,409	605.00	16.97
17.00	32.66	13,137,530	605.02	17.81
18.00	28.72	13,182,753	605.04	18.42
19.00	24.77	13,211,968	605.04	18.81
20.00	20.82	13,225,932	605.05	19.00
21.00	19.79	**13,230,143**	**605.05**	**19.05**
22.00	19.00	**13,231,341**	**605.05**	**19.07**
23.00	18.21	13,229,710	605.05	19.05
24.00	17.42	13,225,384	605.05	18.99
25.00	0.00	13,163,275	605.03	18.15
26.00	0.00	13,099,488	605.01	17.29
27.00	0.00	13,038,702	604.99	16.50
28.00	0.00	12,980,605	604.97	15.78
29.00	0.00	12,925,040	604.96	15.09
30.00	0.00	12,871,897	604.94	14.44
31.00	0.00	12,821,070	604.92	13.81
32.00	0.00	12,772,287	604.91	13.30
33.00	0.00	12,725,316	604.89	12.80
34.00	0.00	12,680,087	604.88	12.33
35.00	0.00	12,636,537	604.87	11.87
36.00	0.00	12,594,603	604.85	11.43
37.00	0.00	12,554,225	604.84	11.01
38.00	0.00	12,515,345	604.83	10.60
39.00	0.00	12,477,908	604.82	10.20
40.00	0.00	12,441,861	604.80	9.83
41.00	0.00	12,407,151	604.79	9.46
42.00	0.00	12,373,729	604.78	9.11
43.00	0.00	12,341,547	604.77	8.77
44.00	0.00	12,310,560	604.76	8.45
45.00	0.00	12,280,723	604.75	8.13
46.00	0.00	12,251,934	604.74	7.88
47.00	0.00	12,223,995	604.73	7.65
48.00	0.00	12,196,871	604.73	7.42

Stage-Discharge for Pond 2P: Kincaid Ash Pond

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
592.50	0.00	602.90	0.00
592.70	0.00	603.10	0.00
592.90	0.00	603.30	0.00
593.10	0.00	603.50	0.00
593.30	0.00	603.70	0.00
593.50	0.00	603.90	0.00
593.70	0.00	604.10	0.00
593.90	0.00	604.30	0.00
594.10	0.00	604.50	2.25
594.30	0.00	604.70	6.65
594.50	0.00	604.90	12.88
594.70	0.00	605.10	21.25
594.90	0.00	605.30	29.88
595.10	0.00	605.50	39.28
595.30	0.00	605.70	49.50
595.50	0.00	605.90	60.47
595.70	0.00	606.10	72.16
595.90	0.00	606.30	84.51
596.10	0.00	606.50	97.50
596.30	0.00	606.70	111.10
596.50	0.00	606.90	125.27
596.70	0.00	607.10	140.00
596.90	0.00	607.30	155.26
597.10	0.00	607.50	171.04
597.30	0.00	607.70	178.13
597.50	0.00	607.90	179.43
597.70	0.00	608.10	180.72
597.90	0.00	608.30	181.99
598.10	0.00	608.50	183.26
598.30	0.00	608.70	184.52
598.50	0.00	608.90	185.77
598.70	0.00	609.10	187.01
598.90	0.00	609.30	188.25
599.10	0.00	609.50	189.48
599.30	0.00	609.70	190.69
599.50	0.00	609.90	**191.90**
599.70	0.00		
599.90	0.00		
600.10	0.00		
600.30	0.00		
600.50	0.00		
600.70	0.00		
600.90	0.00		
601.10	0.00		
601.30	0.00		
601.50	0.00		
601.70	0.00		
601.90	0.00		
602.10	0.00		
602.30	0.00		
602.50	0.00		
602.70	0.00		

Stage-Area-Storage for Pond 2P: Kincaid Ash Pond

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
592.50	0	0
592.70	36	4
592.90	71	14
593.10	107	32
593.30	143	57
593.50	178	89
593.70	214	128
593.90	250	175
594.10	285	228
594.30	321	289
594.50	357	357
594.70	392	432
594.90	428	514
595.10	1,882	674
595.30	4,753	1,337
595.50	7,625	2,575
595.70	10,497	4,387
595.90	13,368	6,774
596.10	20,429	9,944
596.30	31,679	15,155
596.50	42,929	22,616
596.70	54,178	32,326
596.90	65,428	44,287
597.10	99,442	59,636
597.30	156,219	85,202
597.50	212,997	122,123
597.70	269,774	170,400
597.90	326,551	230,033
598.10	379,000	300,805
598.30	427,121	381,417
598.50	475,242	471,653
598.70	523,363	571,513
598.90	571,484	680,998
599.10	699,974	804,125
599.30	908,834	965,006
599.50	1,117,694	1,167,659
599.70	1,326,553	1,412,084
599.90	1,535,413	1,698,280
600.10	1,657,738	2,021,922
600.30	1,693,529	2,357,049
600.50	1,729,320	2,699,334
600.70	1,765,111	3,048,777
600.90	1,800,902	3,405,378
601.10	1,841,795	3,769,393
601.30	1,887,792	4,142,351
601.50	1,933,789	4,524,510
601.70	1,979,786	4,915,867
601.90	2,025,783	5,316,424
602.10	2,075,314	5,726,357
602.30	2,128,380	6,146,726
602.50	2,181,446	6,577,709
602.70	2,234,512	7,019,305
602.90	2,287,578	7,471,514
603.10	2,340,641	7,934,336
603.30	2,393,702	8,407,770
603.50	2,446,762	8,891,816
603.70	2,499,822	9,386,475
603.90	2,552,883	9,891,745
604.10	2,646,675	10,409,664
604.30	2,781,198	10,952,452
604.50	2,915,721	11,522,144
604.70	3,050,244	12,118,740
604.90	3,184,767	12,742,241
605.10	3,326,707	13,393,018
605.30	3,476,061	14,073,295
605.50	3,625,417	14,783,442
605.70	3,774,772	15,523,461
605.90	3,924,126	16,293,351
606.10	4,022,793	17,090,577
606.30	4,070,771	17,899,934
606.50	4,118,749	18,718,886
606.70	4,166,726	19,547,433
606.90	4,214,704	20,385,576
607.10	4,258,282	21,233,095
607.30	4,297,461	22,088,669
607.50	4,336,640	22,952,079
607.70	4,375,819	23,823,325
607.90	4,414,998	24,702,407
608.10	4,452,936	25,589,262
608.30	4,489,634	26,483,519
608.50	4,526,332	27,385,116
608.70	4,563,030	28,294,052
608.90	4,599,728	29,210,328
609.10	4,640,457	30,134,145
609.30	4,685,218	31,066,712
609.50	4,729,978	32,008,232
609.70	4,774,738	32,958,703
609.90	**4,819,499**	**33,918,127**

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October 2021

AECOM

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Kincaid, IL 62540

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October 2016

CCR Rule Report: Initial Safety Factor Assessment

For

Kincaid Ash Pond

At Kincaid Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the Kincaid Ash Pond at the Kincaid Generation, LLC Kincaid Power Station meets the safety factor assessment requirements specified in 40 Code of Federal Regulations (CFR) §257.73(e). The Kincaid Ash Pond is located near Kincaid, Illinois in Christian County, approximately 0.1 miles northeast of the Kincaid Power Station. The Kincaid Ash Pond serves as the wet impoundment basin for CCR produced by the Kincaid Power Station.

The Kincaid Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial safety factor assessment for an existing CCR surface impoundment be completed by October 17, 2016.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the initial safety factor assessment meets the requirements of 40 CFR § 257.73(e). The owner or operator must prepare a safety factor assessment every five years.

2 Initial Safety Factor Assessment

40 CFR §257.73(e)(1)
The owner or operator must conduct initial and periodic safety factor assessments for each CCR unit and document whether the calculated factors of safety for each CCR unit achieve the minimum safety factors specified in (e)(1)(i) through (iv) of this section for the critical cross section of the embankment. The critical cross section is the cross section anticipated to be the most susceptible of all cross sections to structural failure based on appropriate engineering considerations, including loading conditions. The safety factor assessments must be supported by appropriate engineering calculations.

(i) The calculated static factor of safety under the long-term, maximum storage pool loading condition must equal or exceed 1.50.

(ii) The calculated static factor of safety under the maximum surcharge pool loading condition must equal or exceed 1.40.

(iii) The calculated seismic factor of safety must equal or exceed 1.00.

(iv) For dikes constructed of soils that have susceptibility to liquefaction, the calculated liquefaction factor of safety must equal or exceed 1.20.

A geotechnical investigation program and stability analyses were performed to evaluate the design, performance, and condition of the earthen dikes of the Kincaid Ash Pond. The exploration consisted of hollow-stem auger borings, cone penetration tests, installation of piezometers, and laboratory program including strength, hydraulic conductivity, consolidation, and index testing. Data collected from the geotechnical investigation, available design drawings, construction records, inspection reports, previous engineering investigations, and other pertinent historic documents were utilized to perform the safety factor assessment and geotechnical analyses.

In general, the subsurface conditions at the Kincaid Ash Pond consist of medium stiff to very stiff embankment fill (clay) overlying soft to very stiff clay foundation soils, which in turn overlies hard glacial till (clay). Phreatic water is typically at or slightly above the embankment/foundation interface.

Five (5) representative cross sections were analyzed using limit equilibrium slope stability analysis software to evaluate stability of the perimeter dike system and foundations. The cross sections were located to represent critical surface geometry, subsurface stratigraphy, and phreatic conditions across the site. Each cross section was evaluated for each of the loading conditions stipulated in §257.73(e)(1).

The Soils Susceptible to Liquefaction loading condition, §257.73(e)(1)(iv), was not evaluated because a liquefaction susceptibly evaluation did not find soils susceptible to liquefaction within the Kincaid Ash Pond dikes. As a result, this loading condition is not applicable to the Kincaid Ash Pond.

Results of the Initial Safety Factor Assessments for the critical cross-section for each loading condition are listed in Table 1 (i.e. the table identifies the lowest calculated safety of factor calculated for any one of the five analyzed cross sections for each loading condition).

Table 1 – Summary of Initial Safety Factor Assessments

Loading Conditions	§257.73(e)(1) Subsection	Minimum Factor of Safety	Calculated Factor of Safety
Maximum Storage Pool Loading	(i)	1.50	1.57
Maximum Surcharge Pool Loading	(ii)	1.40	1.57
Seismic	(iii)	1.00	1.27
Soils Susceptible to Liquefaction	(iv)	1.20	Not Applicable

Based on this evaluation, the Kincaid Ash Pond meets the requirements in §257.73(e)(1).

3 Certification Statement

CCR Unit: Kincaid Generation, LLC; Kincaid Power Station; Kincaid Ash Pond

I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial safety factor assessment dated October 13, 2016 meets the requirements of 40 CFR §257.73(e).

VICTOR A MODEER
Printed Name

10/13/16
Date

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October 2021

AECOM

Submitted to
Kincaid Generation, LLC
199 Route 104
Kincaid, IL 62540

Submitted by
AECOM
1001 Highlands Plaza Drive West
Suite 300
St. Louis, MO 63110

October 2016

CCR Rule Report: Initial Inflow Design Flood Control System Plan

For

Kincaid Ash Pond

At Kincaid Power Station

1 Introduction

This Coal Combustion Residual (CCR) Rule Report documents that the initial inflow design flood control system plan for Kincaid Ash Pond at the Kincaid Generation, LLC Kincaid Power Station meets the requirements specified in 40 Code of Federal Regulations (CFR) §257.82. The Kincaid Ash Pond is located near Kincaid, Illinois in Christian County, approximately 0.1 miles northeast of the Kincaid Power Station. The Kincaid Ash Pond serves as the wet impoundment basin for CCR produced by the Kincaid Power Station.

The Kincaid Ash Pond is an existing CCR surface impoundment as defined by 40 CFR §257.53. The CCR Rule requires that the initial inflow design flood control system plan for an existing CCR surface impoundment be prepared by October 17, 2016. The plan must document how the inflow design flood control system has been designed and constructed to meet the requirements of 40 CFR §257.82 and be supported by appropriate engineering calculations.

The owner or operator of the CCR unit must obtain a certification from a qualified professional engineer stating that the inflow design flood control system meets the requirements of 40 CFR §257.82. The owner or operator must prepare an inflow design flood control system plan every five years.

2 Initial Inflow Design Flood Control System Plan

40 CFR §257.82
(a) The owner or operator of an existing … CCR surface impoundment … must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (2) of this section.

(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(3) The inflow design flood is:

(i) For a high hazard potential CCR surface impoundment, …, the probable maximum flood;

(ii) For a significant hazard potential CCR surface impoundment, …, the 1,000-year flood;

(iii) For a low hazard potential CCR surface impoundment, …, the 100-year flood; or

(iv) For an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under §257.3-3.

Analyses completed for the initial inflow design flood control system plan of the Kincaid Ash Pond are described in the following subsections. Data and analysis results in the following subsections are based on spillway design information shown on design drawings, construction information, topographic surveys, information about operational and maintenance practices provided by Kincaid Generation, LLC, and field measurements collected by AECOM. The analysis approach and results of the hydrologic and hydraulic analyses are presented in the following subsections.

The Kincaid Ash Pond has a significant hazard potential based on the initial hazard potential classification assessment performed by Stantec in 2016 in accordance with §257.73(a)(2).

2.1 Initial Inflow Design Flood Control Systems (§257.82(a))

An initial inflow design flood control system plan, supported by a hydraulic and hydrologic analysis, was developed for the Kincaid Ash Pond by evaluating the effects of a 24-hour duration design storm for the 1,000-year Inflow Design Flood (IDF) using a hydrologic HydroCAD (Version 10) computer model and a starting water surface elevation of 603.3 feet. The computer model evaluated the Kincaid Ash Pond's ability to collect and control the 1,000-year IDF under existing operational and maintenance procedures. Rainfall data for the 1,000-year IDF was obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14. The NOAA Atlas 14 rainfall depth is 8.80 inches.

The HydroCAD model results for the Kincaid Ash Pond indicate that the CCR unit has sufficient storage capacity and spillway structures to adequately manage (1) flow into the CCR unit during and following the peak discharge of the 1,000-year IDF and (2) flow from the CCR unit to collect and control the peak discharge resulting from the 1,000-year IDF. The peak water surcharge elevation is 605.1 feet during the IDF, and the minimum crest elevation of the Kincaid Ash Pond dike is 605.2 feet. Therefore, overtopping is not expected.

Based on this evaluation, the Kincaid Ash Pond meets the requirements in §257.82(a).

2.2 Discharge from the CCR Unit (§257.82(b))

40 CFR §257.82(b) provides that the discharge from the CCR unit must be handled in accordance with the surface water requirements under 40 CFR §257.3-3, which states the following:

(a) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of pollutants into waters of the United States that is in violation of the requirements of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act, as amended.

(b) For purposes of section 4004(a) of the Act, a facility shall not cause a discharge of dredged material or fill material to waters of the United States that is in violation of the requirements under section 404 of the Clean Water Act, as amended.

(c) A facility or practice shall not cause non-point source pollution of waters of the United States that violates applicable legal requirements implementing an areawide or Statewide water quality management plan that has been approved by the Administrator under section 208 of the Clean Water Act, as amended.

(d) Definitions of the terms Discharge of dredged material, Point source, Pollutant, Waters of the United States, and Wetlands can be found in the Clean Water Act, as amended, 33 U.S.C. 1251 et seq., and implementing regulations, specifically 33 CFR part 323 (42 FR 37122, July 19, 1977).

The handling of discharge was evaluated by reviewing design drawings, operational and maintenance procedures, conditions observed in the field by AECOM, and the inflow design flood control system plan developed per §257.82(a).

Based on this evaluation, outflow from the Kincaid Ash Pond does not discharge into waters of the United States during normal operating conditions. Outflow is transmitted back to the Kincaid Power Station through the recycle intake structure to be recycled for use in plant processes, or is diverted to the onsite wastewater treatment plant and ultimately to Sangchris Lake via a NPDES-permitted outfall. During high-water conditions (a pool elevation of 604.3 feet or higher), outflow from the Kincaid Ash Pond is also routed through the emergency outlet structure and a NPDES-permitted outfall into Sangchris Lake. Hydraulic and hydrologic analyses performed as part of the initial inflow design flood control system plan found that the Kincaid Ash Pond adequately manages outflow during the 1,000-year IDF, as overtopping of the Kincaid Ash Pond embankments is not expected.

Therefore, discharge of pollutants in violation of the NPDES permit is not expected as all discharge is either routed back to the Kincaid Power Station for use in plant operations, is discharged via a NPDES-permitted outfall after treatment, or is routed through the emergency outlet structure and NPDES-permitted outfall to Sangchris Lake, during both normal and IDF conditions. Based on this evaluation, the Kincaid Ash Pond meets the requirements in §257.82(b).

3 Certification Statement

CCR Unit: Kincaid Generation, LLC; Kincaid Power Station; Kincaid Ash Pond

I, Victor A. Modeer, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this CCR Rule Report, and the underlying data in the operating record, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the initial inflow design flood control system plan dated October 13, 2016 meets the requirements of 40 CFR §257.82.

VICTOR A MODEER JR.
Printed Name

10/13/16
Date

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October 2021

PART 845 SAFETY AND HEALTH PLAN

KINCAID POWER PLANT ASH POND

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APPENDICES

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ACRONYMS & ABBREVIATIONS

%	Percent
§	Section
35 I.A.C.	Title 35 of the Illinois Administrative Code
29 C.F.R.	Title 29 of the Code of Federal Regulations
ACGIH	American Conference of Governmental Industrial Hygienists
AP	Ash Pond
CCR	Coal Combustion Residual
HAZWOPER	Hazardous Waste Operations and Emergency Response
ID	identification
IDLH	Immediately Dangerous to Life and Health
IEPA	Illinois Environmental Protection Agency
KGL	Kincaid Generation, LLC
KPP	Kincaid Power Plant
kV	kilovolt
NID	National Inventory of Dams
NIOSH	National Institute for Occupational Safety and Health
No.	number
OSHA	Occupational Safety and Health Administration
Part 845	35 I.A.C. Part 845: Residuals in Surface Impoundments
PEL	Permissible Exposure Level
PFAS	Per- and polyfluoroalkyl substances
PFD	Personal Flotation Device
PNOR	particulates not otherwise recognized
POC	Point of Contact
PPE	personal protective equipment
ppm	parts per million
SDS	Safety Data Sheet
Site	Kincaid Ash Pond
STEL	Short Term Exposure Limit
TLV	Threshold Limit Value
TWA	time-weighted averages
USCG	United States Coast Guard

REVISION SUMMARY

Revision Date	**Description of Changes** (Section title or number – description)	**Responsible Party** (individual name or title, company / agency name, document reference and date)

PREFACE

Kincaid Generation, LLC (KGL) has prepared this Safety and Health Plan in accordance with requirements set forth in Title 35 of the Illinois Administrative Code (35 I.A.C.) Part 845: Residuals in Surface Impoundments (Part 845), Section (§) 845.530. KGL assessed health and safety hazards of its coal combustion residual (CCR) surface impoundments to develop and update this Safety and Health Plan.

This document describes the minimum anticipated protective measures necessary for worker health and safety at the Kincaid Power Plant (KPP) Ash Pond (AP; Vistra identification [ID] number [No.] 141, Illinois Environmental Protection Agency [IEPA] ID No. W0218140002-01, National Inventory of Dams [NID] No. IL50706), herein referred to as the Site. Employees of KGL, contract workers, and third-party contractors must read and comply with the contents of this document. The contents of this document are not intended to cover all situations that may arise nor to waive any provisions specified in Federal, State, and local regulations or site owner / contractor health and safety requirements.

Third-party contractors are accountable for the health and safety of their employees. Third-party contractors are required to prepare a Safety and Health Plan that meets the minimum requirements herein. However, no requirements or provisions within this plan shall be construed as an assumption of KGL of their legal responsibilities as an employer.

This Safety and Health Plan will be reviewed and updated annually, at a minimum. The Safety and Health Plan will also be updated if facility operations change, or a new hazard is identified.

1. INTRODUCTION

This Safety and Health Plan has been developed to outline the requirements to be met by employees of KGL, contract workers, and third-party contractors while performing any activity to construct, operate, or close the AP. This Safety and Health Plan has been developed to meet the requirements of 35 I.A.C. § 845.530 and describes the responsibilities, training requirements, protective equipment, and safety procedures necessary to minimize the risk of injury, fires, explosion, chemical spills, material damage incidents, and near misses related to CCR activities. This Safety and Health Plan incorporates by reference the Occupational Safety and Health Administration (OSHA) regulations contained in Title 29 of the Code of Federal Regulations (29 C.F.R.) § 1910 and 29 C.F.R. § 1926.

The requirements and guidelines in this Safety and Health Plan are based on a review of available information and data, and an evaluation of identified on-site hazards. This Safety and Health Plan will be reviewed with persons assigned to work at the Site and will be available on-site.

1.1 Site Description/History

The KPP is located in the southwest quarter of Section 1, and the northeast quarter of Section 12, Township 13 North, Range 4 West, along West Route 104, Christian County, Illinois and approximately four miles west of the Village of Kincaid. The AP is located between two lobes of Sangchris Lake, which was formed in 1964 by damming Clear Creek, a tributary to the south fork of the Sangamon River. The western lobe of Sangchris Lake forms part of the western and northern border of the AP and is connected to an intake flume for the KPP on the western edge of the AP. A discharge flume from the KPP forms the southern border of Kincaid Ash Pond and is connected to the eastern lobe of Sangchris Lake. The KPP property is surrounded by the lobes of Sangchris Lake and Sangchris Lake State Park to the north and east, and a combination of undeveloped land and surface support facilities associated with the former Peabody Coal Company #10 mine to the south and west (Appendix A).

1.2 Facility Personnel

The following table outlines key facility personnel with respect to facility operations and health and safety. The Plant Control Room is the first point of contact for plant communication, including emergencies.

Name	Position	Phone Number
Tim Arnold	Point-of-Contact (POC)/ Environmental Manager	217-675-7525 Ext. 7525 (internal phone)
Control Room (24/7)		217-675-7551 Ext. 2209 (internal phone)
Ted Lindenbusch	Plant Manager	217-675-7600 Ext. 7600 (internal phone)
Plant Shift Supervisor (24/7)		217-675-7566 217-675-7576
Matthew Gregory	Site Safety Specialist	217-675-7467 Ext. 7467 (internal phone)
David Huber	Plant Tech Specialist	217-675-7359 Ext. 7359 (internal phone)
Matt Ballance	Engineering Manager	618-343-7739 (office) 618-792-7274 (mobile)
Jason Campbell	Dam Safety Manager	217-753-8904 (office) 217-622-3491 (mobile)
Stu Cravens	Senior Technical Expert	217-390-1503 (mobile)
Vic Modeer	Engineering Manager	618-541-0878

1.3 Responsibilities

The following persons have responsibilities associated with communicating and implementing the Safety and Health Plan for the Site.

1.3.1 KGL Point of Contact

The KGL Point of Contact (POC) is a management-level person who is requiring employees, contract workers, or third-party contractors to enter the Site. The KGL POC is responsible to communicate Safety and Health Plan information and requirements to employees, contract workers, and third-party contractors, and oversee work performed at the Site to the extent necessary to confirm implementation of Safety and Health Plan requirements.

1.3.2 KGL Employees

KGL employees are directly hired by KGL. They are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.3 Contract Workers

Contract workers are those hired by KGL through an agency firm. Similar to KGL employees, contract workers are required to implement and/or follow Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.4 Third-Party Contractor Employees

Third-party contractor employees work for firms under contract to KGL. Third-party contractors include prime contractors and all of their lower tier subcontractors. Similar to KGL employees, third-party contractors are required to implement Safety and Health Plan requirements as applicable to their work and exercise their "stop work authority" if safety requirements are unclear or unanticipated site conditions or hazards are observed.

1.3.5 Third-Party Contractor Safety Competent Person

Third-party contractors will be required to designate a Safety Competent Person. The Safety Competent Person must be in a management position (*e.g.,* superintendent, foreman, etc.) with OSHA 30-hour construction safety certification who may perform other duties, unless KGL requires a dedicated Safety Competent Person. A Safety Competent Person must be on site at all times when the subcontractor has employees performing work for KGL and must possess a sound working knowledge of pertinent OSHA regulations, this Safety and Health Plan, and other applicable safety requirements related to the scope of work. Third-party contractors must also designate a backup Safety Competent Person that possesses the same authority and training. The competent person will ensure timely correction of safety deficiencies identified by KGL. The Safety Competent Person is responsible to ensure Safety and Health Plan requirements have been communicated to lower-tier subcontractors and enforce Safety and Health Plan requirements.

2. SITE ACCESS & CONTROL

This section outlines requirements for ensuring that only authorized personnel and visitors are permitted at the Site.

2.1 Facility Security

Elements of site control include restricting access to the Site to persons until they have met the training requirements outlined in this Safety and Health Plan and have been authorized to do so by KPP POC or their representative.

Upon arrival to the site all KGL employees, contract workers, and third-party contractors must check in/out at Security. A COVID-19 screening must also be completed per Section 3.9.

Upon arrival to the Site, all KLG employees, contract workers, and third-party contractors must check in/out at Security. A COVID-19 screening must also be completed per Section 3.9.

2.2 Third-Party Contractor Management

Prior to working at the AP, all third-party prime contractors must maintain an active registration with ISNetworld and maintain a grade of A or B. Lower tier subcontractors are currently not required to be registered in ISNetworld, but this requirement may change at the discretion of KGL.

2.3 Third-Party Contractor Safety and Health Plan

Prior to being authorized to conduct work at the AP, third-party contractors must develop and submit a Safety and Health Plan. The third-party contractor's Safety and Health Plan must be specific to the scope of work that they will be performing at the Site. The third-party contractor's Safety and Health Plan must meet or exceed all the requirements in this Safety and Health Plan, other KGL requirements, and applicable regulations. All lower tier subcontractors of third-party contractors must meet the requirements in this Safety and Health Plan as well as the requirements outlined in the Safety and Health Plan of the third-party with whom they are contracted.

2.4 Authorized Personnel

At a minimum, authorized personnel who will be granted unescorted access to the project include KGL employees, contract workers, and third-party contractors that meet the following:

- Reviewed this Safety and Health Plan and other applicable safety planning documentation
- Have completed all the training, medical surveillance, and drug screen and background investigation requirements as outlined in Section 3 of this Safety and Health Plan.
- Have completed the Site Orientation Training and Ammonia Training.

2.5 Visitors

Visitors must be escorted by Authorized Personnel through the Site if they have not reviewed this Safety and Health Plan or completed the training requirements outlined in Section 3 of this Safety and Health Plan. Visitors may not undertake any activity to construct, operate, or close a CCR surface impoundment.

2.6 Communication

Communication between workers and emergency services must be maintained at all times. Cellular service is not consistently available and cannot be relied upon to summon emergency services. In areas with inconsistent cellular coverage, the following will be implemented:

- Hand held radios will be used to communicate to a central location where a landline or reliable cellular service is available.
- Communication goes through the control room at 217-675-7551

3. TRAINING & MEDICAL REQUIREMENTS

Project personnel must be properly trained for the type of work being performed and in accordance with 35 I.A.C. § 845.530, 29 C.F.R. § 1926 and 29 C.F.R. § 1910, and KGL policies. Additionally, personnel working in areas regulated by the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) must have current medical surveillance. All employees, contractors, and third-party contractors must complete the following prior to beginning any activity to construct, operate, or close the AP.

3.1 HAZWOPER Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors be trained in accordance with 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65. The following training will be completed as required by job function:

- **OSHA 40-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have extensive contact with contaminated materials and/or may be required to wear a respirator.
- **OSHA 24-Hour Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for those personnel who are expected to have minimal contact with contaminated materials and will NOT be required to wear a respirator.
- **OSHA 8-hour Supervisor Training** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, for Site Supervisors, Foremen, Superintendents, and others who will be directing and managing site activities.
- **OSHA 8-hour Refresher** per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65, completed within 12 months of initial 40-hour or 24-hour training and annually thereafter.

The following matrix outlines HAZWOPER training requirements based on typical job functions at KPP AP. It is not intended to be all inclusive, new job functions must be evaluated per 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65.

Training	Job Function
OSHA 40-hour	Ash handlers
OSHA 24-hour	Personnel not required to handle CCR materials
OSHA 8-hour Supervisor Training	Third-Party Contractor Safety Competent Persons
OSHA 8-hour refresher	All personnel

3.2 OSHA Construction Outreach Training

35 I.A.C. § 845.530(c)(2)(E) requires that all employees, contract workers, and third-party contractors complete an OSHA 10-hour or 30-hour construction safety training. These trainings will be completed as follows:

- All employees, contract workers, and third-party contract employees: OSHA 10-hour or 30-hour construction outreach training.
- Supervisors, superintendents, foreman and safety professionals: OSHA 30-hour construction outreach training.

3.3 AP Safety and Health Plan Review

Pursuant to 35 I.A.C. § 845.530(d)(e), before beginning any activity at the Site, and annually thereafter, all KGL employees, contract workers, and third-party contractors must review the content of this HASP. After reviewing this Safety and Health Plan all personnel will understand the following:

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment

- Communications or alarm systems outlined in Section 6
- Response to fires and explosions outlined in Section 6
- Response to a spill or release of CCR
- Information about chemical hazards and hazardous materials outlined in Section 5
- The use of engineering controls, administrative controls, and personal protective equipment (PPE) outlined in Section 4

All personnel will acknowledge this HASP by signing the *Safety and Health Plan Acknowledgment Form (Appendix B).*

3.4 Emergency and Monitoring Equipment Training

All KGL employees, contract workers, and third-party contractors must be aware of how to respond to alarms and other emergencies as outlined in Section 6 of this plan. Individuals may only use facility emergency and monitoring equipment if they have been trained in their use and authorized to do so by the designated POC. Additionally, a written release may need to be completed as required by Vistra Corporate Procedure FFA-POL-0006.

Individual KGL employees and contract workers may be responsible for using, inspecting, repairing and replacing facility emergency monitoring equipment. These individuals will be trained in accordance with procedures identified by KGL. These individuals will review and adhere to the manufacturer's instructions, where applicable.

Third-party contractors are responsible for inspecting, repairing, and replacing any owned emergency (*i.e.*, fire extinguishers) and monitoring equipment (*i.e.*, air monitoring equipment). Third-party contractors will maintain procedures for using, inspecting, repairing, and replacing owned emergency and monitoring equipment that is consistent with the manufacturer's requirements. Third-party contractor employees who are responsible for this equipment will be trained in procedures for using, inspecting, and repairing owned equipment by their employer.

3.5 Ammonia Safety & Emergency Response

The KPP uses anhydrous ammonia in quantities that potentially pose a health risk to persons working on the AP following a major release. All employees, contract workers, and third-party contractors must complete ammonia safety and emergency response training as required and provided by KGL.

3.6 Hazard Communication

All employees, contract workers, and third-party contractors must be trained in chemical hazards (if any) associated with their work in accordance with 29 C.F.R. § 1910.1200. Work tasks performed on the AP may include exposure to compounds identified in the Hazard Communication section of this Safety and Health Plan and is included as part of the Safety and Health Plan Review outlined in Section 3.3.

3.7 Medical Surveillance

All employees, contract workers, and third-party contractors engaged in operations specified in 29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65 and meet one of the criteria outlined in 29 C.F.R. § 1910.120(f)(2) and 29 C.F.R. § 1926.65(f)(2) must participate in a medical surveillance program that is administered by their employer. The criteria for participating in a medical surveillance program are:

- All employees who are or may be exposed to hazardous substances at or above the established permissible exposure limit, without regard to the use of respirators, for 30 days or more a year;
- All employees who wear a respirator for 30 days or more a year; or

- All employees who are injured, become ill or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards from an emergency response or hazardous waste operation.

The medical surveillance program must result in documentation that an individual is cleared to work on sites covered by 29 C.F.R. § 1910.120 and 20 C.F.R. § 1926.65 and is medically fit to wear a respirator when applicable.

3.8 Drug Screen and Background Investigations

KGL requires that contract worker agencies and third-party contractors are responsible for ensuring that all personnel have completed and passed a drug and alcohol test and background investigation prior to on-site work as described in Appendix C.

3.9 COVID-19 Site Entry Guidelines

All personnel entering Vistra work sites shall review and adhere to the site entry guidelines provided in Appendix D.

3.10 Document Management

KGL will maintain employee and contract employee training and medical surveillance records in Human Resources Storage. Third-party contractors are responsible for maintaining training and medical surveillance documentation for their employees. Third-party contractors will produce documentation upon KGL request.

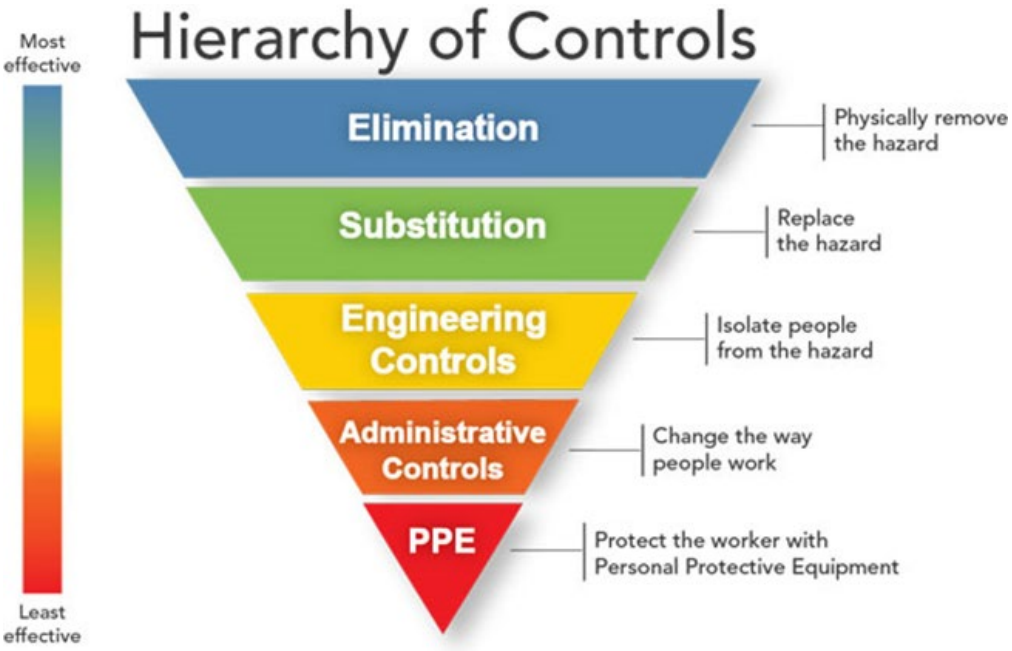
3.11 Industrial Hygiene Sampling Records

Upon receipt of exposure sampling results KGL and third-party contractors must distribute exposure sampling results to employees within 15 business days unless otherwise required by applicable regulation. All personnel exposure sampling results and records must be maintained by the employee’s company for at least 30 years following termination of employment.

4. HAZARD & CONTROLS

The following section outlines general controls for the hazards and controls. Third-party contractors are still responsible for developing a Safety and Health Plan that incorporates requirements of this Safety and Health Plan, other safety requirements for the KPP, as well as the third-party contractor's safety policies and procedures. Safety and Health Plans developed by third-party contractors must be specific to the site and the anticipated work means and methods. Safety and Health Plans that consist of only standard operating procedures or are not otherwise specific to the work performed at the Site will not be accepted by KGL.

KGL requires that a hierarchy of controls be considered when performing work at the AP. Implement controls that favor elimination, substitution, and engineering over the use of administrative controls and PPE when feasible. See the figure below for additional guidance (courtesy of the National Institute for Occupational Safety and Health [NIOSH]).



4.1 Ash/Unstable Surfaces

Prior to working in or on the AP, third-party contractors must notify the facility Environmental Manager, who will then contact the Plant Manager for approval. Work in or on the AP may not begin until the Plant Manager has approved the work. Upon completion of the work, third-party contractors must notify the Environmental Manager that they have left the ash pond.

When working on ash ponds or unstable surfaces the following requirements must be implemented where applicable and feasible. The following table summarizes safety controls for work performed in ash ponds and on unstable surfaces and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Use the lightest available tracked equipment to reduce ground pressure	Use crane mats or other cribbing to support heavy equipment on ash ponds	Traverse compacted paths that have previously been used by heavy equipment	Use a restraint (tethering) system to prevent falls or slips into unstable ash pond surfaces or surface water that represents a drowning hazard

Elimination	Substitution	Engineering	Administrative	PPE
			If an unstable condition exists, complete a Next Level Up Pre-Job Brief prior to accessing the ash pond.	
			Approach the ash pond from the most stable direction	
			Inspect travel paths for recent terrain shifts, particularly following heavy rains or rapid dewatering	
			Working alone on ash ponds is prohibited without pre-approval from the POC.	
			When a drowning hazard exists, implement requirements for working on/near water as outlined in Section 4.4.	
			Implement an emergency response plan with trained responders for falls into (or engulfment by) ash	

4.2 Ash Inhalation/Airborne Exposure

Ash that becomes airborne due to site activities or environmental conditions may result in an exposure to its components as outlined in Section 5.1. KGL and third-party contractors are responsible for ensuring their respective employees' and contract workers' exposures are below occupational exposure limits. Upon request, third-party contractors must demonstrate to KGL that exposure control methods are adequate. The following table summarizes airborne exposure controls and is aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Substitute manual work methods for those that can be completed from the cab of a vehicle	Continually wet work areas to reduce the amount of ash that becomes airborne Equip vehicles and heavy equipment cabs with filters. Clean and change filters as required	Conduct air monitoring or exposure sampling to confirm that airborne exposure is below regulatory limits	If exposure levels are above the PEL, equip employees with respirators appropriate to the level of exposure

4.3 Stuck Vehicles/Equipment

If a vehicle or piece of equipment becomes stuck, a third-party towing or wrecking company who is trained in vehicle extraction must be retained and KGL will be notified. Third-party contractors may extract their own vehicle if they have an approved extraction plan and a competent person is on site to implement the extraction. The extraction plan shall be included as part of the third-party contractor's reviewed and approved Safety and Health Plan. The above notifications are still required.

The hazards presented by stuck vehicles/equipment must not be underestimated. While the weight of the stuck equipment can be calculated, it's impossible to precisely calculate the other forces that are pulling against the towing vehicle which requires special training and experience to properly size towing equipment and select towing techniques. This is especially true for "complex" or high-hazard extractions involving equipment stuck at axle depth (or beyond) or sloped surfaces or any area where extraction activities could trigger shifts in the ground surface. No chains shall be used to remove stuck vehicles/equipment.

The following table summarizes safety controls related to stuck vehicles and equipment and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work on ash ponds is no longer required	Use the lightest available tracked equipment to reduce ground pressure Substitute tracked equipment for wheeled equipment	Use crane mats or other cribbing to support heavy equipment on ash ponds Lighten the load – Remove materials from stuck vehicles or equipment prior to extraction if possible	Only persons trained in vehicle extraction are permitted to remove stuck vehicles/equipment A professional towing/wrecking service is required Prepare for spills (damage to fuel or hydraulic systems)	All persons involved in removing stuck equipment must wear PPE that includes hard hat, safety boots, safety glasses, high visibility vests, and cut resistant gloves

4.4 Working Near/Over Water

All employees, contract workers, and third-party contractors must wear a United States Coast Guard (USCG) approved personal floatation device (PFD), when within 6 feet of water, over water, and/or wading in water where the danger of drowning exists. The PFD must be properly secured to the wearer, free of all defects including rips, tears, stress, and fading, and be kept clean and free of excessive dirt and oil.

If the possibility of falling into water has been eliminated through the use of guardrails, fall restraint, or other method, the use of a PFD is no longer required.

When performing work on water from a vessel, at least one lifesaving rescue vessel (*e.g.,* a skiff) shall be immediately available at locations where employees are working over, in, on, or adjacent to water where the danger of drowning exists. However, if the water is so shallow that rescuers could simply walk/run into the water body without endangering themselves and/or others or the work was being conducted very close to shore (*e.g.,* the length of the skiff from shore would be greater than the working distance from shore and/or the skiff would foul on the bottom), a skiff would not be required.

The following table summarizes the requirements for working over/near water where a drowning hazard exists and are aligned to the hierarchy of controls:

Elimination	Substitution	Engineering	Administrative	PPE
Change the work task or work methods so that work near a drowning hazard is no longer required		Install guardrails that separate work areas from the drowning hazard	All work to be performed by at least two people where each is equipped with proper safety gear and capable of summoning emergency rescue	All personnel are required to wear suitable PFDs
		Utilize equipment (crowd-control barricades, safety fence, etc.) that will keep personnel at least 6 feet from a drowning hazard	When working on water use of a rescue skiff as outlined above	
			Use of a ring buoy with 90 feet of braided polycarbonate (or equivalent) line	
			Ring buoys must be positioned within 100 feet of work (maximum of 200 feet spacing)	

4.5 Heavy Equipment

All heavy equipment operators must be competent and authorized to operate each piece of heavy equipment. Forklift and telehandler (*e.g.,* Lull, JLG) operators must have a license or certificate that indicates they have passed a written test and "road" test for the equipment they will be operating within the last 3 years. Third-party contractors will provide proof of qualification upon request of KGL.

Persons working around heavy equipment must implement the “25 Foot Rule.” The 25 Foot Rule requires that persons get the operator’s attention and permission prior to approaching closer than 25 feet to heavy equipment. Persons must walk quickly through blind spots. Loitering in heavy equipment blind spots (especially to the rear) must be avoided.

Temporary fuel storage tanks will be labelled as to their content and be protected from collision by Site vehicles using solid barricades including balusters, chain link fence, or equivalent. Spill kit (55-gallon sorbent capacity contained in an overpack) and one 20-pound Type ABC fire extinguisher will be located within 45 feet of fueling areas. Tanks will be rated for above ground

use and will be double walled or have secondary containment in case of a leak. Tanks and dispensing hose will be bonded and grounded. On-site filling of fuel storage tanks will be completed with trucks that have automatic over-flow shutoffs. These trucks will be properly bonded to the storage tank and meet all of the other storage tank requirements. Temporary secondary containment must be provided in the refueling area that includes the storage tank and dispensing hoses.

Elimination	Substitution	Engineering	Administrative	PPE
		Heavy equipment (and vehicles) must be equipped with backup alarms, horns, roll-over protection (when feasible)	Operators must be competent and authorized	Operators must use seatbelts when equipped
		Vehicles and heavy equipment operated at night must have headlights, tail lamps, and reflectors	Forklift operators must have a current license or certificate (within 3 years)	High visibility vests are required when working around heavy equipment
			All vehicles and equipment must be turned off when not in use	
			Operators must inspect equipment daily prior to use	
			Persons working near heavy equipment must follow the "25 Foot Rule" and avoid lingering in blind spots as outlined above	
			Always obey site speed limits – 15 mph unless otherwise posted	

4.6 Overhead Powerlines

All overhead powerlines must be assumed to be energized until confirmed otherwise. The minimum clearance distance for equipment working near energized power lines must be in accordance with table found in 29 C.F.R. § 1926.1408(h).

The following table summarizes safety controls for work near energized power lines:

Elimination	Substitution	Engineering	Administrative	PPE
Plan to work away from powerlines	Use heavy equipment with shorter booms/attachments to avoid coming close to power lines	Contact the utility owner to deenergize the line	Install signs to warn personnel of overhead powerlines	

Elimination	Substitution	Engineering	Administrative	PPE
		Contact the utility owner to install insulated sleeves over energized lines	Install a non-conductive distance marker to delineate minimum clearance	
			Use a dedicated spotter to ensure equipment does not enter minimum clearance distances	

4.7 Severe Weather

Severe weather conditions include but are not limited to high winds, electrical storms, heavy rain, and tornados can cause hazardous conditions at CCR surface impoundments. The primary control for severe weather is monitoring weather reports prior to beginning work and as work occurs throughout the day.

Monitor lightning using a commercially available mobile application if cellular service is available. When lightning is observed within 10 miles of the CCR surface impoundment, or a storm is imminent, take shelter in the nearest solid structure or fully enclosed vehicle. If possible, secure all tools, materials, and equipment prior to the storm arriving. Work may resume 30 minutes after the last lightning strike is observed within 10 miles. Shelter locations will be reviewed during the Site Orientation.

Do not conduct work on a CCR surface impoundment when there is a risk for tornados in the area. If on a CCR surface impoundment and a tornado forms, seek the nearest substantial shelter. Shelter locations will be reviewed during the Site Orientation. If no shelter is available, attempt to evacuate to a shelter using a vehicle. If a tornado forms and you are not in a shelter, take one of the following actions:

- Stay in a vehicle with the seat belt on, keep your head below the windows and cover it with your hands
- If there is an area which is noticeably lower than the work area, lie in that area and cover your head with your hands.

The following table summarizes safety controls related to severe weather:

Elimination	Substitution	Engineering	Administrative	PPE
Plan outdoor tasks on days with low potential for severe weather.			Prior to beginning outdoor work monitor the day's weather.	
			Periodically monitor weather throughout the day. Use a weather app which issues alerts for severe weather and lightning, assuming cell service is available	

Elimination	Substitution	Engineering	Administrative	PPE
			Utilize a weather radio if cellular service is inconsistent	
			Stop all outdoor work and seek shelter when lightning is observed	

4.8 Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Employees, contract workers, and third-party contractors will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and in the prevention of heat stress incidents.

Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers. Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium, or unconsciousness. Heat stroke is a life-threatening condition that must be treated immediately by competent medical authority.

4.8.1 Heat Stress Prevention

To prevent heat stress, KGL employees, contract workers, and third-party contractors will implement heat stress prevention measures as outlined in OSHA's Heat Index (below). A summary of these precautions is described below.

Heat Index	Risk Level	Protective Measures
Less than 91°F	Lower (Caution)	Basic heat safety and planning
91°F to 103°F	Moderate	Implement precautions and heighten awareness
103°F to 115°F	High	Additional precautions to protect workers
Greater than 115°F	Very High to Extreme	Triggers even more aggressive protective measures

Know the Symptoms: Some symptoms associated with heat stress are: Employees should be aware of these symptoms with themselves and with their co-workers:

- Elevated heart rate, lack of concentration, difficulty focusing on a task, fatigue
- Irritability and/or sickness

- Cramps, rash, headache
- Loss of desire to drink water
- Fainting
- Skin clammy, moist, and pale (severe heat exhaustion)
- Skin extremely dry and red (heat stroke)

Acclimatize: When high heat stress conditions arise, employees should be exposed to the heat for short work periods followed by longer periods of work. Acclimatization usually takes five (5) days and should be provided for all new employees and employees returning from an absence of two (2) weeks or more. Contact Corporate Health and Safety for proper procedures.

Hydration & Pace of Work: Make sure all employees intake plenty of water throughout the work day (sometimes as much as a quart per worker per hour) and let employees know where the drinking water is located. Adjust your work pace and expectations on how much work can be done during periods of high heat stress. Workers cannot do as much during periods of high heat stress compared with similar periods of low heat stress. After acclimatization, workers may be able to resume a more "normal" work pace as long as fluid intake is adequate.

Work/Rest Periods: If possible, heavy work should be scheduled during the cooler parts of the day (*i.e.,* early morning) and rest periods should be taken in cool areas for longer periods.

Personal Protective Equipment (PPE): Employees using PPE (*i.e.*, Tyvek® suits or other equipment which may retain heat) can be more susceptible to heat stress due to the fact that heat/sweat often cannot escape the suits and/or the equipment. Persons wearing PPE that contributes to heat stress require more hydration, longer rest periods, or a reduced pace of work. Also, more careful monitoring of each person's health status is required by co-workers and management.

The following table summarizes safety controls for heat related illnesses:

Elimination	Substitution	Engineering	Administrative	PPE
Perform outdoor, strenuous, tasks at cooler times of day/year	Use mechanized equipment in place of manual labor	Install fans or air conditioning units in the work area	Train all personnel to know the signs of heat stress/stroke and how to prevent it	Implement the use of cooling vests or other similar PPE
		Install a canopy to provide shade to work areas	Allow workers to acclimatize to the work environment	
		Provide cool, shaded break areas	Adjust work pace to allow for the effects of heat	
			Implement work/rest periods	

4.9 Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness, and cold water. One, or any combination of these factors, can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Employees, contract employees, and third-party contractors will be instructed in the identification of a cold stress victim, the first-aid treatment procedures for the victim and in the prevention of heat stress incidents.

A dangerous situation of rapid heat loss may arise for any individual exposed to high winds and cold temperatures. Major risk factors for cold-related stresses include:

- Wearing inadequate or wet clothing thus increasing the effects of cold on the body.
- Taking certain drugs or medications such as alcohol, nicotine, caffeine, and medication thus inhibiting the body's response to the cold and/or impairing judgment.
- Having a cold or certain disease, such as diabetes, heart, vascular and thyroid problems, and thereby increasing susceptibility to the winter elements.
- Lower body-fat composition or other physiological differences. Statistics show that men experience far greater death rates due to cold exposure than women, potentially attributable to participation in risk-taking activities, lower body-fat composition and/or other physiological differences.
- Becoming exhausted or immobilized, especially due to injury or entrapment, thus speeding up the effects of cold weather.

The following table provides the resulting equivalent chill temperature to exposed skin because of increasing wind speeds at decreasing actual temperatures. Personnel shall be aware of predicted weather conditions before beginning site work and stay apprised of changes.

TABLE 2. Cooling Power or Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)*

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
	Equivalent Chill Temperature (°F)											
calm	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
5	48	37	27	16	6	−5	−15	−26	−36	−47	−57	−68
10	40	28	16	4	−9	−24	−33	−46	−58	−70	−83	−95
15	36	22	9	−5	−18	−32	−45	−58	−72	−85	−99	−112
20	32	18	4	−10	−25	−39	−53	−67	−82	−96	−110	−121
25	30	16	0	−15	−29	−44	−59	−74	−88	−104	−118	−133
30	28	13	−2	−18	−33	−48	−63	−79	−94	−109	−125	−140
35	27	11	−4	−20	−35	−51	−67	−82	−98	−113	−129	−145
40	26	10	−6	−21	−37	−53	−69	−85	−100	−116	−132	−148
(Wind speeds greater than 40 mph have little additional effect.)	LITTLE DANGER In < hr with dry skin. Maximum danger of false sense of security				INCREASING DANGER Danger from freezing of exposed flesh within one minute.				GREAT DANGER Flesh may freeze within 30 seconds.			
	Trenchfoot and immersion foot may occur at any point on this chart.											

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.
Equivalent chilll temperature requiring dry clothing to maintain core body tempearture above 36°C (96.8°F) per cold stress TLV

The following table summarizes safety controls for preventing cold stress:

Elimination	Substitution	Engineering	Administrative	PPE
Perform work during warm parts of the day or warmer parts of the year		Install heaters in enclosed work areas	Train all personnel on the symptoms of cold stress and how to prevent it	All personnel must wear multiple layers of clothing
		Provide a warm break area	Implement work/rest schedule	Utilize hand/foot warmers when required

An additional hazard in cold weather conditions is the increased risk for slips from the accumulation of ice and snow in general work areas, ruts where water is accumulated, and heavy equipment. The following table outlines controls that may be used for preventing slips:

Elimination	Substitution	Engineering	Administrative	PPE
Perform work during warm parts of the day or in areas free of accumulated areas		Clear snow in work areas		Use traction control devices (*i.e.,* YakTrax) on work boots to provide additional traction.
		Apply salt/sand to icy areas		
		Use equipment to access work areas		

4.10 Biological Hazards

The following are biological hazards that may be present at the AP.

4.10.1 Ticks (Lyme Disease) & Mites

Although Lyme disease has been detected throughout the continental United States, it is prevalent primarily in certain areas in New England, the Mid-Atlantic and the northern Midwest states. Although Lyme disease is the most common tickborne illness, other tickborne illnesses include southern tick-associated rash illness, Rocky Mountain spotted fever, ehrlichiosis, and tularemia. More information on Lyme disease and other tickborne illnesses can be found from the CDC.

Prevention

- Standard field gear (work boots, socks, and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with ticks:
  - Wear long pants and long-sleeved shirts that fit tightly at the ankles and wrists, tape cuffs if necessary
  - Wear light colored clothing so ticks can be easily spotted
  - Per- and polyfluoroalkyl substances (PFAS)-free tick repellents (DEET and Permethrin) must be used when walking in all overgrown areas. DEET (≥25 percent [%]) must be applied to skin while permethrin must be applied to clothes and allowed to dry. Spray outer clothing, particularly your pant legs and socks, BUT NOT YOUR SKIN, with an insect repellent that contains permethrin. For heavily infested tick areas, wear spun polypropylene coveralls that have been sprayed with permethrin.
  - Inspect clothing frequently
  - Inspect head and body thoroughly when you return from the field, particularly on your lower legs and areas covered with hair
  - When walking in wooded areas, wear a hard hat, and avoid contact with bushes, tall grass, or brush as much as possible

Removal

- Remove any ticks by tugging with tweezers or special tick removal tools
- Do not squeeze or crush the tick
- DO NOT use matches, a lit cigarette, nail polish, or any other type of chemical to "coax" the tick out

Treatment

- Disinfect the area with alcohol or a similar antiseptic after removal

- Notify the Safety Competent Person of the embedded tick
- For several days to several weeks after removal of the tick, look for the signs of the onset of Lyme disease, such as a rash.
- No further treatment is necessary for ticks embedded <48 hours.
- If other signs or symptoms of Lyme are observed (fever/chills, aches, and pains), then notify the Safety Competent Person and seek medical attention

The following table summarizes safety controls to reduce the hazards associated with ticks and mites.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on tick and mite prevention. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks
			Perform frequent tick checks in the field and a thorough tick check after completing work activities	Apply Permethrin to clothes and DEET (20% or more) to exposed skin
			Call licensed pesticide contractors to remove infestations of bees, wasps, fire ants, etc.	

4.10.2 Insect Bites/Stings

Stinging/biting insects at the AP include spiders, wasps, and bees. Contact with these insects may result in project personnel experiencing adverse health effects that range from being mildly uncomfortable to being life-threatening. Therefore, insects present a serious hazard to project personnel, and extreme caution must be exercised whenever Site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas or equipment staging areas where equipment has not been moved recently.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock. Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people accumulate over time and exposure, therefore even if someone has been stung previously and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again
- Spider bites generally only cause localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse, or if you are allergic to spiders, can cause symptoms that are more serious.

- ***If a worker knows that they are hypersensitive to bee, wasp, or hornet stings, or other insects, they must inform the Safety Competent Person prior to site work. Persons who have been prescribed epi-pens by their physician must have an epi-pen on the Site.***
- Inspect any clothing or PPE that has been left for a period of time prior to putting it on. Shake out the clothing and inspect the inside of safety shoes/boots prior to putting them on
- Nests in active work areas must be eradicated. Small nests may be handled by Site personnel using consumer-type insecticide. A pest control contractor should be hired to handle large or difficult to reach nests.

The following table outlines safety controls to reduce the risk of hazards associated with stinging/biting insects.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on stinging/biting insect prevention. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	Wear light-colored long sleeved shirt tucked into pants. Tuck pant legs into socks
		Eradicate nests in the work area as outlined above.	Instruct personnel to inspect/shake out clothing and work boots that have been left for a period of time.	Apply Permethrin to clothes and DEET (20% or more) to exposed skin – NOTE this will not repel bees/wasps
			Instruct employees who are hypersensitive to insect bites/stings to carry their epi-pen while on site	

4.10.3 Venomous Snakes

There are four species of venomous snakes in Illinois, they are:

- Copperhead
- Cottonmouth Water Moccasin
- Timber rattlesnake
- Eastern Massasauga

Generally, these snakes are found in the southern one-third of the state, with the Cottonmouth Water Moccasin found mostly in the southernmost portions of Illinois. Snakes are generally found in tall grass, wood piles, or other covered areas. Snakes are generally not aggressive towards humans, but if they are encountered avoid the snake and do not provoke it. If bitten by a snake that may be venomous seek medical treatment.

The following table outlines safety controls to reduce the hazard associated with venomous snakes.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove debris piles, overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on the identification of venomous snakes. Areas of vegetation overgrowth and/or debris piles should be considered "high risk" areas	If working in area with snakes cannot be avoided, wear snake chaps
			Instruct personnel to not disturb snakes if they identify one in their work area	
			Use caution when moving staged tools or materials into which snakes may have moved	

4.10.4 Poisonous Plants and Plant Hazards

Poison ivy and poison oak may be present at the Site. Poison ivy thrives in all types of light and usually grows in the form of a trailing vine; however, it can also grow as a bush and can attain heights of 10 feet or more. Poison ivy has pointed leaves that grow in clusters of three. Poison oak resembles poison ivy except that the poison oak leaves are more rounded rather than jagged like poison ivy, and the underside of poison oak leaves are covered with hair.

The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Becoming contaminated with the oils does not require contact with just the leaves. Contamination can be achieved through contact with other parts of the plant such as the branches, stems or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

Symptoms

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact and in many cases, persons experience almost immediate irritation.
- Reddening, swelling, itching, and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

Prevention

- The best treatment appears to be removal of the irritating oil before it has had time to cause inflammation by wiping exposed skin with rubbing alcohol followed by washing with soap and water.
- A visual Site inspection and identification of the plants should be completed prior to starting work so that all individuals are aware of the potential exposure. Avoid contact with any poisonous plants on the Site, and keep a steady watch to identify, report, and mark poisonous plants found on the Site.
- Avoid contact with, and wash daily, contaminated tools, equipment, and clothing.
- Barrier creams (Ivy Block®) and orally administered desensitization may prove effective and should be tried to find the best preventive solution.

- Keeping the skin covered as much as possible (*i.e.*, long pants and long-sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure. PFAS-free spun polypropylene coveralls or Tyvek® may be worn to prevent contact of skin and clothes with poison ivy.

The following table outlines safety controls to mitigate the hazards associated with poisonous plants.

Elimination	Substitution	Engineering	Administrative	PPE
Use mechanical equipment to remove overgrown vegetation		Remove overgrowth and excessive vegetation from walkways and work areas (provide safe access)	Train personnel on the identification of poisonous plants	Wear pants and long sleeves when working in overgrown areas
			Instruct personnel to avoid areas where poisonous plants have been identified	Consider the use of a coverall when working in areas where these plants are present, especially for hypersensitive employees.
			Provide isopropyl alcohol along with soap and water to remove oils from skin, tools, and equipment.	

4.11 Working Alone

As outlined in Section 4.1, working alone while on the AP must be pre-approved by the POC. Working alone is prohibited for tasks deemed to be high risk by KGL including, but not limited to, handling highly hazardous chemicals (sulfuric acid), work over/near water, excavation and trenching, hot work (grinding, welding and torch cutting), and elevated work that requires personal fall arrest. Third-party contractors are responsible for identifying potential high-risk tasks in their Safety and Health Plan and requiring that a buddy system be implemented while high risk work is performed. The buddy must be located in a safe area but may perform other tasks that do not prevent observing the person performing high risk work. Working alone may occur on and around other parts of the AP when there is no drowning hazard or risk of severe injury due to high-risk work.

Elimination	Substitution	Engineering	Administrative	PPE
	Modify work methods by substituting lower hazard methods for high hazard methods	Varies depending on the hazard, but for example, could include installing guardrails (temporary or permanent) which mitigates a fall hazard reducing the risk to levels where working alone may be permitted	Prohibit working alone on ash ponds and for other high hazard tasks without prior approval from the POC.	

Elimination	Substitution	Engineering	Administrative	PPE
			Implement a buddy system whenever feasible (required for high hazard work)	
			Implement a worker check-in, emergency alerting, and monitoring system	

5. HAZARD COMMUNICATION

As required by 35 I.A.C. § 845.530, the OSHA HAZWOPER standards (29 C.F.R. § 1910.120 and 29 C.F.R. § 1926.65) and OSHA Hazard Communication Standard, site personnel, subcontractors, and visitors must be informed of chemical hazards associated with their work area. The information in this section is based on:

- Recommendations in the most recent "NIOSH Pocket Guide to Chemical Hazards" by the Department of Health and Human Services, Centers for Disease Control and Prevention, and the NIOSH Pocket Guide.
- Requirements set forth in the OSHA regulations from as defined in Chapter 17 of 29 C.F.R. § 1910.1200(c) for all hazards not otherwise classified.

5.1 Coal Combustion Residuals

Primary exposure to CCR is through inhalation and skin contact. CCR is typically a fine, black, grey, or tan particulate. CCR is comprised of several components. The following table outlines the components of the CCR. The exact percentage of each component will vary based on the type of ash and location at the surface impoundment.

Chemical	Percentage	PEL	IDLH	ACGIH TLV	Symptoms of Exposure & Health Effects
Crystalline Silica	20-60% (total)	0.05 mg/m^3 (respirable)	25 mg/m^3 (respirable)	0.025 mg/m^3 (respirable)	Cough, dyspnoea (breathing difficulty), wheezing; decreased pulmonary function, progressive respiratory symptoms (silicosis); irritation eyes; [potential occupational carcinogen]
Iron oxide	1-10%	5 mg/m^3	2500 mg/m^3	5 mg/m^3	Benign pneumoconiosis with X-ray shadows indistinguishable from fibrotic pneumoconiosis (siderosis)
Calcium oxide	10-30%	5 mg/m^3	25 mg/m^3	2 mg/m^3	irritation eyes, skin, upper respiratory tract; ulcer, perforation nasal septum; pneumonitis; dermatitis
Titanium dioxide	<3%	15 mg/m^3	ND	10 mg/m^3	Lung fibrosis; [potential occupational carcinogen]
Aluminosilicates	10-60%	15 mg/m^3 (PNOR)	ND	10 mg/m^3 (PNOR)	irritation eyes, skin, throat, upper respiratory system
Magnesium oxide	2-10%				
Magnesium dioxide	<2%				
Phosphorous pentoxide	≤2%				
Sodium oxide	1-10%				
Potassium oxide	≤1%				
Bromide salt	<0.1%				

Footnotes:

All values are 8-hour time-weighted averages (TWAs) unless otherwise indicated.

- PEL: Permissible Exposure Limit, the concentration an employee may be exposed to for an 8-hour work day for a 40-hour work week for which nearly all employees may be repeatedly exposed without adverse health effects.
- IDLH: IMMEDIATELY Dangerous to Life and Health, contaminant concentration which present the possibility for severe health consequences if exposed to the IDLH concentration without the appropriate personal protective equipment (PPE).
- ACGIH TLV: American Conference of Governmental Industrial Hygienists Threshold Limit Value
- mg/m^3 = milligrams per cubic meter of air
- PNOR: Particulates Not Otherwise Regulated
- ND: Not Determined

5.2 Anhydrous Ammonia

Anhydrous ammonia is used at KPP. Ammonia is extremely corrosive, and exposure to it may result in chemical burns to the skin, eyes, and lungs. The Permissible Exposure Limit (PEL) is 50 parts per million (ppm), Threshold Limit Value (TLV) of 35 ppm, Short Term Exposure Limit (STEL) of 35 ppm, and with an Immediately Dangerous to Life and Health (IDLH) level of 300 ppm. Ammonia is also flammable at concentrations ranging from 15% to 28% by volume in air.

When released, anhydrous ammonia will form a visible, dense, white cloud that will travel along the ground on a cool day. If a white cloud is observed at the plant, evacuate the area immediately, do not enter the cloud.

Ammonia training is included in the Site Orientation Training for unescorted visitors. KGL employees having any responsibility for the ammonia at the KPP are required to complete PSM/RMP electronic training. Procedure ADM-EMG-0-004 Hazardous Materials Emergency Response Plan outlines response procedures for an ammonia release.

5.3 Safety Data Sheets

Pursuant to 35 I.A.C. § 845.530(b)(3), KGL will provide Safety Data Sheets (SDSs) to all employees, contract workers, and third-party contractors for the CCR located at the Site. Third-party contractors will provide SDSs to the KPP Site Safety Specialist prior to bringing a material on site. SDSs are provided in Appendix E.

5.4 Signage

The absence of any of the following signage does not mean that a potential hazard does not exist. Signage will be posted by KGL, but employees, contract workers, and third-party contractors must remain vigilant for changing site conditions.

To aid in hazard communication and pursuant to 35 I.A.C. § 845.530(f), KGL will post the following signs at the AP:

- Signs identifying the hazards of CCR, including dust inhalation when handling CCR.
- Signs identifying unstable CCR areas that make the operation of heavy equipment hazardous.
- Signs identifying the necessary safety measures and necessary precautions, including the proper use of PPE.

The following signs may also be posted at the CCR units to aid in hazard communication:

- Anhydrous ammonia hazard communication signs or labels on all tanks, drums, or other storage containers. “Anhydrous ammonia” labels on piping.
- Overhead electrical lines that may be struck by heavy equipment of vehicles will have signs warning drivers of their presence.

6. EMERGENCY RESPONSE PLAN

This emergency response section details actions to be taken in the event of site emergencies. This section is consistent with the KPP Emergency Response Plan (ADM-EMG-0-004 Hazardous Materials Emergency Response Plan). All personnel on site must be familiar with emergency signals and the content of this section.

6.1 Emergency Phone Numbers & Notifications

Emergency Number	
Site Address	**Emergency Phone Number**
199 IL 104 Kincaid, IL	911
Control Room	217-675-7551 Ext. 2209

Medical Treatment	
Local Hospital	**Phone Number**
Memorial Medical Center 701 N 1st St Springfield, IL 62781	217-788-3000

Incident Notifications		
Title	**Name**	**Contact Number**
Tim Arnold (primary)	Environmental Manager	217-675-7525 Ext. 7525
Dave Huber (secondary)	Plant Tech Specialist	217-675-7467 Ext. 7467

6.2 Evacuation Signal

The site evacuation signal is a continuous monotone alarm.

Upon hearing an evacuation signal, all personnel will leave the work area and proceed to the muster point.

6.3 Muster Point

The muster point for the AP is located at Security. The muster point is shown in Appendix A.

6.4 Calls for Emergency Support

In the case of an emergency, site personnel will call 911. The control room will coordinate the arrival of on-site emergency personnel. The individual calling for emergency support will briefly explain the nature of the emergency and site conditions as follows:

- Indicate his/her name
- Location of emergency
- Description of emergency conditions that may require special rescue equipment, such as confined spaces, excavations, and elevated work platforms
- Potential chemical hazards and recommended PPE

6.5 Fire & Explosion Response Plan

Trained site personnel may respond to incipient stage fires using a 20-pound Type ABC dry chemical fire extinguisher or hose. An incipient stage fire is a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers, Class II standpipe or small hose systems without the need for protective clothing or breathing apparatus. Personnel shall only attempt to extinguish the fire if it is safe to do so.

A fire that CANNOT be readily extinguished with a fire extinguisher will require evacuation of the work area personnel to Muster Point areas per this Safety and Health Plan. If personal injuries result from any fire or explosion, the procedures outlined in the Personal Injury Response Plan will also be followed.

All fires or explosions must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

6.6 Injury Response Plan

Treatment for minor injuries will be provided on site using available first aid supplies and personnel trained in first aid. All third-party contractors must have at least one individual on site who is trained in first aid, CPR, and AED use. Third-party contractors must provide their own first aid kits and AED. For minor injuries that are not life-threatening but require further medical attention, employees should be treated by occupational physicians at occupational clinics whenever possible. Treatment of minor injuries by emergency room or personal physicians should be avoided. When injured workers are released back to work with restrictions, all subcontractors are expected to accommodate those restrictions.

Emergency medical incidents include puncture wounds to the head, chest, and abdomen, serious head and spinal cord injuries, and loss of consciousness must be treated at the hospital emergency room listed in Section 6.1 of this Safety and Health Plan.

All injuries must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan.

6.7 Spill Response Plan

In general, KGL employees, contract workers, and third-party contractors are trained and equipped to handle small spills associated with their work. Third-party contractors must include an approved spill response plan in their Safety and Health Plan. Site personnel will generally respond to spills as follows:

- Stop the leak immediately if it can be done without directly contacting the leaking material.
- Remove or stop all ignition sources (hot work, generators, etc.) that are within 25 feet of any part of the spill.
- On-site personnel should immediately secure the area to prevent unauthorized entry into the spill area.
- Although not likely given the anticipated types of spills, site personnel must immediately initiate evacuation if a spill may cause an explosion, death, or serious injury.
- Site personnel may only respond to incipient stage fires regardless if such fires are associated with a spill.
- PPE for spills to open areas generally requires Modified Level D PPE (poly-coat Tyvek®, nitrile gloves, and boot covers or boot decontamination). Over-boots or boot covers may also be used if persons cleaning the spill would have to walk on spilled materials. Latex gloves are not acceptable and will degrade with exposure to petroleum products.

6.8 CCR Spill or Release Response Plan

Response to minor or incidental spills of CCR will be managed as outlined in the General Spill Response Plan. An incidental release is a release of a hazardous substance which does not pose a significant safety or health hazard to employees in the immediate vicinity or to the employee cleaning it up, nor does it have the potential to become an emergency within a short time frame. Incidental releases are limited in quantity, exposure potential, or toxicity and present minor safety or health hazards to employees in the immediate work area or those assigned to clean them up. An incidental spill may be safely cleaned up by employees who are familiar with CCR. Response to major releases of CCR will be in accordance with the KPP Emergency Action Plan,

which can be found on the Luminant CCR website at https://www.luminant.com/ccr/. In the case of a release of CCR contact the Environmental Manager.

6.9 Ammonia Response Plan

Ammonia training is included in the Site Orientation Training. Procedure ADM-EMG-0-004 Hazardous Materials Emergency Response Plan outlines response procedures for an ammonia release.

6.10 Ash Pond Rescue

Ash ponds may be unstable and represent an engulfment hazard if persons and equipment traverse the surface, berms, or other unstable areas. Special training is required on behalf of emergency responders to retrieve persons and equipment who become trapped in unstable ash. **Untrained persons must not enter unstable areas** in an attempt to conduct rescue because of the significant potential that they will also become victims. Call the KPP emergency number and state that an "ash pond rescue" is required. The KPP emergency contact will notify the designated service to perform the ash pond rescue. On-site personnel should remain on stand-by to support the ash pond rescue team as necessary.

6.11 Incident Reporting

All incidents must be reported to the contacts outlined in Section 6.1 of this Safety and Health Plan. An Incident Report must be completed for all injuries, illnesses, spills, fire, explosion, or property damage. The absence of an injury does not preclude the need to complete an Incident Report as such incidents will be classified as "near miss" or "other." It will include, but is not limited to, the nature of the problem, time, location, and corrective actions taken to prevent recurrence.

APPENDIX A
SITE MAP

Y:\Mapping\Projects\22\2285\MXD\845_Operating_Permit\Kincaid\Appendix A_KIN Site Map_SnHP.mxd

PROJECT: 169000XXXX | DATED: 8/20/2021 | DESIGNER: STOLZSD

PART 845 REGULATED UNIT (SUBJECT UNIT)

PROPERTY BOUNDARY

0 250 500 Feet

SITE MAP

PART 845 SAFETY AND HEALTH PLAN

KINCAID POWER PLANT
KINCAID, ILLINOIS

APPENDIX A

RAMBOLL AMERICAS
ENGINEERING SOLUTIONS, INC.

RAMBOLL

APPENDIX B
SAFETY AND HEALTH PLAN ACKNOWLEDGMENT FORM

SAFETY AND HEALTH PLAN ACKNOWLEDGEMENT FORM

I HEREBY CERTIFY THAT I HAVE READ AND UNDERSTOOD ALL HEALTH AND SAFETY PROCEDURES AS STATED HEREIN:

Name and Affiliation (printed)	**Signature**	**Date**

APPENDIX C
DRUG SCREEN POLICIES AND SUPPLEMENTAL TERMS

Drug and Background Investigations

Contractor is solely responsible for ensuring that all members of Contractor Project Team have completed and passed all drug and alcohol tests and background investigations required under this Attachment and under Contractor's own programs before assigning such personnel to perform Work. Contractor is also solely responsible for ensuring that such testing and investigations are performed in accordance with all applicable laws.

1. Required Investigations. Except as otherwise required by applicable law, Required Investigations shall consist of all of the following:

   1.1 a 7-panel drug screening;

   1.2 a background investigation that includes a criminal records check in all counties where the applicable person has resided for at least the last seven (7) years;

   1.3 a third-party verification of previous employment and the highest education level completed by the applicable person;

   1.4 a check of the National Sex Offender Registry and Terrorist Watch List (Denied Parties); and

   1.5 a check of Motor Vehicles Record (if work to be performed by the applicable person requires driving as part of the defined duties).

2. Notices to Tested Persons Regarding Background Checks. All background checks will be conducted in compliance with applicable provisions of the Fair Credit Reporting Act.
3. Forms and Testing Organization for Drug Tests. Except for those positions subject to Department of Transportation ("DOT") drug and alcohol testing regulations, all drug testing shall be performed using the Universal Toxicology four part "Non-DOT" Chain of Custody and Request Form with white and blue top page, and shall be conducted by an independent third-party organization.

4. Pass/Fail Standards – Background Checks. A person shall be deemed to have failed the applicable background check if:

   4.1 information is reported through the background check process indicating that such person has failed to disclose or misrepresented information requested at any time about such a person's criminal background history; or

   4.2 such person has ever committed any felony constituting a violent crime, crime against a person, sexual offense or fraud; or

   4.3 such person has committed any other felony, or has been incarcerated for a felony, within ten (10) years prior to the date of such background check (i.e., for these felonies there must be a ten (10) year lapse in time from the later of the commission and the end of any period of incarceration); or

   4.4 such person has committed any misdemeanor that:

      4.4.1 involves violence that is sexually related; or

4.4.2 consists of a DUI that is the second (or more) DUI in the last two (2) years prior to the date of the background check; or

4.4.3 consists of a theft-related offense; provided that there can be no more than one theft by check and it must have been for an amount less that $100; or

4.4.4 consists of any drug-related misdemeanor committed at any time within forty-eight (48) months prior to the date of the background check.

4.4 For purposes of both felonies and misdemeanors, a person is deemed to have committed the applicable offense if he/she is convicted or enters a plea of guilty or nolo contendere for such offense (to include, without limitation, sentences of probation and deferred adjudication).

5. Pass/Fail Standards – Drug Tests. A person shall be deemed to have failed the applicable drug test if any of the following maximum cut-off levels are exceeded, unless there is a legitimate medical explanation for the presence of a tested substance at or above the applicable cut-off level:

5.1 Amphetamines 500ng/mL

5.2 Barbiturates 150ng/mL

5.3 Benzodiazepines 150ng/mL

5.4 Cocaine 150ng/mL

5.5 Marijuana 150ng/mL

5.6 Opiates 2000ng/mL

5.7 Phencyclidine 25ng/mL

For any positions subject to DOT drug and alcohol testing requirements, testing shall be conducted according to the applicable DOT panel and cutoff levels.

6. Other Requirements.

6.1 Background checks and drug tests will be paid for by Contractor without reimbursement by Company.

6.2 Contractor will keep background checks and drug test records while the applicable persons are working pursuant to this Agreement and for three (3) years thereafter.

6.3 Upon request, Contractor will provide a certification to Company that no person required hereunder to pass a background check or drug test has failed such investigation or test. Contractor will not provide the specific results of the background check or drug test of any individual to Company.

6.4 If any person required under this Agreement to pass a background check or drug test fails such check or test, Contractor will not report the specific results of such check or test to Company and will not allow such individual to perform any Work for Company. Although such person may not be assigned to perform any Work for Company, nothing in this Attachment requires Contractor to take any other action with respect to such person's employment with Contractor.

Supplemental Terms for Onsite Services

1. SAFETY

1.1 Contractor agrees that any safety-related assistance or initiatives undertaken by Company will not relieve Contractor while on Company Property from responsibility for the implementation of, and compliance with, safe working practices, as developed from their own experience, or as imposed by law or regulation, and will not in any way, affect the responsibilities resting with Contractor under the provisions of any agreement to which these policies are attached and to meet all safety requirements as specified by the Occupational Safety & Health Administration (OSHA), the Mine Safety Health Administration (MSHA), including the "Mining Contractor Safety Reference Handbook" located at http://www.vistraenergy.com/wp-content/uploads/2016/12/Contractors-Safety-Handbook_Final-MC-08262016.pdf, the Department of Transportation (DOT) and any other applicable state or federal safety and health laws or regulations.

1.2 In the event that a material safety data sheet, warning label, or other documentation concerning the use of hazardous chemicals at any property owned or controlled by Company or any of its affiliates (collectively, "Company Properties"), applies to any materials or equipment provided by Contractor as an aspect of the Work, such documentation will be provided by Contractor to Company prior to the commencement of any such Work.

1.3 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

2. SECURITY

2.1 It will be the affirmative duty of Contractor to ensure that Contractor Group assists in carrying out all security measures, to include reporting all information or knowledge of matters adversely affecting security to Company's designated security personnel.

2.2 Company reserves the right to exclude any of Contractor's employees from any Company Property by denial of access, suspension or revocation of access authorization, preemptory expulsion, or by any other means, without notice or cause. Former Company employees, and any of Contractor's employees who previously have been excluded from any Company Property, may be brought onto Company property or facilities only if prior approval from Company is obtained. If Contractor terminates a member of Contractor Group performing Work on Company's premises, Contractor shall inform Company immediately, but in no event, no later than twenty-four (24) hours after such employee is terminated in order for Company to remove access to Company Property for such employee.

2.3 Company measures may also include investigations, whether by Company or law enforcement officials. Contractor agrees to cooperate in such investigations and understands that Company

reserves the right to require anyone in Contractor Group to authorize appropriate agencies to release his or her criminal records to Contractor as a condition of either initial or continued permission for access to any Company Property. Investigations may include searches of Contractor Group. Such searches may include searches of facilities assigned to Contractor Group, search of all Company Property areas and property at such Company Property areas, searches of including, but not limited to, offices, lockers, desks, lunch boxes, packages and motor vehicles (regardless of ownership). Without limiting the foregoing, Contractor acknowledges and agrees that all members of Contractor Group, to the extent that Company reasonably determines that such members require security badge access prior to entering onto any Company Property, shall be required to comply with Company's standard security badge requirements, including without limitation a background check to be performed by Company.

3. ISNETWORLD

3.1 Contractor agrees to maintain at Contractor's expense a subscription with ISNetworld (www.ISNetworld.com), Company's safety compliance program or any replacement program therefor, as directed by Company, for the Term of the Agreement. Contractor shall also furnish ISNetworld with any information requested by ISNetworld relating to ISNetworld's evaluation of the Contractor's safety program and practices. As a minimum, requested documents will be related to safety, health, and insurance (i.e., regulatory required training, certifications, safety plans, safe and secure workplace practices, insurance certificates, etc.), OSHA and MSHA injury rates and Experience Modification Rate (EMR).

3.2 Contractor has and during the performance of this Agreement shall continue to report full, complete and accurate information to ISNetworld concerning Contractor's employees.

4. MATERIALS, EQUIPMENT AND LABOR. Contractor will be solely responsible for the proper storage, transportation and disposal of any product or waste, other than sandblasting waste, used or generated in connection with the Work in accordance with all applicable Environmental Laws. Contractor will dispose of all waste materials, other than sandblasting waste, at an off-site disposal facility approved for such waste materials pursuant to applicable Environmental Laws and will complete and sign all waste manifests as the generator of such waste. Company will be responsible for the storage, transportation and disposal of any sandblasting waste generated during the performance of the Work.

5. CONDITIONS AFFECTING WORK

5.1 Contractor will investigate and acquaint itself with the conditions affecting the Work, including but not limited to those related to the transportation, disposal, handling and storage of materials and waste; availability of labor, water, electric power and roads; the uncertainties of weather, river stages or similar physical conditions at the site; the conformation and condition of the ground; and the character of equipment and facilities needed preliminary to and during prosecution of the Work. Contractor has satisfied itself as to the character, quality and quantity of surface and subsurface materials or obstacles to be encountered. Contractor's failure to acquaint itself with any conditions affecting the Work or any available related information will not relieve it from responsibility for properly estimating the difficulty or cost of successfully performing the Work.

5.2 Contractor assumes full responsibility for investigating conditions and determining the existence and magnitude of any hazards to the physical well-being of property of Contractor, the employees, agents, and servants of Contractor, or any other person or entity who is or may become involved in

the performance of Work, and any and all other persons in the vicinity of the Work. Contractor will advise all of the above-specified persons or entities of any hazards relating to Work, and will ensure that those persons or entities are advised of and fully understand the nature of the hazards and safety precautions that can be taken to eliminate or minimize dangers relating to the hazards.

5.3 Contractor will provide information to Company regarding hazardous chemicals and/or consumable products that contain constituents listed in 40 CFR 372.65 used at any Company Property. Contractor will report the amount of such material carried on and off the site, the amount actually used and the manner of use. Contractor will provide the maximum quantity of the material stored on site at any one time and if a waste material was collected, where it was disposed of (location name and address). Contractor will provide information on the amount of material used for the previous calendar year by the first of February.

5.4 Contractor will use its best efforts to ensure that the Work is performed so as to minimize any adverse impact upon natural resources and the environment and will use best industry practices in this regard at all times.

5.5 Contractor acknowledges and agrees that all members of Contractor Group performing Work at any Company Generation or Mining Property are required to view Company's "Contractor/Visitor Safety Orientation" video (in the case of Company Generation property), when applicable, and to read and adhere to Company's "Contractor/Visitor Safety Booklet" (in the case of Company Mining property) prior to performing any Work at any Company Generation or Mining Property.

5.6 Contractor will immediately notify Company as soon as Contractor has reason to believe that Contactor, or any employee or other person performing the Work, is not or may not be performing the Work in compliance with applicable Environmental Laws. Contractor will provide Company with written notice to Company of such actual or potential non-compliance within three (3) days following the discovery thereof. Contractor will take immediate steps to ensure compliance with all applicable Environmental Laws and will, if directed by Company, cease all Work until authorized by Company to resume the Work.

5.7 Contractor will report to Company all accidents involving personal injuries (including death) and damage to property occurring directly or indirectly as a result of the Work performed by Contractor hereunder immediately, but in no event, no later than 24 hours after the occurrence of any such accident. Any accident or incident occurring directly or indirectly as a result of the Work which Contractor must report to a regulatory agency (e.g. OSHA, MSHA, TCEQ) must also be reported to Company immediately following notification to the regulatory agency.

6. WORK SITE PERMITS AND LICENSES

6.1 Subject to the following two paragraphs, Contractor will obtain, prior to the commencement of the Work, and provide to Company upon request, all permits, licenses and governmental authorizations, at its sole expense, required for the performance of the Work. Contractor will be solely responsible for maintaining compliance with such permits, licenses and governmental authorizations.

6.2 In the event that a storm water discharge permit is required for the performance of the Work, (i) Contractor will be responsible for filing a Notice of Intent with respect to the Work, in addition to any Notice of Intent that Company may be required to file, and (ii) Contractor will coordinate with

Company in the preparation and execution of a Storm Water Pollution Prevention Plan for the Work Site.

6.3 In the event that the performance of the Work involves the handling or abatement of asbestos-containing materials, Contractor will coordinate with Company in the preparation and filing of all required notification forms.

7. ACCESS. Should Contractor desire access to the Work Site over any land not controlled by Company, it will, at its sole expense, obtain all proper permits or written permission necessary for that access.

8. COMPANY FACILITIES. Contractor will not use Company's sanitary facilities, changehouses, shops, parks, storage buildings, tools, equipment or other facilities unless so directed by Company. Contractor will not discharge, without Company's prior written authorization, any product or waste used or generated in connection with the Work through any (i) Company-permitted outfall, (ii) Company-owned or operated pollution control equipment, or (iii) storm or sanitary sewer located at or in the vicinity of the Work Site. Any request for authorization to discharge will include, at a minimum, either a copy of the Material Safety Data Sheet for the product or a written description of the waste, including a list of the constituents of the waste and the relative concentrations thereof.

9. ENVIRONMENTAL

9.1 In the event that Contractor discovers during the performance of the Work any substance at the Work Site that is not the subject of the Work or has not otherwise been identified by Company for Contractor, which substance Contractor has reason to believe is or may be a Hazardous Substance that (i) has been or may be released or spilled into the soil, surface water, or groundwater or in a building or structure, or (ii) consists of asbestos-containing materials, lead-based paint, batteries, thermostats, lighting equipment, or equipment containing polychlorinated biphenyls, Contractor will immediately stop Work and notify Company of the discovery. Contractor will not resume the Work until receiving authorization from Company to do so.

9.2 The term "Hazardous Substance" means any product, waste, emission or substance defined, listed or designated as a hazardous or toxic substance, hazardous waste, hazardous material or pollutant by or pursuant to any Environmental Law and includes, but is not limited to, any petroleum-based product, substance or waste, including any additives associated therewith, pesticides, fertilizers, solvents, polychlorinated biphenyls, mercury, lead, lead-based paint, asbestos-containing material or explosives.

9.3 Contractor will immediately notify Company in the event of a spill or release of any material which Contractor knows or has reason to believe is a Hazardous Substance, whether onto the ground, into any body of water, a storm or sanitary sewer, or the air, or anywhere on property owned or controlled by Company, including within any building or structure. Contractor will be solely responsible, as may be required by applicable Environmental Laws, for, in consultation with Company, (i) notifying the appropriate governmental agencies of such spill or release caused or permitted by the acts or omissions of Contractor and (ii) for the cleanup and remediation of such spill or release.

10. PROTECTION OF HIGHWAYS AND RAILROADS. Contractor will make suitable arrangements with governmental authorities and railroads for the construction of all structures, whether underneath or over roads, railroads or rights-of-way to protect the public from accident or delay. Contractor will repair, at its

own expense, to the satisfaction of the governmental authorities or other owners, all roads, railroads and bridges that may be damaged by, or given undue wear due to the Work.

11. CLEANING UP

11.1 Contractor will at all times keep the Work Site free of waste materials or rubbish caused by the Work. After completing the Work, Contractor will remove all its waste materials, rubbish, tools, supplies, equipment and surplus materials from and about the Work Site.

11.2 If Contractor fails to keep the Work Site clean or to clean up after completing the Work, Company may do so and charge all costs of cleaning up to Contractor. Those costs may be deducted from the final payment to Contractor.

12. COLLATERAL WORK. Company and other contractors may be working at the Work Site. Company reserves the right to coordinate the performance of Contractor's Work with the work of others. Contractor will cooperate with and will not delay, impede or otherwise impair the work of others. Company does not guarantee Contractor continuous uninterrupted access to the Work Site, but will provide such access as good construction practices will allow, considering the other activities in the area.

13. ALCOHOLIC BEVERAGES, DRUGS AND WEAPONS. Contractor will inform all members of Contractor Group who may be involved in the performance of any Work of the following Company rules relating to alcoholic beverages, drugs and weapons, with which all personnel are expected to comply:

13.1 Bringing, attempting to bring, possessing, using or being under the influence of intoxicants, drugs, or narcotics while on any Company Property, including but not limited to parking areas, is prohibited. Possessing alcoholic beverages in sealed containers is permitted, however, in designated parking areas.

13.2 Prescription or over-the-counter medications that could affect the performance of safety-sensitive work are allowed on Company Property only if they have been previously cleared by Contractor. Contractor must confirm that the medication and dosage do not impair an individual's ability to perform safety-sensitive work before clearing the individual to perform such work while under the influence of the medication.

13.3 Bringing, attempting to bring, possessing or using firearms, whether classified as legal or illegal, while on any Company Property, including but not limited to buildings, parking areas, recreation facilities, equipment and vehicles, is prohibited, unless otherwise required by applicable law. Use or possession of firearms for specific situations is permitted if approved by function or higher level management of Company.

13.4 Off-the-job involvement with intoxicants, illegal drugs, or illegal narcotics that adversely affects Company's business, to include impairing the individual's ability to perform his job or the public trust in the safe operation of Company, is prohibited.

13.5 Any conduct on any Company Property which is in violation of any state or federal law or regulation is considered a violation of these rules and a breach of any agreement to which these policies are attached.

13.6 In order to enforce these rules, all individuals with access to any Company Property as well as the vehicles, offices, lockers and any personal belongings of such individuals on any Company Property are subject to search by Company and its agents, to include security representatives appointed or employed by Company. Individuals may be required to take a blood, urinalysis or Breathalyzer test, or submit to other recognized investigatory tests or procedures as are deemed appropriate or necessary by Company in the investigation of a violation of these rules.

14. TITLE AND RIGHT. Nothing in the Agreement will vest Contractor with any right of property in materials used after they have been attached to or incorporated into the Work, nor materials for which Contractor has received full or partial payment. All those materials, upon being so attached, incorporated or paid for, will become the property of Company. Any gravel, sand, stone, minerals, timber or other materials excavated, uncovered, developed or obtained in the Work, or on any land belonging to Company may be used, in the performance of the Work, provided such materials meet the requirements of this Agreement. Any objects or natural materials or animals excavated or exposed that may have historical significance or constitute a threatened or endangered species must be brought to the attention of Company.

15. PROTECTION AGAINST LIENS AND ENCUMBRANCES

15.1 Contractor will not at any time permit any lien, attachment or other encumbrance ("Encumbrance") by any person or persons whosoever or by reason of any claim or demand against Contractor to be placed or remain on the property of Company, including, but not limited to, the Work Site upon which Work is being performed or equipment and materials that are being furnished. To prevent an Encumbrance from being placed on the property of Company, Contractor will furnish during the progress of any Work, as requested from time to time, verified statements showing Contractor's total outstanding indebtedness in connection with the Work.

15.2 If Contractor allows any indebtedness to accrue to subcontractors or others and fails to pay or discharge that indebtedness within five (5) days after demand, then Company may withhold any money due Contractor until that indebtedness is paid or pay the indebtedness and apply that amount against the money due Contractor.

15.3 If Contractor allows any Encumbrances, whether valid or invalid to be placed on the property of Company, any and all claims or demands for payment to Contractor will be denied by Company until the Encumbrance is removed. If the Encumbrance is not removed immediately, Company may pay that claim or demand and deduct the amount paid, together with all related expenses, including attorneys' fees, from any further payment due Contractor, or at Company's election, Contractor will, upon demand, reimburse Company for the amount paid and all related expenses. Any payment made in good faith by Company will be binding on Contractor.

16. TERMINATION FOR DEFAULT

16.1 If a petition in bankruptcy should be filed by Contractor, or if Contractor should make a general assignment for the benefit of creditors, or if a receiver should be appointed due to the insolvency of Contractor, or if Contractor should refuse or fail to supply enough properly skilled workmen or proper equipment, materials or services or should fail to make prompt payment to subcontractors, or to pay promptly for materials or labor, or disregard laws, ordinances or the instruction of Company's Contract Coordinator, or if Contractor should refuse or fail to abide by the SOW Construction Schedule or otherwise violate any provisions of the Agreement or SOW, then Company, upon a

determination by Company's Contract Coordinator that sufficient cause exists to justify such action, may, without prejudice to any other right or remedy available to it after giving Contractor seven (7) days' written notice, terminate the Agreement or the SOW and take possession of the Work Site. In the event of such a termination, Company may use all or part of Contractor's equipment and materials and may finish the Work by whatever method Company may deem expedient. In such event, Contractor will not be entitled to receive any further payment hereunder until the Work is finished. If the unpaid balance of the SOW fees will exceed the expense of finishing the Work, including compensation of Company's Contract Coordinator, other Company personnel, third party engineering companies, or other contractors for additional services, such excess will be paid to Contractor. If the expense of finishing the Work will exceed such unpaid balance, Contractor will pay the difference to Company within fifteen (15) days of receiving an invoice for same. The expenses incurred by Company herein, and the damage incurred through Contractor's default, will be determined by Company's Contract Coordinator, in its sole discretion, and such determination will be binding as between the parties.

16.2 In the event of a termination under the provisions of this Section 3, Contractor will transfer and assign to Company, in accordance with Company's instructions, all Work, all construction records, reports, permits, data and information, other materials (including all Company-supplied materials), supplies, Work in progress and other goods for which Contractor is entitled to receive reimbursement hereunder, and any and all plans, drawings, sketches, specifications, and information in connection with the Work, and will take such action as may be necessary to secure Company, at Company's sole election, the rights of Contractor under any or all orders and subcontracts made in connection with the Work.

16.3 In the event that Company so directs or authorizes, Contractor will sell at a price approved by Company, or retain at a mutually agreeable price, any such materials, supplies, Work in progress, or other goods as referred to in the preceding paragraph. In any event, Company will receive any and all records, plans, drawings, data, permits, specifications, sketches, reports, or other information relating to the Work. The proceeds of any such sale or the agreed price will be paid or credited to Company in such manner as Company may direct so as to reduce the amount payable by Company under this Section 3.

APPENDIX D
COVID-19 SITE ENTRY GUIDELINES

COVID-19 Vistra Site Entry Guidelines – *Effective: June 17, 2021*
These guidelines are applicable to ALL PERSONNEL entering Vistra work sites.

To enter a Vistra work site, each person must answer the following three questions with a "no" answer *and* pass the required temperature testing *unless* they display their Vistra vaccination sticker on their employee badge or hardhat:

Site Entry Questions:

1. In the past 10 days, have you tested positive for COVID-19 or are you currently waiting on test results?

2. In the past 10 days, have you been within six feet of someone, where masks were not worn, who:
    a. has tested positive for COVID-19,
    b. is known to be waiting on test results for COVID-19, or
    c. is under a quarantine order?

3. In the past 10 days, have you or someone who has been within six feet of you where masks were not worn had:
    a. flu-like symptoms,
    b. a deep, dry cough,
    c. recent shortness of breath or difficulty breathing,
    d. new loss of taste or smell, and/or
    e. fever of 100 degrees or above?

Temperature Testing:

You must register a temperature between 96- and 100-degrees Fahrenheit as described in the temperature procedures. (see next page for testing procedures)

- If your temperature is below 96 degrees, retest with a different device.
- If your temperature is 100-degrees Fahrenheit or above, retest on another device preferably an ear thermometer, if your temperature still registers 100-degrees Fahrenheit or above you may not enter the site.

Clearance to enter the site:

- If you have answered **"no"** to all three questions ***and*** passed the temperature test, you may enter the site.
- ***If you have an approved Vistra vaccination sticker, you are cleared to enter the site without the temperature test or answering COVID screening questions.***
- If you passed the temperature test ***and*** answered "Yes" to any of the questions, but have been cleared through VistraTravelerSafety (HR clearance) to enter the Vistra work site for that instance of exposure, testing, or symptoms, you may enter the site.

Anyone *not* cleared to enter the work site must immediately leave the work site and notify their supervisor who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.

Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.

Required Temperature Testing Procedures:

All persons entering the site without a Vistra vaccination sticker, who have cleared all questions above, will also submit to temperature testing or self-administer a temperature test as required by the facility management. If a self-administered test is required, then a member of the management team or their designee will witness the testing; however, where that is not practicable, each person must attest that they are only entering the site premises because they have passed the screening questions and temperature test required for entry. Also:

a. Hats may cause false high temperatures and should not be worn for five minutes immediately preceding a forehead temperature test.
b. Each person is responsible for ensuring all self-testing materials and areas touched during testing are sanitized.
c. All personnel should maintain a **distance of at least six feet** from other people during this process or wear required masks.

Temperature Testing Requirements:

1. **All persons entering the site without a Vistra vaccination sticker must register a temperature between 96- and 100-degrees Fahrenheit. Any such person who has a temperature not within that range or who triggers an alarm on a thermal camera** must **retest with a different device**, preferably an **ear thermometer**, if available. If the second test registers a temperature of 100 degrees or above:
    a. That person **may not enter** the Vistra work site and must notify their supervisor, who will notify HR at VistraTravelerSafety@vistracorp.com for next steps.
    b. If there is significant inconsistency between the two tests, repeat another temperature test and use the two closest readings.
2. **Anyone who registers a temperature between 96- and 100-degrees Fahrenheit** may proceed to their work site.
    - **If temperature is below 96 degrees, wait a few minutes and retest with a different device.**

Control rooms and communal areas:

All persons entering the site without a Vistra vaccination sticker should maintain at least six-feet distance from other people as much as possible and should wear face coverings when six-feet distance is not feasible. No one should gather in communal areas (including the temperature-testing area) without a Vistra vaccination sticker. Only operators are allowed in control rooms without plant manager approval.

Vistra Vaccination Sticker protocols:

All persons with a valid Vistra vaccination sticker do not have to socially distance or wear masks while at the site. They will also not be required to quarantine as a part of COVID-19 exposures unless exhibiting COVID-19 symptoms. To be eligible for these protocols, each person must have their approved Vistra vaccination sticker easily visible at all times while at work. If someone who has applied for a Vistra vaccination sticker believes they have specific health conditions that may affect the ability to have a full immune response to the vaccination, please consult your health provider prior to working without a mask.

Any symptomatic employee, unvaccinated employee exposed to COVID-19 or any employee tested for COVID-19 as described above must be cleared through VistraTravelerSafety prior to returning to work.

APPENDIX E
SAFETY DATA SHEETS

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Bottom Ash
Synonyms:	Ash; Ashes; Ash residues; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Coal Fly Ash; Pozzolan; Waste solids.
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause respiratory irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.*

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*20 - 40%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen. Category 1A*
Aluminosilicates[2]	*Various, see Footnote 2*	*10 - 60%*	*Single Exposure STOT, Category 3*
Calcium oxide (CaO)	*1305-78-8*	*10 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Manganese dioxide (MnO_2)	*1313-13-9*	*<2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1 - 10%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant Category 2* *Eye Irritant Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 3*	*Toxic to Reproduction Category 2*

[1]*The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen 1A has been assigned.*

[2]*Aluminosilicates (CAS# 1327-36-2) may be in the form of mullite (CAS# 1302-93-8); aluminosilicate glass; pozzolans (CAS# 71243-67-9); or calcium aluminosilicates such as tricalcium aluminate (C3A), or calcium sulfoaluminate (C4A3S). The form is dependent on the source of the coal and or the process used to create the CCP. Pulverized coal combustion would be more likely to create high levels of pozzolans. Aluminosilicates may have inclusions of calcium, titanium, iron, potassium, phosphorus, magnesium and other metal oxides.*

[3]*Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction Category 2 has been assigned.*

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable	0.05	0.05	0.025	0.05
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): 8 - 11	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point and boiling range (°C): Not applicable	**Partition coefficient: n-octane/water:** Not determined
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; no corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined)
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L
Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13
Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica
  - Titanium dioxide

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO_2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency
- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
- OSHA: Occupational Safety and Health Administration
- PA: Pennsylvania
- PBT: Persistent, Toxic and Bioaccumulative
- PEL: Permissible exposure limit
- PPE: Personal Protective Equipment
- REL: Recommended exposure limit
- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
- STOT-RE: Specific target organ toxicity-repeated exposure
- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
- TSCA: Toxic Substances Control Act
- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
****** Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

DYNEGY

Safety Data Sheet

Section 1
Identification of the Substance and of the Supplier

1.1 Product Identifier

Product Name/Identification:	ASTM Class C Fly Ash
Synonyms:	Coal Fly Ash, Pozzolan
Formula:	UVCB Substance

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advices Against

Relevant Identified Uses:	Component of wallboard, concrete, roofing material, bricks, cement kiln feed.
Uses Advised Against:	None known.

1.3 Details of the Supplier of the SDS

Manufacturer/Supplier:	Dynegy, Inc.
Street Address:	601 Travis Street, Suite 1400
City, State and Zip Code:	Houston, TX 77002
Customer Service Telephone:	800-633-4704

Section 2
Hazards Identification

2.1 Classification of the Substance

GHS Classification(s) according to OSHA Hazard Communication Standard (29 CFR 1910.1200):

- Eye Irritant, Category 2A
- STOT-SE, Category 3 (Respiratory Irritation)
- Carcinogen, Category 1A
- STOT-RE, Category 1 (Lungs)
- Toxic to Reproduction, Category 2

2.2 Label Elements

Labelling according to 29 CFR 1910.1200 Appendices A, B and C*	
Hazard Pictogram(s):	
Signal word:	**DANGER**
Hazard Statement(s):	*Causes serious eye irritation.* *May cause damage to lungs after repeated/prolonged exposure via inhalation.* *May cause respiratory irritation.* *May cause cancer of the lung.* *Suspected of damaging fertility or the unborn child.*
Precautionary Statement(s):	*Obtain special instructions before use.* *Do not handle until all safety precautions have been read and understood.* *Avoid breathing dust.* *Wear protective gloves/protective clothing/eye protection/face protection.* *Wash thoroughly after handling.* *Do not eat drink or smoke when using this product.* *Use outdoors or in a well-ventilated area.* *If exposed or concerned: Get medical advice/attention.* *Store in a secure area.* *Dispose of product in accordance with local/national regulations.*

** Fly ash and other coal combustion products (CCPs) are UVCB substances (unknown or variable composition or biological). Various CCPs, noted as ashes/ash residuals; Ashes, residues, bottom; Bottom ash; Bottom ash residues; Waste solids, ashes under TSCA are defined as: "The residuum from the burning of a combination of carbonaceous materials. The following elements may be present as oxides: aluminum, calcium, iron, magnesium, nickel, phosphorus, potassium, silicon, sulfur, titanium, and vanadium." Ashes including fly ash and fluidized bed combustion ash are identified by CAS number 68131-74-8. The exact composition of the ash is dependent on the fuel source and flue additives composed of many constituents. The*

classification of the final substance is dependent on the presence of specific identified oxides as well as other trace elements.

2.3 Other Hazards

Listed Carcinogens:

-Respirable Crystalline Silica

IARC: [Yes] **NTP:** [Yes] **OSHA:** [Yes] **Other:** **(ACGIH)** [Yes]

Section 3
Composition/Information on Ingredients

Substance	*CAS No.*	*Percentage (%)*	*GHS Classification*
Crystalline Silica	*14808-60-7*	*30 - 60%*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Silica, crystalline respirable (RCS)	*14808-60-7*	*See Footnote 1*	*Repeat Dose STOT, Category 1* *Carcinogen, Category 1A*
Aluminosilicates	*71243-67-9* *1327-36-2*	*30 - 60%*	*Single Exposure STOT, Category 3*
Iron oxide	*1309-37-1*	*1 - 10%*	*Not Classified*
Calcium oxide (CaO)	*1305-78-8*	*20 - 30%*	*Skin Irritant, Category 2* *Eye Irritant, Category 1* *Single Exposure STOT, Category 3*
Magnesium oxide	*1309-48-4*	*2 - 10%*	*Not Classified*
Phosphorus pentoxide (P_2O_5)	*1314-56-3*	*≤2%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Sodium oxide	*1313-59-3*	*1-8%*	*Not Classified*
Potassium oxide (K_2O)	*12136-45-7*	*≤1%*	*Skin Irritant, Category 2* *Eye Irritant, Category 2B*
Titanium dioxide (TiO_2)	*13463-67-7*	*<3%*	*Not Classified*
Bromide salt (calcium)	*7789-41-5*	*See Footnote 2*	*Toxic to Reproduction, Category 2*

Footnote 1: The percentage of respirable crystalline silica has not been determined. Therefore, a GHS classification of Carcinogen, Category 1A has been assigned.

Footnote 2: Analytical data are not available to demonstrate that the concentration of bromide salt is <0.1%; therefore, a GHS classification of Toxic to Reproduction, Category 2 has been assigned.

Section 4
First Aid Measures

4.1 Description of First Aid Measures

Inhalation:	If product is inhaled and irritation of the nose or coughing occurs, remove person to fresh air. Get medical advice/attention if respiratory symptoms persist.
Skin Contact:	If skin exposure occurs, wash with soap and water.
Eye Contact:	If product gets into the eye, rinse copiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical attention/advice if irritation occurs or persists.
Ingestion:	No specific first aid measures are required.

4.2 Most Important Health Effects, Both Acute and Delayed

Acute Effects: Direct exposure may cause respiratory irritation, eye irritation and skin irritation. The product dust can dry and irritate the skin and cause dermatitis and can irritate eyes and skin through mechanical abrasion.

Chronic Effects: Chronic exposure may cause lung damage from repeated exposure. Prolonged inhalation of respirable crystalline silica above certain concentrations may cause lung diseases, including silicosis and lung cancer. Repeated exposure to dusts containing inorganic bromide salts may affect fertility and/or result in effects to the unborn child.

4.3 Indication of Any Immediate Medical Attention and Special Treatment Needed

Seek first aid or call a doctor or Poison Control Center if contact with eyes occurs and irritation remains after rinsing. Get medical advice if inhalation occurs and respiratory symptoms persist.

Section 5
Firefighting Measures

5.1 Extinguishing Media

Suitable Extinguishing Media:	Product is not flammable. Use extinguishing media appropriate for surrounding fire.
Unsuitable Extinguishing Media:	Not applicable, the product is not flammable.

5.2 Special Hazards Arising from the Substance or Mixture

Hazardous Combustion Products:	None known.

5.3 Advice for Firefighters

Special Protective Equipment and Precautions for Firefighters:	As with any fire, wear self-contained breathing apparatus (NIOSH approved or equivalent) and full protective gear.

Section 6
Accidental Release Measures

6.1 Personal Precautions, Protective Equipment and Emergency Procedures

Personal precautions/Protective Equipment:	See Section 8.2.2 Individual Protective Measures. For concentrations exceeding Occupational Exposure Levels (OELs), use a self-contained breathing apparatus (SCBA).
Emergency procedures:	Use scooping, water spraying/flushing/misting or ventilated vacuum cleaning systems to clean up spills. Do not use pressurized air.

6.2 Environmental Precautions

Environmental precautions:	Prevent contamination of drains or waterways and dispose according to local and national regulations.

6.3 Methods and Material for Containment and Cleaning Up

Methods and materials for containment and cleaning up:	Do not use brooms or compressed air to clean surfaces. Use dust collection vacuum and extraction systems. Large spills of dry product should be removed by a vacuum system. Dampened material should be removed by mechanical means and recycled or disposed of according to local and national regulations.

See Sections 8 and 13 for additional information on exposure controls and disposal.

Section 7
Handling and Storage

7.1 Precautions for Safe Handling

Practice good housekeeping. Use adequate exhaust ventilation, dust collection and/or water mist to maintain airborne dust concentrations below permissible exposure limits (note: respirable crystalline silica dust may be in the air without a visible dust cloud).

Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain and test ventilation and dust collection equipment. In cases of insufficient ventilation, wear a NIOSH approved respirator for silica dust when handling or disposing dust from this product. Avoid contact with skin and eyes. Wash or vacuum clothing that has become dusty. Avoid eating, smoking, or drinking while handling the material.

7.2 Conditions for Safe Storage, Including any Incompatibilities

Minimize dust produced during loading and unloading.

Section 8
Exposure Controls/Personal Protection

8.1 Control Parameters

OCCUPATIONAL EXPOSURE LIMITS					
SUBSTANCE		**OSHA PEL TWA (mg/m^3)**	**NIOSH REL TWA (mg/m^3)**	**ACGIH TLV TWA (mg/m^3)**	**CA - OSHA PEL (mg/m^3)**
Calcium oxide		5	2	2	2
Particulates Not Otherwise Regulated	Total	15	15	10	10
	Respirable	5	5	3	5
Respirable Crystalline Silica	Respirable Crystalline Silica	0.05	0.05	0.025	0.05
Titanium dioxide	Total	15	2.4 (fine) 0.3 (ultrafine)	10	10
Manganese dioxide (as manganese compounds)	Total	5 (Ceiling)	1 3 (STEL)	0.1	0.2
	Respirable	-	-	0.02	-

8.2 Exposure Controls

8.2.1 Engineering Controls

Provide ventilation to maintain the ambient workplace atmosphere below the occupational exposure limit(s). Use general and local exhaust ventilation and dust collection systems as necessary to minimize exposure.

8.2.2 Personal Protective Equipment (PPE)

Respiratory protection:	Wear a NIOSH approved particulate respirator if exposure to airborne particulates is unavoidable and where occupational exposure limits may be exceeded. If airborne exposures are anticipated to exceed applicable PELs or TLVs, a self-contained breathing apparatus or airline respirator is recommended.
Eye and face protection:	If eye contact is possible, wear protective glasses with side shields. Avoid contact lenses.
Hand and skin protection:	Wear gloves and protective clothing. Wash hands with soap and water after contact with material.

Section 9
Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Property: Value	Property: Value
Appearance (physical state, color, etc.): Fine tan/ gray particulate	**Upper/lower flammability or explosive limits:** Not applicable
Odor: Odorless[1]	**Vapor Pressure (Pa):** Not applicable
Odor threshold: Not applicable	**Vapor Density:** Not applicable
pH (25 °C) (in water): Not Determined	**Specific gravity or relative density:** 2.2 – 2.9
Melting point/freezing point (°C): Not applicable	**Water Solubility:** Slight
Initial boiling point/boiling range (°C): NA	**Partition coefficient: n-octane/water:** NA
Flash point (°C): Not determined	**Auto ignition temperature (°C):** Not applicable
Evaporation rate: Not applicable	**Decomposition temperature (°C):** Not determined
Flammability (solid, gas): Not combustible	**Viscosity:** Not applicable

[1] The use of urea or aqueous ammonia injected into the flue gas to reduce nitrogen oxides (NOx) emissions may result in the presence of ammonium sulfate or ammonium bisulfate in the ash at less than 0.1%. When ash containing these substances becomes wet under high pH (>9), free ammonia gas may be released resulting in objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces.

Section 10
Stability and Reactivity

10.1 Reactivity:	The material is an inert, inorganic material primarily composed of elemental oxides.
10.2 Chemical stability:	The material is stable under normal use conditions.
10.3 Possibility of hazardous reactions:	The material is a relatively stable, inert material; however, when ash containing ammonia becomes wet under high pH (>9), free ammonia gas may be released resulting in an objectionable/nuisance ammonia odor and potential exposure to ammonia gas especially in confined spaces. Polymerization will not occur.
10.4 Conditions to avoid:	Product can become airborne in moderate winds. Dry material should be stored in silos. Materials stored out of doors should be covered or maintained in a damp condition.
10.5 Incompatible materials:	None known.
10. 6 Hazardous decomposition products:	None known.

Section 11
Toxicological Information

11.1 Information on Toxicological Effects

Endpoint	Data
Acute oral toxicity	LD50 > 2000 mg/kg
Acute dermal toxicity	LD50 > 2000 mg/kg
Acute inhalation toxicity	LD50 > 5.0 mg/L
Skin corrosion/irritation	Does not meet the classification criteria but may cause slight skin irritation. Product dust can dry the skin which can result in irritation.
Eye damage/irritation	Causes serious eye irritation. Positive scores for conjunctiva irritation and chemosis in 2/3 animals based on average of 24, 48 and 72-hour scores with irritation clearing within 21 days; No corneal or iritis effects observed.
Respiratory/skin sensitization	Not a respiratory or dermal sensitizer.
Germ cell mutagenicity	Not mutagenic in in-vitro and in-vivo assays with or without metabolic activation.
Carcinogenicity	Not available. Respirable crystalline silica has been identified as a carcinogen by OSHA, NTP, ACGIH and IARC.
Reproductive toxicity	No developmental toxicity was observed in available animal studies. Reproductive studies on CCPs showed either no reproductive effects, or some effects on male and female reproductive organs and parameters but without a clear dose response. Inorganic bromide salts have been shown to have adverse effects on reproductive parameters in some animal studies.
STOT-SE	CCPs when present as a nuisance dust may result in respiratory irritation.
STOT-RE	In a 180-day inhalation study with fly ash dust, no effects were observed at the highest dose tested. NOEC = 4.2 mg/m^3; it is not possible to assess the level at which toxicologically significant effects may occur. Repeated inhalation exposures to high levels of respirable crystalline silica may result in lung damage (i.e., silicosis).
Aspiration Hazard	Not applicable based product form.

Section 12
Ecological Information

12.1 Toxicity

Fly Ash C (CAS# 68131-74-8)	
Toxicity to Fish	LC50 > 100 mg/L
Toxicity to Aquatic Invertebrates	Data indicates that the test substance is not toxic to *Daphnia magna* (EC50 undetermined).
Toxicity to Aquatic Algae and Plants	EC50 = 10 mg/L

Calcium oxide CAS# 1305-78-8	
Toxicity to Fish	LC50 = 50.6 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Invertebrates	EC50 = 49.1 mg/L The findings were closely related to the pH of the test solutions; therefore, pH is considered to be the main reason for the effects.
Toxicity to Aquatic Algae and Plants	NOEC =48 mg/L @ 72 hours based on $Ca(OH)_2$ The initial pH of the test medium was not directly related to the biologically relevant effects. The formation of precipitates is likely the result of the reaction between CO_2 dissolved in the medium.

12.2 Persistence and Degradability

Not relevant for inorganic materials.

12.3 Bioaccumulative Potential

This material does not contain any compounds that would bioaccumulate up the food chain.

12.4 Mobility in Soil

No data available.

12.5 Results of PBT and vPvB Assessment

This material does not contain any compounds classified as “persistent, bioaccumulative or toxic” nor as “very persistent/very bioaccumulative”.

12.6 Other Adverse Effects

None known.

Section 13

Disposal Considerations

See Sections 7 and 8 above for safe handling and use, including appropriate industrial hygiene practices.

Dispose of all waste product and containers in accordance with federal, state and local regulations.

Section 14
Transport Information

Regulatory entity: U.S. DOT	Shipping Name:	Not Regulated
	Hazard Class:	Not Regulated
	ID Number:	Not Regulated
	Packing Group:	Not Regulated

Section 15
Regulatory Information

15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Mixture

- TSCA Inventory Status

  All components are listed on the TSCA Inventory.

- California Proposition 65.

  The following substances are known to the State of California to be carcinogens and/or reproductive toxicants:

  - Respirable crystalline silica

- State Right-to-Know (RTK)

Component	CAS	MA[1,2]	NJ[3,4]	PA[5]	RI[6]
Ammonium bisulfate	7803-63-6	No	Yes	No	No
Ammonium sulfate	7783-20-2	Yes	No	Yes	No
Calcium oxide	1305-78-8	Yes	Yes	Yes	No
Iron oxide	1309-37-1	Yes	Yes	Yes	No
Magnesium oxide	1309-48-4	No	Yes	No	No
Manganese oxide-as manganese compounds	1313-13-9; Various	No	No	Yes	Yes
Phosphorus pentoxide (or phosphorus oxide)	1314-56-3	Yes	Yes	Yes	No
Potassium oxide	12136-45-7	No	Yes	No	No
Silica-crystalline (SiO2), quartz	14808-60-7	Yes	Yes	Yes	No
Sodium oxide	1313-59-3	No	Yes	No	No
Titanium dioxide	13463-67-7	Yes	Yes	Yes	Yes

[1] Massachusetts Department of Public Health, no date
[2] 189th General Court of The Commonwealth of Massachusetts, no date
[3] New Jersey Department of Health and Senior Services, 2010a
[4] New Jersey Department of Health, 2010b
[5] Pennsylvania Code, 1986
[6] Rhode Island Department of Labor and Training, no date

Section 16
Other Information, Including Date of Preparation or Last Revision

16.1 Indication of Changes

Date of preparation or last revision: February 23, 2018

16.2 Abbreviations and Acronyms

- ACGIH: American Conference of Industrial Hygienists
- CA: California
- CAS: Chemical Abstract Services
- CCP: Coal Combustion Product
- CFR: Code of Federal Regulations
- EPA: Environmental Protection Agency

- GHS: Globally Harmonized System of Classification and Labelling
- IARC: International Agency for Research on Cancer
- LC50: Concentration resulting in the mortality of 50 % of an animal population
- LD50: Dose resulting in the mortality of 50 % of an animal population
- MA: Massachusetts
- NA: Not Applicable
- NJ: New Jersey
- NOEC: No observed effect concentration
- NIOSH: National Institute of Occupational Safety and Health
- NOx: Nitrogen oxides
- NTP: US National Toxicology Program
- OEL: Occupational Exposure Limit
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- RI: Rhode Island
- RCS: Respirable Crystalline Silica
- RTK: Right-to-Know
- SCBA: Self-contained breathing apparatus
- SDS: Safety Data Sheet
- STEL: Short-term exposure limit
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- STOT-SE: Specific target organ toxicity-single exposure
- TLV: Threshold limit value
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- TWA: Time-weighted average
- UEL: Upper explosive limit
- UVCB: Unknown or Variable Composition/Biological
- U.S.: United States
- U.S. DOT: United States of Department of Transportation

16.3 Other Hazards

Hazardous Materials Identification System (HMIS) Degree of hazard (0= low, 4 = extreme)							
Health:	2*	**Flammability:**	0	**Physical Hazards:**	0	**Personal protection:****	

** Chronic Health Effects*
****** Appropriate personal protection is defined by the activity to be performed.*
See Section 8 for additional information.

DISCLAIMER:

This SDS has been prepared in accordance with the Hazard Communication Rule 29 CFR 1910.1200. Information herein is based on data considered to be accurate as of date prepared. No warranty or representation, express or implied, is made as to the accuracy or completeness of this data and safety information. No responsibility can be assumed for any damage or injury resulting from abnormal use, failure to adhere to recommended practices, or from any hazards inherent in the nature of the product.

ATTACHMENT T

October 2021

Phil Morris
Kincaid Generation, L.L.C.
Luminant
1500 Eastport Plaza Drive
Collinsville, IL 62234

May 19, 2021

Mr. Darin LeCrone, P.E.
Manager, Industrial Unit
Bureau of Water, Division of Water Pollution Control, Permits Section
Illinois Environmental Protection Agency
1021 North Grand Avenue, East
Springfield, IL 62794-9276

Re: CCR Surface Impoundment Category Designation and Justification for Kincaid Generation, L.L.C.

Dear Mr. LeCrone:

Pursuant to 35 I.A.C. 845.700(c), Kincaid Generation, L.L.C. submits the information necessary to categorize the CCR surface impoundment located at the Kincaid Power Plant. The following parameters were used in assessing and justifying each assigned category.

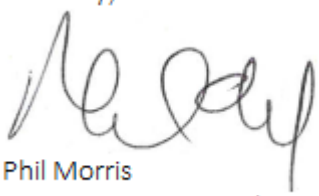
- Category 1 – *Impacts to existing potable water supply well or impacts to groundwater quality within the setback of an existing potable water supply well.*
  - This review includes an assessment of potable water wells within 2,500 feet of CCR surface impoundments to determine whether any potential impacts are occurring within the setback zone of any community water supply well established under the Illinois Groundwater Protection Act.
  - This information was developed during the Part 845 rulemaking and is summarized in Attachment 1, Table 2: Impacts to Potable Water Supply.
- Category 2 – *Imminent threat to human health or the environment or have been designated by IEPA under (g)(5)*
  - The surface impoundment at the Kincaid Power Plant does not pose an imminent threat to human health or the environment. There are no known conditions at or around the facility where someone or something may be exposed to contaminant concentrations reasonably expected to cause harm
- Category 3 – *Located in areas of environmental justice ("EJ") concern*
  - EJ areas were evaluated using the EJ mapping link from IEPA's webpage located at https://www2.illinois.gov/epa/topics/environmental-justice. Per the IEPA mapping tool, the EJ Status thresholds were determined as twice the state averages for Minority and Low Income consistent with 35 IAC 845.700(g)(6).
  - An EJ map denoting the facilities with impoundments is located in Attachment 2.

- Category 4-7
    - Category 4 - Inactive CCR surface impoundments that have an exceedance of the groundwater protection standards in Section 845.600
    - Category 5 - Existing CCR surface impoundments that have exceedances of the groundwater protection standards in Section 845.600
    - Category 6 - Inactive CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600.
    - Category 7 – Existing CCR surface impoundments that are in compliance with the groundwater protection standards in Section 845.600

Based on the information above, category designations have been assigned. The category designations for each CCR impoundment are shown in Attachment 1, Table 1: Category Designations.

If you have any questions regarding this submittal, please contact Phil Morris at 618-343-7794 or phil.morris@vistracorp.com.

Sincerely,



Phil Morris
Senior Environmental Director

Attachments

Attachment 1

Table 1: Category Designation

Facility	Pond Description	Classifications	Potable Water Supply Impacts (Category 1)	Human Health or Environment Threat (Category 2)	Located within Environmental Justice Areas[1] (Category 3)	Standards Exceedances[2] (Categories 4,5,6,7)	Impoundment Category 845.700(g)
Kincaid	Ash Pond	Existing	No	No	No	Yes	5

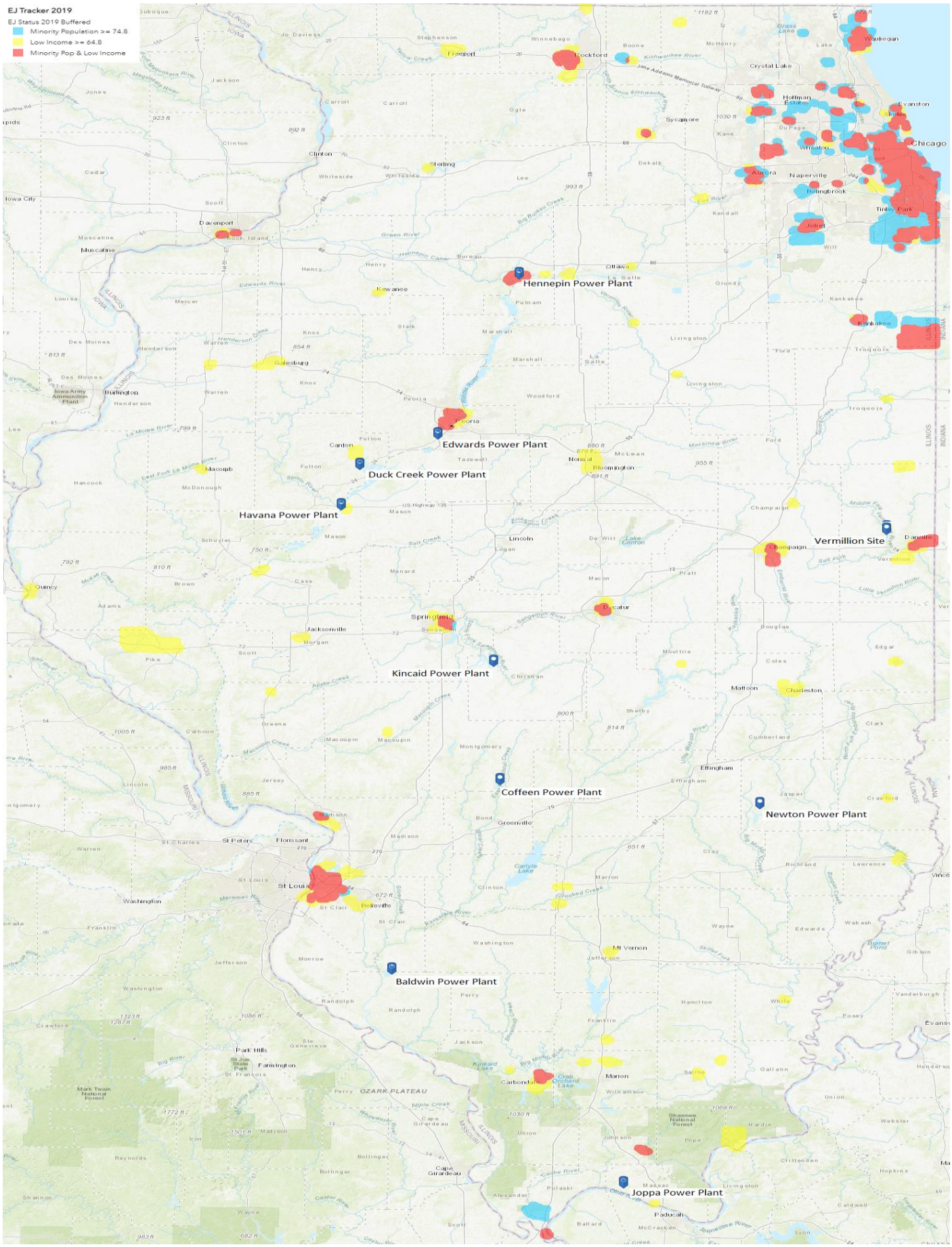
[1] See Attachment 2 Environmental Justice Area Map

[2] Ground water analyses for purposes of categories 4-7, assumptions have been made based on current groundwater data. However, since sampling and analysis is ongoing and subject to IEPA review and approval, IPGC reserves the right to update its category designations for Categories 4-7.

Table 2: Impacts to Potable Water Supply

Site Name	Private and Semi-Private Wells	Non-Community Water Supply (CWS) Wells	Non-CWS Surface Water Intakes	Community Water Supply Wells	CWS Surface Water Intakes
Kincaid	**Present, but not at risk** Twelve (12) water wells were identified; however, they are unlikely to be at risk because of their hydrogeologic location relative to the power plant and/or abandoned status. No off-site wells are located in the downgradient direction.	Absent	**Present, but inactive** One non-CWS surface water intake was identified; however, it is unlikely to be at risk because it is listed as inactive.	Absent	Absent

Attachment 2: EJ Mapping Denoting Facilities with Impoundments



ATTACHMENT U

October 2021

Geosyntec consultants

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October 11, 2021

Kincaid Generation, LLC
199 IL-104
Kincaid, Illinois 62540

Subject: USEPA CCR Rule and IEPA Part 845 Rule Applicability Cross-Reference
2021 USEPA CCR Rule Periodic Certification Report
Ash Pond, Kincaid Power Plant, Kincaid, Illinois

At the request of Kincaid Generation, LLC (KG), Geosyntec Consultants (Geosyntec) has prepared this letter to document how the attached 2021 United States Environmental Protection Agency (USEPA) CCR Rule Periodic Certification Report (Report) was prepared in accordance with both the Federal USEPA CCR Rule[1] and the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 Rule[2]. Specific sections of the report and the applicable sections of the USEPA CCR Rule and Illinois Part 845 Rule are cross-referenced in **Table 1**. A certification from a Qualified Professional Engineer for each of the CCR Rule sections listed in **Table 1** is provided in Section 9 of the attached Report. This certification statement is also applicable to each section of the Part 845 Rule listed in **Table 1.**

Table 1 – USEPA CCR Rule and Illinois Part 845 Rule Cross-Reference

Report Section	USEPA CCR Rule		Illinois Part 845 Rule	
3	§257.73 (a)(2)	Hazard Potential Classification	845.440	Hazard Potential Classification Assessment[3]
4	§257.73 (c)(1)	History of Construction	845.220(a)	Design and Construction Plans (Construction History)
5	§257.73 (d)(1)	Structural Stability Assessment	845.450 (a) and (c)	Structural Stability Assessment
6	§257.73 (e)(1)	Safety Factor Assessment	845.460 (a-b)	Safety Factor Assessment
7	§257.82 (a)(1-3)	Adequacy of Inflow Design Control System Plan	845.510(a), (c)(1), (c)(3)	Hydrologic and Hydraulic Capacity Requirements / Inflow Design Flood Control System Plan
	§257.82 (b)	Discharge from CCR Unit	845.510(b)	Discharge from CCR Surface Impoundment

[1] United Stated Environmental Protection Agency, 2015. *40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule.*
[2] State of Illinois, Joint Committee on Administrative Rule, Administrative Code (2021). *Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Subchapter j: Coal Combustion Waste Surface Impoundment, Part 845 Standards for the Disposal of Coal Combustion Residuals in Surface Impoundments.*
[3] "Significant" and "High" hazard, per the CCR Rule[1], are equivalent to Class II and Class I hazard potential, respectively, per Part 845[2].

CLOSING

This letter has been prepared to demonstrate that the content and Qualified Professional Engineer Certification of the 2021 Periodic USEPA CCR Rule Certification Report fulfills the corresponding requirements of Part 845 of Illinois Administrative Code listed in **Table 1**.

Sincerely,

Thomas Ward, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

2021 USEPA CCR RULE PERIODIC CERTIFICATION REPORT §257.73(a)(2)-(3), (c), (d[1]), (e) and §257.82 ASH POND Kincaid Power Plant Kincaid, Illinois

Submitted to

Kincaid Generation, LLC

199 IL-104
Kincaid, Illinois 62540

Submitted by

Geosyntec consultants

engineers | scientists | innovators

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

October 11, 2021

[1] Except for §257.73(d)(1)(vi).

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EXECUTIVE SUMMARY

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residuals (CCR) Rule [1] certification report (Periodic Certification Report) for the Ash Pond (AP) at the Kincaid Power Plant (KPP)[2], also known as the Kincaid Power Station (KIN), has been prepared in accordance with Rule 40, Code of Federal Regulations (CFR) §257, herein referred to as the "CCR Rule" [1]. The CCR Rule requires that initial certifications for existing CCR surface impoundment, completed in 2016 and subsequently posted on Kincaid Generation, LLC (KG) CCR Website ([2], [3], [4], [5], [6], [7]), be updated on a five-year basis.

The initial certification reports developed in 2016 and 2017 were independently reviewed by Geosyntec ([2], [3], [4], [5], [6], [7], [8], [9]). Additionally, field observations, interviews with plant staff, updated engineering analyses, and evaluations were performed to compare conditions in 2021 at the Ash Pond relative to the 2016 and 2017 initial certifications. These tasks determined that updates are not required for the Initial Hazard Potential Classification and Initial Safety Factor Assessment. However, due to changes at the site, updates were required and were performed for the:

- History of Construction Report;
- Initial Structural Stability Assessment, and
- Initial Inflow Design Flood Control System Plan.

Geosyntec's evaluations of the initial certification reports and updated analyses determined that the KPP Ash Pond meets all requirements for hazard potential classification, history of construction reporting, structural stability, safety factor assessment, and hydrologic and hydraulic control. **Table 1** provides a summary of the initial 2016 certifications and the updated 2021 periodic certifications.

[2] The Ash Pond is also referred to as ID Number W0218140002-01, Ash Pond by the Illinois Environmental Protection Agency (IEPA); CCR unit ID 141 by KG; and IL50706 within the National Inventory of Dams (NID) maintained by the Illinois Department of Natural Resources (IDNR). Within this document it is referred to as the AP.

Table 1 – Periodic Certification Summary

	CCR Rule Reference	Requirement Summary	2016 Initial Certification		2021 Periodic Certification	
			Requirement Met?	Comments	Requirement Met?	Comments
Hazard Potential Classification						
3	§257.73(a)(2)	Document Hazard Potential Classification	Yes	Impoundment was determined to have "Significant" hazard potential classification [2].	Yes	No changes were identified that may affect this requirement.
History of Construction						
5	§257.73(c)(1)	Compile a History of Construction	Yes	A History of Construction report was prepared for the Ash Pond [4].	Yes	A letter listing updates to the History of Construction report is provided in **Attachment C**.
Structural Stability Assessment						
6	§257.73(d)(1)(i)	Stable Foundations	Yes	Foundations were found to be stable [9].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(ii)	Adequate Slope Protection	Yes	Slope protection was adequate [9].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(iii)	Sufficiency of Dike Compaction	Yes	Dike compaction was sufficient for expected ranges in loading conditions [9].	Yes	No changes were identified that may affect this requirement.
	§257.73(d)(1)(iv)	Presence and Condition of Slope Vegetation	Yes	Vegetation was present on exterior slopes and is maintained [9].	Yes	No substantial bare or overgrown areas were observed.
	§257.73(d)(1)(v)(A) and (B)	Adequacy of Spillway Design and Management	Yes	Spillways were adequately designed and constructed and were expected to adequately manage flow during 1,000-year flood [9].	Yes	Spillways were found to be adequately designed and constructed and are expected to manage flow during the 1,000-year flood, after performing updated hydrologic and hydraulic analyses, if the starting water surface elevation does not exceed El. 602.8 ft.
	§257.73(d)(1)(vi)	Structural Integrity of Hydraulic Structures	No	Requirement could not be certified in 2016 due to inability to complete a CCTV inspection of the recycle intake structure pipe. AECOM recommended inspecting this pipe as soon as feasible to address the issue [9].	Periodic certification of §257.73(d)(1)(vi) was performed independently Luminant in 2020 [10].	
	§257.73(d)(1)(vii)	Stability of Downstream Slopes Inundated by Waterbody	Yes	A sudden drawdown factor of safety was determined to satisfy §257.73(d)(1)(vii) [9].	Yes	No changes were identified that may affect this requirement.
Safety Factor Assessment						
7	§257.73€(1)(i)	Maximum storage pool safety factor must be at least 1.50	Yes	The safety factor was calculated to be 1.57 [6].	Yes	No changes were identified that may affect this requirement.
	§257.73€(1)(ii)	Maximum surcharge pool safety factor must be at least 1.40	Yes	The safety factor was calculated to be 1.57 [6].	Yes	No changes were identified that may affect this requirement.
	§257.73(e)(1)(iii)	Seismic safety factor must be at least 1.00	Yes	Safety factor was calculated to be 1.27 [6].	Yes	No changes were identified that may affect this requirement.
	§257.73(e)(1)(iv)	For dike construction of soils that have susceptible to liquefaction, safety factor must be at least 1.20	Not Applicable	Dike soils were not susceptible to liquefaction [6].	Not Applicable	No changes were identified that may affect this requirement.
Inflow Design Flood Control System Plan						
8	§257.82(a)(1), (2), (3)	Adequacy of Inflow Design Control System Plan	Yes	Flood control system adequately managed inflow and peak discharge during the 1,000-year, 24-hour, Inflow Design Flood [9].	Yes	The flood control system was found to adequately manage inflow and peak discharge during the 1,000-year, 24-hour, Inflow Design Flood, after performing updated hydrologic and hydraulic analyses, if the starting water surface elevation does not exceed El. 602.8 ft.
	§257.82(b)	Discharge from CCR Unit	Yes	Discharge from the CCR Unit is routed through an NPDES-permitted outfall during both normal and 1,000-year, 24-hour Inflow Design Flood conditions [7].	Yes	Discharge in pollutants in violation of the NPDES permit were found to not be expected to occur during both normal and 1,000-year, 24-hour Inflow Design Flood conditions, after performing updated hydrologic and hydraulic analyses, if the starting water surface elevation does not exceed El. 602.8 ft.

SECTION 1

INTRODUCTION AND BACKGROUND

This Periodic United States Environmental Protection Agency (USEPA) Coal Combustion Residual (CCR) Rule [1] Certification Report was prepared by Geosyntec Consultants (Geosyntec) for Kincaid Generation, LLC (KG) to document the periodic certification of the Ash Pond (AP) at the Kincaid Power Plant (KPP), also known as the Kincaid Power Station, located at 199 IL-104, Kincaid, Illinois, 62540. The location of KPP is provided in **Figure 1**, and a site plan showing the location of the Ash Pond (AP) is provided in **Figure 2**.

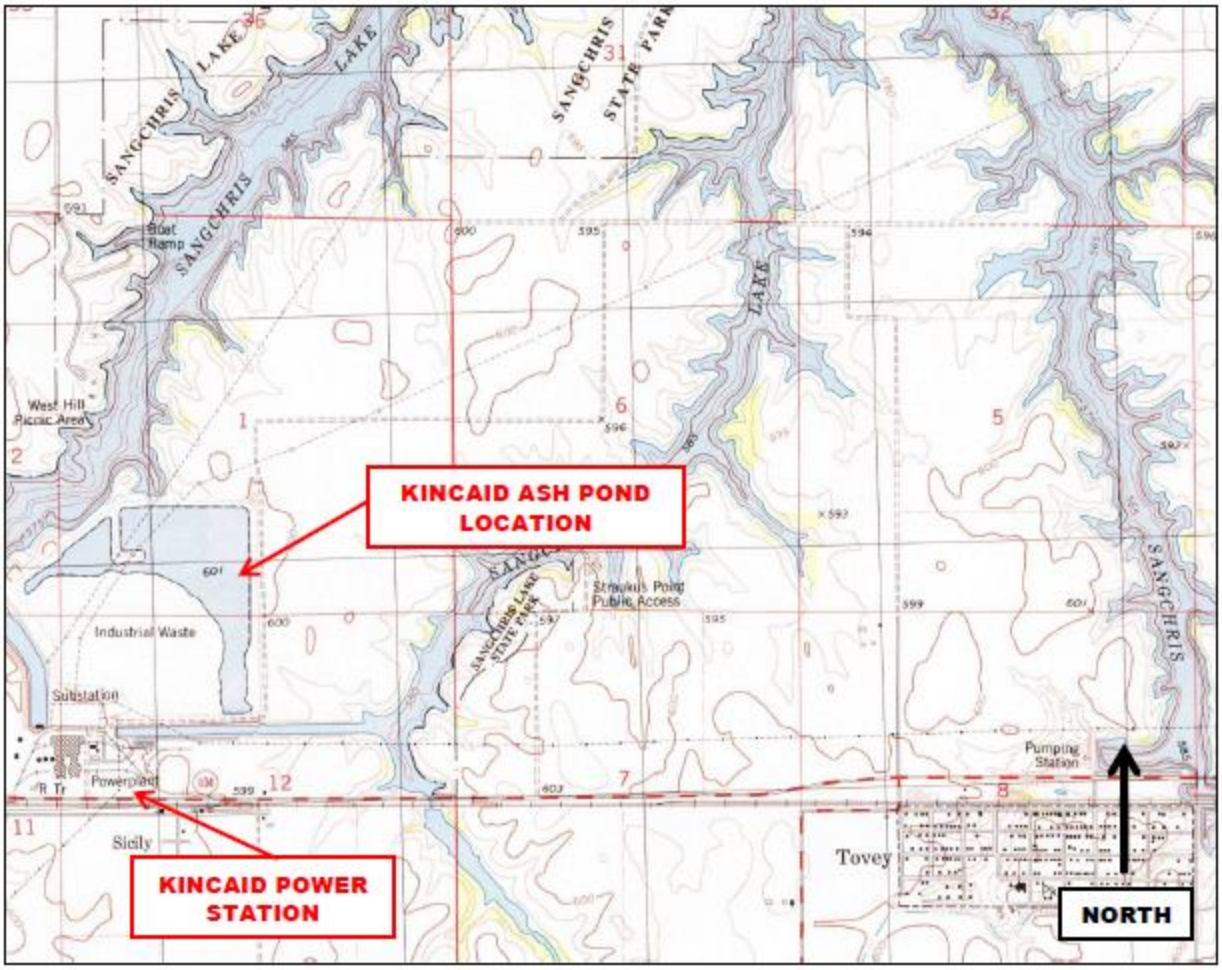


Figure 1 – Kincaid Power Plant Location Map (from AECOM, 2016)

Figure 2 – Kincaid Power Plant Site Plan (adapted from Google Earth Pro, October 2018)

1.1 Ash Pond Description

The Kincaid Ash Pond serves as the wet ash impoundment basin and contains materials such as bottom ash, fly ash, and miscellaneous non-CCR process water from the Kincaid Power Plant. The Kincaid Ash Pond receives sluiced bottom ash from the power plant through eight sluice pipes, which discharge into the southwest side of the basin. A third-party recycling company recovers acceptable ash for beneficial reuse, and unacceptable materials are left in the Kincaid Ash Pond. Due to the volumes of ash removed for beneficial reuse, the quantity of ash within the Kincaid Ash Pond does not significantly change from year to year [9].

Normal outflow from the Kincaid Ash Pond is conveyed into the recycle intake structure (screen house) located at the southeast corner of the embankment. This structure is comprised of a concrete headwall, a fiberglass and steel grating system to control (screen) debris, and a 60-in. diameter reinforced concrete recycle pipe (RCP) with an obvert centerline elevation of 589.45 feet[3], which is used to convey water approximately 2,000 feet westward to the recycle pump house, where it is recycled for use in plant processes or is diverted to the onsite wastewater treatment plant. Outflow

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

from the Kincaid Ash Pond into the recycle pipe is controlled by a steel gate valve installed on the pipe inlet, which can be operated from inside the screen house. A concrete weir is also present in front of the recycle pipe but has a top elevation of 595.21 feet, which is lower than the maximum normal operating pool of the Kincaid Ash Pond (El. 603.3 feet). Therefore, the weir is completely submerged during normal operations [9].

An emergency outlet (effluent) structure is also located at the southeast corner of the impoundment and serves to discharge pond water into the adjacent discharge flume during emergency or upset conditions. The discharge flume feeds into Sangchris Lake. The emergency outlet structure consists of a square concrete riser structure with an exterior steel 3-foot circular gate valve (invert El. 597.21 feet) and opening discharging into the center of the concrete riser structure, which leads into an open 48-inch corrugated metal pipe (CMP) emergency outlet (approximate centerline elevation of 529.5 feet, based on historic drawings). The gate valve can be operated from an access walkway leading to the emergency outlet structure. The top of the emergency outlet structure is open to the Kincaid Ash Pond on three sides, with open dimensions of 3-foot square. The opening effectively acts as a 9-foot-wide overflow weir that is activated when the pool level in the Kincaid Ash Pond exceeds El. 604.3 feet. As the 48-inch CMP is ungated, flow is transmitted freely into the emergency outlet structure when the pond level exceeds El. 604.3 feet and outflows to the discharge flume via the 48-inch CMP, without needing to manually operate the exterior gate valve [9].

An approximately 1,100-foot-long section of the south embankment, adjacent to the discharge flume, has a crest elevation around 6 to 17 feet lower than the rest of the embankment, with typical elevation of 605 ft, and is intended to act as a secondary emergency spillway. Outside of the gravel crest access road and riprap erosion protection at the embankment toe adjacent to the discharge channel, this area is not lined [9].

An engineered liner system is not present beneath the Kincaid Ash Pond. The surface area of the impoundment is approximately 178 acres, and the embankment portion of the Kincaid Ash Pond has a total length of approximately 11,000 feet and a maximum height above the exterior grade of 30 feet. The embankment was constructed as a homogenous earthen structure with well-compacted clayey fill. Portions of the north embankment adjacent to Sangchris Lake include crushed stone near the waterline for erosion protection. The north, northwest, and south embankment sections exhibit approximately 1.4H:1V (horizontal: vertical) downstream slopes, and the south embankment sections near the southeast corner exhibit a 6H:1V slope. Upstream slopes are typically around 3H:1V. Embankment crest width ranges from approximately 10 to 25 feet, and the crest is covered with a gravel access road [9].

As currently operated, the normal pool elevation ranges from 601.8 to 602.5 feet during non-winter conditions. A maximum pool elevation of 603.3 feet may be used during winter conditions to alleviate problems with freezing that may affect flow into the recycle intake structure. Dike crest

elevations range from approximately 604.5 to 607 feet for the south embankment and 614 to 622 feet for all other embankments with erosion-resistant material [9].

Initial certifications for the AP for Hazard Potential Classification (§257.73(a)(2)), History of Construction (§257.73(c)), Structural Stability Assessment (§257.73(d)), Safety Factor Assessment (§257.73(e)(1)), and Inflow Design Flood Control System Plan (§257.82) were completed by Stantec and AECOM in 2016 and 2017 and subsequently posted to KG's CCR Website ([2], [3], [4], [5], [6], [7]). Additional documentation for the initial certifications included detailed operating record reports containing calculations and other information prepared for the hazard potential classification by Stantec [8] and for the structural stability assessment, safety factor assessment, and inflow design flood control system plan by AECOM [9]. These operating record reports were not posted to KG's CCR Website.

1.2 Report Objectives

These following are the objectives of this report:

- Compare site conditions from 2015/2016, when the initial certifications were developed, to site conditions in 2020/2021, when data for the periodic certification was obtained, and evaluate if updates are required for the:
    - §257.73(a)(2) Hazard Potential Classification [2];
    - §257.73(c) History of Construction [4];
    - §257.73(d) Structural Stability Assessment [5];
    - §257.73(e) Safety Factor Assessment [6]; and/or
    - §257.82 Inflow Design Flood Control System Plan [7].
- Independently review the Hazard Potential Classification ([2], [8]), Inundation Map [3], Structural Stability Assessment ([5], [9]), Safety Factor Assessment ([6], [9]), and Inflow Design Flood Control System Plan ([7], [9]) reports to assess if updates may be required based on technical considerations.
    - The History of Construction report [4] was not independently reviewed for technical considerations, as this report contained historical information primarily developed prior to promulgation of the CCR Rule [1] for the CCR units at KPP and did not include calculations or other information used to certify performance and/or integrity of the impoundments under §257.73(a)(2)-(3), §257.73(c)-(e), or §257.82.
- If updates are required, they will be performed and documented within this report.

- Confirm that the AP meets all the requirements associated with §257.73(a)(2)-(3), (c), (d), (e), and §257.82, or, if the AP does not meet all requirements, provide recommendations for compliance with these sections of the CCR Rule [1].

SECTION 2

COMPARISON OF INITIAL AND PERIODIC SITE CONDITIONS

2.1 Overview

This section describes the comparison of conditions at the Ash Pond (AP) between the start of the initial CCR certification program in 2015 and 2016 (initial conditions) and subsequent collection of periodic certification site data in 2020 and 2021 (periodic conditions).

2.2 Review of Annual Inspection Reports

Annual onsite inspections for the AP were performed between 2016 and 2020 ([11], [12], [13], [14], [15]) and were certified by a licensed professional engineer in accordance with §257.83(b). Each inspection report stated the following information, relative to the previous inspection:

- A statement that no changes in geometry of the impounding structure were observed since the previous inspection;
- Information on maximum recorded instrumentation readings and water levels;
- Approximate volumes of impounded water and CCR at the time of inspection;
- A statement that no appearances of actual or potential structural weakness or other disruptive conditions were observed; and
- A statement that no other changes which may have affected the stability or operation of the impounding structure were observed.

In summary, the reports did not indicate any significant changes to the Ash Pond between 2015 and 2020. No signs of instability, structural weakness, or changes which may have affected the operation or stability of the AP were noted in the inspection reports.

2.3 Review of Instrumentation Data

Fifteen piezometers are present at the AP and were monitored monthly by KG between August 23, 2015 and June 16, 2021 [16]. These piezometers consist of KIN-P001 through KIN-P012 and PZ-4A through PZ-4C. Geosyntec reviewed the piezometer data to evaluate if significant fluctuations, partially increases in phreatic levels, may have occurred between development of the initial structural stability and factor of safety certifications ([9], [5], [6]) and May 19, 2021. Available piezometer readings are plotted in **Attachment A**.

In summary, only minor changes in phreatic conditions were observed in the available piezometric data. Phreatic levels typically varied by five feet on average. Changes in these phreatic levels do

not significantly differ from those utilized in the initial structural stability and factor of safety certifications ([9], [5], [6]).

2.4 Comparison of Initial to Periodic Surveys

The initial survey of the Ash Pond, conducted by Weaver Consultants Group (Weaver) in 2015 [17], was compared to the periodic survey of the AP, conducted by IngenAE, LLC (IngenAE) in 2020 [18], using AutoCAD Civil3D 2021 software. This comparison quantified changes in the volume of CCR placed within the AP and considered volumetric changes above and below the starting water surface elevation (SWSE) used for the 2016 §257.82 inflow design flood control plan hydraulic analysis [9]. Potential changes to embankment geometry were also evaluated. This comparison is presented in a side-by-side view of the surveys in **Drawing 1** and a plan view isopach map denoting changes in ground surface elevation in **Drawing 2**. A summary of the water elevations and changes in CCR volumes is provided in **Table 2**.

Table 2 – Initial to Periodic Survey Comparison

Initial Surveyed Pool Elevation (ft)	602.6
Periodic Surveyed Pool Elevation (ft)	602.4
Initial §257.82 Starting Water Surface Elevation (SWSE) (ft)	603.3
Total Change in CCR Volume (CY)	-77,671
Change in CCR Volume Above SWSE (CY)	-49,042
Change in CCR Volume Below SWSE (CY)	-28,819

The comparison indicated that approximately 78,000 CY of CCR may have been removed from the Ash Pond between the initial and periodic surveys. The periodic survey also indicated dike crest elevations of initial and periodic surveys on the order of two feet lower than the initial survey, with the minimum crest elevation being 604.5 feet, compared to 605.2 ft in the initial survey.

2.5 Comparison of Initial to Periodic Aerial Photography

Initial aerial photographs of the Ash Pond collected by Weaver in 2015 [17] were compared to periodic aerial photographs collected by IngenAE in 2020 [18] to visually evaluate if potential site changes (i.e., changes to the embankment, outlet structures, limits of CCR, other appurtenances) may have occurred. A comparison of these aerial photographs is provided in **Drawing 3**. No significant changes were identified.

2.6 Comparison of Initial to Periodic Site Visits

An initial site visit to the Ash Pond was conducted by AECOM in 2015 and documented with a Site Visit Summary and corresponding photographs [19].

A periodic site visit was conducted by Geosyntec on June 10, 2021, with Mr. Thomas Ward, P.E. and Ms. Crystal Luttrell conducting the site visit. The site visit was intended to evaluate potential changes at the site since the initial certifications were prepared (i.e., modification to the embankment, outlet structures or other appurtenances, limits of CCR, maintenance programs, repairs), in addition to performing visual observations of the AP to evaluate if the structural stability requirements (§257.73(d)) were met. The site visit included walking the perimeter of the

AP, visually observing conditions, recording filed notes, and collecting photographs. The site visit is documented in a field observation form and photographic log provided in **Attachment B**.

2.7 Interview with Power Plant Staff

An interview with Mr. Tim Arnold of KPP was conducted by Mr. Thomas Ward, P.E. and Ms. Crystal Luttrell of Geosyntec on June 10, 2021. Mr. Arnold was employed at KPP between 2019 and 2021 as the manager of environmental, with the responsibility of managing the Ash Pond from an environmental standpoint. The interview included a discussion of potential changes that may have occurred at the Ash Pond since development of the initial certifications ([2], [3], [4], [5], [6], [7]).

A summary of the interview is provided below.

- Were any construction projects completed for the CCR Surface Impoundment since 2015, and, if so, can you please describe the work, reason for the work, and provide any design drawings and/or details available?
    - No.
- Were there any changes to the purpose of the CCR Surface Impoundment since 2015?
    - No.
- Were there any changes to the instrumentation program and/or physical instruments for the CCR Surface Impoundment between 2015 and 2021, and, if so, are records available?
    - No.
- Have any area-capacity curves for the CCR Surface Impoundment been prepared since 2015?
    - No.
- Were there any changes to spillways and/or diversion features for the CCR Surface Impoundment completed since 2015, and, if so, are records available?
    - No.
- Were there any changes to construction specifications, surveillance, maintenance, and repair procedures for the CCR Surface Impoundment since 2015, and, if so, are records available?
    - No.
- Were there any instances of dike and/or structural instability for the CCR Surface Impoundment since 2015, and, if so, are records available?

- No.

SECTION 3

HAZARD POTENTIAL CLASSIFICATION - §257.73(a)(2)

3.1 Overview of Initial HPC

The Initial Hazard Potential Classification (Initial HPC) was prepared by Stantec Consulting Services, Inc. (Stantec) in 2016 ([2], [8]), following the requirements of §257.73(a)(2). The Initial HPC included the following information:

- Performing a breach analysis to evaluate the potential hazards associated with a failure of the AP's perimeter containment dike, along the east embankment and the lowest crest elevation on the AP embankment [2].

- Evaluation of potential breach flow paths were evaluated using elevation data and aerial imagery to evaluate potential impacts to downstream structures, infrastructure, frequently occupied facilities/areas, and waterways [2].

- While a breach map is not included within the Initial HPC, it included within the §257.73(a)(3) Initial Emergency Action Plan [3].

The visual analysis indicated that none of the breach scenarios appeared to impact occupied structures, although a breach of the east embankment could impact an infrequently used gravel site access road and a breach to the north would inundate the leachate pond. The Initial HPC concluded that neither breach would be likely to result in a probable loss of human life, although the breach could cause CCR to be released onto farmland, thereby causing environmental damage. The Initial HPC therefore recommended a "Significant" hazard potential classification for the Ash Pond [2].

3.2 Review of Initial HPC

Geosyntec performed a review of the Initial HPC ([2], [8]) in terms of technical approach, input parameters, assessment of the results, and applicable requirements of the CCR Rule [1]. Some technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations. The review included the following tasks:

- Review of all report documentation and figures

- Check that correct CCR Rule guidance is referenced and followed

- Review of appropriate failure mode selections

- Review for changes to the site and surrounding area

- Review that appropriate breach analysis methodology, model software, and inputs were utilized

- Check that selected HPC is appropriate per results of the breach analysis

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

3.3 Summary of Site Changes Affecting the Initial HPC

Geosytnec recommends retaining the "Significant" hazard potential classification for the Ash Pond, per §257.73(a)(2), based on the lack of site changes potentially affecting the Initial HPC occurring since the Initial HPC was developed, as described in **Section 3.3**, and the lack of significant review comments, as described in **Section 3.2**. Updates to the Initial HPC reports ([2], [8]) are not recommended at this time.

SECTION 4

HISTORY OF CONSTRUCTION REPORT - §257.73(c)

4.1 Overview of Initial HoC

The Initial History of Construction report (Initial HoC) was prepared by AECOM in 2016 [4], following the requirements of §257.73(c), and included information on the CCR surface impoundment, AP, at KPP. The Initial HoC included the following information for the CCR surface impoundment:

- The name and address of the owner/operator,
- Location maps,
- Statements of purpose,
- The names and size of the surrounding watershed,
- A description of the foundation and abutment materials,
- A description of the dike materials,
- Approximate dates and stages of construction,
- Available design and engineering drawings,
- A summary of instrumentation,
- A statement that area-capacity curves are not available,
- Information on spillway structures,
- Construction specifications,
- Inspection and surveillance plans,
- Information on operational and maintenance procedures, and
- A statement that historical structural instability had not occurred at any of the CCR surface impoundments.

4.2 Summary of Site Changes Affecting the Initial HoC

Several significant changes were identified at the site that occurred after development of the Initial HoC report [4] and are described below:

- A state identification number (ID) of W0218140002-01 was assigned to the AP by the Illinois Environmental Protection Agency (IEAP).

- Revised area-capacity curves and spillway design calculations for the AP were prepared as part of the Periodical Inflow Design Flood Control System Plan Assessment, as described in **Section 7.**

A letter documenting changes to the HoC report is provided in **Attachment C**.

SECTION 5

STRUCTURAL STABILITY ASSESSMENT - §257.73(d)

5.1 Overview of Initial SSA

The Initial Structural Stability Assessment (Initial SSA) was prepared by AECOM in 2016 ([5], [9]), following the requirements of §257.73(d)(1), and included the following evaluations:

- Stability of dike foundations, slope protection, dike compaction, and slope vegetation,
- Spillway stability including capacity, structural stability and integrity; and
- Downstream slope stability under sudden drawdown conditions for a downstream water body.

The Initial SSA concluded that the AP met all structural stability requirements for §257.73(d)(1)(i) through (v) and (vii), but recommended inspection of the recycle intake structure pipe in the southeast corner of the AP in order to verify that the AP meets the stability and structural integrity criteria for hydraulic outfall structures, per §257.73(d)(1)(vi). An inspection of this intake pipe was not previously performed due to high pipe flows required for operation precluding closed-circuit television (CCTV) inspections.

A periodic certification of the structural stability and structural integrity for hydraulic outfall structures (§257.73(d)(1)(vi)) was performed by Luminant in 2020 [10]. This certification independently determined that the criteria was met due to the condition of the spillway pipes and the soil types within the embankment. Therefore, the review and certification of §257.73(d)(1)(vi) is not included within the scope of this report.

The Initial SSA referenced the results of the Initial Structural Factor Assessment (Initial SFA) ([6], [9]), to demonstrate stability of the stability of foundations and abutments (§257.73(d)(1)(i)) and sufficiency of dike compaction (§257.73(d)(1)(iii)) portions of the SSA criteria. This included stating that slope stability analyses for slip surfaces passing through the foundation met or exceeded the criteria listed in §257.73(e)(1), for the stability of foundations and abutments. For the sufficiency of dike compaction, this included stating that slope stability analyses for slip surfaces passing through the dike also met or exceeded the §257.73(e)(1) criteria.

Additionally, the Initial SSA included a sudden drawdown slope stability analysis to evaluate the effect of a drawdown event in adjacent Sangchris Lake from normal pool to empty pool, as required by §257.73(d)(1)(vii) for CCR units where the downstream slopes are inundated by an adjacent water body. The minimum factor of safety for this loading condition was assumed to be 1.3 based on U.S. Army Corps of Engineers guidance [20].

5.2 Review of Initial SSA

Geosyntec performed a review of the Initial SSA ([5], [9]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Review of photographs collected in 2015 and used to demonstrate compliance with §257.73(d)(1)(i)-(vii).
- Reviewing geotechnical calculations used to demonstrate the stability of foundations, per §257.73(d)(1)(i); sufficiency of dike compaction, per §257.73(d)(1)(iii); and downstream slope stability, per §257.73(d)(1)(vii). Supporting geotechnical investigation and testing data, input parameters, analysis methodology, selection of critical cross-sections, and loading conditions were reviewed.
- Review of the methodology used to demonstrate that a downstream water body that could induce a sudden drawdown condition, per §257.73(d)(1)(vii), is not present.

No significant technical issues were noted within the technical review of the Initial SSA, although a detailed review (e.g., check) of the calculations was not performed.

5.3 Summary of Site Changes Affecting the Initial SSA

One change at the site that occurred after development of the Initial SSA was identified. This change required an update to the Initial SSA and is described below:

- The Initial SSA utilized the results of the Initial Inflow Design Flood Control System Plan (IDF) to demonstrate compliance with the adequacy of spillway design and management (§257.73(d)(1)(v)(A)-(B)). The Initial IDF was subsequently updated to develop a Periodic IDF, based on site changes, as discussed in **Section 7**.

5.4 Periodic SSA

The Periodic IDF (**Section 7**) indicates that spillways are adequately designed and constructed to adequately manage flow during the 1,000-year flood, as the spillways can adequately manage flow during peak discharge from the 1,000-year storm event without overtopping of the embankments. Therefore, the requirements of §257.73(d)(1)(v)(A)-(B) are met for the Periodic SSA.

Certification of §257.73(d)(1)(vi) was independently performed by Luminant [10].

SECTION 6

SAFETY FACTOR ASSESSMENT - §257.73(e)(1)

6.1 Overview of Initial SFA

The Initial Safety Factor Assessment (Initial SFA) was prepared by AECOM in 2016 ([6], [9]), following the requirements of §257.73(e)(1). The Initial SFA included the following information:

- A geotechnical investigation program with in-situ and laboratory testing;
- An assessment of the potential for liquefaction in the dike and foundation soils;
- The development of five slope stability cross-sections for limit equilibrium stability analysis utilizing GeoStudio SLOPE/W software; and
- The analysis of the critical cross-sections for maximum storage pool, maximum surcharge pool, and seismic loading conditions.
    - Liquefaction loading conditions were evaluated via post-earthquake analysis as liquefaction-susceptible soil layers were identified in the soft clay layer located between the foundation clay and glacial till layer in the Kincaid Ash Pond.

The Initial SFA concluded that the Ash Pond met all safety factor requirements, per §257.73(e), as all calculated safety factors were equal to or higher than the minimum required values.

6.2 Review of Initial SFA

Geosyntec performed a review of the Initial SFA ([6], [9]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing geotechnical calculations used to demonstrate the acceptable safety factors, per §257.73(e)(1), in terms of:
    - Completeness and adequacy of supporting geotechnical investigation and testing data;
    - Completeness and approach of liquefaction triggering assessments; and
    - Analyzed loading conditions relative to the applicable CCR Rule [1] requirements and site-specific conditions.
    - Input parameters, analysis methodology, selection of critical cross-sections, loading conditions, and piezometric/groundwater levels utilized for slope stability analyses.

- Reviewing the contents vs. the applicable CCR Rule requirements [1].

No significant technical issues were noted within the technical review, although a detailed review (e.g., check) of the calculations was not performed.

6.3 Summary of Site Changes Affecting the Initial SFA

No changes since development of the Initial SFA were identified that would require updates to the Initial SFA ([6], [9]). Although normal and peak (i.e., flood) water levels within the AP have changed as a result of the Periodic IDF (**Section 7**), water levels are lower than those utilized in the Initial SFA. Therefore, the water levels utilized in the Initial SFA are conservative relative to current conditions.

SECTION 7

INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN - §257.82

7.1 Overview of Initial IDF

The Initial Inflow Design Flood Control System Plan (Initial IDF) was prepared by AECOM in 2016 ([7], [9]), following the requirements of §257.82. The Initial IDF included the following information:

- A hydraulic and hydrologic analysis, performed for the 1,000-year design flood event because of the hazard potential classification of "Significant", which corresponded to 8.08 inches of rainfall over a 24-hour period.

- The Initial IDF utilized a HydroCAD (Version 10) model to evaluate spillway flows and pool level increases during the design flood, with a SWSE of 603.3 feet.

The Initial IDF concluded that the Ash Pond met the requirements of §257.82, as the peak water surcharge elevation estimated by the HydroCAD model was 605.1 feet, relative to a minimum Ash Pond dike crest elevation of 605.2 feet. Therefore, overtopping was not expected. The Initial IDF also evaluated the potential for discharge from the CCR unit and concluded that discharge in violation of the existing NDPES for the Ash Pond was not expected, as all discharge from the Ash Pond during both normal and inflow design flood conditions was expected to be routed back to KPP for use in plant operations, is discharged via a NPDES-permitted outfall after treatment or is routed through the emergency outlet structure and NDPES-permitted outfall to Sangchris Lake [7].

7.2 Review of Initial IDF

Geosyntec performed a review of the Initial IDF ([7], [9]) in terms of technical approach, calculation input parameters and methodology, recommendations, and completeness. The review included the following tasks:

- Reviewing the return interval used vs. the hazard potential classification,

- Reviewing the rainfall depth and distribution for appropriateness,

- Performing a high-level review of the inputs to the hydrological modeling,

- Reviewing the hydrologic model parameters for spillway parameters, starting pool elevation, and storage vs. the reference data, and

- Reviewing the overall Initial IDF vs. the applicable requirements of the CCR Rule [1].

Several comments were identified during review of the Initial IDF. The comments are described below:

- The Initial IDF utilized the National Resource Conservation Service (NRCS) Type II rainfall distribution type [21]. Geosyntec recommends utilizing the Huff 3rd Quartile distribution for areas less than 10 square miles [22] for the reasons listed below.

    - Huff 3rd Quartile distribution was identified to be a more appropriate representation of a 1,000-year, 24-hour storm event per the Illinois State Water Survey (ISWS) Circular 173 [22] which developed standardized rainfall distributions from compiled rainfall data at sites throughout Illinois.

    - Illinois Department of Natural Resources, Office of Water Resources (IDNR-OWR) [23] recommends use of the Huff Quartile distributions in Circular 173 when using frequency events to determine the spillway design flood inflow hydrograph, "*The suggested method to distribute this rainfall is described in the ISWS publication, Circular 173, "Time Distributions of Heavy Rainstorms in Illinois".*

7.3 Summary of Site Changes Affecting the Initial IDF

Two changes at the site that occurred since development of the Initial IDF were identified. These changes required updates to the Initial IDF and are described below:

- The minimum elevation of the perimeter dike is estimated to be 604.5 feet based on the 2020 survey [18], which is 0.7 ft lower than the El. 605.2 ft perimeter dike elevation estimated from the 2015 survey [17].

- Approximately 78,000 CY of CCR were removed above the SWSE utilized for the Initial IDF certification, thereby altering the stage-storage curve, relative to the Initial IDF.

7.4 Periodic IDF

Geosyntec revised the HydroCAD model associated with the Initial IDF to account for the changes in the drainage area, changes in the time of concentration, changes in CCR volume, revised rainfall distribution type, and changes in the lowest point of the perimeter dike elevation, as described in **Section 7.3**.

The following approach and input data were used for the revised analyses:

- The SWSE was lowered from El. 603.3 ft to El. 602.8 ft, in order to provide additional capacity.

- The AP drainage area was updated from 178 acres to 171 acres to reflect the 2020 site survey.

- Time of concentration was updated from 5 minutes to 6 minutes in accordance with the recommended minimum time of concentration for direct entry of rainfall [24].

- The stage-storage (i.e., area-capacity) curve for the AP was updated based on the 2020 site survey [18].
    - A revised stage-volume curve for the AP was prepared based on measuring the storage volume of the AP at every one-foot increment of depth from an elevation at the bottom of the AP (594 ft) to the approximate minimum perimeter dike embankment crest elevation (605 ft). This analysis identified an overall increase of 90,378 CY (56 ac-ft) of storage volume at the AP from the storage used in the 2016 Initial IDF Certification.
- The rainfall distribution type was updated to the "Huff 3rd Quartile" storm type provided by HydroCAD [22].
- The minimum dike crest elevation was updated from 605.2 ft to 604.5 ft based on the 2020 site survey.
- All other input data and settings from the Initial IDF HydroCAD model were utilized, including, but not limited to software package and version, runoff method, analysis time span and analysis time step.

The results of the Periodical IDF Assessment are summarized in **Table 3** and confirm that the AP sill meets the requirements of §257.82(a)-(b) if the SWSE is maintained no higher than El. 602.8 ft, as the peak water surface elevation does not exceed the minimum perimeter dike crest elevations. Additionally, all discharge from the AP is routed through the existing spillway system to the NPDES-permitted outfall, during both normal and IDF conditions. Updated area-capacity curves and HydroCAD model output is provided in **Attachment D**.

Table 3 – Water Levels from Periodical IDF Assessment

Analysis	Starting Water Surface Elevation (ft)	Peak Water Surface Elevation (ft)	Minimum Dike Crest Elevation (ft)
Initial IDF	603.3	605.1	605.2
Periodical IDF Assessment	602.8	604.4	604.5
Initial to Periodic Change[1]	-0.5	-0.7	

Notes:
[1]Postive change indicates increase in the WSE, negative change indicates decrease in the WSE.

SECTION 8 CONCLUSIONS

The Ash Pond at KPP was evaluated relative to the USEPA CCR Rule periodic assessment requirements for:

- Hazard potential classification (§257.73(a)(2));
- History of Construction reporting (§257.73(d));
- Structural stability assessment (§257.73(d)) with the exception of §257.73(d)(1)(vi) that was independently certified by Luminant [10], and considering a starting water surface elevation no higher than El. 602.8 ft;
- Safety factor assessment (§257.73(e)); and
- Inflow design flood control system planning (§257.82), if the starting water surface elevation does not exceed El. 602.8 ft.

Based on the evaluations presented herein, the referenced requirements are satisfied.

SECTION 9

CERTIFICATION STATEMENT

CCR Unit: Kincaid Generation, LLC, Kincaid Power Plant, Ash Pond

I, Thomas W. Ward, being a Registered Professional Engineer in good standing in the State of Illinois, do hereby certify, to the best of my knowledge, information, and belief that the information contained in this 2021 USEPA CCR Rule Periodic Certification Report, has been prepared in accordance with the accepted practice of engineering. I certify, for the above-referenced CCR Unit, that the periodic assessment of the hazard potential classification, history of construction report, structural stability, safety factors, and inflow design flood control system planning, dated October 2016, were conducted in accordance with the requirements of 40 CFR §257.73(a)(2), (c), (d), (e), and §257.82, with the exception of §257.73(d)(1)(vi)) that was independently certified by others.

Thomas W. Ward

10/11/21

Date

Exp. 11/30/2021

SECTION 10

REFERENCES

[1] United States Environmental Protection Agency, 40 CFR Parts 257 and 261; Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities; Final Rule, 2015.

[2] Stantec Consulting Services, Inc., "Initial Hazard Potential Classification Assessment, EPA Final CCR Rule, Ash Pond, Kincaid Power Station, Christian County, Illinois," Fenton, MO, October 12, 2016.

[3] Stantec Consulting Services, Inc., "Kincaid Generation, LLC, Kincaid Power Station, Kincaid, Christian County, IL, Emergency Action Plan, Ash Pond (NID # IL50706)," Fenton, MO, April 13, 2017.

[4] AECOM, "History of Construction, USEPA Final CCR Rule, Kincaid Power Station, Kincaid, Illinois," October 2016.

[5] AECOM, "CCR Rule Report: Initial Structural Stability Assessment For Kincaid Ash Pond At Kincaid Power Station," St. Louis, MO, October 2016.

[6] AECOM, "CCR Rule Report: Initial Safety Factor Assessment For Kincaid Ash Pond At Kincaid Power Station," St. Louis, MO, October 2016.

[7] AECOM, "CCR Rule Report: Initial Inflow Design Flood Control System Plan For Kincaid Ash Pond At Kincaid Power Station," St. Louis, MO, October 2016.

[8] Stantec Consulting Services, Inc., "Documentation of Initial Hazard Potential Classificaiton Assessment, Ash Pond, Kincaid Power Station, Christian County, Illinois," October 12, 2016.

[9] AECOM, "CCR Certification Report: Initial Structural Stability Assessment, Initial Safety Factor Assessment, and Initial Inflow Design Flood Control System Plan for Kincaid Ash Pond at Kincaid Power Station," St. Louis, MO, October 2016.

[10] V. Modeer, *Office Memorandum: Ash Pond Structural Stability Assessment, Kincaid Generation, LLC, Kincaid Power Station,* Luminant, 2020.

[11] J. Knutelski and J. Campbell, *Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Kincaid Power Station, Ash Pond,* August 30, 2016.

[12] J. Knutelski and J. Campbell, *Annual CCR Surface Impoundment Inspection Report (per 40 CFR 257.83(b)(2)), Kincaid Power Station, Ash Pond,* June 24, 2015.

[13] J. Knutelski, *Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Kincaid Generation, Ash Pond,* January 10, 2019.

[14] J. Knutelski, *Annual Inspection by a Qualified Professional Engineer, 40 CFR 257.83(b), Kincaid Generation, Ash Pond,* January 10, 2020.

[15] J. Knutelski, *Annual Inspection by a Qualified Professional Engineer, 40 CFR §257.83(b), Kincaid Generation, Ash Pond,* January 6, 2021.

[16] Kincaid Power Station, *2021 Piezometer Spreadsheet,* 2021.

[17] Weaver Consultants Group, "Dynegy, Collinsville, IL, 2015 - Kincaid Topography," Collinsville, IL, December 2015.

[18] IngenAE, "Luminant, Kincaid Generation, LLC, Kincaid Power Station, December 2020 Topography," Earth City, Missouri, February 26, 2021.

[19] AECOM, "Initial Station Site Visit Summary, Dynegy CCR Compliance Program," June 24, 2015.

[20] U.S. Army Corps of Engineers, "Slope Stability, EM 1110-2-1920," October 31, 2003.

[21] C. E. D. Natural Resource Conservation Service, "Urban Hydrology for Small Watersheds (TR-55)," United States Department of Agriculture, 1985.

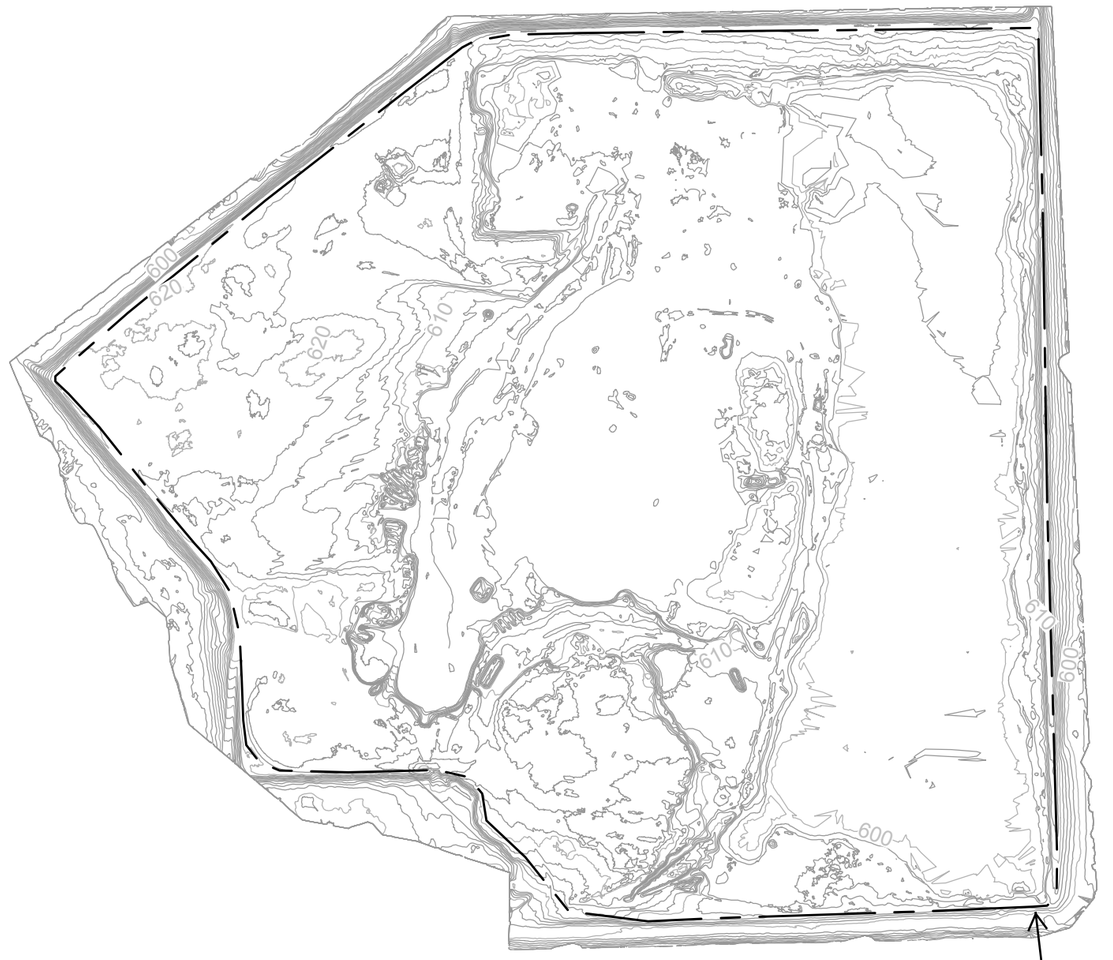
[22] State of Illinois Department of Energy and Natural Resources, "Time Distributions of Heavy Rainstorms in Illinois," State Water Survey Division, Champaign, Illinois, 1990.

[23] State of Illinois Department of Natural Resources, "Procedural Guidelines for Preparation of Technical Data to be Included in Applications for Permits for Construction and Maintenance of Dams," Springfield, Illinois.

[24] USDA Natural Resources Conservation Service, "WinTR-20 Project Formulation Hydrology, Version 3.20".

DRAWINGS

INITIAL SURVEY
12-01-2015 TOPOGRAPHY



PERIODIC SURVEY
02-26-2021 TOPOGRAPHY

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SCALE IN FEET

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - KINCAID TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, KINCAID GENERATION, LLC, KINCAID POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.

INITIAL TO PERIODIC SURVEY COMPARISON
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

Geosyntec consultants

DRAWING 1

GLP8027.07 | JULY 2021

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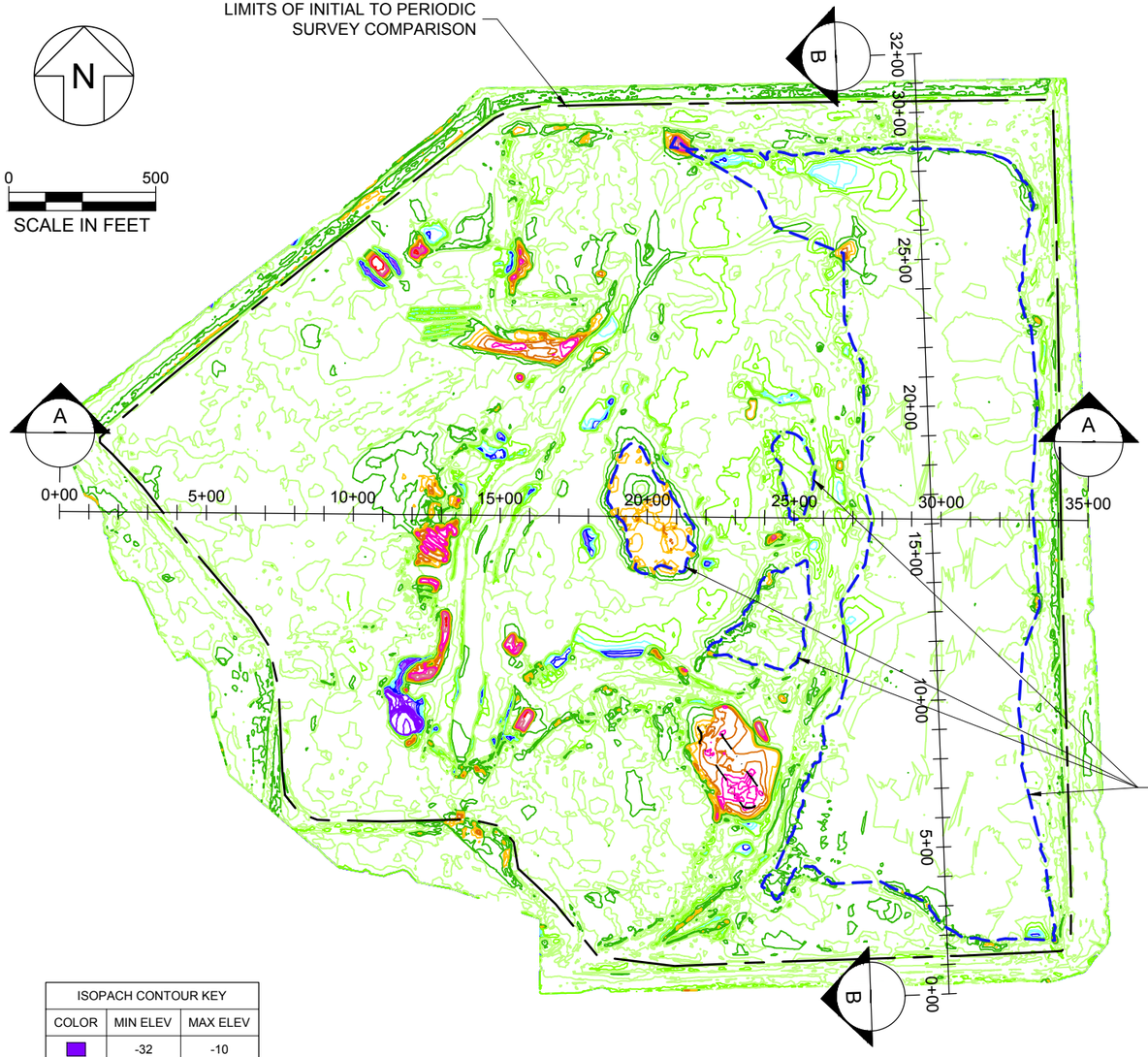
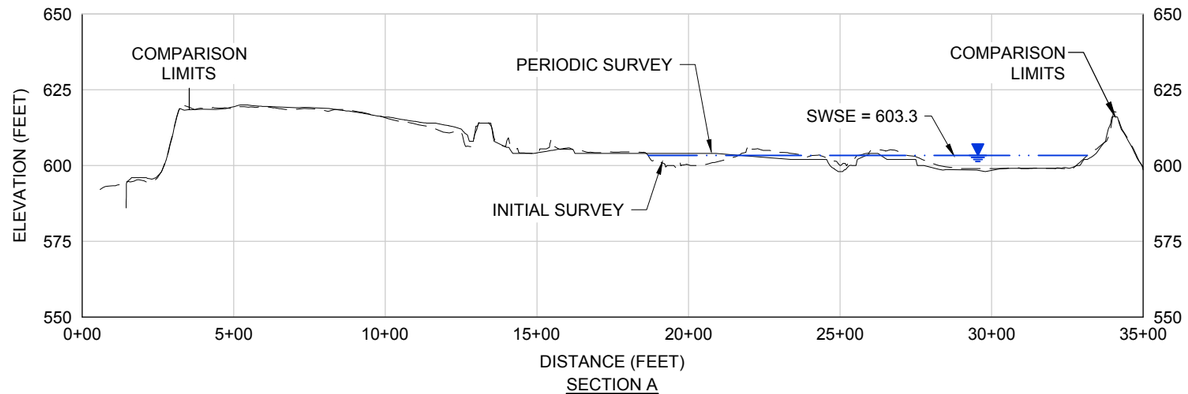
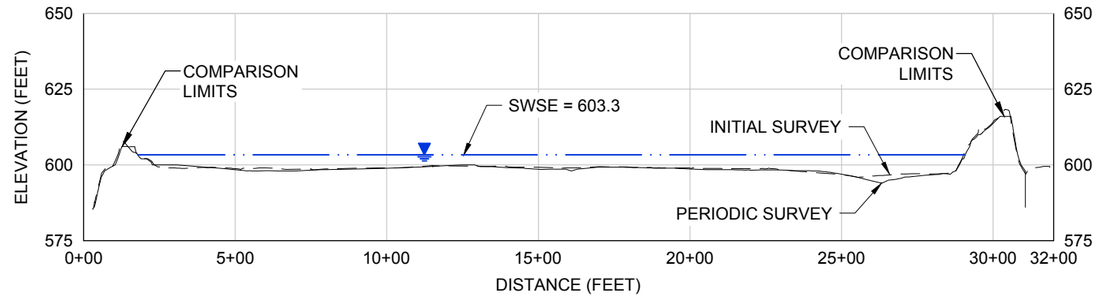




SECTION A



SECTION B

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HORZ: SCALE IN FEET

ISOPACH CONTOUR KEY		
COLOR	MIN ELEV	MAX ELEV
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	-10	-8
	-8	-6
	-6	-4
	-4	-2
	-2	0
	0	2
	2	4
	4	6
	6	8
	8	10
	10	12

NOTES:

1. THE INITIAL SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - KINCAID TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC SURVEY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, KINCAID GENERATION, LLC, KINCAID POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.
3. ALL SURVEY DATA WAS COLLECTED IN THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) AND NORTH AMERICAN DATUM OF 1983 (NAD83) FOR VERTICAL AND HORIZONTAL COORDINATES, RESPECTIVELY.
4. THE STARTING WATER SURFACE ELEVATION (SWSE) OF THE KINCAID ASH POND IS EL. 603.3 FT, AS NOTED IN THE REPORT TITLED “CCR CERTIFICATION REPORT: INITIAL STRUCTURAL STABILITY ASSESSMENT, INITIAL SAFETY FACTOR ASSESSMENT, AND INITIAL INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN FOR KINCAID ASH POND AT KINCAID POWER STATION”, PREPARED BY AECOM, DATED OCTOBER, 2016.

INITIAL TO PERIODIC SURVEY COMPARISON SUMMARY			
SURFACE IMPOUNDMENT	CUT	FILL	NET (CU. YD.)
ASH POND	172,876	95,205	77671 (CUT)
ABOVE SWSE	116,014	66,972	49,042 (CUT)
BELOW SWSE	56,953	28,133	28,819 (CUT)

SURVEY COMPARISON ISOPACH ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

Geosyntec consultants

DRAWING 2

GLP8027.07 | JULY 2021

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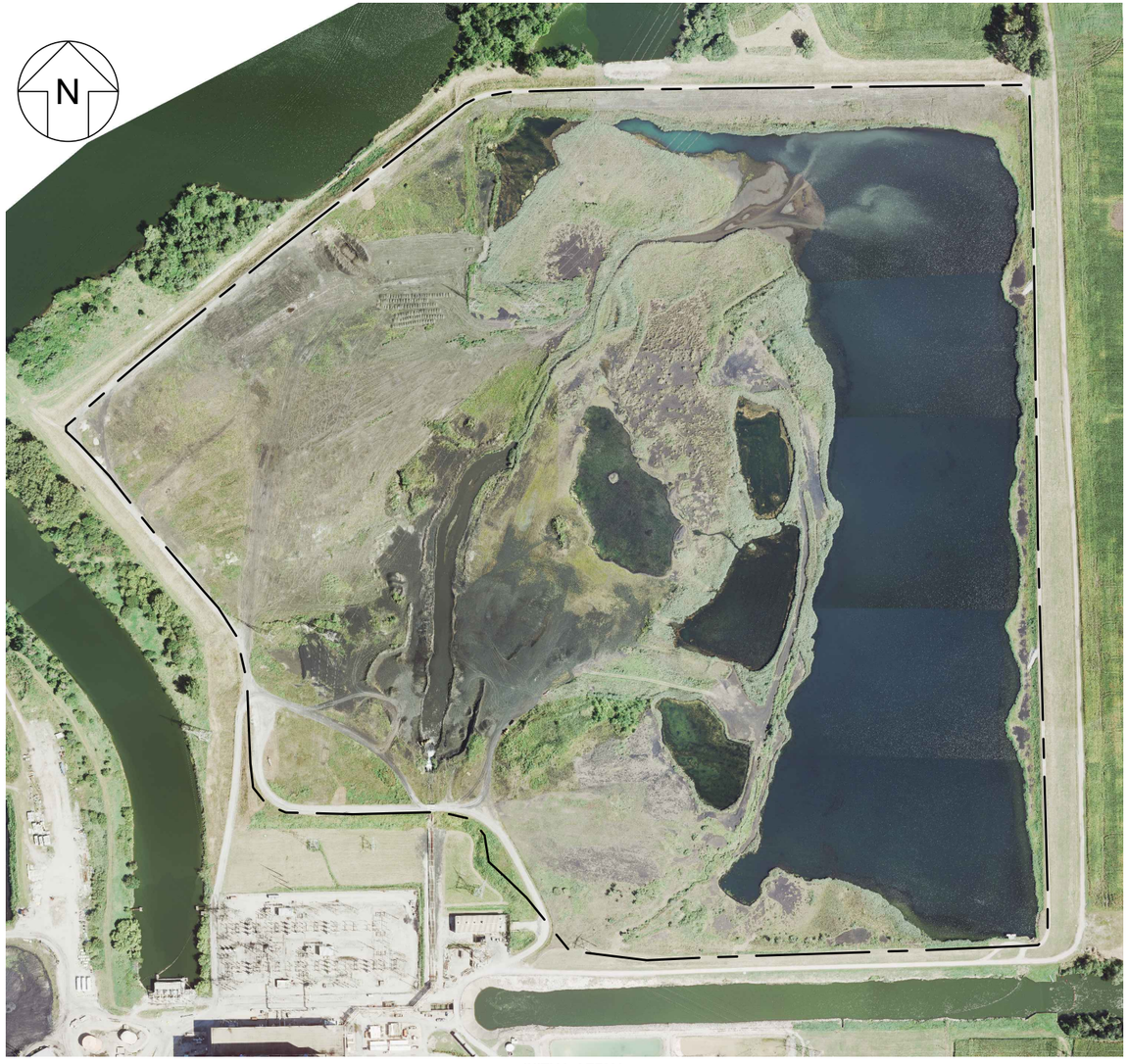

INITIAL AERIAL
12-01-2015 IMAGERY

PERIODIC AERIAL
02-26-2021 IMAGERY

0 500
SCALE IN FEET

NOTES:

1. THE INITIAL IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “DYNEGY, COLLINSVILLE, ILLINOIS, 2015 - KINCAID TOPOGRAPHY”, PREPARED BY WEAVER CONSULTANTS GROUP, DATED DECEMBER 1, 2015.
2. THE PERIODIC IMAGERY WAS TAKEN FROM THE DRAWING PACKAGE TITLED “LUMINANT, KINCAID GENERATION, LLC, KINCAID POWER STATION, DECEMBER 2020 TOPOGRAPHY”, PREPARED BY INGENAE, DATED FEBRUARY 26, 2021.

INITIAL TO PERIODIC AERIAL IMAGERY COMPARISON
ASH POND
KINCAID POWER PLANT
KINCAID, ILLINOIS

Geosyntec consultants

DRAWING 3

GLP8027.07 | MAY 2021

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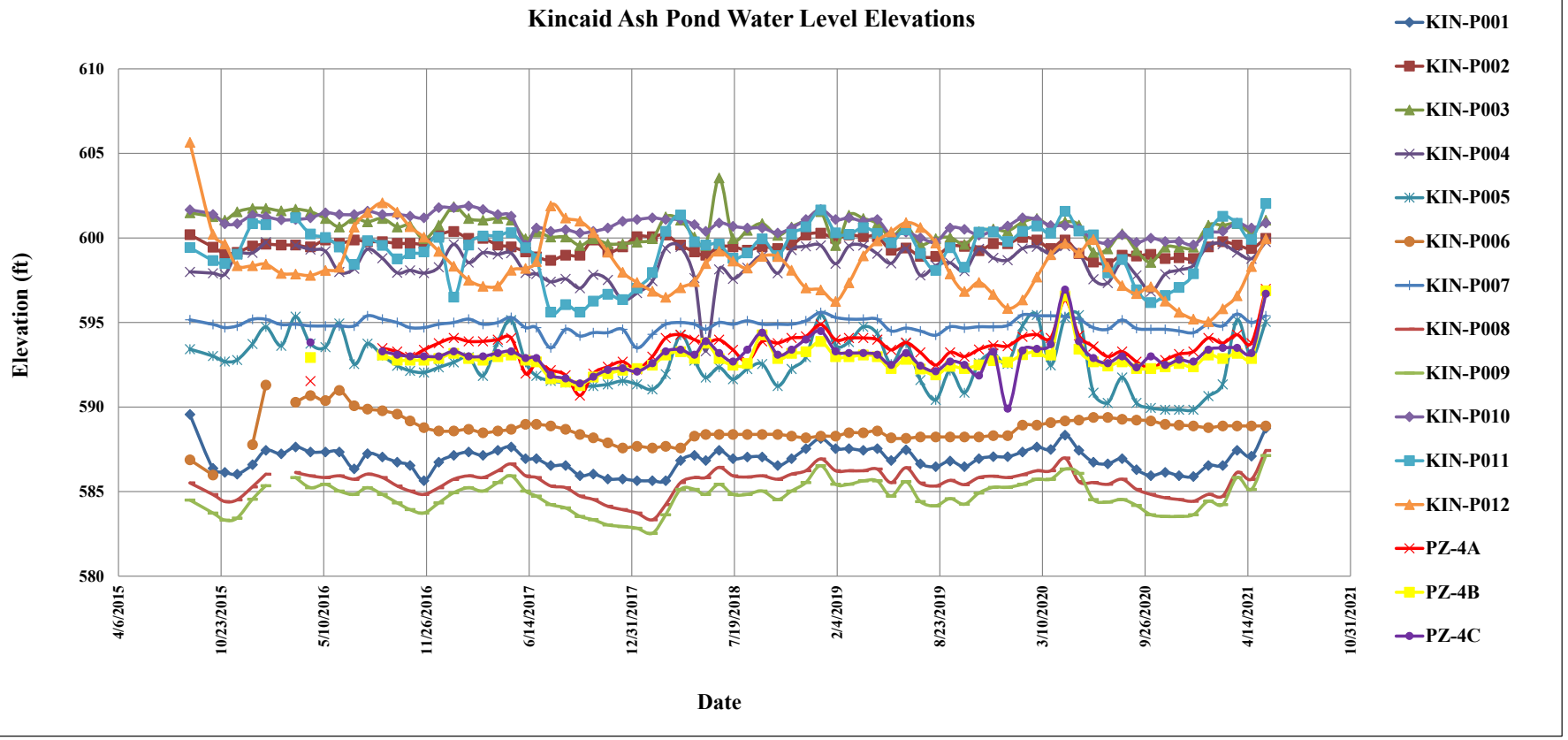
ATTACHMENTS

Attachment A

Ash Pond Piezometer Data Plots



NOTES:
1. Piezometer data was taken from the spreadsheet titled "2021 Piezometer Spreadsheet", provided by the Kincaid Power Station.

PIEZOMETER DATA PERIODIC CERTIFICATION KINCAID POWER STATION KINCAID, ILLINOIS		
Geosyntec consultants		ATTACH.
GLP8027	6/24/2021	A

Attachment B

Ash Pond Site Visit Photolog

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 01

Date: 06/10/2021

Direction Facing: West

Comments: Typical crest along the southern berm, north of the power station.

Photo: 02

Date: 06/10/2021

Direction Facing: South

Comments: Power station south of the ash pond.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 03 **Date:** 06/10/2021 **Direction Facing:** West **Comments:** Crest view of steep and uneven slopes of the southern berm, north of the power plant. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.	
Photo: 04 **Date:** 06/10/2021 **Direction Facing:** West **Comments:** Erosion rills and bulging at southern berm toe. Straw laid. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 05 **Date:** 06/10/2021 **Direction Facing:** Northeast **Comments:** 4- to 6-inch wide apparent animal borrows on slope. Straw laid in the area.	
Photo: 06 **Date:** 06/10/2021 **Direction Facing:** West **Comments:** Crest view of southern berm.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 07

Date: 06/10/2021

Direction Facing: South

Comments: Typical perimeter berm slope along north-south access road.

Photo: 08

Date: 06/10/2021

Direction Facing: Northwest

Comments: Typical southwest perimeter berm slope. Slope is steep with some irregularities and some depressions. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 09 **Date:** 06/10/2021 **Direction Facing:** Northwest **Comments:** Location of settlement noted in the History of Construction (AECOM, 2016) and mitigated at the southwestern berm crest. No indication of settlement observed during this site observation.	
Photo: 10 **Date:** 06/10/2021 **Direction Facing:** Southwest **Comments:** 6-foot wide by 8-inch deep depression along the southwestern berm roughly 400 feet northwest of KIN-P006. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 11

Date: 06/10/2021

Direction Facing: Northeast

Comments: Typical northwestern perimeter berm slope. Slopes are steep with areas of irregularity. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.

Photo: 12

Date: 06/10/2021

Direction Facing: Southeast

Comments: Steep slope and minor depression at the edge of the crest. Located roughly 800 feet southwest of KIN-P007. See Photo 13. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.

GEOSYNTEC CONSULTANTS

Geosyntec consultants

Site Owner: Dynegy Kincaid Generation, LLC	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site Location:** Kincaid Power Plant

Photo: 13 **Date:** 06/10/2021 **Direction Facing:** Southwest **Comments:** Crest view of depression and steep slope. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.	
Photo: 14 **Date:** 06/10/2021 **Direction Facing:** Southeast **Comments:** Steep slope and 8-foot by 6-inch depression located roughly 400 feet southwest of KIN-P007. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site Location:** Kincaid Power Plant

Photo: 15

Date: 06/10/2021

Direction Facing: Southwest

Comments: Disturbed area from apparent monitoring well installation.

Photo: 16

Date: 06/10/2021

Direction Facing: Northeast

Comments: Steep slope along the northwestern portion of the ash pond where the riverside bench is minimal. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site Location:** Kincaid Power Plant

Photo: 17

Date: 06/10/2021

Direction Facing: Northeast

Comments: Apparent riprap buttress along perimeter berm slope located along the northwestern portion of the ash pond where the riverside bench is minimal. The riprap appears to have been overgrown.

Photo: 18

Date: 06/10/2021

Direction Facing: Northeast

Comments: Riprap erosion protection.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 19

Date: 06/10/2021

Direction Facing: Northeast

Comments: 20-foot long / wide depression of the perimeter berm slope located along the northwestern portion of the ash pond where the riverside bench is minimal. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.

Photo: 20

Date: 06/10/2021

Direction Facing: Southwest

Comments: Typical crest view of northwestern perimeter berm.

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 21

Date: 06/10/2021

Direction Facing: Northeast

Comments: Typical crest view of northern perimeter berm.

Photo: 22

Date: 06/10/2021

Direction Facing: Northeast

Comments: Typical toe view of northern perimeter berm.

GEOSYNTEC CONSULTANTS

Geosyntec consultants

Site Owner: Kincaid Generation, LLC	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site Location:** Kincaid Power Plant

Photo: 23

Date: 06/10/2021

Direction Facing: South

Comments: Toe view of depressions and bulging along northern perimeter berm. Slopes previously noted in the initial site investigation by AECOM and not considered a change in site conditions.

Photo: 24

Date: 06/10/2021

Direction Facing: N/A

Comments: Straw and gravel filling on toe along northern perimeter berm.

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Dynegy Kincaid Generation, LLC	**Project Number:** GLP8027
CCR Unit: Ash Pond	**Site Location:** Kincaid Power Plant

Photo: 25

Date: 06/10/2021

Direction Facing: South

Comments: Crest view of eastern perimeter berm with straw on the slope and gravel along the toe.

Photo: 26

Date: 06/10/2021

Direction Facing: South

Comments: Crest view of eastern perimeter berm.

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 27 **Date:** 06/10/2021 **Direction Facing:** East **Comments:** Outfall east of ash pond.	
Photo: 28 **Date:** 06/10/2021 **Direction Facing:** Northeast **Comments:** Southeast corner of ash pond.	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 29

Date: 06/10/2021

Direction Facing: Northeast

Comments: Screen house at southeast corner of ash pond.

Photo: 30

Date: 06/10/2021

Direction Facing: South

Comments: Emergency spillway south of ash pond.

GEOSYNTEC CONSULTANTS
Photographic Record

Site Owner: Kincaid Generation, LLC **Project Number:** GLP8027

CCR Unit: Ash Pond **Site Location:** Kincaid Power Plant

Photo: 31

Date: 06/10/2021

Direction Facing: Northeast

Comments: Two busted outflow pipes south of the ash pond.

Attachment C

Periodic History of Construction Report Update Letter

Geosyntec consultants

1 McBride and Son Center Drive, Suite 202
Chesterfield, MO 63005
PH 636-812-0800
www.geosyntec.com

October 11, 2021

Kincaid Generation, LLC
199 IL-104
Kincaid, Illinois 62540

Subject: Periodic History of Construction Report Update Letter
USEPA Final CCR Rule, 40 CFR §257.73(c)
Kincaid Power Plant
Kincaid, Illinois

At the request of Kincaid Generation, LLC (KG), Geosyntec Consultants (Geosyntec) has prepared this Letter to document updates to the Initial History of Construction (HoC) report for the Kincaid Power Plant (KPP), also known as the Kincaid Power Station (KIN). The Initial HoC report was prepared by AECOM in October of 2016 [1] in accordance with 40 Code of Federal Regulations (CFR) §257.73(c) of the United States Environmental Protection Agency (USEPA) Coal Combustion Residuals Rule, known as the CCR Rule [2]. This letter also includes information required by Section 845.220(a)(1)(B) (Design and Construction Plans) of the state-specific Illinois Environmental Protection Agency (IEPA) Part 845 CCR Rule [3] that is not expressly required by §257.73(c).

BACKGROUND

The CCR Rule required that, by October 17, 2016, Initial HoC reports to be compiled for existing CCR surface impoundments with: (1) a height of five feet or more and a storage volume of 20 acre-feet or more, or (2) a height of 20 feet or more. The Initial HoC report was required to contain, to the extent feasible, the information specified in 40 CFR §257.73(c)(1)(i)-(xii). The Initial HoC report for KPP, which included the existing CCR surface impoundment, the Ash Pond (AP), was prepared and subsequently posted to KG's CCR Website prior to October 17, 2016.

The CCR Rule requires that the Initial HoC to be updated if there is a significant change to any information complied in the Initial HoC report, as listed below:

§ 257.73(c)(2): If there is a significant change to any information complied under paragraph (c)(1) of this section, the owner or operator of the CCR unit must update the relevant information and place it in the facility's operating record as required by § 257.105(f)(9).

KG retained Geosyntec to review the Initial HoC report, review reasonably and readily available information for the AP generated since the Initial HoC report was prepared, and perform a site visit to KPP to evaluate if significant changes may have occurred since the Initial HoC report was prepared. This Letter contains the results of Geosyntec's evaluation and documents significant changes that have occurred at the AP and KPP, as they pertain the requirements of §257.73(c)(1)(i)-(xii).

UPDATES TO HISTORY OF CONSTRUCTION REPORT

Geosyntec's evaluation for the KPP AP determined that no known significant changes requiring updates to the information in the Initial HoC report pertaining to §257.73(c)(1)(ii)-(viii) and §257.73(c)(1)(xi)-(xii) of the CCR Rule had occurred since the Initial HoC report was developed.

However, Geosyntec's evaluation determined that significant changes at the KPP AP pertaining to §257.73(c)(1)(i) and (ix)-(x) of the CCR Rule had occurred since the Initial HoC report had been developed. Additionally, information how long the CCR surface impoundments have been operating and the types of CCR in the surface impoundments, as required by Section 845.220(a)(1)(B) of the Part 845 Rule were not included in the Initial HoC report, as this information is not required by the CCR Rule. Each change and the subsequent updates to the Initial HoC report is described within this section.

Section 845.220(a)(1)(B): A statement of … how long the CCR surface impoundment has been in operation, and the types of CCR that have been placed in the surface impoundment.

East Ash Pond

The AP is in operation since 1965. As of the date of this report, the AP has been present for approximately 56 years [4].

CCR placed in the AP is being used to store and dispose of sluiced bottom ash and to clarify other non-CCR waste streams to be used as recycled water for plant operations. Newly placed ash is recovered by a third party and recycled for beneficial use. [4].

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

A State identification number (ID) for the AP has been assigned by the Illinois Environmental Protection Agency (IEPA). The ID is listed in **Table 1**.

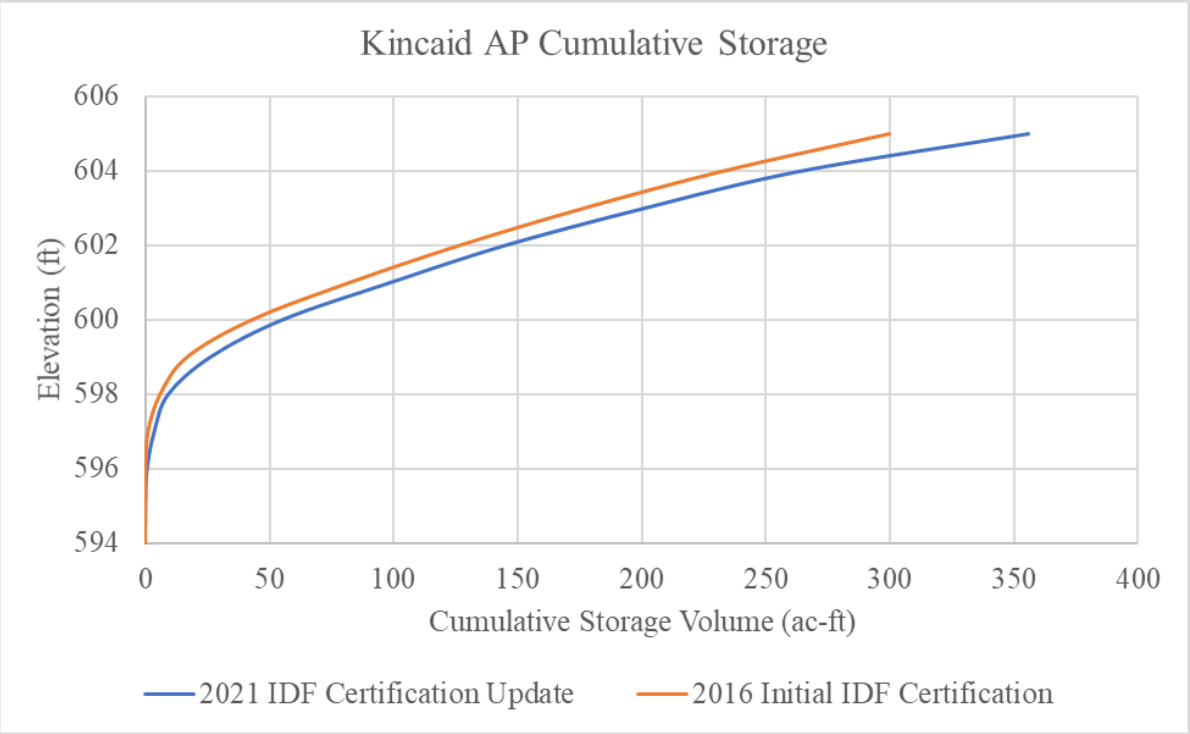
Table 1 – IEPA ID Numbers

CCR Surface Impoundment	State ID
Ash Pond (AP)	W0218140002-01

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

An updated area-capacity curve was prepared for the AP in 2021. This curve is provided in **Figure 1**.

Figure 1 – Area-Capacity Curve for the Ash Pond



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

Updated discharge capacity calculations for the existing spillway were prepared in 2021 using HydroCAD 10 modeling software. The calculations indicate that the AP has

sufficient storage capacity and will not overtop the embankments during the 1,000-year, 24-hour, storm event. The results of the calculations are provided in **Table 2**.

Table 2 – Results of Updated Discharge Capacity Calculations

	Ash Pond
Approximate Berm Minimum Elevation[1], ft	604.5
Approximate Emergency Spillway Elevation[1], ft	Not Applicable
Starting Water Surface Elevation[1] (SWSE), ft	601.8
Peak Water Surface Elevation[1] (PWSE), ft	603.8
Time to Peak, hr	16
Surface Area[2], ac	65.0
Storage[3], ac-ft	115.1

Notes:
[1]Elevations are based on the NAVD88 datum
[2]Surface Area is defined as the water surface area at the PWSE
[3]Storage is defined as the volume between the SWSE and PWSE

engineers | scientists | innovators

CLOSING

This letter has been prepared to document Geosyntec's evaluation of changes that have occurred at the AP at the KPP since the Initial HoC was developed, based on reasonably and readily available information provided by KG, observed by Geosyntec during the site visit, or generated by Geosyntec as part of subsequent calculations.

Sincerely,

Thomas Ward, P.E.
Senior Engineer

John Seymour, P.E.
Senior Principal

engineers | scientists | innovators

REFERENCES

[1] AECOM, "History of Construction, USEPA 40 CFR § 257.73(c), Kincaid Power Station, Kincaid, Illinois," October 2016.

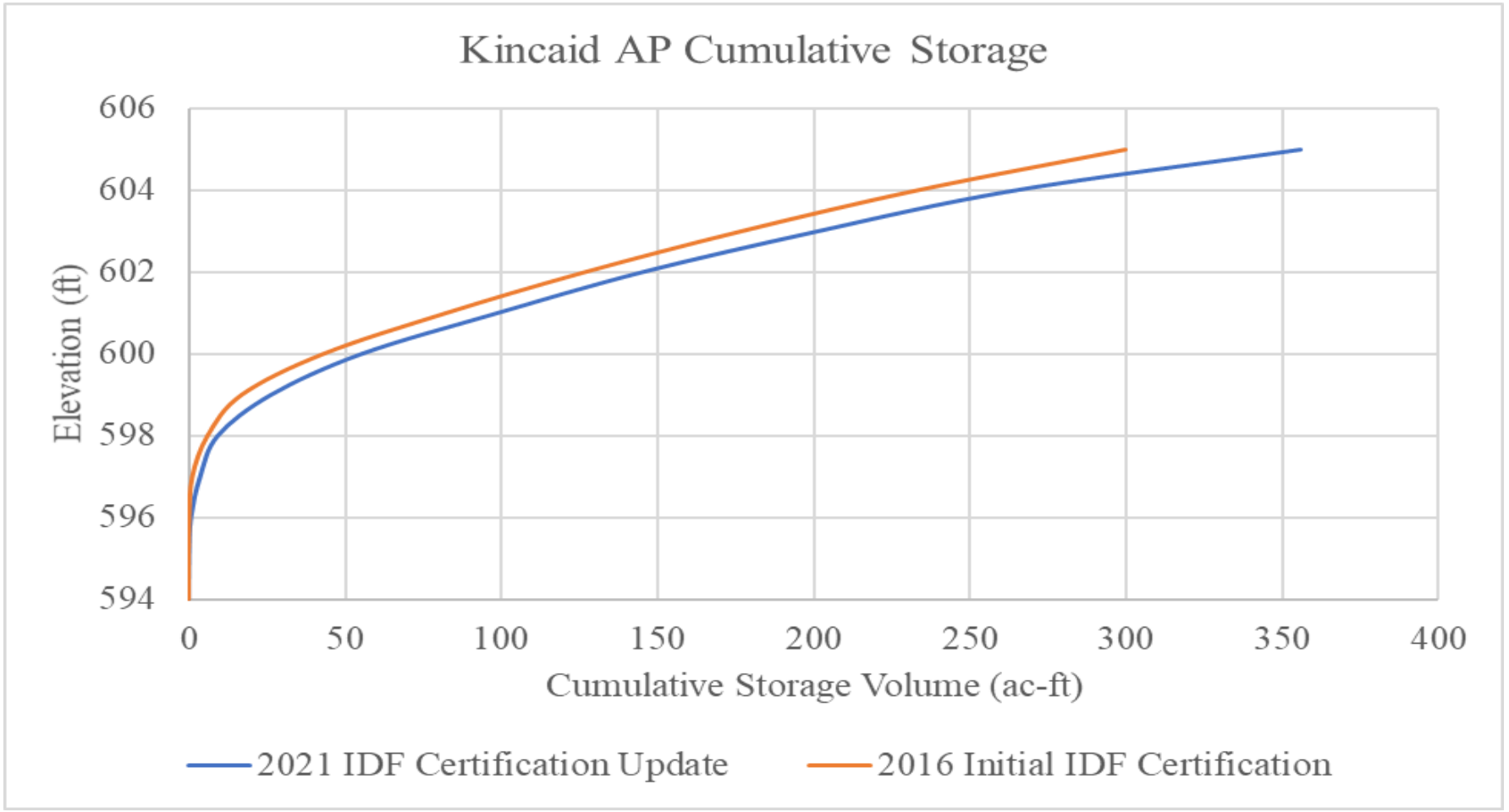
[2] United Stated Environmental Protection Agency, "40 CFR Parts 257 and 261, Hazardous and Solid Waste Management System, Disposal of Coal Combustion Residuals from Electric Utilities, Final Rule, 2015," 2015.

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

[4] AECOM, "History of Construction, USEPA Final CCR Rule, 40 CFR § 257.73(c), Hennepin Power Station, Hennepin, Illinois," October 2016.

Attachment D

Periodic Inflow Design Flood Control System Plan Analyses

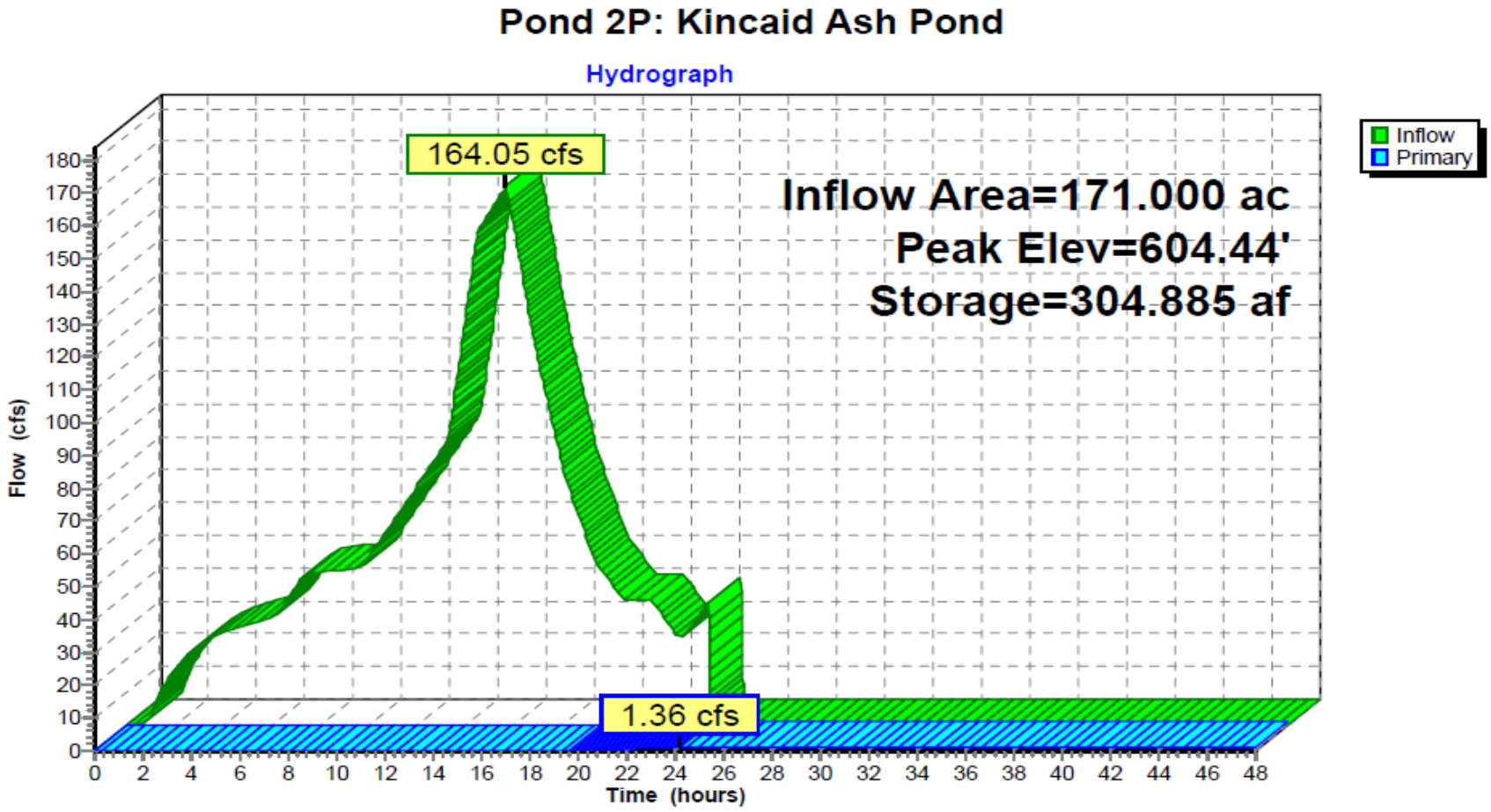


KINCAID AP CUMULATIVE STORAGE
PERIODIC CERTIFICATION
KINCAID POWER PLANT
KINCAID, ILLINOIS

Geosyntec consultants

Figure D-1

GLP8027 | 8/30/2021



ASH POND IDF HYDROGRAPH PERIODIC CERTIFICATION KINCAID POWER PLANT KINCAID, ILLINOIS		
Geosyntec consultants		Figure D-2
GLP8027	8/30/2021	

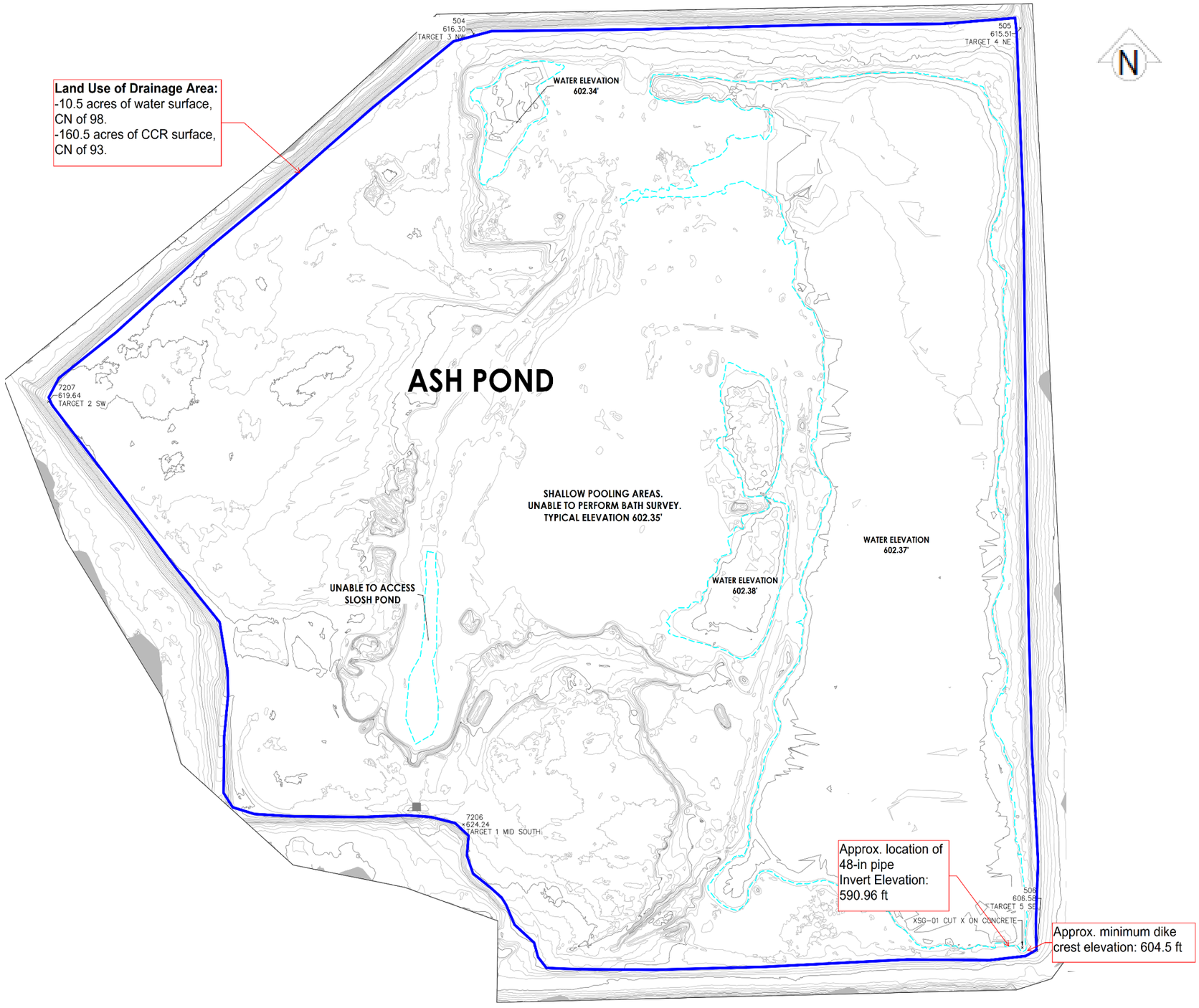


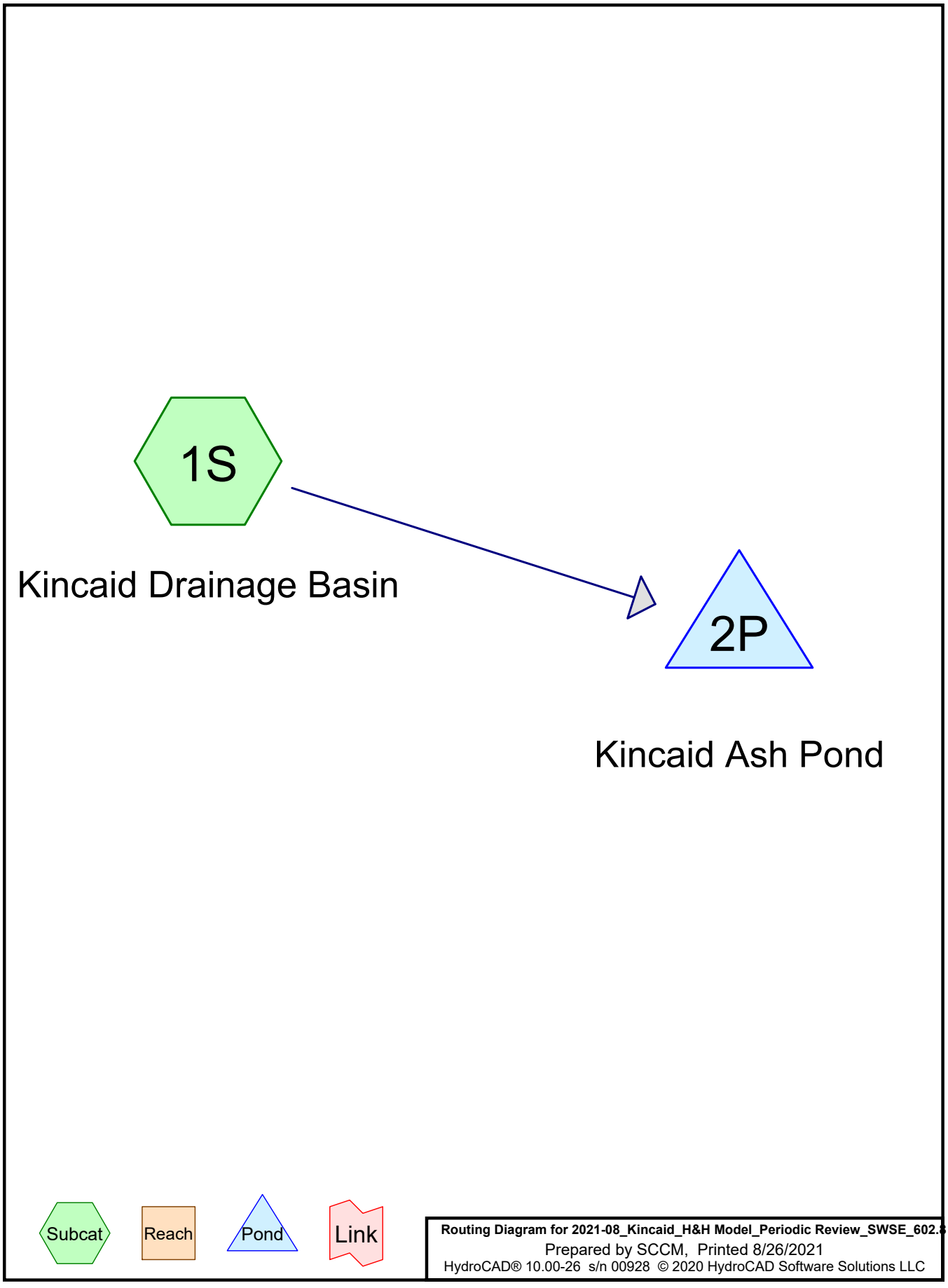
Figure based on IngenAE 2020 Site Topo

NOT TO SCALE

Kincaid Power Station Ash Pond
Hydrologic Workmap

Geosyntec consultants

GLP8027	August 2021	Figure D-3


1S
Kincaid Drainage Basin
2P
Kincaid Ash Pond
Subcat
Reach
Pond
Link

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
160.500	93	CCR Surface (1S)
10.500	98	Water Surface (1S)
171.000	**93**	**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
0.000	HSG D	
171.000	Other	1S
171.000		**TOTAL AREA**

Ground Covers (all nodes)

HSG-A (acres)	HSG-B (acres)	HSG-C (acres)	HSG-D (acres)	Other (acres)	Total (acres)	Ground Cover	Subcatchment Numbers
0.000	0.000	0.000	0.000	160.500	160.500	CCR Surface	1S
0.000	0.000	0.000	0.000	10.500	10.500	Water Surface	1S
0.000	**0.000**	**0.000**	**0.000**	**171.000**	**171.000**	**TOTAL AREA**	

Pipe Listing (all nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Diam/Width (inches)	Height (inches)	Inside-Fill (inches)
1	2P	590.96	590.00	158.0	0.0061	0.025	48.0	0.0	0.0

Time span=0.00-48.00 hrs, dt=0.01 hrs, 4801 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Kincaid Drainage Basin Runoff Area=171.000 ac 6.14% Impervious Runoff Depth=8.08"
Tc=6.0 min CN=93 Runoff=164.05 cfs 115.093 af

Pond 2P: Kincaid Ash Pond Peak Elev=604.44' Storage=304.885 af Inflow=164.05 cfs 115.093 af
Outflow=1.36 cfs 2.632 af

Total Runoff Area = 171.000 ac Runoff Volume = 115.093 af Average Runoff Depth = 8.08"
93.86% Pervious = 160.500 ac 6.14% Impervious = 10.500 ac

Summary for Subcatchment 1S: Kincaid Drainage Basin

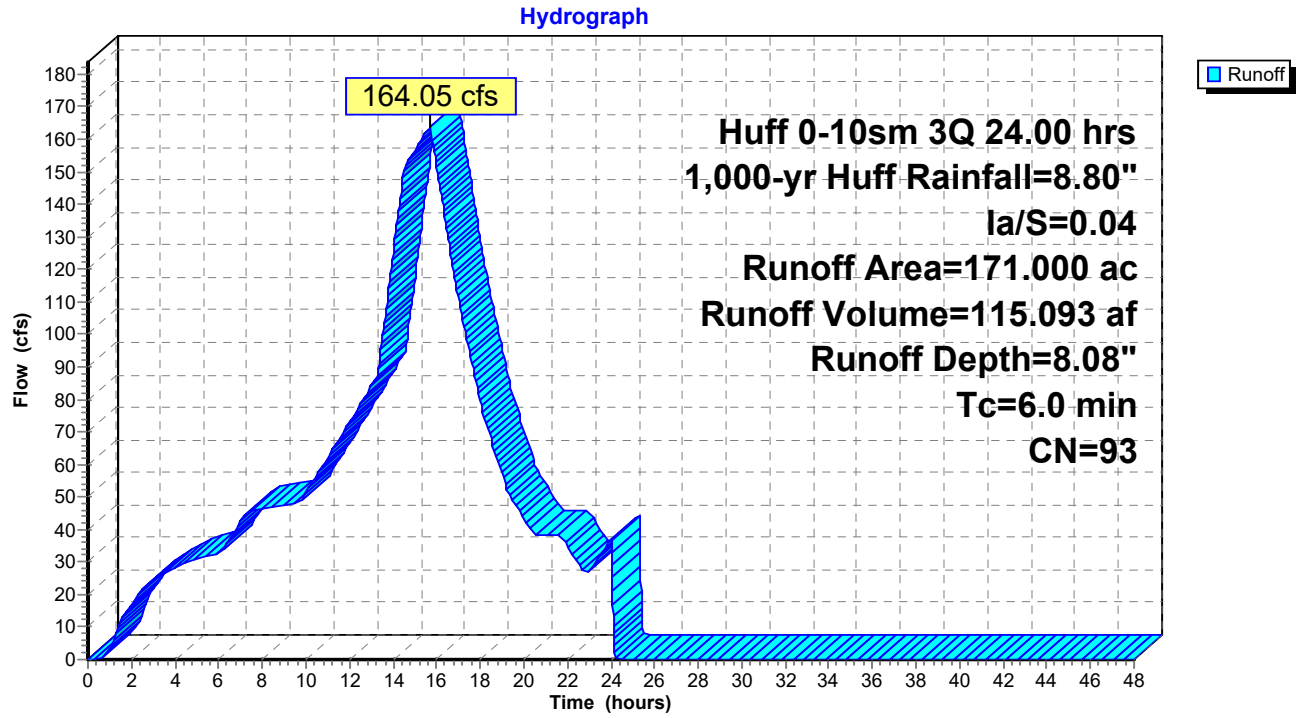
Runoff = 164.05 cfs @ 15.66 hrs, Volume= 115.093 af, Depth= 8.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Huff 0-10sm 3Q 24.00 hrs 1,000-yr Huff Rainfall=8.80", Ia/S=0.04

	Area (ac)	CN	Description
*	10.500	98	Water Surface
*	160.500	93	CCR Surface
	171.000	93	Weighted Average
	160.500		93.86% Pervious Area
	10.500		6.14% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, Rainfall Directly Into Impoundment**

Subcatchment 1S: Kincaid Drainage Basin



Summary for Pond 2P: Kincaid Ash Pond

Inflow Area = 171.000 ac, 6.14% Impervious, Inflow Depth = 8.08" for 1,000-yr Huff event
Inflow = 164.05 cfs @ 15.66 hrs, Volume= 115.093 af
Outflow = 1.36 cfs @ 24.19 hrs, Volume= 2.632 af, Atten= 99%, Lag= 512.0 min
Primary = 1.36 cfs @ 24.19 hrs, Volume= 2.632 af

Routing by Stor-Ind method, Time Span= 0.00-48.00 hrs, dt= 0.01 hrs
Starting Elev= 602.80' Surf.Area= 0.000 ac Storage= 190.055 af
Peak Elev= 604.44' @ 24.19 hrs Surf.Area= 0.000 ac Storage= 304.885 af (114.830 af above start)

Plug-Flow detention time= (not calculated: initial storage exceeds outflow)
Center-of-Mass det. time= 1,227.5 min (2,062.4 - 834.9)

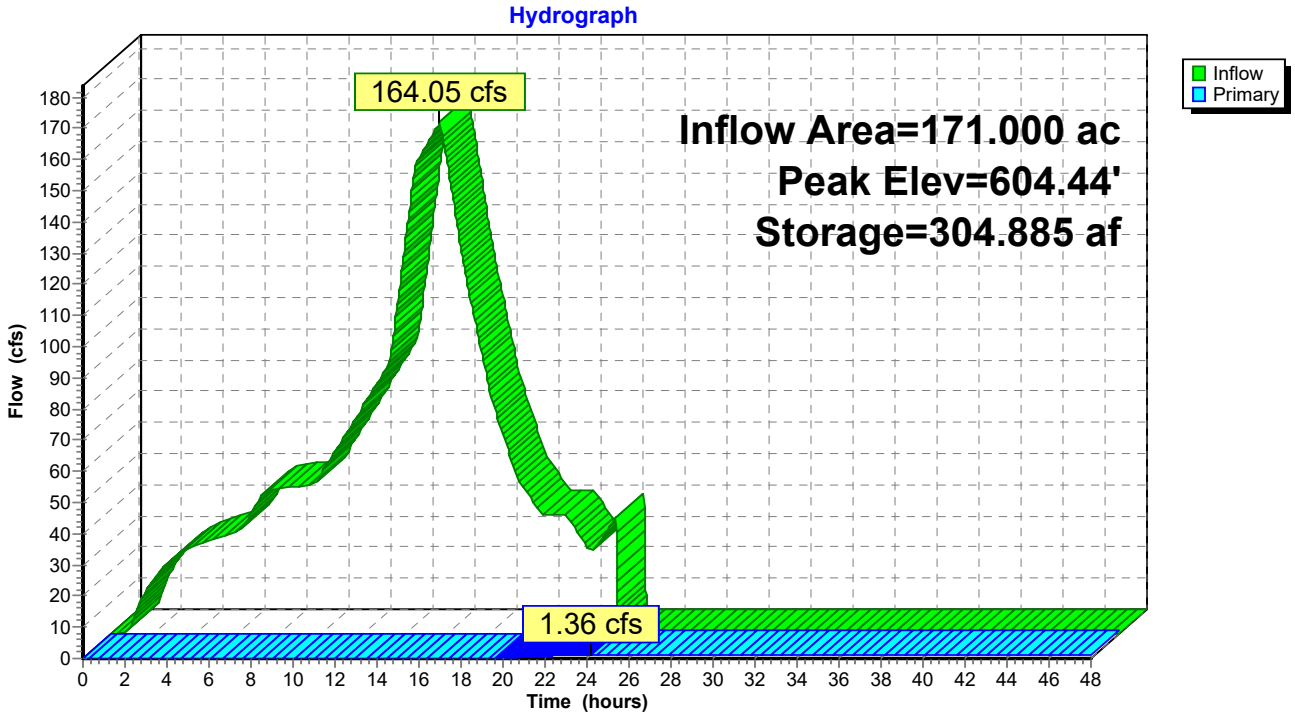
Volume	Invert	Avail.Storage	Storage Description
#1	594.00'	452.335 af	**Custom Stage Data_2021**Listed below

Elevation (feet)	Cum.Store (acre-feet)
594.00	0.000
595.00	0.141
596.00	0.766
597.00	3.702
598.00	9.361
599.00	26.387
600.00	55.333
601.00	98.783
602.00	145.198
603.00	201.269
604.00	264.392
605.00	355.929
606.00	452.335

Device	Routing	Invert	Outlet Devices
#1	Primary	590.96'	**48.0" Round Culvert** L= 158.0' CMP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 590.96' / 590.00' S= 0.0061 '/' Cc= 0.900 n= 0.025 Corrugated metal, Flow Area= 12.57 sf
#2	Device 1	604.30'	**9.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=1.35 cfs @ 24.19 hrs HW=604.44' (Free Discharge)
↑—**1=Culvert** (Passes 1.35 cfs of 155.52 cfs potential flow)
↑—**2=Broad-Crested Rectangular Weir** (Weir Controls 1.35 cfs @ 1.06 fps)

Pond 2P: Kincaid Ash Pond



Luminant

Office Memorandum

Date: November 17, 2020

To: Cynthia Vodopivec

Matt Ballance
Jason Campbell
cc: Charles Koudelka

From: Vic Modeer

Ash Pond Structural Stability Assessment
Kincaid Generation, LLC
Subject: Kincaid Power Station

BACKGROUND

The October 2016 certified "CCR Rule Report: Initial Structural Stability Assessment for the Kincaid Ash Pond at the Kincaid Power Station" (CCR Certification Report) prepared by AECOM for Kincaid Generation, LLC (Kincaid Generation) describes the outlets for the Ash Pond. There are two hydraulic structures that pass through the dike of the Ash Pond, the 48-inch corrugated metal pipe (CMP) emergency outlet structure and a 60-inch reinforced concrete recycle intake pipe (RCP) that passes through the dike and travels back to the plant on the downstream side of the southern dike. The recycle pipe is 20-feet from the toe of the dike with 6 feet of soil cover. No other hydraulic structures pass through the dike of or underlie the base of the Kincaid Ash Pond. The AECOM report states that the Kincaid Ash Pond hydraulic structures cannot be structurally certified due to inability to complete a closed-circuit television (CCTV) inspection of the recycle intake structure pipe. However, the recycle pipes have been inspected numerous times thereafter and found to be structurally sufficient. Thus, both hydraulic structures are structurally sufficient.

Pipe Inspections and Structural Stability Statements. AECOM's 2016 report states that the CMP was able to be internally inspected via a CCTV inspection and found to be "free of significant deterioration, deformation, distortion, bedding deficiencies, sedimentation, and debris." In addition, the AECOM report states that "[e]valuation of design drawings and information about operations and maintenance for [the CMP] did not identify any issues." However, AECOM could not certify that all of the Kincaid Ash Pond hydraulic structures meet the requirements of § 257.73(d)(1)(vi) because it was not able to be internally inspect the RCP due to the

high flow volume. However, the intake structure that includes the section of the RCP through the embankment was observed in the field by AECOM and no structural defects were found as noted in AECOM's report.

The 60-inch RCP was constructed with a lean concrete bedding to prevent settlement during and after construction. The pipe is flowing freely as it is a key part of the plant operation water balance. Inspections of the ground surface above the pipe are performed weekly as part of the weekly inspections in compliance with § 257.83 and do not show any deformation or loss of ground surrounding the pipe.

EVALUATION

Analyses. The critical cross section for the 60-inch RCP is at Station 119+00, at the outlet. The remainder of the southern dike is flatter and does not have pooled water on the upstream face. The results of the 2016 AECOM report address conditions of steeper slope with saturated ash on the upstream face. In order to certify the complete 60-inch RCP is structurally sound in accordance with § 257.73(d)(1)(vi) the following analyses were performed at the critical outlet cross section at Station 119+00:

- § 257.73(e)(1)(i), Maximum storage pool safety factor must be at least 1.50. Figure 1 provides the graphic results of the analysis. The calculated safety factor is 2.86.

- § 257.73(e)(1)(ii), Maximum surcharge pool safety factor must be at least 1.40. Figure 2 provides the graphic results of the analysis. The calculated safety factor is 2.04.

- § 257.73(e)(1)(iii), Seismic safety factor must be at least 1.00, Figures 3 and 3A provide the graphic results of the analysis. The calculated safety factor is greater than 1.00 as shown in Figure 3 and the soils do not sustain perceptible movement according to the results shown in Figure 3A.

    - The analysis of the movement shown in Figure 3A is to determine the integrity of the pipe should earthquake movement occur at the outlet.

    - The design earthquake parameters were taken from the results of the Probabilistic Seismic Hazard Analysis (PSHA) from the 2016 AECOM report.

    - The analysis of Figure 3A is based on the state of the practice method by Jibson, et.al. (Jibson, R.W., Rathje, E.M., Jibson, M.W. and Lee, Y.W., 2013. *SLAMMER: Seismic landslide movement modeled using earthquake records* (No. 12-B1). US Geological Survey).

- § 257.73(e)(1)(iv) For dikes constructed of soils that have susceptibility to liquefaction safety factor must be at least 1.20. The soils are not susceptible to liquefaction, and the results of the analysis have a calculated safety factor of 2.83.

Evaluation. The above evaluation shows that the 60-inch RCP that runs from the pond outlet to the plant does not affect the stability of the impoundment that would cause a release of CCR material. Moreover, a failure within the 60-inch RCP would not cause the dike to become unstable and the dike instability to cause a release of CCR material. The evaluation also shows that the stability of the dike at the inlet structure meets the requirements of the CCR rule so any dike instability will not cause a pipe failure. The inlet structure does not have any structural defects.

Accordingly, based on the above analyses and evaluation of the 60-inch RCP and the information included in the 2016 AECOM report for the CMP, the hydraulic structures at the Ash Pond are structurally sufficient and meet the requirements of § 257.73(d)(1)(vi).

Please let me know if you have any questions.

Sincerely,

Vic Modeer, PE, D.GE
(IL, MO, IN, KY, OH, LA)
Consulting Engineer

FIGURE 1

§257.73(e)(1)(l) Maximum Storage Pool Safety Factor must be at least 1.5

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- Drained shear strengths were used in this analysis

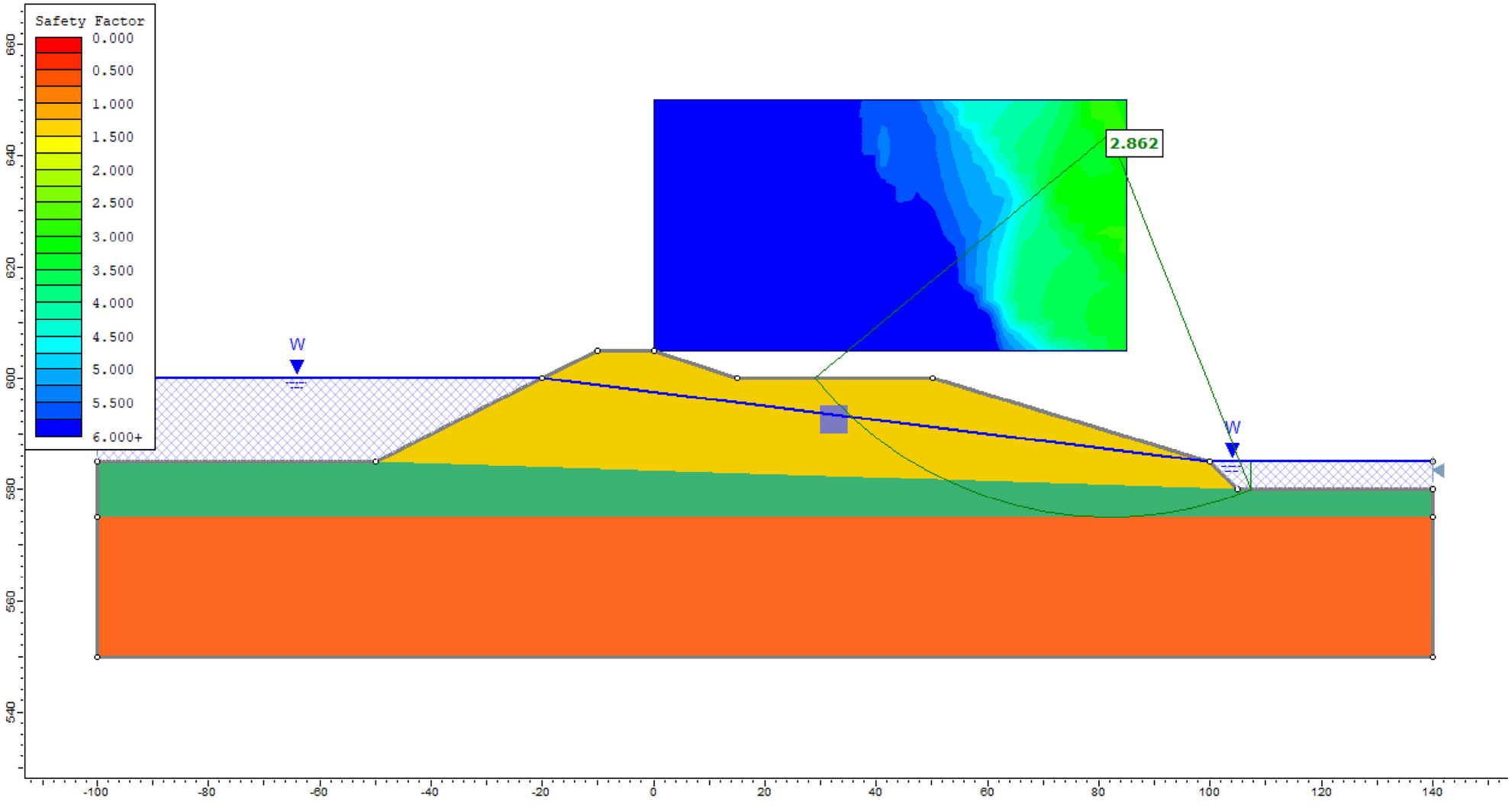


FIGURE 2

§257.73(e)(1)(II) Maximum Surcharge Pool Safety Factor must be at least 1.4

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- Short term undrained strengths were used in this analysis

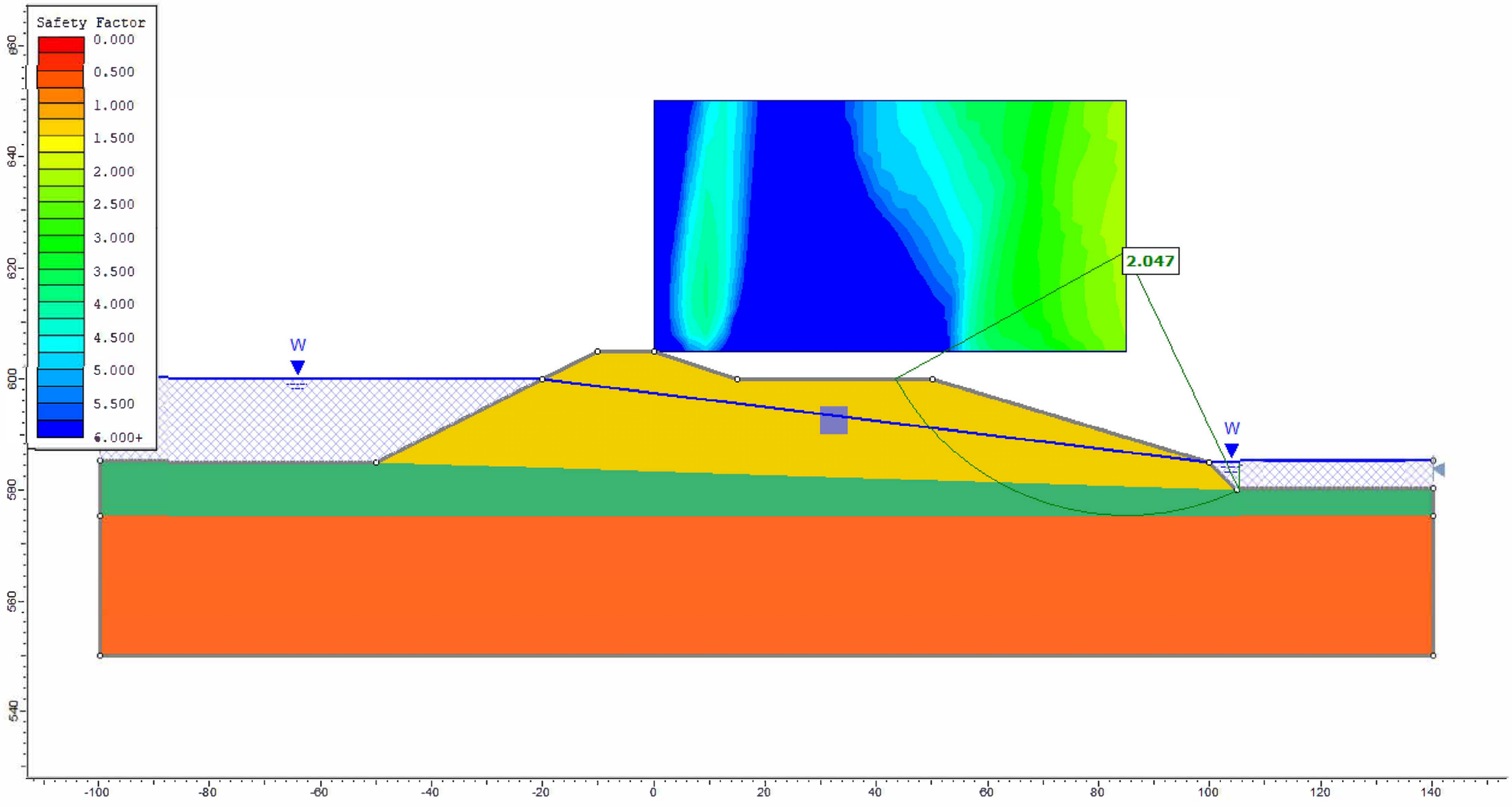


FIGURE 3

257.73(e)(1)(III) Seismic Safety Factor must be at least 1.0

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- The horizontal acceleration from certification report is 0.07
- This analysis finds the lowest horizontal acceleration for a safety factor 1.0
- Lowest horizontal acceleration = 0.204 < 0.07, therefore embankment meets rule

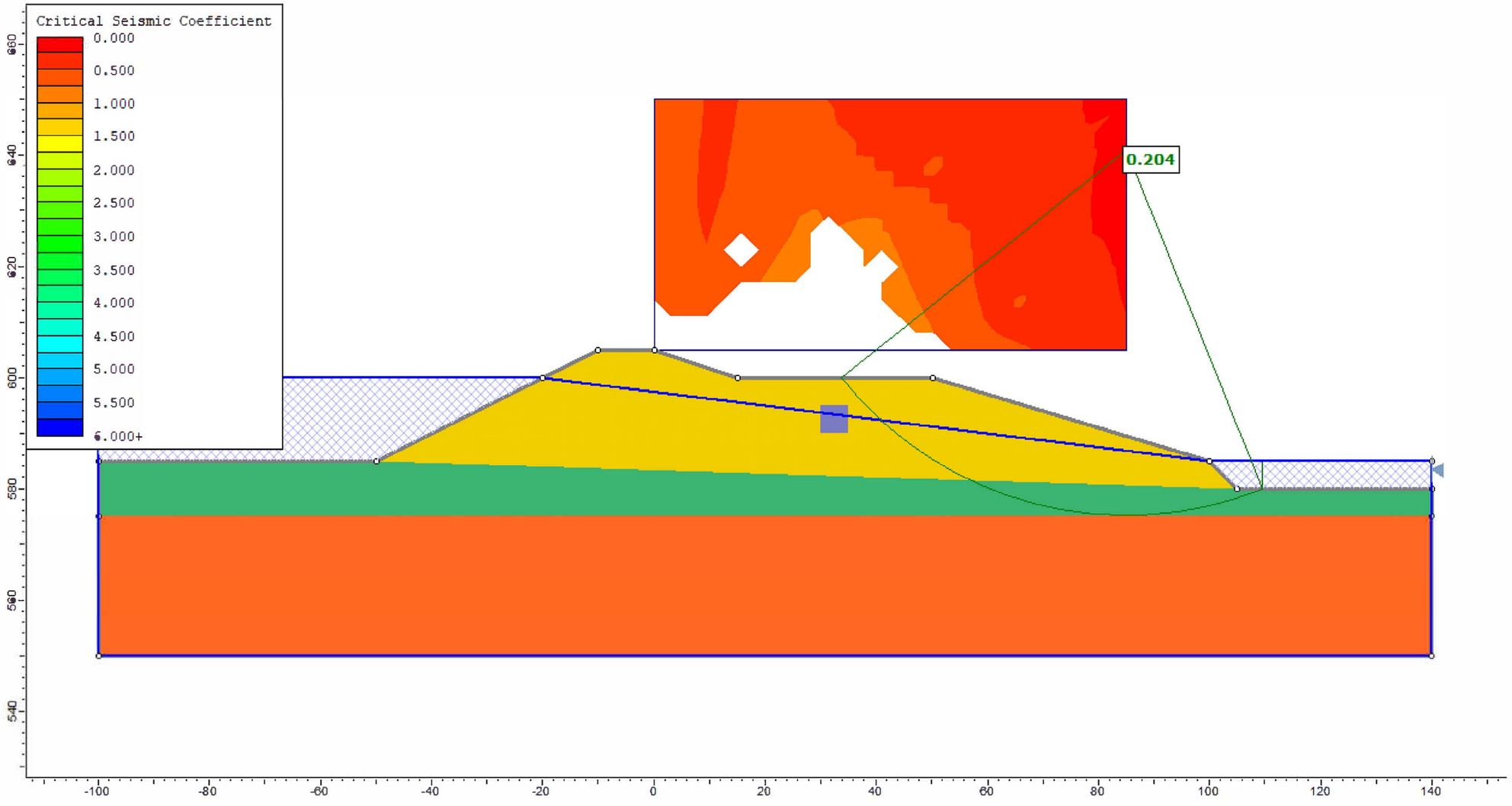


FIGURE 3A

§257.73(e)(1)(III) Seismic Safety Factor must be at least 1.0

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- This analysis shows the displacement from the modeled earthquake in the PSHA from the certification report
- Referece: Jibson, R.W., Rathje, E.M., Jibson, M.W. and Lee, Y.W., 2013. SLAMMER: Seismic landslide movement modeled using earthquake records (No. 12-B1). US Geological Survey.

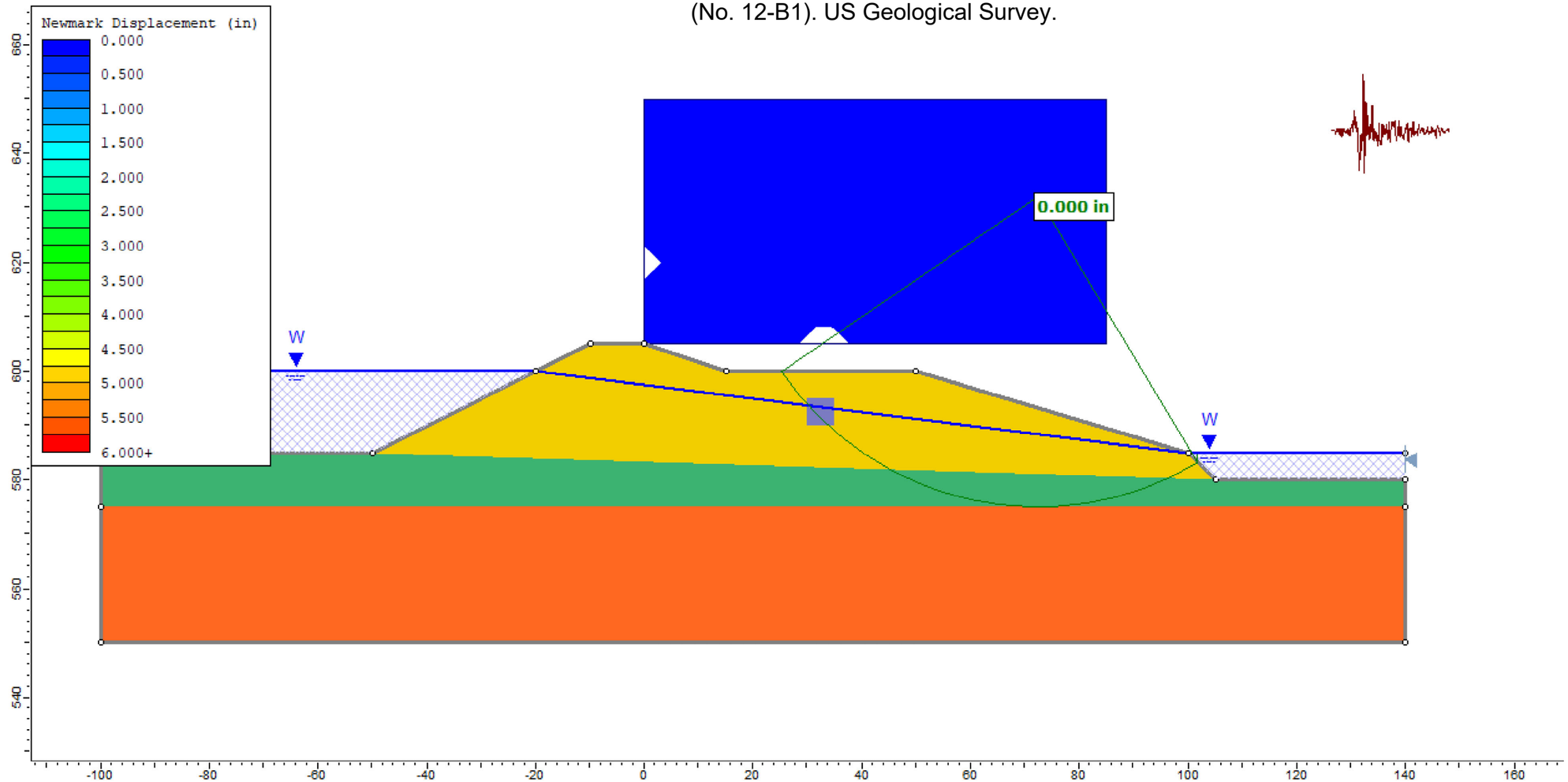
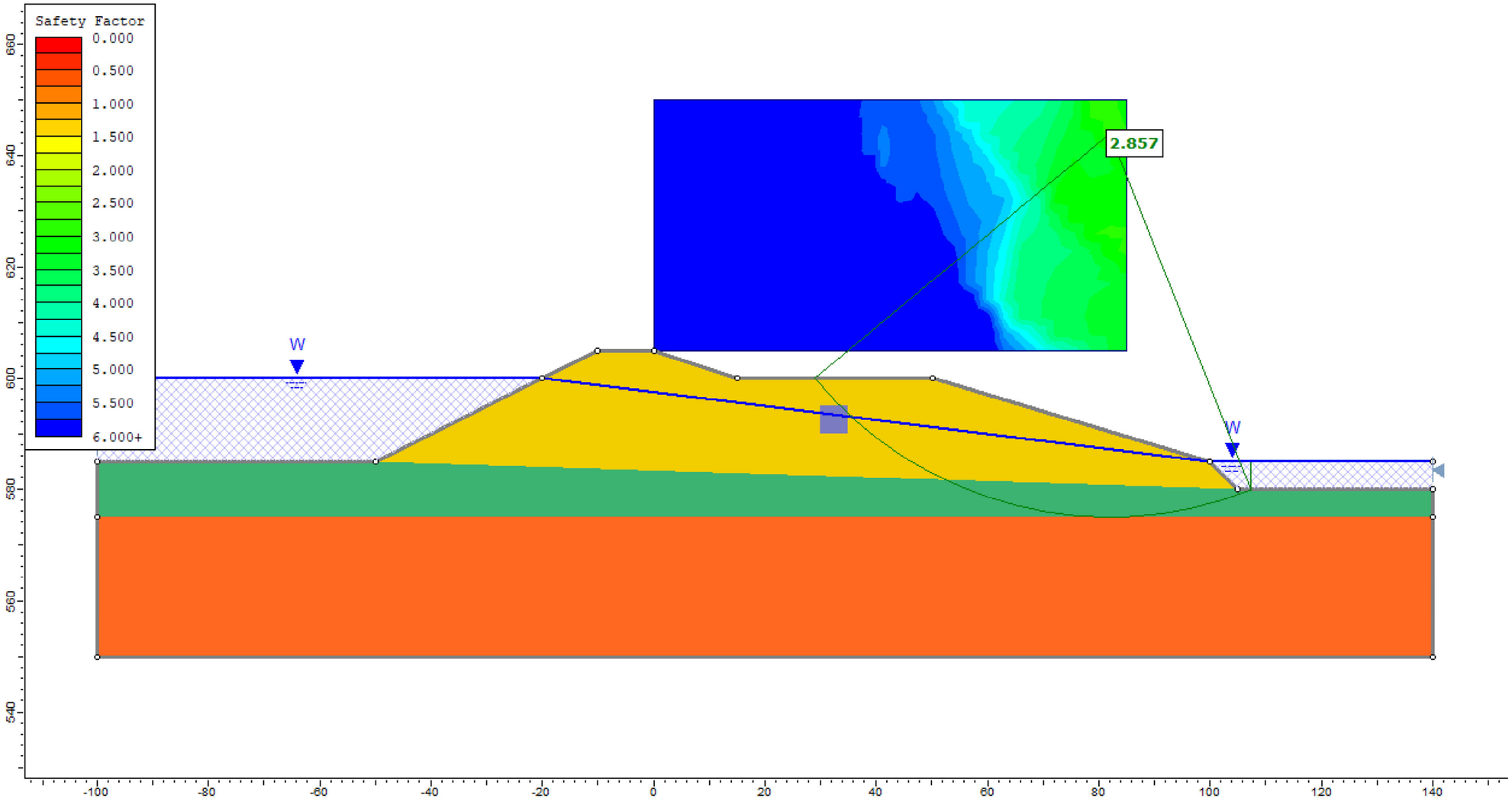


FIGURE 4

§257.73(e)(1)(IV) For dikes constructed of soils that have susceptibility to liquefaction safety factor must be at least 1.2

- Square in embankment represents the 60-inch diameter pipe - in failure - no strength
- The soils immediately below embankment were shown in certification report to be susceptible to earthquake or strain softening
- This analyses slope with strain softened strengths