HISTORY OF CONSTRUCTION

40 CFR 257.73(c)

Auxiliary Ash Pond Complex

Glen Lyn Plant Site

Glen Lyn, Virginia

February 2026

Prepared for: Appalachian Power Company

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

Glen Lyn Plant

Auxiliary ash pond complex

History of construction

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Director – Ash Management Services



I certify to the best of my knowledge, information, and belief the information contained in this report meets the requirements of 40 CFR § 257.73(c).

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1.0 OBJECTIVE

The "Hazardous and Solid Waste Management System: Disposal of Coal Combustion Residuals From Electric Utilities; Legacy CCR Surface Impoundments", 89 Fed. Reg. 38950 (May 8, 2024) (amending 40 C.F.R. §257) requires owners and operators of facilities with a legacy coal combustion residual (CCR) surface impoundment to prepare a history of construction document for each legacy CCR surface impoundment at the facility.

The Auxiliary Ash Pond Complex at Glen Lyn Plant Site is subject to this rule.

2.0 DESCRIPTION OF THE CCR IMPOUNDMENT

The Glen Lyn Plant Site is located adjacent to the New River in Giles County, Virginia, approximately 10 miles east of Princeton, West Virginia. The latitude/longitude of the facility is: 37º 22' 12" N/ 80º 51' 48" W. The facility address is 100 APCO Road, Glen Lyn, VA, 24093. The Auxiliary Ash Pond Complex is located approximately 0.5 miles northwest of the Plant site.

The Glen Lyn Plant operated from 1919 to 2015. The total length of the perimeter dike containing the Auxiliary Ash Pond Complex is nearly 5,000 linear feet, and the Auxiliary Ash Complex is roughly 70 acres in size.

At the time of writing this History of Construction, Appalachian Power Company has an approved closure plan from the Virginia Department of Environmental Quality (January 2026).

3.0 SUMMARY OF OWNERSHIP 275.73(c)(1)(i)

[The name and address of the person(s) owning or operating the CCR unit: the name associated with the CCR unit: and the identification number of the CCR unit if one has been assigned by the state.]

The name associated with the CCR unit is the Auxiliary Ash Pond Complex. Appalachian Power Company, a subsidiary of American Electric Power, is the owner of the Auxiliary Ash Pond Complex at the Glen Lyn Plant Site.

Appalachian Power Company
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Email: aepccrhelp@aep.com

The Auxiliary Ash Pond Complex encompasses areas also known as the West Pond, Auxiliary Pond (Fly Ash Dam), and Glen Lyn Landfill. The Auxiliary Ash Pond Complex site has been assigned the following identification numbers:

- West Pond: Virginia Department of Conservation and Recreation-Dam Safety: 071008
- Auxiliary Ash Pond (Glen Lyn Fly Ash Dam): Virginia Department of Conservation and Recreation-Dam Safety: 071001

- VDEQ Solid Waste Management Facility Permit Number: 222

4.0 LOCATION OF THE CCR UNIT 275.73 (c)(1)(ii)

[The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15-minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.]

A location map is included in Attachment A.

5.0 STATEMENT OF PURPOSE 275.73 (c)(1)(iii)

[A statement of the purpose for which the CCR unit is being used.]

When the Glen Lyn Plant was operational, the Auxiliary Ash Pond Complex was a surface impoundment or landfill for settling and storing coal ash.

6.0 NAME AND SIZE OF WATERSHED THE CCR UNIT IS LOCATED 275.73(c)(1)(iv)

[The name and size in acres of the watershed within which the CCR unit is located.]

The Auxiliary Ash Pond Complex is located within the Region 5 - Ohio Region Watershed and is part of two subgroups:

1. Hydrologic Unit Code = 050500021001 Adair Run-Bluestone Lake watershed area
2. Hydrologic Unit Code = 0505000210 New River-Bluestone Lake watershed area.

Approximately 180 acres drains into a diversion channel before discharging to the West Pond. Approximately 8 acres of onsite drainage is routed to a stormwater channel on the southern edge of the Auxiliary Ash Pond Complex.

7.0 DESCRIPTION OF THE FOUNDATION AND ABUTMENT MATERIALS 275.73(c)(1)(v)

[A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is located.]

Geotechnical information for the site is included as Attachment B. The subsurface conditions summarized herein at the Glen Lyn Auxiliary Ash Pond Complex are from numerous geotechnical investigations.

The foundation soils are alluvial deposits. The upper alluvial soil is generally cohesive and is commonly lean clay or sandy lean clay with consistencies ranging from medium stiff to very stiff. This layer is referred to as clay like alluvium. The thickness of the cohesive alluvial soil ranges between 0 to 25 feet, generally decreasing moving towards the south end of the site. The cohesive alluvial soil generally consists of 50 to 70 percent sand with 30 to 50 percent fines. Plasticity indices range from 10 to 27 percent and liquid limits

range between 27 and 48 percent. The undrained shear strength of this layer ranges from 2000 to 3500 psf.

The lower layer of alluvial soil consists of clayey sand, silty sand, and silt. This layer ranges in thickness from 0 to 23 feet and generally decreases moving towards the north end of the site. This layer is referred to as sand like alluvium. The consistency of this layer ranges between very loose to medium dense. This layer contains 51 to 83 percent sand and 49 to 17 percent fines. Plasticity indices range from non-plastic to 7.

The bedrock is known as the Hinton formation, which is mainly composed of limestone, sandstone and shale. The bedrock on the site is generally a medium hard, fine-grained, slightly to moderately weathered shale. The bedrock elevation ranges from 1477 to 1487 feet above mean sea level across the Auxiliary Ash Pond Complex. The bedrock surface slopes down towards the New River. The site is located close to the axis of the northeast/southwest trending Hurricane Ridge Syncline.

8.0 DESCRIPTION OF EACH CONSTRUCTED ZONE OR STAGE OF THE CCR UNIT

275.73 (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; and the approximate dates of construction of each successive stage of construction of the CCR unit.]

The Glen Lyn Plant operated from 1919 to 2015. The Auxiliary Ash Complex encompasses areas also known as the West Pond, Auxiliary Pond and Ash Landfill. A chronology of ash placement in the Auxiliary Ash Pond Complex is included as Attachment E.

The Auxiliary Ash Pond Complex is contained by a perimeter dike that has been modified over the history of the site. The first sequence of embankment construction occurred in 1958 and created a soil dike around the North and East sides of the Auxiliary Pond. The crest of the dike was at elevation 1525 ft-msl and was constructed with locally available clayey shale. The interior footprint of the Auxiliary Ash Pond was excavated from elevation 1500-1505 ft-msl down to approximately elevation 1490 ft-msl for storage capacity and a borrow source. The slopes of the embankment were 2H:1V.

Subsequent upstream raising occurred at the Auxiliary Ash Pond using fly ash material for embankment construction with a soil cover to create a new crest elevation of 1535 ft-msl in 1963. An internal drainage system consisting of a perforated pipe with lateral drains was installed. Also at this time, a riprap toe buttress was placed along the riverward toe of the embankment along the New River.

In 1965, the crest of the Auxiliary Ash Pond dike was raised to elevation 1540 ft-msl to provide additional ash storage capacity while the West Pond was being constructed. By 1967, the Auxiliary Ash Pond was filled with ash and remained in that state until 1974.

By 1967, the embankment creating the West Pond was completed and built with locally available clayey shaley soil with a crest elevation of 1536 ft-msl. State Route 649 was relocated in the process of creation

of the West Pond. The embankment slopes were 2H:1V, and a riprap toe buttress was built up to elevation 1508 ft-msl.

In 1974, ash was excavated from the Auxiliary Ash pond, and an upstream clay blanket was installed on the upstream face of the Auxiliary Ash pond embankment.

From 1974 to 1981, the ash storage practices at Glen Lyn incorporated dry ash storage between the West Pond and Auxiliary Pond. The facility was operated in a manner that when one ash pond was in service, the other ash pond would be excavated and the material placed on the dry storage area.

By 1981, the Glen Lyn Plant was outfitted with a dry fly ash handling system, meaning all CCR placed in the Auxiliary Ash Pond Complex was placed and compacted in a landfill.

The landfill was licensed by the Virginia Department of Health in 1977 for the sole purpose of disposing of the CCR produced by the Glen Lyn Plant. In 1988, new Virginia Solid Waste regulations were created, and the landfill permit was reissued by the Virginia Department of Environmental Quality (VDEQ) Solid Waste Management (Permit No. 222) in 1994. The permit modification included an increase in disposal capacity, a retrofitted geomembrane liner, geomembrane cap system, and leachate collection system.

Landfill closure activities occurred in phases beginning in 2005 and final closure certification of the entire landfill occurred in October 2014. Ash generated after 2008 was disposed of off-site. The Auxiliary Ash Pond was closed in 2014. At the time of writing this History of Construction, approximately 5 acres of the West Pond remains open and impounds water.

In 2020, Virginia House Bill 443 was passed and requires the Auxiliary Ash Pond Complex to be closed by removal. At the time of writing this History of Construction, Appalachian Power Company has an approved closure plan from the Virginia Department of Environmental Quality (December 2024).

9.0 ENGINEERING STRUCTURES AND APPURTENANCES, 275.73 (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…]

American Electric Power performed an extensive review of historical files, drawings, and other information for the Auxiliary Ash Pond Complex. All readily available drawings are included in Attachment C.

10.0 SUMMARY OF POOL SURFACE ELEVATIONS, AND MAXIMUM DEPTH OF CCR, 275.73 (C)(1)(VII)

[…in addition to the normal operating pool surface elevation and the maximum pool elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment.]

The table below describes the normal pool elevations and maximum pool elevations as well as maximum depth of CCR within the impoundment. The design flood for the West Pond is based on Virginia Department of Conservation and Recreation (VADCR) Dam Safety regulations and is 90% of the Probable Maximum Flood. The Auxiliary Ash Pond is closed and cannot impound water; therefore, this section does not apply for that area.

	West Pond
Normal Pool Elevation	1530 ft-msl
Maximum Pool Elevation following peak discharge from inflow design flood (0.9 PMF, 24 Hr.)	1534.6 ft- msl
Expected Maximum depth of CCR within impoundment (includes landfill)	150 feet

11.0 FEATURES THAT COULD ADVERSELY AFFECT OPERATION DUE TO MALFUNCTION OR MIS-OPERATION (275.73 (c)(1)(vii))

[…and any identifiable natural or manmade features that could adversely affect operations of the CCR unit due to malfunction or mis-operation]

There are no known features such as pipes underneath the Auxiliary Ash Pond Complex that could adversely affect operation due to malfunction or mis-operation.

12.0 DESCRIPTION OF THE TYPE, PURPOSE, AND LOCATION OF EXISTING INSTRUMENTATION 275.73 (C)(1)(VIII)

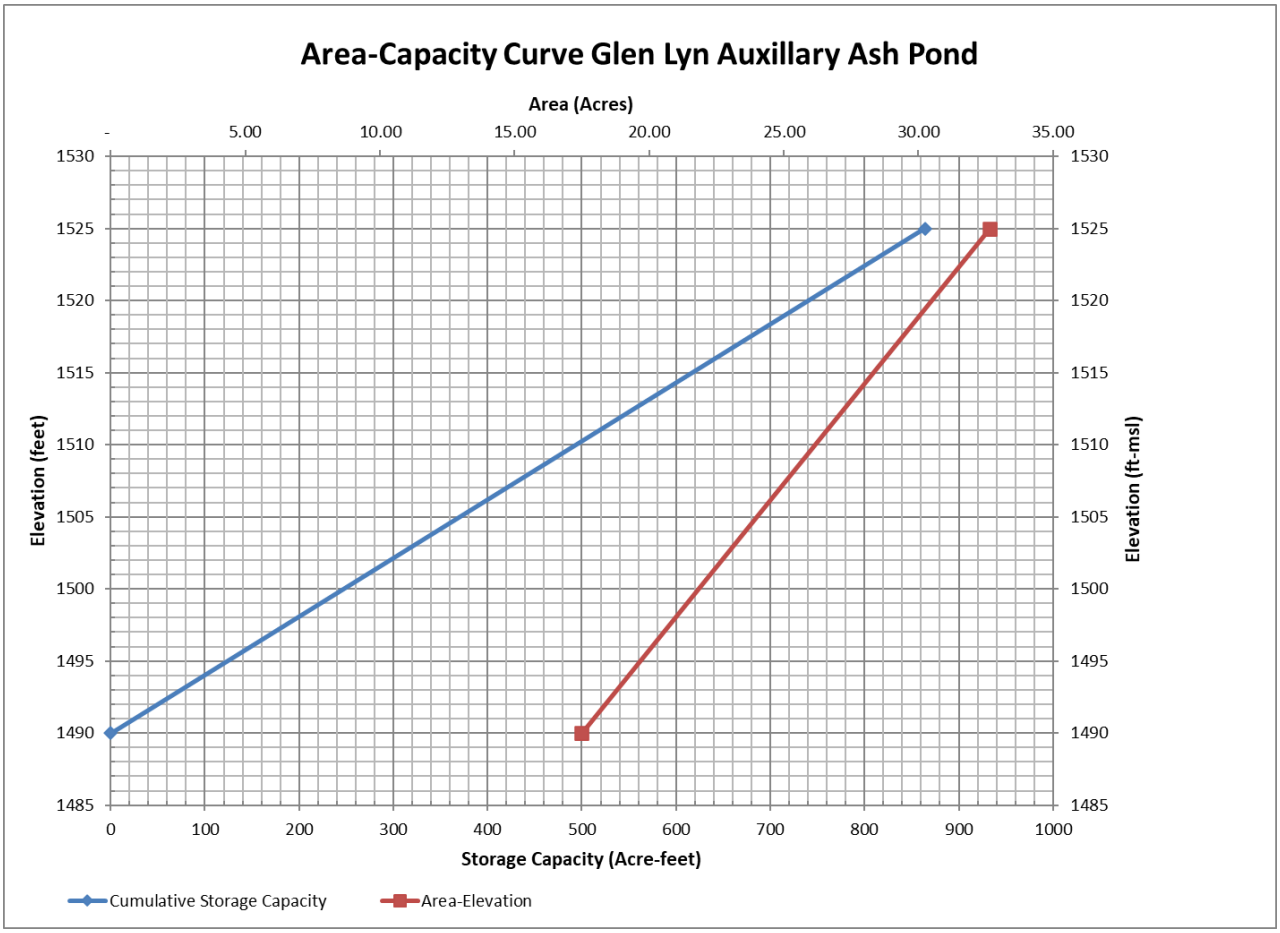
[A description of the type, purpose, and location of existing instrumentation.]

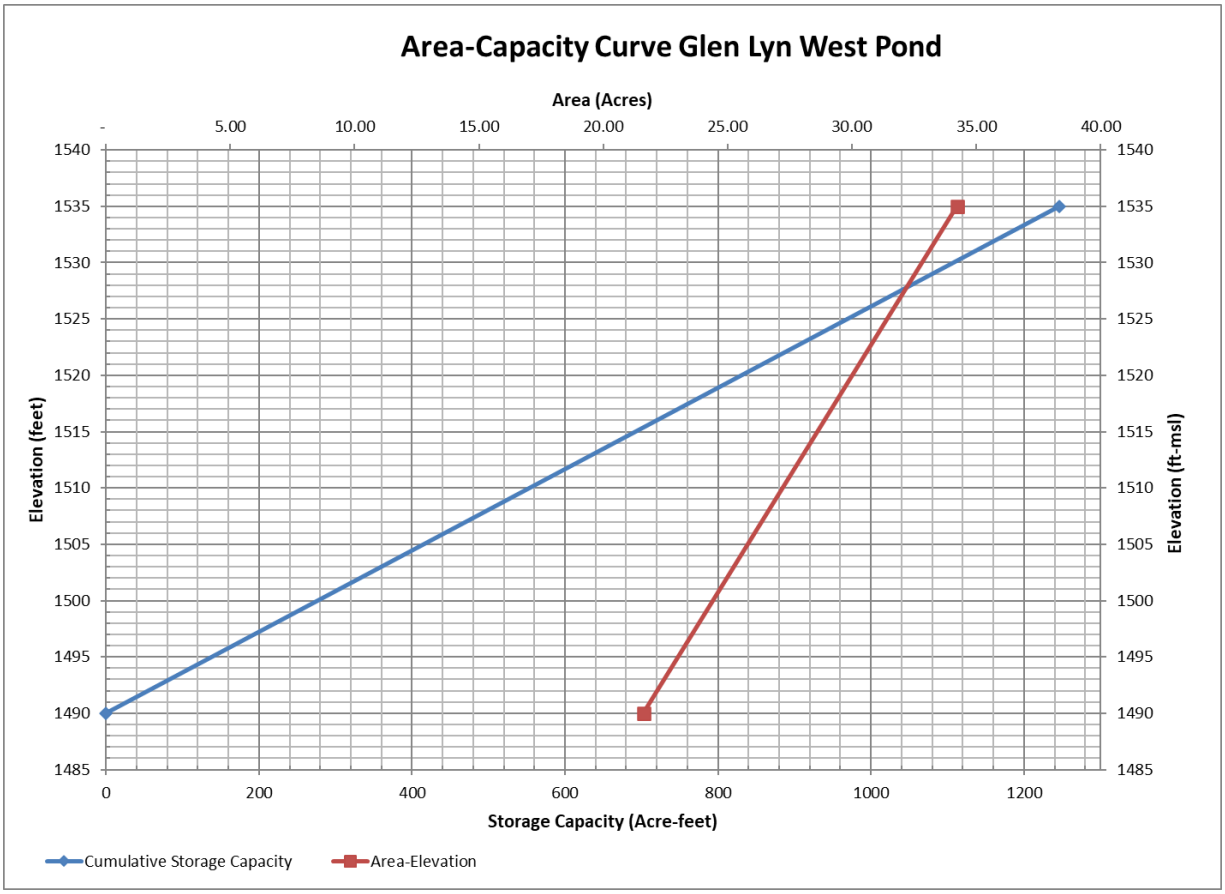
The Auxiliary Ash Pond Complex does not have any instrumentation.

13.0 AREA – CAPACITY CURVES FOR THE CCR UNIT 275.73 (c)(1)(ix)

[Area-capacity curves for the CCR unit.]

The area-capacity curves shown below are based on measurements taken from AEP drawing GLP-6-3621a-5 and AEP drawing S-AP-2670-3621C-4. The area-capacity curves reflect conditions before landfill construction and closure. In total, there is approximately 6.6 M CY of CCR stored within the Auxiliary Ash Pond Complex.





14.0 275.73 (c)(1)(x) DESCRIPTION OF EACH SPILLWAY AND DIVERSION

[A description of each spillway and diversion design features and capacities and calculations used in their determination.]

Water discharges from the Auxiliary Ash Pond Complex through two separate structures. Hydraulic capacity calculations for both structures are included as Attachment E.

At the south end of the site, there is a 20-foot-wide, 2-foot-deep swale on the southern edge of the Auxiliary Ash Pond Complex that discharges stormwater runoff into Adair Run. There is a similarly sized riprap channel extending from the mouth of the swale. The swale and channel were designed to handle the 25-year, 24-hour storm.

On the northern end of the site, the West Pond has a spillway system consisting of a pipe/riser and an open channel, fabric-formed concrete lined emergency spillway. HEC-HMS software was used in the inflow design flood routing analysis. The West Pond spillway was designed to handle flows from the 0.9 PMF.

15.0 SUMMARY CONSTRUCTION SPECIFICATIONS AND PROVISIONS FOR SURVEILLANCE, MAINTENANCE AND REPAIR 275.73 (c)(1)(xi)

[The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.]

There are no readily available portions of the original construction specifications.

As required by the CCR rules the Auxiliary Ash Pond Complex is inspected at least every 7 days by a qualified person. Also, as a requirement of the CCR rules the impoundment is inspected annually by a qualified professional engineer.

If repairs are found to be necessary during any inspection they will be completed as soon as feasible.

16.0 RECORD OR KNOWLEDGE OF STRUCTURAL INSTABILITY 275.73 (c)(1)(xii)

[Any record or knowledge of the structural instability of the CCR unit.]

A section of the dike near the northwest corner of the Auxiliary Ash Pond failed in 1960.

ATTACHMENT A

LOCATION MAP



Location Map: Glen Lyn Site Legacy CCR Surface Impoundments
Drawn by: Dan Murphy
Date: December 9, 2025

0 1,000 2,000 3,000 Feet

ATTACHMENT B

Geotechnical Information



GEI Consultants

Consulting
Engineers and
Scientists

Data Report – Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

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B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\6a Data Report\Glen Lyn Data Report - August 2018.docx

Executive Summary

This report presents data we have obtained and compiled to support the seismic stability analysis of the Ash Landfill and West Pond at the Glen Lyn Plant in Glen Lyn, Virginia. The analyses are presented in a separate Analysis Report (GEI 2018).

The Glen Lyn Ash Landfill and West Pond contain fly ash generated at the Glen Lyn coal-fired power plant. The Glen Lyn facility is located along the New River in Giles County, Virginia, on the border with West Virginia.



Scope

This report includes:

- A summary of the construction history of the landfill.
- Data obtained from field explorations and laboratory testing performed in 1972 by AEP, 1990 by GAI Consultants, Inc., and 2010 by MACTEC.
- Data from field explorations and laboratory testing performed by GEI in 2017 and 2018.
- Cross-sections at three locations representative of the variation in embankment and foundation geometry and materials.
- Descriptions and summaries of the available data for the various ash and soil materials.

We performed field explorations (2017) and laboratory testing (2017 and 2018) to provide data to evaluate the seismic stability of the Ash Landfill and West Pond.

Our 2017 explorations consisted of 34 borings, 3 shallow test pits, and 29 seismic cone penetration tests. Six open standpipe piezometers were installed.

Subsurface Conditions

Three cross-sections are shown in Figs. 5a through 5c. The locations of the sections are shown in Fig. 3. The sections illustrate the locations of the various fill materials, ash, and foundation soil layers based on the landfill design and explorations.

The fill materials and natural soils above bedrock consisted of the following layers:

Fill Materials	Natural Soils
▪ Clay Dike ▪ Sluiced Ash ▪ Stacked Ash ▪ Clay Cap ▪ Earth Fill ▪ Riprap	▪ Clay-like alluvium ▪ Sand-like alluvium

Bedrock consists primarily of shale.

Descriptions of the soil and rock are contained in this report. Evaluations of soil and ash strengths for analyses are presented in a separate report (GEI 2018).

1. Introduction

1.1 Purpose

The purpose of this data report is to collect and compile available data for the Ash Landfill and West Pond. This data report will serve as the basis for selection of material properties for the seismic stability and deformation analyses. The selection of material properties and the seismic analyses will be presented in a separate analysis report.

This report presents:

- A description of the construction history of the Ash Landfill and West Pond.
- Data from previous (1964 through 2010) construction documents, subsurface explorations, and laboratory testing.
- The results of the 2017 and 2018 GEI field explorations and laboratory testing programs.
- Subsurface cross sections based on the available data.
- Descriptions of the various embankment and foundation soil materials, based on the available data.
- Evaluation of groundwater levels.

1.2 Scope of Services

Our scope of services for this data report included:

- Collected and reviewed documents related to the construction of the Ash Landfill and West Pond, landfill closure, and explorations, laboratory testing, and analyses performed previously by others.
- Designed and executed a field exploration and laboratory testing program (2017 and 2018 program).
- Developed cross-sections at three locations considered critical due to the geometry and subsurface conditions.
- Prepared descriptions and summaries of the available data for the various ash and soil materials.

1.3 Authorization

This work was authorized by American Electric Power under Professional Services Agreement 02903785x215, including Amendment 1.

1.4 GEI Personnel

The key GEI personnel responsible for this report were:

Bill Walton, P.E., S.E.	Principal
Michael Paster, P.E.	Project Manager
Michelle Perez-Canals, P.E.	Geotechnical Engineer
William Lukas, Ph.D.	Geotechnical Engineer
Gillian M. Gregory, Ph.D., P.E.	In-House Reviewer

2. Site Description

2.1 Site History

The Glen Lyn Plant is a coal-fired power plant that operated from 1919 to 2015 (Appalachian Power, undated brochure). The plant is located on the New River in the town of Glen Lyn, Giles County, Virginia, on the border with West Virginia (Figs. 1 and 2).

A chronology of ash disposal, including aerial photographs, is presented in Appendix A. Ash disposal in the area of the current landfill began in 1958. Closure of the ash landfill began in the 1990s and was complete by 2008. After 2008, ash from the plant was disposed of offsite.

2.2 Site Description

Selected historic and current site photos are provided in Appendix B. Various historical drawings showing conditions and designs for various phases of the landfill construction, and showing results of historical subsurface explorations, are provided in Appendix C.

A site plan is shown in Fig. 3. For this report we will refer to the New River as being east of the Ash Landfill, and the West Pond as being north of the Ash Landfill.

The Ash Landfill and the West Pond are bounded on the north and east by a compacted clay dike (founded on natural alluvium), which separates the Ash Landfill and West Pond from the New River. To the west, the Ash Landfill and the West Pond are contained by bedrock-controlled hillsides. To the south, the Ash Landfill is separated from the Auxiliary Pond (now closed) by a clay dike founded on natural alluvium.

The term Ash Landfill refers to the area that has been closed and capped. The term West Pond refers to the area north of the Ash Landfill which has not been capped. The Leachate Collection Pond is located between the Ash Landfill and the West Pond.

2.3 Elevations and Horizontal Coordinates

Elevations are in feet and are referenced to Mean Sea Level of 1929 (National Geodetic Vertical Datum, or NGVD29).

The highpoint of the landfill is at El. 1640. The crest of the dike along the river varies from about El. 1536 to El. 1548. The New River is at about El. 1483 at the landfill.

The horizontal coordinate system used by AEP for the vicinity of the Ash Landfill is a site-specific coordinate system, which applies only to the Ash Landfill, the West Pond, and the

Auxiliary Pond. We refer to this as the Glen Lyn Fly Ash Landfill Horizontal Datum (GLFLHD). The control points for this system are as shown in the table below.

Monument ID	GLFLHD	NAD 83
2602	N 389,189.25	N 3,670,029.63
	E 1,310,616.21	E 10,793,445.73
2605	N 388,986.83	N 3,669,827.21
	E 1,311,018.55	E 10,793,848.07

To convert from NAD83 to GLFLHD, subtract 3,280,840.38 from the NAD83 northing, and subtract 9,482,829.52 from the NAD83 easting. For example,

N389,000.00, E1,310,000 (GLFLHD) corresponds to N3,669,840.38, E10,792,829.52 (NAD83).

Based on our review, GLFLHD is within a couple of hundred feet of NAD27. This has led to some confusion on historic AEP drawings. For example, the drawings below state that NAD 27 was used, but it appears that GLFLHD was used.

Drawing Title	Drawing Number	Created By	Date/ Rev	Stated Horizontal Datum	Correct Horizontal Datum
Fly Ash Storage Area General Plan	16-3540-3	AEP	9/06/79 Rev3	"Comparable to Virginia So. State Plane Grid"	GLFLHD
Design Plans Glen Lyn Plant Landfill Expansion Coal Combustion By-Product Disposal Facility	56-30100 through 56-30122	GAI Consultants	Various	NAD 27	GLFLHD
Ash Area End of 1992 As Built Status	56-30210-0	AEP	4/16/93 Rev0	NAD 27	GLFLHD
Ash Area Cross-Sections	56-30211-0 56-30212-0	AEP	4/16/93 Rev0	NAD 27	GLFLHD
Potentiometric Map of the Alluvium Active Fill Area 1993	56-13170-26	AEP	11/30/16 Rev26	NAD 27	GLFLHD
Potentiometric Map of Bedrock Active Fill Area 1993	56-13172-26	AEP	11/30/16 Rev26	NAD 27	GLFLHD
Well Location Plan Active Fill Area 1993	56-13171-7	AEP	Rev7	NAD 27	GLFLHD
Glen Lyn Plant Landfill 2008 As-Built	--	AEP	2/06/08	NAD 27	GLFLHD

2.4 Previous Data and Analysis Reports

Data reports and stability analyses prepared since 1972 are listed in Table 1.

Casagrande Consultants gave recommendations for the construction of the new dike extensions with respect to slope stability in 1972.

AEP performed a series of compaction tests on fly ash at Glen Lyn in 1973.

GAI Consultants, Inc. performed field investigations and stability analyses prior to the closure of the landfill in 1990. A slope stability program using the modified Bishop method was used to assess the stability of two planned cross-sections. Additionally, the stability of the liner and the cap were checked using the Infinite Slope and Wedge methods, respectively. GAI Consultants, Inc. reran the slope stability analyses in 1993 following modifications to the closure design.

MACTEC performed a field investigation in 2009 to assess the subsurface conditions around the perimeter of the landfill.

In 2014, GAI Consultants, Inc. performed an analysis of 100-year flood impacts resulting from the planned closure and regrading of the West Pond. The GAI report was updated in July 2016.

3. Previous Subsurface Explorations

3.1 Introduction

Several exploration programs have been performed previously and are discussed below. The exploration programs are summarized in Table 2, and the locations of borings and cone penetration tests (CPTs) performed from 1972 through 2010 are shown in Fig 3. Boring logs, well logs, and CPT logs from previous explorations are presented in Appendix D. Some exploration data are shown in the historical drawings in Appendix C.

3.2 1972 Borings

In 1972 the Appalachian Power Company performed 21 mud rotary, flight auger, and hollow stem auger borings with standard penetration test (SPTs) along the length of the dikes located at the site. Borings were performed through the dike as well as through the placed and sluiced fly ash layers just inside of the dikes.

3.3 1990/1991 Borings and Wells

In 1990 AEP engaged GAI Consultants, Inc. to perform 17 hollow stem auger borings with SPTs and 12 monitoring well installations (MW-1 thru MW-12). Well details are discussed below in Section 5.2. The borings were located across the site, including through the stacked and sluiced fly ash. Additionally, one boring was hand-augered to the northwest of the ash landfill and five borings were hand-augered from a boat in the West Pond. Tube samples were also taken.

In 1991 GAI Consultants, Inc. performed an additional 7 hollow stem auger borings with SPTs and installed an additional five wells (B-18-A, B-18-B, B-20, B-20-A, and B-21).

3.4 1993 to 1995 Borings and Wells

Additional subsurface exploration programs were performed for which no boring logs and only limited data are available. From 1993 to 1995, borings labelled B-22 through B-30 were performed and monitoring wells MW-13 through MW-23 were installed. These explorations are shown on cross-sections in drawings 56-13167 and 56-13168 prepared by AEP. The cross-sections show the soil layers encountered in each exploration.

3.5 2006 Auxiliary Pond Borings and Wells

In 2006 an investigation of the Auxiliary Pond was performed with nine borings labelled GLLE-01 through GLLE-09. We do not know who performed the borings. These borings are shown on cross-sections in drawing 56-30306-A prepared by GAI Consultants. The cross-sections show the soil layers encountered in each exploration. Four monitoring wells were

installed as part of the program. In 2015, three monitoring wells were installed to replace wells from 2006 that were abandoned. We do not know who installed the replacement wells.

3.6 2009 Borings, CPTs and Piezometers

In 2009 AEP engaged MACTEC Engineering and Consulting, Inc., and Tri-State Drilling to perform five hollow stem auger borings (P-0901 through P-0905) and three CPT soundings. Piezometers were installed in all five borings. Four borings were performed roughly at the four corners of the Ash Landfill with an additional boring performed in a dry area of the West Pond, near the leachate collection pond. Five feet of bedrock was cored at each of the boring locations. Three CPT soundings, with pore pressure dissipation tests every 10 ft, were performed adjacent to three of the borings.

4. 2017 GEI Exploration Program

4.1 Introduction

The purposes of our 2017 field program were to:

- Obtain high quality thin-wall tube samples in the clay dike, stacked ash, sluiced ash, and in foundation layers that may be susceptible to strength loss due to earthquake shaking.
- Confirm the validity of the previous data, particularly the SPT blowcounts.
- Install open standpipe piezometers to measure the groundwater levels in the bedrock and in the ash.
- Collect data from SCPT testing including shear wave velocities.

The explorations were performed during September and October 2017 in 22 clusters of borings and seismic cone penetrometer tests across the site, as shown in Fig. 3. Piezometer locations are shown in Fig. 4a.

In total, the explorations consisted of 21 standard penetration test (SPT) borings, 13 tube sampling borings, 23 seismic cone penetration tests (SCPTs), and 6 fast-push cone penetration tests (CPT-Fs).

The 22 clusters were:

Cluster ID	SPT Boring	Tube Boring	SCPT	CPT-F	Open Standpipe Piezometer ID	Location
101	B101	B101U	SCPT101, SCPT101a	- -	- -	Crest of New Clay Dike
102	B102	- -	- -	- -	- -	Toe of New Clay Dike
103	B103	- -	- -	- -	- -	Near West Pond
104	- -	- -	SCPT104	CPT104F	- -	Between Leachate Pond and Landfill
105	B105	B105U	SCPT105	CPT105F	B105	Between Leachate Pond and Landfill
106	B106	B106U	SCPT106	CPT106F	- -	Between Leachate Pond and Landfill
107	B107	- -	SCPT107	- -	B107	Middle Landfill Bench – Back of Landfill

Cluster ID	SPT Boring	Tube Boring	SCPT	CPT-F	Open Standpipe Piezometer ID	Location
108	B108	- -	- -	- -	- -	Top of Landfill
109	B109	B109U	SCPT109	CPT109F	B109	Middle Landfill Bench
110	B110	B110U, B110U-A	SCPT110, SCPT110a, SCPT110b, SCPT110c	- -	- -	Crest of New Clay Dike
111	B111	- -	- -	- -	- -	Downstream Midslope of New Clay Dike
112	B112, B112a	B112U	SCPT112	- -	- -	Along New River
113	B113	B113U	SCPT113	- -	- -	Crest of Old Clay Dike
114	B114	- -	- -	- -	- -	Top of Landfill
115	B115	B115U	SCPT115	CPT115F, CPT115Fa	B115	Middle Landfill Bench
116	B116	B116U	SCPT116	- -	- -	Crest of Ash-Raised Old Clay Dike
117	B117	- -	SCPT117	- -	- -	Crest of Ash-Raised Old Clay Dike
118	B118	- -	SCPT118	- -	- -	Crest of Ash-Raised Old Clay Dike
119	B119	B119U, B119U-A	SCPT119	- -	- -	Crest of New Clay Dike
120	B120	- -	SCPT120, SCPT120a, SCPT120b	- -	- -	Middle Landfill Bench
121	- -	- -	SCPT121, SCPT121a	- -	- -	Middle Landfill Bench
122	B122	B122U	- -	- -	B122, B122U	Lower Landfill Bench

We installed open standpipe piezometers in six borings, as shown in the table above. Details of the open standpipe piezometers are presented below in Section 4.4.

Photos of the drilling, sampling, and CPT testing are included in Appendix E.

4.2 Borings

4.2.1 General

Boring logs from the 2017 explorations are provided in Appendix F. We used the Unified Soil Classification system for our soil descriptions. Table 3 presents the schedule of borings. Boring locations are shown in Figs. 3, 3a, and 3b.

All borings were drilled by two crews from Terracon Consultants, Inc., as a direct contractor to AEP. Terracon used a truck-mounted Simco 2800 HS(HT) and a track mounted Acker Renegade drill rig for the SPT and undisturbed tube sample borings. GEI engineers or geologists observed and logged the borings.

Borings were drilled in general accordance with ASTM D 1586 (normal SPT), D 1587 (tube sampling), and D 6066 (liquefaction-related SPT). For mud rotary drilling, Terracon used tri-cone roller bits with steel teeth. The roller bits had deflectors that prevented drill fluid from jetting directly downward. Terracon used either 3-inch-I.D. or 4-inch-I.D. casing, which was advanced by pushing or spinning. For hollow stem augering, Terracon used either 3.25- or 4.5-inch-I.D. augers with carbide teeth and a removable center bit.

All mud rotary boreholes were kept full of drilling mud at all times during drilling and sampling operations to prevent blow-in or disturbance at the bottom of the hole. To reduce the risk of hydraulic fracturing, boreholes in the clay dikes were performed using hollow stem augers. We regularly checked the borehole depth prior to SPT testing or tube insertion by measuring the drill rods and stickup to check for blow-in.

Most borings were terminated at refusal on bedrock. Refusal was defined as 50 blows for less than 6 inches of SPT penetration. Terracon cored the bedrock in six borings. Completed borings that did not have piezometers were grouted using Portland cement grout with a small amount of bentonite. Initial grouting took place through a tremie pipe whose bottom was located near the bottom of the boring. Once good grout return was observed at the top of the hole, the tremie pipe and casing were removed and the grout topped off from the ground surface.

Jar and tube samples were transported by truck to GEI's office in Woburn, Massachusetts.

4.2.2 Standard Penetration Testing

Standard Penetration Tests (SPT) were performed in general accordance with ASTM D 1586 (normal SPT) and ASTM D 6066 (liquefaction-related SPT) using an automatic hammer, AWJ drill rods, and a 30-inch-long, 2-inch-O.D. split-spoon sampler. SPT Borings located on the clay dike and the top of the landfill were advanced using 3.25-inch-I.D. hollow stem augers. SPT borings located on the benches of the landfill and the West Pond were advanced using mud rotary drilling with either 3- or 4-inch-I.D. casing. The split-spoon sampler was typically driven 24 inches and contained a catcher that was in good condition.

Photos of representative soil samples for some of the soil layers are included in Appendix E. Soil samples were placed in plastic bags and stored in clear glass jars with screw-on lids. We used electric tape around the lid to help seal in the moisture.

GRL Engineers, Inc., as a subcontractor to Terracon, measured the hammer energy of both drill rigs. The results are summarized below. GRL's energy measurement report is included in Appendix G.

Rig	Boring where the Energy was Tested	Samples where the Energy was Tested	Depths where the Energy was Tested (ft)	Hammer Efficiency (%)	Hammer Efficiency Correction (C_E)
Acker Renegade	B106	S25 – S28	56.5 – 65.5	88	1.47
Simco 2800	B119	S11, S13, S15, S17, S19, S21	25.0 – 52.0	85	1.42

4.2.3 Tube Sampling

Sixty-four tube samples were obtained in 18 borings in general accordance with ASTM D 1587. Either a GUS sampler, an Osterberg sampler, or a direct push sampler was used based on the material being sampled (as seen in photos in Appendix E).

Borings with tube samples on landfill benches were advanced with 4-inch-I.D. casing and drilling mud. Borings with tube samples on the clay dike or on top of the landfill were advanced with 3.25- or 4.25-inch-I.D. hollow stem augers. Sampling tubes were 3-inch-O.D., 30- or 36-inch-long, thin-wall, galvanized steel Shelby tubes. For each tube, the I.D. of the cutting edge was slightly smaller than the I.D. of the rest of the tube. Clearance ratios, defined as (tube I.D. – cutting edge I.D.) / (cutting edge I.D.), ranged from 0.22 percent to 0.97 percent, all less than the ASTM maximum of 1 percent to reduce sample disturbance.

For each tube sample, we took precise measurements of penetration and recovery, which allowed us to compute whether the sample expanded or compressed when sampled. In general, the change in density during sampling was minimal.

We took the following precautions to reduce tube sample disturbance:

- Mud rotary borings were advanced and cleaned out with drilling mud using relatively low-density drill fluid and low down-hole drilling pressures.
- The cutting edge of each tube was sharp, and the clearance ratios for all tubes were less than 1.0 percent.

- For the GUS and Osterberg samplers, Terracon pushed each tube hydraulically using the drill fluid until fluid return could be seen at the top of the casing, indicating a full push, or until the fluid pressure maxed out.
- For the direct push sampler, Terracon pushed each tube in one continuous motion that stopped at twenty-four inches of penetration or tube refusal.
- The waiting period after pushing until start of extraction for each tube ranged from 15 minutes (clay tubes) to 45 minutes (sand and ash tubes). For direct push samples Terracon rotated the drill rods through up to two revolutions with wrenches to shear the bottom of the tube sample. GUS and Osterberg samplers do not allow for post-penetration tube rotation. During drill rod and tube sampler removal, Terracon took care to break rods and remove the sampler slowly to avoid creating suction and avoid excessive vibration or disturbance.
- We prepared each sample of sandy soil and stacked or sluiced ash for transport with filter paper and a floating packer on top and an expanding packer on the bottom. The packers had holes drilled in them to allow water to drain from the sample. If the tube was full to the bottom edge, the bottom packer was not used. Plastic caps with small slits cut in them to allow drainage of the sample were attached to the top and bottom of the tube using electrical or duct tape.
- We measured the distance between the top of the tube and the top packer prior to placing the top cap and storing the sample at the site. After shipment to the laboratory in Woburn, Massachusetts, we measured this distance again to document any change in sample height.
- We prepared each sample of clayey soil for transport with an expanding packer on both top and bottom. If the tube was full to the bottom edge, the bottom packer was not used. The ends were sealed with rubber caps and electrical or duct tape.
- We drove the tube samples to GEI in specially constructed padded racks in an enclosed van. Each tube was held in a vertical position at all times, from sampling in the field to strength testing in the lab. We took care to avoid jarring or disturbing the tube samples during sampling, storage, transportation, and testing.

4.2.4 Rock Core

Terracon cored 10 ft of bedrock in three borings and 9 ft and 15 ft of bedrock in two borings. They seated the casing in rock and cored using a wireline NQ2 double-barrel core barrel for five borings and a wireline HQ double-barrel core barrel for one boring. We recorded the coring times per foot on the logs. The rock coring equipment used for each boring is presented below.

Location	Boring	Length of Core (ft)	Core Barrel Size
North Corner of Dike	B101	10	NQ2 (2" core)
West Pond/Landfill Divider Dike	B105	10	NQ2 (2" core)
Bench on East Side of Landfill	B109	15	NQ2 (2" core)
Toe of East Side of Dike	B112A	10	NQ2 (2" core)
Bench on East Side of Landfill	B115	9	NQ2 (2" core)
Bench on East Side of Landfill	B122	10	HQ (2.5" core)

Rock core was placed in wooden core boxes and logged in the field. The boxes were stored at the plant.

4.3 Cone Penetration Tests

4.3.1 General

We performed 23 Seismic Cone Penetration Tests (SCPTs) and six fast-push Cone Penetration Tests (CPT-F) with the assistance of the Terracon drillers using both the truck-mounted Simco 2800 HS(HT) and track-mounted Acker Renegade drill rigs (photos in Appendix E). For the SCPTs the 1.4-inch-diameter cone (area of 10 cm^2) was pushed at a target rate of between 1.5 and 2.5 cm/sec. Tip resistance, sleeve friction, and pore water pressure measurements were recorded every 2 cm. The pore water pressure response was measured at the back of the cone (the shoulder).

Six CPT-Fs were pushed at an increased penetration rate of approximately 10 cm/sec to assess the state of drainage during cone penetration through the saturated fly ash. (The lower tip resistance and skin friction measured in the fly ash in fast-push CPTs indicated that the fly ash was at least partially drained during normal rate CPTs, and probably undrained during the fast-push CPTs.)

A 5-ton capacity tension-type cone, with separate load cells for tip resistance and skin friction, was used in the fly ash to provide accurate measurements of skin friction. A 10-ton capacity subtraction cone was used in the clay dike.

SCPTs were terminated upon refusal, which occurred in different layers at different locations.

For SCPTs on the clay dike, Terracon predrilled to a depth of 15 to 25 ft due to the stiff and gravelly nature of the dike material. The 15- to 25-ft predrilled depth was grouted upon completion.

SCPT and CPT-F logs, and figures comparing CPT and CPT-F results at the same location, are provided in Appendix H. The tip resistance data are reported as q_t. The measured tip resistance (q_c) was adjusted to obtain q_t, where

> q_t = Measured CPT tip resistance corrected for unequal end-area pore-water-pressure effects (Lunne, Robertson, and Powell, 1997). For CPTs in clean to silty sands (and fly ash) there generally is little or no pore water pressure generated, and thus q_c and q_t are essentially the same in sands.

The CPT logs report friction as both the sleeve friction f_s and R_f (friction ratio, equal to f_s / q_t).

4.3.2 Shear Wave Velocity Measurements

Shear wave velocity measurements were made at 18 SCPT locations. The measurements are presented in the CPT logs in Appendix H. Summary plots showing measured shear wave velocities for each soil and ash layer are provided at the end of Appendix H.

Shear waves were generated by striking the end of a steel beam with fins embedded in the soil with an instrumented sledgehammer. The instrumented sledgehammer identifies time equal to zero for travel of the shear wave. The shear wave velocity was calculated using the time for the shear wave to travel down to the SCPT geophone. Measurements were made every meter as the cone was advanced.

4.4 Open Standpipe Piezometers

Six open standpipe piezometers (observation wells) were installed at the locations indicated in the table above in Section 4.1, and as shown in Fig. 4a. Installation logs are contained in Appendix I. Table 4 contains a summary of the installation depths and screened intervals. Five piezometers were screened in the sluiced fly ash above the alluvial foundation soil, and one was screened in the bedrock/alluvium.

The piezometers consisted of a 10- or 20-ft-long, 2-inch-ID, 0.010-inch slotted PVC pipe set in a 12.2- to 24.2-ft-thick sand filter zone. The slotted pipe section was connected to a solid 2-inch-ID PVC riser pipe. A bentonite plug, about 1.5 to 5 ft long, was installed above the filter sand, and the remainder of the hole was grouted to the ground surface. When the piezometer was not installed at the bottom of the boring a bentonite plug (18.7 ft to 29.4 ft thick) was placed below the filter sand to the bottom of the boring.

In December 2017, a contractor to AEP installed a locking steel surface casing, extending about 3 ft above the ground surface, to protect each piezometer. A concrete pad and protective steel pipe bollards were also installed (detail provided in Appendix I). We did not observe this work.

5. Cross Sections and Piezometer Data

5.1 Cross Sections

Figs. 5a through 5c show cross sections at three locations on the landfill and West Pond. The cross sections show SPT N_{60} values (for clay-like soils) and $N_{1,60}$ values (for sand-like soils and ash). GEI 2017 borings were corrected using hammer energy from onsite SPT hammer energy testing. For previous borings, a 60 percent hammer energy was assumed because no information on the hammer type used was available.

5.2 Piezometer Data

5.2.1 Available Data

The locations of the six open standpipe piezometers we installed in 2017 and 14 wells and piezometers installed previously are shown in Fig. 4a. Table 5 provides a listing of the wells and piezometers that are still active, and available installation information.

More than 30 wells and piezometers were previously installed across the site between 1990 and 2015. Based on drawing GL-56-13171-7 (included in Appendix C) and on measurements of water levels provided by AEP, 14 of those wells and piezometers still remain.

(Between 2006 and 2015, 12 piezometers were installed around the Auxiliary Pond, 6 of which still remain. Information on these piezometers, obtained from AEP Drawing GL-56-13171, is not included in Table 5.)

Water levels measured in piezometers are presented in Table 6. The sources of these data are:

- AEP Excel Spreadsheet "well levels GZ" for data from about 1994 through 2005.
- AEP Excel Spreadsheet "GW_Elevation" for data from August 2001 through September 2016.
- Table 4 for piezometers we installed in 2017.
- AEP pdf document "GL SWLs Fall 2017" for data collected on September 25, 2017.

5.2.2 Piezometric Levels in the Ash

We estimated piezometric water elevations in the ash primarily from five of the six piezometers installed in 2017 that were screened in the ash (B105, B107, B109, B115, B122U). The piezometer locations are shown in Fig. 4b. At B116 and B117, where no piezometers were installed in the ash, we used our field observations during drilling to estimate the phreatic surface. The transition from dry to wet in the ash was clearly visible in the samples. [Of the

pre-2017 wells and piezometers screened in the ash, all were abandoned by 1998 except two MACTEC wells (P-0903 and P-0904). But these two wells were screened in both the ash and the alluvium, so we did not rely on these wells.]

No active wells or piezometers were available below the leachate collection system that is present below most of the landfill. And we did not advance borings through the leachate collection system. Therefore, we used judgment to estimate the elevation of the phreatic surface below the leachate collection system. MW-21, which was abandoned in 1997, had a 1997 water level reading in the ash at El. 1536.85. The leachate collection system was installed and the landfill has been capped since then. For our analyses, we assumed the current water level below the highest point in the landfill is at El. 1535.

In our cross-sections (Figs. 5a, 5b, and 5c), we drew straight lines from El. 1535 below the highest point in the landfill to the available piezometer readings or explorations with water level observations. On cross-section 3 we also used the water level of the West Pond (El. 1530) to estimate the piezometric surface.

Based on the groundwater levels in piezometers B109 and B122, the piezometric surface remained almost horizontal from the exploration done on the second landfill bench (B109) to the exploration on the first landfill bench and behind the dikes (B122).

5.2.3 Piezometric Levels in Alluvium and Bedrock

We installed one piezometer isolated at the alluvium/bedrock interface in 2017. Also, ten piezometers previously installed in the alluvium or bedrock are still active. As shown in Table 6 and in cross section 2 (Fig. 5b, boring B122), the piezometric levels in the alluvium and bedrock are lower than the piezometric levels in the ash above it. We interpret this to mean that the bedrock and sand-like alluvium have a connection to the New River, and that the clay-like alluvium acts as at least a partial barrier (aquitard) to downward flow of water from the ash.

We used the piezometer information from the alluvium and field observations in the explorations on the dike to estimate the piezometric surface through the dikes. We also used the elevation of the New River to draw the piezometric surface.

6. Laboratory Testing

6.1 Previous Laboratory Testing

Previous laboratory testing programs are summarized in Table 7 and discussed below.

Laboratory testing (including Atterberg limits, grain size distribution, minimum and maximum density, specific gravity, and one Proctor curve) was performed following the 1972 subsurface explorations. The results of the testing are presented in a memorandum titled "Soils Testing – Glen Lyn Plant – Glen Lyn, Virginia" prepared by General Analytics, Inc.

Laboratory testing (including index testing, dry density, specific gravity, direct shear, and consolidation tests) were performed following the 1990 subsurface explorations. The results of the testing are presented in Appendix H titled "Results of Laboratory Soils Test and Boring Logs" of a report prepared by GAI Consultants, Inc. (We do not have a copy of the full report.)

The moisture content and wet and dry density of the fly ash were tested following the 2010 subsurface explorations. The results of the testing are presented in a report titled "Density of Soil Specimens" prepared by MACTEC.

We do not know if any lab testing was performed following the other previous site explorations.

Chemical analyses of the fly ash were performed by AEP in 1998, 2002, 2005, 2007, and 2010 per reports titled "Fly Ash Analysis" and presented in the "Chemical Analysis of Fly Ash" PDF provided to us. The exact origin of the samples is unknown, but the sample IDs are listed as being from Units 5&6, the Silo, or simply "Yearly Sample." The results show the ash is primarily silica (43.9 – 52.4 percent), aluminum oxide (21.6 – 26.2 percent), and total carbon (11.2 – 18.2 percent). pH measurements varied widely from 4.7 to 10.2.

Ohio State University (OSU) performed testing on bulk samples of fly ash from test pits at the West Pond in 2017. Their data are presented in "Investigating the Liquefaction Potential of Impounded Fly Ash: Glen Lyn Power Plant," Draft Report May 25, 2017.

6.2 2017 and 2018 GEI Laboratory Testing

The following sections of this report present the details of the 2017 and 2018 GEI lab testing program, and include summaries of lab tests performed previously, as described above. The 2017 and 2018 testing program was performed primarily in our Woburn, Massachusetts laboratory, with some tests performed by the geotechnical laboratory at Virginia Tech (VA Tech) in Blacksburg, VA.

We and VA Tech performed the following index and strength testing on samples from the 2017 field explorations.

Test Type	No. of Tests on Clay Dike	No. of Tests on Ash	No. of Tests on Alluvium
Grain size analyses	7	10	20
Atterberg limits tests	11	11	12
Specific gravity tests	0	16	0
Unit weight tests on tube samples	9	14	5
Isotropically consolidated undrained triaxial compression tests on tube samples	9	6	5
One-dimensional consolidation tests on foundation sandy clay samples.	--	--	4

6.3 Index Testing

6.3.1 Grain Size Distribution

We performed grain size distribution tests (sieves and combined sieve and hydrometer tests) on jar and tube samples in general accordance with ASTM D6913 and D7928.

Material	Sieve Only	Combined Sieve and Hydrometer
Clay Dike	7	0
Fly Ash	2	8
Clay-like Alluvium	6	0
Sand-like Alluvium	14	0

Figs. 6a through 6d show the grain size curves for the clay dike, clay-like alluvium, sand-like alluvium, and fly ash (sluiced and stacked) from our 2017 and 2018 testing. Fig. 6e shows an electron microscope photo of the sluiced ash. The grain size data are tabulated in Tables 8a to 8c.

Additional electron microscope photos and individual grain size test results are provided in Appendix J.

6.3.2 Atterberg Limits

We performed 37 Atterberg (liquid and plastic) limit tests in general accordance with ASTM D4318. We also measured the natural water content of the test specimens.

We performed Atterberg Limits on the following layers:

- Clay Dike (11 tests)
- Fly Ash (11 tests – All nonplastic)
- Alluvium (15 tests – 4 nonplastic results)

Figs. 7a and 7b show the test results in the clay dike and alluvium plotted in Atterberg limits charts. The data are tabulated in Tables 8a, 8b, and 8c. The Atterberg limits results generally plot above the A-line, indicating clayey soil with low to medium plasticity. Individual test reports are provided in Appendix J.

6.3.3 Maximum and Minimum Realizable Density

Bachus and Santamarina (2012) proposed methods for measuring the relative "realizable" density of fly ash as an alternative to the definition of relative density (based on void ratios) commonly used for soils. They stated in Section 4.2 of their 2012 report:

> "Occluded and internally connected voids in fly ash add significant difficulty to the accurate and consistent determination of specific gravity of solids (Gs) for fly ash. This limitation has a direct bearing on the calculation of void ratio, porosity, and degree of saturation. Failure to recognize occluded and internally connected voids can lead to the erroneous utilization of pre-existing soil correlations and experience. These, in turn, can lead to incorrect conclusions regarding the behavior of fly ash.
>
> In particular, void ratio is the central parameter used to assess the tendency to volume change (contractive or dilative) of natural soils, while the degree of saturation determines whether excess pore pressure (positive or negative) will be generated during undrained loading. Therefore, **alternative approaches that do not rely on void ratio are needed** to more accurately characterize ponded fly ash.
>
> The terms "minimum and maximum realizable densities," ρ_{min} and ρ_{max}, are proposed in this study (or γ_{min} and γ_{max} when considering minimum and maximum realizable unit weights). Test procedures are suggested to determine these parameters. Specifically, the maximum realizable density uses the conventional standard Proctor compaction test familiar to geotechnical engineers. The minimum realizable density uses a technique referenced as "formation under shear."
>
> These two density limits can be consistently obtained to provide a robust reference range to assess the in situ density (ρ_o) in terms of relative realizable density $Dr = (\rho_o - \rho_{min})/(\rho_{max} - \rho_{min})$. The classical geotechnical engineering framework used for granular materials can be extended to include fly ash when the fly ash is characterized in terms of relative realizable density. It is explicitly recognized that threshold values (and techniques) used for assessing the relative density of sands do not necessarily translate to fly ash."

[Note that the form of the equation for relative realizable density is different than the form of the standard equation for relative density based on void ratio.]

Measurements of minimum and maximum realizable density of fly ash are shown in Table 9.

6.3.4 Specific Gravity

We performed 18 measurements of specific gravity on jar and batch samples in general accordance with ASTM D854, using 500 ml pycnometers. The oven temperatures used to dry the test specimens, and the drying of the ash as part of sample preparation were varied for the different tests. Table 10 presents our test results, and results from previous investigations. The results are summarized below.

Soil Type	GEI Range	GEI Median	AEP (1972)	GAI (1990)	OSU (2017)	Selected for Analyses
Sluiced Ash	2.14 - 2.30 18 tests	2.23	2.15 – 2.17 2 tests	2.3 1 test	2.15 1 test	2.22

Bachus and Santamarina (2012), state that the presence in fly ash of occluded voids and voids that are interconnected through small pore throats means that specific gravity measurements made on fly ash are not directly comparable to specific gravity measurements on soil. Following the work of Bachus and Santamarina (2012), we measured the specific gravity using water, and the results may be considered as the "effective" specific gravity of solids.

6.3.5 Unit Weight

We performed 28 measurements of dry and total unit weight, in general accordance with ASTM D7263, on undisturbed tube specimens. We also evaluated laboratory tube and field compaction data obtained previously by others. The results are listed in Tables 11a through 11d for clay dike, alluvium, sluiced ash, and stacked ash, respectively, and are summarized in the tables below.

For interest, the tables below also show the values of total unit weight selected for analyses. The bases for those selections are described in the Analysis Report (GEI 2018).

Unit Weight – Clay Dikes and Alluvium – 2017 Field Explorations					
Soil type	Dry Unit Weight, lb/ft^3		Total Unit Weight lb/ft^3		
	Range	Median	Range	Median	Selected for Analysis
Old Clay Dike 3 values	106.1 – 111.8	110.4	122.2 – 129.8	127.6	**127**
New Clay Dike 5 values	108.2 – 114.3	112.8	130.1 – 135.2	133.3	**133**
Alluvium 6 values	93.6 – 106.3	~100	120.5 – 129.8	~127	**127**

Dry Unit Weight in Tube, lb/ft^3 – Sluiced and Stacked Ash								
Soil type	GEI 2018 Range	GEI Median	GAI 1990 Range	GAI 1990 Median	MACTEC 2010 Range	MACTEC 2010 Median	AEP 1972 Aux Pond Range	AEP 1972 Aux Pond Median
Sluiced fly ash below phreatic surface	47.9 – 67.9 11 values	55.2	51.7 – 71.1 6 values	~62.0	50.2 – 70.3 5 values	58.3	43.5 – 53.9 6 values	~51
Sluiced fly ash above phreatic surface	--	--	--	--	58.0 1 value	58.0	36.9 – 44.7 7 values	40.8
Stacked fly ash tube data	52.6 – 60.3 3 values	53.9	--	--	--	--	--	--
Stacked fly ash compaction data	From AEP compaction testing, 2005 through 2007: 51 values of dry unit weight: 54.7 to 71.4. Average = 61.9							

Note: For the GEI sluiced fly ash values, we corrected the measured in-tube density to account for volume change that occurred during sampling. This was a minimal correction.

Total Unit Weight in Tube, lb/ft^3 – Sluiced and Stacked Ash									
Soil Type	**GEI 2018 Range**	**GEI Median**	**GAI 1990 Range**	**GAI 1990 Median**	**MACTEC 2010 Range**	**MACTEC 2010 Median**	**AEP 1972 Aux Pond Range**	**AEP 1972 Aux Pond Median**	**Selected for Analysis**
Sluiced fly ash below phreatic surface	88.8 – 99.8 11 values	92.9	73.4 – 99.6 6 values	~93	86.7 – 100.0 5 values	89.9	85.3 – 92.7 6 values	~88	**92**
Sluiced fly ash above phreatic surface	--	--	--	--	92.4 1 value	92.4	59.5 – 69.8 7 values	66.3	**77**
Stacked fly ash tube data	64.1 – 83.1 3 values	64.4	--	--	--	--			**78**
Stacked fly ash compaction data	From AEP compaction testing, 2005 through 2007: 51 values of total unit weight: 70.3 to 94.2. Median = 80.1								

Note: For the GEI sluiced fly ash values, we corrected the measured in-tube density to account for volume change that occurred during sampling. This was a minimal correction.

6.4 Consolidation Testing – Clay-like Alluvium

We performed four one-dimensional consolidation tests (in general accordance with ASTM D2435) on clay-like alluvium samples, to estimate the maximum past pressure. All the tests were performed on specimens extruded and trimmed from tube samples obtained from below the clay dike.

Test results are summarized below. Individual test reports are presented in Appendix K.

Boring and Sample	Sample Depth (ft)	Test Type	Estimated In-Situ Effective Vertical Stress (psf)	Range of Maximum Past Pressure from Test (psf)	Best Estimate of Maximum Past Pressure from Test (psf)
B101U U3	55.2	Incremental Load	7,150	4,000 – 5,000	4,600
B110U U3	53.9	Incremental Load	6,960	4,000 – 6,400	5,800
B119U-A U2	43.2	Constant Rate of Strain	5,460	12,000 – 20,000	16,000
B119U-A U2	43.2	Incremental Load	5,460	6,200 – 9,000	7,800

The consolidation curves were relatively rounded, making it somewhat difficult to interpret the maximum past pressure. However, the tests indicate that the overconsolidation ratio is close to 1.0, indicating that the clay-like alluvium is normally consolidated. A one-dimensional consolidation test performed by GAI in 1990 also indicated that the overconsolidation ratio was close to 1.0.

6.5 Strength Testing

6.5.1 General

The following triaxial testing was performed at our laboratory in Woburn, Massachusetts and at the VA Tech laboratory in Blacksburg, Virginia:

- Nine triaxial compression tests on tube samples to measure the undrained strength of the clay dike.
- Four triaxial compression tests on tube samples to measure the undrained strength of the clay-like alluvium.
- Six triaxial compression on tests on tube samples to measure the undrained peak and steady state strength of the sluiced ash.

All triaxial tests were isotropically consolidated undrained triaxial compression tests with pore water pressure measurements (CIUC′ or R-bar) in general accordance with ASTM D4767.

We used care to keep tube samples upright at all times during shipment from the field and handling within the lab. Samples were transported in padded racks to reduce vibrations.

In 1990, GAI reported the following results for four direct shear tests:

Material per GAI	Assumed Material Type	Boring	Depth (ft)	Cohesion (psf)	Friction Angle (degrees)
Fly Ash	Sluiced ash below phreatic surface	7-B	36 - 38	580	23.6
Fly Ash	Sluiced ash below phreatic surface	B-17	41 - 42	660	26.2
Silty Clay	Clay-like alluvium	B-4	54 - 56	260	26.1
Silty Clay	Clay dike	B-9	16 - 18	500	32.0

6.5.2 Triaxial Tests on Clay Dike

We performed nine triaxial tests on tube samples of the compacted clay dike. Test results are summarized in Table 12. Individual test reports are presented in Appendix L.

The nine test specimens were isotropically consolidated in the triaxial cell to pressures between about 1,400 and 5,000 psf.

The peak undrained strengths are plotted against consolidation stress in Fig. 8, with separate symbols for the old dike (built in 1958) and the new dike (built in 1964 and 1965).

6.5.3 Triaxial Tests on Clay-like Alluvium

We performed five triaxial tests on tube samples from the clay-like alluvium. Four of the five specimens of clay-like alluvium were intended to be consolidated to about 2/3 of the estimated in situ vertical effective stress before shearing. The actual consolidation stress was about 90 percent of that. One specimen was consolidated to a higher stress.

Test results are summarized in Table 13. Peak undrained strengths are plotted against consolidation stress in Fig. 9. Individual test reports are presented in Appendix L.

6.5.4 Triaxial Tests on Tube Samples of Sluiced Fly Ash

We performed six triaxial tests on tube samples of sluiced fly ash, in general accordance with ASTM D4767. Test results are summarized in Table 14. Individual test results are provided in Appendix L.

The fly ash specimens were isotropically consolidated to between 1 and 4 times the estimated in situ vertical effective stress to increase the likelihood of contractive behavior during shear. This resulted in the ash during shear being denser than the ash in situ. Therefore, the measured undrained strengths and friction angles are likely to be higher than the in-situ values.

Measured friction angles at maximum obliquity ranged from 33.8 to 35.9 degrees and measured friction angles at steady state ranged from 32.4 to 36.0 degrees.

Peak undrained strength and steady state strength are plotted against consolidation stress in Fig. 10.

6.5.5 Pluviation for Reconstituted Fly Ash Specimens

In preparation for testing of reconstituted fly ash specimens, we experimented with wet pluviation procedures.

Table 15 presents the specimen dry densities obtained by different laboratories for different batches of Glen Lyn sluiced fly ash. The dry densities we obtained for Batch #2 ranged from 69.2 to 71.1 pcf. This compares to the dry densities measured in the eleven 2017 tube samples of 48.9 to 68.8 pcf (median of 55.2 pcf).

The dry unit weight and relative realizable density of different batches of ash, which were all obtained in shallow test pits from the West Pond, varied significantly.

Testing of reconstituted specimens has not been performed as of March 2018, pending discussions regarding the need for the testing and the appropriate method of sample preparation to achieve relative realizable densities that model in situ conditions.

7. Subsurface Conditions

7.1 General

Our understanding of subsurface conditions at the Glen Lyn Ash Landfill and West Pond is based on our evaluation of the information discussed above. This chapter describes the various soil layers encountered in the explorations. Selection of soil properties for analysis is described in the Analysis Report (GEI 2018).

The clay dikes along the New River, which support the ash landfill and West Pond are about 50 ft high. The top of the ash landfill is about 100 ft higher than the crest of the clay dikes.

Cross sections at three locations are presented in Figs. 3 and 5a, 5b, and 5c. The cross sections were selected as representative locations of potential stability failures.

The cross-sections are located at:

- Section 1: Through the landfill, perpendicular to the New River (portion of landfill nearer to the Auxiliary Pond).
- Section 2: Through the landfill at the highest point of the landfill, perpendicular to the New River (through center of landfill).
- Section 3: Through the landfill at the highest point of the landfill, parallel to the New River, through the leachate collection pond, the West Pond, the clay dike, and to the New River.

7.2 Material Types

The different material types are:

Fill Materials	Natural Soils	Bedrock
▪ Clay Dike ▪ Clay Cap ▪ Earth Fill ▪ Stacked Ash ▪ Sluiced Ash ▪ Riprap	▪ Clay-like alluvium ▪ Sand-like alluvium	▪ Shale

7.3 Soil and Ash Materials

N-values listed in this section are corrected for hammer energy for clays and corrected for hammer energy and overburden pressure for sands and fly ash. N-values are from 2017

explorations only, because information on hammer energy was not available for the historical borings.

7.3.1 Clay Dike

The original (old) dike was constructed around 1958 according to historical documents and correspondence. It was originally constructed to El. 1525 and runs along the south and east edges of what is today the Auxiliary Pond, and the south portion of the east edge of the Ash Landfill. No historical information is available on construction methods or borrow sources for the old dike. Several previous borings and one 2017 boring penetrated the old dike. Based on our 2017 explorations and AEP drawing 56-30306-A, the old dike was raised from El. 1525 to about El. 1548 using compacted fly ash.

The new Clay Dike was constructed in 1965 to El. 1536 from local borrow. The new Clay Dike runs along the east and north of the landfill. Between 1980 and 1989 the new dike was raised to its current elevation. We do not have information on the dates or the borrow sources for the material used to raise the dike.

Based on boring B-113, the old Clay Dike consists primarily of clayey sand and sandy clay. The new Clay Dike consists of compacted sandy lean clay with pockets of gravelly clay and clayey sand. Our 2017 explorations encountered numerous instances of obstructions or rough drilling. We recovered one cobble from the tip of an auger, and one 5-inch-long piece of steel cable.

Grain size analyses were performed on five samples that were sandier than the typical Clay Dike material. These samples contained minimal gravel, 52 to 78 percent sand, and 21 to 47 percent fines (Fig. 6a).

Fig. 11a contains a histogram of corrected N_{60}-values (including $N_{1,60}$-values for sandy samples) for the clay dike. The N_{60} and $N_{1,60}$ values generally ranged between 6 and 35 with a median of 26, indicating the clay dike is stiff to hard. Plasticity indices ranged from 6 to 18 with liquid limits between 27 and 38, indicating the clay dike has low to medium plasticity (Fig. 7a).

Laboratory strength data was discussed above in Section 6.5. As shown in Fig. 8, measured undrained strengths ranged from about 1,000 to 6,500 psf, with most values between 1,500 and 3,500 psf.

7.3.2 Clay Cap

A clay cap approximately 2 ft thick was placed on top of the stacked ash during the closure of the landfill. Underneath the clay cap is a geosynthetic cap consisting of (from top down) a woven geotextile, two layers of non-woven geotextile, a geonet, and a PVC cap.

For our explorations we drilled through the clay cap and geosynthetic cap before beginning sampling and SPT testing. At the end of the exploration program AEP retained Ryan

Incorporated Central as general contractor and Chesapeake Containment Systems as geosynthetic installer to repair the penetrated liner and clay cap at all of the exploration locations. The work was documented in a report prepared by AMEC Foster Wheeler. This work was performed in December 2017.

7.3.3 Earth Fill

The dike dividing the Ash Landfill and the West Pond (now dividing the Ash Landfill and the Leachate Collection Pond) was constructed sometime between 1973 and 1976. The 1990 design drawings for the leachate collection system and the Ash Landfill closure refer to the divider dike as "earth fill." Two of our borings and three CPTs penetrated through this layer. The layer consists of sandy lean clay and clayey sand. The N_{60} and $N_{1,60}$ values were 7, 8, 12, 20, 32, and 42. No laboratory testing was performed on this layer. Based on field and laboratory observations, the earth fill material is similar to the clay dike material.

7.3.4 Stacked Ash

The stacked ash is found in the Ash Landfill area above the sluiced ash. Dry stacking began in the Ash Landfill in 1973. By 1978 all of the Ash Landfill area was being used for dry stacking. The stacked ash layer goes from the top of sluiced ash (typically El. 1524 to El. 1539) to El. 1640 at the highest point of the Ash Landfill. Stacked ash was also used to raise the old dike to its current elevation. The stacked ash consists mostly of fine sand and silt sized particles. In some locations fine gravel sized particles were also encountered.

Fig. 11b contains a histogram of corrected N-values ($N_{1,60}$) for the stacked ash. The $N_{1,60}$ values generally ranged between 6 and 35, with some values higher than that, indicating the stacked ash is loose to dense.

Grain size analyses indicate the stacked ash generally consists of minimal gravel, 10 to 72 percent fine sand, and 17 to 90 percent fines. In most samples, the stacked fly ash consisted primarily of silt sized particles, with less than 10 percent clay size (finer than 0.005 mm) and less than 11 percent sand sized (greater than 0.074 mm) particles (Fig. 6b).

7.3.5 Sluiced Ash

Sluiced ash started being placed in the Auxiliary Pond around 1958. The disposal area was expanded in 1965 with the addition of the Ash Landfill area and the West Pond. All three of the disposal areas have been used for sluicing ash at some time in their history. The West Pond has only been used for sluicing. The Ash Landfill was first used for sluicing, but in 1973 it began being used for dry stacking also.

The sluiced ash consisted of fine sand to silt sized particles. The sluiced ash could often be recognized because it had thin horizontal layers (varves) with different particle sizes and shades of gray. The top of the sluiced ash layer varied from El. 1524 to El. 1539.

In boring B120, layers of what appeared to be sluiced ash were found beginning at El. 1559. This seems unlikely, because the top of the clay dikes was at about El. 1544. We expect that these samples consisted of ash that was original sluiced, and then excavated and stacked. It must be just a coincidence that the layering was horizontal.

Fig. 11c contains a histogram of corrected N-values ($N_{1,60}$) for the sluiced ash, both above and below the phreatic surface. The $N_{1,60}$ values generally ranged between 0 and 15 with a few higher values, indicating the sluiced ash is very loose to medium dense. Sluiced ash below the water table had consistently lower $N_{1,60}$ values, ranging between 0 and 4.

Grain size analyses indicate the sluiced ash generally consists of no gravel, 6 to 84 percent fine sand, and 16 to 94 percent fines. In most samples, the sluiced fly ash consisted primarily of silt sized particles, with less than 7 percent clay size (finer than 0.005 mm) and less than 12 percent sand sized (larger than 0.074 mm) particles (Fig. 6b).

The sluiced ash was nonplastic as indicated by field descriptions and confirmed by Atterberg limits testing.

7.3.6 Clay-Like Alluvium

The top layer of existing alluvial soil consisted of lean clay to sandy lean clay. As shown in Table 16, the layer had a maximum thickness of 25 ft at B101 at the north end of the landfill at the corner of the West Pond near the river. The layer thickness decreased toward the south and was not present at the south end of the landfill. We refer to this as the "clay-like" alluvium to differentiate it from the sandier alluvium also present at the site.

Fig. 11d contains a histogram of corrected N-values (N_{60}) for the clay-like alluvium. The N_{60} values generally ranged between 6 and 30 with a median of 17, indicating the clay-like alluvium is medium to very stiff. Grain size analyses indicate the clay-like alluvium generally consists of minimal gravel, 50 to 70 percent fine sand, and 30 to 50 percent fines (Fig. 6c). Plasticity indices ranged from 10 to 27 with liquid limits between 27 and 48, indicating low to medium plasticity (Fig. 7b).

Laboratory strength test data are discussed above in Section 6.5. As shown in Fig. 9, the laboratory undrained strengths ranged from about 2,000 psf to 3,500 psf.

7.3.7 Sand-Like Alluvium

The lower layer of existing alluvial soil consisted of clayey sand, silty sand, and silt. As shown in Table 16, the layer had a maximum thickness of 23 ft at B118 at the south end of the landfill (near the Auxiliary Pond). The layer thickness decreased toward the north, and was thin or not present at the north end of the landfill (under the West Pond). We refer to this as the "sand-like" alluvium to differentiate it from the more clayey alluvium also present at the site.

Fig. 11e contains a histogram of corrected N-values ($N_{1,60}$) for the sand-like alluvium. The $N_{1,60}$ values generally ranged between 0 and 15 with a median of 11, indicating the sand-like alluvium is generally very loose to medium dense. Grain size analyses indicate the sand-like alluvium generally consists of minimal gravel, 51 to 83 percent fine sand, and 49 to 17 percent fines (Fig. 6d). Plasticity indices ranged from nonplastic to 7, indicating the sand-like alluvium is nonplastic or has low plasticity. For specimens with some plasticity, the liquid limits varied between 22 and 27 (Fig. 7b).

7.4 Dike Rip Rap and Bedrock

7.4.1 Dike Riprap

Riprap is found along the downstream toe of the old and new clay dike. Two of our borings went through this layer, and the observed thickness was about 3 ft. No SPTs were performed in this layer.

7.4.2 Bedrock

The USGS Bedrock Geologic Map of the Lerona 7.5' Quadrangle, West Virginia identifies the bedrock in the area of Glen Lyn as the Hinton Formation, which is mainly composed of limestone, sandstone, and shale.

No cores were taken during the 1972 AEP borings, but the bedrock encountered at refusal was described as either "red clayshale" or "grayish brown sandstone," consistent with the bedrock geology map.

GAI Consultants collected eight rock cores during their 1990 subsurface investigation. Coring depths ranged from 4.5 to 46.3 ft. The rock was generally described as gray or red claystone or clayshale, with Rock Quality Designations (RQDs) ranging from 0 percent to 100 percent, with typical values between 40 and 100 percent. RQD tended to increase with increasing depth.

MACTEC collected five rock cores during their 2009 subsurface investigation. All five cores were 5 ft in length and were described as "moderately hard, … slightly weathered shale." The RQDs values were 90, 0, 58, 50, and 80 percent.

We collected bedrock cores in six of the 2017 borings, to depths of 9 to 15 ft. Cores were taken in either 5- or 10-ft runs. RQDs were generally low, ranging from 18 percent to 65 percent with a mean of 36 percent. The bedrock generally consisted of medium hard, fine-grained, slightly to moderately weathered shale. We did not identify any voids or significant water losses during coring.

Based on the 2017 borings, the bedrock below the West Pond and Landfill is relatively flat, with all but one boring indicating bedrock elevations ranging from El. 1477.2 to El. 1487.6. The rock

elevation at B107 (the boring furthest from the river) was El. 1491.8, which implies the bedrock surface may slope downward towards the New River.

8. References

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MACTEC (2010). "Geotechnical Data Report, AEP Glen Lyn Drilling," prepared for American Electric Power, February 22.

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The Ohio State University (2017). "Investigating the Liquefaction Potential of Impounded Fly Ash: Glen Lyn Power Plant, Draft Report" submitted to American Electric Power, May 25.

Tables

Table 1. Previous Data and Analysis Reports
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Data and Analysis Reports

Date	Author	Document Name/Description
Nov. 23, 1972	Casagrande Consultants	**Glen Lyn Plant Fly Ash Dikes**: Recommendations for the construction of the new dike extensions.
Nov. 15, 1973	AEP	**Compaction Tests on Flyash at Glen Lyn Plant**: Report on a series of compaction tests on fly ash performed at Glen Lyn.
Dec. 11, 1990	GAI Consultants	**Glen Lyn Stability Analyses**: Field explorations and stability analyses for the maximum storage conditions and closure of the fly ash disposal area. Includes stability analyses for critical cross-sections as well as for the cover soil, flood estimates for the New River. Input soil properties and a descriptive note are also included.
Mar. 5, 1993	GAI Consultants	**Stability Analysis**: Reevaluation of one of the cross-sections analyzed for analyses in 1990.
Feb. 22, 2010	MACTEC	**Geotechnical Data Report**: Geotechnical data report for borings/piezometers located around the perimeter of the landfill.
Nov. 2014, edited July 2016	GAI Consultants	**Flood Level and Floodway Study for West Pond Glen Lyn Plant:** Presents the 100-year flood impacts resulting from the planned closure of the West Pond.

Table 2. Previous Subsurface Explorations
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Date	By	Program	Comments
March to April 1972	AEP	21 borings: D0 – D19 with D2A and C332. 2 wells: D3 and D16.	4" flight augers and rotary wash with mud slurry, SPTs.
Sept. 1990 – Nov. 1991	GAI Consultants	24 borings: B-1 through B-21 with B-18-A, B-18-B, and B-20-A. 6 hand auger borings: 1 through 6 17 wells: MW-1 through MW-12, B-18-A, B-18-B, B-20, B-20-A, and B-21	Hollow-stem augers, SPTs, tube samples, rock cores, hand augering from boat in West Pond.
Nov. 1993 – March 1995	Unknown	11 borings: B-22 through B30 and MW-19 and MW-20. 11 wells: MW-13 through MW-23	These borings and wells are referenced in AEP drawing no. 56-13171-7. Cross-sections including these borings are shown on drawings 56-13167 and 56-13168.
2006	Unknown	**Auxiliary Pond:** 9 borings: GLLE-01 through GLLE-09. 4 wells: GLLE-03, GLLE-04, GLLE-06, and GLLE-08 2015: 3 wells replaced?	These borings and wells are referenced in AEP drawing no. 56-13171-7. Cross-sections including these borings are shown on drawing 56-30306-A.
Sept. – Oct. 2009	MACTEC	5 borings: P-0901 through P-0905. 5 piezometers: P-0901 through P-0905. 3 CPTs with dissipation tests: CPT-0901, CPT-0903, CPT-0905.	Hollow stem augers, SPTs, tube samples, rock cores. Presented in "Geotechnical Data Report, AEP Glen Lyn Drilling" dated Feb. 22, 2010.

Notes:
1. Between 2006 and 2015 at least 12 wells were installed around the Auxiliary Pond. The only source of information on these wells is Drawing 56-13171-7.

Table 3. Schedule of 2017 GEI Explorations

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Boring No.	Location	Exploration Type	Ground Surface Elevation (ft)	Depth of Boring (ft)	No. of Split Spoon Samples Taken	No. Tubes Taken	Length of Rock Core Taken (ft)	Northing[1] (ft)	Easting[1] (ft)
B101	Clay Dike	SPT	1536.8	56.8	24	0	10	390,431	1,308,860
B101U	Clay Dike	Tube	1536.6	57.5	0	3	0	390,427	1,308,866
SCPT101	Clay Dike	SCPT	1536.7	37.6	--	--	--	390,434	1,308,854
SCPT101a	Clay Dike	SCPT	1536.8	57.8	--	--	--	390,437	1,308,850
B102	Toe of Dike	SPT	1506.7	28.6	13	0	0	390,500	1,308,892
B103	West Pond	SPT	1536.6	49.0	16	3	0	390,214	1,308,911
SCPT104	Landfill	SCPT	1542.1	43.6	--	--	--	389,632	1,308,970
CPT104F	Landfill	CPT-F	1542.2	38.3	--	--	--	389,634	1,308,973
B105	Landfill	SPT	1545.4	65.0	26	0	10	389,770	1,309,176
B105U	Landfill	Tube	1545.4	56.2	0	5	0	389,767	1,309,170
SCPT105	Landfill	SCPT	1546.4	53.4	--	--	--	389,764	1,309,180
CPT105F	Landfill	CPT-F	1545.8	47.3	--	--	--	389,762	1,309,177
B106	Landfill	SPT	1545.3	66.3	29	0	0	389,851	1,309,298
B106U	Landfill	Tube	1545.5	52.8	0	4	0	389,855	1,309,306
SCPT106	Landfill	SCPT	1546.1	54.1	--	--	--	389,847	1,309,307
CPT106F	Landfill	CPT-F	1546.4	55.8	--	--	--	389,844	1,309,304
B107	Landfill	SPT	1583.5	91.7	29	1	0	389,320	1,309,175
SCPT107	Landfill	SCPT	1583.5	71.9	--	--	--	389,325	1,309,173
B108	Landfill	SPT	1639.5	35.4	15	2	0	389,092	1,309,706
B109	Landfill	SPT	1572.1	88.0	34	0	15	389,401	1,309,864
B109U	Landfill	Tube	1572.1	82.3	0	9	0	389,396	1,309,873
SCPT109	Landfill	SCPT	1572.3	82.2	--	--	--	389,404	1,309,857
CPT109F[2]	Landfill	CPT-F	1572.0	74.7	--	--	--	389,404	1,309,857
B110	Clay Dike	SPT	1542.6	63.7	27	0	0	389,539	1,309,944
B110U	Clay Dike	Tube	1542.7	60.3	0	6	0	389,535	1,309,950
B110UA	Clay Dike	Tube	1542.2	16.0	0	1	0	389,545	1,309,940
SCPT110	Clay Dike	SCPT	1542.6	24.6	--	--	--	389,545	1,309,940
SCPT110a	Clay Dike	SCPT	1542.5	5.5	--	--	--	389,547	1,309,938
SCPT110b	Clay Dike	SCPT	1542.5	18.5	--	--	--	389,547	1,309,938
SCPT110c[2]	Clay Dike	SCPT	1542.5	61.2	--	--	--	389,547	1,309,938
B111	Clay Dike	SPT	1509.1	29.8	12	0	0	389,592	1,309,992
B112	Toe of Dike	SPT	1490.3	8.0	4	0	0	389,644	1,310,035
B112A	Toe of Dike	SPT	1490.5	10.3	4	0	10	389,642	1,310,039
B112U	Toe of Dike	Tube	1490.5	9.8	0	2	0	389,641	1,310,042
SCPT112[2]	Toe of Dike	SCPT	1490.5	9.3	--	--	--	389,641	1,310,042
B113	Toe of Dike	SPT	1523.8	43.8	20	0	0	389,394	1,310,385
B113U	Toe of Dike	Tube	1523.8	35.0	0	4	0	389,393	1,310,384
SCPT113	Toe of Dike	SCPT	1524.2	42.4	0	0	0	389,386	1,310,386
B114	Landfill	SPT	1641.0	37.0	15	2	0	388,831	1,310,165
B115	Landfill	SPT	1569.6	91.0	38	0	9	389,096	1,310,430
B115U	Landfill	Tube	1569.6	83.4	0	7	0	389,093	1,310,440
SCPT115	Landfill	SCPT	1569.3	80.0	--	--	--	389,088	1,310,444
CPT115F	Landfill	CPT-F	1569.4	4.5	--	--	--	389,092	1,310,441
CPT115FA[2]	Landfill	CPT-F	1569.4	78.0	--	--	--	389,092	1,310,441
B116	Clay Dike	SPT	1538.1	57.8	29	0	0	389,298	1,310,475
B116U	Clay Dike	Tube	1538.0	49.6	0	2	0	389,301	1,310,471
SCPT116	Clay Dike	SCPT	1538.2	56.4	--	--	--	389,295	1,310,482
B117	Clay Dike	SPT	1547.3	64.0	33	0	0	389,212	1,310,518
SCPT117	Clay Dike	SCPT	1547.3	64.9	--	--	--	389,218	1,310,512
B118	Clay Dike	SPT	1542.4	61.4	29	2	0	389,227	1,310,633
SCPT118	Clay Dike	SCPT	1542.7	42.3	0	0	0	389,221	1,310,643
B119	Clay Dike	SPT	1537.7	60.5	25	0	0	390,147	1,309,132
B119U	Clay Dike	Tube	1537.9	57.2	0	4	0	390,143	1,309,134
B119UA	Clay Dike	Tube	1537.8	53.3	0	3	0	390,153	1,309,125
SCPT119	Clay Dike	SCPT	1538.0	57.0	--	--	--	390,139	1,309,138
B120	Landfill	SPT	1569.6	86.7	0	39	0	389,191	1,310,260
SCPT120	Landfill	SCPT	1571.6	56.3	--	--	--	389,175	1,310,272
SCPT120a	Landfill	SCPT	1571.6	3.9	--	--	--	389,173	1,310,276
SCPT120b	Landfill	SCPT	1571.6	84.5	--	--	--	389,173	1,310,276
SCPT121	Landfill	SCPT	1573.7	79.3	--	--	--	389,190	1,310,217
B122	Landfill	SPT	1551.8	81.8	22	0	10	389,466	1,309,909
B122U	Landfill	Tube	1551.8	61.0	0	4	0	389,471	1,309,899

1: Northing and Easting are in GLFLHD.
2: Location is approximate

Table 4. 2017 GEI Open Standpipe Piezometers

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

Piezometer No.		B105	B107	B109	B115	B122	B122U
Northing and Easting (GLFLHD)		N 389,770 E 1,309,176	N 389,320 E 1,309,175	N 389,401 E 1,309,864	N 389,096 E 1,310,430	N 389,466 E 1,309,909	N 389,472 E 1,309,899
Installation Date		9/15/2017	10/17/2017	9/21/2017	9/30/2017	10/15/2017	10/14/2017
Piezometer Location		Bench between landfill and leachate	Bench on west side of landfill	Middle bench on east side of landfill	Middle bench on southeast side of landfill	Lower bench on east side of landfill	Lower bench on east side of landfill
As-Drilled Ground Surface El. (ft)		1545.4	1583.4	1572.3	1569.9	1551.8	1551.8
Depth to Bottom of Piezometer from Top of PVC (ft)		47.2	75.3	76.1	72.6	84.2	51.7
PVC Stickup from Ground Surface (ft)		2.0	2.7	2.1	2.0	3.0	3.0
Elevation of Top of PVC (ft)		1547.5	1586.1	1574.4	1571.9	1554.7	1554.7
Elevation of Top of Sanded Zone (ft)		1512.4	1524.4	1521.3	1522.0	1482.2	1513.3
Elevation of Top of Screen (ft)		1510.4	1521.1	1518.5	1519.9	1480.7	1511.0
Elevation of Bottom of Screen (ft)		1500.4	1511.1	1498.5	1499.9	1470.7	1501.0
Elevation of Bottom of Silt Trap (ft)		1500.2	1510.9	1498.3	1499.7	1470.5	1500.8
Elevation of Bottom of Sanded Zone (ft)		1498.7	1510.4	1497.1	1499.3	1470.1	1500.8
Elevation of Bottom of Hole (ft)		1470.4	1491.7	1469.3	1469.9	1470.1	1500.8
Soil Layers in Sand Filter Interval		Sluiced Ash	Sluiced Ash	Sluiced Ash	Sluiced Ash	Bedrock/ Alluvium	Sluiced Ash
Elevation of Sand Filter Interval (ft)		1512.4 - 1498.7	1524.4 - 1510.4	1521.3 - 1497.1	1522 - 1499.3	1482.2 - 1470.1	1513.3 - 1500.8
Groundwater Elevation, NGVD29 (ft)	28-Sep-17	--	--	1527.0	--	--	--
	1-Oct-17	1530.0	--	--	--	--	--
	5-Oct-17	1530.2	--	1526.9	1508.4	--	--
	15-Oct-17	1530.4	--	1526.9	1508.5	--	--
	18-Oct-17	--	--	--	--	1512.9	1526.5
	19-Oct-17	1530.4	1514.6	1526.7	1508.3	1509.2	1526.5
	16-Nov-17	1531.2	1533.1	1526.8	1508.2	1509.0	1526.6

Table 5. Well and Piezometer Installation Data
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Well or Piezometer Number	Boring No.	Installed By	Date of Installation	Well Dia. (in)	Casing Type	Elevation Top of Filter Pack (ft)	Elevation Top of Screen (ft)	Elevation Bottom of Screen (ft)	Elevation Bottom of Filter Pack (ft)	Elevation Bottom of Borehole (ft)	Well Depth (ft)	Layer of Piezometer Screen	Comments	Data Source
MW-1	B-01	GAI	11/08/1991	2.0	PVC Sch 40	1493.4	1492.4	1483.4	1482.5	1482.5	28.0	Alluvium	Ash Landfill	GAI Data Report and Drawing GL-56-13171
MW-5	B-05	GAI	10/04/1990	2.0	PVC Sch 40	1541.1	1537.1	1528.1	1526.2	1525.0	54.1	Bedrock	Ash Landfill	Drawing GL-56-13171
MW-6	B-08	GAI	09/18/1990	2.0	PVC Sch 40	1493.6	1492.0	1483.0	1481.0	1480.0	63.8	Alluvium	Ash Landfill	Drawing GL-56-13171
MW-7	B-09	GAI	11/07/1990	2.0	PVC Sch 80	1458.2	1445.6	1443.6	1442.7	1439.0	103.7	Bedrock	Ash Landfill	GAI Data Report and Drawing GL-56-13171
MW-8	B-10	GAI	10/28/1990	2.0	PVC Sch 40	1482.5	1481.5	1471.0	1470.0	1470.0	54.4	Alluvium / Bedrock	Ash Landfill	GAI Data Report and Drawing GL-56-13171
MW-9	B-13	GAI	11/10/1990	1.0	PVC Sch 80	1546.4	1535.3	1533.3	1531.3	1531.3	41.6	Bedrock	Ash Landfill; Geomon	GAI Data Report and Drawing GL-56-13171
MW-13	B-22	--	11/03/1993	2.0	PVC Sch 40	1491.7	1490.7	1481.2	1479.9	1479.9	57.1	Bedrock	Pre-Pack Screen	Drawing GL-56-13171
MW-14	B-23	--	11/04/1993	2.0	PVC Sch 40	1491.2	1489.8	1480.3	1479.4	1478.8	60.6	Alluvium	Pre-Pack Screen	Drawing GL-56-13171
MW-15	B-24	--	11/10/1993	2.0	PVC Sch 40	1471.6	1470.6	1461.1	1459.6	1459.6	80.0	Bedrock	Pre-Pack Screen	Drawing GL-56-13171
MW-16	B-25	--	11/18/1993	2.0	PVC Sch 40	1491.3	1489.9	1480.4	1478.9	1478.6	62.8	Alluvium	Pre-Pack Screen	Drawing GL-56-13171
MW-17	B-26	--	02/15/1994	2.0	PVC Sch 40	1492.1	1489.0	1479.5	1479.5	1479.5	62.5	Alluvium	Pre-Pack Screen	Drawing GL-56-13171
MW-18	B-27	--	01/06/1994	2.0	PVC Sch 40	1474.2	1473.4	1464.4	1462.4	1441.3	131.5	Bedrock	Pre-Pack Screen	Drawing GL-56-13171
PZ-0903	P-0903	MACTEC	09/25/2009	1.0	PVC	1535.7	1534.7	1474.7	1472.6	1467.6	73.5	Multiple	60-ft Screen Monitoring Well	MACTEC Drilling Report
PZ-0904	P-0904	MACTEC	10/01/2009	1.0	PVC	1567.0	1566.0	1533.0	1532.0	1527.0	45.4	Multiple	33-ft Screen Monitoring Well	MACTEC Drilling Report
B105	B105	GEI	09/15/2017	2.0	PVC	1512.4	1510.4	1500.4	1498.7	1470.4	45.2	Sluiced Ash	10-ft screen	GEI
B107	B107	GEI	10/17/2017	2.0	PVC	1524.4	1518.5	1511.1	1510.4	1491.7	72.5	Sluiced Ash	10-ft screen	GEI
B109	B109	GEI	09/21/2017	2.0	PVC	1521.3	1518.5	1498.5	1497.1	1469.3	75.2	Sluiced Ash	20-ft screen	GEI
B115	B115	GEI	09/30/2017	2.0	PVC	1522.0	1519.9	1499.9	1499.3	1469.9	70.6	Sluiced Ash	20-ft screen	GEI
B122	B122	GEI	10/15/2017	2.0	PVC	1482.2	1480.7	1470.7	1470.1	1470.1	81.1	Alluvium / Bedrock	Top of filter material is in alluvium	GEI
B122U	B122U	GEI	10/14/2017	2.0	PVC	1513.3	1511.0	1501.0	1500.8	1500.8	50.8	Sluiced Ash	10-ft screen	GEI

Table 6. Groundwater Level Data
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Well	Boring	Elevation of Top of PVC (ft, NGVD 29)	Layer of Well Screen	Groundwater Elevation													
				8/20/2001	9/17/2002	9/9/2003	9/9/2004	10/27/2005	12/15/2006	10/17/2007	9/22/2008	9/8/2009	11/17/2010	5/6/2011	9/27/2011	4/16/2012	10/1/2012
MW-1	B-01	1512.54	Alluvium	1504.0	1505.9	1504.3	1512.5	1499.5	1498.4	1496.6	1497.2	1497.4	1499.0	1500.2	1495.6	1499.1	1496.2
MW-2	B-02	1539.35	Clay Dike	1524.4	1523.6	1524.9	1539.4	1531.4	1530.8	1529.9	1530.2	1530.5	1531.2	1532.4	1531.5	1532.3	1531.6
MW-3	B-03	1538.78	Alluvium	1503.6	1502.0	1504.7	1507.6	1505.2	1505.9	1503.4	1503.9	1504.8	1506.2	1502.7	1505.4	1507.3	1505.6
MW-4	B-04	1539.35	Bedrock	1480.7	1480.1	1481.7	1539.4	1485.2	1480.4	1479.7	1480.0	1480.5	1482.2	1483.6	1483.2	1482.7	1481.6
MW-5	B-05	1581.47	Bedrock	1534.9	1532.6	1538.2	1540.4	1538.7	1536.2	1533.5	1533.6	1535.5	1537.6	1536.6	1534.6	1536.9	1534.7
MW-6	B-08	1546.26	Alluvium	1502.2	1500.9	1502.8	1502.9	1503.2	1501.9	1501.2	1500.9	1501.5	1502.9	1503.4	1502.2	1503.0	1502.4
MW-7	B-09	1545.64	Bedrock	1481.9	1480.5	1483.9	1487.5	1489.2	1481.6	1480.7	1481.1	1481.4	1483.2	1483.5	1483.6	1484.1	1483.2
MW-8	B-10	1526.23	Alluvium / Bedrock	1482.6	1482.0	1484.6	1487.0	1484.3	1483.7	1482.6	1482.8	1483.3	1485.1	1486.5	1485.0	1485.8	1484.6
MW-9	B-13	1575.45	Bedrock	1559.5	1557.6	1565.8	1567.9	1560.9	1564.3	1558.8	1558.9	1562.5	1568.0	1567.4	1560.0	1568.9	1561.0
MW-10		1547.62	Alluvium	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Dry	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned
MW-10A	B-14	1548.16	Alluvium										1488.6	1489.1	1488.5	1488.9	1488.5
MW-11	B-15	1547.69	Bedrock	1482.6	1482.6	1483.4	1547.7	*	1482.3	1481.7	1482.0	1482.5	1483.8	1485.3	1484.6	1484.4	1483.9
MW-13	B-22	1538.30	Bedrock	1505.5	1503.5	1505.9	1507.6	1506.2	1505.8	1504.5	1504.8	1505.4	1506.7	1507.7	1505.7	1507.4	1505.9
MW-14	B-23	1541.42	Alluvium	1497.9	1496.4	1498.6	1501.2	1498.9	1498.2	1497.4	1497.4	1497.8	1499.0	1499.8	1499.0	1500.0	1498.8
MW-15	B-24	1541.55	Bedrock	1481.3	1480.6	1482.4	1541.6	1481.9	1481.1	1480.3	1480.5	1481.1	1482.7	1483.7	1483.7	1483.1	1482.2
MW-16	B-25	1543.34	Alluvium	1500.3	1499.1	1500.7	1500.0	1501.2	1500.4	1499.6	1499.4	1499.8	1501.0	1501.5	1500.7	1501.3	1500.8
MW-17	B-26	1544.20	Alluvium	1488.2	1487.3	1489.4	1489.4	1490.3	1488.7	1488.4	1488.5	1488.8	1489.5	1490.9	1490.0	1490.2	1490.0
MW-18	B-27	1572.21	Bedrock	1508.0	1502.2	1509.3	1508.1	1504.3	1505.5	1502.0	1505.8	1515.4	1510.3	1510.7	1501.9	1509.6	1502.3
MW-19	MW-19	1543.63	Alluvium	1529.5	1527.5	1530.0	1543.6	1530.7	1530.1	1528.5	1528.9	1529.6	1530.2	1531.4	1529.3	1531.4	1529.9
MW-20	MW-20	1544.02	Bedrock	1481.2	1480.4	1482.0	1544.0	1481.7	1480.8	1480.0	1480.3	1480.8	1482.5	1482.9	1483.5	1483.1	1481.8
MW-21	B-28	1584.90	Fly Ash														
MW-22	B-29	1585.74	Alluvium														
MW-23	B-30	1585.26	Bedrock														
B-18-A	B-18	1538.21	Alluvium														
B-18-B	B-18	1538.10	Fly Ash														
B-20	B-20	1574.93	Alluvium														
B-20-A	B-20	1574.79	Fly Ash														
B-21	B-21	1567.39	Fly Ash														
PZ-0901	PZ-0901	1540.94	Ash and Alluvium														
PZ-0902	PZ-0902	1538.78	Ash and Alluvium														
PZ-0903	PZ-0903	1548.13	Ash and Alluvium														
PZ-0904	PZ-0904	1578.37	Ash and Alluvium														
PZ-0905	PZ-0905	1550.74	Ash and Alluvium														

Note: Data provided by AEP. Only one measurement per year shown before 2015.

Table 6. Groundwater Level Data
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Well	Boring	Elevation of Top of PVC (ft, NGVD 29)	Layer of Well Screen	Groundwater Elevation											GEI Confirmation
				4/2/2013	10/7/2013	3/25/2014	9/22/2014	3/26/2015	9/21/2015	3/21/2016	9/26/2016	6/9/2017	9/25/2017	10/5/2017	Fall 2017
MW-1	B-01	1512.54	Alluvium	1501.4	1496.2	1500.3	1494.6	1506.6	1503.8	1506.1	1504.7		1504.6		found
MW-2	B-02	1539.35	Clay Dike	1533.1	1531.4	1532.9	1531.7	1529.1	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	broken riser visible
MW-3	B-03	1538.78	Alluvium	1508.0	1506.1	1507.8	1505.9	1508.6	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	not seen
MW-4	B-04	1539.35	Bedrock	1483.8	1482.8	1483.5	1481.7	1483.8	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	not seen
MW-5	B-05	1581.47	Bedrock	1535.3	1534.6	1535.2	1533.8	1536.2	1535.5	1537.3	1536.4	`	1536.2		found
MW-6	B-08	1546.26	Alluvium	1502.7	1502.2	1502.6	1502.0	1503.2	1502.4	1503.4	1502.7		1500.5	1502.5	found
MW-7	B-09	1545.64	Bedrock	1484.8	1483.8	1483.8	1482.7	1484.7	1482.2	1484.7	1482.3		1482.1	1481.4	found
MW-8	B-10	1526.23	Alluvium / Bedrock	1486.1	1485.3	1485.7	1484.4	1486.4	1484.2	1486.4	1484.2		1484.4	1484.3	found
MW-9	B-13	1575.45	Bedrock	1569.1	1561.0	1568.4	1561.4	1569.5	1560.8	1569.3	1561.8		1559.9		found - across road
MW-10		1547.62	Alluvium	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	not seen
MW-10A	B-14	1548.16	Alluvium	1489.1	1488.6	1488.8	1488.4	1489.2	1488.6	1489.4	1488.5		1488.7		found
MW-11	B-15	1547.69	Bedrock	1485.5	1484.6	1484.5	1483.5	1485.5	1483.3	1485.4	1483.6		1483.3		found
MW-13	B-22	1538.30	Bedrock	1507.7	1506.3	1507.7	1506.2	1508.2	1505.5	1507.8	1505.8		1505.2	1505.1	found
MW-14	B-23	1541.42	Alluvium	1499.9	1499.1	1500.0	1498.6	1500.8	1498.7	1500.4	1499.0		1499.1	1498.2	found
MW-15	B-24	1541.55	Bedrock	1487.1	1483.2	1484.1	1482.2	1484.4	1481.8	1484.2	1481.6		1482.0	1481.9	found
MW-16	B-25	1543.34	Alluvium	1501.1	1500.5	1501.4	1500.4	1501.6	1500.6	1501.7	1500.8		1501.1	1500.9	found
MW-17	B-26	1544.20	Alluvium	1490.1	1489.9	1490.0	1489.7	1490.2	1490.1	1490.5	1490.2		1490.2	1490.2	found
MW-18	B-27	1572.21	Bedrock	1507.7	1503.4	1509.0	1504.1	1510.6	1510.6	1511.6	1504.2		1503.9		found - across road
MW-19	MW-19	1543.63	Alluvium	1531.6	1529.7	1531.6	1530.0	1531.7	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	not seen
MW-20	MW-20	1544.02	Bedrock	1484.2	1483.1	1483.6	1482.0	1484.1	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	Abandoned	not seen
MW-21	B-28	1584.90	Fly Ash												covered by landfill
MW-22	B-29	1585.74	Alluvium												covered by landfill
MW-23	B-30	1585.26	Bedrock												covered by landfill
B-18-A	B-18	1538.21	Alluvium												not there
B-18-B	B-18	1538.10	Fly Ash												not there
B-20	B-20	1574.93	Alluvium												covered by landfill
B-20-A	B-20	1574.79	Fly Ash												covered by landfill
B-21	B-21	1567.39	Fly Ash												covered by landfill
PZ-0901	PZ-0901	1540.94	Ash and Alluvium										Abandoned	Abandoned	
PZ-0902	PZ-0902	1538.78	Ash and Alluvium										Abandoned	Abandoned	
PZ-0903	PZ-0903	1548.13	Ash and Alluvium									1533.5	1530.6	1530.0	
PZ-0904	PZ-0904	1578.37	Ash and Alluvium										1543.1	1541.7	
PZ-0905	PZ-0905	1550.74	Ash and Alluvium					Abandoned May 2014 per AEP Drawing 56-13171-7 rev 7							

Note: Data provided by AEP. Only one measurement per year shown before 2015.

Table 7. Previous Laboratory Testing
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Laboratory Testing	Report
▪ Moisture content, grain size, Atterberg limits ▪ Minimum and maximum density ▪ Specific gravity ▪ Proctor test	August 17, 1972 Memorandum titled "Soils Testing – Glen Lyn Plant – Glen Lyn, Virginia" by General Analytics, Inc.
▪ Moisture content, grain size, Atterberg limits ▪ Specific gravity ▪ Direct shear ▪ Consolidation tests	1990 Appendix titled "Results of Laboratory Soils Test and Boring Logs" by GAI Consultants, Inc.
▪ Moisture content ▪ Wet and dry density	2010 Report titled "Density of Soil Specimens" by MACTEC.
▪ Chemical analysis of fly ash	1998, 2002, 2005, 2007, 2010 Reports titled "Fly Ash Analysis" by AEP.
▪ Minimum and maximum realizable density ▪ Cyclic triaxial tests	"Investigating the Liquefaction Potential of Impounded Fly Ash: Glen Lyn Power Plant." Draft Report May 25, 2017, The Ohio State University

Table 8a. Gradation and Atterberg Limits – Clay Dike

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

Program	Boring	Boring Location	Sample No.	Depth to Middle of Sample (ft)	Elev. At Middle of Sample (ft)	w %	PL	LL	PI	% Gravel	% Sand	% Fines
AEP 1972	D4	Crest of Dike	1	0.8	1535.3	20.5	20	30	10	--	--	--
			2	5.3	1530.8	23.0	18	27	9	--	--	--
			3	10.5	1525.5	21.4	20	32	12	--	--	--
			4	12.3	1523.8	17.6	17	23	6	--	--	--
			5	20.5	1515.5	24.3	18	28	10	--	--	--
			6	25.3	1510.8	21.2	18	33	15	--	--	--
	D7	Crest of Dike	1	0.8	1535.3	15.5	19	26	7	--	--	--
			2	5.5	1530.5	18.2	19	27	8	--	--	--
			3	10.5	1525.5	17.3	18	27	10	--	--	--
			4	15.5	1520.5	23.2	NP	NV	NP	--	--	--
			5	20.5	1515.5	18.6	17	26	9	--	--	--
GAI 1990	B-4	Crest of Dike	ST-3	36.0	1501.1	18.0	19	32	13	1	43	56
GEI 2017	B101	Crest of Dike	S7	16.0	1520.8	17.4	27	21	6	--	--	--
			S9 (0-7")	21.0	1515.8	--	--	--	--	2	78	21
	B110	Crest of Dike	S7	16.0	1526.6	20.7	38	20	18	--	--	--
			S15	36.0	1506.6	--	--	--	--	0	52	48
	B110U	Crest of Dike	U2-A	36.8	1505.9	20.0	35	19	16	--	--	--
	B110UA	Crest of Dike	U1	16.0	1526.7	--	36	21	15	--	--	--
	B113	Old Dike	U2	27.3	1496.5	--	24	19	5	0	53	47
						--	25	20	5	0	52	48
			S7	16.0	1507.8	15.6	24	18	6	0	54	46
			S11 (3-15")	25.0	1498.8	19.5	26	17	9	0	53	47
	B119	Crest of Dike	S8 (0-13")	16.0	1521.7	15.6	29	17	12	--	--	--
	B120	Old Dike	S24	58.0	1511.6	23.6	37	20	17	--	--	--
			S26	61.0	1508.6	17.1	28	15	13	0	53	47

Table 8b. Gradation and Atterberg Limits – Alluvium

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

Program	Boring	Boring Location	Sample No.	Depth to Middle of Sample (ft)	Elev. At Middle of Sample (ft)	w %	PL	LL	PI	% Gravel	% Sand	% Fines
AEP 1972	D4	Crest of Dike	7	30.5	1505.5	20.1	21	27	6	--	--	--
			8	35.5	1500.5	18.0	18	29	11	--	--	--
			9	40.5	1495.5	24.2	19	30	10	--	--	--
			10	45.5	1490.5	22.2	20	28	9	--	--	--
			11	50.5	1485.5	26.8	22	35	13	--	--	--
			12	54.5	1481.5	26.2	NP	NV	NP	--	--	38
	D7	Crest of Dike	6B	26.8	1509.3	28.0	17	27	9	--	--	--
			7	30.3	1505.8	23.8	21	31	11	--	--	--
			8	35.3	1500.8	16.6	20	24	5	--	--	--
			9A	40.3	1495.8	20.0	19	28	10	--	--	--
GAI 1990	B-3	Crest of Dike	ST-1	43	1494.1	28	20	43	22	0	21	79
	B-4	Crest of Dike	ST-4	50	1487.1	25	22	42	20	0	10	90
			ST-5	55	1482.1	29	24	45	21	0	6	94
	B-9	Crest of Dike	ST-3	17	1525.7	19	20	32	12	1	46	53
	B-17	Under Landfill	ST-3	66	1503.8	20	21	27	6	0	50	50
GEI 2017	B101	Crest of Dike	S19	45.5	1491.3	23.4	48	21	27	--	--	--
			S22 (23-30")	53	1483.8	--	--	--	--	0.0	28.4	71.6
	B101U	Crest of Dike	U2	53	1483.8	26.1	35	18	17	--	--	--
			U3	56	1480.8	28.1	34	20	14	--	--	--
	B102	Midslope of Dike	S12 (6-18")	27.5	1480.5	35.7	NV	NP	NP	0.1	49.1	50.8
	B103	West Pond	S14	43.5	1493.1	24.8	--	--	--	0.0	62.6	37.4
	B105	Divider Dike	S21 (6-14")	55	1490.4	23	32	18	14	31.5	38.0	30.5
	B106	Divider Dike	S26	60	1485.3	22.1	31	19	12	42.1	35.8	22.1
	B109	Landfill Slope	S31	81	1493.4	25.7	--	--	--	0.0	69.3	30.7
	B110	Crest of Dike	S23	55	1487.6	22.5	34	19	15	1.6	37.1	61.3
	B111	Midslope of Dike	S7	17	1492.1	16.7	27	20	7	0.0	54.3	45.7
			S11 (12-24")	37	1472.1	25.7	22	16	6	2.5	59.2	38.3
	B112	New River Beach	S2 (9"-22")	3	1487.4	20.2	--	--	--	0.0	70.3	29.7
	B113	Old Dike	S16	35	1488.8	12.2	NV	NP	NP	0.0	72.2	27.8
			S19 (top)	40	1483.8	--	--	--	--	0.1	70.9	29.0
	B115	Landfill Slope	S33	80	1489.6	23.1	24	22	2	0.0	71.8	28.2
			S35	84	1485.6	--	--	--	--	13.0	60.7	26.3
	B116	Crest of Dike	S26	51	1487.1	26.4	NV	NP	NP	--	--	--
	B117	Crest of Dike	S30	59	1488.3	21.2	--	--	--	0.0	64.7	35.3
	B118	Crest of Dike	S25	53	1489.4	19.0	NV	NP	NP	0.0	65.1	34.9
			S26(bottom)	55	1487.4	15.7	--	--	--	0.0	83.1	16.9
	B120	Landfill Slope	S36	81	1488.6	25.3	--	--	--	0.0	74.0	26.0
	B122	Landfill Slope	S15	58	1493.8	19.8	27	17	10	0.0	53.3	46.7
			S16	60	1491.8	20.9	30	18	12	--	--	--

Table 8c. Gradation and Atterberg Limits – Fly Ash
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Program	Boring	Boring Location	Sample No.	Depth to Middle of Sample (ft)	Elev. at Middle of Sample (ft)	w %	PL	LL	PI	% Gravel	% Sand	% Fines
GAI 1990	7-B	n.a.[1]	ST-1	6.0	n.a.	22	NP	NV	NP	1	17	82
			ST-3	33.0	n.a.	42	NP	NV	NP	0	33	67
			ST-5	37.0	n.a.	42	NP	NV	NP	1	11	88
	11-B	n.a.	ST-3	37.0	n.a.	29	NP	NV	NP	0	27	73
	B-12	Ash Raised Dike	ST-1	7.0	1540.1	34	NP	NV	NP	0	21	79
			ST-2	41.0	1506.1	51	--	--	--	--	--	--
	12-C	n.a.	ST-3	45.0	n.a.	52	NP	NV	NP	0	4	96
	B-17	Under Landfill	ST-1	41.5	1528.3	63	NP	NV	NP	0	20	81
GEI 2017	B103	West Pond	S11	36.0	1500.6	52.4	NV	NP	NP	0	6	94
	B105	West Pond	S16	44.0	1501.4	74.2	NV	NP	NP	0	8	93
	B107	Landfill Bench	S4	21.0	1562.5	33.6	NV	NP	NP	--	--	--
	B108	Top of Landfill	S2	5.0	1634.5	15.9	NV	NP	NP	--	--	--
			S13	29.0	1610.5	--	--	--	--	11	72	17
	B109	Landfill Bench	S6	18.5	1553.6	33.7	NV	NP	NP	0	12	88
			S18	48.5	1523.6	73.2	NV	NP	NP	0	14	87
	B114	Top of Landfill	S11	26.0	1615	--	NV	NP	NP	--	--	--
	B115	Landfill Bench	S7	18.5	1551.1	31.3	NV	NP	NP	0	9	91
			S27	67.0	1502.6	70.2	NV	NP	NP	0	8	92
	B116	Ash Raised Dike	S6	11.0	1527.1	14.5	NV	NP	NP	0	10	90
	B118	Ash Raised Dike	S11 (4-21")	21.0	1521.4	--	--	--	--	0	84	16
			S14	27.0	1515.4	31.5	NV	NP	NP	0	22	78

1: Boring location and elevation unknown.

Table 9. Minimum and Maximum Realizable Density of Fly Ash
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Sample or Batch ID	Year Tested	Specific Gravity	Tester	Minimum Realizable Dry Density (lb/ft^3)	Mininmum Realizable Dry Density Avg (lb/ft^3)	Maximum Realizable Dry Density (lb/ft^3)	Maximum Realizable Dry Density Avg (lb/ft^3)	Optimum Water Content (%)	Optimum Water Content Avg (%)	Source of Material/Description of Ash
GEI Batch 1 - from West Pond	2017	2.22	GEI - Will L.	50.8	51.4	71.6	73.0	35.6	34.9	Batch 1 is a mixture of one bucket obtained from the West Pond by Dan Pizzino (AEP) in March 2017 and one bucket obtained from the West Pond by Bill Walton (GEI) in Sept. 2017. Min density dried at 110°C prior to testing.
			GEI - Nick M.	51.3		74.3		34.2		
			GEI - Michelle P.	52.2		--		--		
GEI Batch 2 - from West Pond	2017	2.26	GEI - Will L.	53.3	53.9	76.5	76.5	34.0	34.0	Batch 2 is a mixture of one bucket obtained from the West Pond by Dan Pizzino (AEP) in March 2017 and two buckets obtained from the West Pond by Bill Walton (GEI) in Sept. 2017. Min density dried at 110°C prior to testing.
			GEI - Will L.	53.9		--		--		
			GEI- Nick M.	54.4		--		--		
GEI Batch 2 - from West Pond	2018	2.26	GEI - Alex H.	50.0	52.8	--	--	--	--	Batch 2 is a mixture of one bucket obtained from the West Pond by Dan Pizzino (AEP) in March 2017 and two buckets obtained from the West Pond by Bill Walton (GEI) in Sept. 2017. Dried at 45°C prior to testing.
			GEI - Will L.	54.0						
			GEI - Will L.	54.3						
			OSU	55.8	--					
B114 Test Pit	2018		GEI - Will L.	48.2	48.6	--	--	--	--	Sample is from one of the two buckets of ash collected from below the landfill cap during repair and protective piezometer casing installation at GEI 2017 Boring B114. Dried at 60°C prior to testing.
			GEI - Will L.	48.4						
			GEI - Will L.	49.2						
B103 U1	2018		GEI - Esad F.	47.8	48.7	--	--	--	--	Sample is from tube U1 taken by GEI in 2017 in Boring B103 (29 - 31 ft). Dried at 45°C prior to testing. **In-tube dry unit weight, 3 tube sections: 61.6, 58.0, 67.2 pcf**
			GEI - Will L.	48.3						
			GEI - Will L.	49.9						
B106U U3	2018		GEI - Matt F.	38.5	39.1	--	--	--	--	Sample is from tube U3 taken by GEI in 2017 in Boring B106U (47-49 ft). Dried at 45°C prior to testing. **In-tube dry unit weight, 2 tube sections: 47.9, 48.2 pcf**
			GEI - Will L.	39.4						
			GEI - Will L.	39.5						
Batch 3	2018	2.30	Virginia Tech	60.2	--	67.7	--	36.9	--	Batch 3 is three buckets obtained from the West Pond by Dan Pizzino (AEP) in March 2017. Min density dried at 45°C prior to testing.
Batch from Greg Lee	2017	2.15	OSU	45.2	--	61.2	--	43.7	--	OSU 2017 testing was performed on buckets of Glen Lyn ash taken by Greg Lee (AEP) from the West Pond in Jan 2017. Min density dried at 45°C prior to testing.
S-9672	2006	--	AEP	--	--	58.4	61.0	46.6	--	--
S-9445, Unit 6 Fly Ash	2005	--	AEP	--	--	61.2		42.2	--	--
S-9632	2005	--	AEP	--	--	60.7		43.5	--	--
S-9347, Unit U5 & U6 Fly Ash, Summer burn 2004	2004	--	AEP	--	--	63.1		41.8	--	--
S-8759, Unit 5&6	2002	--	AEP	--	--	61.8		42.8	--	--
S-8267	2000	--	AEP	--	--	69.3	--	35.2	--	--

Table 10. Specific Gravity of Fly Ash
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Program	Boring or Batch ID	Sample ID	Stacked or Sluiced	Elev. (ft)	G_s	Tester	Drying Before Test	Oven Temp to Measure Dry Mass
GEI 2017	Batch 1 - from West Pond	--	sluiced	1527	2.22	Will L.	Air dried to 30 to 35% moisture content	110 C
	Batch 2 - from West Pond	--	sluiced	1527	2.22	Will L.	Air dried to 35 to 40% moisture content	110 C
					2.27	Will L.	Air dried to 35 to 40% moisture content	60 C
					2.25	Will L.	Air dried to 35 to 40% moisture content	60 C
					2.26	Will L.	Oven dry at 60 C	60 C
					2.26	Will L.	Oven dry at 60 C	60 C
					2.27	Will L.	Oven dry at 110 C	60 C[1]
					2.26	Will L.	Oven dry at 110 C	60 C[2]
					2.28	Will L.	Oven dry at 110 C	110 C[1]
					2.27	Will L.	Oven dry at 110 C	110 C[2]
	B103	S6 (jar)	sluiced	1523	2.23	Nick M.	none	110 C
	B105	S9 (jar)	sluiced	1519	2.21	Nick M.	none	110 C
	B107	S4 (jar)	stacked	1563	2.23	Nick M.	none	110 C
	B109	S8 (jar)	stacked	1549	2.24	Nick M.	none	110 C
	B114	S6 (jar)	stacked	1624	2.20	Nick M.	none	110 C
	B115	S27 (jar)	sluiced	1503	2.14	Nick M.	none	110 C
VA Tech 2017	Batch 3 - from West	--	sluiced	~1527	2.30	B.C.	none	60 C
					2.30	B.C.	none	60 C
OSU 2017	OSU 2017 Batch	--	sluiced	--	2.15	M.A.	none	60 C
AEP 1972	--	Unit 5	--	--	2.15	--	Unknown	--
		Unit 6	--	--	2.17	--	Unknown	--
GAI 1990	7-B	ST-3	sluiced	--	2.3	--	Unknown	--
					2.25	**Median**		
					2.24	**Average**		

1: Dry weight of ash changed from 49.799 g to 49.736 g between drying at 60 C and 110 C.
2: Dry weight of ash changed from 49.721 g to 49.562 g between drying at 60 C and 110 C.

Table 11a. Unit Weight of Clay Dike

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

Program	Boring	Sample	Test Number[1]	Depth (ft)	Total (Wet) Mass of Soil[2] (g)	Volume of Soil in Tube[3] (cm^3)	Water Content[4] (%)	Total Unit Weight[5] (lb/ft^3)	Dry Unit Weight[6] (lb/ft^3)	Old or New Dike[7]
GAI 1990	B-4	ST-3	--	36	--	--	18	132.4	112.1	New
	B-9	ST-3	--	17	--	--	19	133.3	112.4	New
GEI 2017	B101U	U1	R'1	21.8	1333.00	624.48	18.13	133.3	112.8	New
	B101U	U1	R'2	21.1	1318.40	632.80	17.88	130.1	110.3	New
	B110U	U2-A	R'3	36.8	1346.20	621.79	19.41	135.2	113.2	New
	B110U-A	U1	VT1	16	1444.89	669.67	17.85	134.7	114.3	New
	B113U	U1	R'4	25.4	1072.49	618.70	19.41	108.2	90.6	Old
	B113U	U1	R'5	24.8	1204.61	615.34	15.17	122.2	106.1	Old
	B113U	U2	VT2	27.5	1243.10	608.06	15.59	127.6	110.4	Old
	B113U	U2	VT3	27.5	1272.00	611.69	16.10	129.8	111.8	Old
	B119U-A	U1	R'6	25.1	1301.45	619.44	21.23	131.2	108.2	New
						Average[8]:	17.8%	131.0	111.2	
						Median[8]:	17.9%	131.8	112.0	
						Old Dike Avg.[9]:	15.6%	126.6	109.4	
						New Dike Avg.[9]:	18.1%	133.3	112.8	

Selected unit weight for Old Dike: 127 lb/ft^3

Selected unit weight New Dike: 133 lb/ft^3

Notes:

1. The test number indicates the type of test (R' for Consolidated Isotropic Undrained Triaxial Tests and C for One-Dimensional Consolidation Tests) and test number.
2. The total (wet) weights were calculated from weighing the soil within the shelby tubes and subtracting the mass of the tube itself.
3. The volume of the soil was calculated by measuring the length of soil within the tube with a ruler and the inside diameter of the tube with a caliper.
4. The water content was measured from the trimmings of the soil from the tube.
5. The total unit weight of soil was calculated by the equation: $\gamma_T=M_T/V$.
6. The dry unit weight was calculated by the equation: $\gamma_d=\gamma_T/(1+\omega)$.
7. Old Dike refers to the Center Pond dikes built in 1958. New Dike refers to the West Pond Landfill dikes constructed in 1964-1965.
8. GEI and GAI tests. R'4 was excluded from the average and median calculations, because there appeared to be a mismeasurement of sample length in tube, in the laboratory.
9. GEI tests. R'4 was excluded from old dike average.

Table 11b. Unit Weight of Alluvium

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

Program	Boring	Sample	Test Number[1]	Depth (ft)	Total (Wet) Mass of Soil[2] (g)	Volume of soil in tube[3] (cm^3)	Water Content[4] (%)	Total Unit Weight[5] (lb/ft^3)	Dry Unit Weight[6] (lb/ft^3)
GAI 1990	B-3	ST-1	--	43	--	--	28	121.4	94.8
	B-4	ST-4	--	50	--	--	25	129.8	103.9
	B-4	ST-5	--	55	--	--	29	125.6	97.0
	B-17	ST-3	--	66	--	--	20	137.4	117.3
GEI 2017	B101U	U2	R'15	53.9	1266.47	631.50	26.1	125.2	99.3
	B101U	U2	R'16	53.2	1286.92	632.30	25.0	127.1	101.6
	B101U	U3	C1	55.2	621.34	305.06	26.8	127.2	100.3
	B101U	U3	R'14	55.7	1199.36	621.19	28.8	120.5	93.6
	B110U	U3	R'7	53.5	1307.97	628.84	22.2	129.8	106.3
	B119U-A	U2	VT4	43.2	1643.80	804.25	22.8	127.6	103.9
						All Tests Average:	25.4%	127.2	101.8
						All Tests Median:	25.6%	127.1	101.0
						GEI Average:	25.3%	126.2	100.8
						GEI Median:	25.6%	127.1	101.0

Selected unit weight: 127 lb/ft^3

Notes:

1. The test number indicates the type of test (R' for Consolidated Isotropic Undrained Triaxial Tests and C for One-Dimensional Consolidation Tests) and test number.
2. The total (wet) weights were calculated from weighing the soil within the shelby tubes and subtracting the mass of the tube itself.
3. The volume of the soil was calculated by measuring the length of soil within the tube with a ruler and the inside diameter of the tube with a caliper.
4. The water content was measured from the trimmings of the soil from the tube.
5. The total unit weight of soil was calculated by the equation: $\gamma_T = M_T / V$.
6. The dry unit weight was calculated by the equation: $\gamma_d = \gamma_T / (1+\omega)$.

Table 11c. Unit Weight of Sluiced Fly Ash
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

	Below Phreatic Surface				Above Phreatic	
Program	**Avg. In Tube Total Unit Weight (lb/ft^3)**	**Median In Tube Total Unit Weight (lb/ft^3)**	**Avg. In Tube Dry Unit Weight (lb/ft^3)**	**Median In Tube Dry Unit Weight (lb/ft^3)**	**Median In Tube Total Unit Weight (lb/ft^3)**	**Median In Tube Dry Unit Weight (lb/ft^3)**
GEI 2017	93.1	92.4	55.8	54.7	--	--
MACTEC 2010	93.2	89.9	60.7	58.5	92.4	58.0
GAI 1990	88.3	~93	62.5	62.0	--	--
AEP 1972 Aux.	88.9	~88	50.5	51.4	66.3	40.8
All Programs	90.5	91.0	57.3	54.7	67.0	42.0

In Situ Dry Unit Weight of Saturated Fly Ash Selected for Analyses	In Situ Total Unit Weight of Saturated Fly Ash Selected for Analyses	In Situ Total Unit Weight of Fly Ash **above** phreatic surface Selected for Analyses = 55(1+water content) w_c from 2017 jar samples = 40%
55 lb/ft^3	**92 lb/ft^3**	**77 lb/ft^3**

								In Tube								In Situ	
Program	**Boring**	**Sample**	**Triaxial Test Number**	**Depth (ft)**	**Above or Below Phreatic Surface?**	**Water Content from Trimmings w_{tr} (%)**	**Water Content from Whole Sample[1] (%)**	**Volume of Sample in Tube[2], V (cm^3)**	**Total Mass of Sample[3], M_t (g)**	**Dry Mass of Sample[4], M_d (g)**	**Total Unit Weight in Tube[5], γ_{ti} (lb/ft^3)**	**Dry Unit Weight based on γ_{ti} and w_{tr}[6] γ_{di} (lb/ft^3)**	**Total Unit weight assuming S = 100%,[7] γ_t (lb/ft^3)**	**Dry Unit Weight,[8] γ_d (lb/ft^3)**	**ΔV/V from in situ to trimmed tube in lab (%)**	**Total Unit weight assuming S = 100%,[9] $\gamma_{t,is}$ (lb/ft^3)**	**Dry Unit Weight[9], $\gamma_{d,is}$ (lb/ft^3)**
GEI 2017	B103	U1	unit weight	30.6	Below	50.7	54.1	632.12	963.44	623.63	95.1	63.2	96.2	61.6	-2.5	93.8	60.0
	B103	U1	R'9	29.8	Below	50.7	60.1	651.96	965.89	606.11	92.5	61.4	94.3	58.0	-2.5	91.9	56.6
	B103	U1	unit weight	29.3	Below	46.7	45.8	370.69	583.35	399.07	98.2	67.0	99.3	67.2	-2.5	96.8	65.5
	B103	U2	unit weight	32.3	Below	41.4	52.5	625.98	995.74	680.67	99.3	70.2	99.7	67.9	1.4	101.1	68.8
	B105U	U4	R'10	42.6	Below	65.5	69.9	644.51	941.07	556.58	91.2	55.1	92.0	53.9	-1.6	90.6	53.0
	B105U	U4	unit weight	41.9	Below	73.5	70.6	634.35	920.84	536.98	90.6	52.2	91.4	52.8	-1.6	90.0	52.0
	B106U	U3	R'12	48.6	Below	75.7	71.4	637.40	831.80	489.04	81.5	46.4	88.7	47.9	2.0	90.5	48.9
	B106U	U3	unit weight	47.9	Below	74.1	81.4	394.22	552.91	304.58	87.6	50.3	88.9	48.2	3.0	91.6	49.7
	B109U	U4	R'8	46.2	Below	64.3	65.6	639.40	930.82	565.81	90.9	55.3	92.8	55.2	1.1	93.8	55.8
	B109U	U5	R'11	61.8	Below	81.4	86.1	643.80	889.69	481.69	86.3	47.6	88.1	46.7	2.6	90.3	47.9
	B122U	U3	R'13	46.5	Below	72.8	67.3	634.78	929.15	555.74	91.4	52.9	92.4	54.7	-0.1	92.4	54.6
MACTEC 2010	P-0901	UD-5		19	Below	77.4					89.1	50.2					
	P-0901	UD-8		31	Below	43.0					100.0	69.9					
	P-0901	UD-7		27	Below	48.2					86.7	58.5					
	P-0903	UD-9		35	Below	65.4					89.9	54.4					
	P-0903	UD-7		27	Below	42.3					100.0	70.3					
	P-0903	UD-5		19	Above	59.1					92.4	58.0					
GAI 1990[10]	7-B	ST-1		6	Above?	22					75.3	61.7					
	7-B	ST-3		33	Below?	42					99.6	70.1					
	7-B	ST-5		37	Below?	42					73.4	51.7					
	11-B	ST-3		37	Below?	29					91.7	71.1					
	12-C	ST-3		45	Below?	52					94.7	62.3					
	B-17	ST-1		43	Below	63					94.9	58.2					
AEP 1972	Auxiliary Pond	1		1.3	Above	33.2					59.5	44.7					
		2		4.0	Above	80.3					67.7	37.5					
		3		7.3	Above	48.9					66.3	44.5					
		4		10.3	Above	70.9					69.8	40.8					
		5		12.8	Above	62.0					59.7	36.9					
		6		15.8	Above	52.8					65.8	43.1					
		7		18.8	Above	72.9					69.3	40.1					
		8		22.8	Below	76.5					87.2	49.4					
		9		25.8	Below	70.0					88.2	51.9					
		10		28.8	Below	72.0					92.7	53.9					
		11		31.8	Below	71.9					87.5	50.9					
		12		34.8	Below	72.5					92.5	53.6					
		13		37.8	Below	96.2					85.3	43.5					

Notes:

1. The water content of the whole sample is computed using the total mass measured prior to the test and the oven-dried dry mass after the test.
2. The volume of the sample was measured by measuring the length of the soil with a ruler while it was still in the shelby tube. The inside diameter of the tube was measured with calipers.
3. Total mass of the sample is the mass of the sample in the tube less the mass of the tube and any packers/filter paper.
4. The dry mass of soil includes soil stuck to the tube after extrusion and the membrane after breaking down the specimen. The soil was oven dried and then weighed.
5. The total unit weight in tube was calculated by the equation: $\gamma_{ti} = (M_t/V)\gamma_w$
6. The dry unit weight was calculated by the equation: $\gamma_{di} = \gamma_{ti}/(1+w_{tr})$
7. The ash samples were allowed to drain in the tube, so measuring the total unit weight directly may not be representative of field conditions. The samples were all below the water table, so 100% saturation is a reasonable assumption. The following equation was used: $\gamma_T=(1-1/G_s)\gamma_d+\gamma_w$, where γ_w is taken as 62.4 lb/ft^3. A median specific gravity, G_s, of 2.22 was used.
8. The dry unit weight was calculated by the equation: $\gamma_d=(M_d/V)\gamma_w$
9. The in-situ unit weights were calculated by the equation: $\gamma_{d,is} = \gamma_{di}(1 + (\Delta V/V)x100)$
10. Calculation steps for GAI 1990 are assumed.

Table 11d. Unit Weight of Stacked Fly Ash

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant

Glen Lyn, Virginia

					In Tube							In Situ	
Program	Boring and Sample	Depth (ft)	Water Content from Trimmings w_{tr} (%)	Water Content from Whole Sample[1] (%)	Volume of Sample,[2] V (cm^3)	Total Mass of Sample,[3] M_t (g)	Dry Mass of Sample,[4] M_d (g)	Total Unit Weight,[5] γ_{ti} (lb/ft^3)	Dry Unit Weight,[7] γ_d (lb/ft^3)	Dry Unit Weight based on γ_{ti} and w_{tr}[6] γ_{di} (lb/ft^3)	ΔV/V from in situ to trimmed tube in lab (%)	Total Unit Weight,[8] $\gamma_{t,is}$ (lb/ft^3)	Dry Unit Weight,[8] $\gamma_{d,is}$ (lb/ft^3)
GEI 2017	B114 U1	24.7	23.2	22.2	452.36	466.49	381.37	64.4	52.6	52.3	1.7	65.5	53.5
	B115U U1	21.7	33.2	36.5	394.78	525.75	381.39	83.1	60.3	62.4	n.m.[9]	n.m.	n.m.
	B122U U2	10.7	16.9	18.8	433.37	444.64	373.84	64.1	53.9	54.8	n.m.	n.m.	n.m.
							Average	70.5	55.6				
							Median	64.4	53.9				

Notes:

1. The water content of the whole sample is computed using the total mass measured prior to the test and the oven-dried dry mass after the test.
2. The volume of the sample was measured by measuring the length of the soil with a ruler while it was still in the shelby tube. The inside diameter of the tube was measured with calipers.
3. Total mass of the sample is the mass of the sample in the tube less the mass of the tube and any packers/filter paper.
4. The dry mass of soil includes soil stuck to the tube after extrusion. The soil was oven dried and then weighed.
5. The total unit weight in tube was calculated by the equation: $\gamma_{ti} = (M_t/V)\gamma_w$
6. The dry unit weight was calculated by the equation: $\gamma_{di} = \gamma_{ti}/(1+w_{tr})$
7. The dry unit weight was calculated by the equation: $\gamma_d=(M_d/V)\gamma_w$
8. The in-situ unit weights were calculated by the equation: $\gamma_{d,is} = \gamma_{di}(1 + (\Delta V/V)x100)$
9. It appeared that the samples in B115U,U1 and B122U,U2 slipped partially out of the tube during sampling. Therefore, estimates of in situ density, as compared to tube density, could not be made.

Table 12. Clay Dike Strength Test Data
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Tests By	Boring	Tube Sample	Triaxial Test Number	Tube Top Depth (ft)	Triaxial Sample Mid-Depth (ft)	Triaxial Sample Elevation (ft)	In Situ Mean Effective Stress $(0.66\sigma'_v)^1$ (psf)	N_{60} in Nearby SPT	q_t in Nearby CPT (tsf)	Old or New Dike?	Consolidated-Undrained Triaxial Test						
											Effective Confining Stress at Start of Shear (psf)	Equivalent Vertical Effective Stress at Start of Shear[1] (psf)	Peak Shear Strength (psf)	Shear Strength at 10% Strain (psf)	Strain at Peak $(\sigma_1-\sigma_3)$	Friction Angle at $(\sigma_1/\sigma_3)_{max}$ (degrees)	Strain at $(\sigma_1/\sigma_3)_{max}$
GEI 2018	B101U	U1	R'1	20.2	21.8	1,514.8	2,770	12	--	New	1,700	2,550	1,630	1,440	15.8	35.5	3.5
			R'2		21.1	1,515.5	2,680			New	3,500	5,250	3,280	2,800	18.4	35.0	4.4
	B110U	U2-A	R'3	36.3	36.8	1,505.9	4,670	25	120	New	4,510	6,765	2,990	2,990	9.6	33.1	4.8
	B113U	U1	R'4	23.8	25.4	1,498.4	3,230	8	30	Old	2,010	3,015	910	900	17.3	34.4	4.0
			R'5		24.8	1,499.0	3,150			Old	3,930	5,895	1,710	1,660	15.5	35.0	8.4
	B119U-A	U1	R'6	23.9	25.1	1,512.8	3,190	23	--	New	2,470	3,705	3,140	2,840	18.4	32.7	2.4
VA Tech 2017	B110U-A	U1	1	13.7	*14.7*	1,529.0	1,740	15	--	New	1,440	2,160	3,310	2,840	20.0	36.1	1.7
	B113U	U2	2	26.4	*27.4*	1,496.4	3,350	7	10	Old	2,450	3,675	2,304	2,090	19.5	34.0	8.1
			3		*27.4*	1,496.4	3,350			Old	5,040	7,560	6,340	5,900	16.0	36.4	4.6

Note 1: We assumed that the clay dike samples below a depth of about 20 ft were approximately normally consolidated, and that the in-situ Ko value was 0.5. The average in-situ stress would then be (1+0.5+0.5)/3 times the vertical effective stress.

Table 13. Clay-Like Alluvium Strength Test Data
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Tests By	Boring	Tube Sample	Triaxial Test Number	Tube Top Depth (ft)	Triaxial Sample Mid-Depth (ft)	Triaxial Sample El. (ft)	Thickness of Clay Dike Above (ft)	Depth to Water (ft)	In Situ Mean Effective Stress $(0.66\sigma'_v)^1$ (psf)	N_{60} in Nearby SPT	q_t in Nearby CPT (tsf)	Soil Description	Consolidated-Undrained Triaxial Test						
													Effective Confining Stress at Start of Shear (psf)	Equivalent Vertical Effective Stress at Start of Shear[1] (psf)	Peak Shear Strength (psf)	Shear Strength at 10% Strain (psf)	Strain at Peak $(\sigma_1-\sigma_3)$	Friction Angle at $(\sigma_1/\sigma_3)_{max}$ (degrees)	Strain at $(\sigma_1/\sigma_3)_{max}$
GEI 2018	B101U	U2	R'15	52.2	53.9	1482.7	32.0	40.0	4,110	8	18	Sandy Lean Clay (CL)	3,730	5,600	2,090	2,070	12.6	34.0	7.8
			R'16	52.2	53.2	1483.4	32.0	40.0	4,080	8	18	Sandy Lean Clay (CL)	7,350	11,030	3,410	3,390	12.3	32.4	7.4
		U3	R'14	55.0	55.7	1480.9	32.0	40.0	4,190	6	10	Sandy Lean Clay (CL)	3,770	5,660	2,170	2,160	13.5	33.0	9.1
	B110U	U3	R'7	52.1	53.5	1489.2	49.5	47.1	4,460	9	18	Sandy Lean Clay (CL)	4,260	6,390	3,190	2,850	19.6	34.1	8.6
VA Tech 2017	B119U-A	U2	4	42.2	43.0	1494.9	37.5	45.0	3,790	13	20	Lean Clay (CL)	3,640	5,460	3,020	2,560	18.1	33.9	5.8

Note 1: We assumed that the clay dike samples below a depth of about 20 ft were approximately normally consolidated, and that the in-situ Ko value was 0.5.
The average in-situ stress would then be (1+0.5+0.5)/3 times the vertical effective stress.

Table 14. Consolidated Isotropic Triaxial Compression (R') Tests on Tube Samples of Fly Ash
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Test No.	Boring	Sample	Sample Depth (ft)	Unit Weight				Estimated In Situ Vertical Effective Stress (ksf)	Effective Consol. Stress (ksf)	At Peak Shear Stress				At Steady-State				
				In-Situ (lb/ft^3)	After Sampling (lb/ft^3)	During Shear (lb/ft^3)	Change from In-Situ to Shear (lb/ft^3)			Shear Stress, q_p (ksf)	Lateral Effective Stress (ksf)	Axial Strain (%)	Friction Angle, ϕ (deg.)	Shear Stress, q_{us} (ksf)	Lateral Effective Stress (ksf)	Axial Strain (%)	Friction Angle, ϕ_{us} (deg.)	$S_{us} = q_{us}\cos(\phi_{us})$ (ksf)
R'8	B109U	U4	46.2	55.77	55.08	57.34	1.57	4.05	4.00	3.73	2.96	12.5	33.8	3.56	2.92	17.5	33.3	2.98
R'9	B103	U1	29.8	56.64	56.06	62.29	5.65	1.21	8.10	3.30	2.63	12.8	33.8	3.03	2.63	19.1	32.4	2.56
R'10	B105U	U4	42.6	53.04	52.16	57.48	4.44	2.07	8.09	5.36	4.05	12.7	34.7	5.36	4.05	12.7	34.7	4.41
R'11	B109U	U5	61.8	47.91	46.01	53.26	5.36	4.45	12.07	5.04	3.81	15.8	34.7	5.04	3.75	15.0	35.0	4.13
R'12	B106U	U3	48.6	48.65	47.71	56.29	7.65	2.05	4.05	2.86	2.04	13.0	35.9	2.83	1.99	12.0	36.0	2.29
R'13	B122U	U3	46.5	54.69	54.41	56.66	1.97	2.80	4.04	1.94	1.55	12.4	33.8	1.91	1.53	11.0	33.8	1.59

Table 15. Dry Unit Weight of Fly Ash Achieved in the Lab
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Operator	Test/ Specimen ID	Sample Prep Before Pluviation	Effective Confining Pressure (psi)	Dry Unit Weight (lb/ft^3)	Water Content at Saturation in Triaxial Cell (%)	Relative Realizable Density (%)
OSU 2017 All specimens assumed to be from the same batch of fly ash.	S2-P8	Oven dry at 40 to 45 C	20	54.7	80	59.4
	S3-P9		20	54.0	79	55.0
	S1-P10		20	55.0	79	61.3
	S2-P11		20	55.0	85	61.3
	S3-P12		20	54.5	81	58.1
	S2-P14		20	54.8	77	60.0
	S1-P15		20	54.4	83	57.5
	S3-P17		20	55.4	81	63.8
	S3-P20		20	54.7	76	59.4
	S2-P21		20	54.9	73	60.6
OSU 2018	GEI Batch 2	TBD	TBD	TBD	TBD	TBD
GEI 2018	Pluv #1 - Batch 1 - med. Vibration - round flask	Air dry to 30% to 40% water content	15	66.0	50	67.6
	Pluv #2 - Batch 2 - high vibration - Erlenmeyer flask		7	71.1	n.m.	76.1
	Pluv #3 - Batch 2 - low vibration Erlenmeyer flask		7	69.2	n.m.	67.7
	Slurry #1 - Batch 2		7	71.2	n.m.	76.5
	Pluv #4 - Batch 2 - low vibration, Erlenmeyer Flask, 2.8" mold. Severe necking.	Oven dry at 45 C	3	69.5	n.m.	69.0
	Pluv #5 - Batch 2 - low vibration Erlenmeyer Flask, vert consol in mold, 2.8" mold.		3	70.1	n.m.	71.7
VA Tech	Batch 3	TBD	15	64.7	n.m.	60.0
			15	65.5	n.m.	70.7

Formula for Relative Realizable Density:

$$D_r(\%) = \frac{\gamma d_{specimen} - \gamma d_{min}}{\gamma d_{max} - \gamma d_{min}} \times 100$$

γd_{min}= Minimum realizable density (pcf)

γd_{max}= Maximum realizable density (pcf)

Operator	Minimum Realizable Dry Density (lb/ft^3)	Maximum Realizable Dry Density (lb/ft^3)
OSU 2017	45.2	61.2
GEI 2018 Batch 1	51.4	73.0
GEI 2018 Batch 2	53.9	76.5
OSU Test on GEI 2018 Batch 2	55.8	--
VA Tech Batch 3	60.2	67.7

n.m. - not measured

OSU 2017 testing was performed on buckets of Glen Lyn ash taken by Greg Lee (AEP) from the West Pond in Jan 2017.
Batch 1 is a mixture of one bucket obtained from the West Pond by Dan Pizzino (AEP) in March 2017 and one bucket obtained from the West Pond by Bill Walton (GEI) in Sept. 2017.
Batch 2 is a mixture of one bucket obtained from the West Pond by Dan Pizzino (AEP) in March 2017 and two buckets obtained from the West Pond by Bill Walton (GEI) in Sept. 2017.
Batch 3 is a mixture of three buckets obtained from the West Pond by Dan Pizzino (AEP) in March 2017.

Table 16. Thickness of Clay-like and Sand-like Alluvium Layers
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

Boring ID	Clay-like Alluvium			Sand-like Alluvium		
	Top Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)	Top Elevation (ft)	Bottom Elevation (ft)	Thickness (ft)
B101	1504	1479	25	--	--	--
B102	1494	1478	16	--	--	--
B103	--	--	--	1494	1489	5
B105	1496	1487	9	1487	1482	5
B106	1495	1479	16	--	--	--
B107	1508	1492	16	--	--	--
B109	1494	1492	2	1492	1485	7
B110	1492	1479	13	--	--	--
B111	1491	1486	5	1486	1480	6
B112	--	--	--	1490	1481	9
B113	--	--	--	1495	1480	15
B115	--	--	--	1494	1480	14
B116	--	--	--	1498	1481	17
B117	--	--	--	1489	1483	6
B118	--	--	--	1504	1481	23
B119	1500	1477	23	--	--	--
B120	1505	1492	13	1492	1483	9
B122	1496	1485	11	--	--	--

Note: B108 and B114 were only in stacked ash and are omitted.

Figures



0 200000 400000

APPROXIMATE SCALE, FEET

SOURCE:

1. Image from Google Maps.

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

SITE LOCATION MAP

Project 1700685 | August 2018 | Fig. 1

\\geiconsulta B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\6a Data Report\Figs\Fig. 1 Site Location Map.dwg - 3/23/2018



0 800 1600

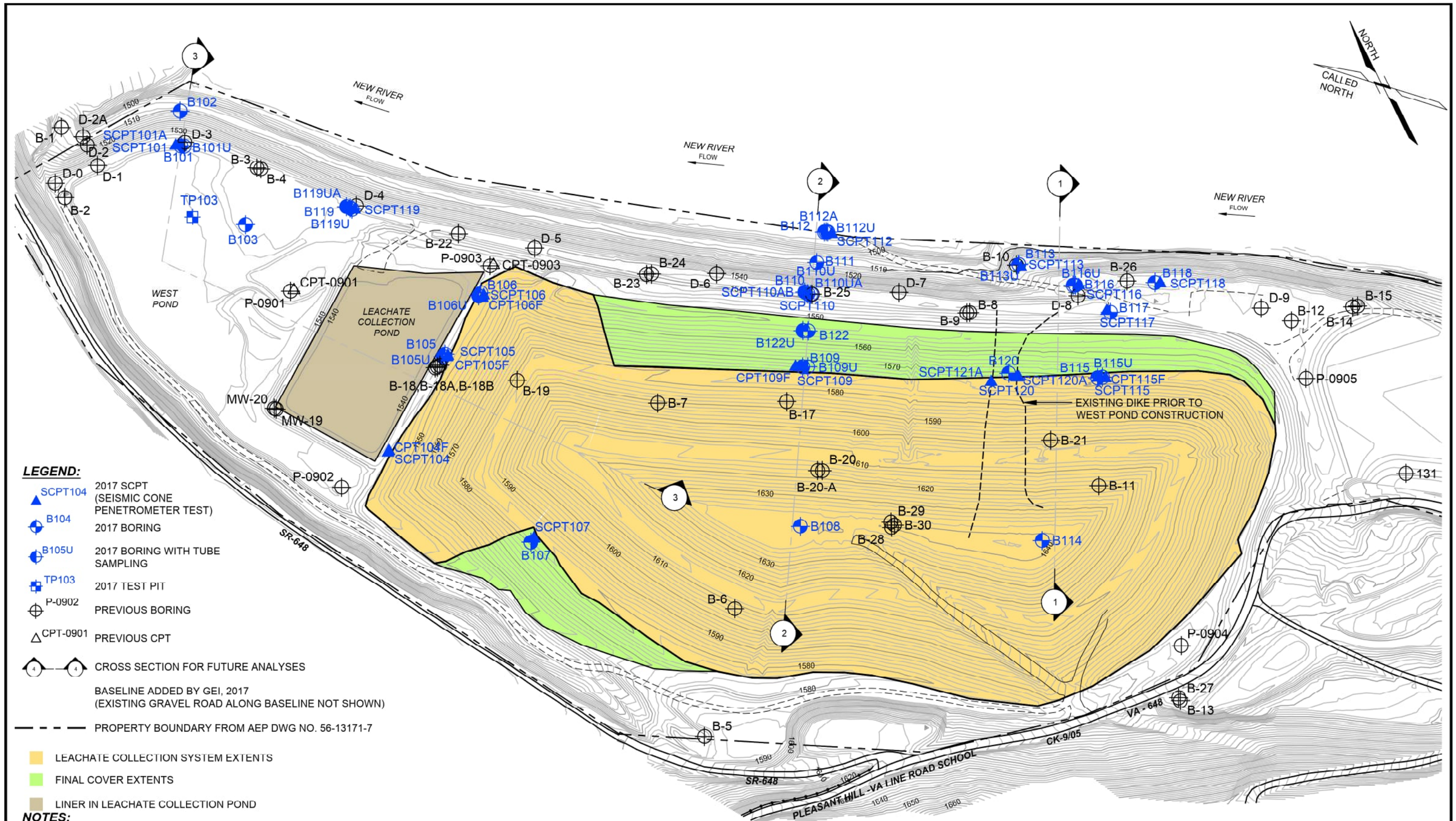
SCALE, FEET

SOURCE:

1. Google Earth Image dated 9/16/2015

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	AERIAL SITE LOCATION PLAN
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig 2

\\geiconsulta B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\6a Data Report\Figs\Fig. 2 Aerial Site Location Plan.dwg - 3/23/2018



LEGEND:

- SCPT104 — 2017 SCPT (SEISMIC CONE PENETROMETER TEST)
- B104 — 2017 BORING
- B105U — 2017 BORING WITH TUBE SAMPLING
- TP103 — 2017 TEST PIT
- P-0902 — PREVIOUS BORING
- CPT-0901 — PREVIOUS CPT
- CROSS SECTION FOR FUTURE ANALYSES
- BASELINE ADDED BY GEI, 2017 (EXISTING GRAVEL ROAD ALONG BASELINE NOT SHOWN)
- PROPERTY BOUNDARY FROM AEP DWG NO. 56-13171-7
- LEACHATE COLLECTION SYSTEM EXTENTS
- FINAL COVER EXTENTS
- LINER IN LEACHATE COLLECTION POND

NOTES:

1. PLAN BASED ON 2008 TOPOGRAPHY RECEIVED FROM AEP.
2. VERTICAL DATUM NGVD 1929.
3. THE COORDINATE SYSTEM USED BY AEP FOR THE LANDFILL IS A SITE SPECIFIC COORDINATE SYSTEM, WHICH APPLIES ONLY TO THE FLYASH LANDFILL, THE WEST POND AND THE AUXILIARY POND. WE WILL CALL THIS THE GLEN LYN FLY ASH LANDFILL HORIZONTAL DATUM (GLFLHD).
4. 2017 PIEZOMETERS INSTALLED IN B105, B107, B109, B115, B122 AND B122U.

0 200 400
SCALE 1"=200'

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

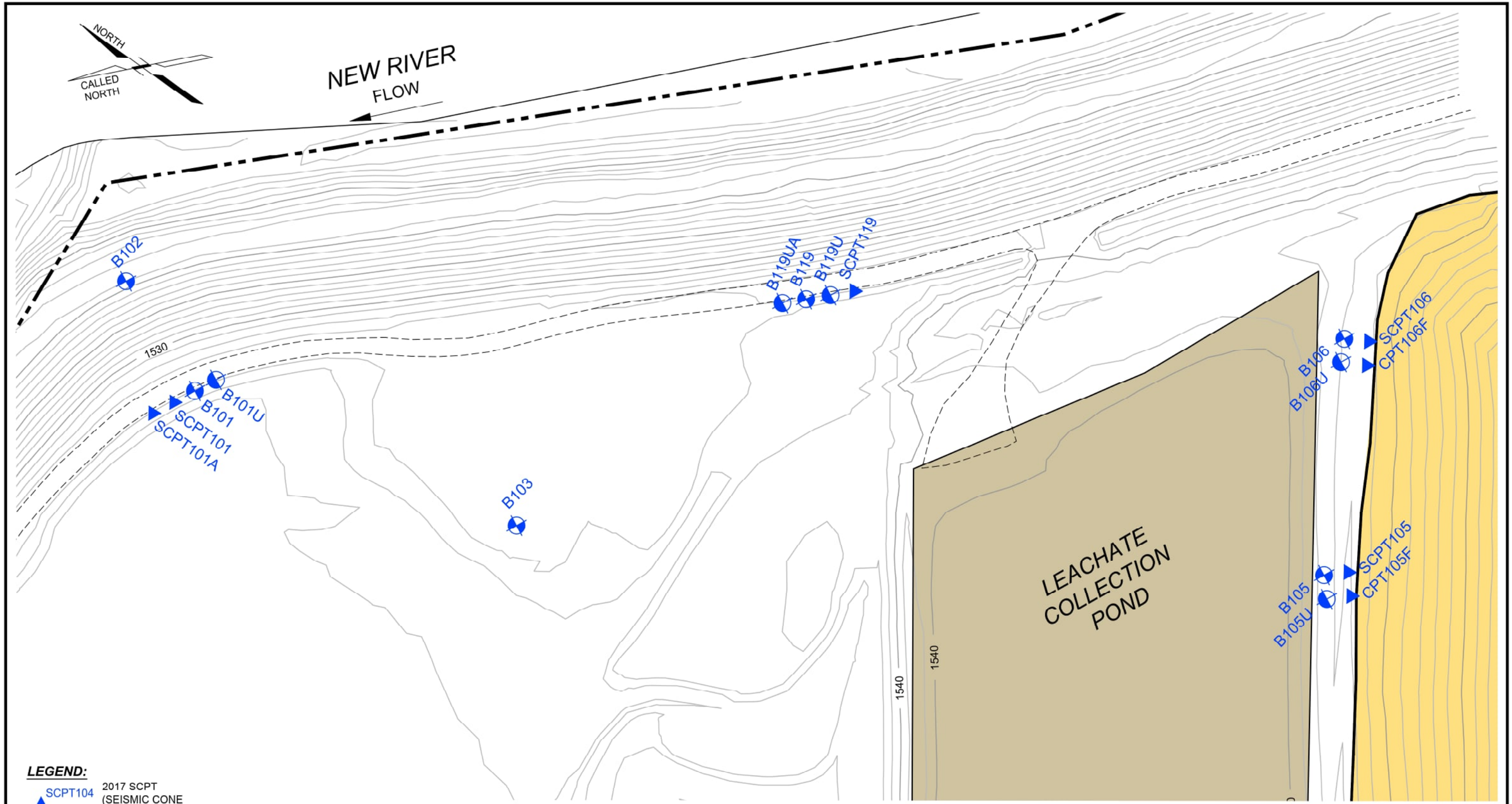
American Electric Power
Columbus, Ohio

GEI Consultants

BORING LOCATION PLAN

Project 1700685 | August 2018 | Fig. 3

\\geiconsulta B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\4 CAD Drawings\1700685-04 Final Boring Location Plan.dwg - 3/23/2018



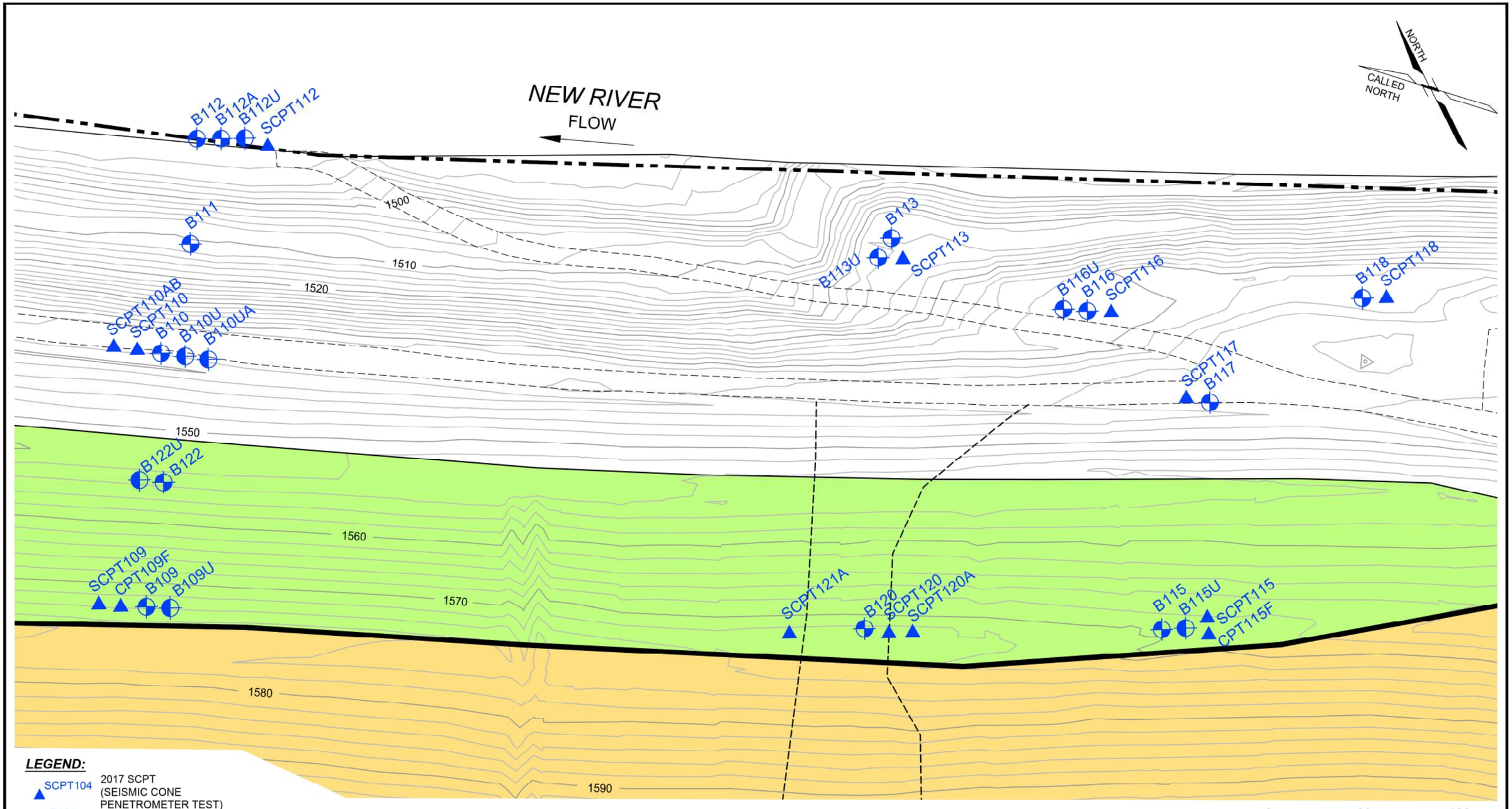
LEGEND:

- SCPT104 — 2017 SCPT (SEISMIC CONE PENETROMETER TEST)
- B104 — 2017 BORING
- B105U — 2017 BORING WITH TUBE SAMPLING
- PROPERTY BOUNDARY FROM AEP DWG NO. 56-13171-7
- LEACHATE COLLECTION SYSTEM EXTENTS
- LINER IN LEACHATE COLLECTION POND

NOTES:

1. PLAN BASED ON 2008 TOPOGRAPHY RECEIVED FROM AEP.
2. VERTICAL DATUM NGVD 1929.
3. EXPLORATION LOCATIONS ARE SHOWN SCHEMATICALLY. ACTUAL EXPLORATION LOCATIONS WITHIN A CLUSTER WERE CLOSER TOGETHER THAN SHOWN HERE. FOR ACTUAL COORDINATES, SEE TABLE 3 OR EXPLORATION LOGS.

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	Detail A of 2017 Explorations
American Electric Power Columbus, Ohio	Project 1700685	August 2018 — Fig. 3a



LEGEND:

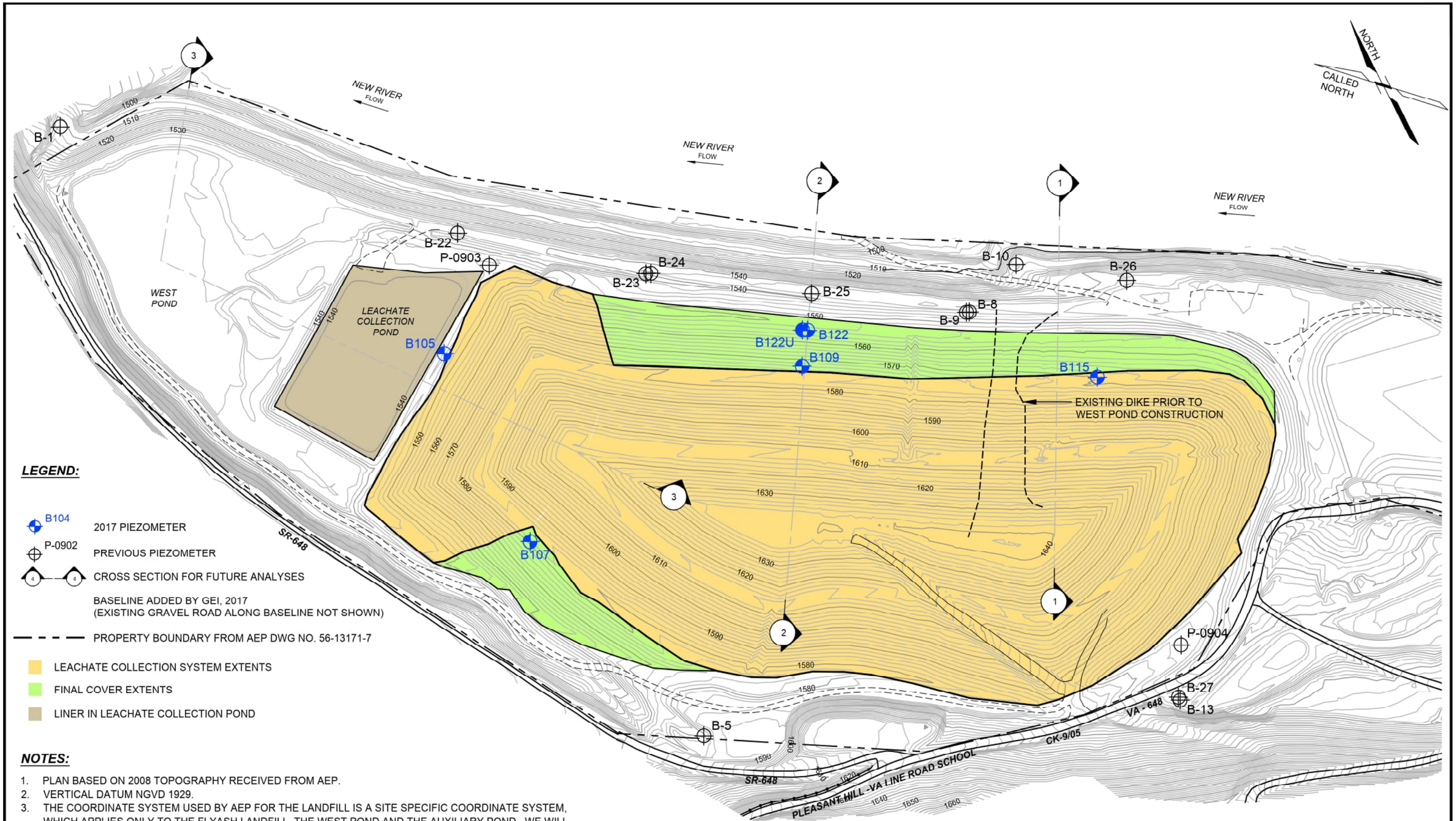
- SCPT104 — 2017 SCPT (SEISMIC CONE PENETROMETER TEST)
- B104 — 2017 BORING
- B105U — 2017 BORING WITH TUBE SAMPLING
- PROPERTY BOUNDARY FROM AEP DWG NO. 56-13171-7
- LEACHATE COLLECTION SYSTEM EXTENTS
- FINAL COVER EXTENTS

NOTES:

1. PLAN BASED ON 2008 TOPOGRAPHY RECEIVED FROM AEP.
2. VERTICAL DATUM NGVD 1929.
3. EXPLORATION LOCATIONS ARE SHOWN SCHEMATICALLY. ACTUAL EXPLORATION LOCATIONS WITHIN A CLUSTER WERE CLOSER TOGETHER THAN SHOWN HERE. FOR ACTUAL COORDINATES, SEE TABLE 3 OR EXPLORATION LOGS.

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	Detail B of 2017 Explorations
American Electric Power Columbus, Ohio	Project 1700685	August 2018 — Fig. 3b

\\geiconsulta B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\4 CAD Drawings\1700685-04 Final Boring Location Plan Detail Views.dwg - 3/23/2018



LEGEND:

- B104 — 2017 PIEZOMETER
- P-0902 — PREVIOUS PIEZOMETER
- CROSS SECTION FOR FUTURE ANALYSES
- BASELINE ADDED BY GEI, 2017 (EXISTING GRAVEL ROAD ALONG BASELINE NOT SHOWN)
- PROPERTY BOUNDARY FROM AEP DWG NO. 56-13171-7
- LEACHATE COLLECTION SYSTEM EXTENTS
- FINAL COVER EXTENTS
- LINER IN LEACHATE COLLECTION POND

NOTES:

1. PLAN BASED ON 2008 TOPOGRAPHY RECEIVED FROM AEP.
2. VERTICAL DATUM NGVD 1929.
3. THE COORDINATE SYSTEM USED BY AEP FOR THE LANDFILL IS A SITE SPECIFIC COORDINATE SYSTEM, WHICH APPLIES ONLY TO THE FLYASH LANDFILL, THE WEST POND AND THE AUXILIARY POND. WE WILL CALL THIS THE GLEN LYN FLY ASH LANDFILL HORIZONTAL DATUM (GLFLHD).

0 200 400
SCALE 1"=200'

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

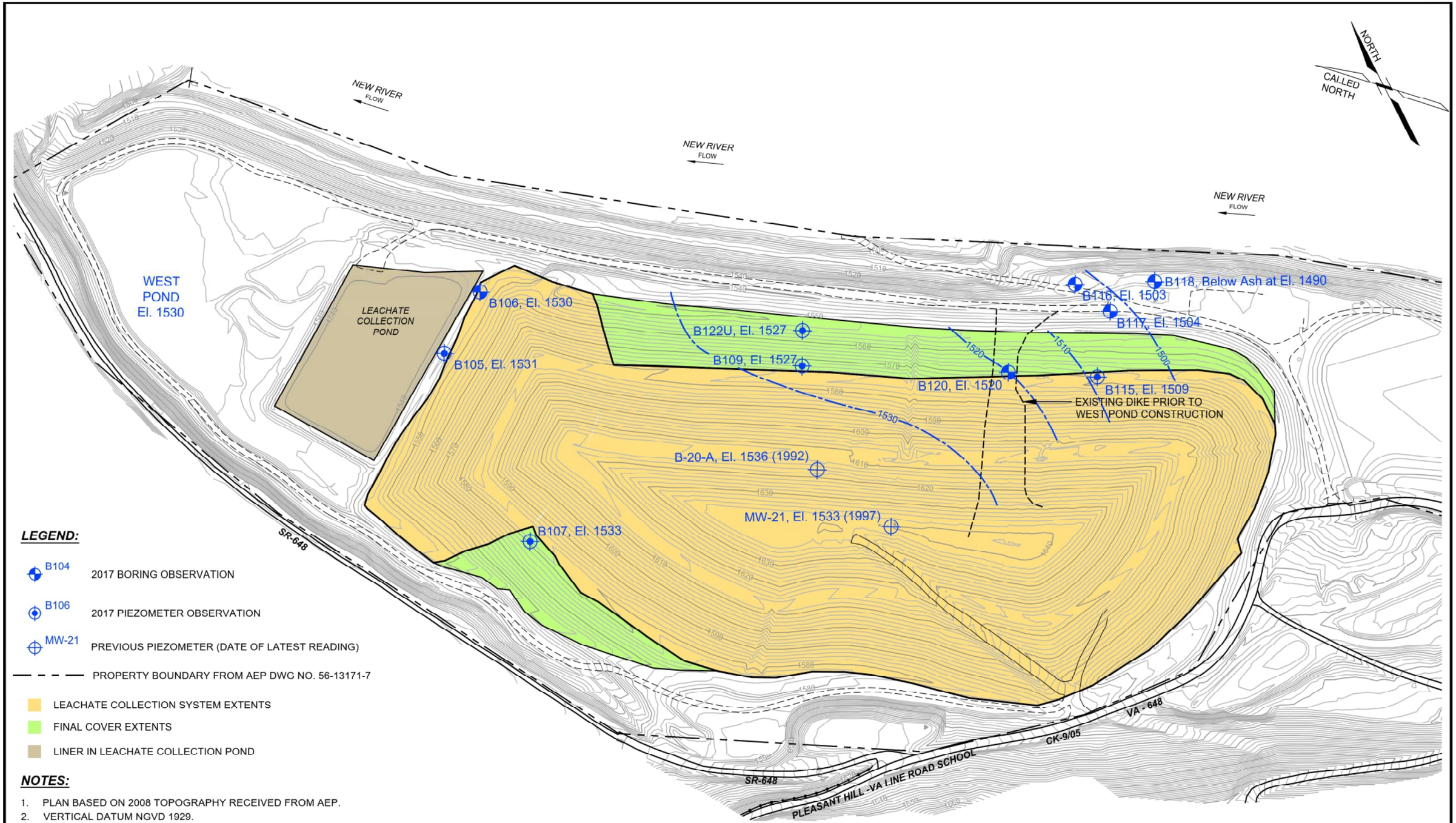
American Electric Power
Columbus, Ohio

GEI Consultants

PIEZOMETER LOCATION PLAN

Project 1700685 | August 2018 | Fig. 4

\\geiconsulta B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\4 CAD Drawings\1700685-04 Final Boring Location Plan.dwg - 3/23/2018



LEGEND:

- B104 — 2017 BORING OBSERVATION
- B106 — 2017 PIEZOMETER OBSERVATION
- MW-21 — PREVIOUS PIEZOMETER (DATE OF LATEST READING)
- PROPERTY BOUNDARY FROM AEP DWG NO. 56-13171-7
- LEACHATE COLLECTION SYSTEM EXTENTS
- FINAL COVER EXTENTS
- LINER IN LEACHATE COLLECTION POND

NOTES:

1. PLAN BASED ON 2008 TOPOGRAPHY RECEIVED FROM AEP.
2. VERTICAL DATUM NGVD 1929.
3. THIS PLAN SHOWS WELLS, PIEZOMETERS, AND BORINGS THAT PROVED THE ELEVATION OF THE PHREATIC SURFACE IN THE SLUICED FLY ASH. UNLESS OTHERWISE NOTED, ELEVATIONS WERE MEASURED IN 2017.

0 200 400
SCALE 1"=200'

Seismic Stability Ash Landfill and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

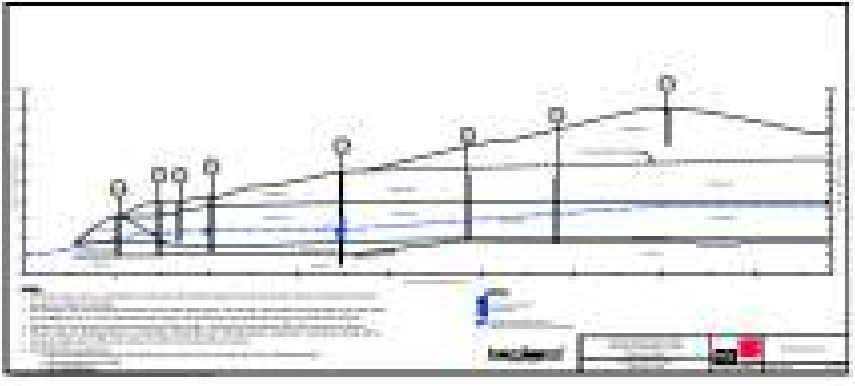
GEI Consultants

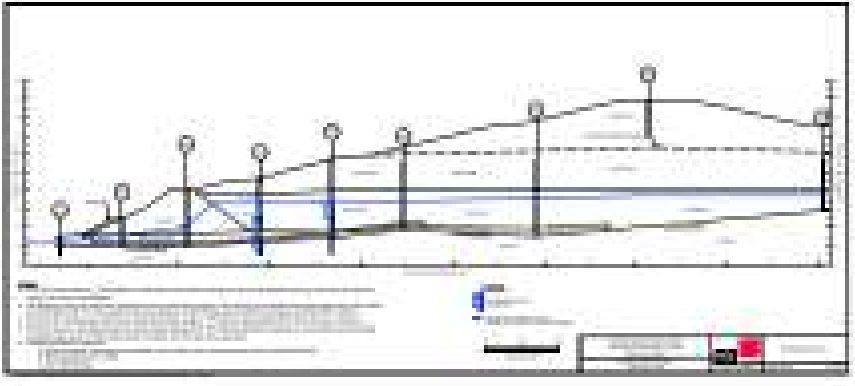
Project 1700685

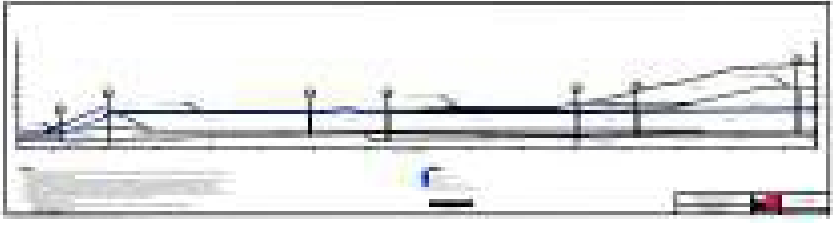
PIEZOMETRIC SURFACE IN SLUICED ASH

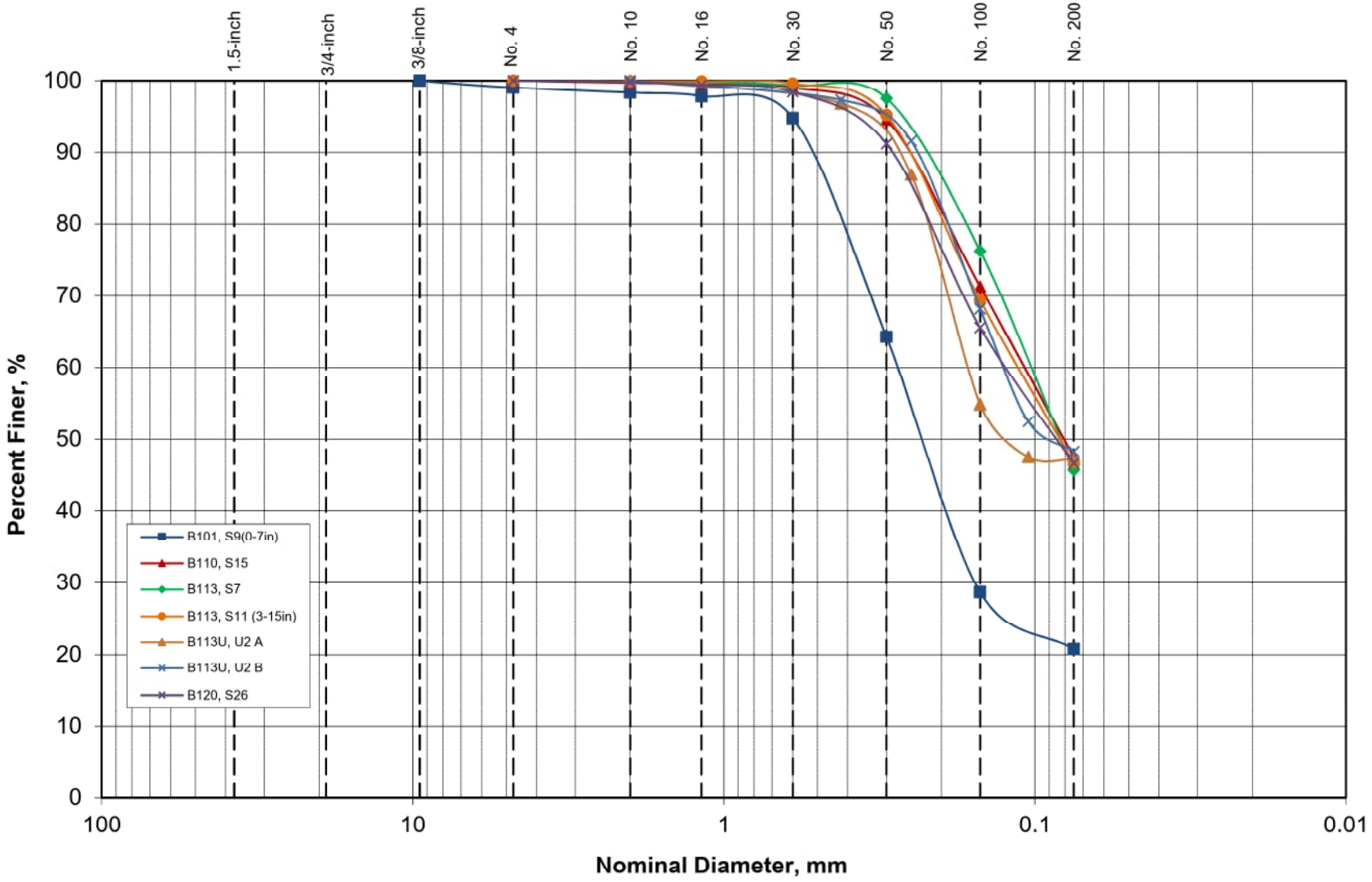
August 2018 Fig. 4b

\\geiconsulta B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\4 CAD Drawings\1700685 Phreatic Surface in Ash.dwg - 3/28/2018



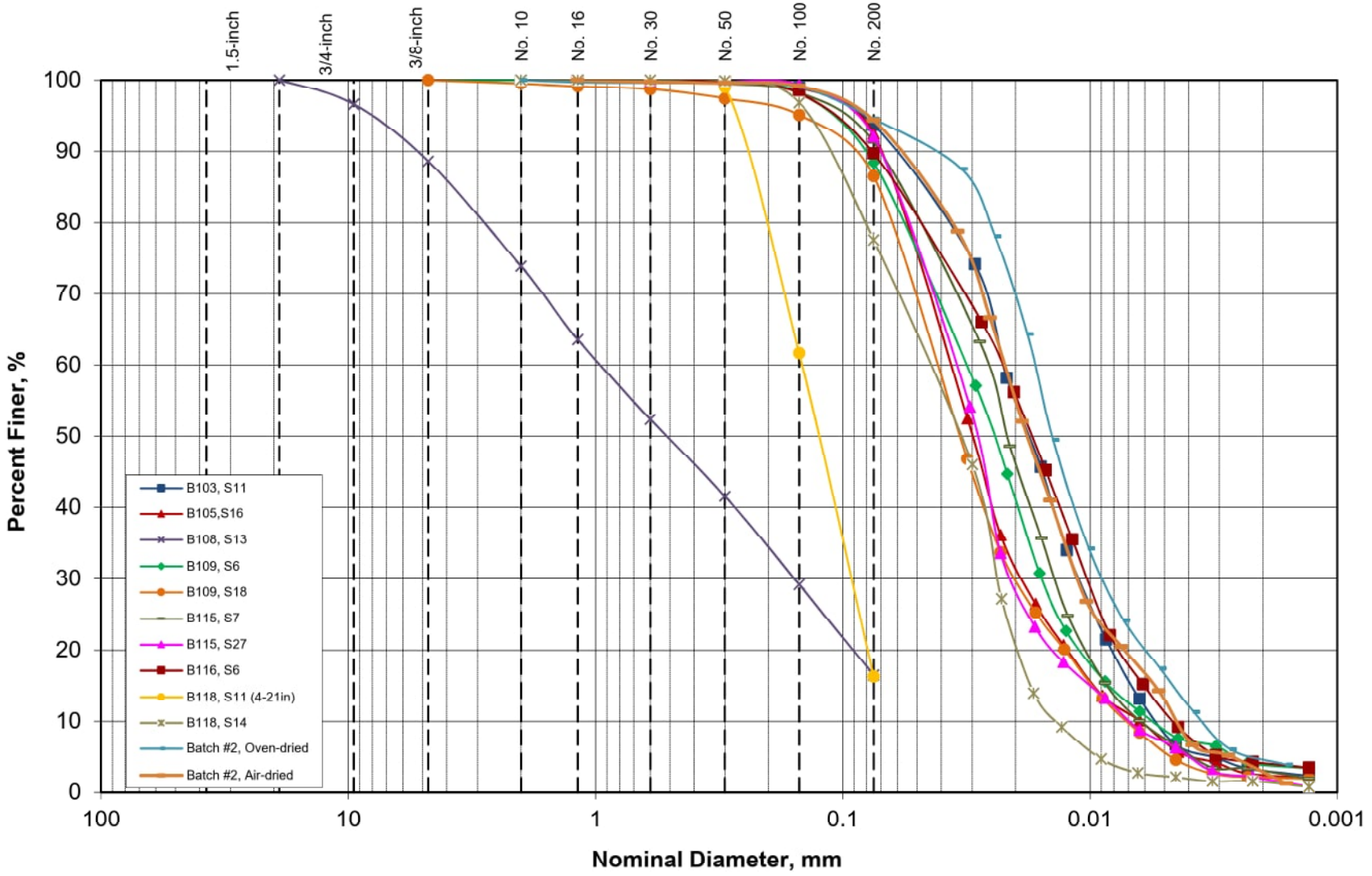






Note:
1. See Appendix J for individual test results.

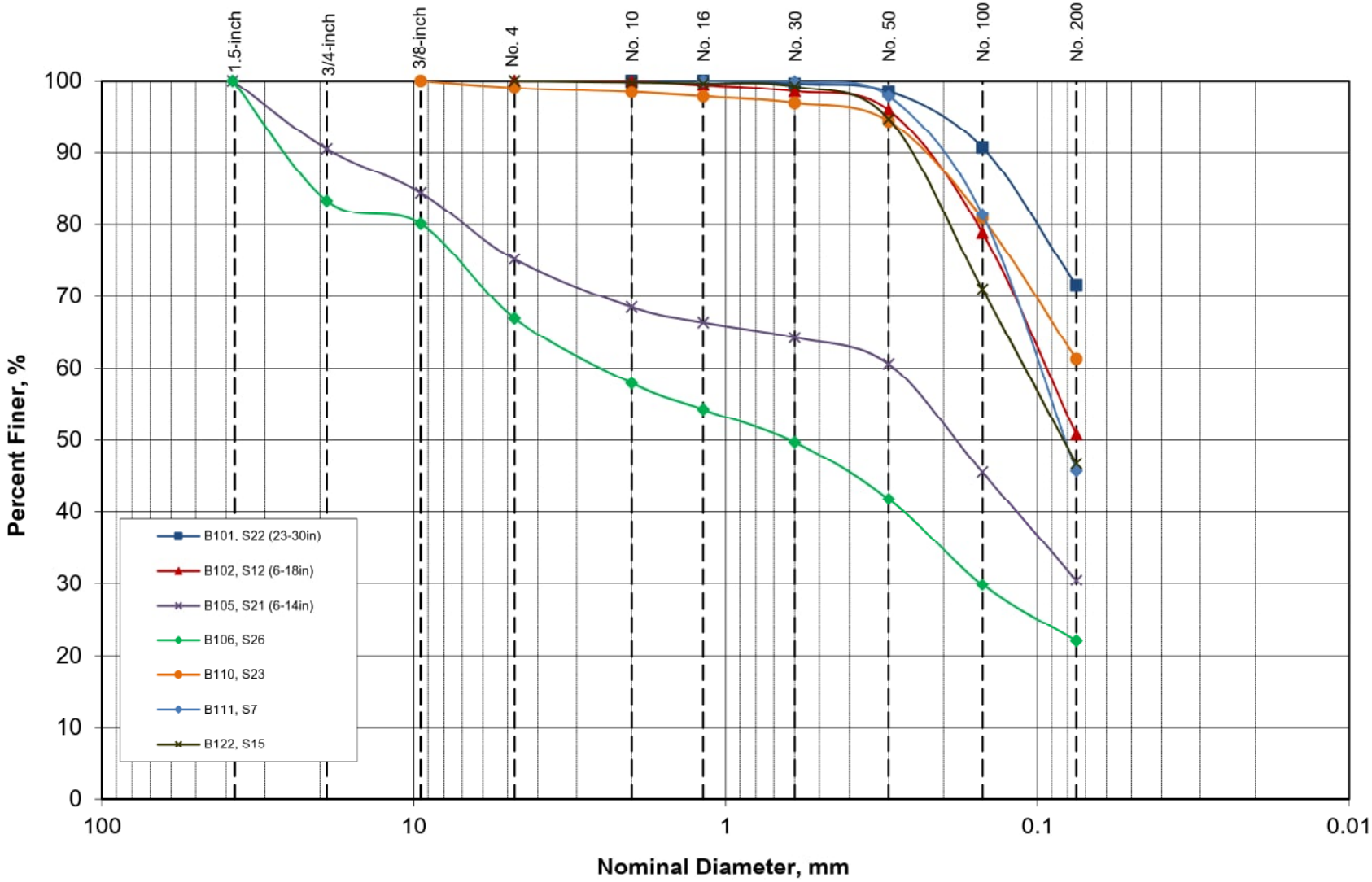
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia		GRAIN SIZE CURVES CLAY DIKE	
American Electric Power Columbus, Ohio	GEI Consultants	Project 1700685	August 2018 Fig. 6a



Note:

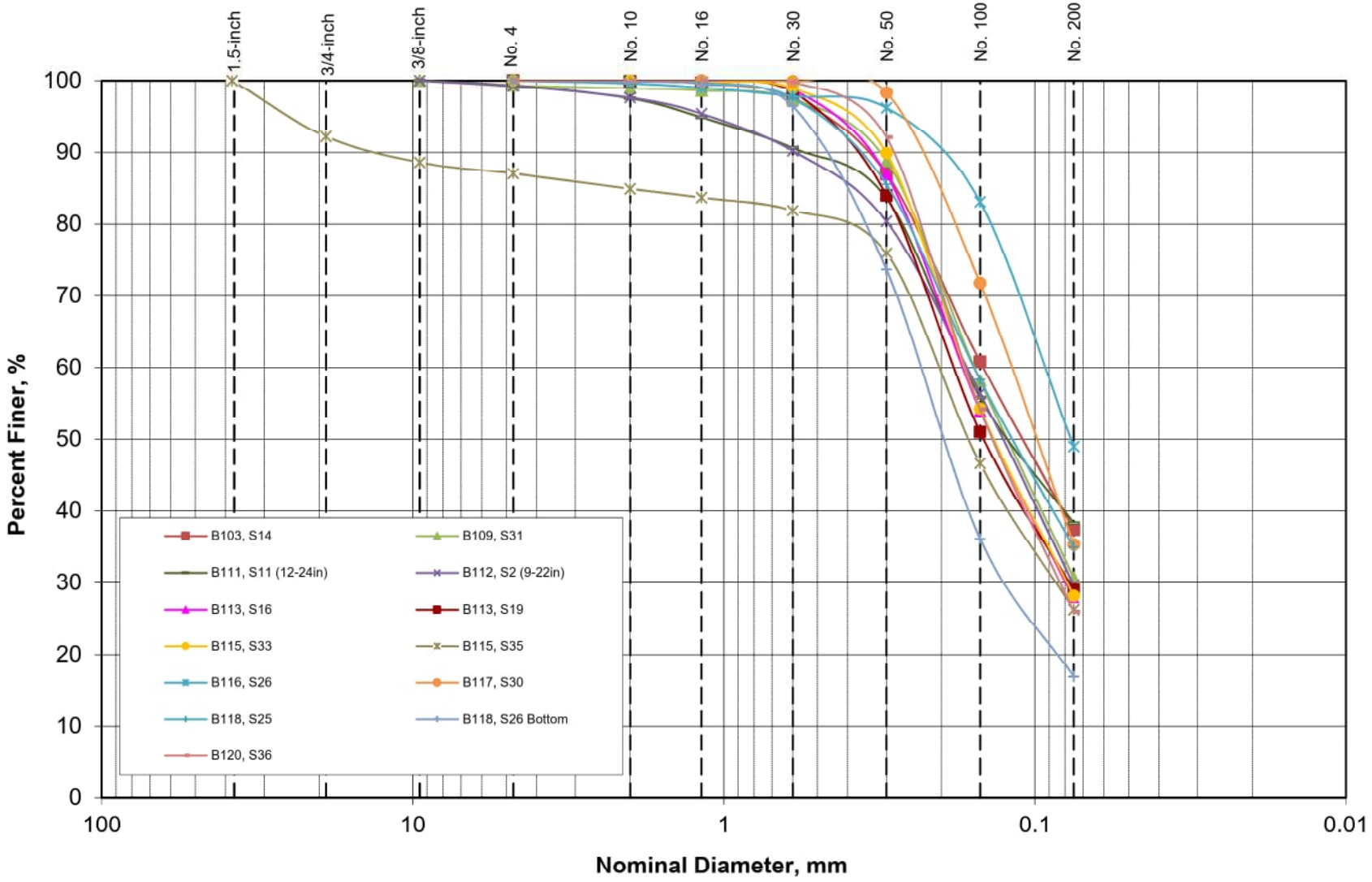
1. B108, S13 is stacked bottom ash
2. B118, S11 (4-21in) is a thick layer of light gray cenospheres.
3. See Appendix J for individual test results.

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	GRAIN SIZE CURVES FLY ASH
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 6b



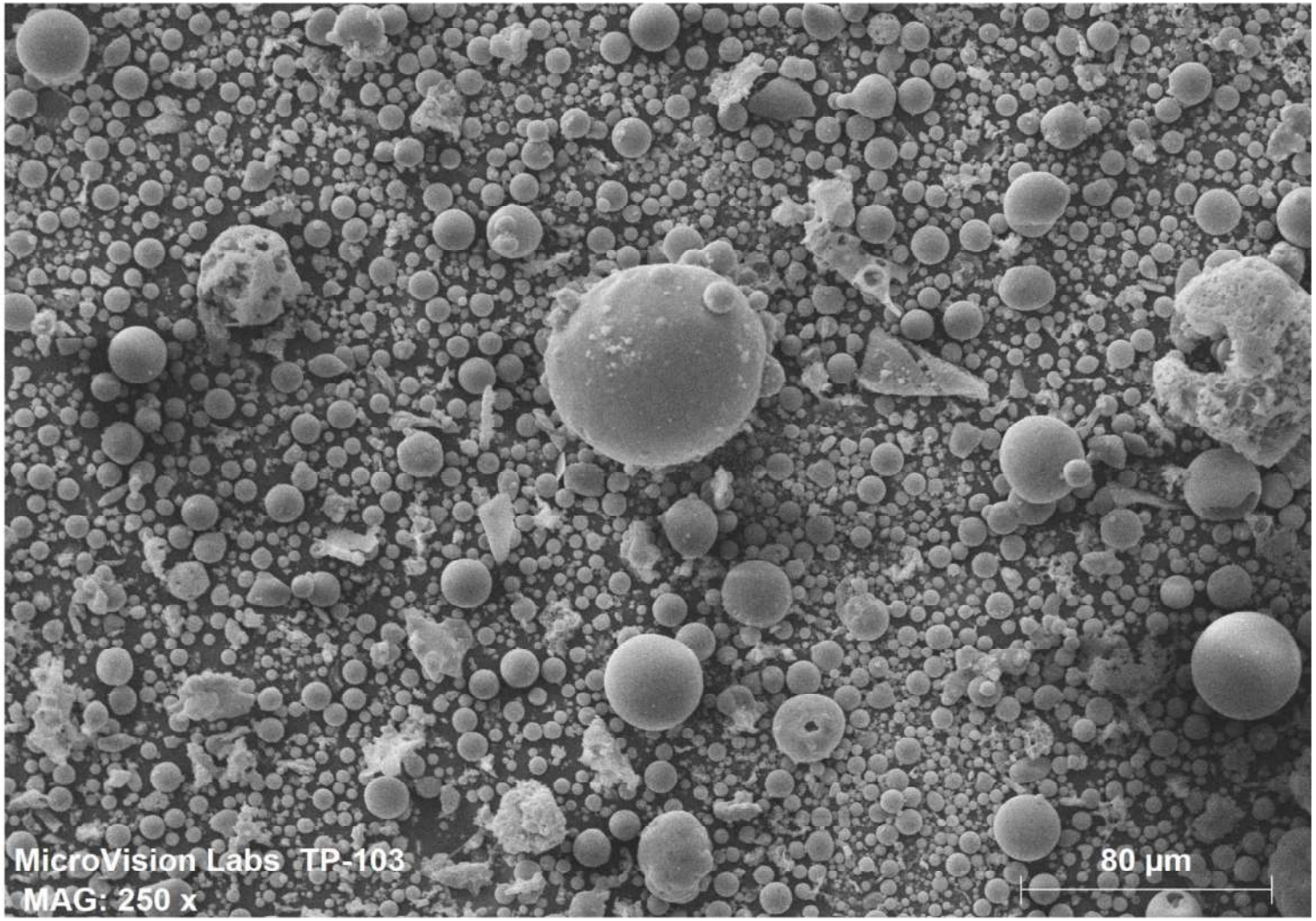
Note:
1. See Appendix J for individual test results.

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	GRAIN SIZE CURVES CLAY-LIKE ALLUVIUM
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 6c

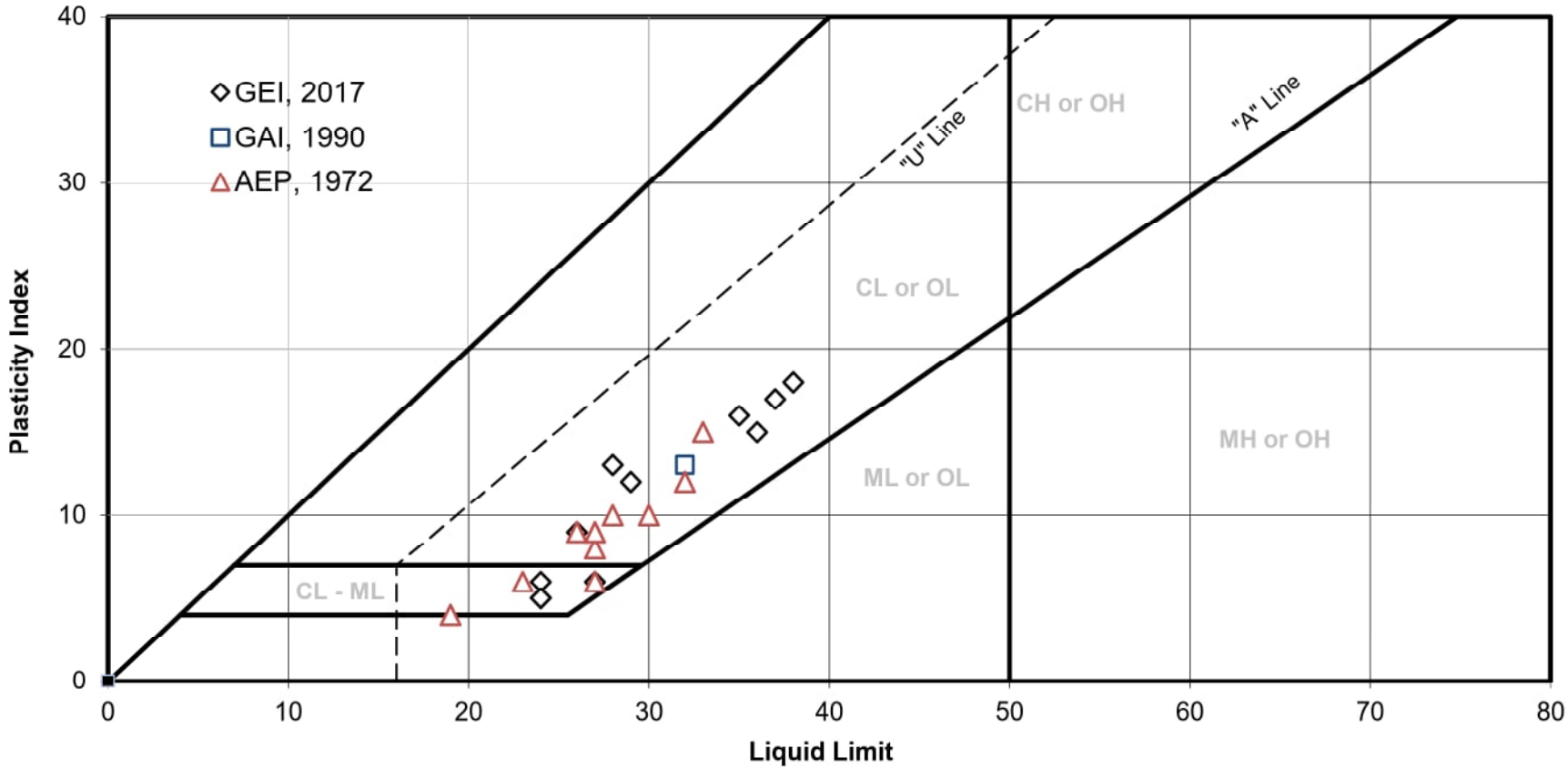


Note:
1. See Appendix J for individual test results.

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	GRAIN SIZE CURVES SAND-LIKE ALLUVIUM
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 6d



Notes: Refer to Appendix J for individual test data.	Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	ELECTRON MICROSCOPE PHOTO SLUICED ASH AT WEST POND
	American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 6e



Notes:
Refer to Appendix J for individual test data.

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

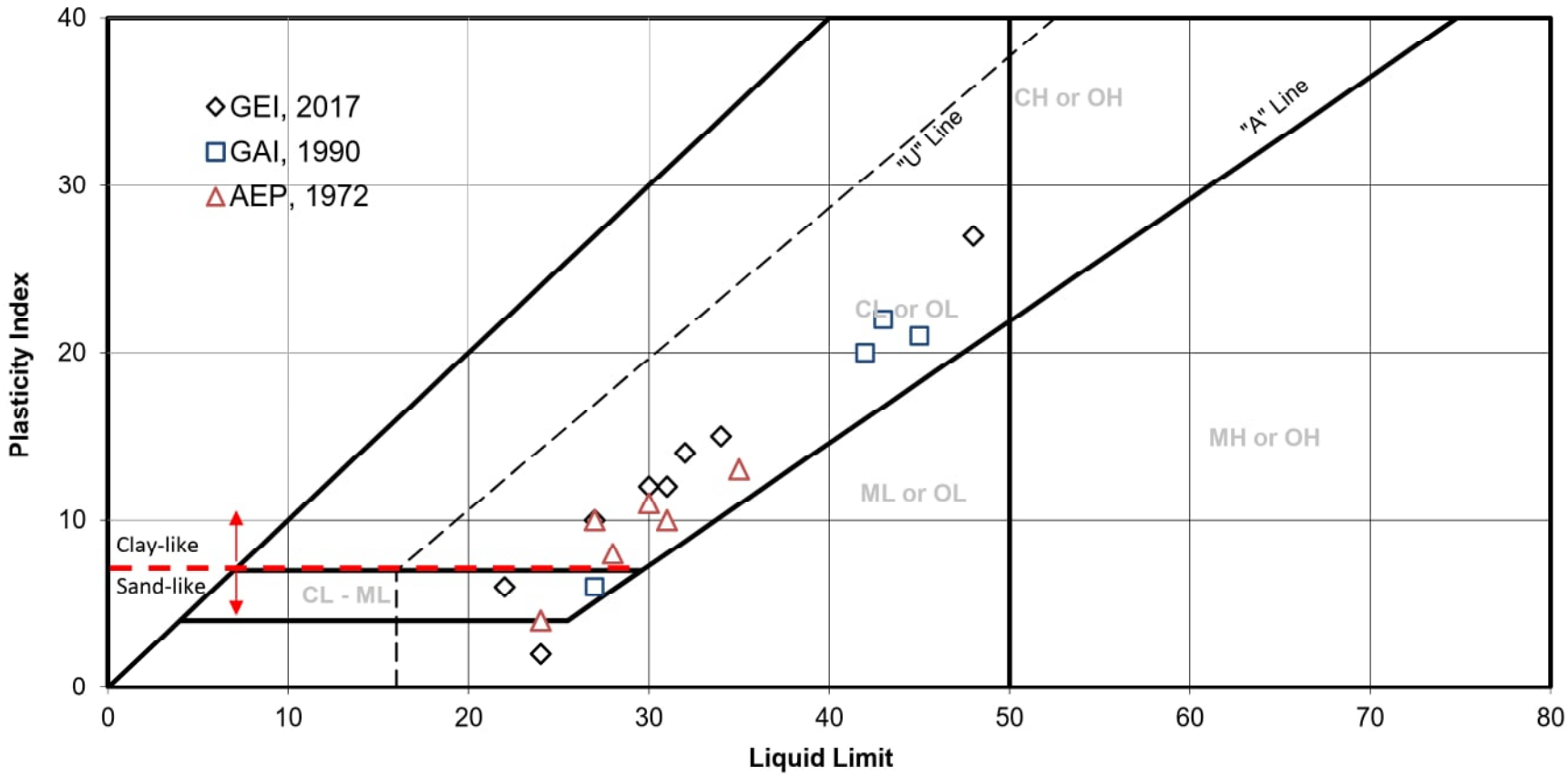
GEI Consultants

Project 1700685

ATTERBERG LIMITS -
CLAY DIKE

August 2018

Fig. 7a



Notes:
Refer to Appendix J for individual test data.

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

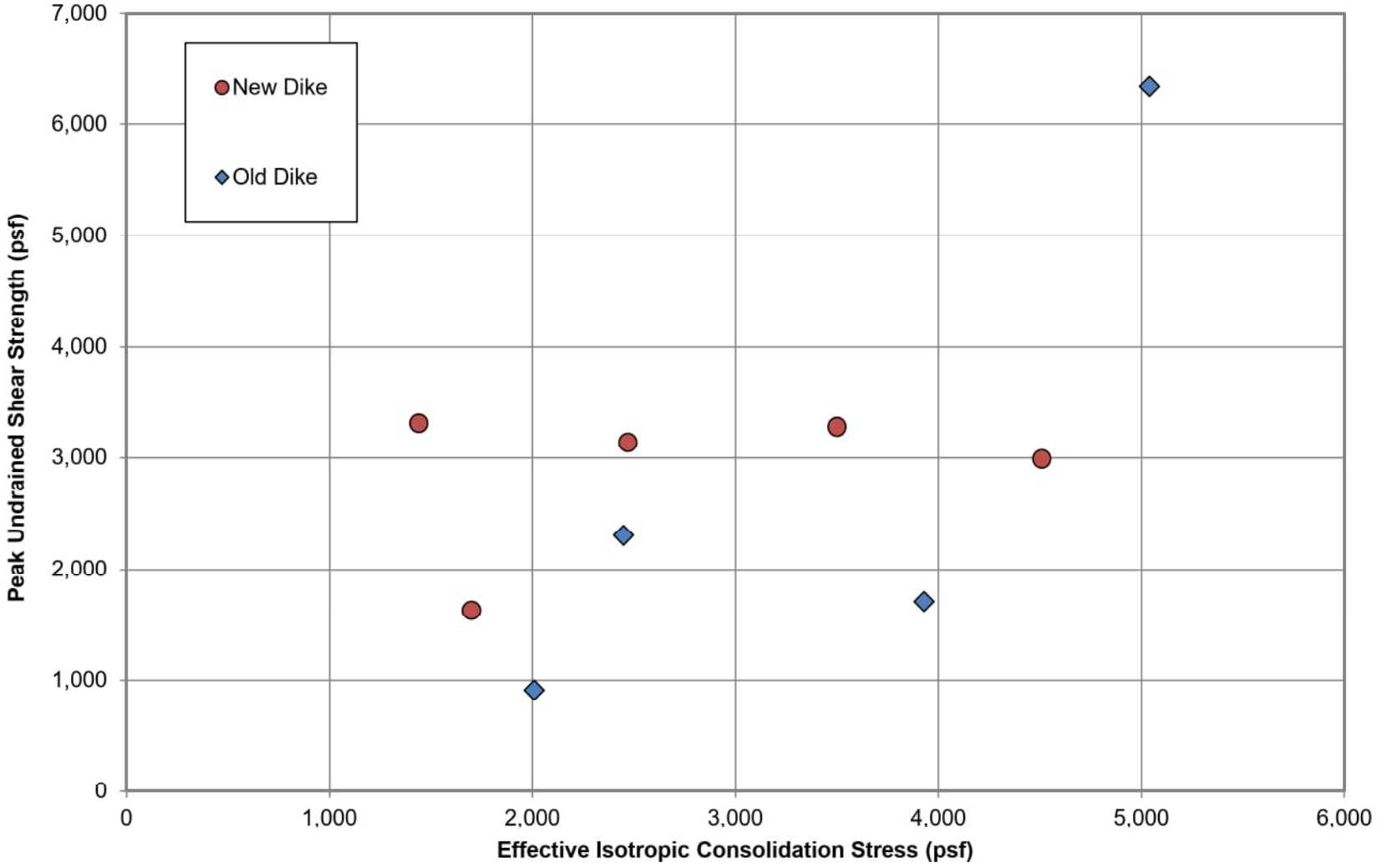
GEI Consultants

Project 1700685

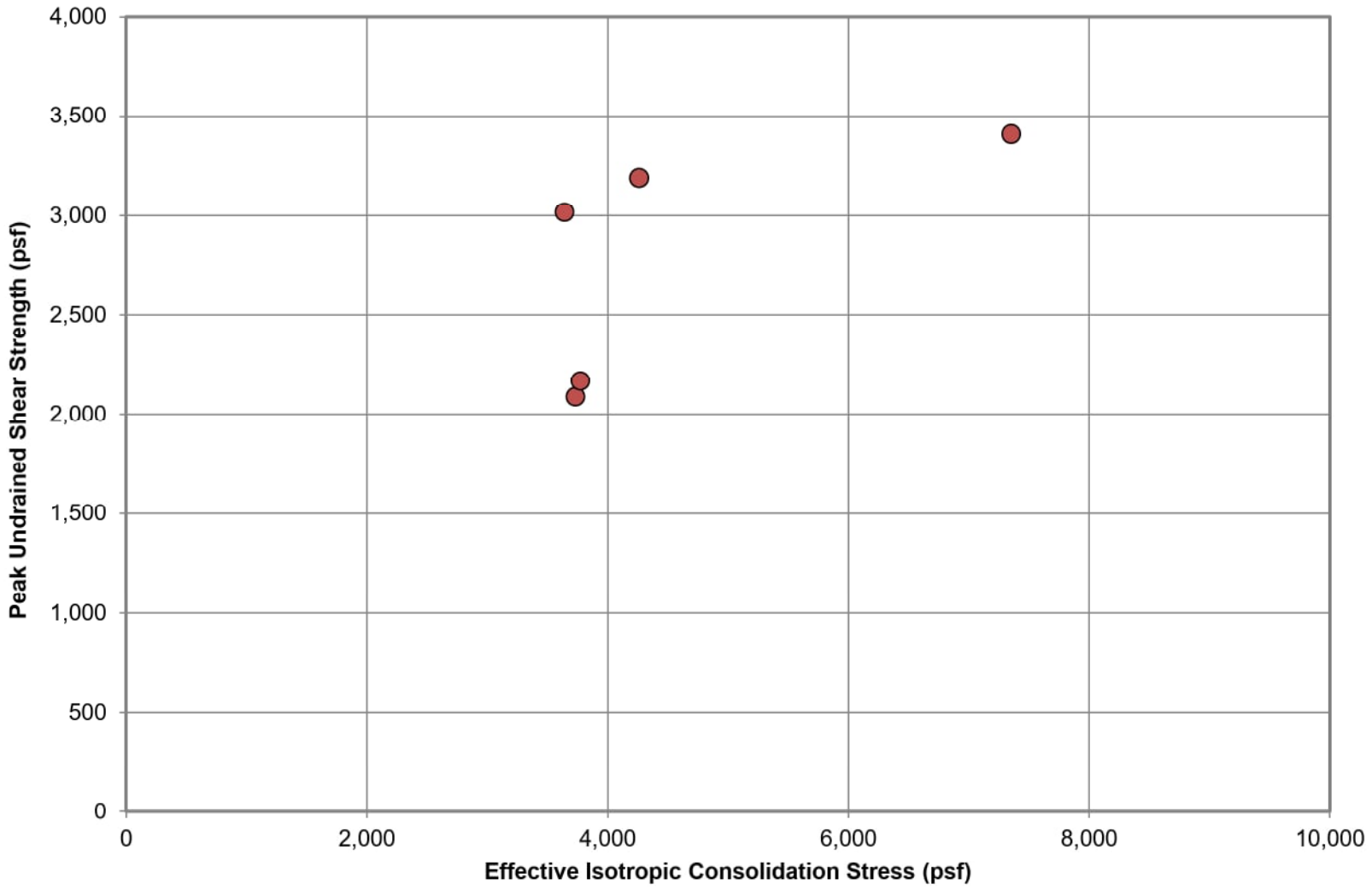
ATTERBERG LIMITS -
ALLUVIUM

August 2018

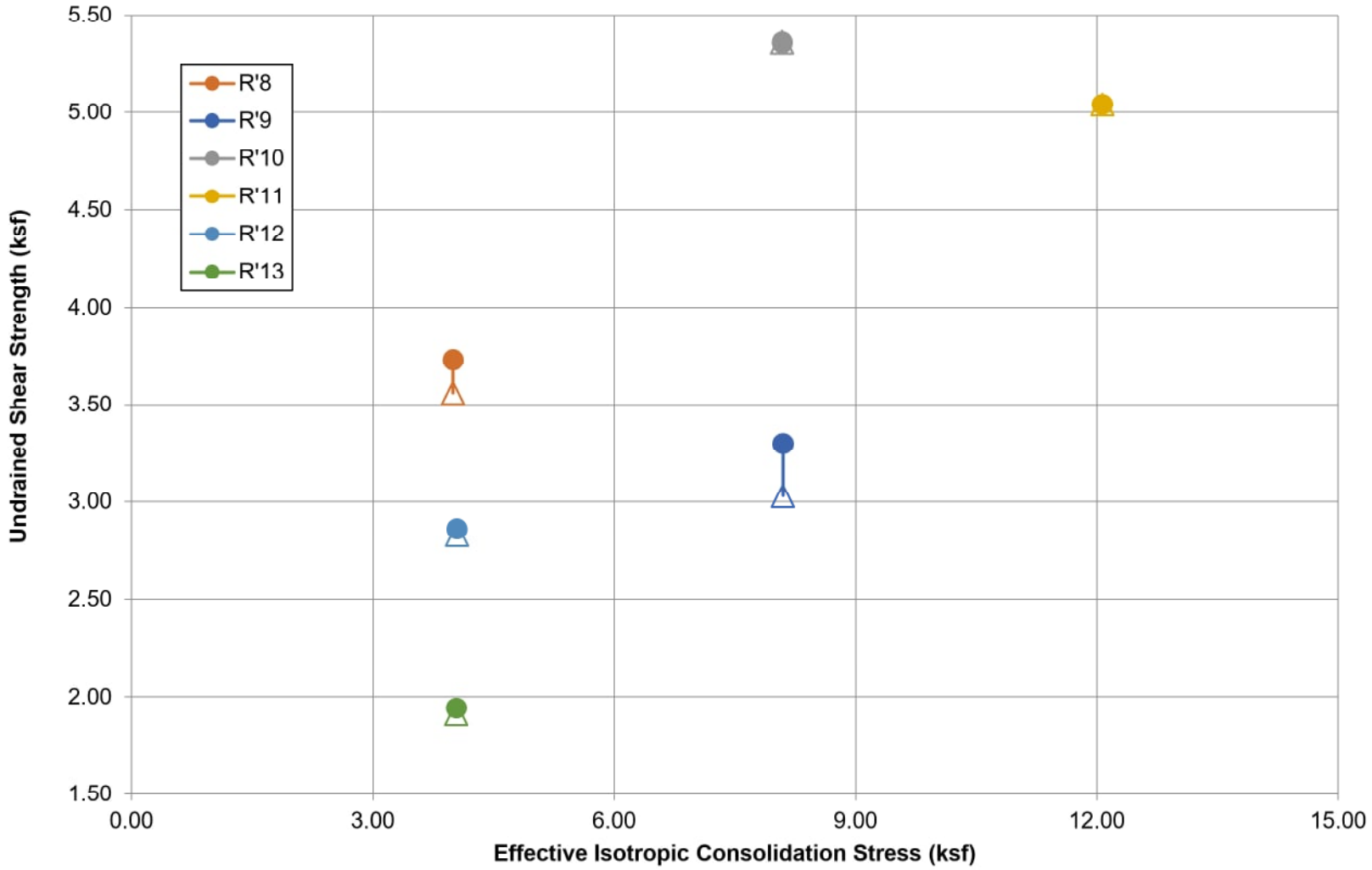
Fig. 7b



Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	UNDRAINED SHEAR STRENGTH CLAY DIKE
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 8

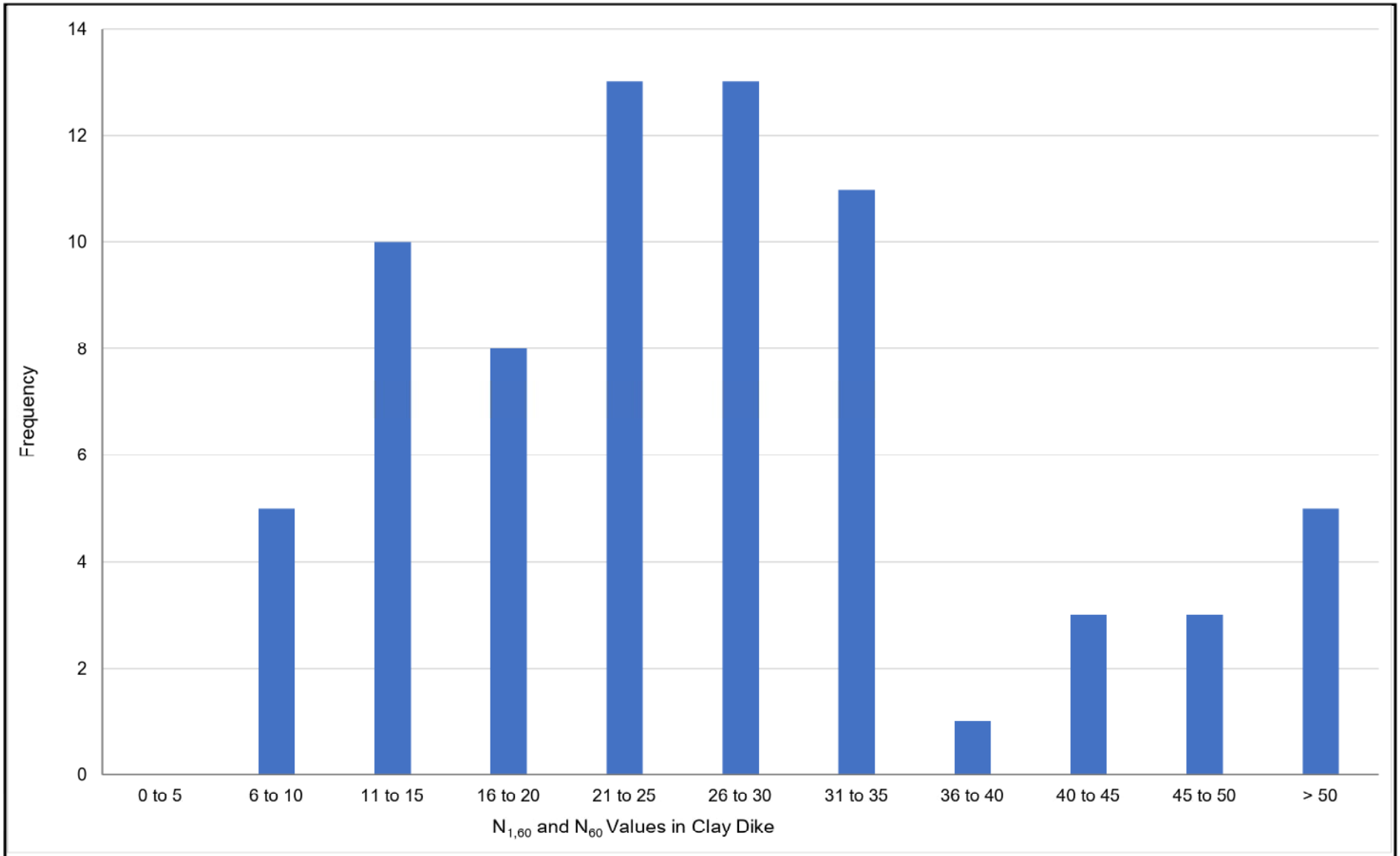


Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	UNDRAINED SHEAR STRENGTH CLAY-LIKE ALLUVIUM
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 9



Note: Solid circles are peak shear strength, q_p. Empty triangles are steady state strength, q_{us}.

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	UNDRAINED SHEAR STRENGTH SLUICED ASH
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. 10



No. of N Values	72
Median	26
Mean	28
Std. Dev	15.6

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

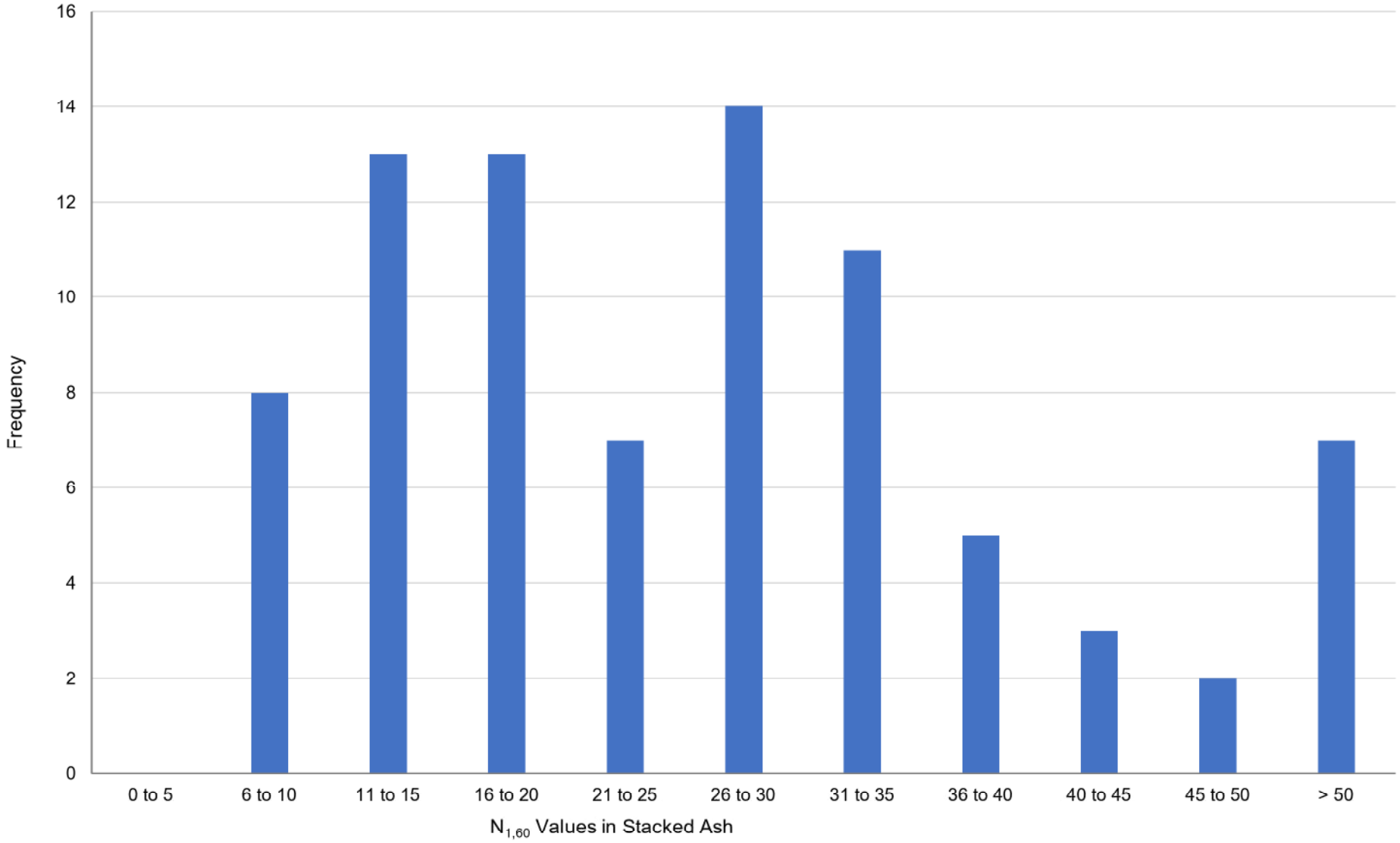
American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CLAY DIKE
N-VALUE HISTOGRAM

August 2018 Figure 11a



No. of N Values	83
Median	26
Mean	28
Std. Dev	16.3

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

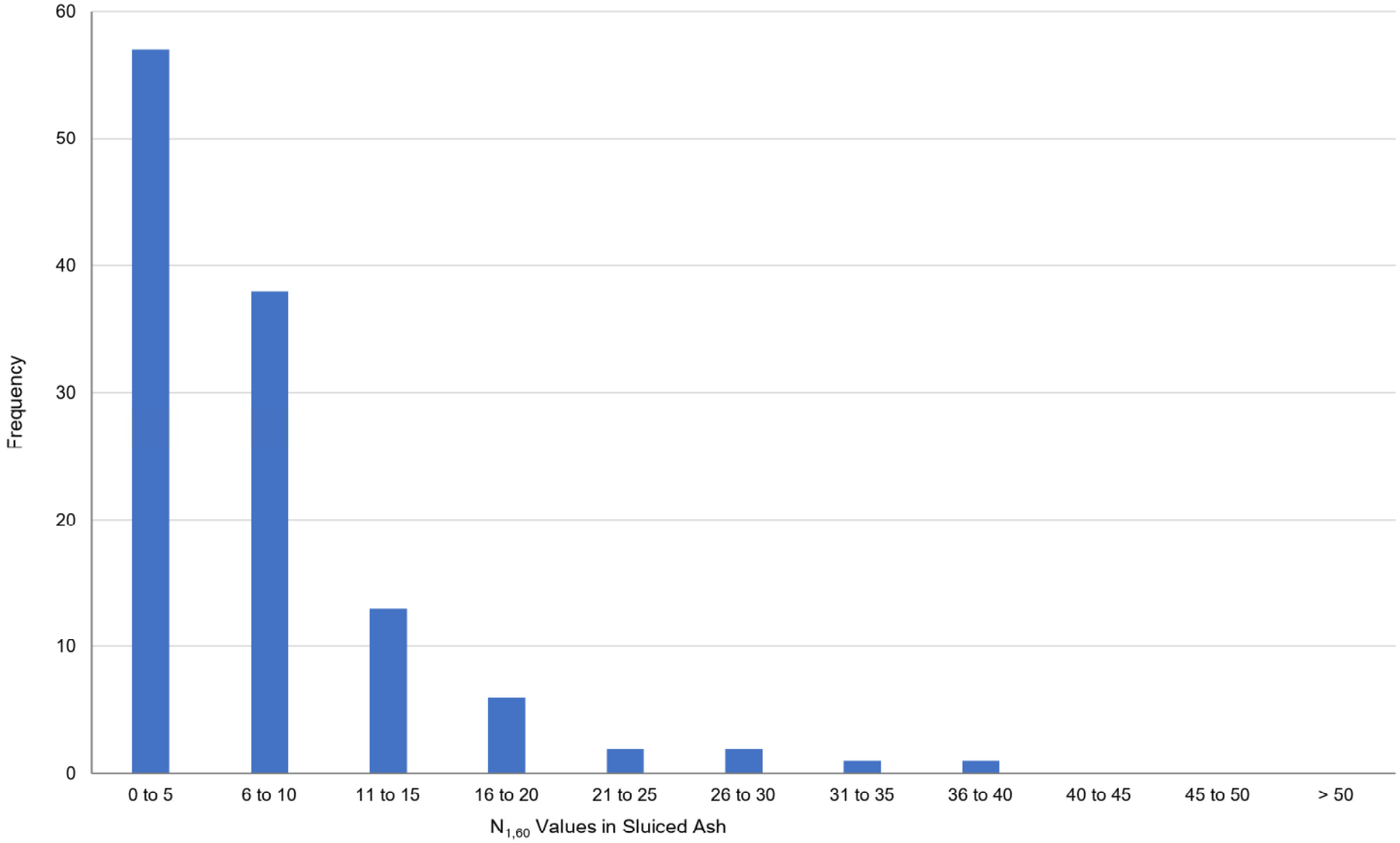
GEI Consultants

Project 1700685

STACKED ASH
N-VALUE HISTOGRAM

August 2018

Figure 11b



No. of N Values	120
Median	2
Mean	5
Std. Dev	6.4

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

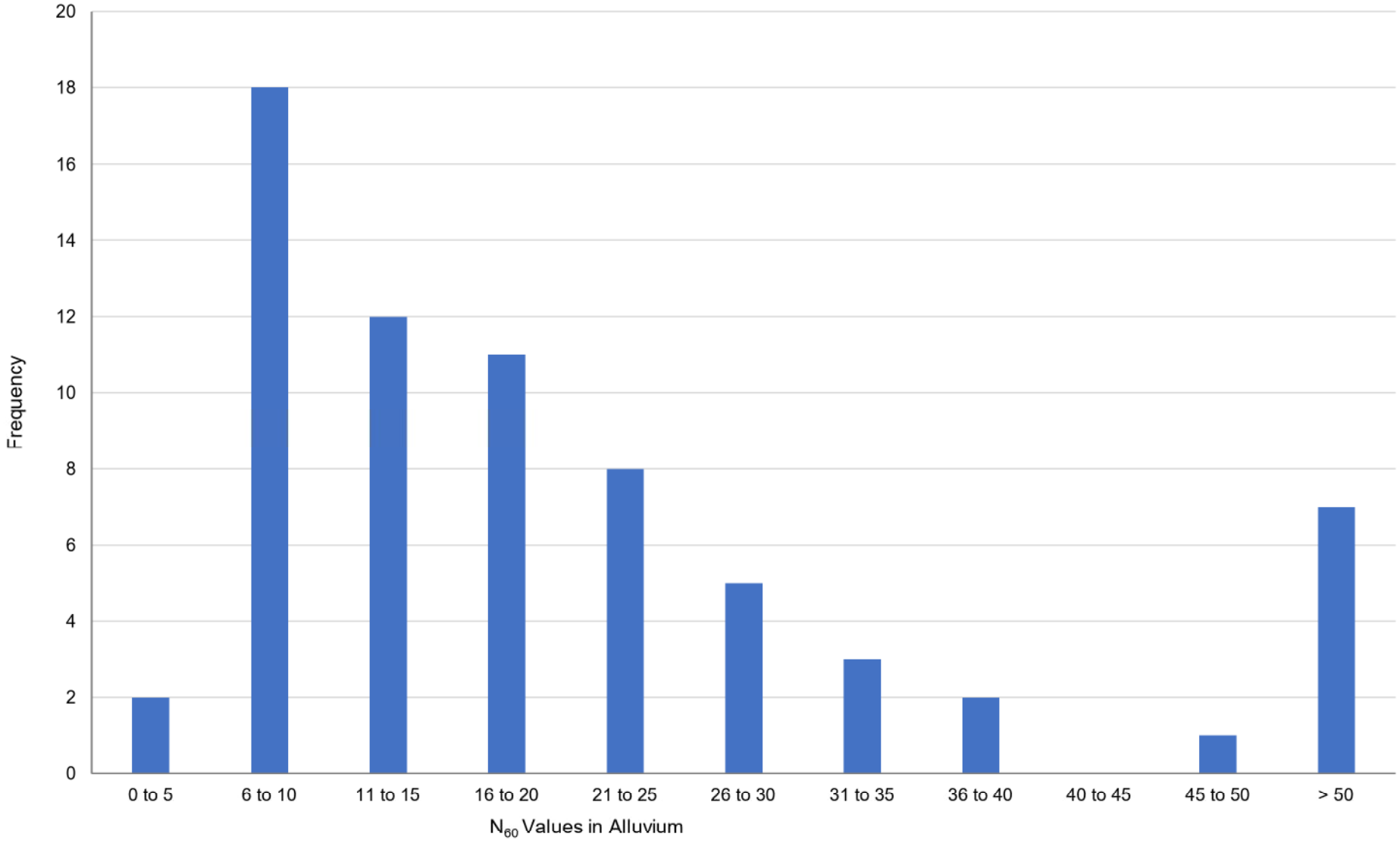
GEI Consultants

Project 1700685

SLUICED ASH
N-VALUE HISTOGRAM

August 2018

Figure 11c



No. of N Values	69
Median	17
Mean	28
Std. Dev	38.5

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

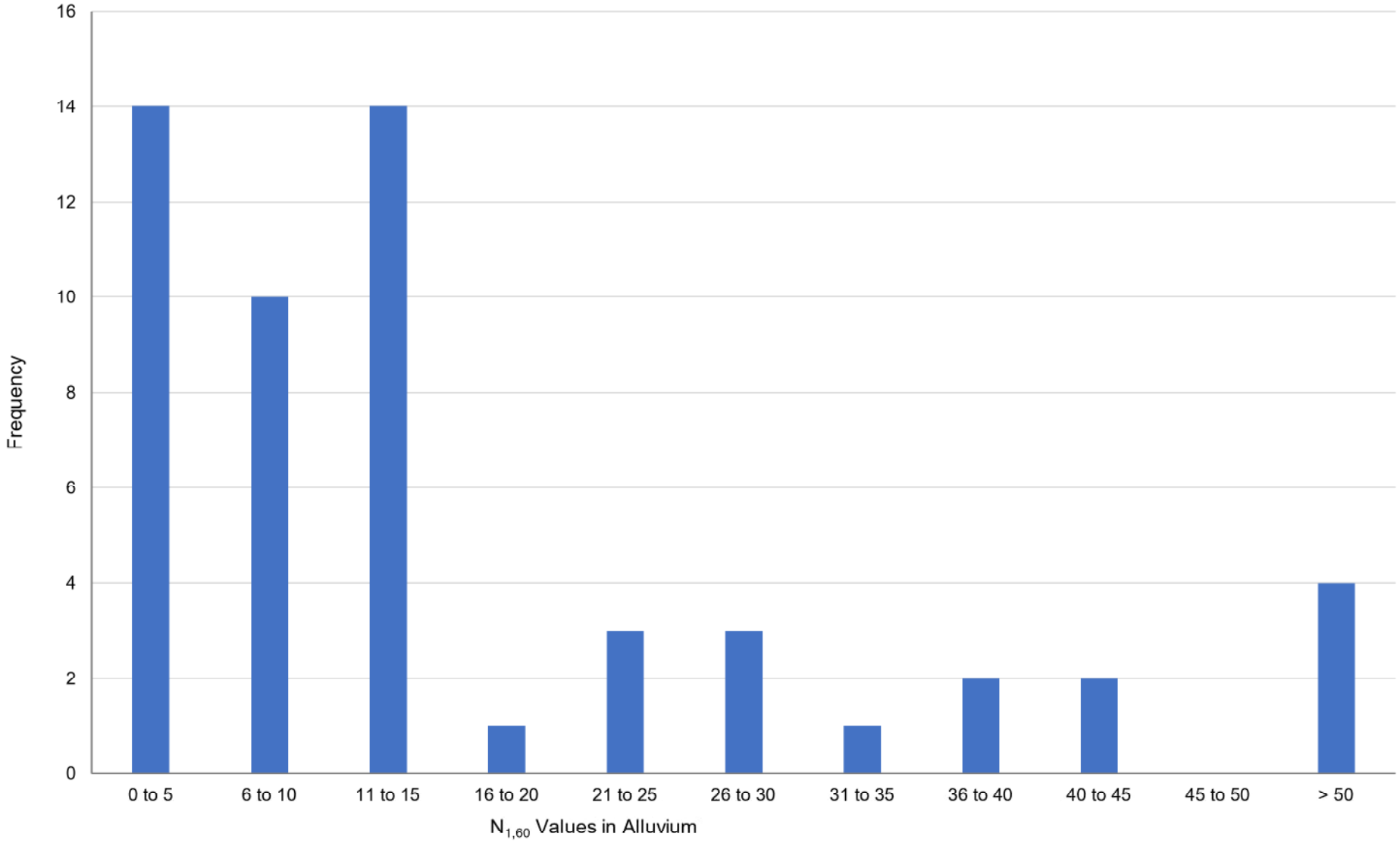
GEI Consultants

Project 1700685

CLAY-LIKE ALLUVIUM
N-VALUE HISTOGRAM

August 2018

Figure 11d



No. of N Values	54
Median	11
Mean	27
Std. Dev	47.9

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

SAND-LIKE ALLUVIUM
N-VALUE HISTOGRAM

August 2018

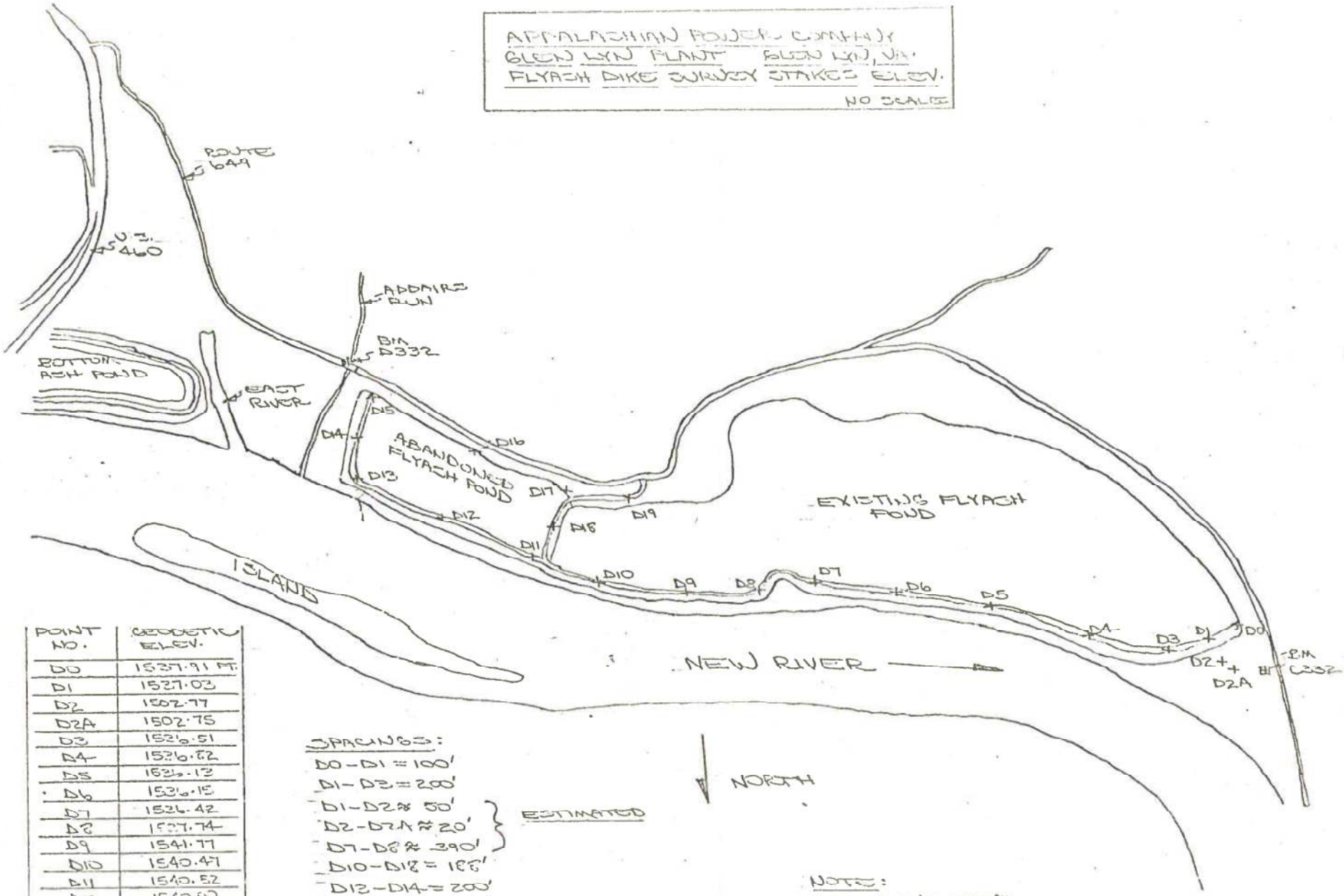
Figure 11e

Appendix D

Historical Boring and CPT Logs 1972-2010

- **1972 Dike Boring Logs – AEP**
- **1990 Boring and Well Installation Logs – GAI Consultants, Inc.**
- **2010 Geotechnical Data Report (Boring Logs) – MACTEC**
- **2010 Presentation of In Situ Testing Program Results (CPT Logs) – by ConeTec for MACTEC**
- **2010 Well Installation Logs – MACTEC**

APPALACHIAN POWER COMPANY
GLEN LYN PLANT GLEN LYN, VA.
FLYASH DIKE SURVEY STAKES ELEV.
NO SCALE



POINT NO.	GEODETIC ELEV.
D0	1537.91 Ft.
D1	1537.03
D2	1502.77
D2A	1502.75
D3	1526.51
D4	1526.62
D5	1526.13
D6	1526.15
D7	1526.42
D8	1537.74
D9	1541.77
D10	1540.47
D11	1540.52
D12	1540.00
D13	1540.19
D14	1541.07
D15	1541.00
D16	1540.12
D17	1541.12
D18	1529.39
D19	1526.72
C332	1519.751 USC&GS

SPACING:
D0 - D1 = 100'
D1 - D2 = 200'
D1 - D2 ≈ 50' } ESTIMATED
D2 - D2A ≈ 20' } ESTIMATED
D7 - D8 ≈ 390' } ESTIMATED
D10 - D12 = 180'
D12 - D14 = 200'
D14 - D15 = 160'
D17 - D18 = 129'
ALL OTHERS = 400'

NOTE:
FOR PLANT DATUM
ADD 2.1 Ft. TO
GEODETIC ELEVS.

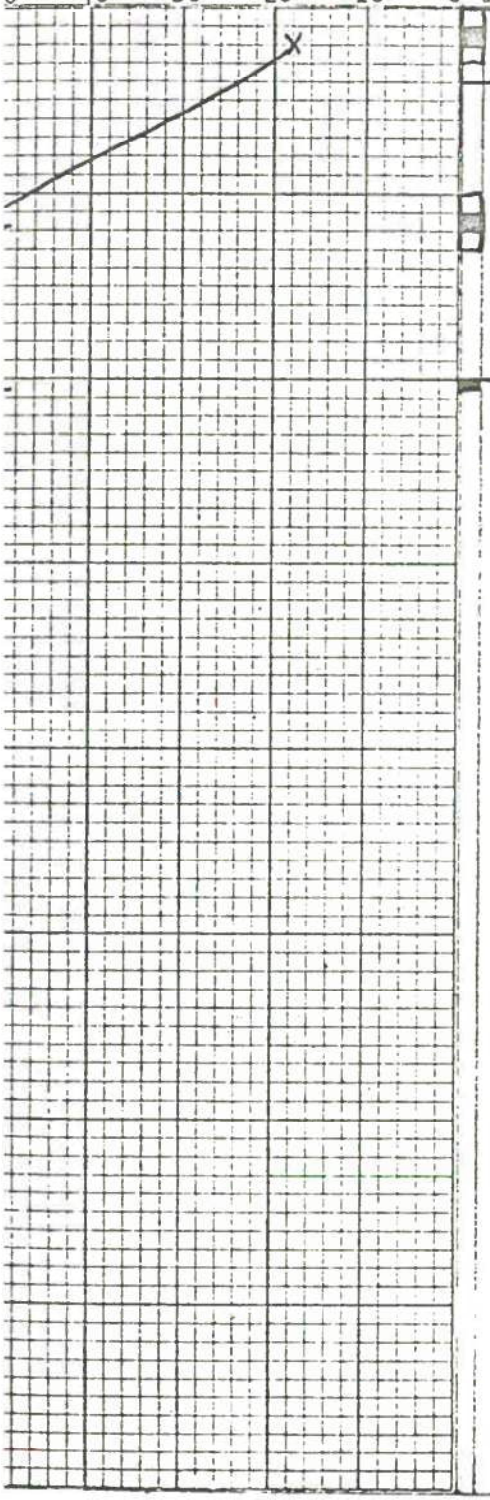
Dwg No. GL-0

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Flyash Dike DATE: April 3, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

BORING NUMBER: D-O ELEVATION: 1537



LOG	DEPTH	SOIL DESCRIPTION
		T O P S O I L
		Reddish brown silty CLAY with rock fragments. Very stiff. Low to medium plasticity. Moist.
	5	CL
	10	Red CLAYSHALE.
		Auger refusal at 10.2'. April 3, 1972

KEY
X Std. Penetration Resistance ("N")
Δ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

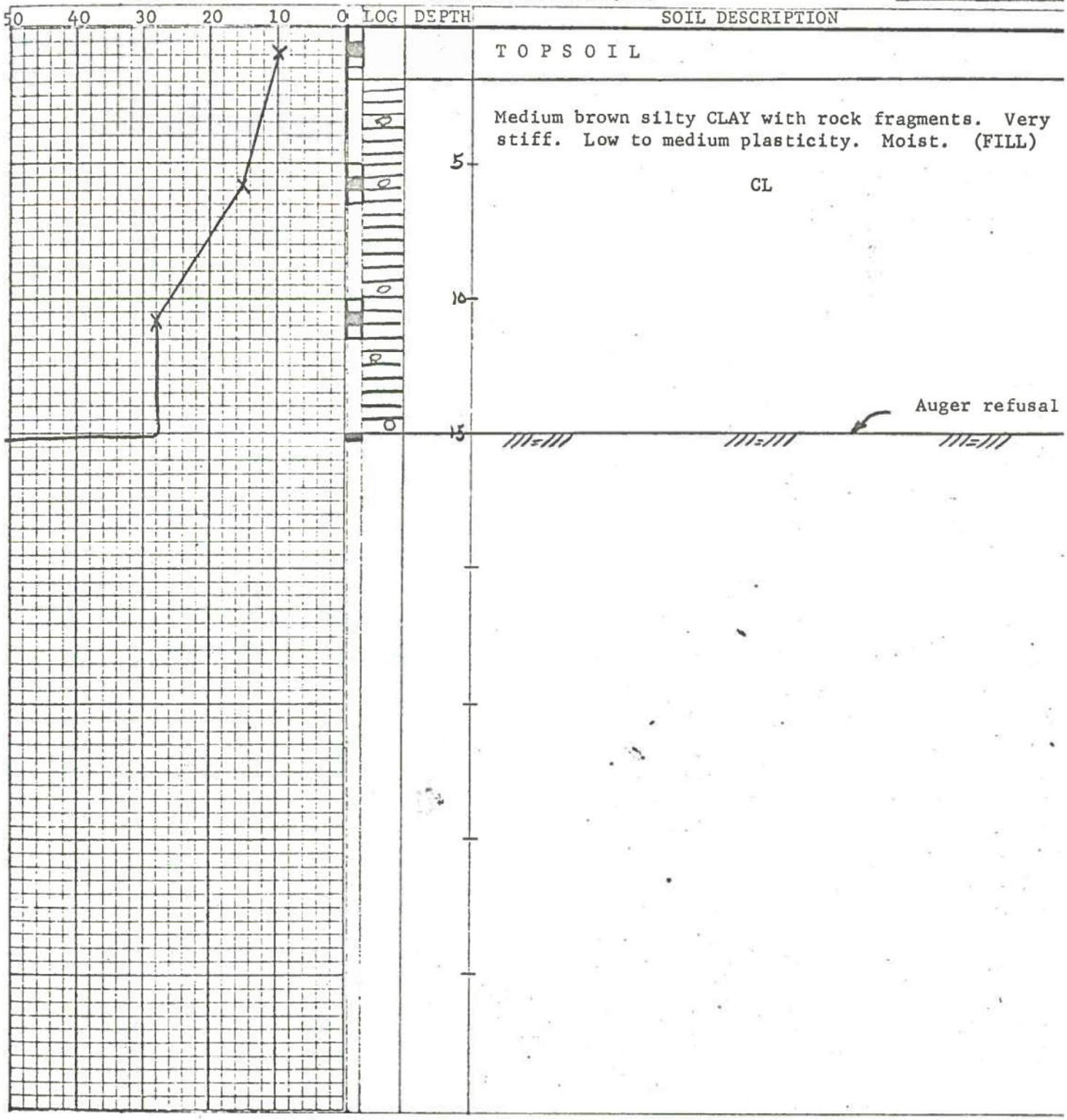
Water Level: Dry Hole
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Flyash Dike DATE: April 3, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-1 ELEVATION: 1532.0



KEY

X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

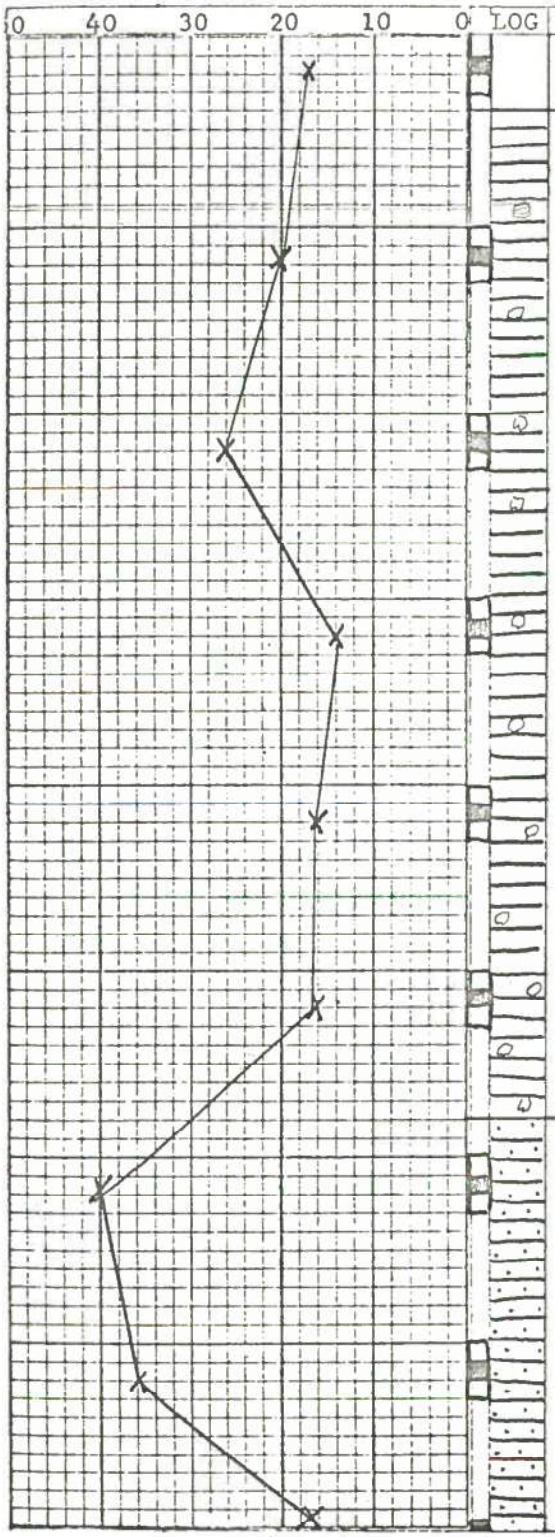
Water Level: Dry Hole
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Flyash Dike DATE: April 5, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-3 ELEVATION: 1530±



SOIL DESCRIPTION

TOPSOIL

Medium brown silty CLAY with rock fragments. Very stiff. Moist. Low to medium plasticity. Some mica (FILL).

CL

Brown sandy CLAY. Very stiff. Low to medium plasticity.

CL

Bottom of boring 41.5'.
April 5, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

Water Level: 13' (2 days after drilling)
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks: Perforated pipe installed

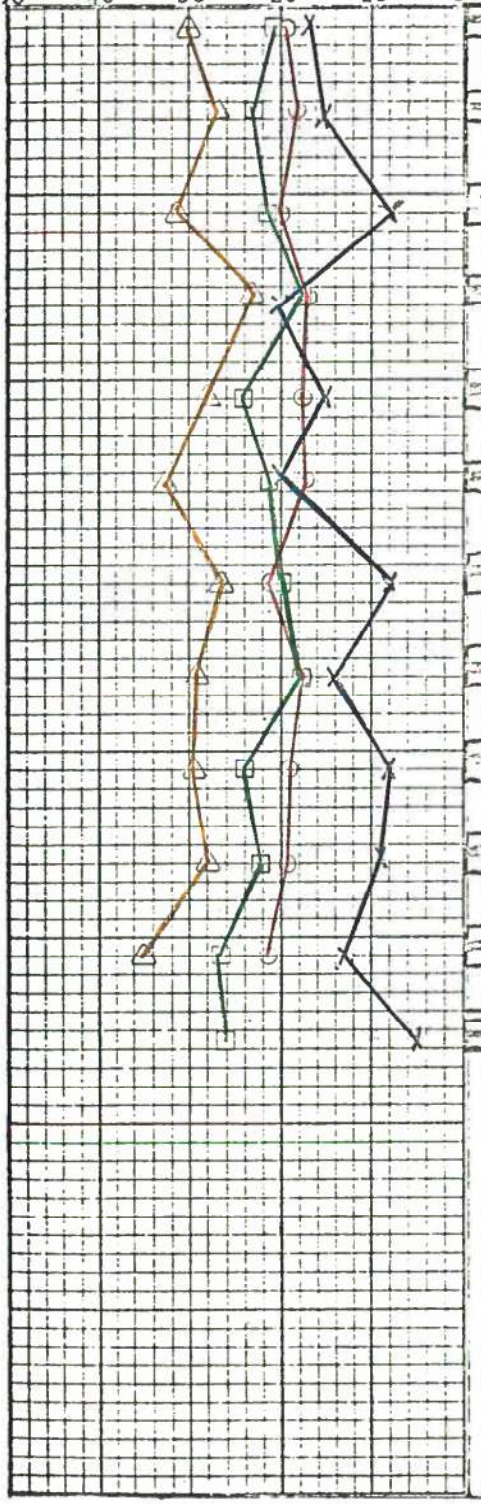
AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 3, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

BORING NUMBER: D-4 ELEVATION: 1536

TEST DATA



LOG	DEPTH	SOIL DESCRIPTION
	10	Medium brown silty sandy CLAY with considerable rock fragments. Moist. Low to medium plasticity. Some mica. (DIKE FILL) Stiff consistency. CL
	20	
	30	
	40	Grayish brown sandy CLAY with occasional rock fragments. Stiff consistency. Low plasticity. ML
	50	
	60	Gray clayey silty fine SAND. Loose. SM SC
		End of boring 56'. April 3, 1972

KEY
- X Std. Penetration Resistance ("N")
- Δ Liquid Limit %
- ⊡ Water Content %
- ⊙ Plastic Limit %

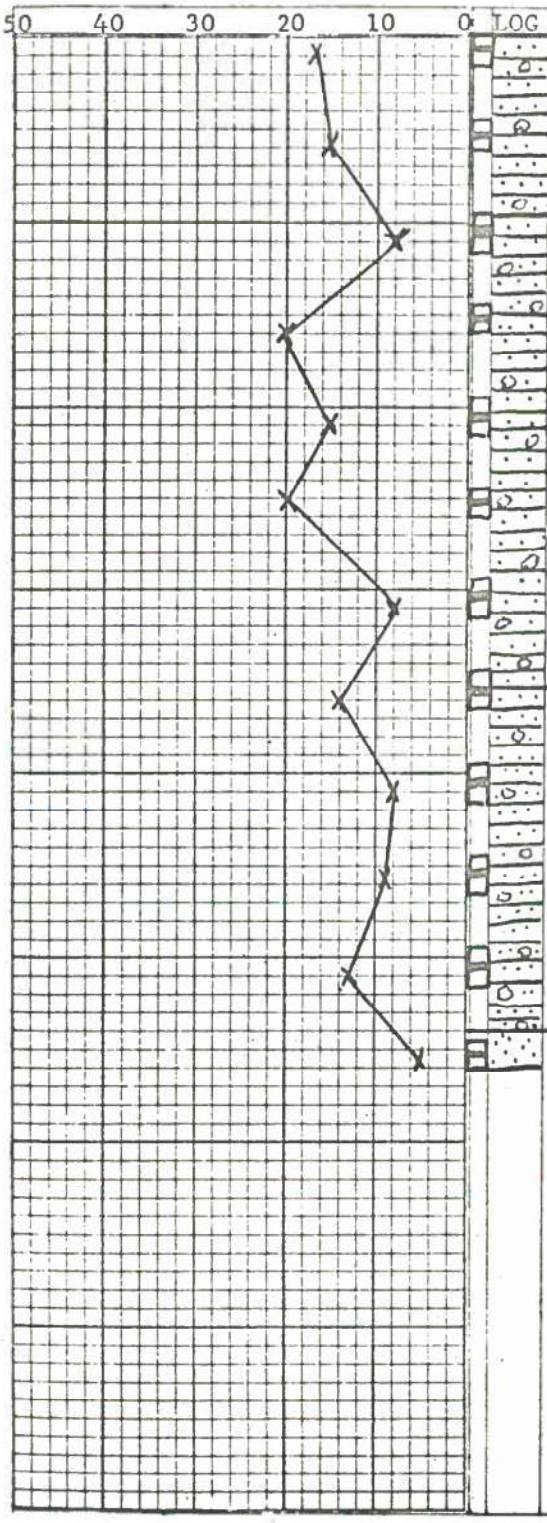
Water Level: Mud drilled.
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 3, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

TEST DATA BORING NUMBER: D-4 ELEVATION: 1531



SOIL DESCRIPTION

Medium brown silty sandy CLAY with considerable rock fragments. Moist. Low to medium plasticity. Some mica. (DIKE FILL) Stiff consistency.

CL

Grayish brown sandy CLAY with occasional rock fragments. Stiff consistency. Low plasticity.

ML

Gray clayey silty fine SAND. Loose.

SM
SC

End of boring 56'.
April 3, 1972

KEY

X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

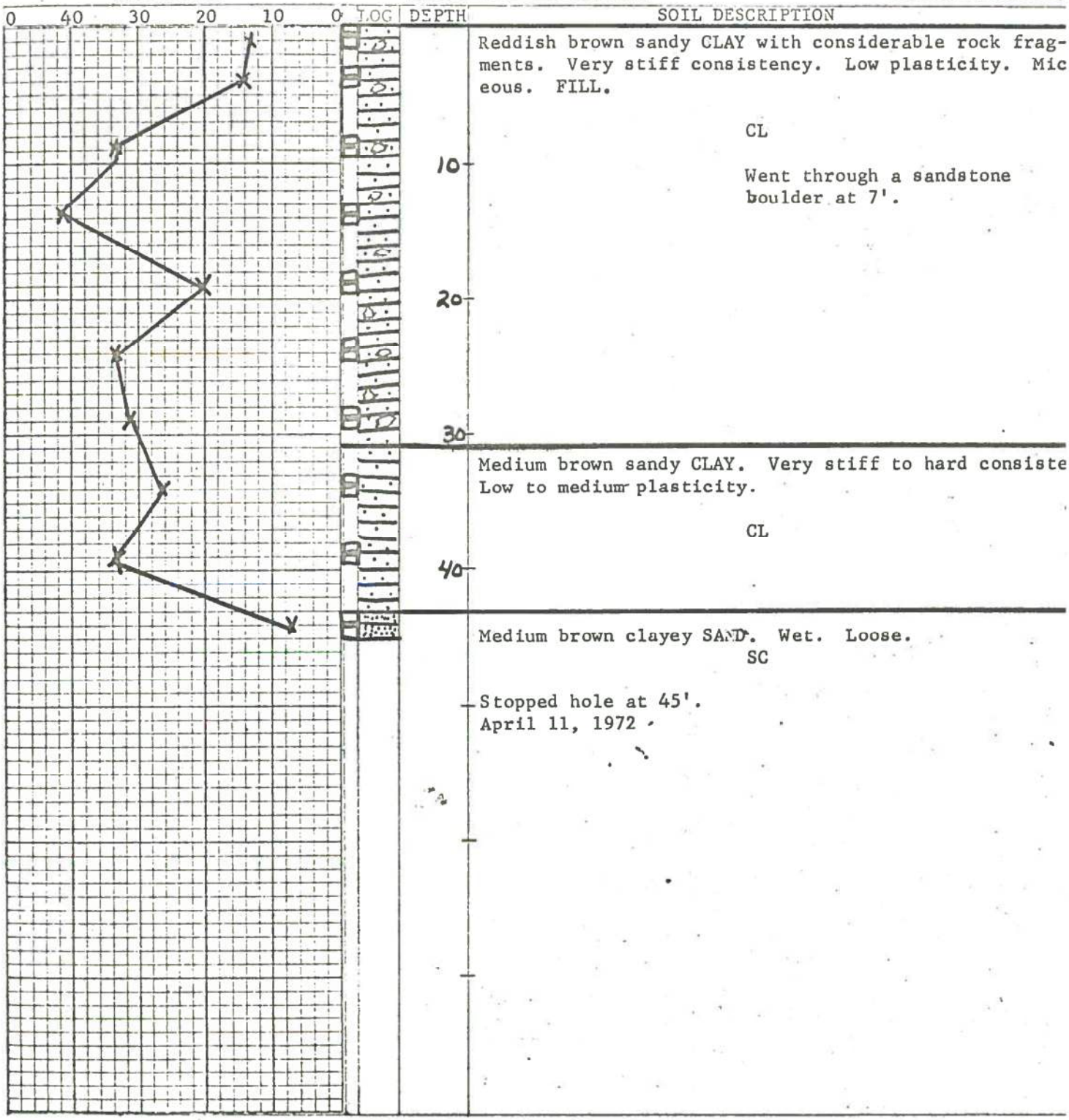
Water Level: Mud drilled.
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Flyash Dike DATE: April 11, 1972

COMPANY: Appalachian Power Co. LOCATION: See Plan

BORING NUMBER: D-5 ELEVATION: 1536



SOIL DESCRIPTION

Reddish brown sandy CLAY with considerable rock fragments. Very stiff consistency. Low plasticity. Micaceous. FILL.

CL

Went through a sandstone boulder at 7'.

Medium brown sandy CLAY. Very stiff to hard consiste Low to medium plasticity.

CL

Medium brown clayey SAND. Wet. Loose.

SC

Stopped hole at 45'.
April 11, 1972

KEY

X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

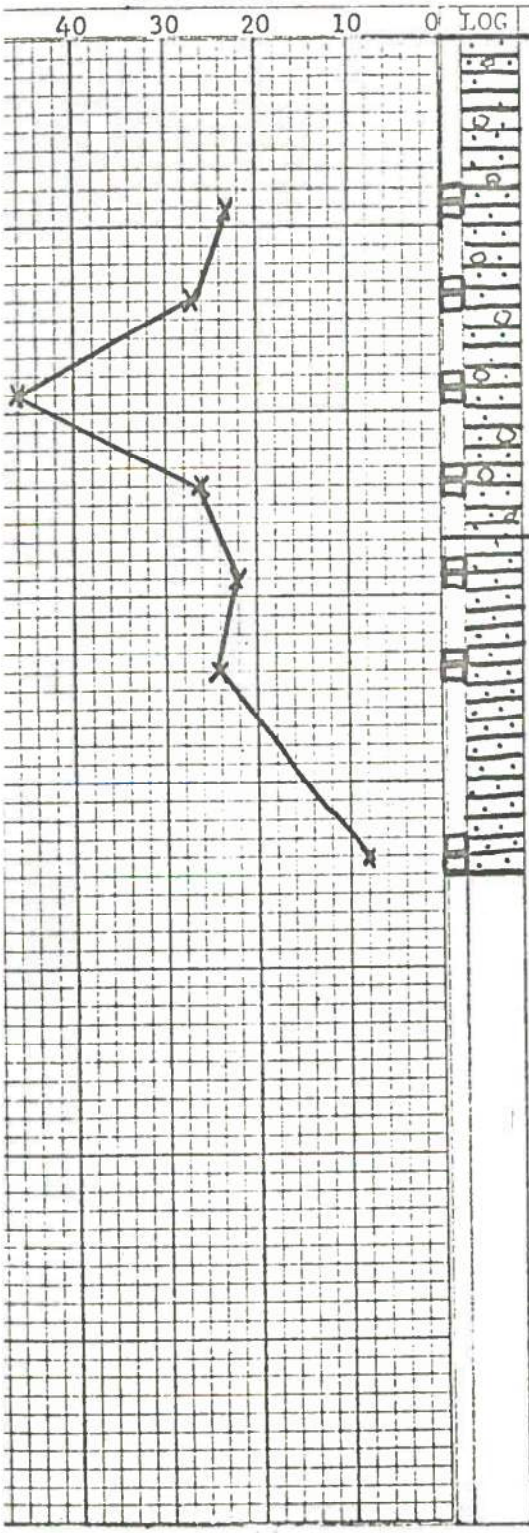
Water Level: 43'
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
CORN MATERIALS LABORATORY
LOG OF BORING

OJECT: Glen Lyn Flyash Dike DATE: April 12, 1972

MPANY: Appalachian Power Company LOCATION: See Plan

BORING NUMBER: D-6 ELEVATION: 1536.2



SOIL DESCRIPTION

Reddish brown sandy CLAY with rock fragments. Very stiff to hard. Low to medium plasticity. (FILL)

CL

Soft clay at 8'.

Attempeed to push Shelby Tubes but there were too many rock fragments and the tubes just bent out ofshape.

With more rock fragments.

Medium brown sandy CLAY with mica. Very stiff grading to stiff with depth. Low plasticity. Moist.

ML

Difficult augering at 35-40'.

Stopped hole at 45'.
April 12, 1972

KEY

X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

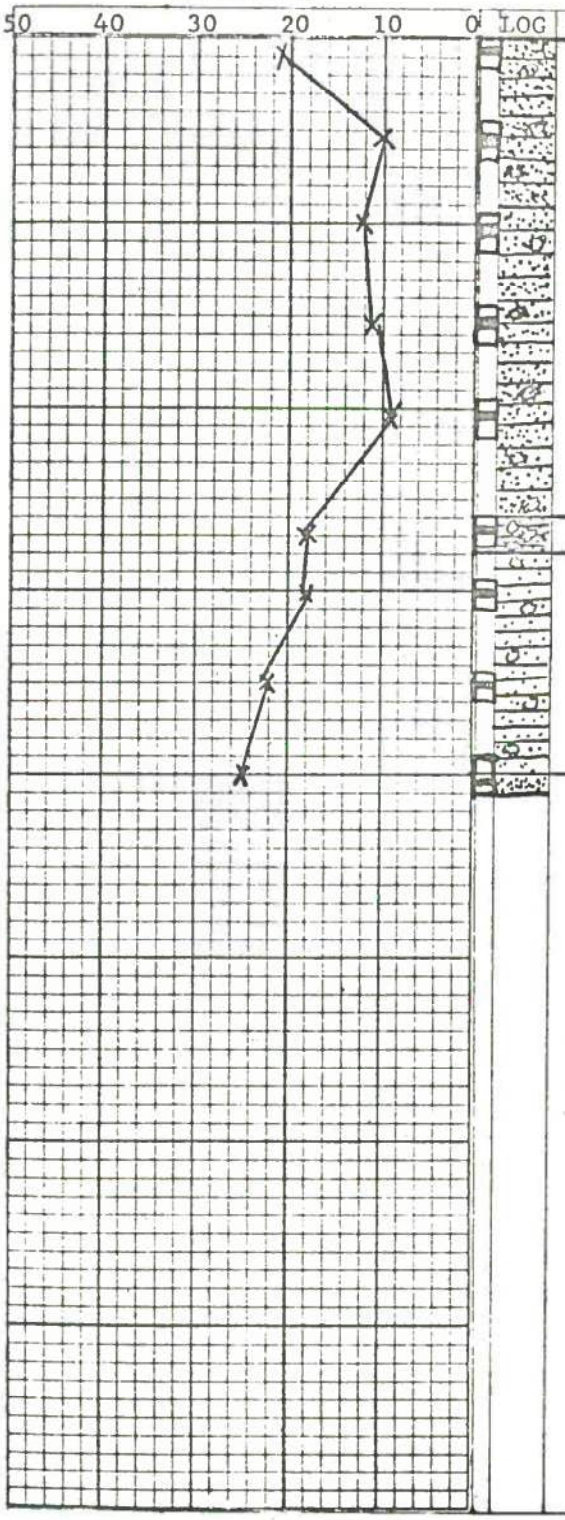
Water Level: 43'
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 4, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER B-7 ELEVATION: 1536



LOG	DEPTH	SOIL DESCRIPTION
		Medium brown sandy silty CLAY with rock fragments. (DIKE FILL) Stiff consistency. Low to medium plasticity. Micaeous. Moist.
		CL
	10	
	20	
		Medium brown silty CLAY with rock fragments. Soft and sticky. Wet.
	30	Medium brown sandy silty CLAY with rock fragments. Low plasticity. Very stiff. Micaeous. Moist.
		CL
	40	Brown silty fine SAND. Medium dense.
		SM
		End of boring 40'. April 4, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

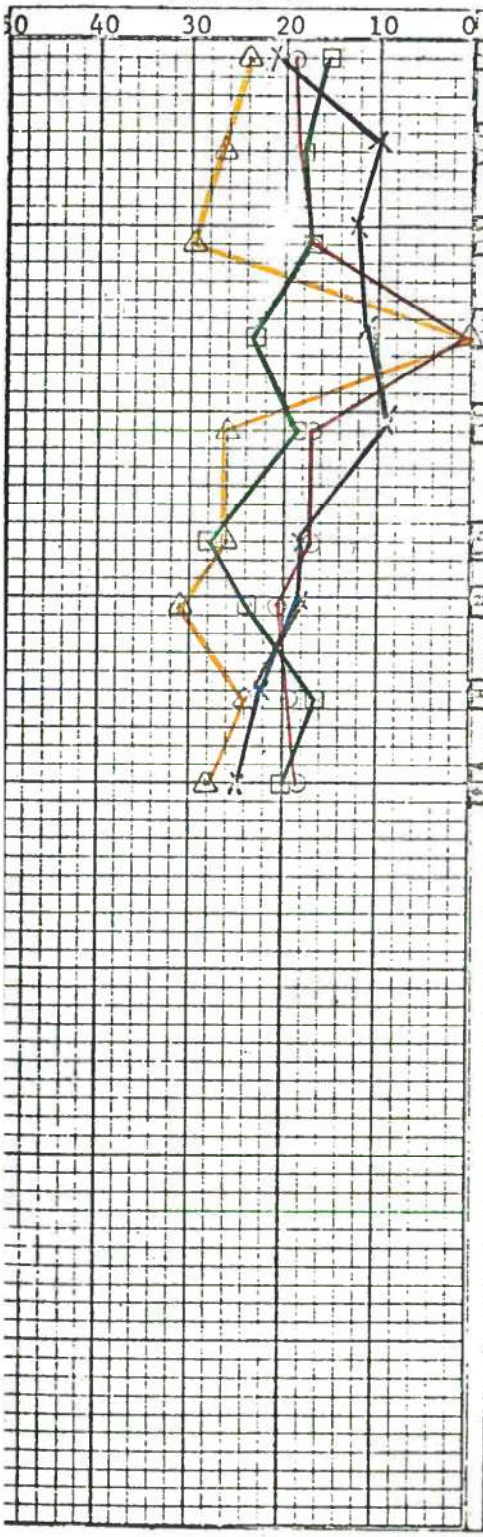
Water Level: Mud drilled.
Drilling Method: Rotary wash with mud slurry.
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 4, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

BORING NUMBER B-7 ELEVATION: 1536



SOIL DESCRIPTION

Medium brown sandy silty CLAY with rock fragments. (DIKE FILL) Stiff consistency. Low to medium plasticity. Micaeous. Moist.

CL

Medium brown silty CLAY with rock fragments. Soft and sticky. Wet.

Medium brown sandy silty CLAY with rock fragments. Low plasticity. Very stiff. Micaeous. Moist.

CL

Brown silty fine SAND. Medium dense.

SM

End of boring 40'.
April 4, 1972

KEY
- Std. Penetration Resistance ("N")
- Liquid Limit %
- Water Content %
- Plastic Limit %

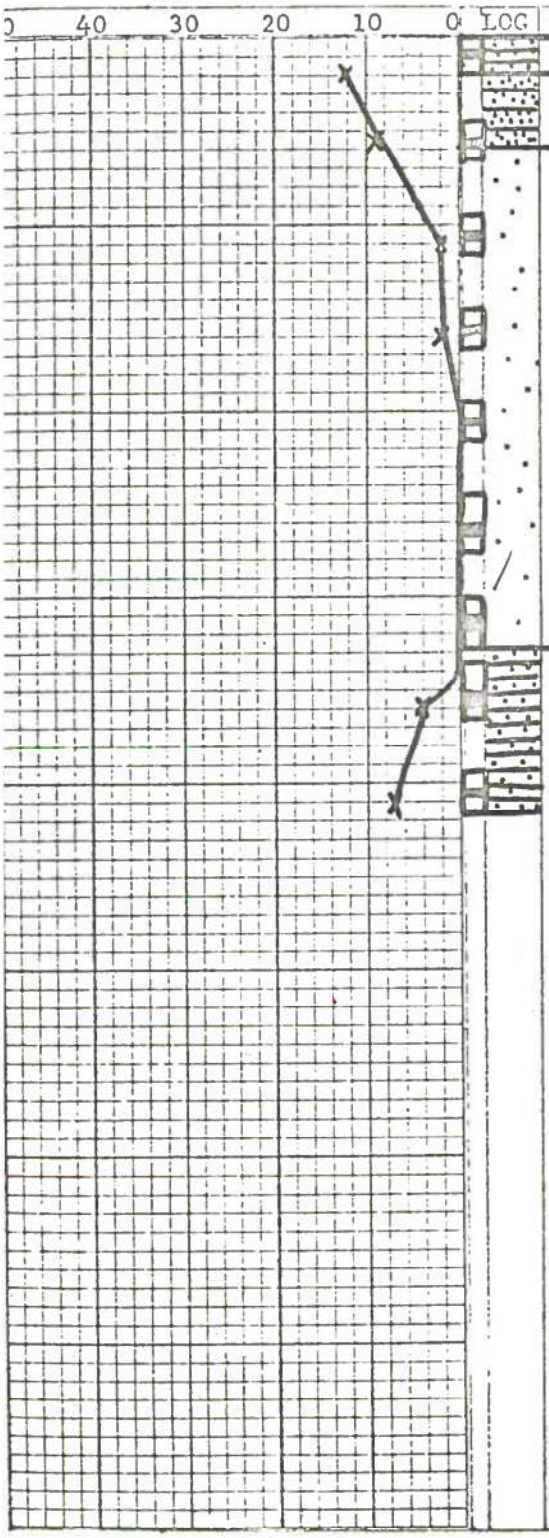
Water Level: Mud drilled.
Drilling Method: Rotary wash with mud slurry.
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 7, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-8 ELEVATION: 1532.?



LOG	DEPTH	SOIL DESCRIPTION
		Dk. brn. sandy organic CLAY with rock frag. TOPSOIL
		Medium brown clayey SAND with mica. Loose.
		SC
		Black FLY ASH. Very loose.
	10	
	20	
	30	
		Medium brown sandy CLAY. Soft to medium consistency. Low to medium plasticity. Some mica.
	40	CL
		End of boring 41.5'. April 11, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

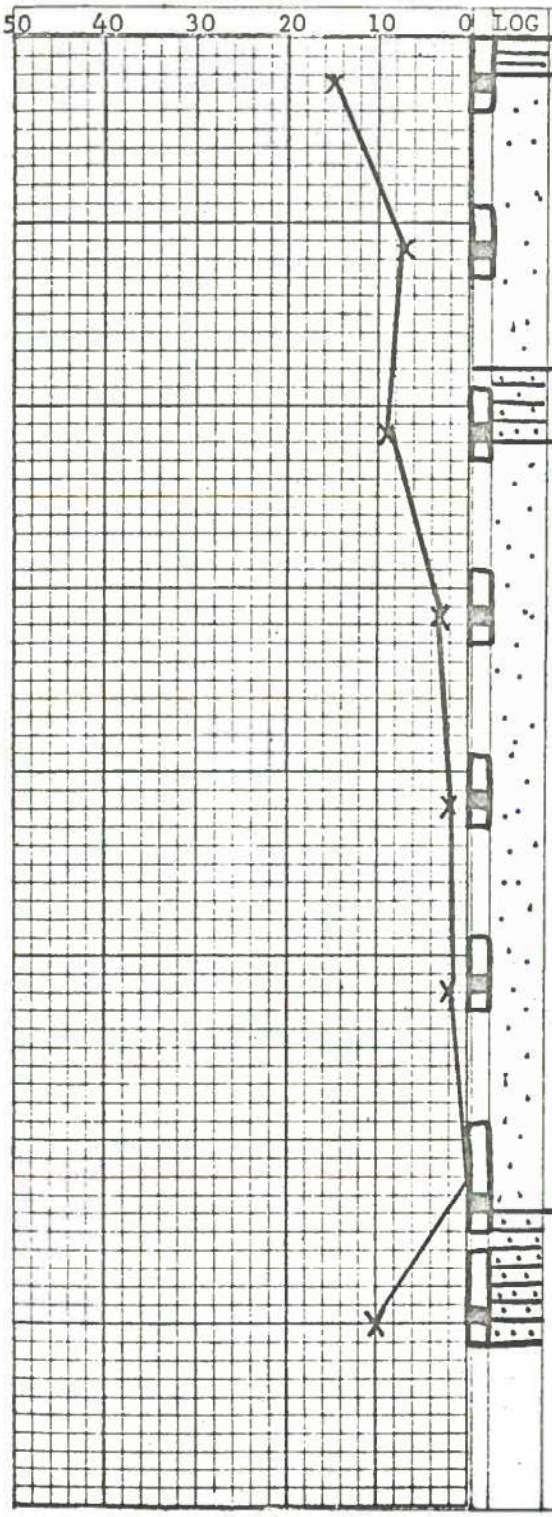
Water Level: 14.5'.
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: March 30, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-9 ELEVATION: 1541.2



LOG	DEPTH	SOIL DESCRIPTION
		Medium brown sandy CLAY. Very stiff.
	5	Black FLY ASH. (Placed) ML
	10	Medium brown sandy CLAY. Very stiff. CL
	15	Black FLY ASH. (Sluiced) Very loose. ML
	20	
	25	
	30	
	35	Medium brown clayey SAND. (Impervious) Micaeous. Medium dense. SC
		Stopped hole at 35.5'. March 30, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

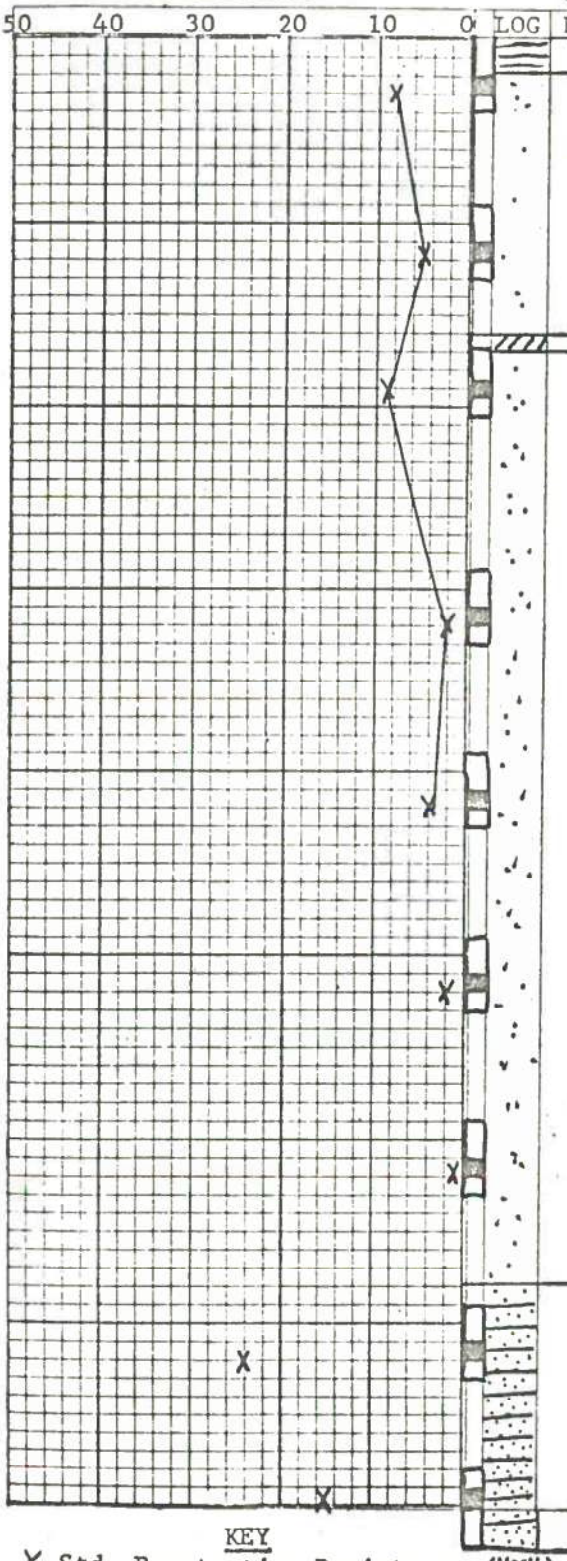
Water Level: 24'
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 6, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

TEST DATA BORING NUMBER: D-10 ELEVATION: 154



LOG	DEPTH	SOIL DESCRIPTION
		4" of medium brown CLAY.
	5	Black FLY ASH. Loose. ML
		Medium brown CLAY - 4 inches
	10	Black FLY ASH. Loose. ML
	15	
	20	
	25	
	30	
	35	Brown clayey fine to medium SAND. Medium dense. Compact. Some mica. SC
	40	End of hole 41.5'. April 6, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

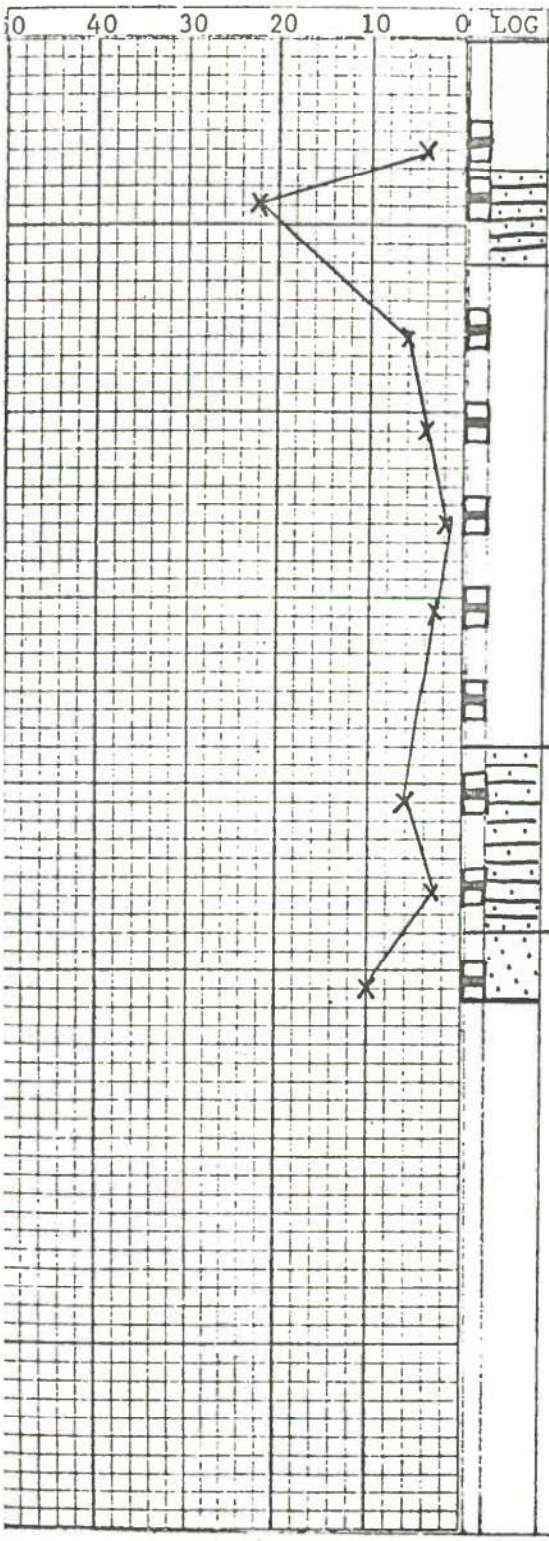
Water Level: 26.5'.
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: March 29, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

BORING NUMBER: D-11 ELEVATION: 1540.5



SOIL DESCRIPTION

Black FLYASH (placed).

ML

Brownish-gray sandy CLAY. Very stiff in consistenc
Low plasticity.

ML

Black FLYASH. Very loose.

ML

Lost tub of drilling mud at 38.5'.

Medium brown very sandy CLAY. Medium stiff.

ML
SC

Brown medium SAND. Medium dense.

SP

End of boring 51.5'.
March 30, 1972

KEY

X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

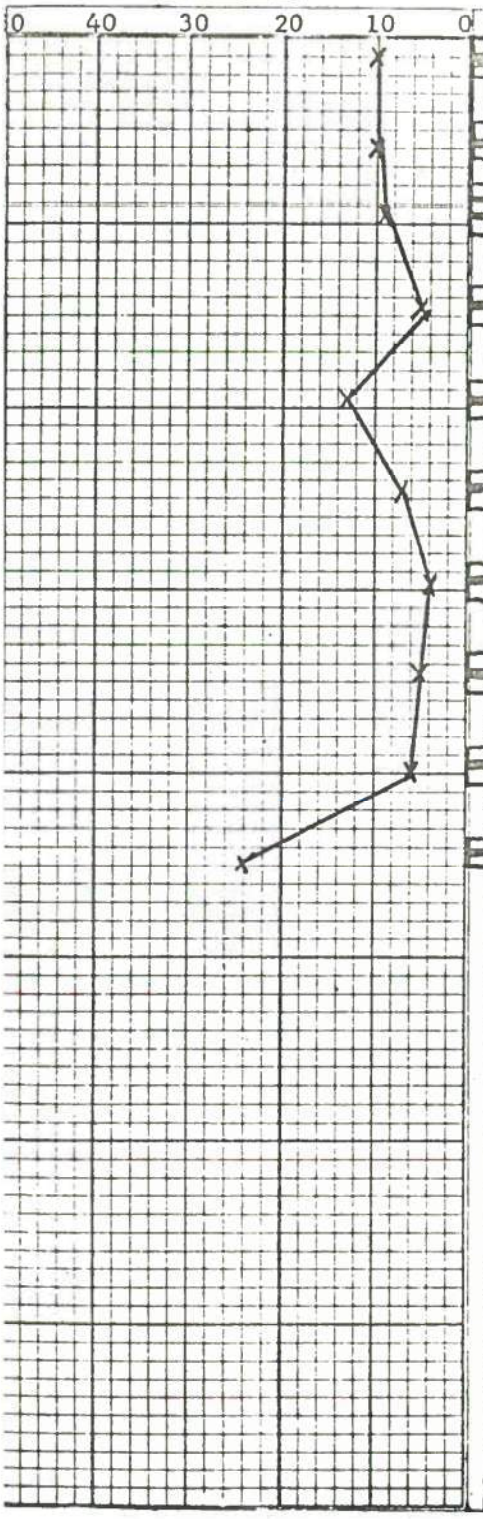
Water Level: 24'
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Plant Dike DATE: March 29, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-12 ELEVATION: 1540



LOG	DEPTH	SOIL DESCRIPTION
		Black FLYASH
		6" medium brown clayey SAND.
		Black FLYASH (Loose)
		6" of Medium brown clayey SAND.
	10	Black FLY ASH. Loose to very loose. ML
	20	
	30	
	40	Medium brown very sandy CLAY. (Impervious) Stiff. ML SC With rock fragments.
		End of boring 45'. March 29, 1972
	50	

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

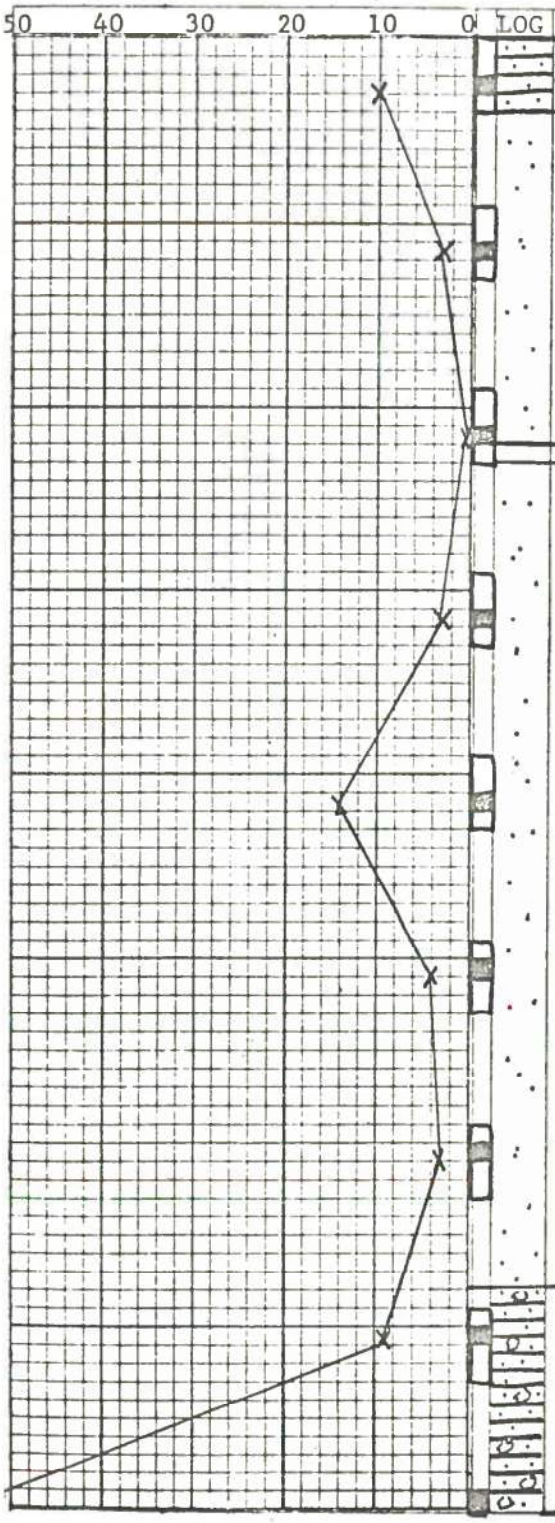
Water Level: 28.5'.
Drilling Method: Rotary wash with mud slurry.
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 5, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

TEST DATA BORING NUMBER: D-13 ELEVATION: 1540



LOG	DEPTH	SOIL DESCRIPTION
		22" of medium brown CLAY with some sand. CL
		Black FLY ASH. Very loose.
	5	
		Complete loss of drilling mud at 10'. Unable to hold hole open. Drove 15' of casing.
	10	4" Medium brown sandy CLAY.
		Black FLY ASH. Very loose. ML
	15	
	20	
	25	
	30	
	35	Brown very sandy CLAY with rock fragments. Stiff. ML
		End of boring 40.4'. April 5, 1972
	40	Red clay shale.

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

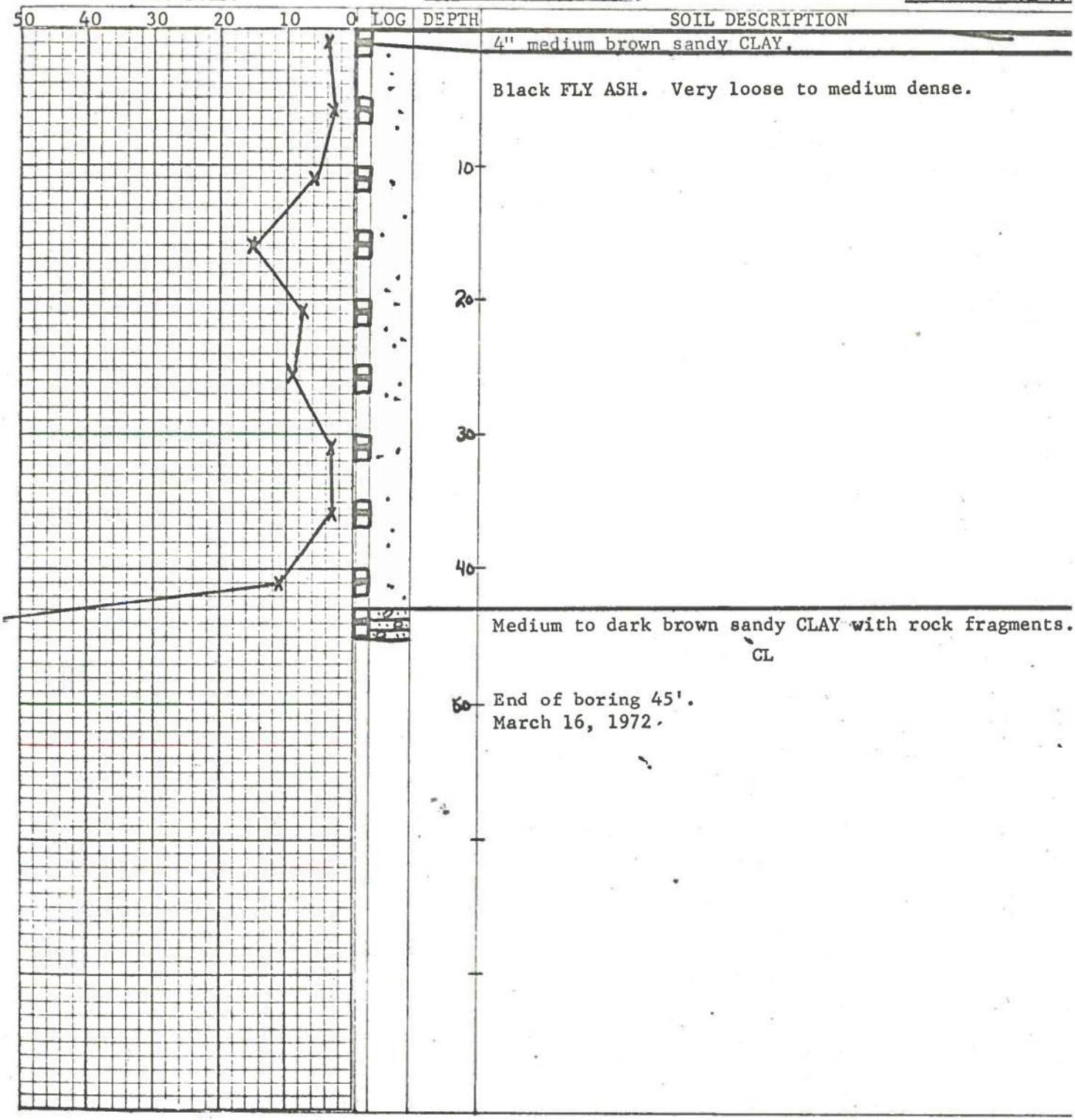
Water Level: 30'
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: March 15, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

TEST DATA BORING NUMBER: D-14 ELEVATION: 1541.



SOIL DESCRIPTION

4" medium brown sandy CLAY.

Black FLY ASH. Very loose to medium dense.

Medium to dark brown sandy CLAY with rock fragments.
CL

End of boring 45'.
March 16, 1972.

KEY

X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

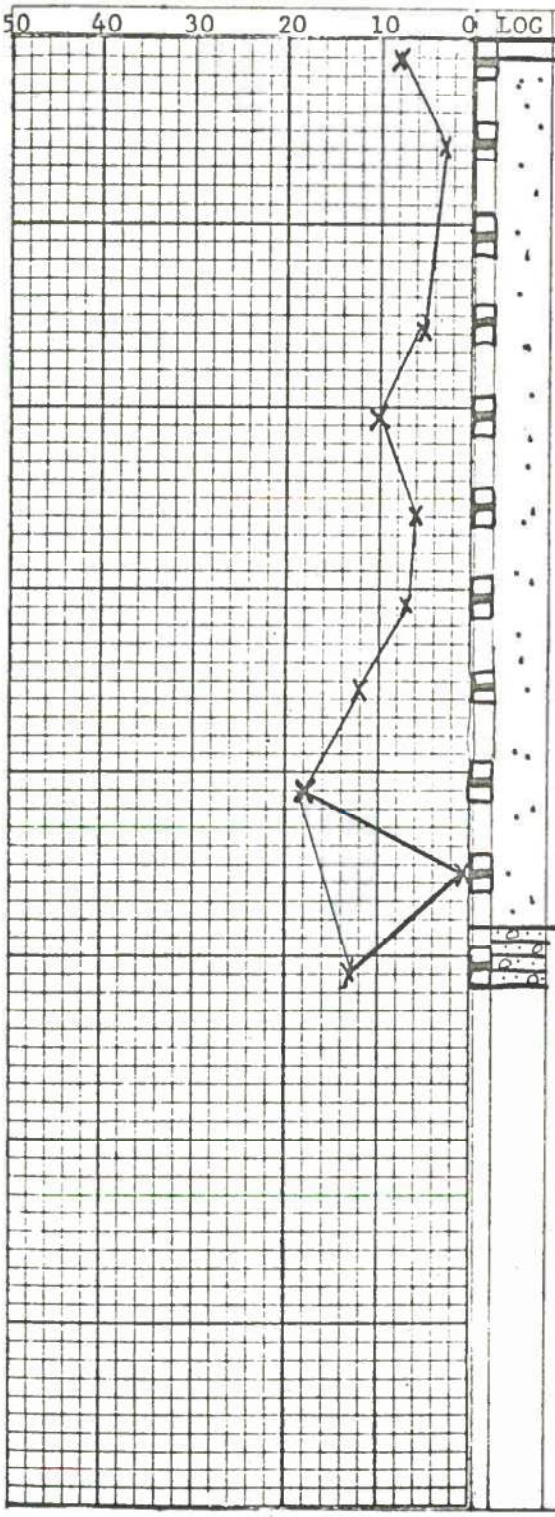
Water Level: Dry Hole
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Flyash Dike DATE: April 5, 1972

COMPANY: Appalachian PowerCompany LOCATION: See Plan

TEST DATA BORING NUMBER: D-15 ELEVATION: 1541.



LOG	DEPTH	SOIL DESCRIPTION
		14" of medium brown CLAY.
		Black FLY ASH. Very loose to medium dense. ML
	10	
	20	Lost tank at drilling mud at 9.5'. Drove casing to 15'. Saturated at 20' (water pocket).
	30	
	40	
	50	Red sandy CLAY with rock fragments. Wet. Soft to medium stiff. CL
		Stopped hole at 51.5'. April 6, 1972

KEY
X Std. Penetration Resistance ("N")
Δ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

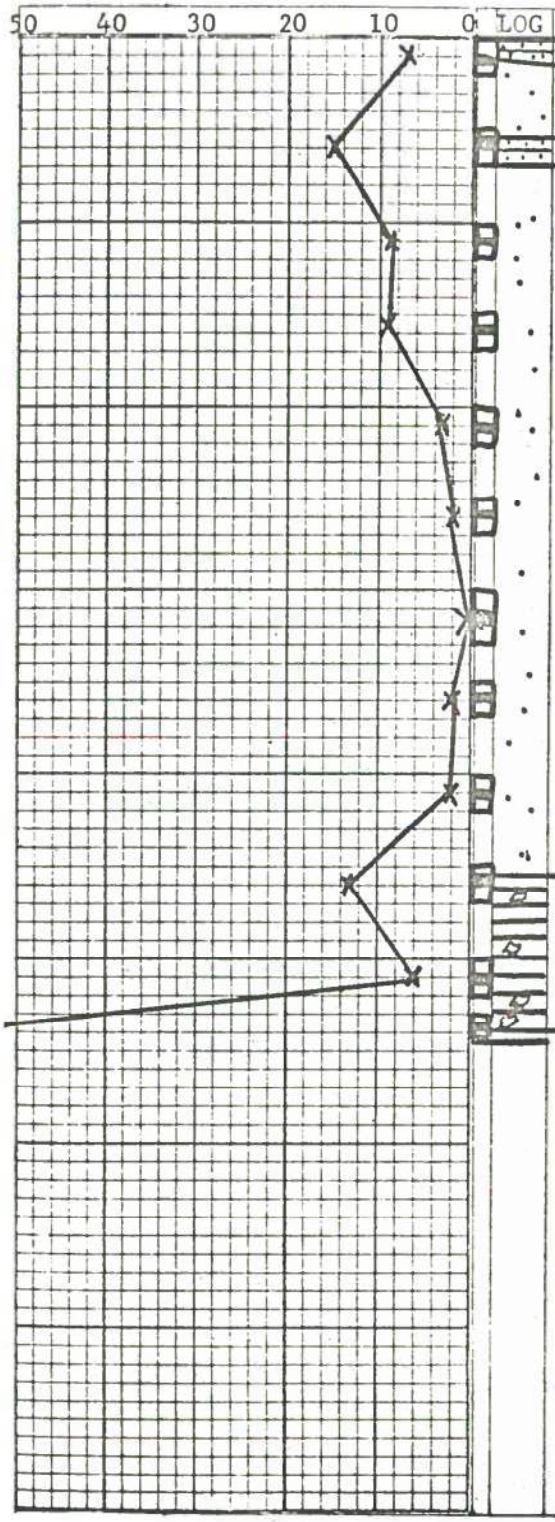
Water Level: 35'
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: March 15, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-16 ELEVATION: 1540.



LOG	DEPTH	SOIL DESCRIPTION
		8" medium brown sandy CLAY.
		Black FLY ASH. (Placed). Loose.
		ML
		Medium brown sandy CLAY. Very stiff.
	10	Black FLY ASH. Loose to very loose.
		ML
	20	Very wet at 21'.
	30	
	40	
		Reddish brown silty CLAY with rock fragments. Very stiff.
	50	CL
		Grayish brown SANDSTONE.
		End of boring 54.3'.
		March 15, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
⊡ Water Content %
⊙ Plastic Limit %

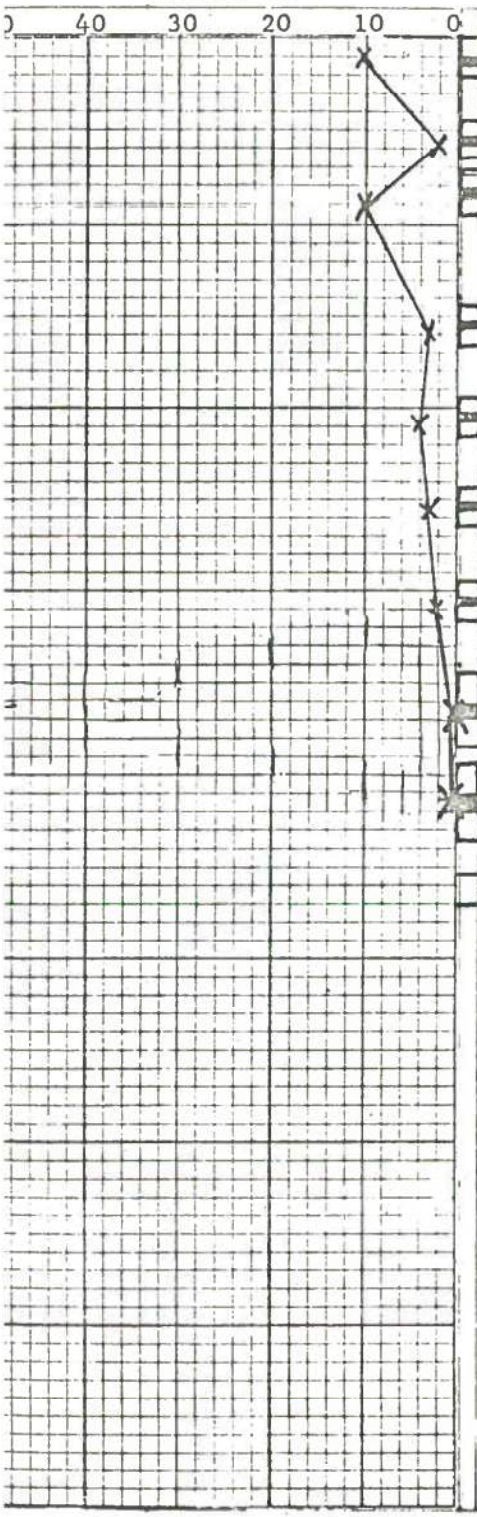
3/15 3/16 3/17
Water Level: 38' - 25' - 31'
Drilling Method: Hollow stem augers - 8 3/8"
Sample Method: Split Spoon
Remarks: Perforated pipe installed for water levels

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 5, 1972

COMPANY: Appalachian Power Company LOCATION: See Plot Plan

TEST DATA BORING NUMBER: D-17 ELEVATION: 1536.4



LOG	DEPTH	SOIL DESCRIPTION
		18" of medium brown CLAY. Stiff. CL
		Black FLY ASH. Very loose. ML
		12" of layer of medium brown clay. Stiff.
	10	Black FLY ASH. Very loose. ML
	20	▽
	30	
	40	
		Medium brown sandy silty CLAY, with rock fragments. Medium consistency.
	50	CL
		End of boring 47.5'. April 5, 1972

KEY
X Std. Penetration Resistance ("N")
△ Liquid Limit %
□ Water Content %
⊙ Plastic Limit %

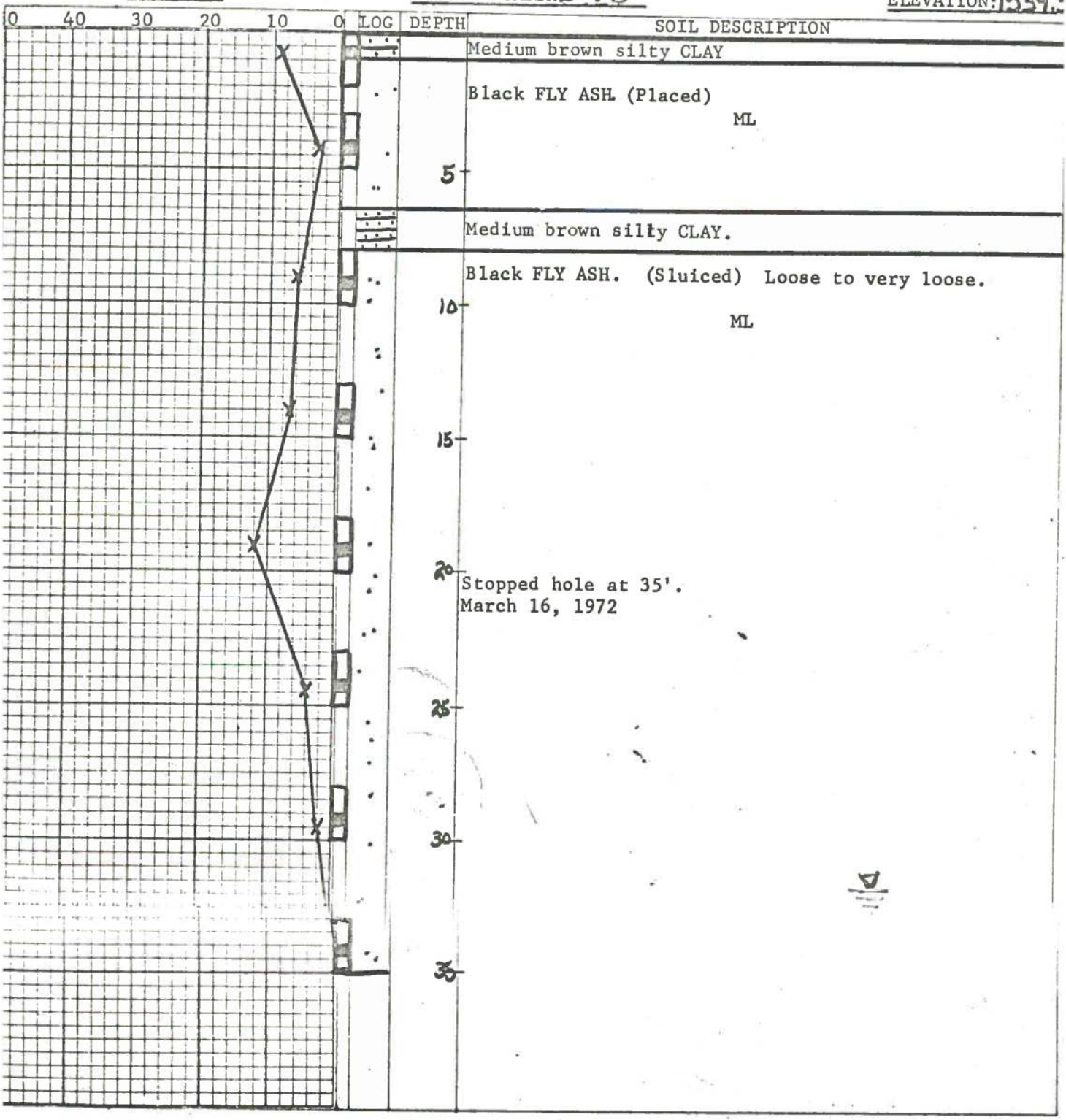
Water Level: 19'
Drilling Method: Rotary Wash w/ mud slurry
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: March 16, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER: D-18 ELEVATION: 1539.3



KEY

X Std. Penetration Resistance ("N")
Δ Liquid Limit %
□ Water Content %
⊙ Plastic Limit %

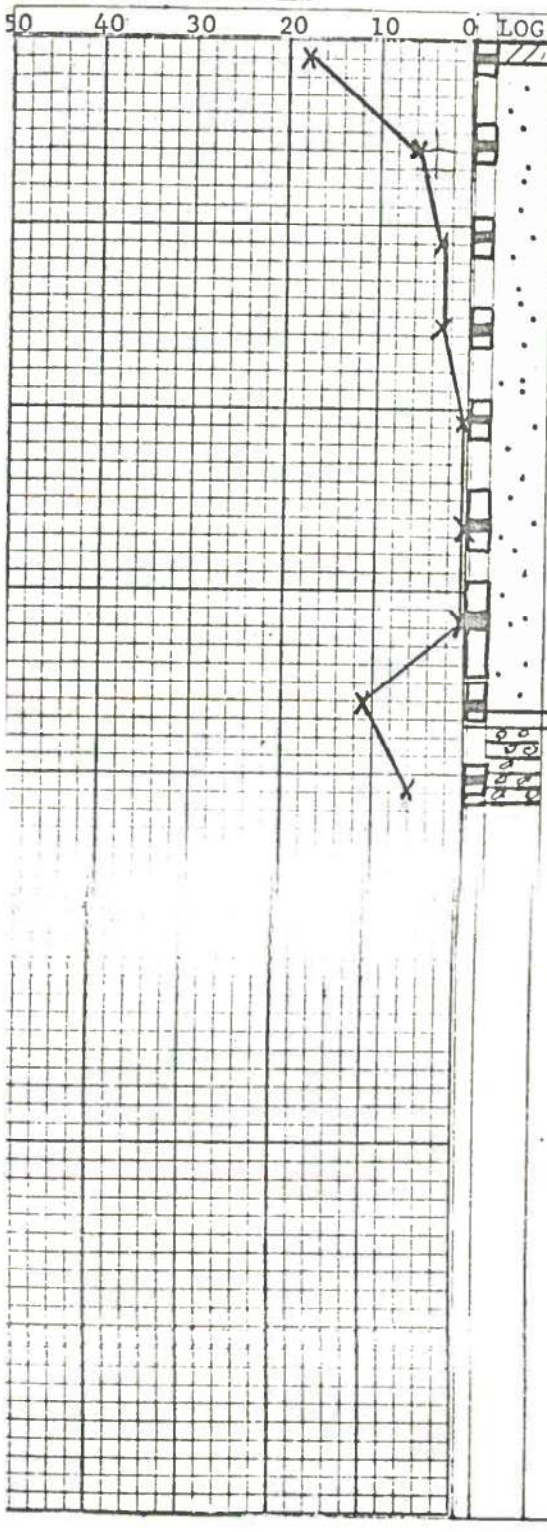
Water Level: 33'
Drilling Method: 4" Flight Augers
Sample Method: Split Spoon
Remarks:

AMERICAN ELECTRIC POWER SERVICE CORPORATION
SPORN MATERIALS LABORATORY
LOG OF BORING

PROJECT: Glen Lyn Dike DATE: April 4, 1972

COMPANY: Appalachian Power Company LOCATION: See Plan

TEST DATA BORING NUMBER D-19 ELEVATION: 1536±

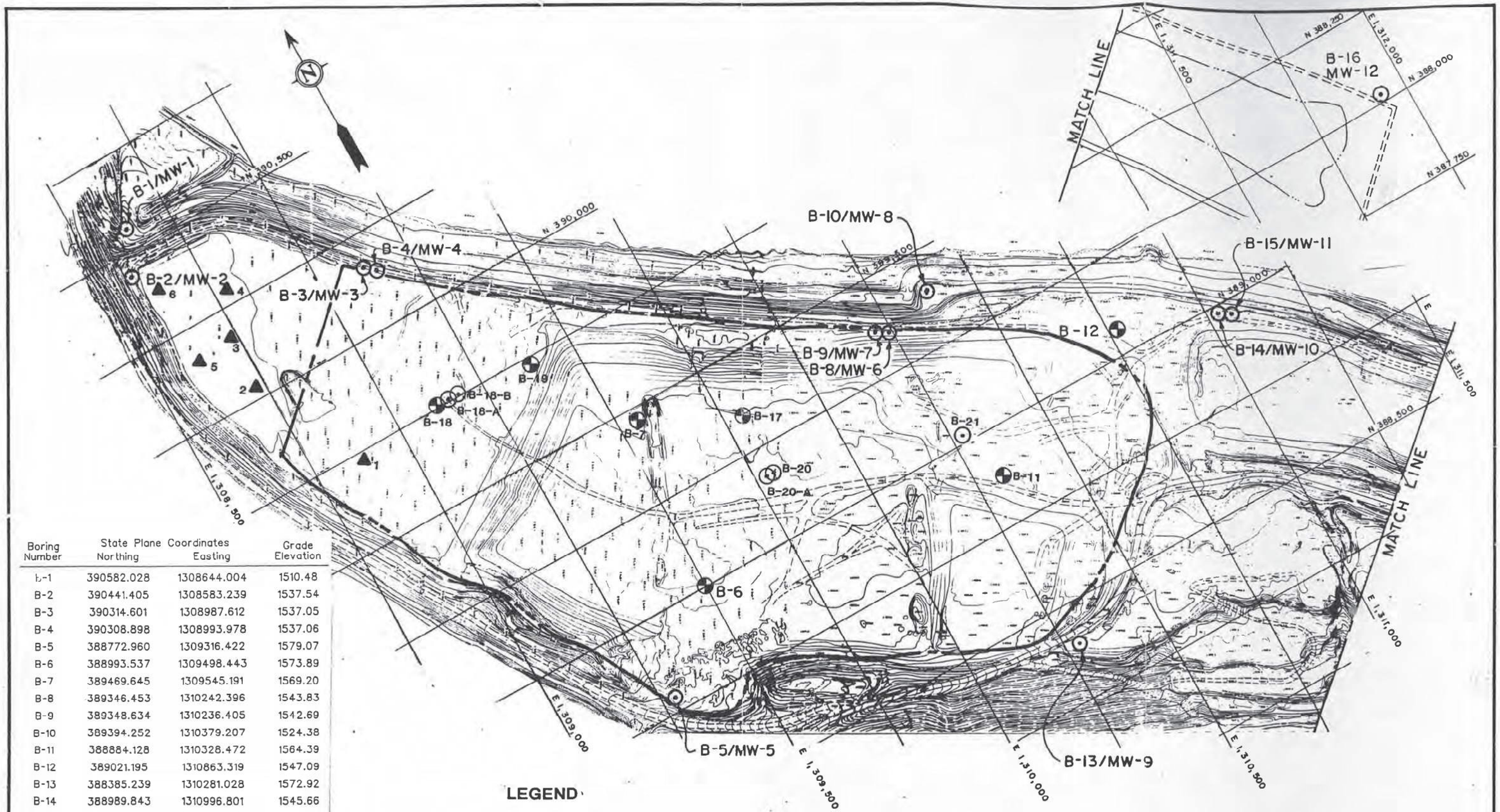


LOG	DEPTH	SOIL DESCRIPTION
		Medium brown sandy CLAY.
		Black FLY ASH. Loose to very loose.
	10	
	20	
	30	
		TOP SOIL.
	40	Dark brown silty CLAY with rock fragments. Medium stiff. Moist to wet.

KEY

X Std. Penetration Resistance ("N")
Δ Liquid Limit %
□ Water Content %
○ Plastic Limit %

Water Level: 9.5'.
Drilling Method: Rotary wash with mud slurry
Sample Method: Split Spoon
Remarks:



Boring Number	State Plane Coordinates Northing	Easting	Grade Elevation
B-1	390582.028	1308644.004	1510.48
B-2	390441.405	1308583.239	1537.54
B-3	390314.601	1308987.612	1537.05
B-4	390308.898	1308993.978	1537.06
B-5	388772.960	1309316.422	1579.07
B-6	388993.537	1309498.443	1573.89
B-7	389469.645	1309545.191	1569.20
B-8	389346.453	1310242.396	1543.83
B-9	389348.634	1310236.405	1542.69
B-10	389394.252	1310379.207	1524.38
B-11	388884.128	1310328.472	1564.39
B-12	389021.195	1310863.319	1547.09
B-13	388385.239	1310281.028	1572.92
B-14	388989.843	1310996.801	1545.66
B-15	388986.634	1311007.280	1545.37
B-16	388012.011	1311934.322	1540.44
B-17	389348.566	1309798.637	1569.81
B-18	NOT SURVEYED - LOCATION APPROXIMATED		
B-18-A	389752.564	1309149.392	1535.95
B-18-B	389752.995	1309155.308	1535.97
B-19	389702.340	1309291.878	1536.76
B-20	389179.353	1309802.209	1572.60
B-20-A	389184.226	1309793.503	1572.63
B-21	389019.057	1310277.914	1565.67

LEGEND

- BORING LOCATION
- BORING LOCATION WITH PIEZOMETER INSTALLATION
- APPROXIMATE SITE BOUNDARY
- APPROXIMATE LOCATIONS OF HAND AUGERED BORINGS (10-90)

FIGURE 2

GAI CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists
[illegible] Beatty Rd. • Pittsburgh, Monroeville, Pa. 15146
412- [illegible]

SITE PLAN AND BORING LOCATIONS
GLEN LYN PLANT

AMERICAN ELECTRIC POWER SERVICE CORPORATION
COLUMBUS, OHIO

DWN. LK | CHKD. DAG
APPD. DWO | DATE 12/11/90
SCALE: 1" = 250'
DRAWING NUMBER 90 - 364 - B2 | 1 REV

BRUNING 44-142 43457-1

GAI CONSULTANTS, INC.

DEFINITION OF TERMS USED TO DESCRIBE SUBSURFACE MATERIALS

SOILS

DENSITY OF GRANULAR SOILS IS BASED ON STANDARD PENETRATION RESISTANCE

DESIGNATION	STANDARD PENETRATION RESISTANCE (BLOWS/FOOT)
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	OVER 50

CONSISTENCY OF COHESIVE SOILS IS BASED ON FIELD AND/OR LABORATORY TESTS

CONSISTENCY	UNC. COMPRESSIVE STR. (TONS PER SQUARE FOOT)	FIELD IDENTIFICATION
VERY SOFT	LESS THAN 0.25	EASILY PENETRATED SEVERAL INCHES BY FIST
SOFT	0.25 TO 0.50	EASILY PENETRATED SEVERAL INCHES BY THUMB
MEDIUM STIFF	0.50 TO 1.0	CAN BE PENETRATED SEVERAL INCHES BY THUMB WITH MODERATE EFFORT
STIFF	1.0 TO 2.0	READILY INDENTED BY THUMB BUT PENETRATED ONLY WITH GREAT EFFORT
VERY STIFF	2.0 TO 4.0	READILY INDENTED BY THUMBNAIL
HARD	MORE THAN 4.0	INDENTED WITH DIFFICULTY BY THUMBNAIL

ADDITIONAL TERMS USED IN THE DESCRIPTION OF SOILS:

AND — INDICATES APPROXIMATELY EQUAL AMOUNTS OF MATERIALS, SUCH AS A SAND AND GRAVEL MIXTURE. IF THE MATERIALS OCCUR IN THIN SEPARATE SEAMS, IT IS NOTED IN THE DETAILED WORD CLASSIFICATION. THE THICKNESS IS GIVEN WHERE POSSIBLE
EXAMPLE: MEDIUM DENSE SAND AND GRAVEL, OR DENSE INTERBEDDED COARSE SAND AND GRAVEL (¼" - ¾") THICK

SOME — INDICATES A SIGNIFICANT AMOUNT OF THE ACCESSORY MATERIAL
EXAMPLE: MEDIUM DENSE SILTY SAND - SOME GRAVEL

TRACE — INDICATES A MINOR AMOUNT OF THE ACCESSORY MATERIAL
EXAMPLE LOOSE SILTY SAND - TRACE OF GRAVEL

INTERBEDDED — USED TO DESCRIBE THIN ALTERNATING SEAMS. THICKNESS IS GIVEN WHERE POSSIBLE
EXAMPLE: HARD INTERBEDDED SILT AND CLAY (APPROXIMATELY 1/16" THICK)

ROCK

TERM	DEFINITION
SEAM	THIN (12 INCHES OR LESS) PROBABLY CONTINUOUS LAYER
SOME	INDICATES SIGNIFICANT (15 to 40 PERCENT) AMOUNTS OF THE ACCESSORY MATERIAL EXAMPLE: ROCK COMPOSED OF SANDSTONE (70%) AND SEAMS OF SHALE (30%) WOULD BE: SANDSTONE – SOME SHALE SEAMS
FEW	INDICATES MINOR (5-15 PERCENT) AMOUNTS OF THE ACCESSORY MATERIAL EXAMPLE: ROCK COMPOSED OF SANDSTONE (90%) AND SEAMS OF SHALE (10%) WOULD BE: SANDSTONE - FEW SHALE SEAMS
INTERBEDDED	USED TO INDICATE THIN OR VERY THIN ALTERNATING SEAMS OF MATERIAL OCCURRING IN APPROXIMATELY EQUAL AMOUNTS EXAMPLE: ROCK COMPOSED OF SANDSTONE (50%) AND SHALE (50%) SEAMS WOULD BE.INTERBEDDED SANDSTONE AND SHALE

THE DEGREE OF BROKENNESS OF THE ROCK IS DESCRIBED BY ONE OF THE FOLLOWING TERMS:

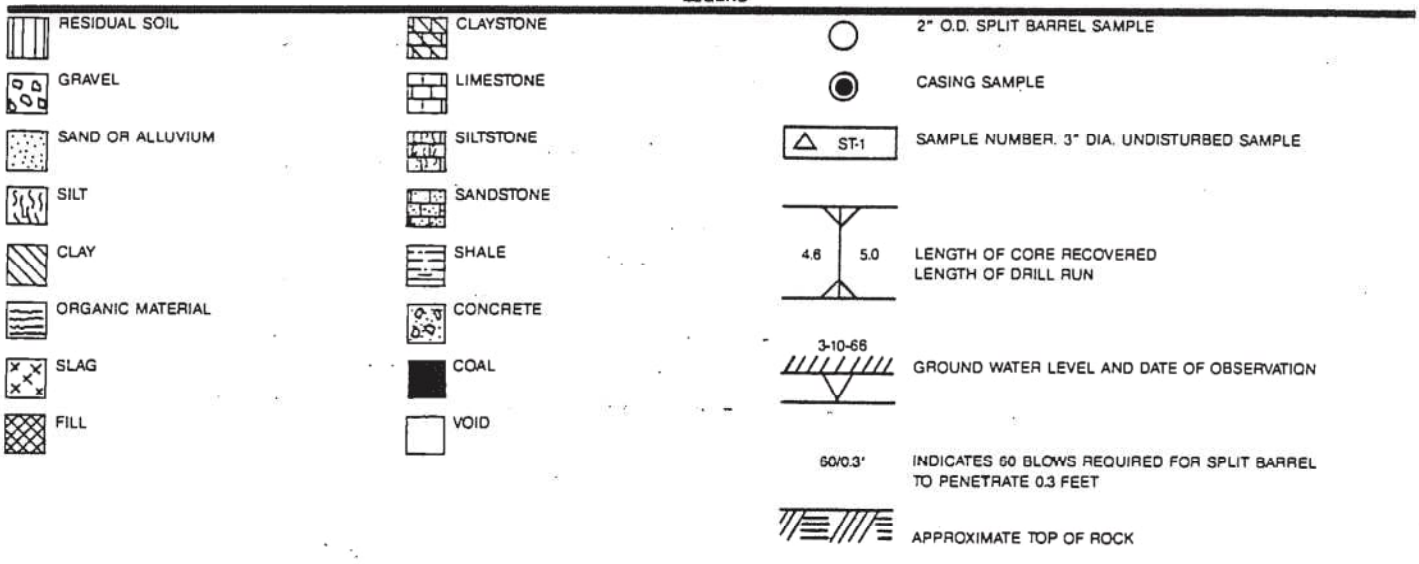
DESCRIPTIVE TERMS	ABBREVIATION	SPACING
VERY BROKEN	(V. BR.)	LESS THAN 2 INCHES
BROKEN	(BR.)	2 INCHES - 1 FOOT
BLOCKY	(BL.)	1 FOOT - 3 FEET
MASSIVE	(M.)	3 FEET - 10 FEET

RQD–ROCK QUALITY DESIGNATION IS CUMULATIVE LENGTH OF PIECES OF CORE EQUAL TO OR GREATER THAN FOUR INCHES IN LENGTH DIVIDED BY THE TOTAL LENGTH OF CORE RUN, EXPRESSED AS A PERCENTAGE

THE FOLLOWING BASIC NAMES ARE APPLIED TO THE TYPE OF ROCK FOUND AT THE SITE:

ROCK TYPE	CHARACTERISTICS
SANDSTONE	MADE UP PREDOMINANTLY OF GRANULAR MATERIALS RANGING BETWEEN 1/16 AND 2MM IN DIAMETER
SILTSTONE	MADE UP OF GRANULAR MATERIALS LESS THAN 1/16MM IN DIAMETER. FRACTURES IRREGULARLY. MEDIUM THICK TO THICK BEDDED
CLAYSTONE	VERY FINE GRAINED ROCK MADE UP OF CLAY MATERIALS. FRACTURES IRREGULARLY. VERY SMOOTH TO TOUCH. GENERALLY HAS IRREGULARLY SPACED PITTING ON SURFACE OF DRILLED CORES.
SHALE	A FISSILE VERY FINE GRAINED ROCK. FRACTURES ALONG BEDDING PLANES
LIMESTONE	ROCK MADE UP PREDOMINANTLY OF CALCITE ($CA\ CO_3$) EFFERVESCES UPON THE APPLICATION OF HYDROCHLORIC ACID.
COAL	ROCK CONSISTING MAINLY OF ORGANIC REMAINS.

LEGEND



gai CONSULTANTS, INC.

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 7.66 FT BELOW TOC. BORING NO. B-1/MW-1

24 HRS 7.41 FT BELOW TOC.

DATE 11-8-90 FIELD ENGINEER SCW PAGE NO. 1 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	2/2/2	DS-1/1.5			STIFF	YLW/BRN	CLAYEY SAND TRACE MICA	SC/CL	BORING ON BULLDOZED ROAD THEREFOR THERE IS NO TOPSOIL
1.5									
2.5									
5.0	6/9/15	DS-2/1.5							
7.5									
10.0	5/6/7	DS-3/1.5		9.2	V. STIFF	RED/BRN	SANDY CLAY FEW WEATHERED SHALE FRGS	CL/GC	
13.5									
15.0	10/5/2	DS-4/1.0							SATURATED ~14.5 FT
18.5				18.8	SOFT	GRY	SILTY SAND SOME MICA	SM	
20.0	2/2/3	DS-5/1.5							
23.5									
25.0	4/9/17	DS-6/0.6							VERY HARD ROCK IN END OF SPLIT SPOON
28.5		50/0.4		28.7	MED SOFT	RED	CLAYSTONE	V. BR	TOP OF ROCK 28.7
29.1							BOTTOM OF BORING 28.7 FT.		

REMARKS** AEP DRILLERS: TERRY SMITH SCOTT TAYLOR CME-75 RIG

PIEZOMETER CONSTRUCTION DETAILS ON PAGE 2.

PROJECT NO. 90-364-10

BORING NO. B-1

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-1

HRS

DATE 11-8-90 FIELD ENGINEER SCW PAGE NO. 2 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							PIEZOMETER CONSTRUCTION DETAILS		
							- BORING DEPTH 28.0 FT. 2" TIP AT		
							28 FT SAND TO 17.1 FT. (SAND #7 OHIO OTTE)		
							- BENTONITE PELLET SEAL 17.1 TO 13.3		
							- CEMSEAL SLURRY (50 LBS/50 GAL H_2O)		
							TREMIED TO THE SURFACE.		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-1

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

FORM CE-6
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING B-2/MW-2

Job No. _____
Company APCO Glen Lyn
Project ASH Storage AREA
Coordinates _____

Location of Boring:	
Water Level	12.0
Time	7:45
Date	9-6-90

Boring No. ____ Date 9-5-90 Sheet 1 of 2
Type of Samples: SPT ✓ 3" Tube ____ Core ____
Casing used ____ Size ____ Drilling Mud used ____
Boring Begun 9-5-90 Boring Completed 9-6-90
Ground Elevation ____ Referred to ____ Datum
Field Party Smith - Taylor Rig 75

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
											Boring moved 70' West	
1	4.0	5.5	7	6	3	10"				CL	Clay - Reddish Br. moist med to low plasticity w/ Trace of Sand size Clay/shale Frag.	
2	9.0	10.5	2	2	2			10		CL	Sandy Clay - Lt. Br. wet 100% Fine Grain	
3	14.0	15.5	4	7	10	18"				CL	Clay - Red - moist - med to low plasticity - w/ some Sand size Shale Frags	
4	19.0	20.5	10	11	8	14		20			Same as 3 w/ 1 - 1 3/8" Sand Stone Frags	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

4 x 6¼ HSA ✓

FORM CE-6
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING B-2/MW-2

Job No. _____
Company _____
Project _____
Coordinates _____

Boring No. ____ Date _____ Sheet 2 of 2
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling Mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ Referred to _____ Datum
Field Party _____ Rig _____

Location of Boring:	
Water Level	
Time	
Date	

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								20				
5	24.0	25.5	7	10	12	18"				CL	Clay - Red - moist - med. to low plasticity w/ some Sand Size Shale Frag's	
6	26.3	26.3	50/.2								Clayey Sand & Gravel - Red. Saturated - 3/8" max size - Flat Angular - Shale	
								30			Auger Refusal 26.3	
											Stopped Hole 26.5	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-8
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING B-3/MW-3

Job No. _____
Company APCO Glen Lyn
Project Ash Storage Area
Coordinates _____

Boring No. _____ Date 9-6-90 Sheet 1 of 4
Type of Samples: SPT ✓ 3" Tube ✓ Core _____
Casing used — Size — Drilling mud used —
Boring begun 9-6-90 Boring Completed 9-11-90
Ground Elevation _____ Referred to _____ Datum
Field Party Smith - Taylor Rig 75

Location of Boring:		
Water Level	Dry	17.0
Time	7:45	7:45
Date	9-11-90	9-12-90

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
1	0	1.5	24	24	14	16"					Sandy clay - Br. moist w/ some ash	
2	1.5	3.0	12	12	14	15"					Sandy clay - Red/Br. w/ Sandstone + Sandy Shale Frags.	
3	3.0	4.5	5	6	8	18"					Same as 2	
4	4.5	6.0	8	5	8	18"					Same as 2	
5	6.0	7.5	8	11	13	18"					Same as 2	
6	7.5	7.9	50/.4			4"						
7	9.4	9.5				.2					Auger Refusal 7.9 - moved Hole 10' South - Auger Refusal 7.6 (Boldens)	
8	9.5	14.7				.1					7.9-9.7 .2 Lt. B. Sandstone Bolden 9.7-14.7 Lt. Br. Sand Stone Last 1.5' No. Resistance Core in Box	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

9 x 4½" HSA ✓

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING B-3/MW-3

Job No. _____
Company _____
Project _____
Coordinates _____
Location of Boring: _____

Water Level	
Time	
Date	

Boring No. _____ Date _____ Sheet 2 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ Referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								10			Augered through Bolden zone	
9	15.0	16.5	14	8	11	0		15				
10	16.5	18.0									Augered through Bolden No Sample Taken	
11	18.5	21.0	50/.1			0						

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock
NW Casing 3"
SW Casing 6"

Recorder _____

RM CE-5
v. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING B-3/MW-3

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring: _____
Water Level _____
Time _____
Date _____

Boring No. 1 Date _____ Sheet 3 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling Mud used _____
Boring Begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								20				
12	22.5	24.0	18	50/.1		5"					Sandy clay - Br + Gray Fine Grain w/ Sand Stone Frag + Quartz Frag	
13	27.5	29.0	7	5	7	12"					Clay + clay shale - Red - moist	
								30				
14	32.5	32.6	50/.1			0						
	34.0	35.2	Core			.3					Bolder - Auger Refusal - 24.0	
	35.2	40.2				5.0					35.2 - 40.2 Cored - Soil Clayey Sand - Br + Gray	
								40				

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

RM CE-5
V. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING B-3/MW-3

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring: _____
Water Level _____
Time _____
Date _____

Boring No. _____ Date _____ Sheet 1 of 1
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling Mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ Referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
S	42.5	44.2				1.2					Shelby Tube End of Tube Push 1.1 bent Time 13 sec Rec. 1.2 PSI 400	
16	47.5	49.0	10	10	10	18					Sandy clay - Br. wet	
								50				
17	52.5	54.0	8	9	11	18"					Sandy clay - Br. moist w/	
18	57.5	58.2	10	59/.4		9"					Clay Sand - Gray - Saturated w/ Large Gravel in End of Spoon	
											Bottom of boring 58.2	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1535 GWL 0 HRS 49.8 FT W/ TOOLS IN HOLE — BORING NO. B-4/MW-4

~~HRS~~ 1 WEEK 53.40 FT

DATE 10/9/90 FIELD ENGINEER DAG/SCW — PAGE NO. 1 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
1.5	24 30 12	S-1/1.1			HARD	RED-BRN-GRAY	SILTY CLAY W/ SANDSTONE FRAGS UP TO > SAMPLER Ø FILL	CL-GL	* 74.5 MOIST
3.0	7 7 12	S-2/0.9							* 74.5
4.5	7 6 10	S-3/1.3							* > 4.5
6.0	6 6 7	S-4/1.3							*2.0
7.5	8 11 11	S-5/0.6							* > 4.5
9.0	7 10 12	S-6/1.1							* > 4.5
10.5	9 9 9	S-7/1.1							* > 4.5
12.0		ST-1/0.3							DID NOT RETAIN ST
13.5	5 6 6	S-8/1.3			V. STIFF		SILTY CLAY (TR. SAND)		* 2.5
15.5	5 7 8	S-9/1.5 ST-2/0.5					SILTY, CLAYEY SAND/SILTY SANDY CLAY (MICACEOUS)	SC-CL	* 3.0 DID NOT RETAIN ST
17.0	4/8 12 12	S-10/0.1					SILTY CLAY W/ SANDSTONE FRAGS > SAMPLER Ø	CL	
18.5	36 11 12	S-11/1.5							* 2.5
20.0	NOT RECORDED	S-12/1.5					(FEW BLACK ORGANICS)		*2.0
24.0									V. MOIST
25.5	10 4 6	S-13/1.5			HARD	RED			* 4.5
29.0									
30.5	64 6	S-14/1.3			STIFF		(0.1' SILTY SANDY CLAY IN BOTTOM)		* 1.5

3¼" I.D. HOLLOW-STEM AUGERS (6" O.D.), CONT. S/S SAMPLES TO 20', S/S ON 5' CENTERS

REMARKS** TO TOP OF ROCK @ 57.3' EXCEPT WHERE ST'S TAKEN, 3" O.D. DIAMOND BIT WIRELINE CORE TO 100.0'. SEE Pg. 4 FOR MONITORING WELL INFO. PROJECT NO. 90-364-10

BORING NO. B-4/MW-4

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1535 GWL 0 HRS 49.8 FT W/ TOOLS IN HOLE — BORING NO. B-4/MW-4
~~HRS~~ 1 WK, 53.40 FT

DATE 10/9/90 FIELD ENGINEER DAG/SCW — PAGE NO. 2 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							SILTY, SANDY CLAY W/ SOME SH FRAGS, MICACEOUS, FEW ORGANICS	SC-CL	MOIST - V. MOIST
34.0									
35.5	4/6/10	S-15/1.5			V. STIFF	RED-TAN			* 3.5
37.1		ST-3/1.6							
39.0									
40.5	7/7/10	S-16/0.8				GRAY	SILTY CLAY / CLAYEY SILT (TR. SAND) (MICACEOUS)	CL-MH	FZ.5
44.0									
45.5	4/3/6	S-17/1.5			M. STIFF - STIFF	GRAY-BRN			* 1.0 SPOON WET WET
49.0									
		ST-4/1.55			?				
51.0									
54.0									
		ST-5/1.9							
56.0									
57.3				11=11	M. HARD	GRAY	FINE - MED. GR. SANDSTONE	BR	10/10/90
	4.4 6.2	71%	52%						

REMARKS** SEE Pg. 1

PROJECT NO. 90-364-10

BORING NO. B-4/MW-4

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1535 GWL 0 HRS 49.8 FT W/ TOOLS IN HOLE — BORING NO. B-4 / MW-4
~~HRS~~ 1 WK. 53.40 FT

DATE 10/10/90 FIELD ENGINEER DAG / SCW — PAGE NO. 3 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					M. HARD	GRAY	FINE - MED. GR. SANDSTONE	BR	
	4.4 6.2	71%	32						
63.5									
65.0	03 1.5	20%	0	65.0					VERT. FRACT 63.0'-63.5' - BLK STAINS
					M. SOFT - M. HARD	GRAY-RED	INTERBEDDED SILTY SHALE AND FINE GR. SANDSTONE		
	4.1 5.0	82%	32						
				69.5					
70.0				70.0	SOFT		(0.5' DECOMPOSED SHALE)		
					M. SOFT - M. HARD		SILTY SHALE (CALCAREOUS)		VERT. JOINTS FILLED W/ CALCITE @ 68'
	2.8 2.5	>100%	40						* LOST WATER RETURN @ 71.5 FT.
72.5				73.0					
	2.5 2.5	100%	90		M. SOFT - M. HARD	RED-GRAY	CLAYEY SHALE / CLAYSTONE (SLIGHTLY CALCAREOUS)	BR-BL	10/11/90
75.0									
	10.0 10.0	100%	88						
				81.0					
							INTERBEDDED FINE GR. SANDY AND SILTY SHALE		
							(0.5' DECOMPOSED LIMY SHALE @ 83.5')		
85.0				85.0					
						RED	CLAYEY SHALE / CLAYSTONE		
	9.8 10.0	98%	67						

REMARKS** SEE Pg. 1

PROJECT NO. 90-364-10

BORING NO. B-4 / MW-4

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP- GLEN LYN — PROJECT NO. 90-364-10

ELEVATION -1535 GWL 0 HRS 49.8 FT w/ TOOLS IN HOLE — BORING NO. B-4 / MW-4

~~HRS~~ 1 WK, 5340 FT

DATE 10/11/90 FIELD ENGINEER DAG / SCW — PAGE NO. 4 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					M. SOFT - M. HARD	RED	CLAYEY SHALE / CLAYSTONE	BB-B	
	98/100	98%	67						YELLOW-BRN STAIN ON FRACT.
									0.2' LIMY ZONE
95.0				95.0					
					M. HARD	RED-GRAY	CLAYEY SILTSTONE W/ FEW INTERBEDDED SH SEAMS		10/15/90
	48/50	96%	47						HAD PROBLEMS WITH CORE BBL
									10/16/90
									HIT HARD ROCK - RUINED 2 BITS
							BOTTOM OF BORING @ 100.0'		
					GEOMON	MONITORING WELL:			
							TIP OF GEOMON 88.75 FT		
							TOP OF SCREEN 83.75 FT		
							TOP OF SAND 76.5 FT		
							TOP OF BENTONITE 75.0 FT		
							BENTONITE GROUT UP TO NEAR GROUND SURFACE, STEEL CASING		

REMARKS** SEE Pg. 1

PROJECT NO. 90-364-10

BORING NO. B-4 / MW-4

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1573 GWL 0 HRS 23.9 FT W/ TOOLS IN HOLE — BORING NO. B-5/MW-5
24 HRS 37.3 FT

DATE 9/25/90 FIELD ENGINEER D A GRAHLHERR — PAGE NO. 1 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	2 2 4	S-1/1.5			LOOSE	DK GRAY	FLY ASH AND BOTTOM ASH (TR. RED, BRICK-LIKE FRAGS UP TO 1/2" ϕ)	ML-GM	MOIST
3.5									
3.0	2 2 4	S-2/1.5							
4.5	4 4 6	S-3/1.5							
6.0	3 2 1	S-4/1.3			V. LOOSE				
7.5	2 2 2	S-5/1.0			M. STIFF-STIFF	TAN-RED GRAY	SILTY CLAY; SOME SS FRAGS UP TO 3/4" ϕ, SOME FLY ASH FILL	CL-CL	V. MOIST — PIECE OF PVC PIPE IN SPOON - DRAIN → CUT THROUGH A 6" CORE WITH PVC DRAIN
9.0	3 2 7	S-6/1.0							
10.5	6 44 45	S-7/1.3							WET
12.0	17 27 17	S-8/1.0				RED-TAN	SILTY CLAY AND SS FRAGS UP TO 3/4" ϕ AND SS BOULDERS (FRAGS > SAMPLER ϕ)	GC	ADDED WATER TO CLEAN PLUG FROM AUGERS
13.5	9 28 23	S-9/0.6							PH = 8.35
15.0	17 21 25	S-10/0.8							C = 2.77 @ 25°C
16.5	17 37 34	S-11/0.8							
18.0	30 30 30	S-12/0.2							
18.5	50/0.1	S-13/0.0		18.5	STIFF		MORE BOULDERS		VERY LITTLE OR NO WATER RETURN
	3.0 3.9	77%	0						COULD NOT ADVANCE AUGERS, THOUGHT WE WERE ON ROCK BUT CLAY & BOULDERS AS SHOWN
22.4									
	4.9 5.0	98%	0						
27.4									
	3.1 3.4	91%	0						

CME 75, TRUCK MOUNT; 6¼" HOLLOW-STEM AUGERS, CONTINUOUS SPLIT-SPOON SAMPLES

REMARKS** TO 18.5 FT; USED 6" ROLLER BIT TO CLEAN PLUG FROM AUGERS @ 10.5 FT (SEE REMARKS) ADVANCED 6" CASING TO 45.3 FT & REAMED HOLE TO 6" TO 54.1 FT IN ORDER TO SET 2" ϕ PVC WELL. SEE ATTACHED WELL DIAGRAM.

PROJECT NO. 90-364-1A

BORING NO. B-5/MW-5

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP- GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1573 GWL 0 HRS 23.9 FT w/ TOOLS IN HOLE HRS — BORING NO. B-5/MW-5

DATE 9/26/90 FIELD ENGINEER DA GRAHLHERR — PAGE NO. 2 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
30.5	3.1 3.4	91%	0		STIFF	RED-TAN	SILTY CLAY AND SS FRAGS UP TO 3/4" ∅ AND SS BOULDERS	GC	
	3.5 4.6	76%							
35.4									
	0.4 5.0	8%							
40.4				40.4			CHERT AND SS GRAVEL UP TO AND > CORE ∅ SOME CLAY AND SS FRAGS		FOUND POLISHED CHERT GRAVEL
	1.6 3.5	46%							
43.9				43.9 //=//					
44.9	1.0 1.0	100%			M. HARD	RED-GRAY	SHALY SILTSTONE	BR.	10/3/90 HOLE WAS OVER-REAMED FROM 44.9 - 45.3 FT
45.3									
46.3	0.7 1.0	70%			SOFT	RED	SHALY CLAYSTONE (SLIGHTLY WEATHERED)	V.BR-BR.	
	2.4 2.5	96%							
48.8									
	BORING WAS REAMED W/ 6" ROLLER BIT							?	REAMED HOLE TO TO 54.1 FT., CUTTINGS WERE RED CLAYSTONE
54.1									
							BOTTOM OF BORING @ 54.1 FT		

REMARKS** SEE Pg. 1

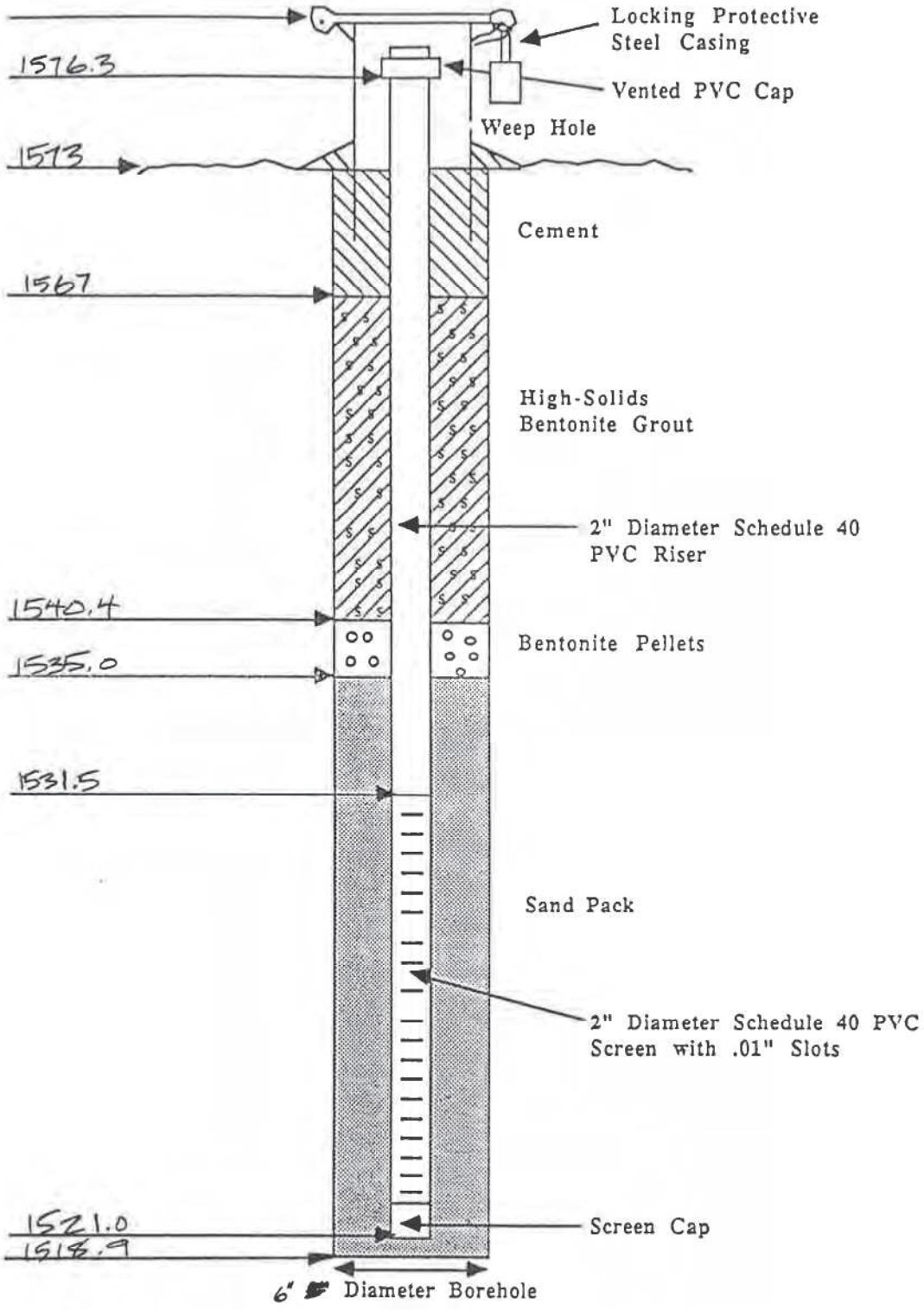
PROJECT NO. 90-364-10

BORING NO. B-5/MW-5

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

Elevations
APPROXIMATE



AEP - GLEN LYN 90-364-10
BORING B-5 / MW-5
CONSTRUCTION DIAGRAM FOR
[redacted] MONITORING WELL
(Not to Scale)

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company APCO. Glen Lyn
Project Ash Storage Area
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 6 Date 8-30-90 Sheet 1 of 3
Type of Samples: SPT ✓ 3" Tube _____ Core _____
Casing used — Size — Drilling mud used —
Boring begun 8-30-90 Boring Completed 8-30-90
Ground Elevation _____ Referred to _____ Datum
Field Party Smith - Taylor Rig 75

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
1	4.0	5.5	9	10	10	18"					Fly ash - moist	
2	9.0	10.5	6	9	9	18"		10			Fly ash moist	
3	14.0	15.5	5	11	19	18"					Fly ash moist	
4	19.0	20.5	6	7	9	18"		20			Fly ash moist w/ shale fines.	

6" x 3.25 HSA ✓
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 6 Date _____ Sheet 2 of 3
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								20				
5	24.0	25.5	9	9	8	18"					Fly ash moist	
6	29.0	30.5	7	5	10	18"		30			Fly ash Saturated	
7	34.0	35.5	5	5	5	18"					Fly ash wet to Saturated	
8	39.0	40.5	2	2	3	18"					Fly ash Saturated	
								40				

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 6 Date _____ Sheet 3 of 3
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								40				
9											Hydro Punch Sample - 45.5'	
											pH - 8.66	
											SC - 843	
10	49.0	50.5'	1	1	1	18"		50			Fly Ash Saturated	
11	54.0	55.5	29	59/4		9"					Top 6" Fly Ash Saturated	
											Bottom 3" Bx. Clay of Sandstone Frag	
											Auger Refusal 55.2	
											Stopped Hole 55.2 + Grouted	
								60			Bottom of Boring	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company APCO Glenlyn
Project ASH STORAGE AREA
Coordinates _____

Location of Boring:	
Water Level	34.0
Time	
Date	

Boring No. 7 Date 8-29-90 Sheet 1 of 4
Type of Samples: SPT ✓ 3" Tube — Core —
Casing used — Size — Drilling Mud used —
Boring Begun 8-29-90 Boring Completed 8-29-90
Ground Elevation _____ Referred to _____ Datum
Field Party SMITH - TAYLOR Rig 75

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
1	4.0	5.5	3	3	5	18"					FLY ASH-GRAY-MOIST	
2	9.0	10.5	3	4	7	18"		10			Same	
3	14.0	15.5	3	4	6	15"					Same	
4	19.0	20.5	3	6	7	18"		20			Same	

6" x 3.25 HSA ✓
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 7 Date _____ Sheet 2 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								20				
5	24.0	25.5	5	7	6	18"					Gray - Fly Ash - moist	
6	29.0	30.5	7	8	11	18"		30			Same as 5	
7	34.0	35.5	2	2	3	18"					Fly Ash - Gray Saturated	
8	39.0	40.5	1	1	1	18"					Same as 7	
								40				

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 1 Date _____ Sheet 3 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								40				
9	44.0	45.5	1	1	1	18"					Fly Ash- Gray- Saturated	
10	49.0	50.5	2	2	3	18"					Same as 9	
								50				
11	54.0	55.5	1	1	1	18"					Same as 9	
12	59.0	60.5	1	1	1	18"					Same as 9	
								60				

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-9
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 7 Date _____ Sheet 4 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling Mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ Referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								60				
13	64.0	65.5									Fly Ash - Saturated Weight of Drill Rods	
14	69.0	70.5									Same as 13	
								70				
17	74.0	75.5	4	7	5	18"					Clayey Sand - Br. Saturated	
16	79.0	80.5	3	1/12		0						
								80			Auger Refusal 82.7	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 58.37 BORING NO. B-9
24 HRS 60.23

DATE 10-28-90 FIELD ENGINEER SCW PAGE NO. 1 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							MATERIAL CLASSIFICATION WAS		
							PERFORMED ON B-8 AND IS FOUND		
							ON THE FIELD CLASSIFICATION		
							SHEETS FOR BORING B-8		
6.0									
	1100 PSI 36 SEC	ST-1 2.0/1.8							
8.0									
12.0									
	300 PSI 24 SEC	ST-2 2.0/1.9							
14.0									
	300 PSI 32 SEC	ST-3 2.0/1.9							
16.0									

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-9

HRS

DATE 10-28-90 FIELD ENGINEER SCW PAGE NO. 2 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							MATERIAL CLASSIFICATION WAS PERFORMED ON B-8 AND IS FOUND ON THE FIELD CLASSIFICATION SHEETS FOR BORING B-8		
37.0									
	900 PSI 53 SEC	ST-4 2.0/1.7							
39.0									

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-9

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-9

HRS

DATE 11-5-90/11-6-90 FIELD ENGINEER SCW PAGE NO. 3 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							SOILS NOT CLASSIFIED SEE B-8		AUGERING TO ROCK
							↓		
							TOP OF ROCK 63.8		
63.8				63.8					
64.7	0.7 0.9	78%	0%		MED SOFT	GRY/GRN	SILTY SHALE	V. BR.	SOME VERTICAL FRACS
		100%	50%				(64.85 TO 65.10 SANDSTONE, SLIGHTLY CALCAREOUS)		
			4/1.5	62.9					
67.3	1.5 2.2	68%	27%		MED SOFT	GRY	SANDY SHALE	V. BR	SOME HORIZ. FRACS IRON STAIN
			[illegible]	67.9					
	2.3 2.4	96%	[illegible]		MED SOFT	GRY	SILTY SHALE	V. BR	MOST FRACS IRON STAINED FEW VERTICAL NEAR VERT.
69.7							(GRY/GRN WEATHERED SILTY SHALE 69.8-70.0)		IRON STAINED VERTICAL FRAC 0.4 FT AT 69.7
			3.0/4.2	70.2	MED SOFT	RED	SANDY CLAYSTONE	BR.	
	5.0 5.0	100%	71%				(HIGH ANGLE FRACTURES FILLED WITH QUARTZ)		
74.7									
			[illegible]/5.0						
	3.3 3.3	100%	79%						
78.0				78.15					
	1.7 1.7	100%	99%		MED HARD	GRY	CALCAREOUS SHALE	BR/BL	
79.7									
				81.1					
			4.1/5.0		MED SOFT	RED	CLAYSTONE	BR/BL	
	5.0 5.0	100%	82%	85.1					
					MED HARD	RED	SANDY CLAYSTONE (CALCAREOUS)	BL/M.	SOME IRON STAINING ON FRACTURE SURFACES.
84.7									POORLY DEFINED HIGH ANGLE FRACTURES EX. 83.3 FT.
							(GRY/GRN INTERBEDDINGS)		
	3.3 3.3	100%	100%						
86.0				87.4	MED HARD	GRY	CALCAREOUS SHALE	BL.	
	1.7 1.7	100%	1.4/1.5 65%	88.9	MED SOFT	GRY	CLAYSTONE	VBR/BR.	
89.9									

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-9

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 58.37 BORING NO. B-9

HRS 60.53

DATE 11-6-90 FIELD ENGINEER SCW PAGE NO. 4 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
				90.7	MED SOFT	GRY	CLAYSTONE	BR	
			4.8/5.0		MED SOFT	RED/GRY/GRN	CLAYSTONE INTERFILED RED/GRY-GRN	BR/GL	
	5.0 5.0	100%	80%	92.5	MED SOFT	RED/GRY	CLAYSTONE (HIGH ANGLE IRON STAIN FRACTURE)	V. BR	~93 FT LOST WATER RETURN
				93.7	MED HARD	GRY	SANDY CLAYSTONE	BR/GL	
94.7					↓	↓	↓	↓	
	3.3 3.3	100%		96.4	MED HARD	GRY	CLAYEY SANDSTONE	BR	SOME HIGH ANGLE FRACS
98.8					↓	↓	↓	↓	
	1.7 1.7	100%							
99.7									
	4.0			101.6	MED HARD	GRY/BK GRY	CLAYEY SANDSTONE WITH CARBONACEOUS SHALE LENSES	GL	
				102.7	MED HARD	GRY	SHALE (SLIGHTLY CARBONACEOUS)	↓	(102.8 SLICKENSIDE)
103.7				103.1	MED HARD	DK GRY	CARBONACEOUS SHALE (SLICKENSIDE 103.4)	V. BR.	SMALL COAL SEAM 103.1 TO 103.2 FT
					BOTTOM OF BORING 103.7				
					GEOMON CONSTRUCTION DETAILS				
					BENTONITE PELLETS TO PLUG OFF COAL SEAM @ 103.1 FT. PELLETS TO 97.4				
					THEN 0.5 FT SAND (98.9) SET GEOMON SAND TO 84.5 (#4 OHIO QUARTZ)				
					BENTONITE PELLET SEAL TO 77.7 FT. LET PELLETS EXPAND OVERNIGHT				
					BENTONITE SLURRY (50 GAL WATER 50 lbs BENSEAL) BACKFILLED TO SURFACE				
					WITH CUTTINGS.				

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-9

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1530 GWL 0 HRS 28.9 FT w/TOOLS IN HOLE — BORING NO. B-10/MW-8
24 HRS 40.0 FT

DATE 9/26/90 FIELD ENGINEER D.A. GRAHLHERR — PAGE NO. 1 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
1.5							RED, CLAY SHALE FRAGS FILL FOR ACCESS RD. - NO SAMPLE		NO SAMPLE 0'-1½'
3.0	5 9 9	S-1/1.0			M. DENSE	RED-TAN	SILTY, CLAYEY SAND; SOME/TR. SANDSTONE FRAGS UP TO AND	SC	DRY (0.2' FLY ASH IN SPOON)
4.5	5 9 10	S-2/1.5					> SAMPLER ϕ - (FILL) (SANDSTONE & QUARTZITE BOULDERS)		
6.0	50/0.1	S-3/0.0							
7.5	50/0.6	S-4/0.1							
9.0	11 12 13	S-5/1.5							MINE-SPOIL-LIKE MATL'L
10.5	16 19 22	S-6/1.3			DENSE				
12.0	21 16 20	S-7/1.2							
13.5	10 15 20	S-8/1.5							
15.0	13 20 21	S-9/1.5		15.0					SOME ORGANICS-GRASS
16.5	10 13 14	S-10/1.5			M. DENSE		SANDY, CLAYEY SILT; TR. MICA	ML-MH	MOIST
18.0	15 15 12	S-11/1.5							
19.5	7 6 11	S-12/1.5							
22.2						GRAY			
23.7	11 9 8	S-13/1.3							
27.2									
28.7	6 7 12	S-14/1.3		28.0			SILTY SAND; FINE - MED. GRAINED	SM	

CME 75 TRUCK-MOUNT; 6¼" HOLLOW-STEM AUGERS; CONTINUOUS SPLIT SPOON SAMPLES

REMARKS** TO 19.5 FT, SPLIT-SPOON SAMPLES @ 5 FT INTERVALS FROM 19.5 TO 45.0 FT; HOLE CLEANED W/ 6" ROTARY & WATER @ 45 FT; CORED W/NX DIAMOND-BIT & WIRE-LINE BARREL TO 53.8 FT; REAMED CORE HOLE TO 6" W/ ROTARY BIT TO 54.4 FT IN ORDER TO SET 2" ϕ PVC MONITORING WELL; SEE ATTACHED WELL DIAGRAM.

PROJECT NO. 90-364-10

BORING NO. B-10/MW-8

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1530 GWL 0 HRS 28.9 FT W/ TOOLS IN HOLE — BORING NO. B-10/MW-8

24 HRS 40.0 FT

DATE 9/26/90 FIELD ENGINEER — PAGE NO. 2 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					M. DENSE	GRAY	SILTY SAND; FINE - MED. GRAINED	SM	MOIST — AUGER CHATTER, @ ~31.0
32.2				32.0					
	6 4 8	S-15/1.5				GRAY-BRN	SILTY CLAYEY SAND; TR. MICA	SM-SC	
33.7									
37.2									V. MOIST - WET
	4 3 4	S-16/1.5			LOOSE		(HIGHER CLAY %)		9/27/90
38.7									
42.2									
	4 20 50/0.4	S-17/1.5			DENSE - V. DENSE	GRAY-RED-BRN	SILTY SAND & RIVER GRAVEL UP TO 4"ø + SAMPLER ø	SM-GM	WET
43.7									
45.0	50/0.1	S-18/0.0		45.0					
				11:17	M. HARD	GRAY	SANDY, SHALY SILTSTONE	BR.	~HOR. BEDDING
									M, TIGHT VERT. FRACTS FILLED W/ CLAY
	8.3 8.8	94%	47						
									HOLE REAMED TO 6" FROM 45 TO 54.4 FT TO SET 2" ø PVC WELL
				51.6					
					SOFT	RED-GRAY	WEATHERED SILTY SHALE	V. BR.	
53.8									
54.4				54.4					
							BOTTOM OF BORING @ 54.4 FT		

REMARKS** SEE PAGE No. 1

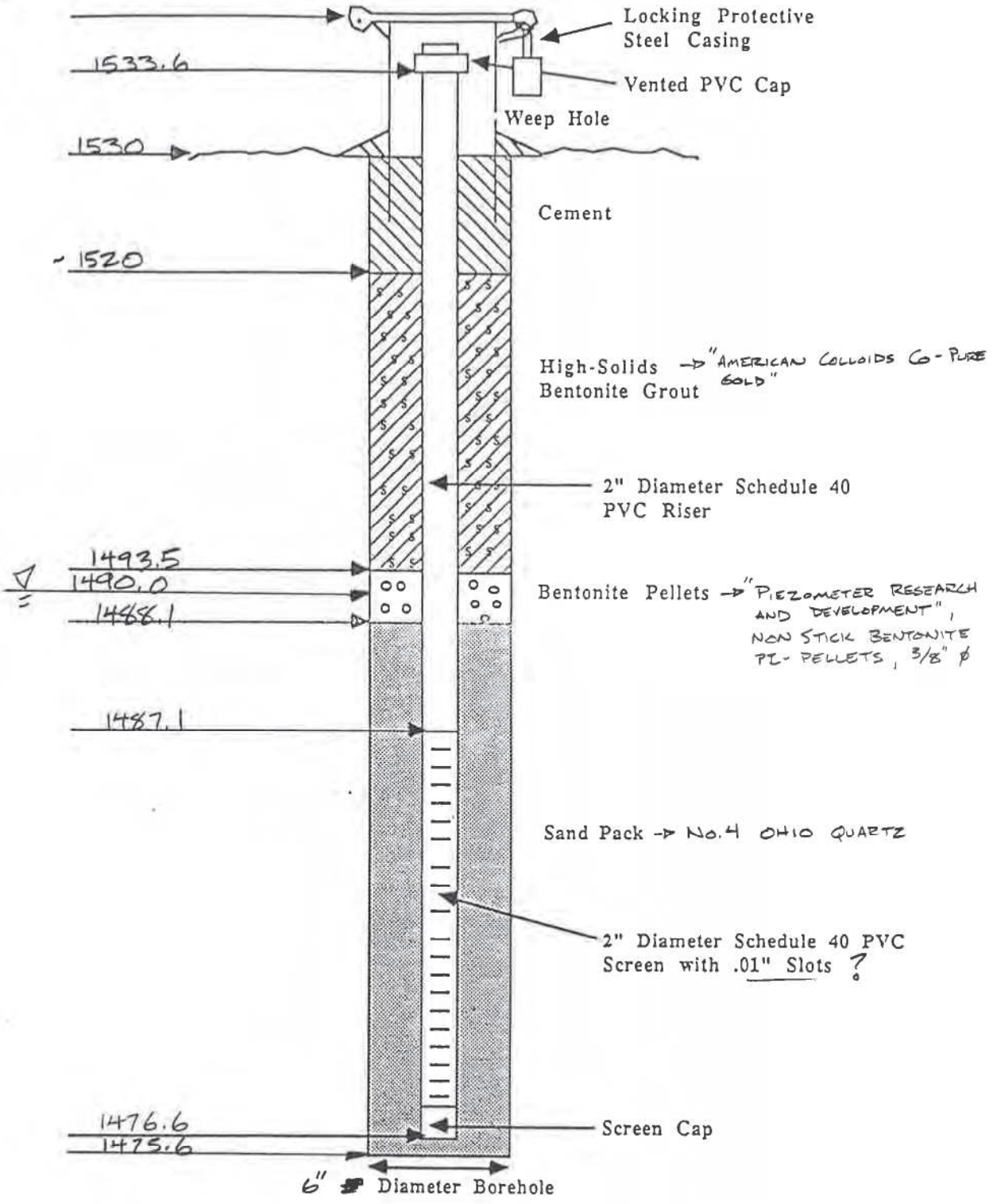
PROJECT NO. 90-364-10

BORING NO. B-10/MW-8

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

Elevations
APPROXIMATE



AEP - GLEN LYN 90-364-10
BORING B-10 / MW-8 DAG

CONSTRUCTION DIAGRAM FOR
~~DEEP~~ MONITORING WELL
(Not to Scale)

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company APCo Glen Lyn
Project Ash Storage Area
Coordinates _____

Location of Boring:	
Water Level	43.0
Time	10:00
Date	8-29-90

Boring No. 11 Date 8-29-90 Sheet 1 of 4
Type of Samples: SPT ✓ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun 8-29-90 Boring Completed 8-29-90
Ground Elevation _____ referred to _____ Datum
Field Party Smith - Taylor Rig 75

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
												moved hole 10' North
1	3.5	5.0	4	3	2	18"					Fly Ash moist	
2	8.5	10.0	4	7	8	18"		10			Fly Ash moist	
3	13.5	15.0	7	6	4	18"					Fly Ash moist	
4	18.5	20.0	2	2	4	18"		20			Fly Ash moist	

6" x 3.25 HSA ✓
HW Casing Advancer 4"
NQ Core Rock
NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 11 Date _____ Sheet 2 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								20				
5	23.5	25.0	6	5	9	18"					Fly ash moist	
6	28.5	30.0	5	5	4	18"					Fly ash moist Last 6" wet	
								30				
7	33.5	35.0	4	4	8	18					Fly ash moist	
8	38.5	40.0	2	2	2	18"					Fly ash - Saturated	
								40				

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 11 Date _____ Sheet 3 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
9	43.5	45.0	1	1	1	18		40			Fly Ash. Saturated	
10	48.5	50.0	7	8	5	18"		50			Fly Ash Saturated	
11	53.5	55.0	1	1	1	18					Fly Ash Saturated	
12	58.5	60.0	1	1	1	18"		60			Fly Ash Saturated	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 11 Date _____ Sheet 4 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								60				
13	63.5	65.0	29	29	11	13"					Clayey Sand + Gravel - Sandstone + Sandy clay Shale Fans - mixed w ash at top. Saturated	
14	68.5	69.4	23	50/4		10"					Sandy clay + Sandy clay Shale w Sand Stone Fans.	
								90			Stopped Hole 69.4	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

RM CE-5
V. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company Apco Glen Lyn
Project Ash Storage Area
Coordinates _____
Location of Boring: _____

Water Level	
Time	
Date	

Boring No. 11-B Date 9-25-90 Sheet 1 of 1
Type of Samples: SPT _____ 3" Tube ✓ Core _____
Casing used _____ Size _____ Drilling Mud used _____
Boring begun 9-25-90 Boring Completed 9-25-90
Ground Elevation _____ Referred to _____ Datum
Field Party MacKnight - Taylor Rig 75

Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"	Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
									Hole drilled for Shelby Tubes	
	5.0	7.0							2.0 Push 12 Sec Fly Ash 1.5 Rec moist	
	34.5	36.5							2.0 Push Fly Ash 13 Sec moist 1.7 Rec	
	36.5	38.5							Push 2.0 Fly Ash Time 17 Sec moist Rec 1.9 Bottom Saturated	
	38.5	40.5							Push 2.0 Rec 1.6 Fly Ash Time 10 Sec Saturated	
	40.5	42.5							Push 2.0 Rec 1.6 Time 20 Sec	
									Stopped Hole 42.5	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock
NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company Allo Glen Lyn
Project Ash Storage Area
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 12 Date 8-22-90 Sheet 1 of 4
Type of Samples: SPT ✓ 3" Tube ✓ Core ✓
Casing used _____ Size _____ Drilling mud used _____
Boring begun 8-22-90 Boring Completed 8-28-90
Ground Elevation _____ referred to _____ Datum
Field Party Smith - Taylor Rig 75

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
1	4.0	5.5	2	1	1	17"					Fly Ash - moist w/ organics	
2	9.0	10.5	1	1	1	18"		10			Fly Ash - moist w/ trace of lt. Sandy Clay	
3	14.0	15.5	3	2	2	18"					Bottom Ash Fine to med Grained moist	
4	19.0	20.5	2	1	2	18"		20			Fly Ash - moist	

6" x 3.25 HSA ✓
HW Casing Advancer 4"
NQ Core Rock ✓
NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 12 Date _____ Sheet 2 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								20				
5	24.0	25.5	2	2	3	18"					Fly Ash. moist. Trace of Organic	
6	29.0	30.5	4	4	6	18"		30			Fly Ash moist	
7	34.0	35.5	6	6	6	18"					Fly Ash. moist	
8	39.0	40.5	3	3	4	18"		40			Fly Ash. moist	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 13 Date _____ Sheet 3 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								40				
9	44.0	45.5	1	1/12"		18"					Fly Ash - Saturated	
10	49.0	50.5	1	1	1	18"		50			Fly Ash Saturated	
11	54.0	55.5	2/18"			18"					Fly Ash Saturated	
											10" Fly Ash Saturated	
12	59.0	60.5	1/12"	6		15"					5" Ash + Clayey Sand mixed up Clayey sand below Saturated	
								60				

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

FORM CE-5
REV. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company _____
Project _____
Coordinates _____

Location of Boring:	
Water Level	
Time	
Date	

Boring No. 12 Date _____ Sheet 4 of 4
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling mud used _____
Boring begun _____ Boring Completed _____
Ground Elevation _____ referred to _____ Datum
Field Party _____ Rig _____

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"			Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
								60				
13	64.0	64.8	23	50/.3							Clayey sand + Gravel - Saturated Limestone in bottom of spoon	
	64.0	66.5'				1.2	0				Sandy lime stone + Sandy shale multi-color	
	66.5'	71.5'				4.8	10				.2 Same as above 2.7 Gray sandy clay shale w/ Rust seams	
								70			1.9 Soft Red Sandy clay shale	
	71.5	74.8				3.3	72				.8 Sandy clay shale + Sandy limestone 2.5 Sandy Red clay shale	
											Stopped hole - 74.8	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

M CE-5
. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

B No. _____
MPANY APCO Glen Lyn
OJECT ASH STORAGE Area A
ORDINATES _____

OCATION OF BORING:

ATER LEVEL	
IME	
ATE	

BORING No. 12-C DATE 9-19-90 SHEET 1 OF 1
TYPE OF SAMPLES: SPT _____ 3" TUBE ✓ CORE _____
CASING USED _____ SIZE _____ DRILLING MUD USED _____
BORING BEGUN 9-19-90 BORING COMPLETED 9-19-90
GROUND ELEVATION _____ REFERRED TO _____ DATUM
FIELD PARTY Mc Knight - Taylor RIG 75

NUMBER	SAMPLE DEPTH IN FEET FROM	TO	STANDARD PENETRATION RESISTANCE BLOW / 6"	TOTAL LENGTH RECOVERY	RQD %	DEPTH IN FEET	GRAPH LOG	USCS	SOIL / ROCK IDENTIFICATION	DRILLER'S NOTES
	40.0	42.0		0						
	42.0	44.0							Push 1.9 Fly Ash Top moist Tim 15 Sec Bottom Saturated Rec 1.5	
	44.0	45.5							Push 1.5 Tim 8 Sec Fly Ash 1.4 Rec. Saturated	
	48.0	50.0		0						

6" x 3.25 HSA
HW CASING ADVANCER 4"
NQ CORE ROCK
NW CASING 3"
SW CASING 6"

RECORDER _____

CM CE-5
V. 1/87

AMERICAN ELECTRIC POWER SERVICE CORPORATION
AEP CIVIL ENGINEERING LABORATORY
LOG OF BORING

Job No. _____
Company Apco Glen Lyn
Project Ash Storage Area A
Coordinates _____

Location of Boring:

Water Level	
Time	
Date	

Boring No. 12-D Date 9-19-90 Sheet 1 of 1
Type of Samples: SPT _____ 3" Tube _____ Core _____
Casing used _____ Size _____ Drilling Mud used _____
Boring begun 9-19-90 Boring Completed 9-19-90
Ground Elevation _____ Referred to _____ Datum
Field Party MacKnight - Taylor Rig 75

Sample Number	Sample Depth in Feet From	To	Standard Penetration Resistance Blow / 6"	Total Length Recovery	RQD %	Depth in Feet	Graph Log	USCS	Soil / Rock Identification	Driller's Notes
	40.0	42.0							Push 2.0 Time 15 Sec Fly Ash Moist Rec 1.0	
	46.0	48.0							Push 1.0 Fly Ash Time 18 Sec Saturated Rec .8 May be disturbed	

6" x 3.25 HSA
HW Casing Advancer 4"
NQ Core Rock

NW Casing 3"
SW Casing 6"

Recorder _____

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-13

HRS

DATE 11-9-90 FIELD ENGINEER SCW PAGE NO. 1 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					MED STIFF	RED	SANDY CLAY	CL	
4.0									
	9/18/17	CS-1/1.5			V. STIFF	RED/BRN	SILTY CLAY	CL	
5.5									
9.0									
9.9	46/10.9	CS-2/0.7			V. STIFF	RED/BRN	SANDY CLAY AND SANDSTONE FRAGS	CL/GC	
14.0									
	12/24/27	CS-3/1.5			V. STIFF	RED/BRN	SANDY CLAY AND WEATHERED YLW/GRN SS FRAGS	CL/GC	
15.5									
19.0	50/1	NO SAMPLE							
							TOP OF ROCK 21.8 FT		
21.8				21.8	MED SOFT	RED	CLAYSTONE	V. BR	
			19/33						
	3.4 3.8	89%	26%						
25.6							(25.6 TO 25.8 GRY CLAYSTONE)		HIGH ANGLE FRACTURES CLOSED W/O WEATHERING
			2%						
	5.0 5.0	100%	90%						

REMARKS** DRILLERS (AEP) TERRY SMITH SCOTT TAYLOR RIG CME-75

PROJECT NO. 90-364-10

BORING NO. B-13

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN AEP — PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 10.01 FT TOC — BORING NO. B-13

24 HRS 10.24 FT TOC

DATE 11-9-90 FIELD ENGINEER SCW — PAGE NO. 2 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
				20.0	MED SOFT	RED	CLAYSTONE	v. BR	
31.6				22.0	MED SOFT	RED	SANDY CLAYSTONE	BR	
					MED. HARD	RED/GRY	CLAYEY SANDSTONE	BR/BL	
			30%	32.4	F. SOFT	RED	CLAYSTONE	I. BR	MEAS. 75° FRACTURE AT 34 FT. IRON STAINED
	4.8 5.0	96%	63%	34	MED SOFT	GRY/GRN	CLAYSTONE	BR	
				35.6	MED SOFT	RED	CLAYSTONE	BR	
36.6								↓	
			11.5/5.0					BL/M	
	EO 5.0	100%	76%						
41.6					↓	↓	BOTTOM OF BORING 41.6	↓	
							GEOMON CONSTRUCTION DETAILS		
							- SET GEOMON TIP AT 41.6 FT		
							-SAND TO 26.6 FT (16 FT) #1 OHIO QTZ)		
							- BENTONITE PELLET SEAL TO 22.6 FT		
							- GENSEAL SLURRY (30 GAL H_2O / 50 lbs BENSEAL)		
							TREMIED FROM 22.6 UP TO SURFACE.		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-13

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN AEP — PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ — BORING NO. B-14

HRS

DATE 10-26-90 FIELD ENGINEER SCW — PAGE NO. 1 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							MATERIAL CLASSIFICATION WAS PERFORMED ON B-15 AND IS FOUND ON THE FIELD CLASSIFICATION SHEETS FOR BORING B-15		
5.0									
10.0									
15.0									
18.0	500 PSI 40 SEC	ST-1/1.3							
20.0									
25									
30									

REMARKS** NON-SAMPLED BORING & SHELBY TUBES ONLY

DRILLERS (AFP) TERRY SMITH SCOTT TAYLOR

PROJECT NO. 90-364-10

BORING NO. B-14

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-14

HRS

DATE 10-26-90 FIELD ENGINEER SCW PAGE NO. 2 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							MATERIAL CLASSIFICATION WAS PERFORMED ON B-15 AND IS FOUND ON THE FIELD CLASSIFICATION SHEETS FOR BORING B-15.		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-14

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN DEP. PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 53.57 BORING NO. B-14

HRS 54.36

DATE 10-27-90 FIELD ENGINEER JCW PAGE NO. 3 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
61							TOP OF ROCK 61.75		AUGER REFUSAL
							PIEZOMETER CONSTRUCTION DETAILS 10-28-90		
							AUGERED TO 63 FT USING 6 INCH I.D. AUGERS. WASHED OUT PLUG USING ROLLER BIT AND WATER. SCHEDULE 40 PVC CASING WITH 9 FT SCREEN WITH 0.020 SLOTS. HIGH QUARTZ SAND FOR FILTER PACK PLACED AROUND SCREENED INTERVAL TO 51.0 FT (6 BAGS #4 OHIO QUARTZ) 100 LBS/BAG TO 51.05 FT. 3/8 INCH BENTONITE PELLETS HANG UP IN AUGERS PIEZOMETER PULLS UP NO LONGER PLACED AT CORRECT HORIZONS MUST BE PULLED HOLE ROLLER BIT WASHED AND WE'LL TRY AGAIN. WASHED 600+ GALLONS WATER RETURN CLEAN PULLING TOOLS TO TRY INSTALLATION AGAIN. PULLED BIT ROLLER BIT THERE WAS APPROXIMATELY 5 TO 6 FT OF BENTONITE TWO INCHES THICK ALL THE WAY AROUND THE GUIDE. HOLE DEPTH APPROX 61.5 FT.		
							2ND INSTALLATION		
							USED SAME CASING. SAND FROM 61.5 TO 49.8 (9½ BAGS) 3/8 BENTONITE PELLETS TO 47.2 THE REMAINED BENSEAL (1½ 50 LB BAGS IN 50 GALLONS H2O) FROM BENTONITE SEAL UP.		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-14

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-15

HRS

DATE 10-25-90 FIELD ENGINEER SCW PAGE NO. 1 OF 4

	DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
	1	2	3	4	5	6	7	8	9	10
1		9/10/8	05-1/1.5			V. STIFF	RED/BRN	SANDY CLAY TRACE MICA SOME SS. FRAGS & SHALE FRAGS	CL/SC	MOIST
	1.5				1.9					
2	3.0	8/8/7	05-2/1.3			MED ST/STIFF	GRY/BLK	FLY ASH		MOIST
3	4.5	3/2/1	05-3/1.3		5.0					
4	6.0	3/3/18	05-4/1.2		5.4	MED STF.	RED/BRN	SANDY CLAY (MICA) TO RED SANDY CLAY	CL/SC	GRY/GRN S.S. FRAGS
5	7.5	7/4/4	05-5/1.5		7.3	SOFT	GRY/BLK	FLY ASH		
6	9.0	2/1/1	05-6/1.1							
7	10.5	V1/0	05-7/1.1							
8	12.0	3/3/4	05-8/1.5							
9	13.5	5/6/4	05-9/1.5		12.6	STF/V. STF	RED/BRN	CLAYEY SAND MICA BOTTOM 1" FLY ASH	SC/CL	TRACE S.S. FRAGS.
					13.4	SOFT	GRY/BLK	FLY ASH TRACE BRN CLAY	ML/CH	
10	15.0	5/3/3	05-10/1.5		14.5	SOFT	GRY/BLK	FLY ASH	ML	
11	16.5	2/1/1	05-11/1.5					(TRACE BRN CLAY 15.2 FT)		
12	18.0	2/2/2	05-12/1.4							
13	19.5	2/2/3	05-13/1.5							
	23.5									
14	25.0	3/3/3	05-14/1.5							
	28.5									
15	30.0	2/2/3	05-15/1.5			SOFT	GRY/BLK LT GRY	FLY ASH LAYERED LIGHT AND DARK		

REMARKS** DRILLERS TERRY SMITH SCOTT TAYLOR CME 75 RIG AEP

PROJECT NO. 90-364-10

BORING NO. B-15

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-15

HRS

DATE 10-25-90 FIELD ENGINEER SCW PAGE NO. 2 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					SOFT	DK GRY LT GRY	FLY ASH LAYERED LIGHT & DARK	ML	
33.5									
16 35.0	3/2/3	05-16/1.5							
38.5									
17 40.0	2/1/1	05-17/1.5							SATURATED AT 39.6 FT APPARENTLY PERCHED ABOVE CLAY LAYER
43.5									
18 45.0	2/2/6	05-18/1.5					(BRN CLAYEY SAND TRACE MICA 43.8→44.7)		MOIST
48.5				48.8	STIFF	BRN	SAND (MICA) SANDSTONE FRAGS	SC	MOIST TO SATURATED
19 50.0	7/7/10	05-19/1.5							
53.5									
54.5 55.0	4/3/3	05-20/1.5							SATURATED
58.5									
21 60	3/4/3	05-21/1.5							

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-15

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-15

HRS

DATE 10-26-90 10-30-90 10-31-90 FIELD ENGINEER SCW PAGE NO. 3 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					STIFF	BRN	SAND SOME CLAY (MICA)	SC	
63.5 / 63.8	1000 PSI 15 SEC	CT-1 / 0.3		63.8		BRN	BROKEN SANDSTONE WITH CLAYEY SAND	GC	63.8 AUGER REF
	.75 1.5	50%	0		MED H/H	GRY	SANDSTONE	BR.	PROBABLE BOULDER
65.3					MED SOFT	RED	CLAYSTONE	BR	LOST WATER [illegible]
			4 1/4.5				67.8 A 0.1 FOOT SOFT LAYER GRY/SRN DECOMPOSED SHALE		
	4.8 4.8	100%	85%						
70.1				70.3	MED. HARD	GRY	SHALE	BR/V, BR	CORING STOPS DUE
70.1	2.0 2.0	100%	0%	71.8	SOFT	GRY	CLAY		TO BARREL BEING [illegible]
				72.1	MED. HARD	GRY	SHALE	BR/BL.	10-30-90 3" CORE BARREL TO TRY TO FREE TOOLS
									CORED TO BOTTOM FREED OTHER BARREL
			3.0/6.0						CORED 3 INCH TO 71.5 FT.
	6.0 6.0	100%	65%	75.7	HARD	GRY	CLAYEY SANDSTONE	BR	VERTICAL IRON STAINED FRACTURE 75.8
				76.6	MED. HARD	RED/GRY	SANDY SHALE	BR.	
78.1									
				79.7	HARD	GRY	CLAYEY SANDSTONE		
	7.0 7.0	100%	100%						
85.1									

REMARKS** BIT STUCK 10-26-90 UNABLE TO RETRIEVE DRIVE TOOLS IN HOLE ABOVE ON.

PROJECT NO. 90-364-10

BORING NO. B-15

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 56.10 BELOW GROUND SURFACE BORING NO. B-15

24 HRS 63.42 BELOW TOP OF CASING

DATE 10-31-90 / 11-1-90 FIELD ENGINEER SCW PAGE NO. 4 OF 4

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					HARD	GRY	CLAYEY SANDSTONE	M.	
	7.0 7.0	70%	100%						
92.9									
	2.2 2.2	100%	100%						
95.1									
	4.8 5.0	96%	100%						
101.1									
	5.0 5.0	100%	100%						
105.1									
	5.0 5.0	100%	100%						
110.1							BOTTOM OF BORING 110.1 FT		

GEOMON CONSTRUCTION DETAILS:
- SAND (#4 OHIO QUARTZ) BACKFILLED IN BORING TO 88.1 FT THEN 3/8 BENTONITE PELLETS FOR 2ND TO DEPTH 85.1. GEOMON TIP SET 85.1 FT SAND (#4 OHIO QUARTZ) TO DEPTH 67.6 FT
- BENTONITE PELLETS TO DEPTH 60.6 FT LET SET 1.5 HRS THEN PT BENTONITE SLURRY TREMIED FROM BOTTOM UP ~~50 GAL/HEAD GENSETTE~~

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-15

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-16

HRS

DATE 10-22-90 10/24/90 FIELD ENGINEER SCW PAGE NO. 1 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
				2.4	STF/V. STF	DK GRY	TOPSOIL	OL/SC	
1.5	2/6/9	OS-1/1.1				RED/BRN	CLAYEY SAND TRACE MICA	SC	
3.0	7/7/7	OS-2/1.4		2.4	STIFF	GRY/BLK	FLY ASH	ML	
4.5	3/3/3	OS-3/1.5							
6.0	2/1/2	OS-4/1.5							
7.5	1/1/1	OS-5/1.5							
9.0	1/1/0	OS-6/1.5							
10.5	1/1/0	OS-7/1.5							
	300 PSI 3.4 SEC	ST-1/1.9							
12.5									
14.0	2/2/2	OS-8/1.5							
17.5									
19.0	2/1/2	OS-9/1.5							
22.5									
24	2/2/3	OS-10/1.5							
27.5									
29.0	3/3/4	OS-11/1.5							

REMARKS** DRILLERS AEP TERRY SMITH SCOTT TAYLOR RIG CME-75

PROJECT NO. 90-364-10

BORING NO. B-16

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ HRS BORING NO. B-16

DATE 10-29-90 FIELD ENGINEER SCW PAGE NO. 2 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					MED STIFF	GRY/BLK	FLY ASH	ML	
32.5									
34.0	1/1/1	05-12/1.5							BOTTOM OF AT SATURATED
									SATURATED 32.1 FT
37.5									
39	5/13/33	05-13/1.4		38.6	MED STIFF	BRN	CLAYEY SAND TRACE MICA	SC	
					STIFF	RED/BRN	SANDY CLAY SOME SHALE FRAGS (MOIST)	CL/ML	ITY SHELBY TO BE AT 43.5 FT
43.5									BEND'S PUSH TOO SHALLOW
44.0	7/14/17	05-14/0.8					(QUARTZITE FRAG IN GRAVEL 43.7 FT)		
									ROLLER BIT ~44 TO 47.5
47.5									
49.0	19/50/4	05-15/0.3			HARD +	GRY/BRN	WEATHERED SANDY SHALE		ROLLER BIT 48.5 TO 50.0
									ROLLER BIT TO 52.6
									WASH HOLE 1/2 HR WATER
52.6				50.6	TOP OF ROCK 50.6				
					HARD	GRY	SANDSTONE	V.BR	BEGIN CORING 50.6
CORE RUN #1	7.1 7.4	76%	100						
				58.5	MED HARD VERY SOFT	GRY	INTERBEDDED SANDSTONE AND SHALE	CL/ML	
60.0							BOTTOM OF BORING 60 FT		

REMARKS** X'S MARKED ON CORE SAMPLE ARE LOSSES CAUSED BY DRILLING

PROJECT NO. 90-364-10

BORING NO. B-16

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN AFP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS 41.64 BORING NO. B-16
24 HRS 44.28

DATE 10-30-90 FIELD ENGINEER SCW PAGE NO. 3 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					CORED TO 60.0 FT. THEN REEN SWING TO SEAL IN				
					ROLLER BIT IS BROKEN OFF IN THE HOLE GOING				
					TO BENSEAL THE HOLE SHUT TRY AGAIN.				
					2nd BORING:		- PIEZOMETER CONSTRUCTION DETAILS		
							- BOTTOM OF BORING 55.1 FT		
							- SET PIEZOMETER AT BOTTOM		
							- SAND (#4 OHIO QUARTZ) TO 43.3 FT		5
							- BENTONITE PELLET SEAL TO 36.00 FT		
							- BENSEAL 1 BAG/5 GALLONS PREMIXED WITH UP		
							WATER LEVEL 45.05 FT		
							STICK UP 3.41 FT		
							WATER LEVEL 48.73		
							STICK UP 3.41		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-16

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-17

HRS

DATE 10-24-90 FIELD ENGINEER SCW PAGE NO. 1 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
1.5	4/6/9	OS-1/1.2		0.5	STIFF	BRN	BROWN SANDY SILTY CLAY	CL/SC	
				1.6	SOFT TO MED. STIFF	GRY/BRN	FLY ASH	ML	DRY
3.5									
5.0	11/15/17	OS-2/1.5							DRY
8.5									
10.0	2/3/5	OS-3/1.5							DRY
13.5									
15.0	6/3/4	15-4/1.5							DRY
18.5									
20.0	3/0/3	OS-5/1.5							DRY
23.5									
25.0	3/2/3	OS-6/1.5							
28.5									
30.0	7/10/11	OS-7/1.5			↓	↓	↓	↓	DRY

REMARKS** DRILLERS TERRY SMITH, SCOTT TAYLOR (AEP) RIG CME-75

—BORING LOCATED HALF WAY BETWEEN 7 AND 11

PROJECT NO. 90-364-10

BORING NO. B-17

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ HRS BORING NO. B-17

DATE 10-24-90 FIELD ENGINEER SCW PAGE NO. 2 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					SOFT/MED SOFT	GRY/BLK	FLY ASH	ML	DRY
33.5									SATURATED BOTTOM
35.0	1/2/3	OS-8/1.5				GRY/BLK/BRN	FLY ASH SOME CLAY		0.5 FT OF OS-8
38.5									
	250 PSI 32 SEC	ST-H/UNUSED							
40.5									
	300 PSI 18 SEC	ST-I/1.9				GRY/BLK	FLY ASH		
43.5									
48.5									
50.0	2/2/4	SS-II/1.3							BEGAN TO MAINTAIN CASING WATER LEVEL IN BORING THROUGH APPROX WATER LEVEL 30 FT.
53.5									
55.0	1/2/2	OS-12/1.5				GRY/BLK	FLY ASH		INDUCED WATER TO ~34.0 FT IN BORING PRIOR TO HAMMERING
58.5									
	UNKNOWN UNKNOWN	ST-J/1.4							

REMARKS** SHELBY TUBES AND SPLIT BARREL ARE CONSECUTIVELY NUMBERED TOGETHER BY (AEP)

PROJECT NO. 90-364-10

BORING NO. B-17

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC

PROJECT GLENLYN (AEP) PROJECT NO. 90-364-10

ELEVATION _____ GWL 0 HRS _____ BORING NO. B-17

HRS

DATE _____ FIELD ENGINEER SCW PAGE NO. 3 OF 3

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
60.5					SOFT/MED SOFT	GRY/BLK	FLY ASH	ML	
63.5									
65.0	5/9/40	OS-14/1.5		64.5	V. STF/HARD	BROWN	SANDY CLAY WITH SOME SANDSTONE FRAGS	SC/CL	INDUCED WATER LEVEL = 34' — WATER TO SWELLING
68.5									
	500 PSI 45 sec	ST-3/1.8							
67.5									
68.5									
70.0	5/9/14	OS-16			STIFF	RED/BRN	CLAYEY SAND (MICACEOUS)	SC/CL	
71.8				71.8			AUGER REFUSAL 71.8 FT		TOP OF ROCK 71.8 FT
							APPEARS TO BE SANDSTONE		
							QUARTZITE BOULDERS IN CLAY		
							50/1 BLOWCOUNTS		
							CLOSURE: BORING BACKFILLED WITH BENSEAL 1 BAG (50 LBS) MIXED WITH 55 GALLONS WATER BACKFILLED TO SURFACE WITH CUTTINGS		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-17

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION — GWL 0 HRS GROUTED BORING NO. B-18

HRS

DATE 11-12-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 1 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	3 4 6 3	S-1 1.8/2.0		0.2	M. STF	GRY/BRN	CLAY	CH	
2.0					V. SOFT	GRY/BLK	FLY ASH	ML	MOIST
	2 1 2 3	S-2 1.7/2.0							
4.0									
	1 1 1 1	S-3 0.2/2.0							
6.0									
	1	S-4 0.2/2.0							MOIST TO SATURATED
8.0									PUT TRAPS IN SAMPLER
	1	S-5 2.0/2.0							SATURATED ASH
10.0									
	1	S-6 2.0/2.0							
12.0									
	1	S-7 2.0/2.0							
14.0									
	1	S-8 2.0/2.0							
16.0									
	1	S-9 2.0/2.0							
18.0									
	1	S-10 2.0/2.0							SAMPLER DROPPING UNDER
20.0									WEIGHT OF SAMPLER RODS
	1	S-11 2.0/2.0							
22.0									
25.0									
	1 1 1	S-12 1.8/2.0							
27.0									

REMARKS** H. C. NUTTING CO. TRUCK MOUNT MOBILE B-61 BORING ADVANCED WITH 3½" I.D. HOLLOW STEM AUGERING IN CONJUNCTION WITH CONTINUOUS STANDARD PENETRATION SAMPLING 0-22 FT THEN (CONT P.2) PROJECT NO. 90-364-10

BORING NO. B-18

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION — GWL 0 HRS GROUTED BORING NO. B-18
HRS

DATE 11-12-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 2 OF 2

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	1	S-13 1.9/2.0			V. SOFT	GRY/BLK	FLY ASH	ML	SATURATED ASH
32.0									
35.0									
	1	S-14 2.0/2.0							
37.0									
40.0									
	3 4 4 6	S-15 20/20		40.1	M. STF	RED/BRN	SANDY CLAY	CL/SC	
42.0									
45.0									
	2 4 3 5	S-16 20/2.0		45.7	M. STF	YLW/BRN	CLAYEY SAND	SC/CL	
47.0									
50.0				50.1					
	100/0.3	S-16 0.4/2.0		50.8	M. STF	RED/BRN	SAND AND GRAVEL	SW/GN	TOP OF ROCK
52.0						RED	CLAYEY SHALE	V. BR.	
							BOTTOM OF BORING 51.0 FEET		
							- BORING BACKFILLED WITH VOLCLAY GROUT		
							51.0 TO 10.0 FT. BELOW THE SURFACE,		
							- TREMMIED FROM BOTTOM OF BORING UPWARD		

REMARKS** STANDARD PENETRATION SAMPLING 5 FOOT INTERVALS 25-52 FT.

DRILLERS: J.D. MARTIN, STEVE WANSTRATH, DARRELL BAILEY PROJECT NO. 90-364-10

BORING NO. B-18

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1535.95 GWL 0 HRS 8.69 BTOC BORING NO. B-18-A
24 HRS 9.00 BTOC

DATE 11-19-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 1 OF 2

STATE PLANE COORDINATES N. 389752.564 E. 1309149.392

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					V. SOFT	GRY/BLK	FLY ASH	ML	

REMARKS** H.C. NUTTING CO. TRUCK MOUNT MOBILE B-61. BORING ADVANCED WITH 3¼" I.D. HOLLOW STEM AUGERS 0-41 FEET. AUGERS STOPPED AND BORING ADVANCED WITH 3" Ø SPLIT (CONT. P. 2)

PROJECT NO. 90-364-10

BORING NO. B-18-A

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1535.95 GWL 0 HRS 8.69 BTOC BORING NO. B-18-A
24 HRS 9.00 BTOC

DATE 11-19-91 FIELD ENGINEER S.C. WIGTON PAGE NO. 2 OF 2

STATE PLANE COORDINATES N. 389752.564 E. 1309149.392

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					V. SOFT	GRY/BLK	FLY ASH	ML	
				40.1					
41.0					M, STF	RED/BRN	SANDY CLAY	CL/SC	
		○ S-1							NO SAMPLE COLLECTED
43.0									
		○ S-2							NO SAMPLE COLLECTED
45.0									
		○ S-3		45.4	M, STF	YLW/BRN	CLAYEY SAND	SC/CL	NO SAMPLE COLLECTED
47.0									
		○ S-4							NO SAMPLE COLLECTED
49.0									
							BOTTOM OF BORING 49.0 FEET		
							PIEZOMETER CONSTRUCTION DETAILS		
							- SET 2.0 FEET 3/4-INCH Ø 0.010-INCH SLOT SCREEN		AT 49.0 FEET
							- NATURAL MATERIALS CAVED IN ANNULUS 49.0 FT TO		45.0 FEET
							- BENTONITE PELLETS 45.0 TO 43.0 FT.		
							- THICK VOLCLAY GROUT 43.0 TO ~20.0 FT		
							- FLY ASH IN ANNULUS TO THE SURFACE THEN 2FT X		2 FT 4" THICK CONCRETE
							PAD AND LOCKING STEEL PROTECTIVE CASING 4-INCH I.D 4 FT LONG		
							- 3/4 PVC CAP VENTED		

REMARKS** BARREL SAMPLER 41.0 - 49.0 FEET

DRILLERS: STEVE WANSTRATH, DARRYL BAILEY PROJECT NO. 90-364-10

BORING NO. B-18-A

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1535.97 GWL 0 HRS 6.08 BTOC BORING NO. B-18-B
24 HRS 6.38 BTOC

DATE 11-19-91 FIELD ENGINEER S.C. WIGTON PAGE NO. 1 OF 2

STATE PLANE COORDINATES N. 389752.995 E. 1309155.308

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					V. SOFT	GRY/BLK	FLY ASH	ML	

REMARKS** H.C. NUTTING CO. TRUCK MOUNT MOBILE B-61 BORING ADVANCED WITH 3¼" I.D. HOLLOW STEM AUGERS 0-38 FT. DRILLERS: STEVE WANSTRATH, DARRYL BAILEY PROJECT NO. 90-364-10

BORING NO. B-18-B

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1535.97 GWL 0 HRS 6.08 BTOC BORING NO. B-18-B
24HRS 6.38 BTOC

DATE 11-19-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 2 OF 2

STATE PLANE COORDINATES N. 389752.995 E. 1309155.308

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					V. SOFT	GRY/BLK	FLY ASH	ML	
38.0							BOTTOM OF BORING 38.0 FT.		
							PIEZOMETER CONSTRUCTION DETAILS		
							- SET 6 INCH COORS ALUMINUM FILTER HIGH AIR ENTRY CASSAGRANDE SPECIAL POROUS TUBE PIEZOMETER AT 38.0 FEET		
							- 3/4-INCH PVC RISER TO SURFACE		
							- ANNULUS CONSISTS OF FLY ASH ENTIRE LENGTH		
							- 2 FT x 2 FT 4 INCH THICK CONCRETE PAD AND LOCKING PROTECTIVE STEEL CASING 4-INCH I.D. 4 FT LONG.		
							- VENTED PVC CAP ON RISER.		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-18-B

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1536.76 GWL 0 HRS GROUTED BORING NO. B-19

HRS

DATE 11-13-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 1 OF 2

STATE PLANE COORDINATES N. 389702.340 E. 1309291.878

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	3 3 4 6	○ S-1 1.9/2.0			SOFT	GRY/BLK	FLY ASH	ML	DRY
2.0									
	5 4 5 7	○ S-2 1.5/2.0							
4.0									
	3 2 1 1	○ S-3 2.0/2.0							SATURATED 5.3 FT.
6.0									
	1 2 5 7	○ S-4 2.0/2.0							
8.0									
	2 4 4 5	○ S-5 1.4/2.0							
10.0									
	1 3 2 3	○ S-6 2.0/2.0							
12.0									
		△ ST-1							
14.0									
	1 1 1 1	○ S-7 1.4/2.0			▽				
16.0					V. SOFT				
	1 1	○ S-8 1.6/2.0							
18.0									
	1 1	○ S-9 1.4/2.0							
20.0									
	1 1	○ S-10 1.8/2.0							
22.0									
25.0									
	1	○ S-11 1.3/2.0							
27.0									
					▽	▽	▽	▽	

REMARKS** H.C. NUTTING CO. TRUCK MOUNT MOBILE B-61. BORING ADVANCED WITH 3¼" I.D. HOLLOW STEM AUGERING IN CONJUNCTION WITH CONTINUOUS STANDARD PENETRATION) SAMPLING 0-22 FT.

(CONT P. 2)

PROJECT NO. 90-364-10

BORING NO. B-19

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1536.76 GWL 0 HRS GROUTED BORING NO. B-19

HRS

DATE 11-13-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 2 OF 2

STATE PLANE COORDINATES N. 389702.340 E. 1309291.878

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	1 1	S-12 1.2/2.0			V. SOFT	GRY/BLK	FLY ASH	ML	
32.0									
35.0									
	1 1	S-13 1.8/2.0							
37.0									
40.0			-						
	8 9 10 11	S-14 2.0/2.0		40.6	M. STF	RED/BRN	CLAYEY SAND	SC/CL	
42.0									
	7 10 12 16	S-15 2.0/2.0							
44.0									
	46 42 28	S-16 2.0/2.0							
46.0									
	5 8 9 11	S-17 2.0/2.0		47.2					
48.0					M. STF	RED/BRN	CLAYEY SAND SOME GRAVEL	SC/GC	
	10 12 37 41	S-18 2.0/2.0							
50.0									
	6 8 8 12	S-19 2.0/2.0							
52.0									
	56 100/8.4	S-20 0.9/2.0		52.4		RED	CLAYEY SHALE	V. BR	
54.0							BOTTOM OF BORING 52.4 FEET		
							- BORING BACKFILLED WITH VOLCLAY GROUT		
							52.4 FEET TO 8 FEET BELOW SURFACE		
							- TREMMIED FROM BOTTOM OF BORING UPWARD.		

REMARKS** THEN 5-FOOT INTERVALS 25-40 FEET THEN CONTINUOUS 40.0 TO 52.4 FEET

DRILLERS: J.D. MARTIN, STEVE WANSTRAM, DARRELL BAILY PROJECT NO. 90-364-10

BORING NO. B-19

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1572.60 GWL 0 HRS 41.0 BTOC BORING NO. B-20
48 HRS 38.45 BTOC

DATE 11-13-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 1 OF 3

STATE PLANE COORDINATES N. 389179.353 E. 1309802.209

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	3 2 4 8	S-1 1.4/2.0		0.6	M. STF	RED/BRN	CLAY (FILL)	ML	
2.0					SOFT	GRY/BLK	FLY ASH	ML	
10.0									
	7 12 14	S-2 2.0/2.0							
12.0									
20.0									
	5 5 5 6	S-3 2.0/2.0							
22.0									
25.0									
	8 8 8 10	S-4 2.0/2.0							
27.0									

REMARKS** H. C. NUTTING CO. TRUCK MOUNT MOBILE B-61. BORING ADVANCED WITH 3¼" I.D. HOLLOW STEM AUGERS IN CONJUNCTION WITH STANDARD PENETRATION SAMPLING 0-2 FT, 10-12 FT, 20-22 FT

(CONT P. 2)

PROJECT NO. 90-364-10

BORING NO. B-20

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1572.60 GWL 0 HRS 41.0 BTOC BORING NO. B-20
48 HRS 38.45 BTOC

DATE 11-13-91 FIELD ENGINEER S.C. WIGTON PAGE NO. 2 OF 3

STATE PLANE COORDINATES N. 389179.353 E. 1309802.209

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	9 7 8	S-5 2.0/2.0			SOFT	GRY/BLK	FLY ASH	ML	
32.0									
35.0									
	1 2 1 2	S-6 2.0/2.0							SATURATED S-6
37.0									
40.0									
	2 3 2 2	S-7 2.0/2.0							
42.0									
45.0									
	1 1 3 4	S-8 1.8/2.0							
47.0									
50.0									
	1 1 1 3	S-9 2.0/2.0							
52.0									
55.0									
	1 1 3 4	S-10 2.0/2.0							
57.0									

REMARKS** THEN 5-FOOT INTERVALS 25-75 FT THEN CONTINUOUS 75-83 FT.

DRILLERS: STEVE WANSTRATH, DARRYL BAILEY

PROJECT NO. 90-364-10

BORING NO. B-20

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN FLY ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1572.60 GWL 0 HRS 41.0 BTOC BORING NO. B-20
48 HRS 38.45 BTOC

DATE 11-13-91/11-14-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 3 OF 3

STATE PLANE COORDINATES N. 389179.353 E. 1309802.209

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	1 2 3 4	S-11 2.0/2.0			SOFT	GRY/BLK	FLY ASH	ML	
62.0									
65.0									
	1 1 3 5	S-12 2.0/2.0							
67.0									
70.0									
	1 1 1 2	S-13 2.0/2.0							
72.0									
				93.4	M. STF	RED/BRN	CLAYEY SAND	SC/CL	
75.0									
	5 6 7 9	S-14 2.0/2.0							
77.0				76.7	SOFT	GRY/BLK	FLY ASH	ML	
	7 11 7 10	S-15 2.0/2.0		78.4					
79.0					M. STF	BRN	CLAYEY SAND	SC/CL	
80.0									
	7 6 21 51	S-16 0.5/2.0				GRY/GRN	SANDSTONE	BR	
82.0							BOTTOM OF BORING 82.3 FT.		
83.0	42 33 50/4"	S-17 0.3/2.0					PIEZOMETER CONSTRUCTION DETAILS		
							- SET 1.5 FT 3/4-INCH Ø 0.010-INCH SLOT SCREEN	AT 80.5	FEET
							- SILICA SAND 80.5 - 78.7 FEET		
							- BENTONITE PELLETS 78.7 - 78.0 FEET		
							- THICK VOLCLAY GROUT 78.0 - 56.5 FT.		
							- ASH TO THE SURFACE THEN 2 FT x 2 FT SQ.		
							CONCRETE PAD AND LOCKING STEEL PROTECTIVE		
							CASING 4-INCH I.D. · 4 FT. LONG		
							- PVC. CAP ON CASING VENTED		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-20

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1572.63 GWL 0 HRS 39.12 BTOC BORING NO. B-20-A
72 HRS 35.69 BTOC

DATE 11-14-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 1 OF 3

STATE PLANE COORDINATES N. 389184.226 E. 1309793.503

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
					SOFT	GRY/BLK	FLY ASH	ML	

REMARKS** H.C. NUTTING CO. TRUCK MOUNT MOBILE B-61 BORING ADVANCED WITH 3¼" I.D. HOLLOW STEM AUGERS 0-70 FEET. DRILLERS: STEVE WANSTRATH, DARRYL BAILEY

PROJECT NO. 90-364-10

BORING NO. B-20-A

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1572.63 GWL 0 HRS 39.12 BTOC BORING NO. B-20-A
72 HRS 35.69 BTOC

DATE 11-14-91 FIELD ENGINEER S.C. WIGTON PAGE NO. 2 OF 3

STATE PLANE COORDINATES N. 389184.226 E. 1309793.503

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
31.0					SOFT	GRY/BLK	FLY ASH	ML	

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-20-A

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1572.63 GWL 0 HRS 39.12 BTOC BORING NO. B-20-A
72 HRS 35.69 BTOC

DATE 11-14-91 FIELD ENGINEER S.C. WIGTON PAGE NO. 3 OF 3

STATE PLANE COORDINATES N. 389184.226 E. 1309793.503

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
61.0					SOFT	GRY/BLK	FLY ASH	ML	
70.0							BOTTOM OF BORING 70.0 FEET		
							PIEZOMETER CONSTRUCTION DETAILS		
							- SET 6 INCH COORS ALUMINUM FILTER HIGH AIR ENTRY CASSAGRANDE SPECIAL POROUS PIEZOMETER AT 70.0 FEET	TUBE	
							- 3/4 INCH PVC RISER TO SURFACE		
							- ANNULUS CONSISTS OF FLY ASH ENTIRE LENGTH		
							- 2 FT x 2 FT 4" THICK CONCRETE PAD AND LOCKING PROTECTIVE STEEL CASING 4-INCH I.D. x 4 FT LONG.		
							- VENTED PVC CAP ON RISER		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-20-A

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1565.67 GWL 0 HRS 40.31 BTOC BORING NO. B-21
72 HRS 41.50 BTOC

DATE 11-14-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 1 OF 3

STATE PLANE COORDINATES N. 389019.057 E. 1310277.914

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	4 10 12 19	S-1 1.9/2.0		0.3 / 1.1	SOFT	BRN	SILTY CLAY	CL/ML	TOPSOIL
2.0					M. STF	BRN/RED	SILTY SANDY CLAY AND ROCK FRAG'S	GC/CL	
					SOFT	GRY/BLK	FLY ASH	ML	
10.0									
	2 3 4 5	S-2 2.0/2.0							
12.0									
20.0									
	6 7 7 11	S-3 2.0/2.0							
22.0									
25.0									
	6 8 12 14	S-4 2.0/2.0							
27.0									

REMARKS** H. C. NUTTING CO. TRUCK MOUNT MOBILE B-61. BORING ADVANCED WITH 3½-INCH I.D. HOLLOW STEM AUGERING IN CONJUNCTION WITH STANDARD PENETRATION SAMPLING (CONT P. 2)

PROJECT NO. 90-364-10

BORING NO. B-21

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1565.67 GWL 0 HRS 40.31 BTOC BORING NO. B-21
72 HRS 41.50 BTOC

DATE 11-15-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 2 OF 3

STATE PLANE COORDINATES N. 389019.057 E. 1310277.914

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	7 8 9 12	S-5 2.0/2.0			SOFT	GRY/BLK	FLY ASH	ML	
32.0									
35.0									
	3 3 4 6	S-6 2.0/2.0							
37.0									
40.0					V. SOFT				-
	1 2 2 3	S-7 2.0/2.0							SATURATED ASH
42.0									
45.0									
	1 1 3 4	S-8 2.0/2.0							
47.0									
50.0									
	2 3 4 10	S-9 2.0/2.0							
52.0									
55.0									
	2 1 3 5	S-10 2.0/2.0							
57.0									

REMARKS** 0-2 FT, 10-12 FT, 20-22 FT THEN 5-FOOT INTERVALS 25-60 FT. THEN CONTINUOUS 65-69 FT.

DRILLERS: STEVE WANSTRATH, DARRYL BAILEY PROJECT NO. 90-364-10

BORING NO. B-21

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT GLEN LYN ASH DISPOSAL AREA ADDITIONAL BORINGS PROJECT NO. 90-364-10

ELEVATION 1565.67 GWL 0 HRS 40.31 BTOC BORING NO. B-21
72 HRS 41.50 FT. BELOW GROUND SURFACE

DATE 11-15-91 FIELD ENGINEER S. C. WIGTON PAGE NO. 3 OF 3

STATE PLANE COORDINATES N. 389019.057 E. 1310277.914

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
	12, 2	S-11 2.0/2.0			V. SOFT	GRY/BLK.	FLY ASH	ML	
62.0									
65.0									
	11 5 11	S-12 2.0/2.0							
67.0				66.8	M. STF	BRN	CLAYEY SAND	SC/CL	
	5 14 80 63	S-13 1.4/2.0		68.4					
69.0						GRY/GRN	SANDSTONE		
							BOTTOM OF BORING 69.0 FT.		
							PIEZOMETER CONSTRUCTION DETAILS		
							- BENTONITE PELLETS 68.5 - 66.5 FEET		
							- SILICA SAND 66.5 - 64.0 FEET		
							- SET POROUS TUBE PIEZOMETER AT 64.0		
							FEET. 3/4-INCH DIAMETER PVC		
							TUBING TO SURFACE. ANNULUS		
							CONSISTS OF ASH CAVING AROUND		
							STAND PIPE AND POUROUS TUBE		
							- POROUS TUBE : 6-INCH COORS ALUMINUM		
							FILTER HIGH AIR ENTRY		
							CASSA GRANDE SPECIAL		
							- 2 FT x 2 FT CONCRETE PAD 4-INCHES THICK		
							AND LOCKING STEEL PROTECTIVE CASING		
							4-INCH I.D. 4 FT LONG		

REMARKS** _____

PROJECT NO. 90-364-10

BORING NO. B-21

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1533 GWL 0 HRS @ SURFACE HRS — BORING NO. HAND AUGER 1

DATE 10/17/90 FIELD ENGINEER D. GRAHLHERR — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
1.0				1.0	SOFT	DK. GRAY	FLY ASH (WET)	ML	WATER @ SURFACE, GOOD RETURN
					V. SOFT	DK. GRAY	FLY ASH (VERY WET)	ML	NO RETURN, ABLE TO PUSH AUGER W/O TWISTING
5.0									
10.0									
13.0				13.0					
13.5				13.5	SOFT				STIFFER, HAD TO TWIST BUT NO RETURN
15.0				15.0	V. SOFT				SAME AS 1'-13.0'
					M. STIFF		FLY ASH (WET)		STIFFER, REQ'D MUCH WORK TO ADVANCE AUGER HAD RETURN
19.0				19.0					
					BOTTOM OF HOLE @ 19.0'				

REMARKS** HOLE HAND AUGERED W/ 3" DIA AUGER. STOPPED AUGERING @ 19' SIDE HOLE WAS CAVING, AUGERS ALMOST STUCK.

PROJECT NO. 90-364-10

BORING NO. HAND AUGER 1

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1532 GWL 0 HRS @ SURFACE - SEE LOG BELOW HRS — BORING NO. HAND AUGER 2

DATE 10/17/90 FIELD ENGINEER D. GRAHLHERR — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							WATER IN POND	ML	WATER DEPTH IN POND ~3'
3.0				3.0			BOTTOM OF POND		
					V. SOFT	DK. GRAY	FLY ASH		NO RETURN, ABLE TO PUSH AUGER W/O TWISTING
5.0									
9.0				9.0					
10.0					SOFT				LITTLE RETURN, EASILY AUGERED
14.0				14.0					
15.0					M. SOFT -	DK. GRAY TO	FLY ASH (COARSER GRAINED)		FULL RETURN, VERY HARD TO AUGER FROM SMALL BOAT
16.0				16.0	M. STIFF	BLACK			
							BOTTOM OF HOLE @ 16.0'		

REMARKS** HOLE HAND AUGERED W/ 3" DIA AUGER FROM SMALL BOAT IN POND. STOPPED AUGERING WHEN IT BECAME PHYSICALLY IMPOSSIBLE TO ADVANCE THE HOLE FROM THE SMALL BOAT.

PROJECT NO. 90-364-10

BORING NO. HAND AUGER 2

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN PROJECT NO. 90-364-10

ELEVATION ~1532 GWL 0 HRS @ SURFACE - SEE LOG BELOW BORING NO. HAND AUGER 3

HRS

DATE 10/17/90 FIELD ENGINEER D. GRAHLHERR PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							WATER IN POND	-	WATER DEPTH IN POND ~ 3'
3.0				3.0			BOTTOM OF POND		
					V. SOFT	DK GRAY	FLY ASH	ML	NO RETURN, ABLE TO PUSH AUGER W/O TWISTING
5.0									
10.0									
11.0				11.0					
					SOFT				NO RETURN, EASILY AUGERED
15.0				15.0					
					M. SOFT -	DK GRAY TO BLACK	FLY ASH (COARSER GRAINED)		FULL RETURN, VERY HARD TO AUGER FROM SMALL BOAT
17.0				17.0	M. STIFF				
							BOTTOM OF HOLE @ 17.0'		

REMARKS** HOLE AUGERED W/ 3" DIA. HAND AUGER FROM SMALL BOAT IN POND. STOPPED AUGERING WHEN IT BECAME PHYSICALLY IMPOSSIBLE TO ADVANCE THE HOLE FROM THE SMALL BOAT.

PROJECT NO. 90-364-10

BORING NO. HAND AUGER 3

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1532 GWL 0 HRS @ SURFACE - SEE LOG BELOW HRS — BORING NO. HAND AUGER 4

DATE 10/17/90 FIELD ENGINEER D. GRAHAERR — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							WATER IN POND		WATER DEPTH IN POND ~ 4'
							BOTTOM OF POND		
4.0				4.0					
5.0					V. SOFT	DK. GRAY	FLY ASH	ML	NO RETURN, ABLE TO PUSH AUGER W/O TWISTING
10.0									
11.0				11.0					
					SOFT				NO RETURN, EASILY AUGERED
15.0				15.0					
					M. SOFT -	DK. GRAY TO BLACK	FLY ASH (COARSER GRAINED)		FULL RETURN, VERY HARD TO AUGER FROM SMALL BOAT
17.0				17.0	M. STIFF				
							BOTTOM OF HOLE @ 17.0'		

REMARKS** HOLE AUGERED W/ 3" DIA. HAND AUGER FROM SMALL BOAT IN POND. STOPPED AUGERING WHEN IT BECAME PHYSICALLY IMPOSSIBLE TO ADVANCE HOLE FROM THE SMALL BOAT.

PROJECT NO. 90-364-10

BORING NO. HAND AUGER 4

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ≈1532 GWL 0 HRS @ SURFACE - SEE LOG BELOW HRS — BORING NO. HAND AUGER 5

DATE 10/17/90 FIELD ENGINEER D. GRAHLHERR — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							WATER IN POND		WATER DEPTH IN POND ≈ 4.5'
							BOTTOM OF POND		
4.5				4.5					
					V. SOFT	DK. GRAY	FLY ASH	ML	NO RETURN, ABLE TO PUSH AUGER W/O TWISTING
10.0									
11.0				11.0					
					SOFT				NO RETURN, EASILY AUGERED
15.0				15.0					
					M. SOFT - M. STIFF	DK. GRAY TO BLACK	FLY ASH (COARSER GRAINED)		FULL RETURN, VERY HARD TO AUGER FROM SMALL BOAT
17.0				17.0					
							BOTTOM OF HOLE @ 17.0'		

REMARKS** HOLE AUGERED W/ 3" DIA. HAND AUGER FROM SMALL BOAT IN POND. STOPPED AUGERING WHEN IT BECAME PHYSICALLY IMPOSSIBLE TO ADVANCE HOLE FROM THE SMALL BOAT

PROJECT NO. 90-364-10

BORING NO. HAND AUGER 5

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

gai CONSULTANTS, INC.

PROJECT AEP - GLEN LYN — PROJECT NO. 90-364-10

ELEVATION ~1532 GWL 0 HRS @ SURFACE - SEE LOG BELOW HRS — BORING NO. HAND AUGER 6

DATE 10/17/90 FIELD ENGINEER D. GRAHLHEER — PAGE NO. 1 OF 1

DEPTH FEET	BLOWS PER SIX INCHES OR CORE RECOVERY/RUN	SAMPLE NO., TYPE & RECOVERY OR % ROCK RECOVERY	RQD (%)	DESCRIPTION: PROFILE	DESCRIPTION: SOIL DENSITY—CONSISTENCY OR ROCK HARDNESS	DESCRIPTION: COLOR	DESCRIPTION: MATERIAL CLASSIFICATION	USCS OR ROCK BROKENNESS	REMARKS*
1	2	3	4	5	6	7	8	9	10
							WATER IN POND	ML	WATER DEPTH IN POND ~ 8.0'
5.0							BOTTOM OF POND		
8.0				8.0	V. SOFT	DK. GRAY	FLY ASH		NO RETURN ABLE TO PUSH AUGER W/O TWISTING
10.0									
15.0				15.0	SOFT				NO RETURN, EASILY AUGERED
17.0				17.0	M. SOFT TO M. STIFF	DK. GRAY TO BLACK	FLY ASH (COARSER GRAINED)		FULL RETURN, HARD TO AUGER FROM SMALL BOAT
20.0				20.0	M. STIFF - STIFF	TAN	SANDY CLAY W/ SOME ROCK FRAGS	CL-SC	CLAY APPEARED TO BE ORIGINAL GROUND?
22.0				22.0			BOTTOM OF HOLE @ 22.0'		

REMARKS** HOLE AUGERED W/ 3" DIA. HAND AUGER FROM SMALL BOAT IN POND. STOPPED AUGERING WHEN IT BECAME PHYSICALLY IMPOSSIBLE TO ADVANCE HOLE FROM THE SMALL BOAT.

PROJECT NO. 90-364-10

BORING NO. HAND AUGER 6

*POCKET PENETROMETER READINGS

**METHOD OF ADVANCING AND CLEANING BORING

GEOTECHNICAL DATA REPORT

AEP GLEN LYN DRILLING

GLEN LYN, VIRGINIA

MACTEC

Prepared For:

AMERICAN ELECTRIC POWER

Columbus, Ohio

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.

Abingdon, Virginia

MACTEC Project 3050090132

February 22, 2010

February 22, 2010

Mr. Gary F. Zych
American Electric Power
1 Riverside Plaza
Columbus, Ohio 43215

Phone: 614-716-2917

Subject: **Geotechnical Data Report**
AEP Glen Lyn Drilling
Glen Lyn, Virginia
MACTEC Project# 3050090132

Dear Mr. Zych:

MACTEC Engineering and Consulting, Inc., (MACTEC) is pleased to submit our results for soil and rock sampling, piezometer installation at the AEP Glen Lyn site, in Glen Lyn, Virginia. Our services, as authorized by Mr. Timothy A. Randolph of AEP, were provided in general accordance with our proposal number PROP09ABIN.031 dated August 13, 2009.

This report reviews the project information provided to us, discusses the site and subsurface conditions encountered, piezometer installation procedures and ground water level measurements.. The Appendices contain the Field Exploratory Procedures, a Key Sheet, Test Boring Logs, Piezometer Construction Logs and Cone Penetrometer Testing Summary.

MACTEC appreciates this opportunity to provide our services to you and we look forward to serving as your geotechnical consultant throughout this project. Please contact us if you have questions regarding the information presented.

Sincerely,

MACTEC ENGINEERING AND CONSULTING, INC.

Jason C. Monk E.I.T.
Staff Engineer

Brian D. Owens, P.E.
Principal Engineer
Office Manager

JCM/RDR/BDO:mss

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1.0 INTRODUCTION AND OBJECTIVES

This report presents the findings of our subsurface exploration recently performed for the existing Ash Dike at the American Electric Power (AEP) Glen Lyn Plant in Glen Lyn, Virginia. We were selected by Mr. Timothy A. Randolph on behalf of American Electric Power (AEP) to perform a subsurface exploration at the existing Ash Dike at the AEP Glen Lyn Plant.

The objectives of our subsurface exploration was to gather information about the site and subsurface conditions that could be used by AEP in their analysis of the existing Ash Dike at the Glen Lyn Plant. Laboratory testing has not been completed at this time. However, if requested, we will perform laboratory testing on samples selected by AEP. An assessment of site environmental conditions or an assessment for the presence or absence of pollutants in the soil, bedrock, surface water, or ground water of the site was beyond the proposed objectives of our exploration. Therefore, any statements in this report or attachments regarding color, odor, or unusual items or conditions are for information purposes only.

2.0 SUBSURFACE EXPLORATION SUMMARY

Subsurface conditions were explored with five widely spaced test borings drilled at predetermined locations at the site in general accordance with the procedures presented in Appendix A, as well as three cone penetrometer test (CPT) soundings in general accordance with the procedures presented in Appendix D . The boring locations and depths were provided by Mr. Gary Zych of AEP. Our geotechnical engineer established the actual boring and CPT locations in the field by taping distances and estimating angles relative to on-site landmarks. Therefore, the locations shown on the Boring Location Plan (Figure 2) should be considered approximate.

Subsurface conditions encountered at the boring locations are shown on the Test Boring Records in Appendix B and within the attached Cone Penetrometer Testing Report in Appendix D. These Test Boring Records represent our interpretation of the subsurface conditions based on the field logs and visual examination of the field samples by one of our engineers. The lines designating the interfaces between various strata on the Test Boring Records represent the approximate interface locations.

The refusal materials in all five of the test borings were explored using NQ rock coring procedures. The Recovery Ratio and Rock Quality Designation (RQD) of the recovered rock core samples were estimated

in the laboratory during visual classification. The Recovery Ratio is defined as the percentage ratio between the length of core recovered and the length of core drilled on a given core run. RQD is defined as the percentage ratio between the sum of lengths of moderately hard or better core recovered that are at least 4 inches in length to the length of core drilled on a given core run. Recovery Ratios and RQD values are shown on the Test Boring Records in Appendix B. The recovery ratios ranged from 0 to 100 percent and the RQD values ranged from 0 to 90 percent.

A summary of the total depth, depth of fill/ash soils, depth of residual/alluvial soils and depth to bedrock encountered in the borings is shown below in Table 2-1.

Table 2-1
Test Boring Summary

Boring Number	Date Completed	Top of Ground Elevation (feet)	Total Boring Depth (feet)	Depth of Fill Soils (feet)	Depth to Top of Rock (feet)	Top of Rock Elevation (feet)
P-0901	9/30/2009	1537	61.8	42.0	56.8	1480.2
P-0902	9/24/2009	1534	43.1	21.0	38.1	1495.9
P-0903	9/25/2009	1542	73.1	63.0	68.1	1473.9
P-0904	10/1/2009	1545	45.0	34.0	40.0	1505.0
P-0905	10/2/2009	1574	74.0	59.5	69.0	1505.0

Note: Elevations are estimations from topographical map and should be considered approximate.
Depths are in feet below ground surface.

Prepared by JCM on 2/22/10
Checked by BDO on 2/22/10

3.0 PIEZOMETER INSTALLATION SUMMARY

Five ground water piezometers were installed under the supervision of a MACTEC geotechnical professional during September and October 2009 at the AEP Glen Lyn Site in Glen Lyn, Virginia. Piezometers were installed after the completion of drilling activities for each test boring location. All piezometers were constructed using a 1 inch I.D. threaded PVC pipe. Screen intervals were constructed using #10 slotted, 1 inch, threaded PVC pipe in 5 foot length. Sand pack consisted of DSI GP#2 sand extending approximately one foot below the screened interval and approximately two feet above the

screened interval. ENVIROPLUG© medium bentonite pellet seals were placed approximately four feet above the sand pack and below the surface of bedrock. Annual space was grouted with Volclay© grout to ground surface for each well. Measurements of 24-hour ground water levels were made upon the completion of piezometers. A summary of the well installation and screen length is presented in Table 3-1. Piezometer installation logs are included in Appendix C.

Table 3-1
PIEZOMETER Installation Summary

Boring Number	Date Installed	Total Boring Depth (feet)	Top of Screen (feet)	Bottom of Screen (feet)	Top of Ground Elevation (feet)	Elevation of Top of Screen (feet)	Elevation of Bottom of Screen (feet)	Depth of 24-Hour Groundwater Level (feet)
P-0901	9/30/2009	61.8	5.8	55.8	1537	1531.2	1481.2	8.3
P-0902	9/24/2009	43.1	5.0	37.6	1534	1529.0	1496.4	2.1
P-0903	9/25/2009	73.1	6.0	66.0	1542	1536.0	1476.0	19.7
P-0904	10/1/2009	45	6.0	39.0	1545	1539.0	1506.0	31.4
P-0905	10/2/2009	74	8.0	68.0	1574	1566.0	1506.0	47.1

Note: Elevations are estimations from topographical map and should be considered approximate. Depths in feet below ground surface.

Prepared by JCM on 2/22/10
Checked by BDO on 2/22/10

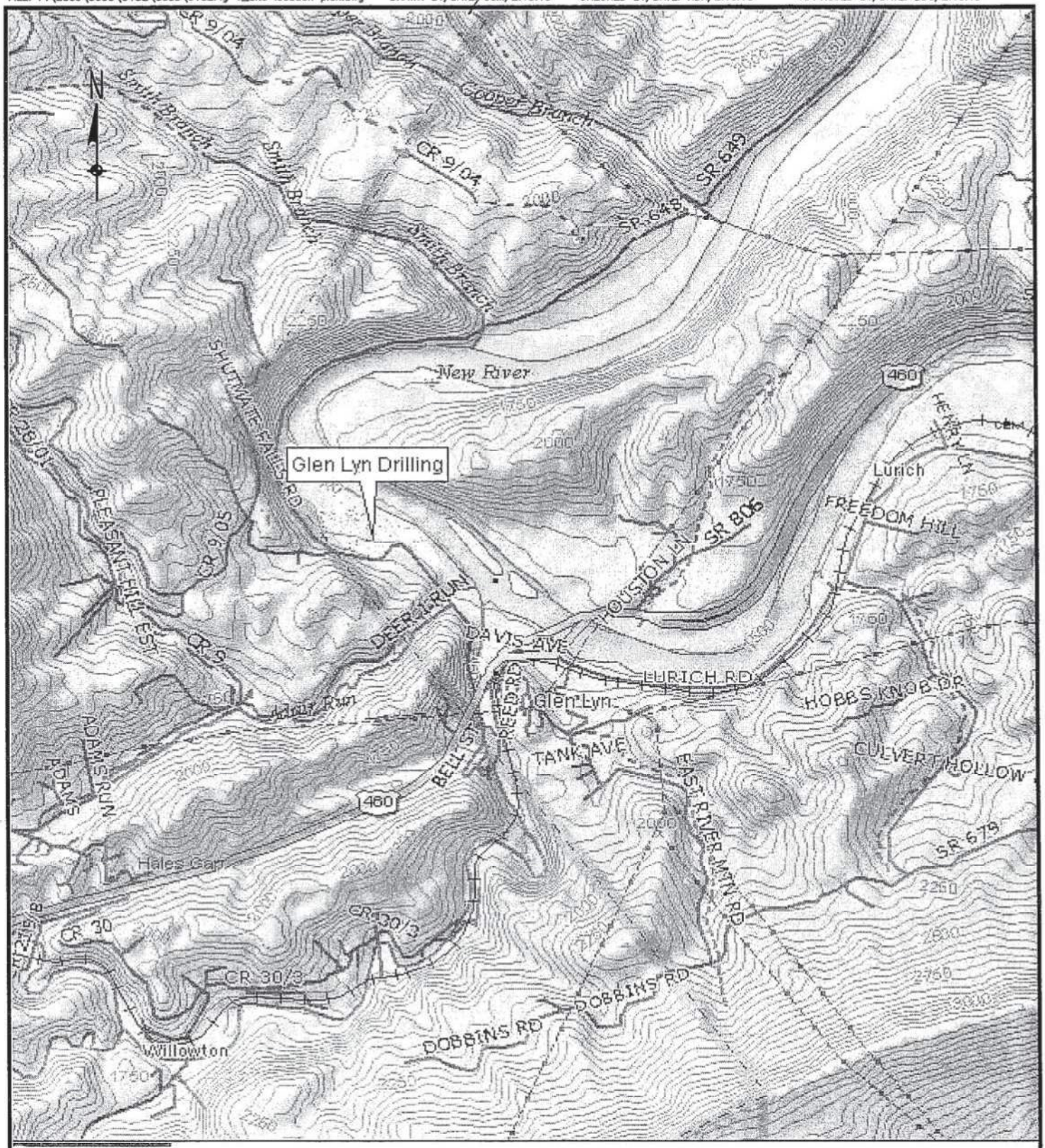
Lockable, steel well casing protective caps were installed at each location. Well caps were extended approximately 3 foot above ground surface and set in concrete cement.

4.0 CONE PENETROMETER TESTING

Cone penetration testing was completed at the request of AEP upon the completion of geotechnical drilling and sampling activities. A total of three test soundings were performed at locations selected by AEP adjacent to borings P-0901, P-0903, and P-0905. Testing was carried out with at 20-ton track mounted CPT rig using a integrated electronic seismic piezocone. Data was recorded every 5 cm as the cone advanced recording tip resistance (qc), sleeve friction (fs), and dynamic pore pressure (U). During testing pore pressures were allowed to dissipate at 10 ft intervals until refusal. Test results are provided in Appendix D.

FIGURES

FILE: P:\2009\3050\0132\acad\0132Fig 1_site location plan.dwg DRAWN BY/DATE: JCM/2.15.10 CHECKED BY/DATE: RDR/2.15.10 APPROVED BY/DATE: BDO/2.15.10



NOTE: Delorme Topo USA 7.0.

DRAWING NOT TO SCALE

AEP Glen Lyn Drilling
Glen Lyn, VA

MACTEC

MACTEC Engineering and Consulting, Inc.
1070 West Main Street, Suite 5
Abingdon, Virginia 24210

SITE LOCATION PLAN

PROJECT NO.
3050-09-0132

FIGURE 1

FILE: P:\2009\3050\0132\acad\0132Fig 2_boring location plan.dwg DRAWN BY/DATE: JCM/2.15.10 CHECKED BY/DATE: RDR/2.16.10 APPROVED BY/DATE: BDO/2.16.10



Cone Penetrometer Test Location

Soil Boring Location

NOTE: Drawing provided by others.

DRAWING NOT TO SCALE

AEP Glen Lyn Drilling
Glen Lyn, VA

MACTEC

MACTEC Engineering and Consulting, Inc.
1070 West Main Street, Suite 5
Abingdon, Virginia 24210

BORING LOCATION PLAN

PROJECT NO. 3050-09-0132

FIGURE 2

APPENDIX A

FIELD EXPLORATORY PROCEDURES

FIELD EXPLORATORY PROCEDURES

Soil Test Boring

All boring and sampling operations were conducted in general accordance with ASTM D 1586. The borings were advanced by mechanically turning continuous steel hollow-stem auger flights into the ground. At regular intervals, soil samples were obtained with a standard 2.25-inch I.D., 2-inch O.D., split-tube sampler. The sampler was first seated 6 inches to penetrate any loose cuttings and then driven an additional foot with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot of penetration was recorded and is designated the "standard penetration test (SPT) resistance." Proper evaluation of the penetration resistance provides an index to the soil's strength, density, and ability to support foundations.

Representative portions of the soil samples obtained from the split-tube sampler were sealed in glass jars and transported to our laboratory, where they were examined by our engineer to verify the driller's field classifications. Test Boring Records are attached, graphically showing the soil descriptions and penetration resistances.

Undisturbed Sampling

For quantitative testing, relatively undisturbed samples are obtained by pushing sections of thin-walled steel or brass tubing (Shelby tube) into the soil at the desired sampling levels. This procedure is described by ASTM Specification D 1587. Each tube is carefully removed from the ground, sealed, and transported to the laboratory for specialized testing. Locations and depths of undisturbed samples are shown on the Test Boring Records.

Rock Coring

Prior to coring, casing is set in the hole drilled through the overburden soils, if necessary, to keep the hole from caving. Refusal materials are then cored according to ASTM D 2113, using a diamond-studded bit fastened to the end of a hollow, double-tube core barrel. This device is rotated at high speeds, and the cuttings are brought to the surface by circulating water. Core samples of the material penetrated are protected and retained in the swivel-mounted inner tube. Upon completion of each core run, the core barrel is brought

to the surface, the core recovery is measured, the samples are removed, and the core is placed in boxes for transportation and storage.

The core samples are returned to the laboratory where the refusal material is identified, and the percent core recovery and rock quality designation are determined by a soils engineer or geologist. The percent core recovery is the ratio of the sample length obtained to the depth drilled, expressed as a percent. The rock quality designation (RQD) is obtained by summing up the length of core recovered, including only the pieces of core that are 4 inches or longer, and divided by the total length drilled.

The percent core recovery and RQD are related to the soundness and continuity of the refusal material. Refusal material descriptions, recoveries, and the bit size used are shown on the "Test Boring Records."

The NQ and NX sizes designate bits that obtain rock cores 1-7/8 and 2-1/8 inches in diameter, respectively.

Water Level Measurements

Water level readings and caved depths are measured in completed borings as noted on the Test Boring Records. These water level readings indicate the approximate location of the ambient ground-water table at the time of our field investigation. In some instances, the caved depths may possibly indicate ground-water activity.

The time of boring water level reported on the Test Boring Records is determined by field crews as the drilling tools are advanced. Additional water table readings are generally obtained approximately one day after the borings are completed. The time lag is used to permit stabilization of the ground-water table that has been disrupted by the drilling operations. Additionally, water levels were taken after the completion of piezometer installation. The readings are taken by dropping a weighted line down the boring or using an electrical probe to detect the water level surface.

APPENDIX B

KEY TO SYMBOLS AND DESCRIPTIONS

TEST BORING RECORDS

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than the No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels, gravel - sand mixtures, little or no fines.
			GP	Poorly graded gravels or grave - sand mixtures, little or no fines.
		GRAVELS WITH FINES (Appreciable amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures.
			GC	Clayey gravels, gravel - sand - clay mixtures.
	SANDS (More than 50% of coarse fraction is SMALLER than the No. 4 Sieve Size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands or gravelly sands, little or no fines.
		SANDS WITH FINES (Appreciable amount of fines)	SM	Silty sands, sand - silt mixtures
			SC	Clayey sands, sand - clay mixtures.
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts and with slight plasticity.
			CL	Inorganic lays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts.
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils.

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

SILT OR CLAY	SAND			GRAVEL		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

No.200 No.40 No.10 No.4 3/4" 3" 12"

U.S. STANDARD SIEVE SIZE

Reference: The Unified Soil Classification System, Corps of Engineers, U.S. Army Technical Memorandum No. 3-357, Vol. 1, March, 1953 (Revised April, 1960)

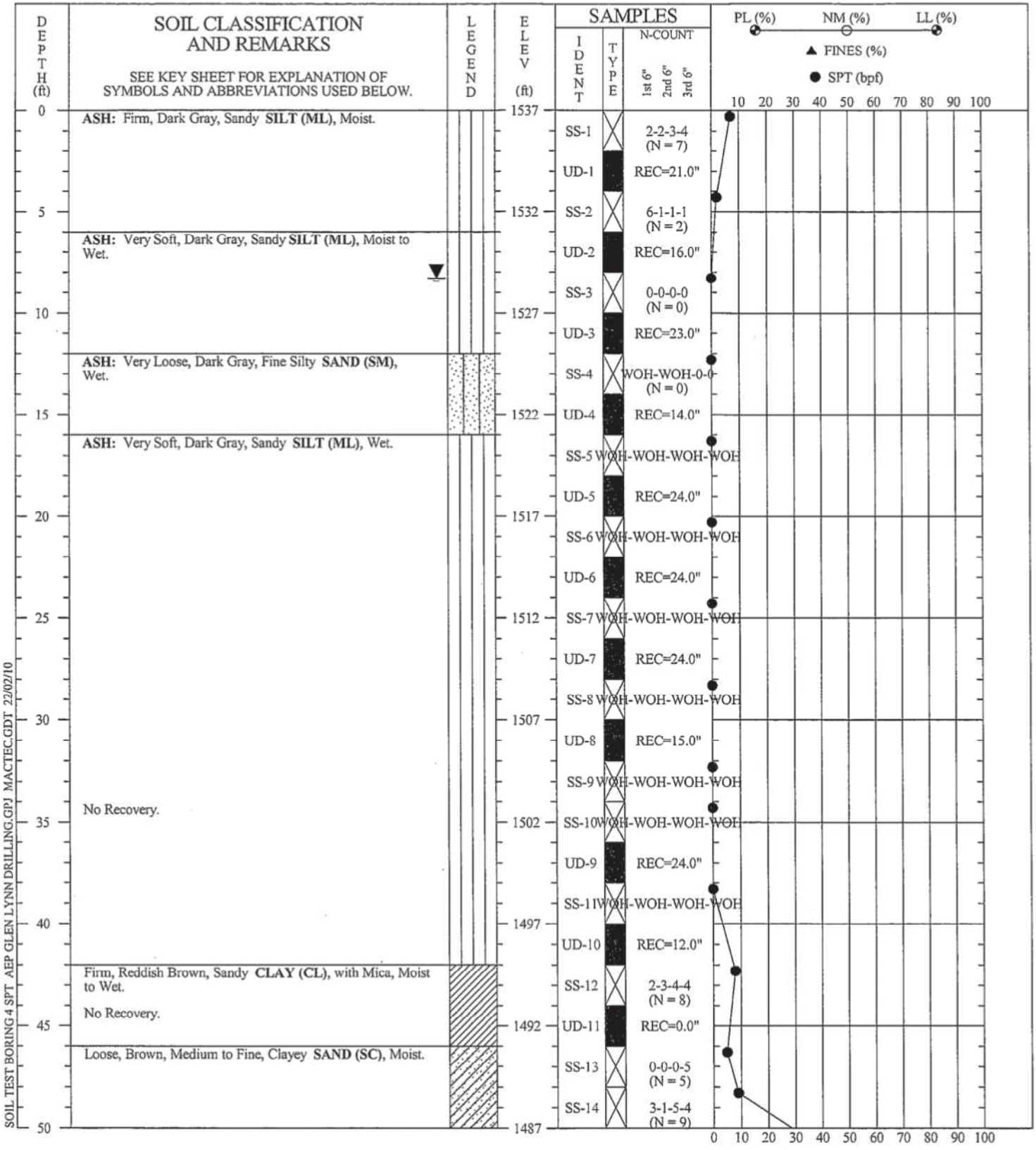
	Undisturbed Sample		Auger Cuttings
	Split Spoon Sample		Bulk Sample
	Rock Core		Crandall Sampler
	Dilatometer		Pressure Meter
	Packer		No Recovery
	Water Table at time of drilling		Water Table after 24 hours

Correlation of Penetration Resistance with Relative Density and Consistency

SAND & GRAVEL		SILT & CLAY	
No. of Blows	Relative Density	No. of Blows	Consistency
0 - 4	Very Loose	0 - 1	Very Soft
5 - 10	Loose	2 - 4	Soft
11 - 20	Firm	5 - 8	Firm
21 - 30	Very Firm	9 - 15	Stiff
31 - 50	Dense	16 - 30	Very Stiff
Over 50	Very Dense	Over 31	Hard

KEY TO SYMBOLS AND DESCRIPTIONS

MACTEC



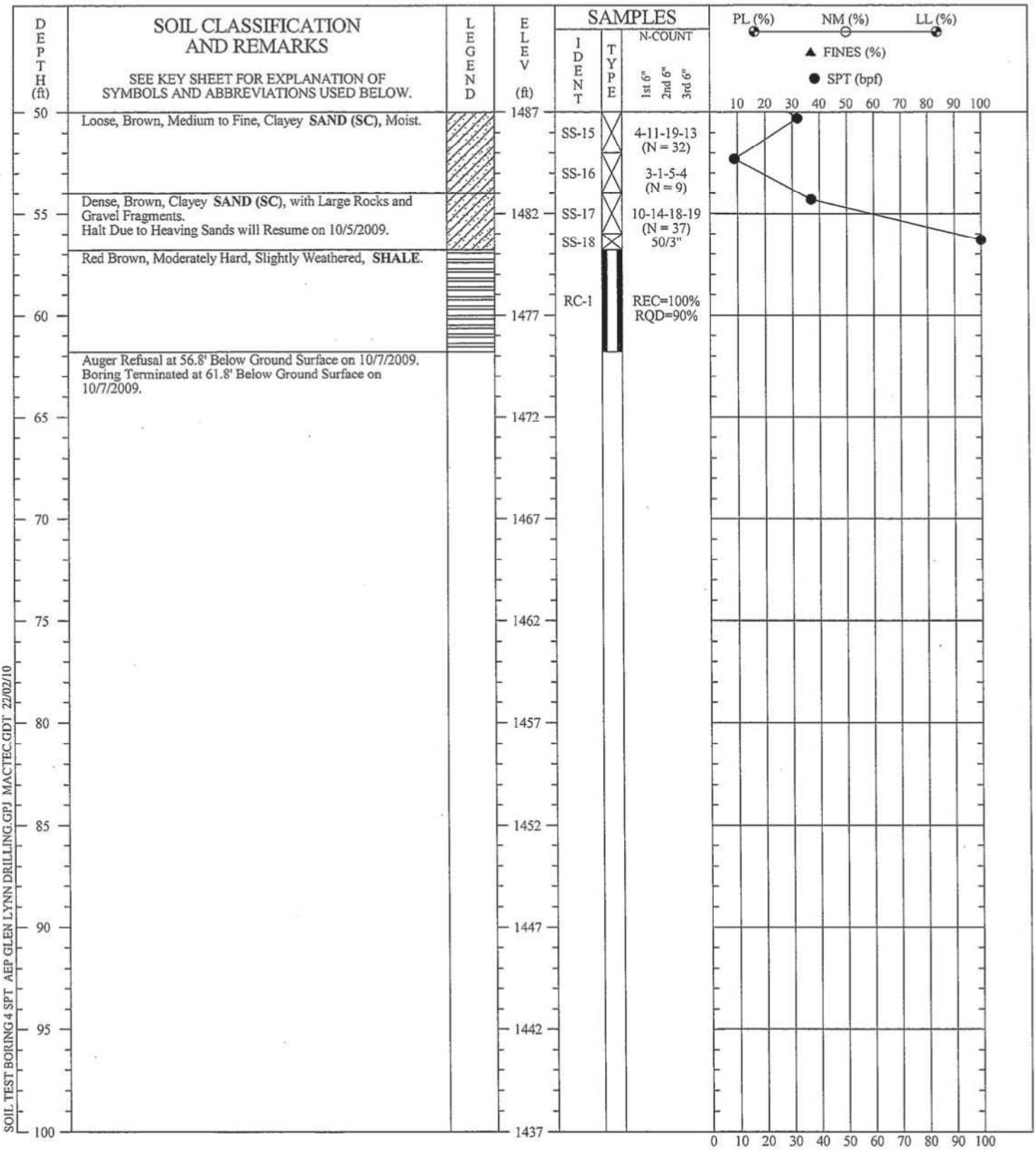
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: P-0901
PROJECT: AEP Glen Lynn Drilling
LOCATION: Glen Lyn, Virginia
DRILLED: 29 September 2009
PROJECT NO.: 3050-09-0132

MACTEC



SOIL TEST BORING 4 SPT AEP GLEN LYNN DRILLING.GPJ MACTEC.GDT 22/02/10

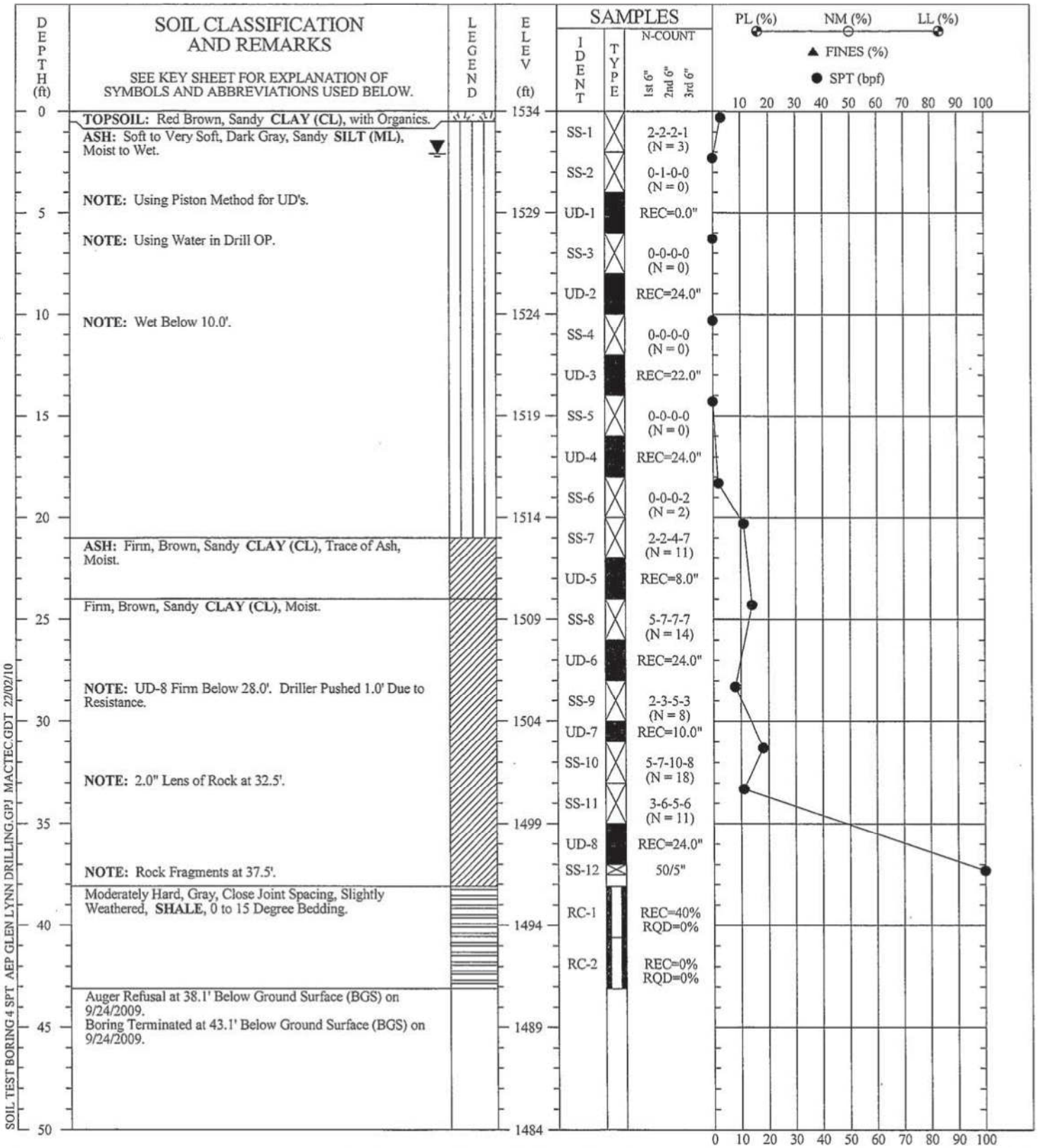
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.:	P-0901
PROJECT:	AEP Glen Lynn Drilling
LOCATION:	Glen Lyn, Virginia
DRILLED:	29 September 2009
PROJECT NO.:	3050-09-0132

MACTEC



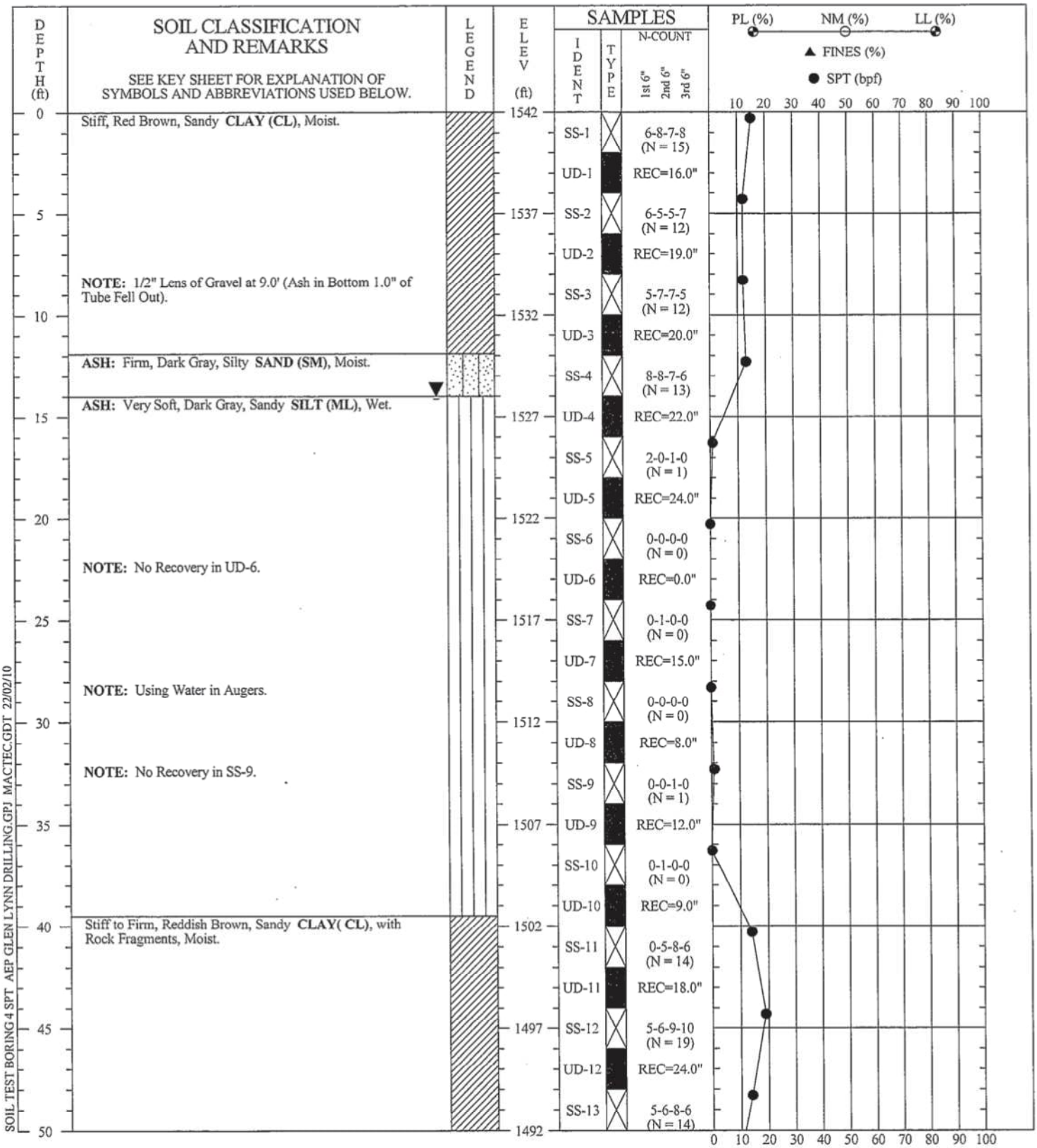
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.:	P-0902
PROJECT:	AEP Glen Lynn Drilling
LOCATION:	Glen Lyn, Virginia
DRILLED:	23 September 2009
PROJECT NO.:	3050-09-0132

MACTEC



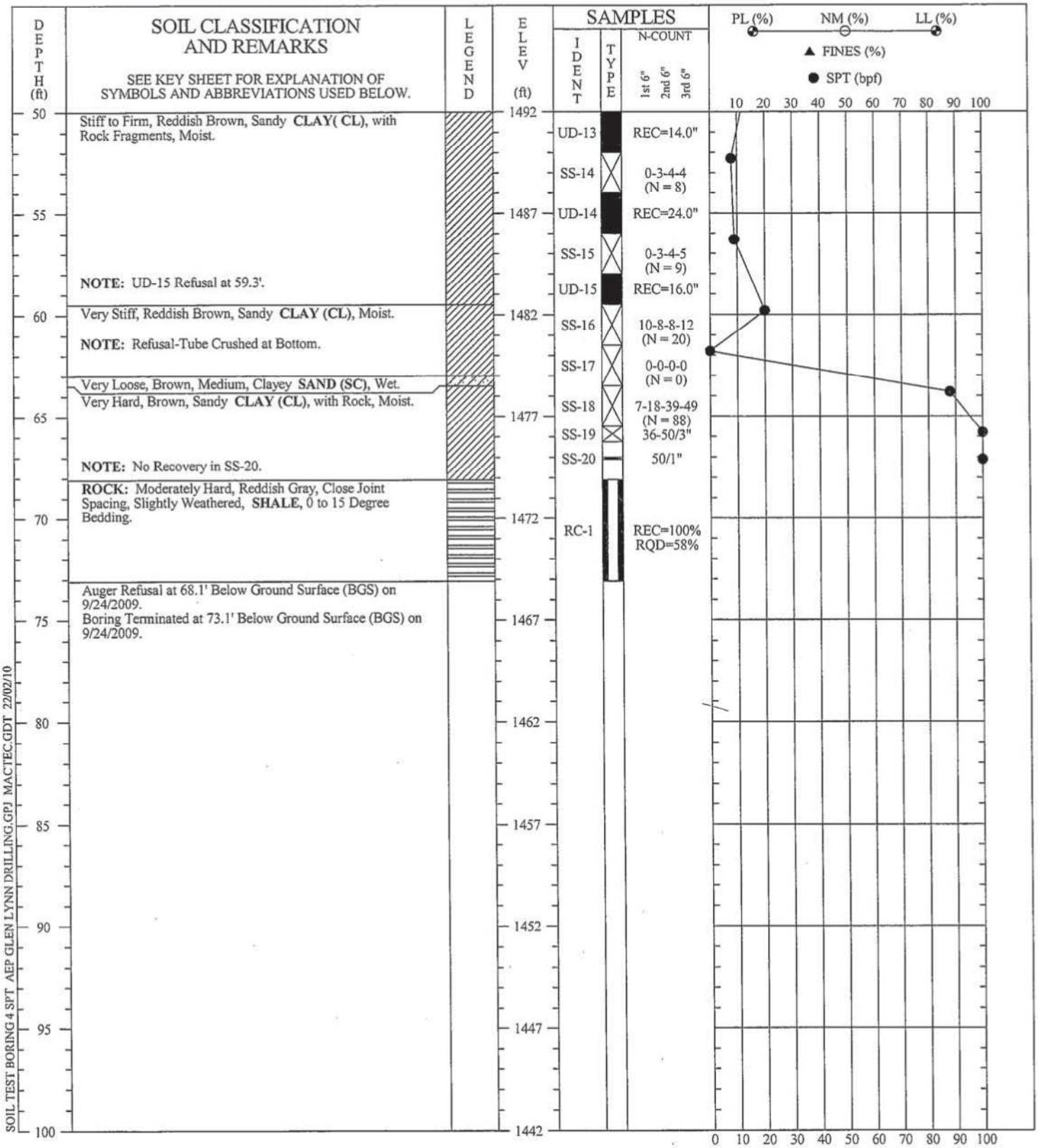
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.:	P-0903
PROJECT:	AEP Glen Lynn Drilling
LOCATION:	Glen Lyn, Virginia
DRILLED:	25 September 2009
PROJECT NO.:	3050-09-0132

MACTEC



SOIL_TEST BORING 4 SPT AEP GLEN LYNN DRILLING.GPJ MACTEC.GDT 22/02/10

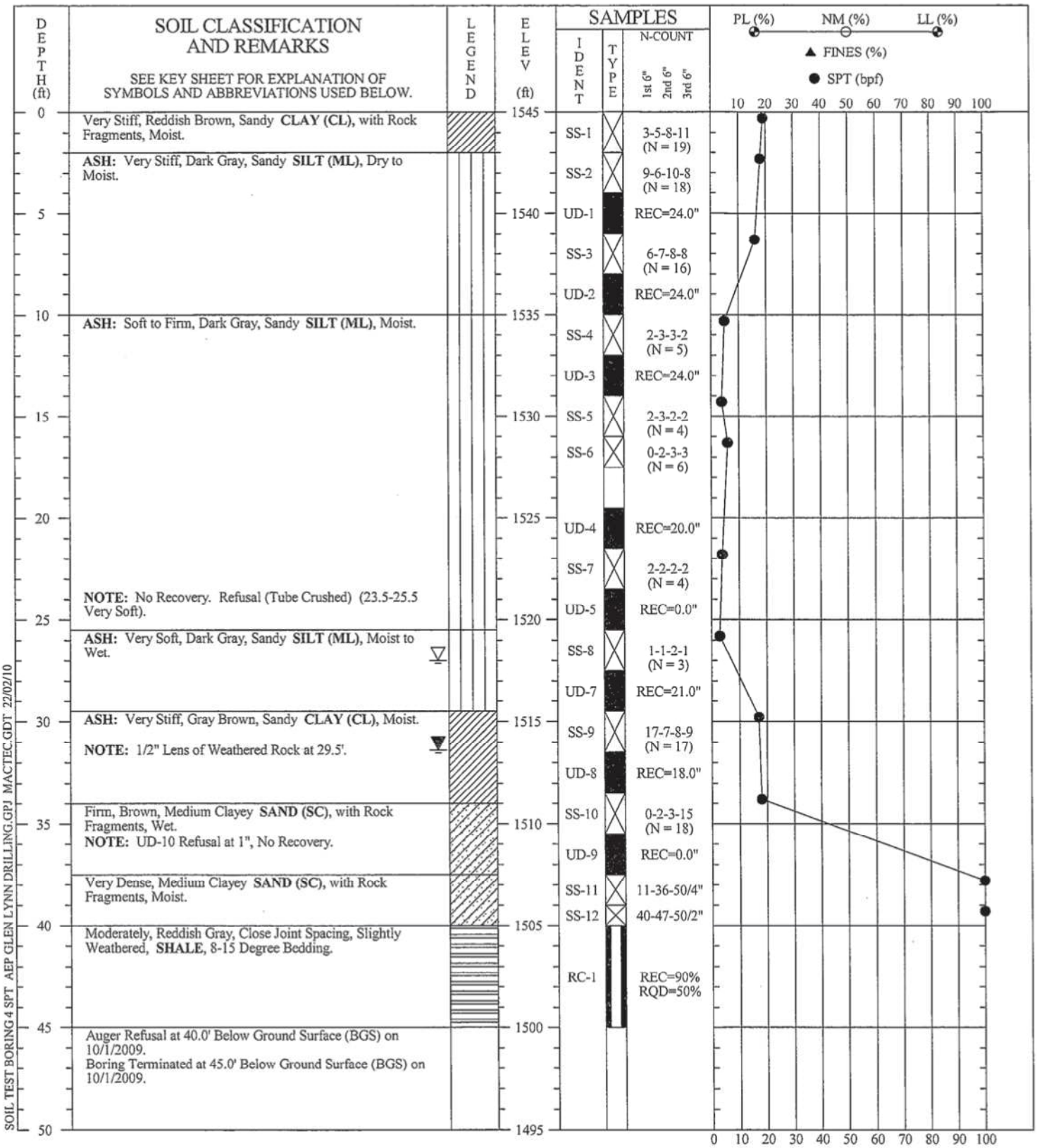
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.:	P-0903
PROJECT:	AEP Glen Lynn Drilling
LOCATION:	Glen Lyn, Virginia
DRILLED:	25 September 2009
PROJECT NO.:	3050-09-0132

MACTEC



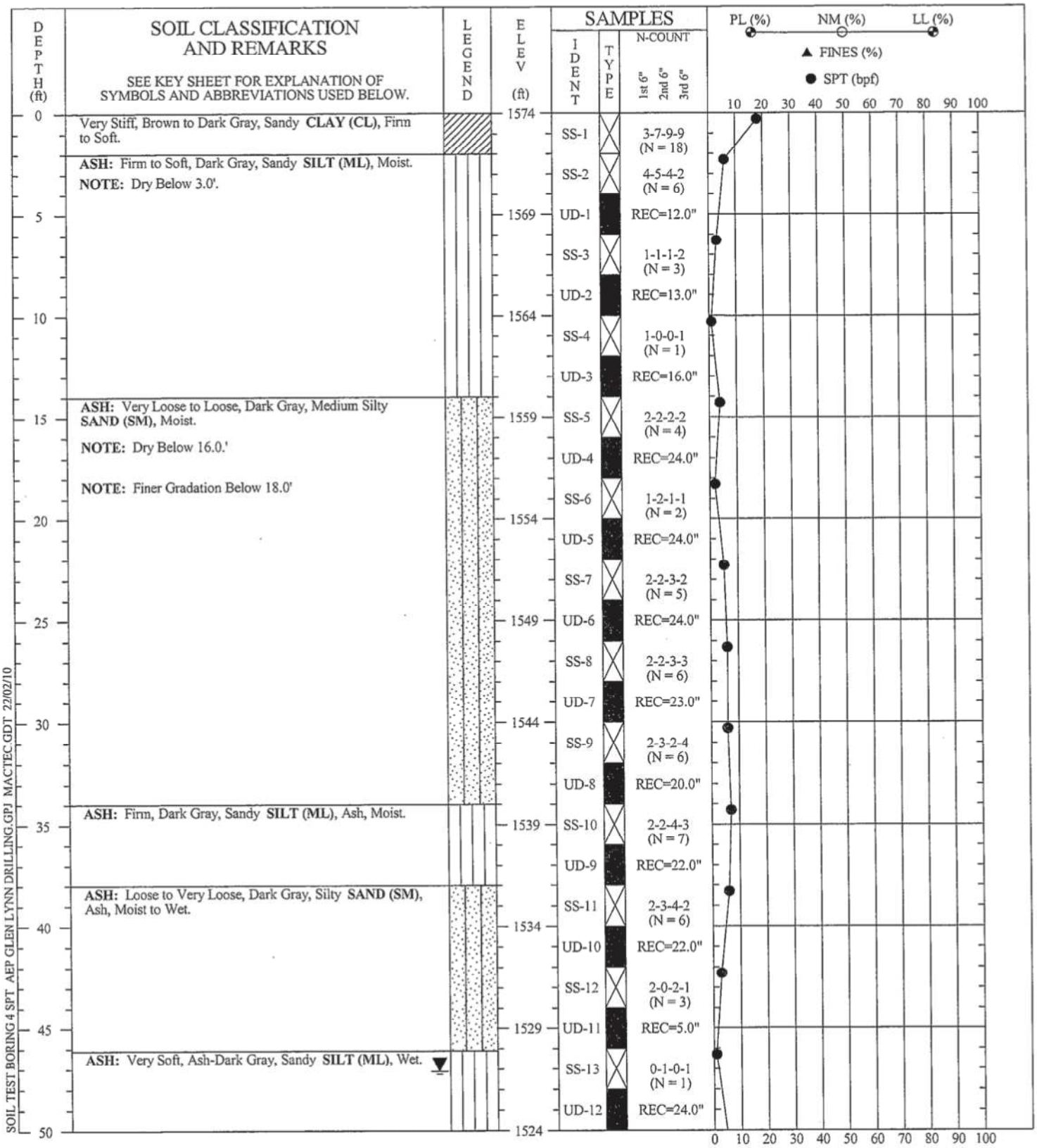
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: P-0904
PROJECT: AEP Glen Lynn Drilling
LOCATION: Glen Lyn, Virginia
DRILLED: 30 September 2009
PROJECT NO.: 3050-09-0132 **PAGE 1 OF 1**

MACTEC



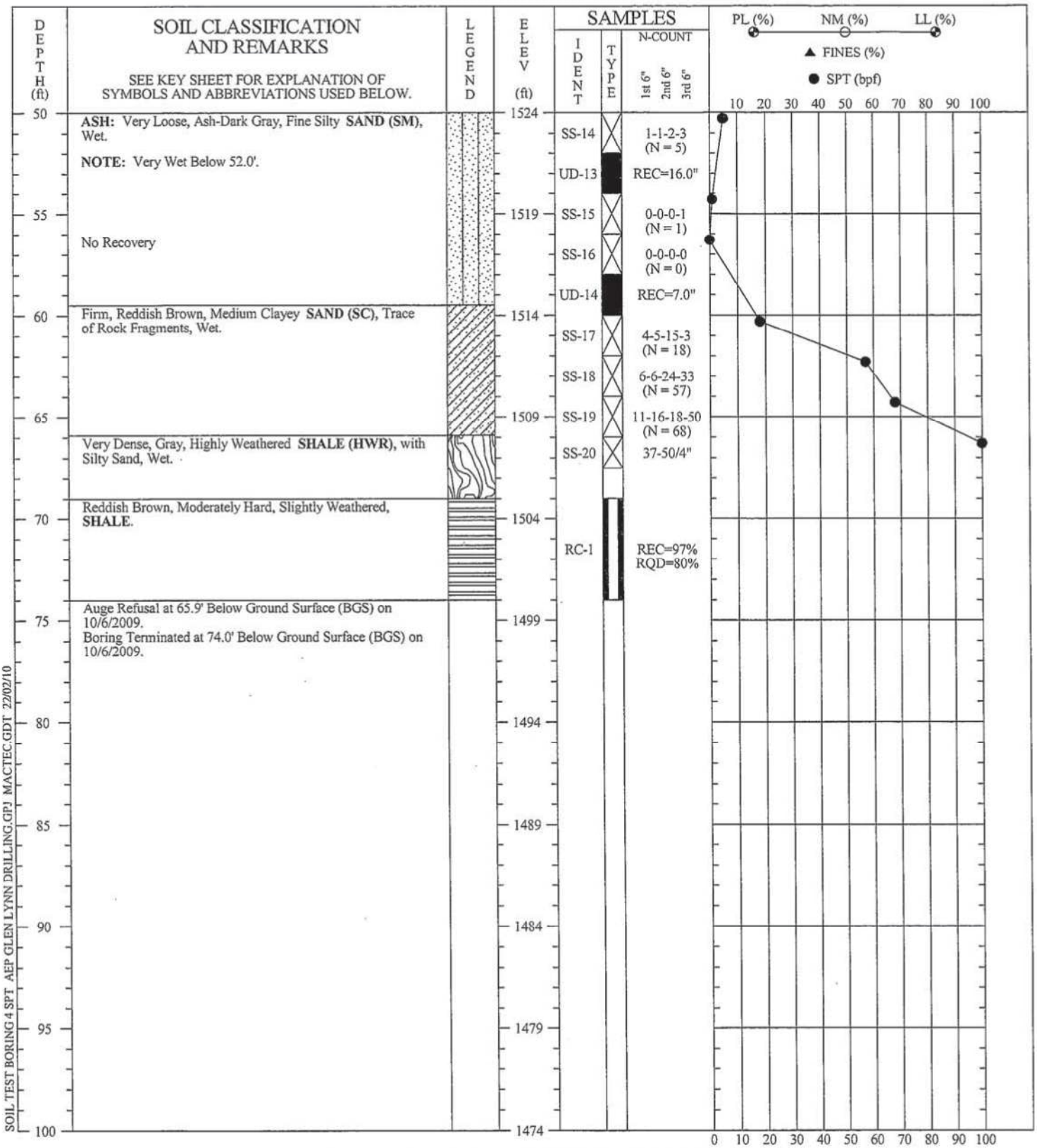
DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: P-0905
PROJECT: AEP Glen Lynn Drilling
LOCATION: Glen Lyn, Virginia
DRILLED: 01 October 2009
PROJECT NO.: 3050-09-0132

MACTEC



DRILLER:	Tri-State Drilling
EQUIPMENT:	CME-75 Truck Rig
METHOD:	3.25" HSA
HOLE DIA.:	6 inch
REMARKS:	
LOGGED BY:	D. Vass
CHECKED BY:	R. Rasnake

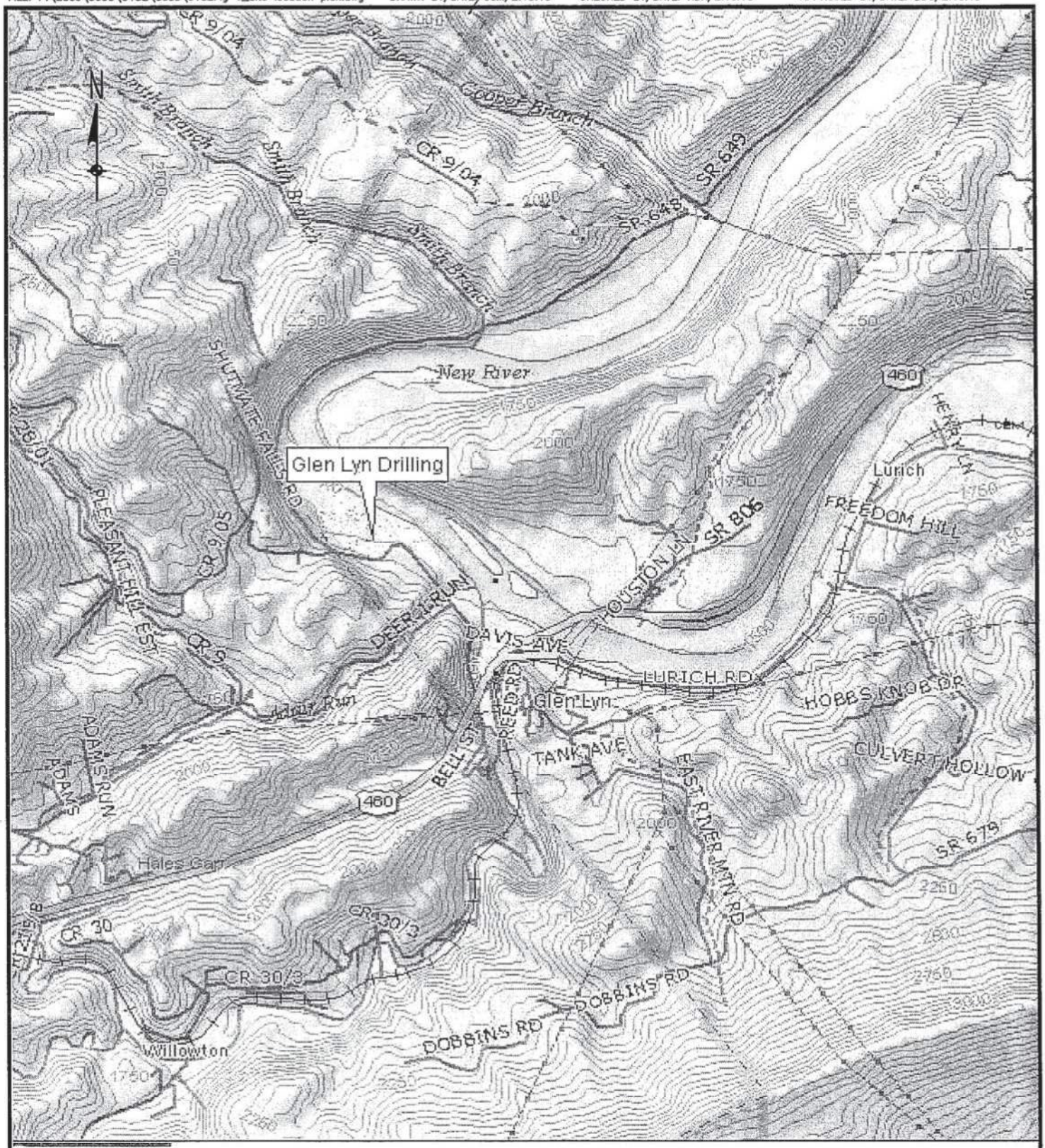
THIS RECORD IS A REASONABLE INTERPRETATION OF SUBSURFACE CONDITIONS AT THE EXPLORATION LOCATION. SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND AT OTHER TIMES MAY DIFFER. INTERFACES BEWEEN STRATA ARE APPROXIMATE. TRANSITIONS BETWEEN STRATA MAY BE GRADUAL.

SOIL TEST BORING RECORD

BORING NO.: P-0905
PROJECT: AEP Glen Lynn Drilling
LOCATION: Glen Lyn, Virginia
DRILLED: 01 October 2009
PROJECT NO.: 3050-09-0132

MACTEC

FILE: P:\2009\3050\0132\acad\0132Fig 1_site location plan.dwg DRAWN BY/DATE: JCM/2.15.10 CHECKED BY/DATE: RDR/2.15.10 APPROVED BY/DATE: BDO/2.15.10



NOTE: Delorme Topo USA 7.0.

DRAWING NOT TO SCALE

AEP Glen Lyn Drilling
Glen Lyn, VA

MACTEC

MACTEC Engineering and Consulting, Inc.
1070 West Main Street, Suite 5
Abingdon, Virginia 24210

SITE LOCATION PLAN

PROJECT NO.
3050-09-0132

FIGURE 1

FILE: P:\2009\3050\0132\acad\0132Fig 2_boring location plan.dwg DRAWN BY/DATE: JCM/2.15.10 CHECKED BY/DATE: RDR/2.16.10 APPROVED BY/DATE: BDO/2.16.10



Cone Penetrometer Test Location

Soil Boring Location

NOTE: Drawing provided by others.

DRAWING NOT TO SCALE

AEP Glen Lyn Drilling
Glen Lyn, VA

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MACTEC Engineering and Consulting, Inc.
1070 West Main Street, Suite 5
Abingdon, Virginia 24210

BORING LOCATION PLAN

PROJECT NO. 3050-09-0132

FIGURE 2

PRESENTATION OF IN SITU TESTING PROGRAM RESULTS

AEP Facility
Glen Lyn, VA
December 28 & 29, 2009

Prepared for:

MACTEC Engineering & Consulting

Prepared by:



ConeTec Inc.
Charles City, Virginia

January 11, 2010

Rev. By. JCM

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TABLE 2 Dissipation Test Summary

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FIGURE 2 Typical Dissipation Tests

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APPENDIX B Pore Pressure Dissipation Tests
APPENDIX C CPT Interpretation Methods

1.0 INTRODUCTION

This report presents the results of a piezocone penetrometer testing (CPTU) program carried out at the AEP Facility near Glen Lyn, VA. The work was performed under subcontract to MACTEC Engineering & Consulting. The CPTU program took place during the period of December 28 & 29, 2009.

Three CPTU soundings were completed at selected locations. CPT sounding locations were selected and numbered under the direction of Mr. Jason Monk with MACTEC Engineering & Consulting. This report presents the findings of our exploration.

2.0 FIELD EQUIPMENT AND PROCEDURES

2.1 CONE PENETRATION TESTING

The cone penetrometer tests were carried out using an integrated electronic seismic piezocone. In soundings CPT-0901 and CPT-0902, the piezocone used was a compression model cone penetrometer with a 10 cm^2 tip and a 150 cm^2 friction sleeve. In sounding CPT-0903, the piezocone used was a compression model cone penetrometer with a 15 cm^2 tip and a 225 cm^2 friction sleeve. The cones are designed with an equal end area friction sleeve and a tip end area ratio of 0.80. The piezocone dimensions and the operating procedure were in accordance with ASTM Standard D-5778-07. A diagram of the cone penetrometer used for this project is shown as Figure 1.

Pore pressure filter elements, made of porous plastic, were saturated under a vacuum using silicone oil as the saturating fluid. The pore pressure element was six millimeters thick and was located immediately behind the tip (the U_2 location) for all soundings.

The cone was advanced using a 20-ton track mounted CPT rig. The following data were recorded every five centimeters (approximately every 2 inches) as the cone was advanced into the ground:

- Tip Resistance (qc)
- Sleeve Friction (fs)
- Dynamic Pore Pressure (U)

The field data recorded is included on the attached CD.

Before each sounding a complete set of analog baseline readings are taken with an integated multi-meter and compared with the digitized value on the computer screen. This provides a check on the analog to digital conversion board.

Evaluation of the analog baselines is key to consistent readings. The baseline data should be stable and should not wander excessively during the course of a sounding. Baseline data can be used to apply corrections to the cone data where necessary. For this project, the baseline shift from sounding to sounding was small, typically less than 0.1% of full scale, and no data corrections were applied.

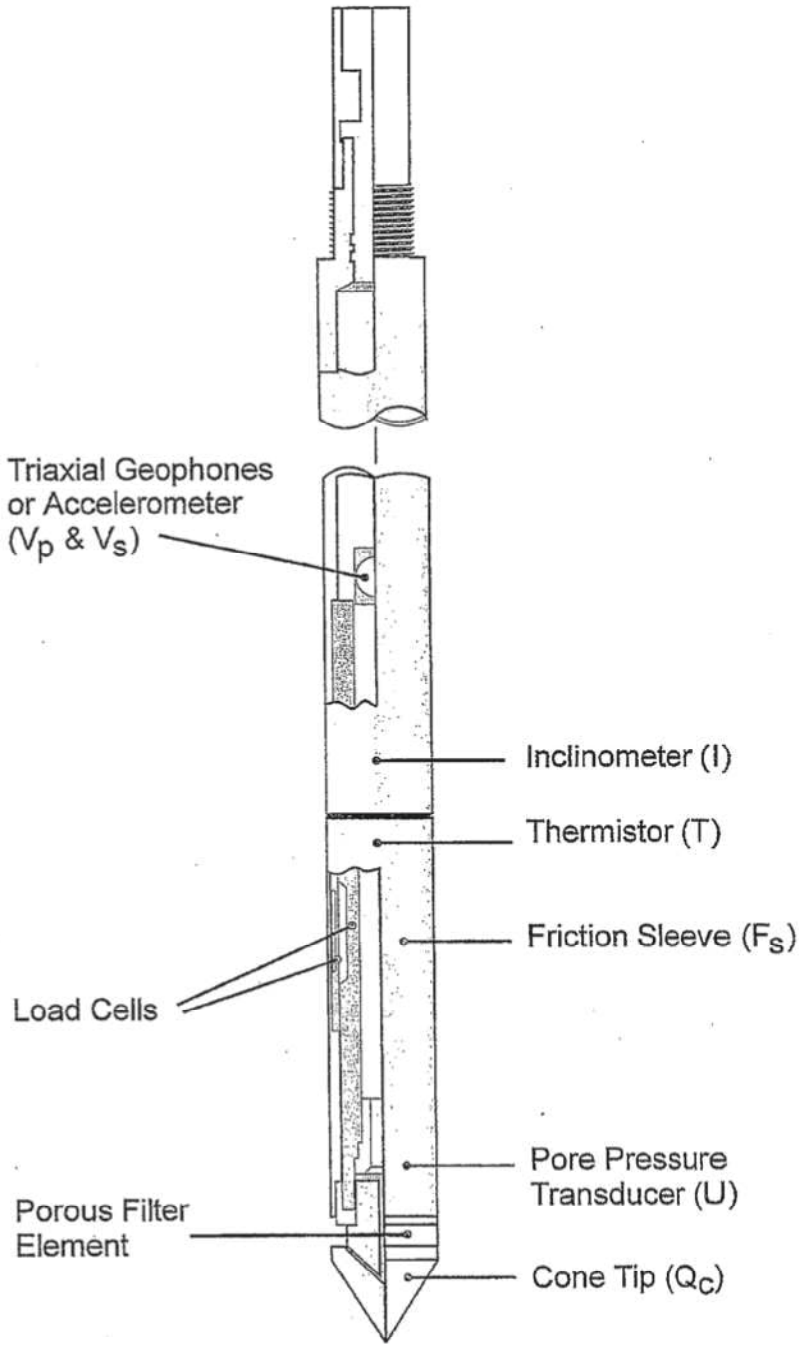


FIGURE 1 - TYPICAL CONE PENETROMETER

2.2 PORE PRESSURE DISSIPATION TESTS

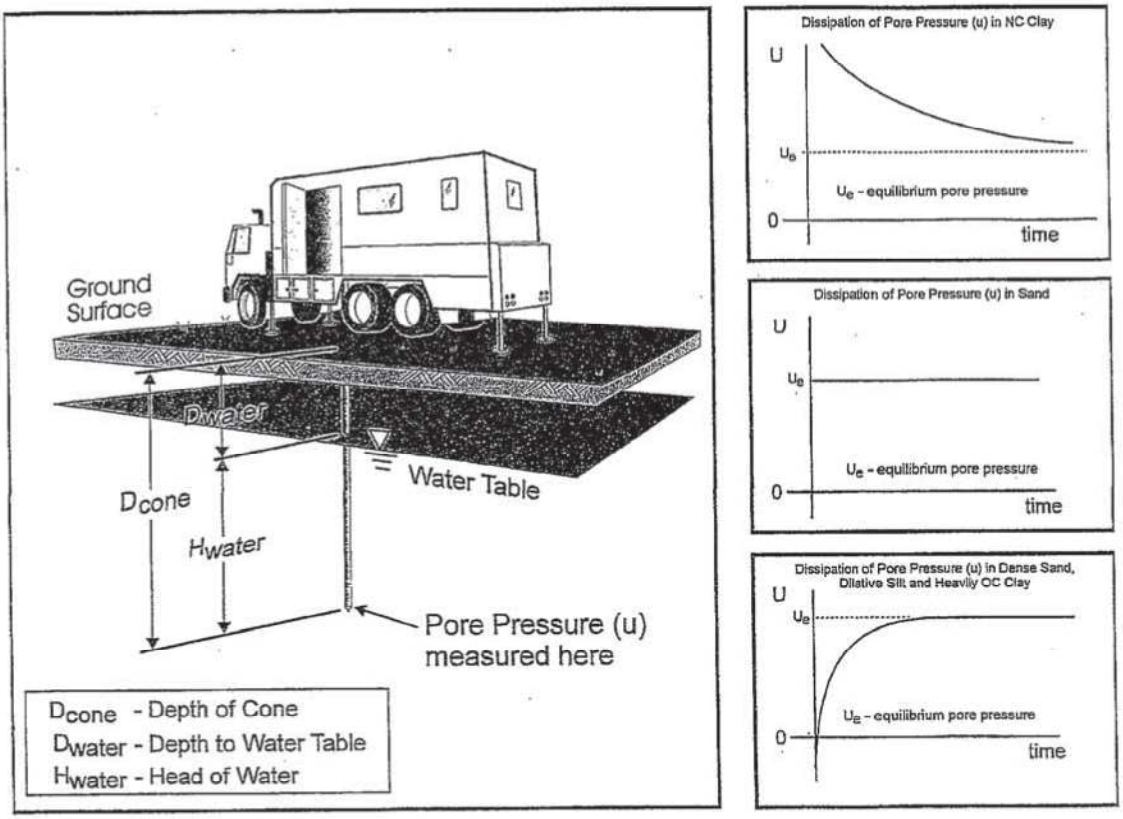
When cone penetration is stopped, the piezocone essentially becomes a piezometer. While stopped, pore water pressures are automatically recorded at five-second intervals and the readings are stored in a dissipation file. Dissipation data can then be plotted onto a dissipation curve consisting of pore water pressure (U) verses time (t). The shapes of dissipation curves are very useful in evaluating soil type, drainage and in situ static water level.

A flat curve that stabilizes quickly (i.e. less than 30 seconds) is typical of a free draining sand. In this case, the final measured pore water pressure is the static in situ water pressure.

Soils that generate excess dynamic pore water pressure during penetration will dissipate this excess pressure when penetration stops. The shape of the dissipation curve and the time of dissipation can be used to estimate c_h, the coefficient of consolidation that can in turn be used to calculate K_h, the horizontal permeability.

Figure 2 shows some idealized shapes of various pore water pressure dissipation curves. The reader is referred Robertson et. al., 1992 to reference dissipation test data analytical techniques.

Estimation of Ground Water Table from CPT Dissipation Tests



Water Table Calculation

$$D_{water} = D_{cone} - H_{water}$$

where $H_{water} = U_e$ (depth units)

Useful Conversion Factors:
1psi = 0.704m = 2.31 feet (water)
1tsf = 0.958 bar = 13.9 psi
1m = 3.28 feet

FIGURE 3 - TYPICAL DISSIPATION TESTS

3.0 CONE PENETRATION TEST DATA AND INTERPRETATION

3.1 ANALYSIS OF PIEZOCONE DATA - GENERAL

A total of three CPTU test locations were completed to depths up to approximately 65 ft below existing grade. All soundings were halted when refusal conditions were met. The interpretation of cone data is based on the relationship between cone bearing, qc, sleeve friction, fs, and penetration pore water pressure, U. The friction ratio, Rf , (sleeve friction divided by cone bearing) is a calculated parameter which is used to infer soil behavior type. 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.

The interpretation of soils encountered on this project was carried out using established correlations presented in Appendix C. It should be noted that it is not always possible to clearly identify a soil type based on qc, fs and U. Occasionally soils will fall within different soil categories on the classification charts. In these situations, experience and judgment and an assessment of the pore pressure dissipation data should be used to infer the soil behavior type. Computer tabulations of the interpreted soil types along with certain other geotechnical parameters for each cone hole is presented in the .xls files on the data CD.

Each of the parameters measured in the sounding is discussed briefly below. A detailed explanation of CPTU testing and interpretation of the results can be found in Robertson et. al. 1992.

TIP RESISTANCE (q_c): The resistance to penetration, measured at the cone tip, provides an accurate profile of subsurface strata. The recorded tip resistance is a composite of the penetration resistance of the soils located five to ten cone diameters (8 to 18 inches) in front of and behind the tip. The actual resistance "sensed" by the tip depends on the soil properties and on the relative stiffness of the layers encountered. Tip resistance is often corrected for pore pressure effects when testing in soft saturated cohesive soils.

For this project the correction was made and the tip resistance shown, q_t is the corrected tip resistance.

The correction used is: $q_t = q_c + (1\text{-}a)U$

Where:
q_t = corrected tip resistance
q_c = measured tip resistance
a = net area ratio for cone (0.80 for this project)
U = dynamic pore water pressure measured behind tip

SLEEVE FRICTION (f_s) The resistance recorded on the friction sleeve, is a measure of

the remolded strength of the soil. Values of sleeve friction in very soft soils (such as peat) may fluctuate due to the measured force being small relative to the capacity of the measuring load cell.

FRICTION RATIO (R_f) The ratio of sleeve friction to tip resistance expressed as a percentage, is an indicator of soil type. Cohesive soils generally have friction ratios that are greater than two, while sands and non-plastic silts have friction ratios that are lower than two.

PORE PRESSURE (U) Dynamic pore water pressure is measured during penetration. Dynamic pore water pressure data can be found in the .cor and .xls files. Static pore water pressure is measured when cone penetration is stopped. The measured dynamic pore water pressure changes with the location of the porous filter and negative readings are possible when the filter is located behind the tip.

It is important to note that the CPT classifies soil by physical behavior, not by grain size; therefore, the CPT classification should be verified against samples obtained from a conventional drilling program. While the CPT soil classification may not always be accurate in terms of the actual label it applies to a particular soil, it is very accurate in grouping soils with similar mechanical properties.

Table 1 in Appendix A presents a summary of the CPT soundings, including sounding depth and estimated depth of ground water table.

3.2 CONE PLOTS

The data from the soundings was plotted using the computer program ScreenZW. The CPT plots are included in Appendix A. ScreenZW was developed by ConeTec Inc. and it incorporates soil behavior type (SBT) classification as part of the plot. The soil classification is based on the classification chart reproduced chart in Appendix C.

3.3 PORE PRESSURE DISSIPATION TEST RESULTS

When conducting CPT investigations, pore water pressure dissipations are automatically recorded during pauses in penetration. The pore water pressure data is recorded at five second intervals. Pore pressure dissipation test plots are included in Appendix B. The water table depths used in the data interpretation are derived from the pore water pressure dissipation tests below the water table.

4.0 REFERENCES

Houlsby, G.T. and Teh, C.I., 1988, ISPOPT-1, Volume 2 pp 777-784

Lunne, T., Robertson, P.K., and Powell, J.J.M., 1997, *Cone penetration Testing in Geotechnical Practice*, Spon Press. NY

Mayne, P.W., 1995,"Profiling Yield Stresses in Clays by In Situ Tests", TRR No. 1479. National Academy Press, Washington D.C.

Mayne, P.W., Christopher, B. R., DeJong, J., (2001), Manual on Subsurface Exploration, National Highway Institute Publication # FHWA NHI-01-031, Washington D.C.

Robertson, P.K., 1989, "Soil Classification using the Cone Penetration Test", Canadian Geotechnical Journal, vol. 27, pages 151-158.

Robertson, P.K., Sully, J., Woeller, D.G., Lunne, T., Powell, J.M., and Gillespie, D.J., 1992, "Estimating Coefficient of Consolidation from Piezocone Tests", Canadian Geotechnical Journal, vol. 29, pages 539-550.

APPENDIX A

CONETEC

AEP Facility- Glen Lyn, VA
December 28 & 29, 2009
09-986

Table 1: Sounding Summary

Sounding Number	Filename	Depth (ft)	Estimated GWT (ft)	Comments
CPT-0901	986cp01	51.3	7	10 cm^2 cone
CPT-0903	986cp02	58.7	14	10 cm^2 cone
CPT-0905	986cp03	64.5	51	15 cm^2 cone

Table 2: Pore Pressure Dissipation Test Summary

Sounding	Depth (ft)	Duration (sec)	ch (cm^2/min)*
CPT-0901	10.0	600	13.4
CPT-0901	20.0	240	**
CPT-0901	30.0	360	39
CPT-0901	40.0	425	**
CPT-0901	50.0	420	7.67
CPT-0903	20.0	420	47
CPT-0903	30.0	300	**
CPT-0903	40.0	480	**
CPT-0903	50.0	540	2.54
CPT-0905	10.0	300	**
CPT-0905	20.3	305	**
CPT-0905	30.0	550	**
CPT-0905	40.0	420	**
CPT-0905	50.0	540	**
CPT-0905	60.0	420	**
CPT-0905	62.3	240	**
CPT-0905	64.5	185	**

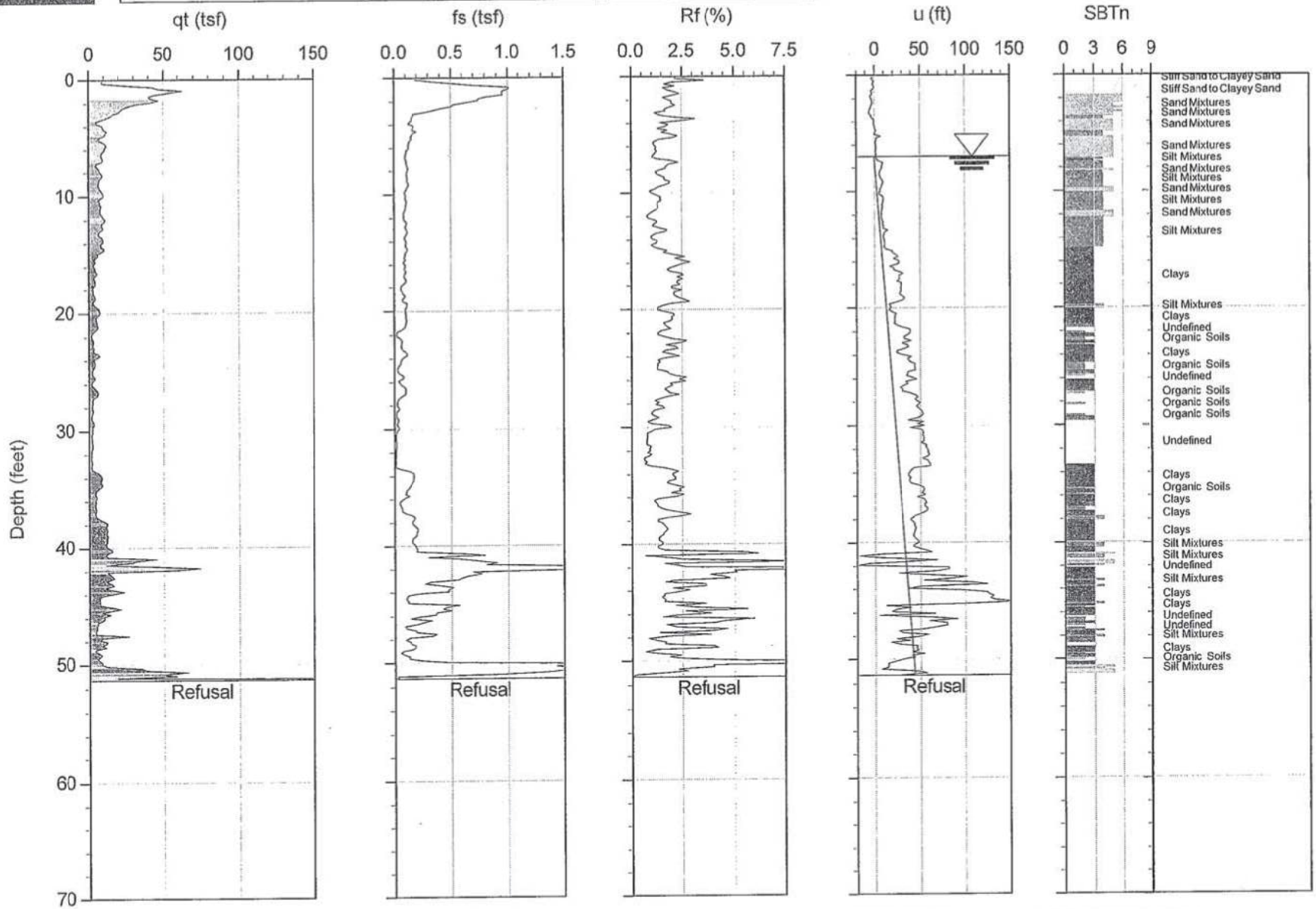
* Calculated using Ir = 100
** No appreciable dissapation occurred

CONETEC

MACTEC

Job No: 09-986
Date: 12:28:09 15:12
Site: Glen Lyn Drilling

Sounding: CPT-0901
Cone: 205:T500F10U500



Max Depth: 15.650 m / 51.34 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 986CP01.COR
Unit Wt: SBT Chart Soil Zones

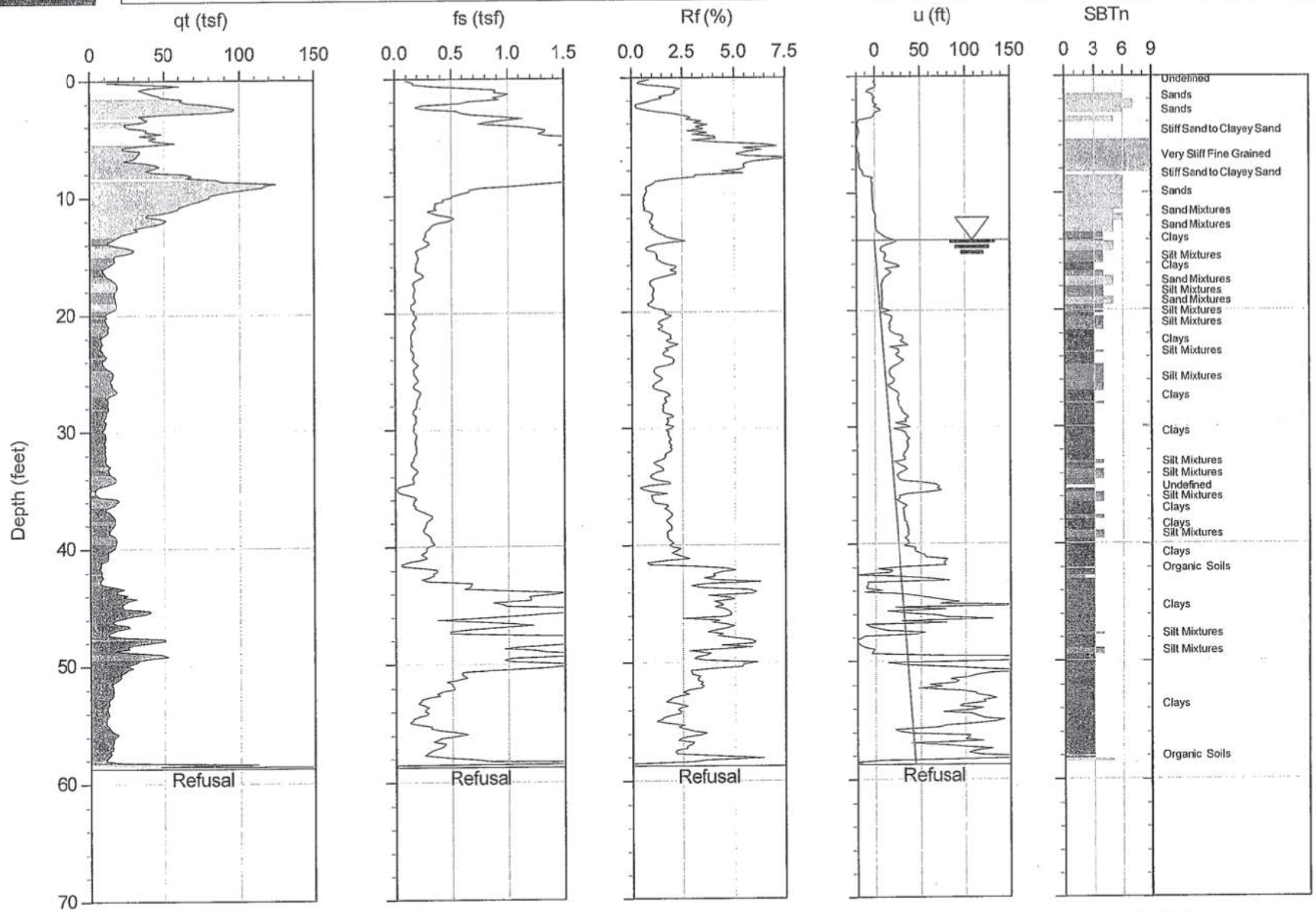
SBT: Lunne, Robertson and Powell, 1997

CONETEC

MACTEC

Job No: 09-986
Date: 12:29:09 08:06
Site: Glen Lyn Drilling

Sounding: CPT-0903
Cone: 205:T500F10U500



Max Depth: 17.900 m / 58.73 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 986CP02.COR
Unit Wt: SBT Chart Soil Zones

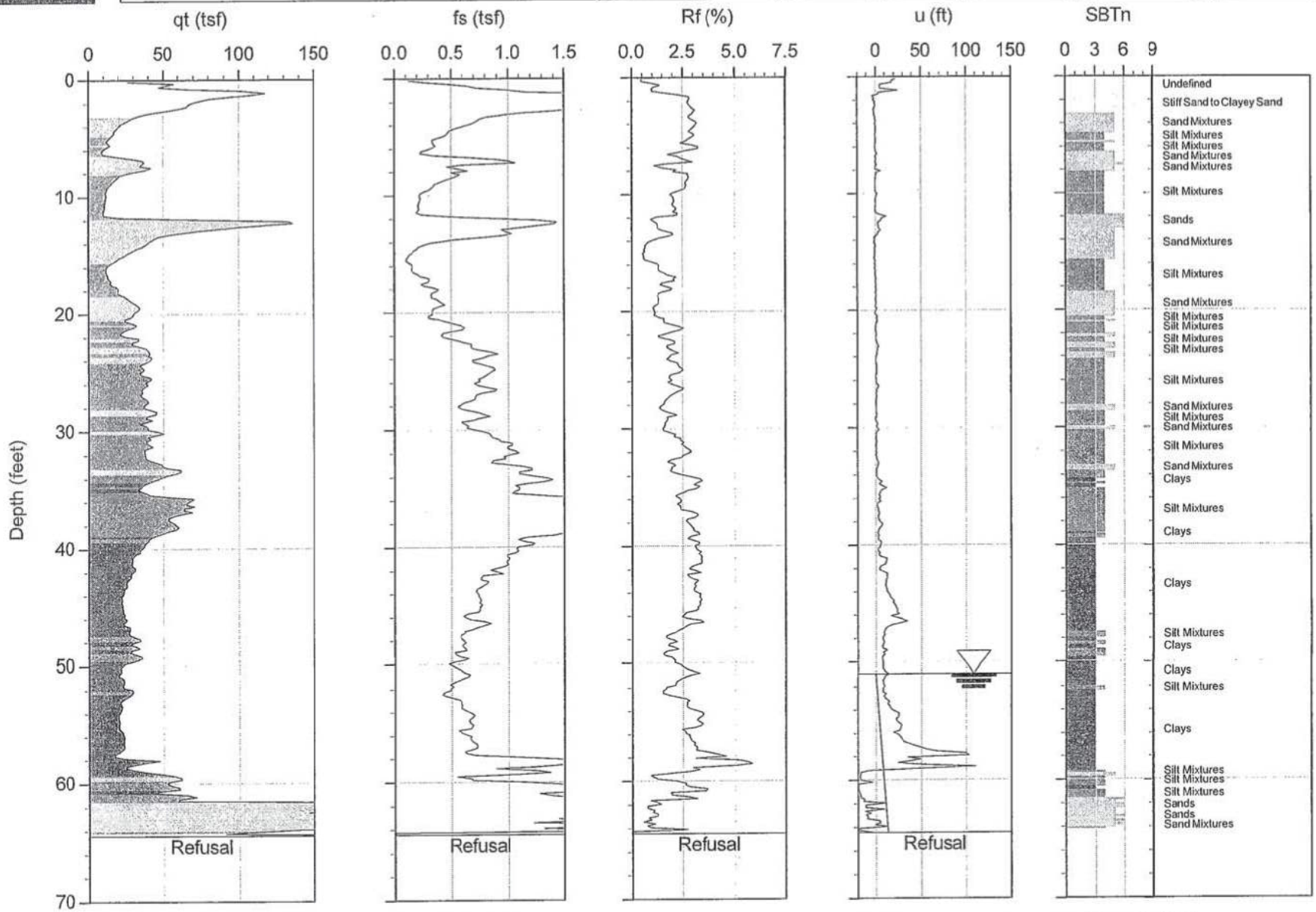
SBT: Lunne, Robertson and Powell, 1997

CONETEC

MACTEC

Job No: 09-986
Date: 12:29:09 10:12
Site: Glen Lyn Drilling

Sounding: CPT-0905
Cone: 195:T1500F15U500



Max Depth: 19.650 m / 64.47 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 986cp03.cor
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997

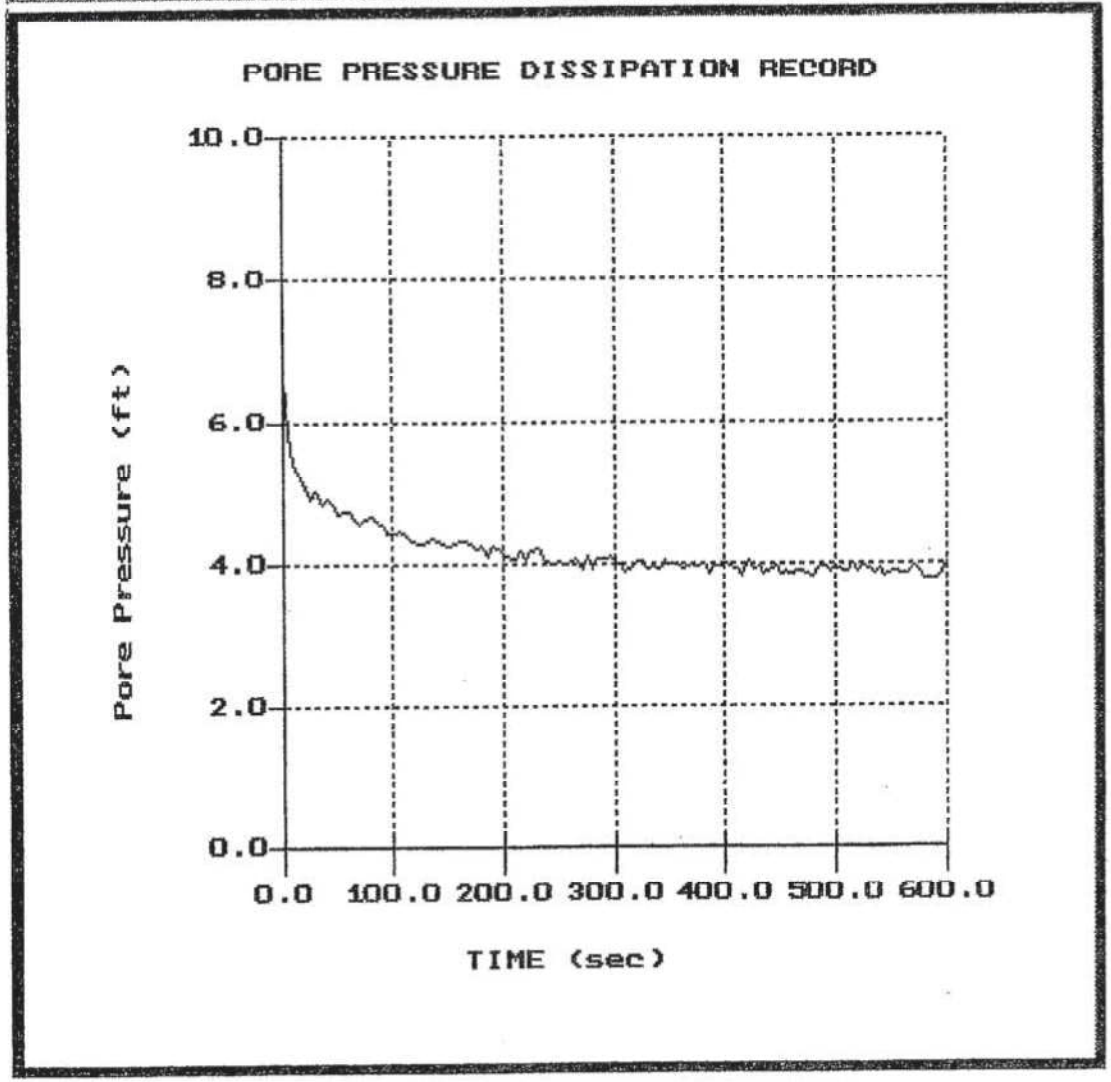
APPENDIX B

MACTEC

Hole:CPT-0901
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:28:09 15:12

File: 986CP01.PPD
Depth (m): 3.05
(ft): 10.01
Duration : 600.0s
U-min: 3.77 580.0s
U-max: 6.59 0.0s

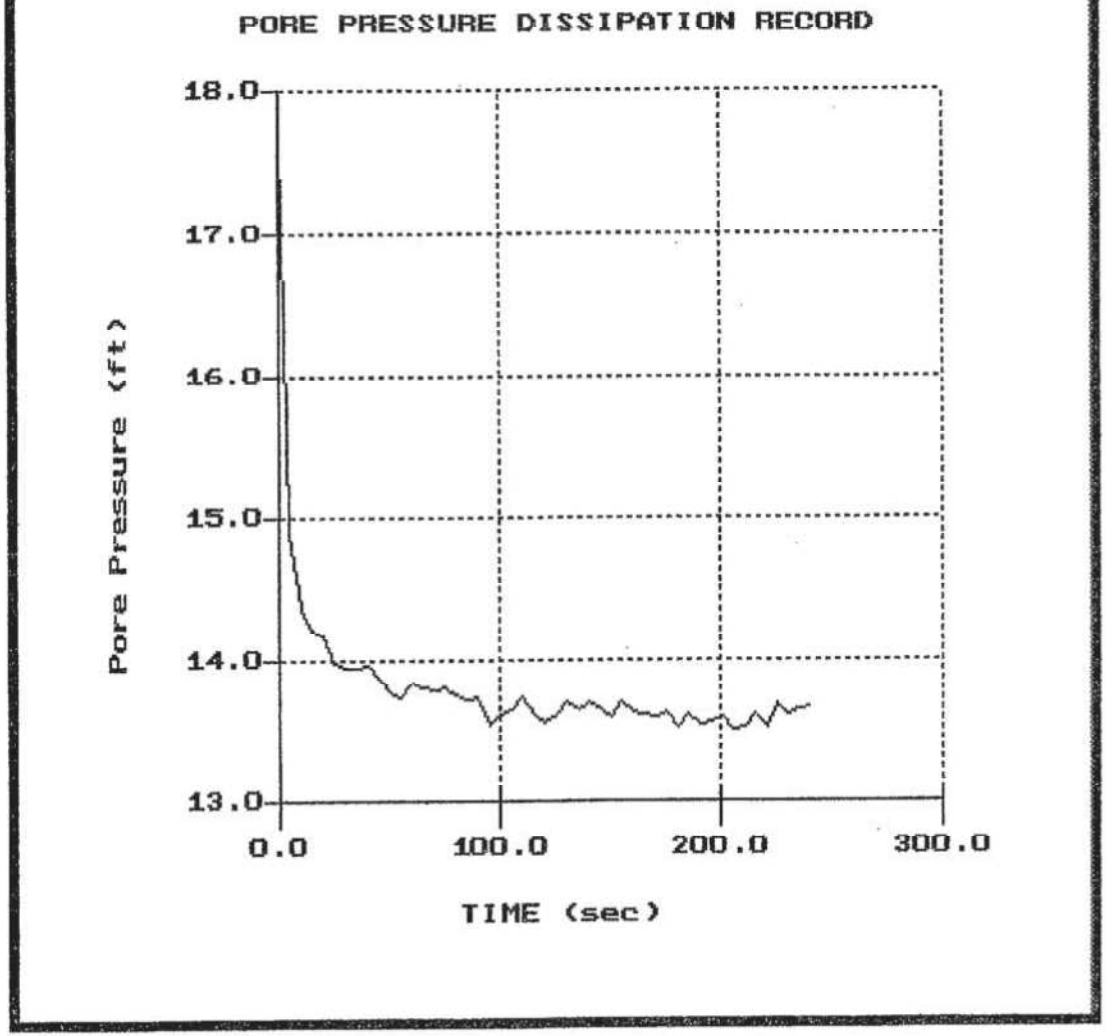


MACTEC

Hole:CPT-0901
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:28:09 15:12

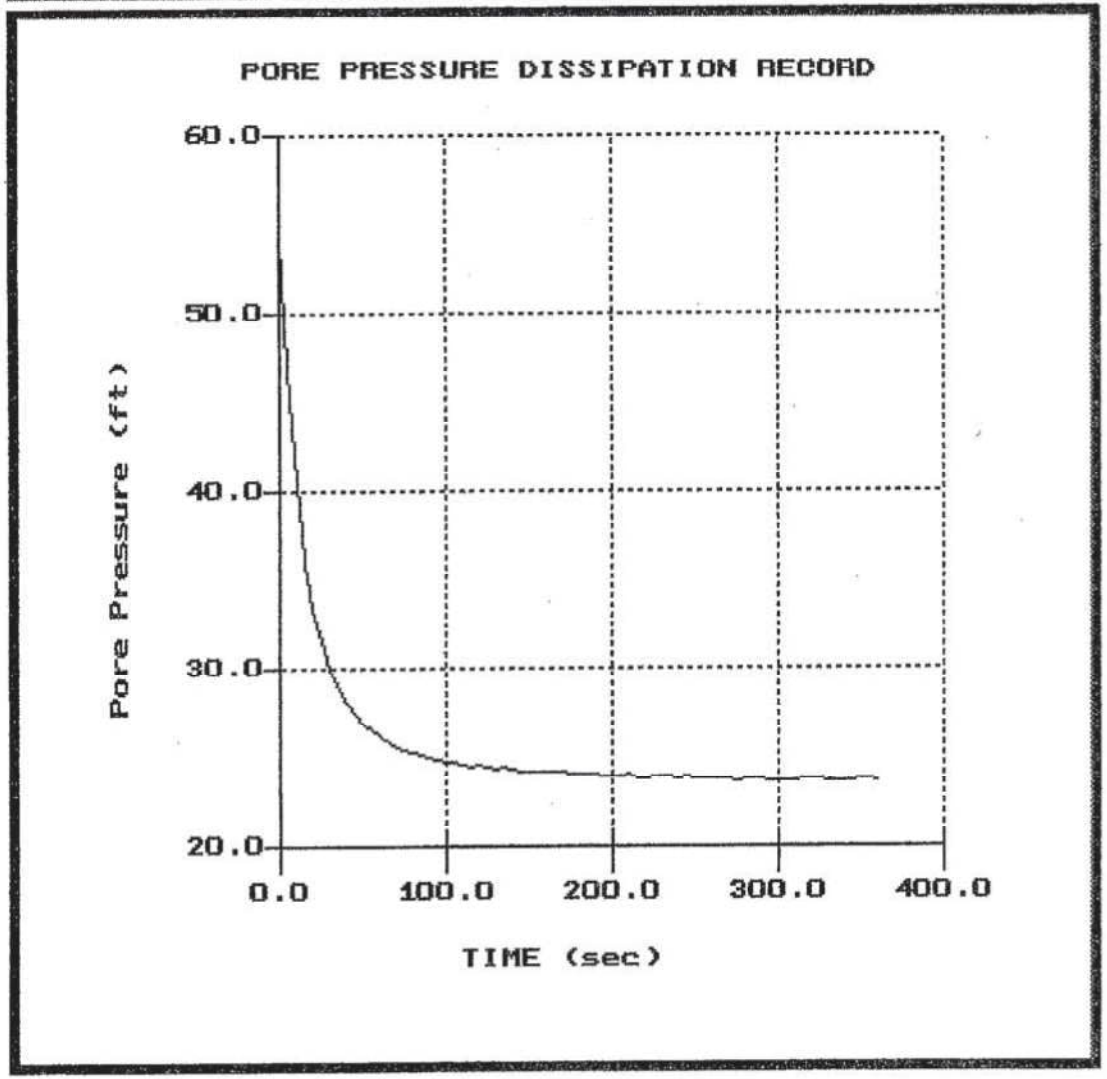
File: 986CP01.PPD
Depth (m): 6.10
(ft): 20.01
Duration : 240.0s
U-min: 13.50 205.0s
U-max: 17.73 0.0s



MACTEC

Hole:CPT-0901
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:28:09 15:12

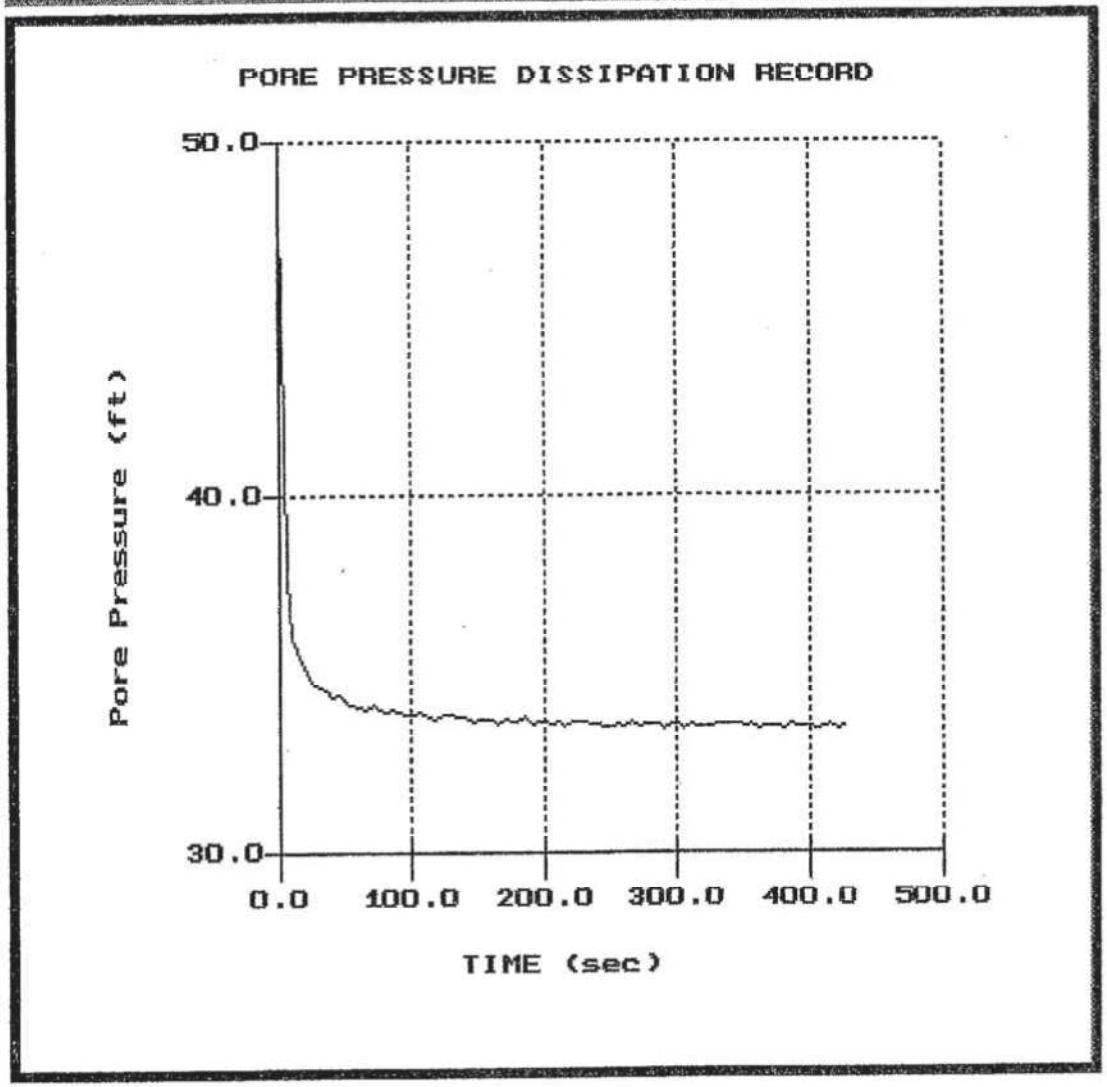


File: 986CP01.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 360.0s
U-min: 23.54 360.0s
U-max: 54.26 0.0s

MACTEC

Hole:CPT-0901
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:28:09 15:12

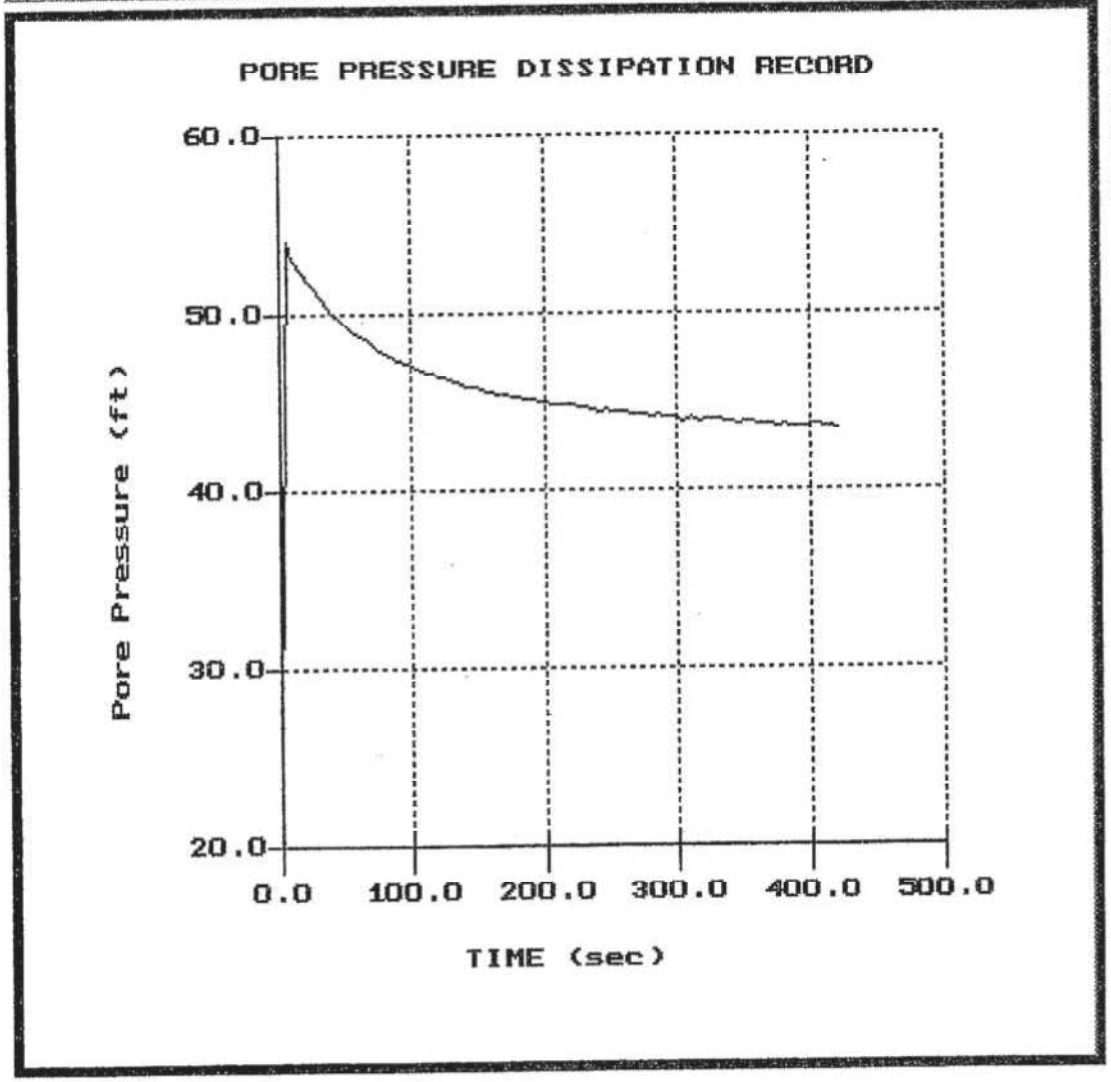


File: 986CP01.PPD
Depth (m): 12.20
(ft): 40.03
Duration : 425.0s
U-min: 33.48 305.0s
U-max: 48.55 0.0s

MACTEC

Hole:CPT-0901
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:28:09 15:12

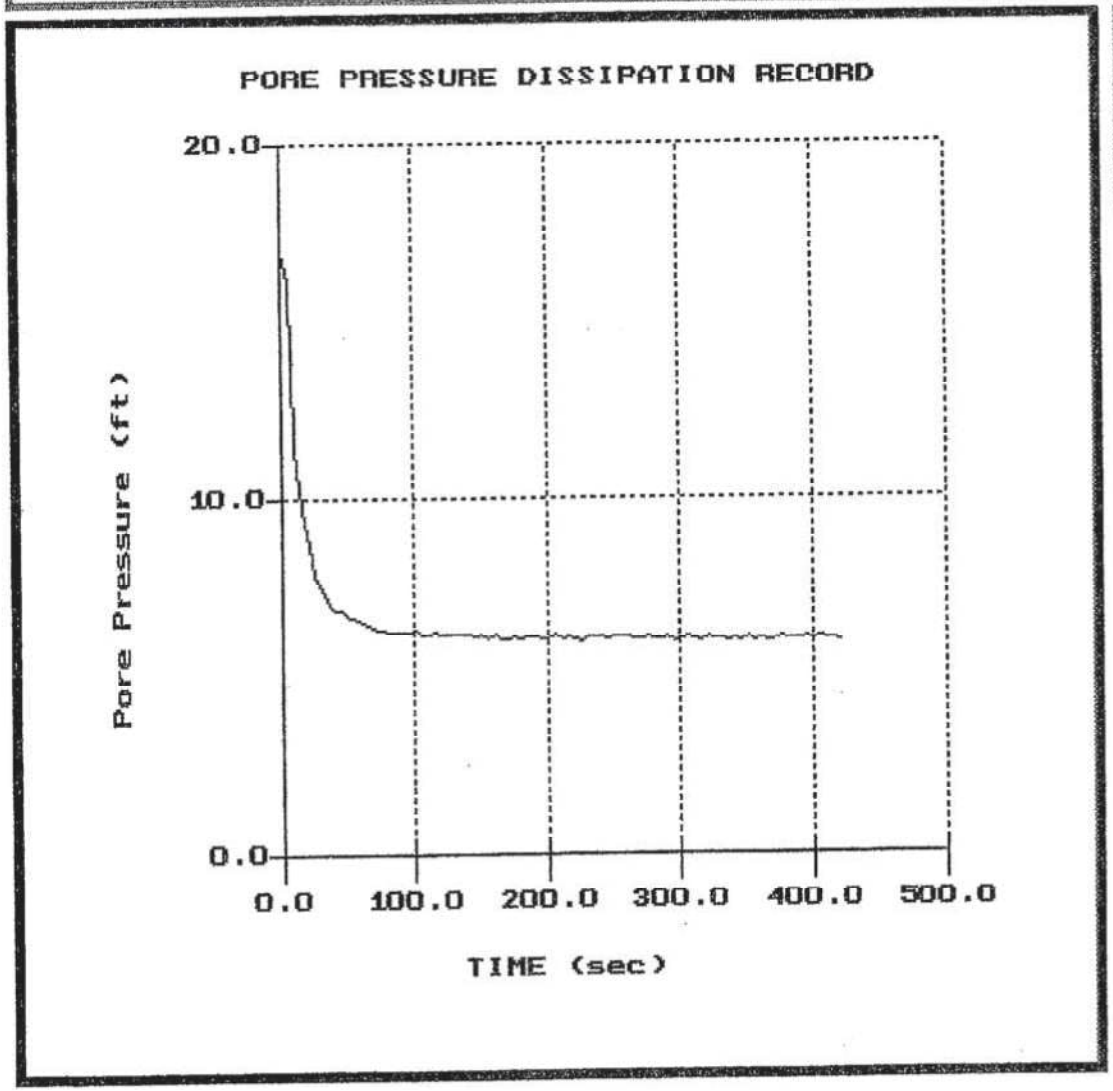


File: 986CP01.PPD
Depth (m): 15.25
(ft): 50.03
Duration : 420.0s
U-min: 26.61 0.0s
U-max: 53.98 5.0s

MACTEC

Hole:CPT-0903
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:29:09 08:06

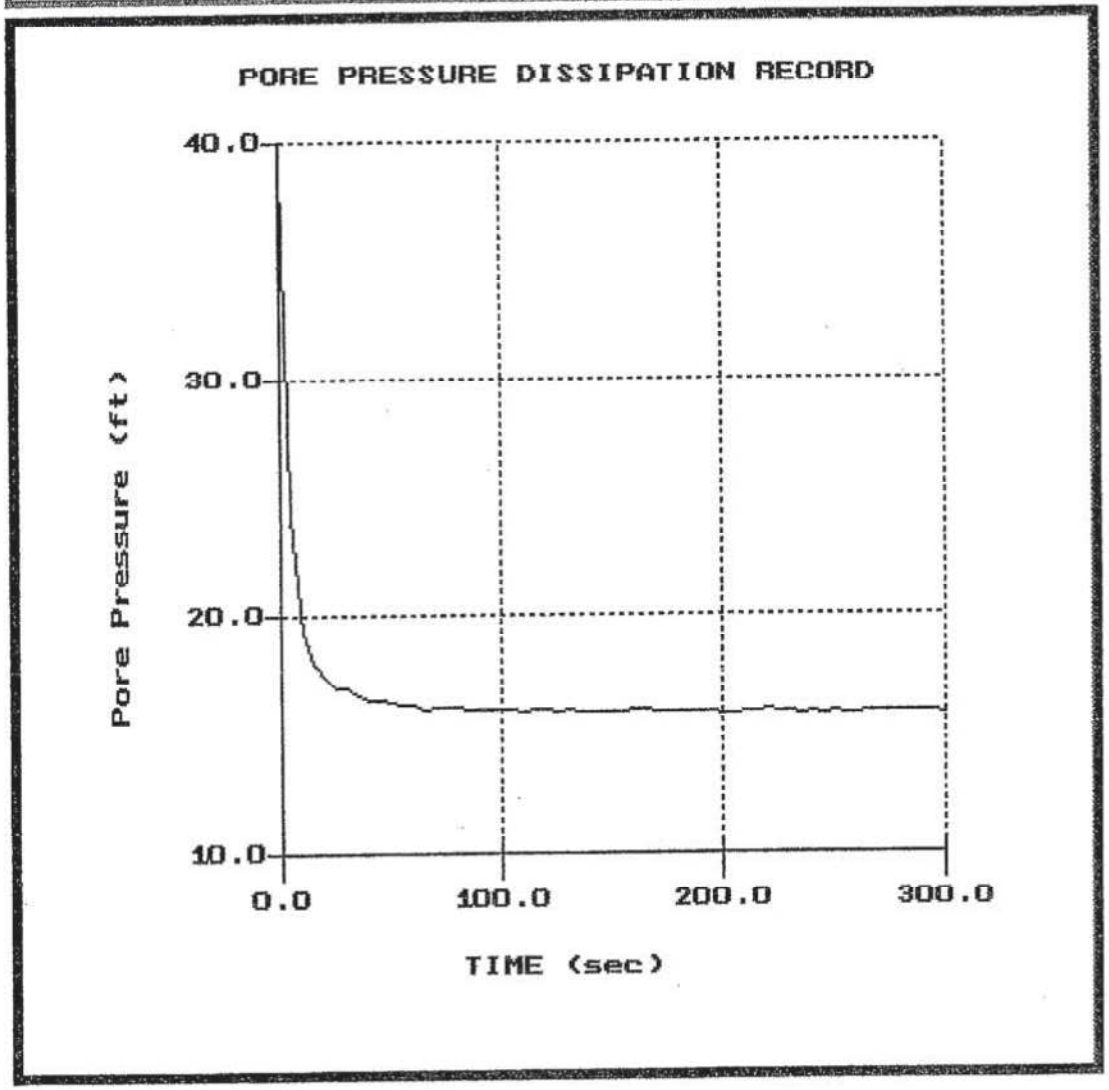


File: 986CP02.PPD
Depth (m): 6.10
(ft): 20.01
Duration : 420.0s
U-min: 5.97 355.0s
U-max: 17.04 0.0s

MACTEC

Hole:CPT-0903
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:29:09 08:06



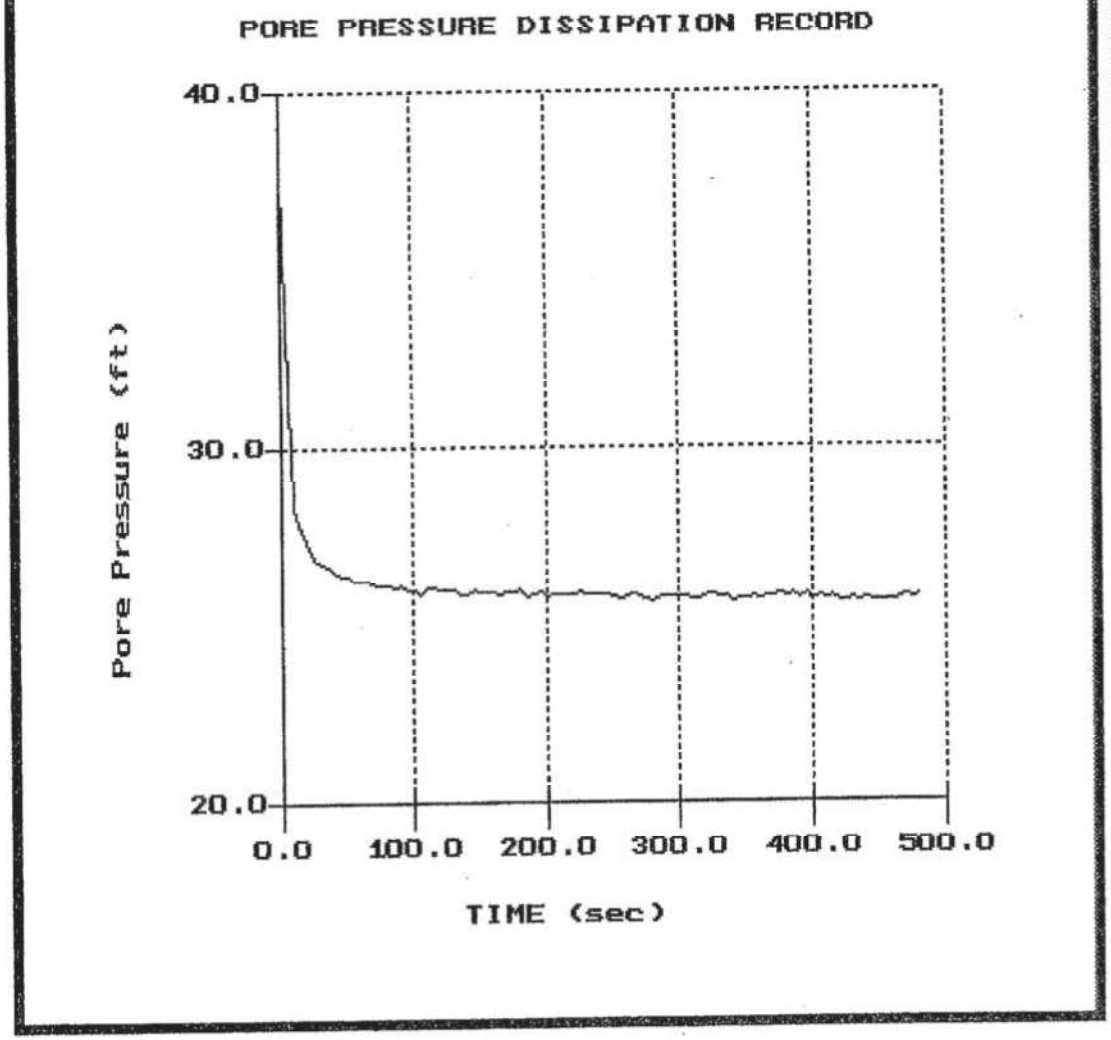
File: 986CP02.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 300.0s
U-min: 15.83 235.0s
U-max: 39.49 0.0s

MACTEC

Hole:CPT-0903
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:29:09 08:06

File: 986CP02.PPD
Depth (m): 12.20
(ft): 40.03
Duration : 480.0s
U-min: 25.61 435.0s
U-max: 37.91 0.0s

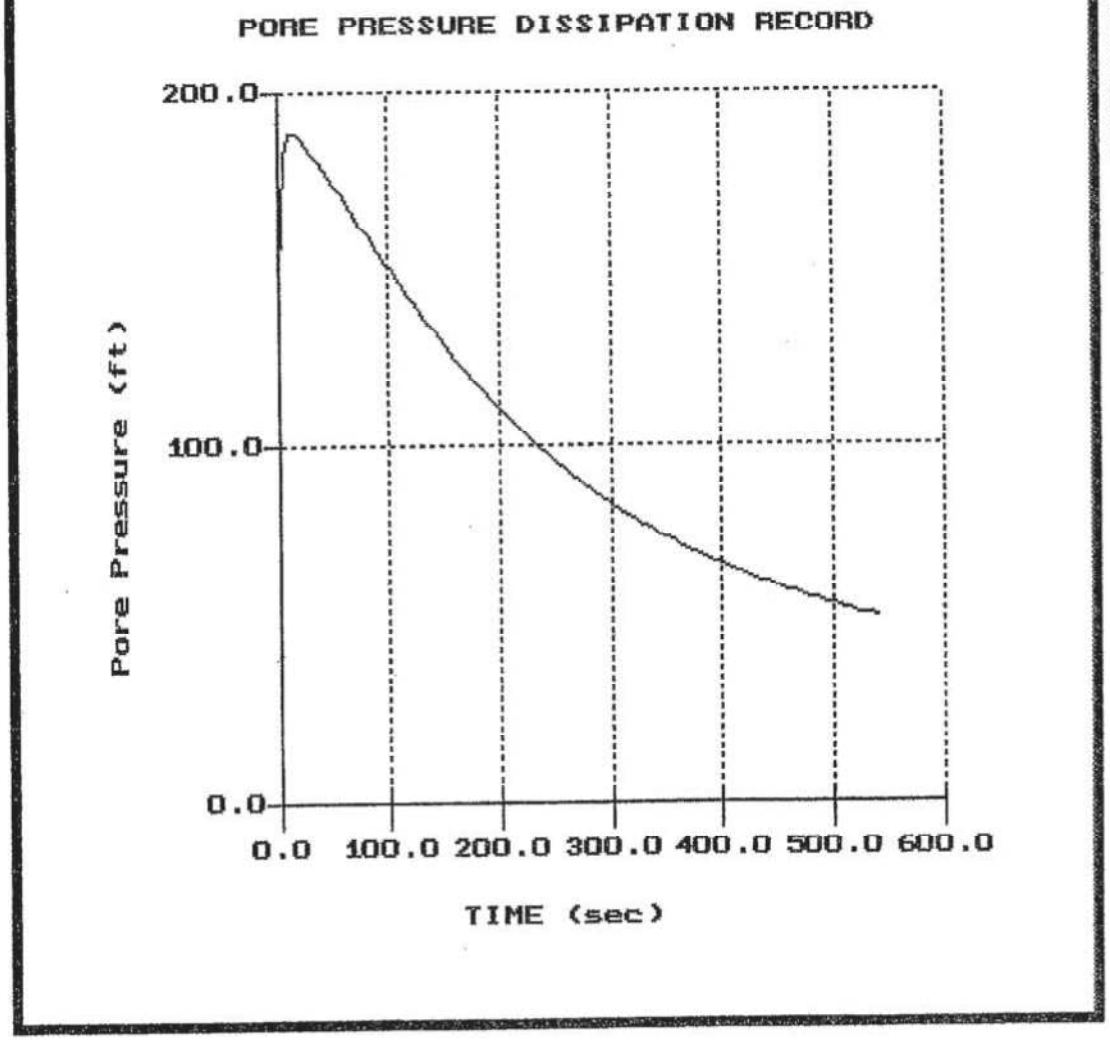


MACTEC

Hole:CPT-0903
Location:Glen Lyn Drilli

Cone:205:T500F10U500
Date:12:29:09 08:06

File: 986CP02.PPD
Depth (m): 15.25
(ft): 50.03
Duration : 540.0s
U-min: 52.12 540.0s
U-max: 188.32 10.0s

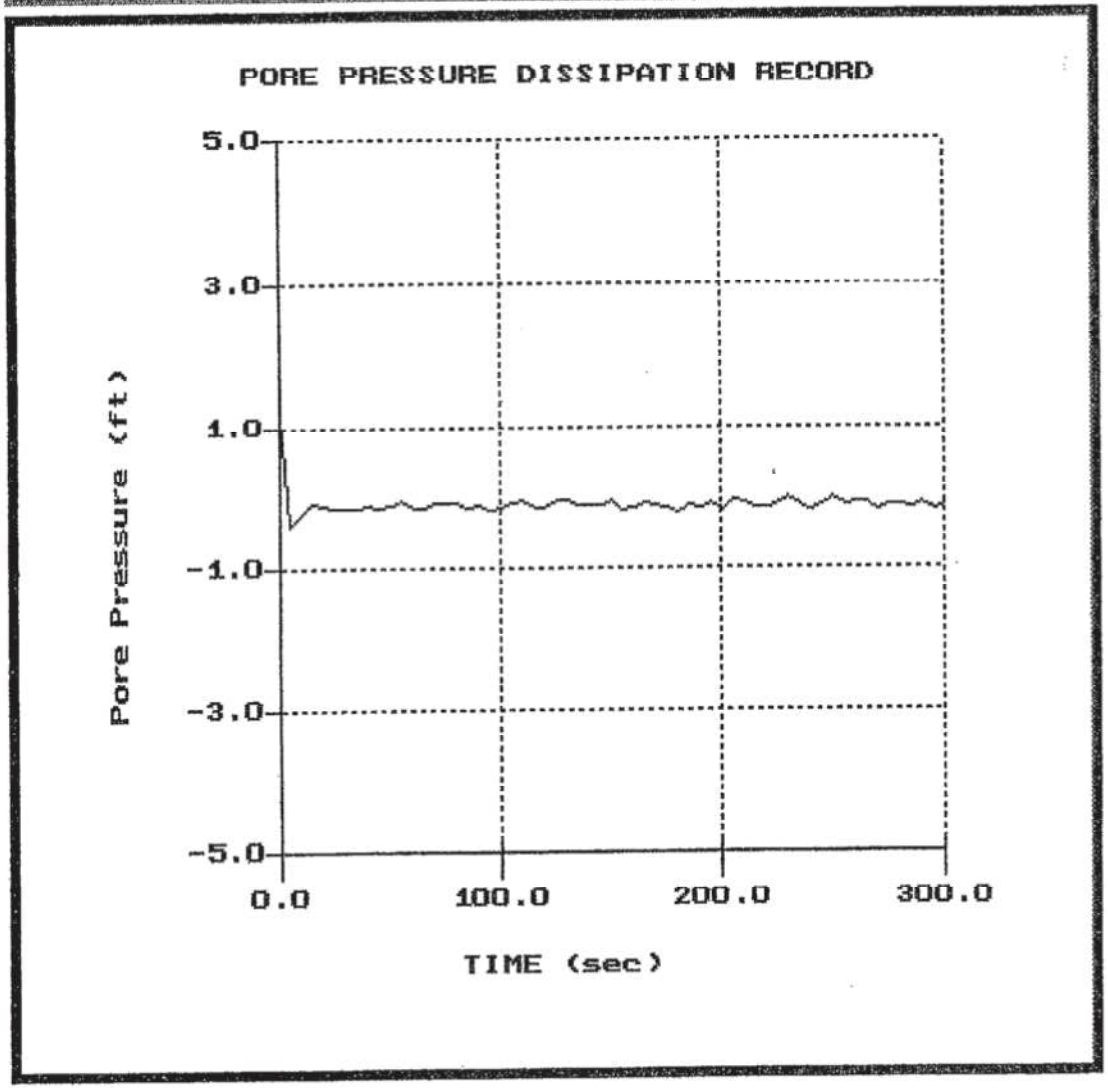


MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

File: 986CP03.PPD
Depth (m): 3.05
(ft): 10.01
Duration : 300.0s
U-min: -0.42 5.0s
U-max: 1.14 0.0s

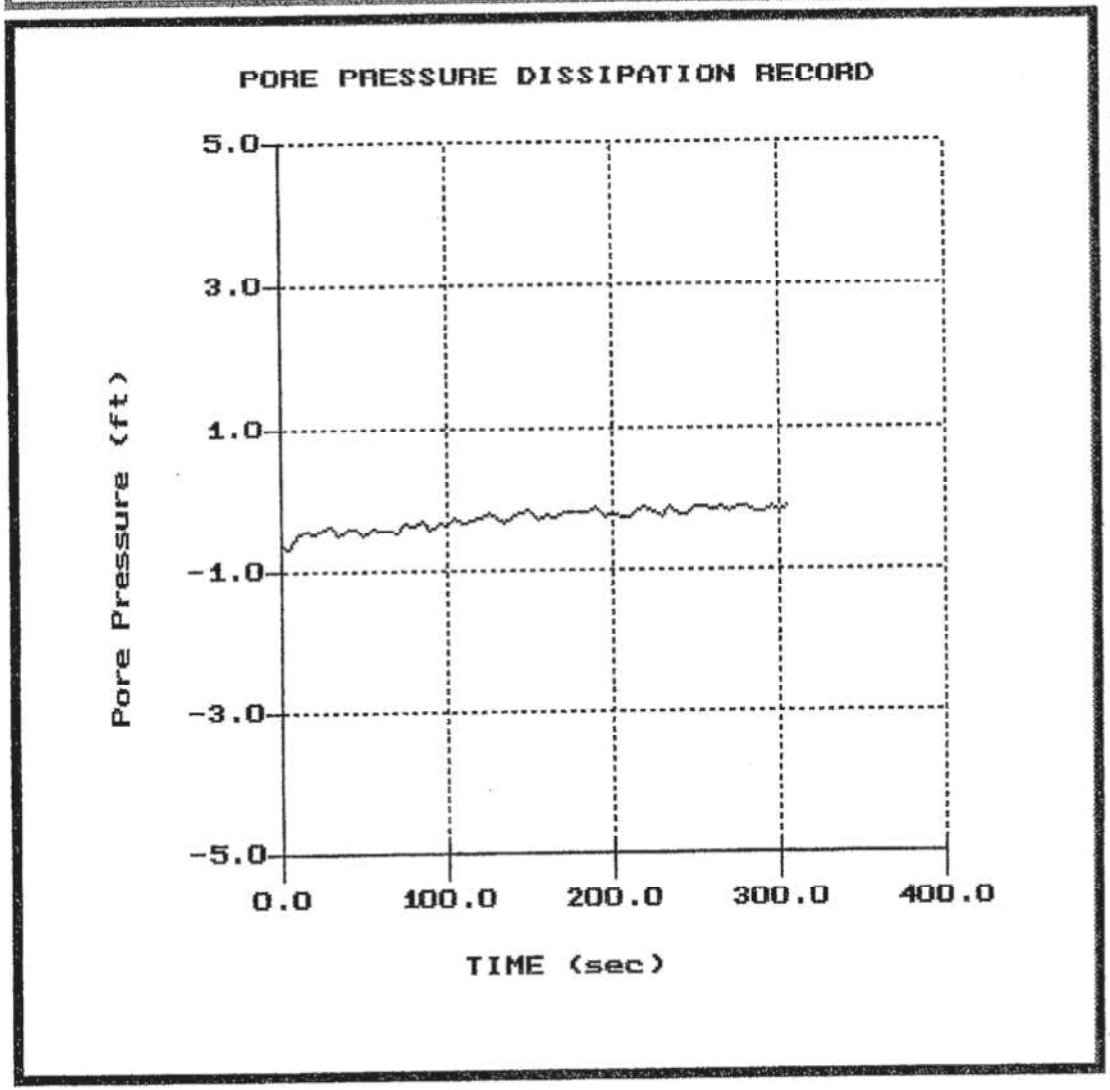


MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

File: 986CP03.PPD
Depth (m): 6.20
(ft): 20.34
Duration : 305.0s
U-min: -0.71 5.0s
U-max: -0.13 265.0s

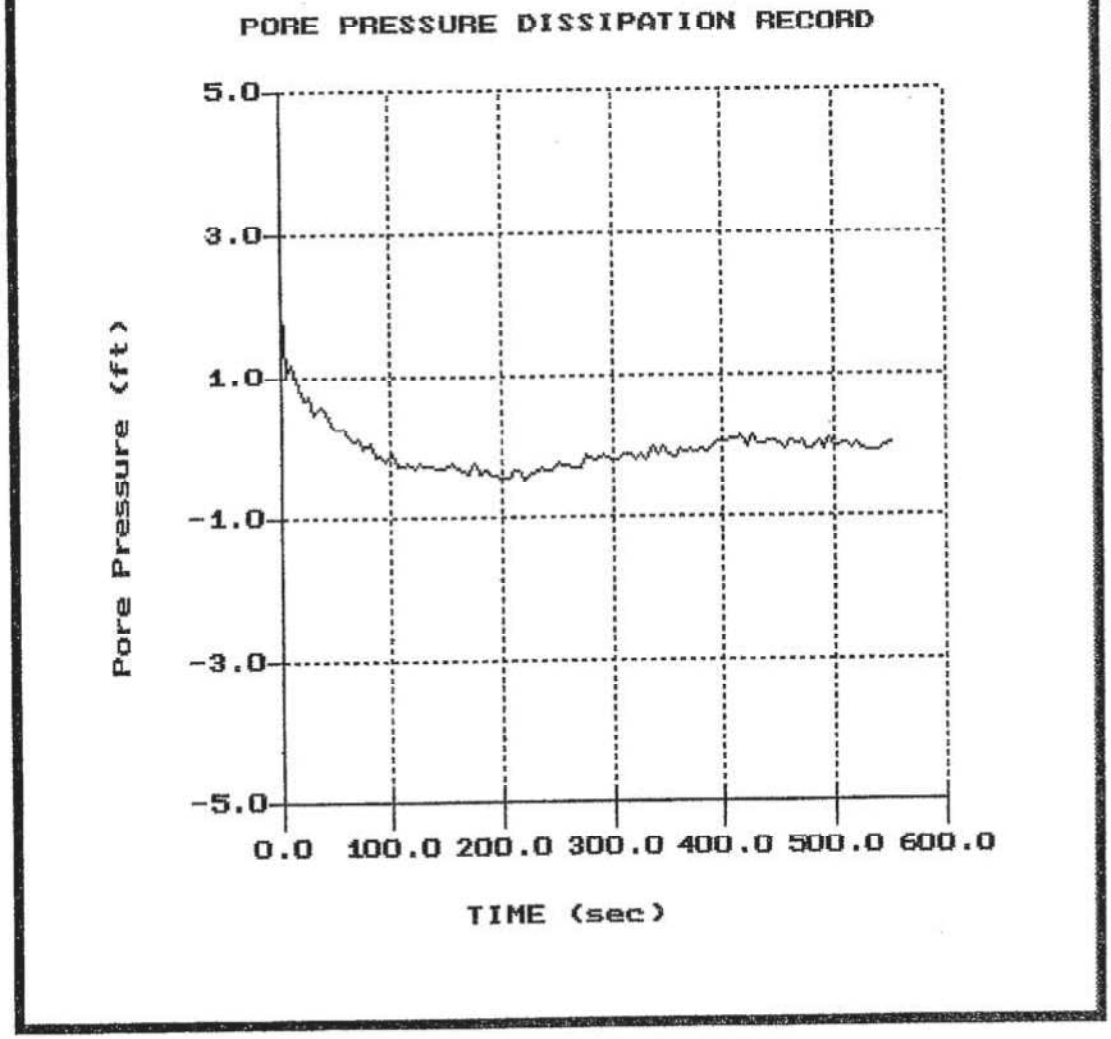


MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

File: 986CP03.PPD
Depth (m): 9.15
(ft): 30.02
Duration : 550.0s
U-min: -0.50 220.0s
U-max: 1.99 0.0s

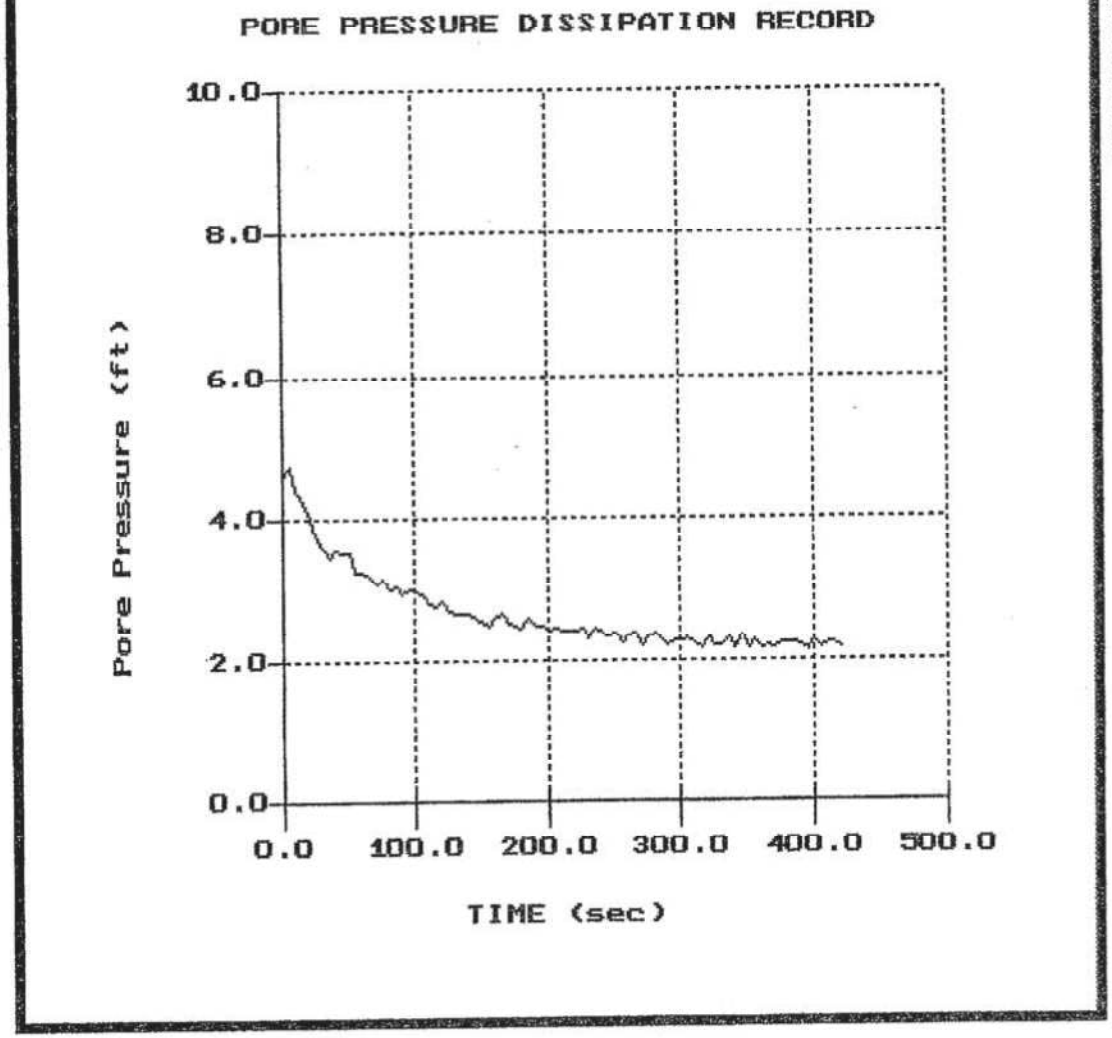


MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

File: 986CP03.PPD
Depth (m): 12.20
(ft): 40.03
Duration : 420.0s
U-min: 2.11 395.0s
U-max: 4.73 5.0s

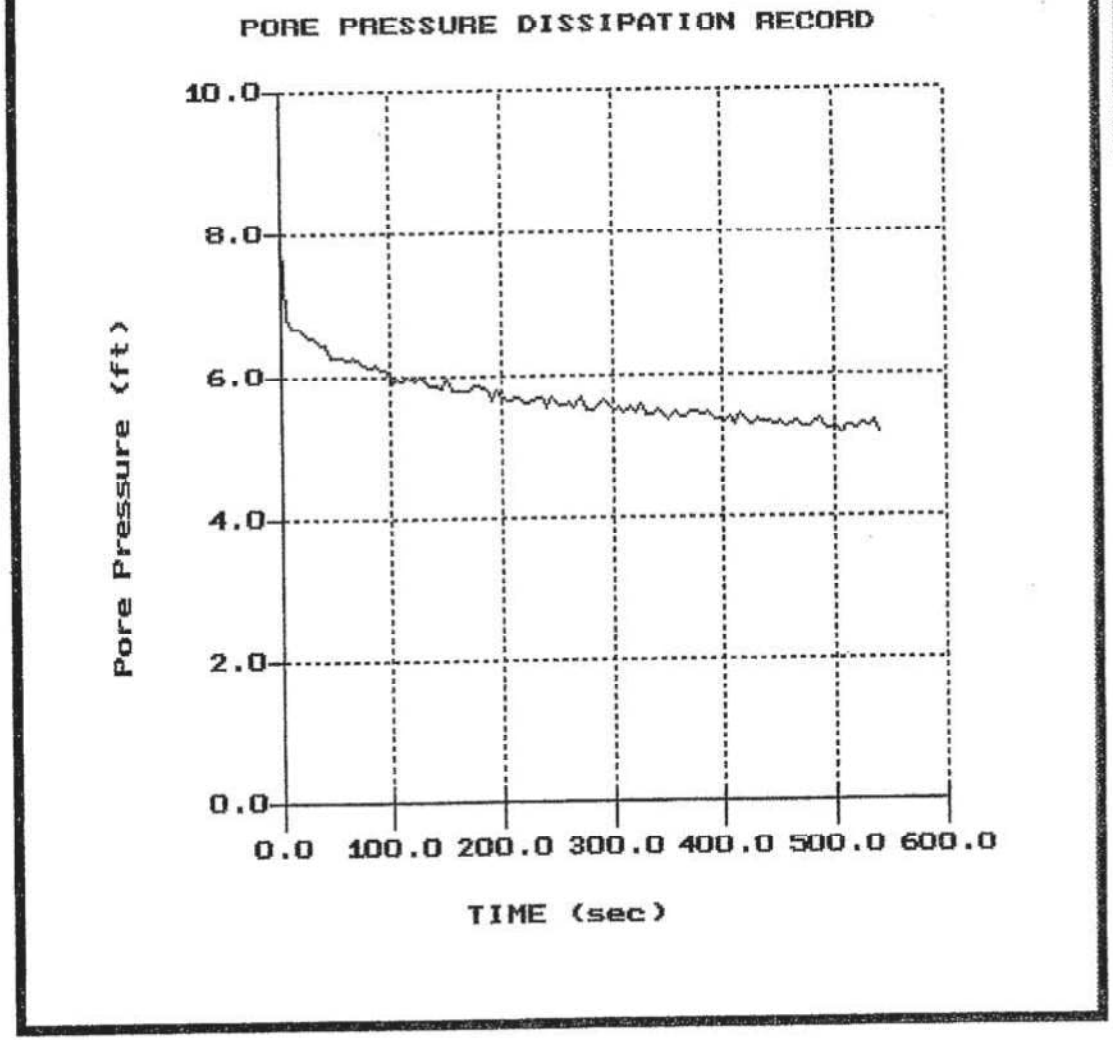


MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

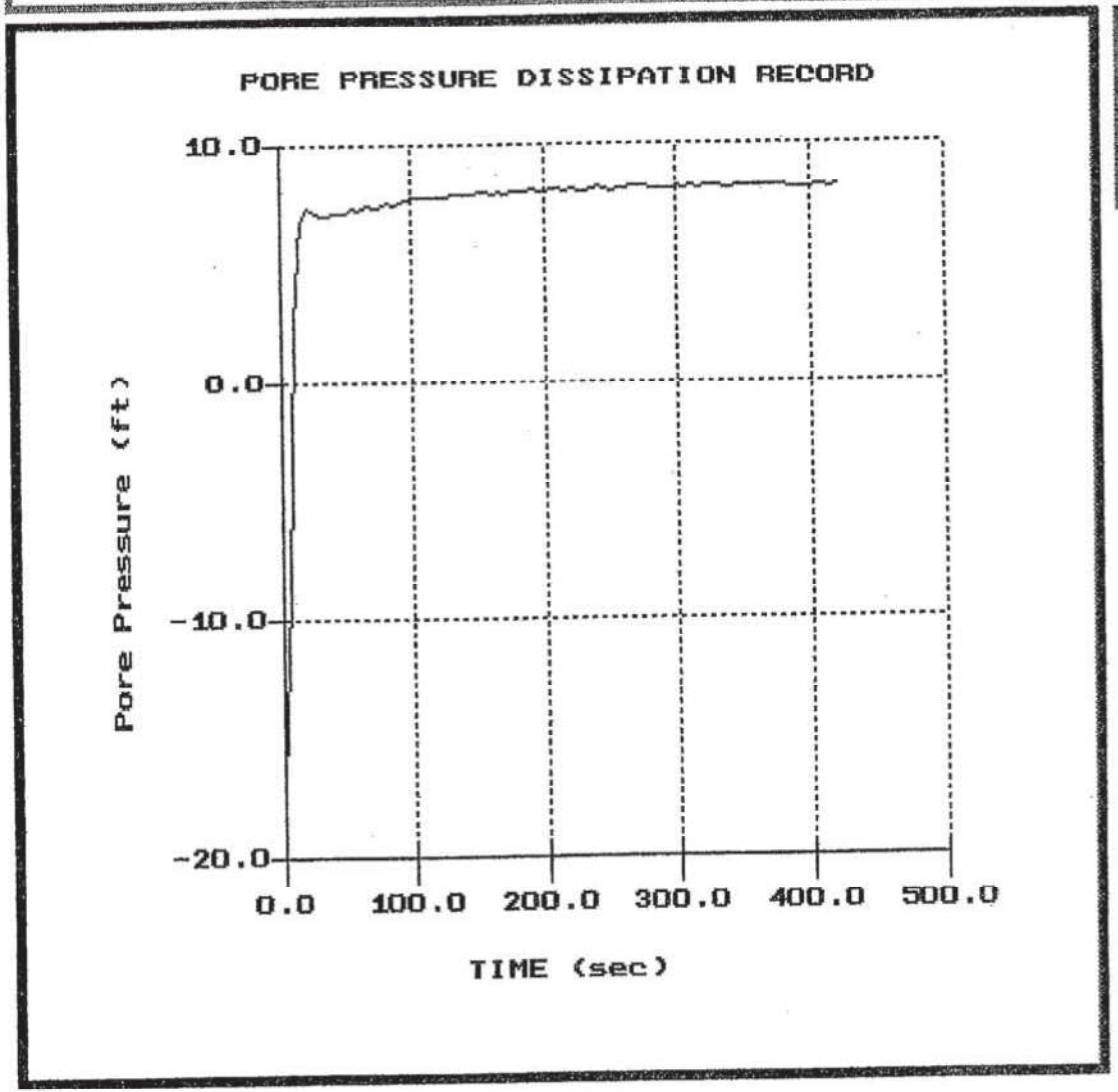
File: 986CP03.PPD
Depth (m): 15.25
(ft): 50.03
Duration : 540.0s
U-min: 5.14 505.0s
U-max: 7.95 0.0s



MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12



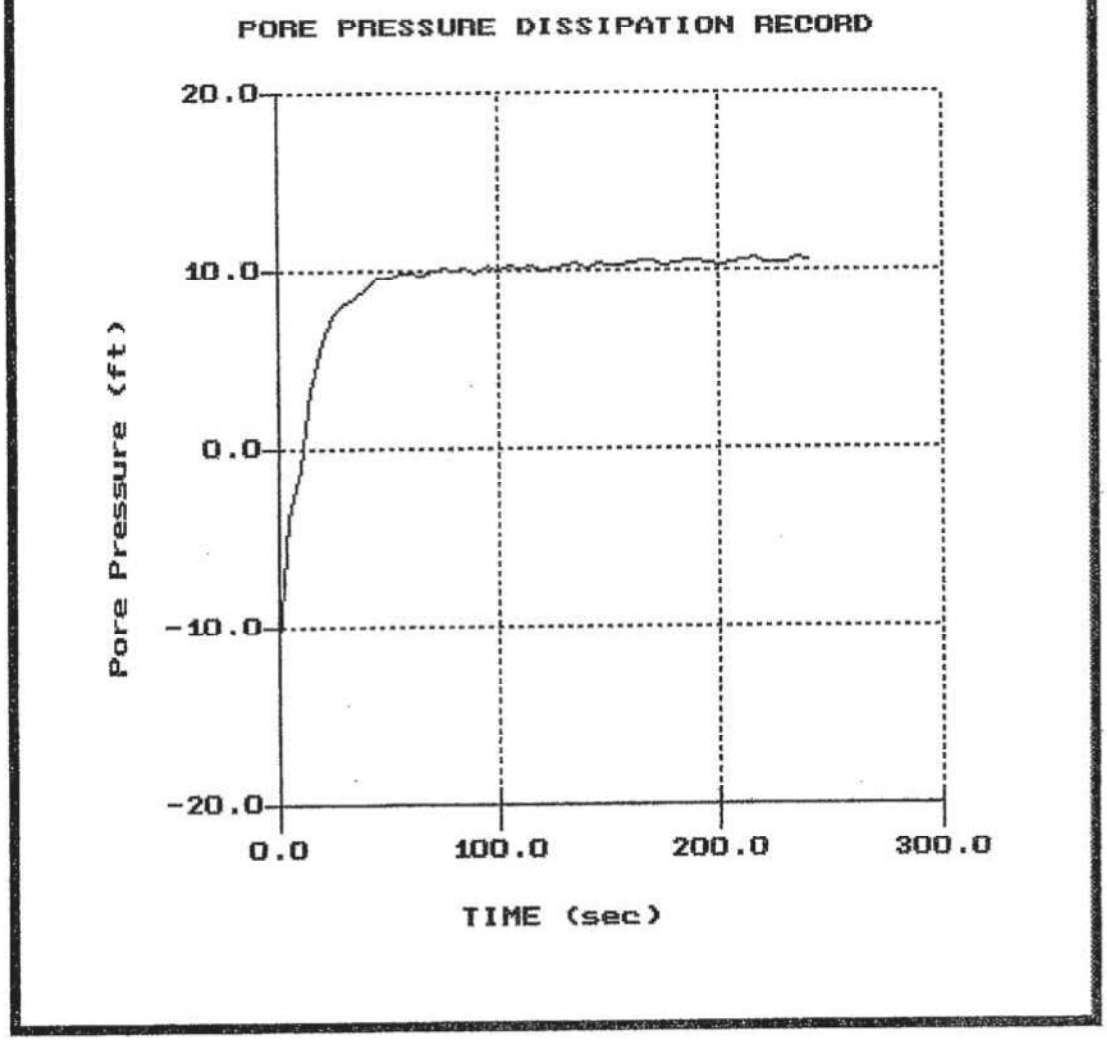
File: 986CP03.PPD
Depth (m): 18.30
(ft): 60.04
Duration : 420.0s
U-min: -17.03 0.0s
U-max: 8.28 410.0s

MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

File: 986CP03.PPD
Depth (m): 19.00
(ft): 62.34
Duration : 240.0s
U-min: -11.12 0.0s
U-max: 10.65 215.0s

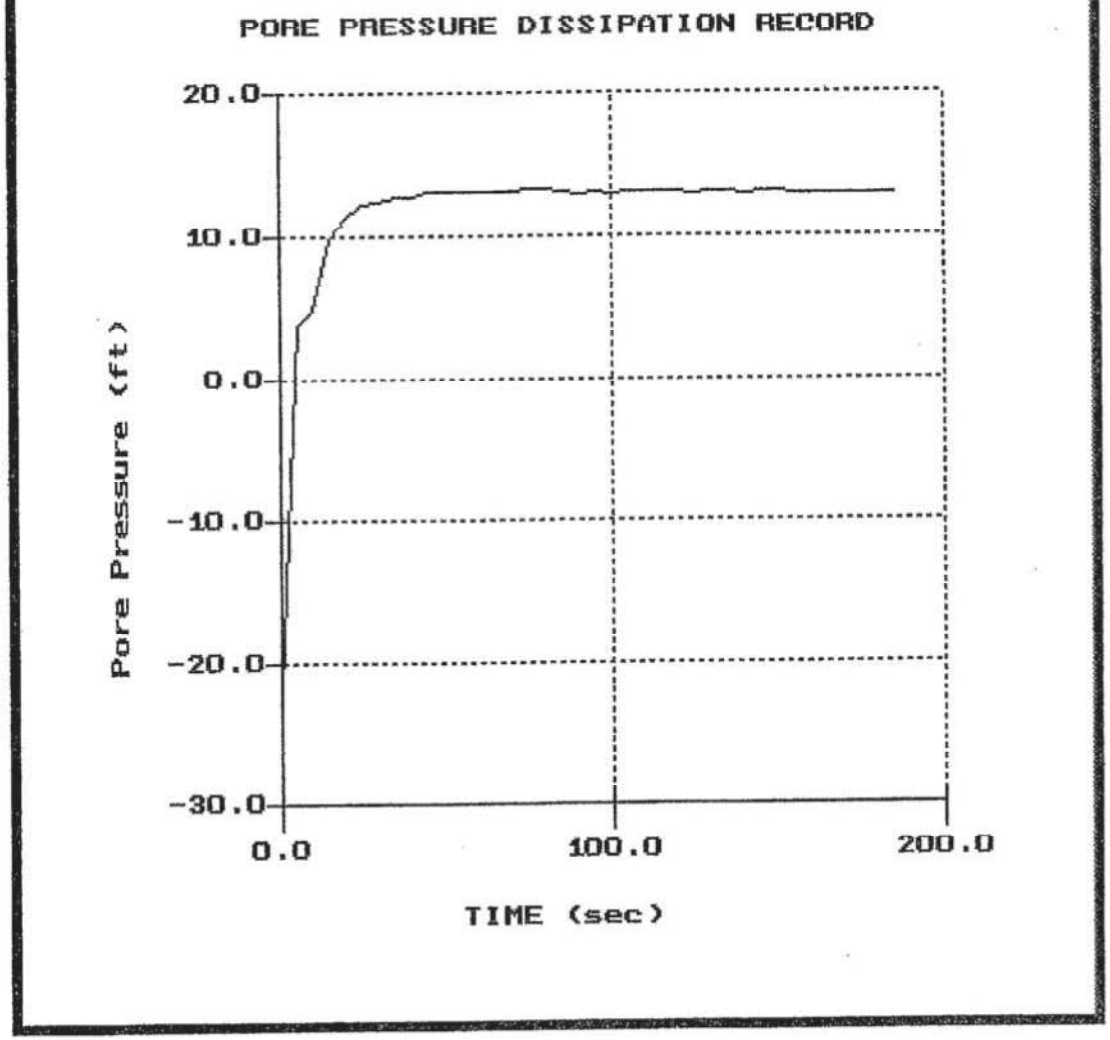


MACTEC

Hole:CPT-0905
Location:Glen Lyn Drilli

Cone:195:T1500F15U500
Date:12:29:09 10:12

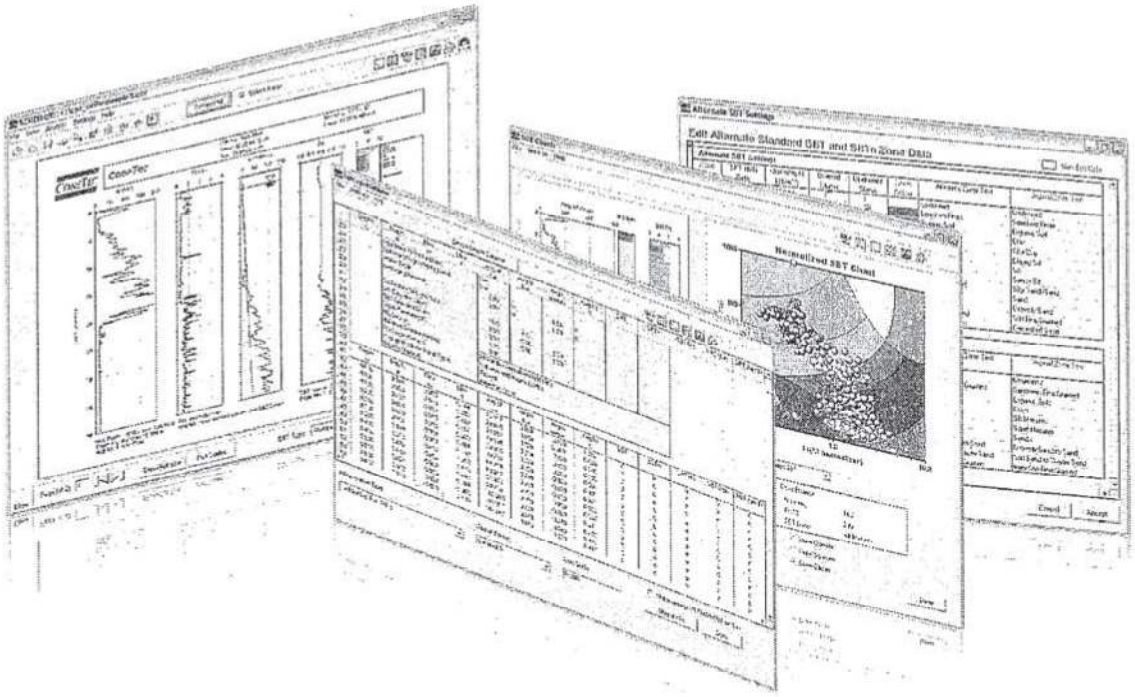
File: 986CP03.PPD
Depth (m): 19.65
(ft): 64.47
Duration : 185.0s
U-min: -22.11 0.0s
U-max: 13.18 75.0s



APPENDIX C

CONETEC INTERPRETATION METHODS

A Detailed Description of the Methods Used in ConeTec's CPT Interpretation and Plotting Software



Revision SZW-Rev 02
March 12, 2008

Prepared by Jim Greig

CONETEC

ConeTec Interpretations as of March 12, 2008

ConeTec's interpretation routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. The interpreted values are not considered valid for all soil types. The interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design. Reference to current literature is strongly recommended. ConeTec does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the program and does not assume liability for any use of the results in any design or review. Representative hand calculations should be made for any parameter that is critical for design purposes. The end user of the interpreted output should also be fully aware of the techniques and the limitations of any method used in this program. The purpose of this document is to inform the user as to which methods were used and what the appropriate papers and/or publications are for further reference.

The CPT interpretations are based on values of tip, sleeve friction and pore pressure averaged over a user specified interval (e.g. 0.20m). Note that q_t is the tip resistance corrected for pore pressure effects and q_c is the recorded tip resistance. Since all ConeTec cones have equal end area friction sleeves, pore pressure corrections to sleeve friction, f_s, are not required.

The tip correction is: $q_t = q_c + (1-a) \bullet u_2$

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 cone (typically 0.80 for ConeTec cones)

The total stress calculations are based on soil unit weights that have been assigned to the Soil Behavior Type zones, from a user defined unit weight profile or by using a single value throughout the profile. Effective vertical overburden stresses are calculated based on a hydrostatic distribution of equilibrium pore pressures below the water table or from a user defined equilibrium pore pressure profile (this can be obtained from CPT dissipation tests). For over water projects the effects of the column of water have been taken into account as has the appropriate unit weight of water. How this is done depends on where the instruments were zeroed (i.e. on deck or at mud line).

Details regarding the interpretation methods for all of the interpreted parameters are provided in Table 1. The appropriate references cited in Table 1 are listed in Table 2. Where methods are based on charts or techniques that are too complex to describe in this summary the user should refer to the cited material.

The estimated Soil Behavior Types (normalized and non-normalized) are based on the charts developed by Robertson and Campanella shown in Figures 1 and 2. The Bq classification charts are not reproduced in this document but can be reviewed in Lunne, Robertson and Powell (1997) or Robertson (1990).

Where the results of a calculation/interpretation are declared *'invalid'* the value will be represented by the text strings "-9999" or "-9999.0". In some cases the value 0 will be used. Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g. drilled out section or data gap).
2. Where the interpretation method is inappropriate, for example, drained parameters in an undrained material (and vice versa).
3. Where interpretation input values are beyond the range of the referenced charts or specified limitations of the interpretation method.
4. Where pre-requisite or intermediate interpretation calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the interpreted parameters listed in Table 1 may be included in the output files delivered with this report.

The output files are provided in Microsoft Excel XLS format. The ConeTec software has several options for output depending on the number or types of interpreted parameters desired. Each output file will be named using the original COR file basename followed by a three or four letter indicator of the interpretation set selected (e.g. BSC, TBL, NLI or IFI) and possibly followed by an operator selected suffix identifying the characteristics of the particular interpretation run.

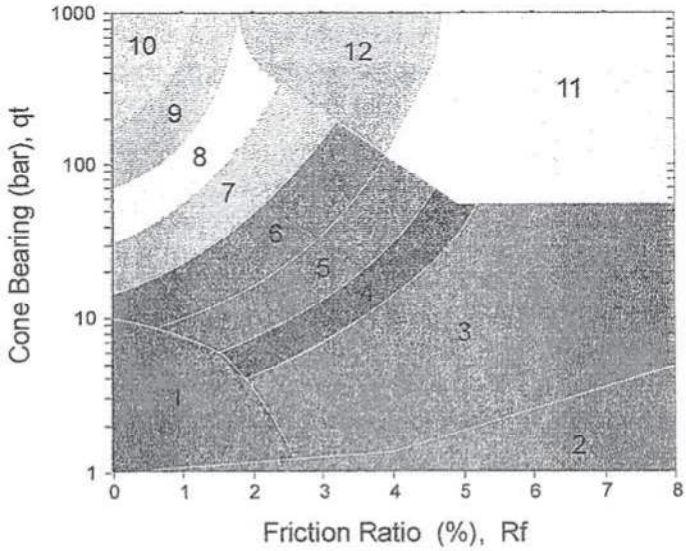
Table 1
CPT Interpretation Methods

Interpreted Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where interpretations are done at each point then Mid Layer Depth = Recorded Depth)*	*Depth (Layer Top) + Depth (Layer Bottom) / 2.0*	
Elevation	Elevation of Mid Layer based on sounding collar elevation supplied by client	Elevation = Collar Elevation - Depth	
Avgqc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when interpretations are done at each point*	
Avgqt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a) \bullet u$	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when interpretations are done at each point*	
Avgfs	Averaged sleeve friction (f_s)	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when interpretations are done at each point*	
AvgRf	Averaged friction ratio (Rf) where friction ratio is defined as: $Rf = 100\% \bullet \frac{fs}{qt}$	$AvgRf = 100\% \bullet \frac{Avgfs}{Avgqt}$ *n=1 when interpretations are done at each point*	
Avgu	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when interpretations are done at each point*	
AvgRes	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} RESISTIVITY_i$ *n=1 when interpretations are done at each point*	
AvgUVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when interpretations are done at each point*	
AvgTemp	Averaged Temperature (this data is not always available since it is a specialized test)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} TEMPERATURE_i$ *n=1 when interpretations are done at each point*	
AvgGamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} GAMMA_i$ *n=1 when interpretations are done at each point*	
SBT	Soil Behavior Type as defined by Robertson and Campanella	See Figure 1	2, 5

Interpreted Parameter	Description	Equation	Ref
U.Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) user supplied unit weight profile	See references	5
T. Stress σ_v	Total vertical overburden stress at Mid Layer Depth. *A layer is defined as the averaging interval specified by the user. For data interpreted at each point the Mid Layer Depth is the same as the recorded depth.*	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ where γ_i is layer unit weight h_i is layer thickness	
E. Stress σ'_v	Effective vertical overburden stress at Mid Layer Depth	$Estress = Tstress - u_{eq}$	
Ueq	Equilibrium pore pressure determined from one of the following user selectable options: 1) hydrostatic from water table depth 2) user supplied profile	For hydrostatic option: $u_{eq} = \gamma_w \bullet (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is unit weight of water D is the current depth D_{wt} is the depth to the water table	
Cn	SPT N_{60} overburden correction factor	$Cn=(\sigma_v')^{-0.5}$ where σ_v' *is in tsf* $0.5 < C_n < 2.0$	
N_{60}	SPT N value at 60% energy calculated from qt/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	4, 5
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure	$(N_1)_{60} = Cn \bullet N_{60}$	4
$N_{60}Ic$	SPT N_{60} values based on the Ic parameter	$(qt/pa)/ N_{60} = 8.5 (1 - Ic/4.6)$	5
$(N_1)_{60}Ic$	SPT N_{60} value corrected for overburden pressure (using N_{60} I_c). User has 2 options.	1) $(N_1)_{60}Ic = Cn \bullet (N_{60} Ic)$ 2) $q_{c1n}/ (N_1)_{60}Ic = 8.5 (1 - Ic/4.6)$	4 5
$(N_1)_{60cs}Ic$	Clean sand equivalent SPT $(N_1)_{60}Ic$. User has 3 options.	1) $(N_1)_{60cs}Ic = \alpha + \beta((N_1)_{60}Ic)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}Ic)$ 3) $q_{c1ncs})/ (N_1)_{60cs}Ic = 8.5 (1 - Ic/4.6)$ FC ≤ 5%: $\alpha = 0$, $\beta=1.0$ FC ≥ 35% $\alpha = 5.0$, $\beta=1.2$ 5% < FC < 35% $\alpha = \exp[1.76 - (190/FC^2)]$ $\beta = [0.99 + (FC^{1.5}/1000)]$	10 10 5
Su	Undrained shear strength - N_{kt} is user selectable	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
k	Coefficient of permeability (assigned to each SBT zone)		5
Bq	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ *where:* $\Delta u = u - u_{eq}$ *and* u *= dynamic pore pressure* u_{eq} *= equilibrium pore pressure*	1, 5
Q_t	Normalized q_t for Soil Behavior Type classification as defined by Robertson, 1990	$Qt = \frac{qt - \sigma_v}{\sigma'_v}$	2, 5

Interpreted Parameter	Description	Equation	Ref
F_r	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson, 1990	$Fr = 100\% \bullet \frac{fs}{qt - \sigma_v}$	2, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson and Campanella	See Figure 2	2, 5
SBT-BQ	Non-normalized soil behavior type based on the Bq parameter	See Figure 5.7 (reference 5)	2, 5
SBT-BQn	Normalized Soil Behavior base on the Bq parameter	See Figure 5.8 (reference 5) or Figure 3 (reference 2)	2, 5
I_c	Soil index for estimating grain characteristics	$Ic = [(3.47 - \log_{10}Q)^2 + (\log_{10} Fr + 1.22)^2]^{0.5}$ Where: $Q = \left(\frac{qt - \sigma_v}{P_{a2}}\right)\left(\frac{P_a}{\sigma'_v}\right)^n$ And *Fr is in percent* P_a = atmospheric pressure P_{a2} = atmospheric pressure *n varies from 0.5 to 1.0 and is selected in an iterative manner based on the resulting* I_c	3, 8
FC	Apparent fines content (%)	$FC=1.75(Ic^{3.25}) - 3.7$ $FC=100$ for $Ic > 3.5$ $FC=0$ for $Ic < 1.26$ $FC = 5\%$ if $1.64 < Ic < 2.6$ AND $F_r<0.5$	3
Ic Zone	This parameter is the Soil Behavior Type zone based on the Ic parameter (valid for zones 2 through 7 on SBTn chart)	Ic < 1.31 Zone = 7 1.31 < Ic < 2.05 Zone = 6 2.05 < Ic < 2.60 Zone = 5 2.60 < Ic < 2.95 Zone = 4 2.95 < Ic < 3.60 Zone = 3 Ic > 3.60 Zone = 2	3
PHI ϕ	Friction Angle determined from one of the following user selectable options: a) Campanella and Robertson b) Durgunoglu and Mitchel c) Janbu d) Kulhawy and Mayne	See reference	5 5 5 11
Dr	Relative Density determined from one of the following user selectable options: a) Ticino Sand b) Hokksund Sand c) Schmertmann 1976 d) Jamiolkowski - All Sands	See reference	5
OCR	Over Consolidation Ratio	a) Based on Schmertmann's method involving a plot of $S_u/\sigma_v' / (S_u/\sigma_v')_{NC}$ and OCR where the Su/p' ratio for NC clay is user selectable	9
State Parameter	The state parameter is used to describe whether a soil is contractive (SP is positive) or dilative (SP is negative) at large strains based on the work by Been and Jefferies	See reference	8, 6, 5
Es/qt	Intermediate parameter for calculating Young's Modulus, E, in sands. It is the Y axis of the reference chart.	Based on Figure 5.59 in the reference	5

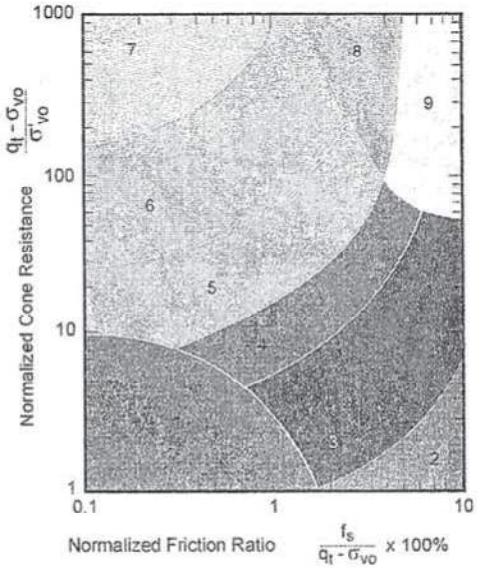
Interpreted Parameter	Description	Equation	Ref
Young's Modulus E	Young's Modulus based on the work done in Italy. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in the Es/qt chart.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3} \bullet (\sigma'_v + \sigma'_h + \sigma'_h)$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress and $\sigma_h = K_o * \sigma_v'$ with Ko assumed to be 0.5	5
q_{c1}	q_t normalized for overburden stress used for seismic analysis	$q_{c1} = q_t \bullet (Pa/\sigma_v')^{0.5}$ where: Pa = atm. Pressure q_t is in Mpa	3
q_{c1n}	q_{c1} in dimensionless form used for seismic analysis	$q_{c1n} = (q_{c1} / Pa)(Pa/\sigma_v')$ where: Pa = atm. Pressure and n ranges from 0.5 to 0.75 based on Ic.	3
K_{SPT}	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) * (FC - 5))$	10
K_{CPT}	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference)	10
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \bullet K_{cpt}$	3
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833 [(q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93 [(q_{c1ncs}/1000]^3 + 0.08$	10
CSR	Cyclic Stress Ratio	$CSR = (\tau_{av}/\sigma_v') = 0.65 (a_{max} / g) (\sigma_v/ \sigma_v') r_d$ $r_d = 1.0 - 0.00765\ z$ $z \leq 9.15m$ $r_d = 1.174 - 0.0267\ z$ $9.15 < z \leq 23m$ $r_d = 0.744 - 0.008\ z$ $23 < z \leq 30m$ $r_d = 0.50$ $z > 30m$	10
MSF	Magnitude Scaling Factor	See Reference	10
FofS	Factor of Safety against Liquefaction	$FS = (CRR_{7.5} / CSR)\ MSF$	10
Liquefaction Status	Statement indicating possible liquefaction	Takes into account FofS and limitations based I_c and q_{c1ncs}.	10



Zone	qt / N	Soil Behavior Type
1	2	sensitive fine grained
2	1	organic material
3	1	clay
4	1.5	silty clay to clay
5	2	clayey silt to silty clay
6	2.5	sandy silt to clayey silt
7	3	silty sand to sandy silt
8	4	sand to silty sand
9	5	sand
10	6	gravelly sand to sand
11	1	very stiff fine grained *
12	2	sand to clayey sand *

* overconsolidated or cemented

Figure 1 Non-Normalized Behavior Type Classification Chart



Zone	Normalized Soil Behavior Type
1	sensitive fine grained
2	organic material
3	clay to silty clay
4	clayey silt to silty clay
5	silty sand to sandy silt
6	clean sands to silty sands
7	gravelly sand to sand
8	very stiff sand to clayey sand
9	very stiff fine grained

Figure 2 Normalized Behavior Type Classification Chart

Table 2 References

No.	References
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MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0901** SHEET **1** OF **2**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
0			**ASH:** Firm, Dark Gray, Sandy **SILT (ML)**, Moist.	(Bentonite 0.0' - 4.0')	
				(Top of Sand at 4.0')	
5			**ASH:** Very Soft, Dark Gray, Sandy **SILT (ML)**, Moist to Wet.	(Top of Screen at 5.8')	1532
	▼				
10			**ASH:** Very Loose, Dark Gray, Fine Silty **SAND (SM)**, Wet.		1527
15			**ASH:** Very Soft, Dark Gray, Sandy **SILT (ML)**, Wet.		1522
20					1517
25					1512
30					1507
35			No Recovery.		1502
40					1497
45			Firm, Reddish Brown, Sandy **CLAY (CL)**, with Mica, Moist to Wet. No Recovery.		1492
			Loose, Brown, Medium to Fine, Clayey **SAND (SC)**, Moist.		

DRILLING CONTRACTOR **Tri-State Drilling**
DRILLING METHOD **3.25" HSA**
DRILLING EQUIPMENT **CME-75 Truck Rig**
DATE DRILLED **9/29/2009**

REMARKS:

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0901** SHEET **2** OF **2**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
			Loose, Brown, Medium to Fine, Clayey **SAND (SC)**, Moist.		
55			Dense, Brown, Clayey **SAND (SC)**, with Large Rocks and Gravel Fragments. Halt Due to Heaving Sands will Resume on 10/5/2009.	(Bottom of Screen at 55.8')	1482
60			Red Brown, Moderately Hard, Slightly Weathered, **SHALE**.	(Bentonite 56.8' - 61.8')	
			Auger Refusal at 56.8' Below Ground Surface on 10/7/2009. Boring Terminated at 61.8' Below Ground Surface on 10/7/2009.		
65					
70					
75					
80					
85					
90					
95					
100					
105					

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0902** SHEET **1** OF **1**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
0	▼		**TOPSOIL:** Red Brown, Sandy **CLAY (CL)**, with Organics.		
			ASH: Soft to Very Soft, Dark Gray, Sandy **SILT (ML)**, Moist to Wet.	(Bentonite 0.0' - 4.0')	
			NOTE: Using Piston Method for UD's.	(Top of Sand at 4.0')	
5			**NOTE:** Using Water in Drill OP.	(Top of Screen at 5.0')	1529
10			**NOTE:** Wet Below 10.0'.		1524
15					1519
20			**ASH:** Firm, Brown, Sandy **CLAY (CL)**, Trace of Ash, Moist.		1514
25			Firm, Brown, Sandy **CLAY (CL)**, Moist.		1509
30			**NOTE:** UD-8 Firm Below 28.0'. Driller Pushed 1.0' Due to Resistance.		1504
35			**NOTE:** 2.0" Lens of Rock at 32.5'.		1499
			NOTE: Rock Fragments at 37.5'.	(Bottom of Screen at 37.6')	
40			Moderately Hard, Gray, Close Joint Spacing, Slightly Weathered, **SHALE**, 0 to 15 Degree Bedding.	(Bentonite38.1' - 43.1')	1494
45			Auger Refusal at 38.1' Below Ground Surface (BGS) on 9/24/2009. Boring Terminated at 43.1' Below Ground Surface (BGS) on 9/24/2009.		

DRILLING CONTRACTOR **Tri-State Drilling**
DRILLING METHOD **3.25" HSA**
DRILLING EQUIPMENT **CME-75 Truck Rig**
DATE DRILLED **9/23/2009**

REMARKS:

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0903** SHEET **1** OF **2**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
0			Stiff, Red Brown, Sandy **CLAY (CL)**, Moist.	(Bentonite 0.0' - 5.0')	
5				(Top of Sand at 5.0') (Top of Screen at 6.0')	1537
			NOTE: 1/2" Lens of Gravel at 9.0' (Ash in Bottom 1.0" of Tube Fell Out).		
10					1532
			ASH: Firm, Dark Gray, Silty **SAND (SM)**, Moist.		
	▼		**ASH:** Very Soft, Dark Gray, Sandy **SILT (ML)**, Wet.		
15					1527
20			**NOTE:** No Recovery in UD-6.		1522
25					1517
			NOTE: Using Water in Augers.		
30					1512
			NOTE: No Recovery in SS-9.		
35					1507
40			Stiff to Firm, Reddish Brown, Sandy **CLAY(CL)**, with Rock Fragments, Moist.		1502
45					1497

DRILLING CONTRACTOR **Tri-State Drilling**
DRILLING METHOD **3.25" HSA**
DRILLING EQUIPMENT **CME-75 Truck Rig**
DATE DRILLED **9/25/2009**

REMARKS:

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0903** SHEET **2** OF **2**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
55			Stiff to Firm, Reddish Brown, Sandy **CLAY(CL)**, with Rock Fragments, Moist.		1487
			NOTE: UD-15 Refusal at 59.3'.		
60			Very Stiff, Reddish Brown, Sandy **CLAY (CL)**, Moist.		1482
			NOTE: Refusal-Tube Crushed at Bottom.		
			Very Loose, Brown, Medium, Clayey **SAND (SC)**, Wet.		
65			Very Hard, Brown, Sandy **CLAY (CL)**, with Rock, Moist.	(Bottom of Screen at 66.0')	1477
			NOTE: No Recovery in SS-20.		
70			**ROCK:** Moderately Hard, Reddish Gray, Close Joint Spacing, Slightly Weathered, **SHALE**, 0 to 15 Degree Bedding.	(Bentonite 68.1' - 73.1')	1472
75			Auger Refusal at 68.1' Below Ground Surface (BGS) on 9/24/2009. Boring Terminated at 73.1' Below Ground Surface (BGS) on 9/24/2009.		
80					
85					
90					
95					
100					
105					

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0904** SHEET **1** OF **1**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
0			Very Stiff, Reddish Brown, Sandy **CLAY (CL)**, with Rock Fragments, Moist.		
			ASH: Very Stiff, Dark Gray, Sandy **SILT (ML)**, Dry to Moist.	(Bentonite 0.0' - 5.0')	
5				(Top of Sand at 5.0') (Top of Screen at 6.0')	1540
10			**ASH:** Soft to Firm, Dark Gray, Sandy **SILT (ML)**, Moist.		1535
15					1530
20					1525
			NOTE: No Recovery. Refusal (Tube Crushed) (23.5-25.5 Very Soft).		
25	▽		**ASH:** Very Soft, Dark Gray, Sandy **SILT (ML)**, Moist to Wet.		1520
30	▼		**ASH:** Very Stiff, Gray Brown, Sandy **CLAY (CL)**, Moist. **NOTE:** 1/2" Lens of Weathered Rock at 29.5'.		1515
35			Firm, Brown, Medium Clayey **SAND (SC)**, with Rock Fragments, Wet. **NOTE:** UD-10 Refusal at 1", No Recovery.		1510
			Very Dense, Medium Clayey **SAND (SC)**, with Rock Fragments, Moist.	(Bottom of Screen at 39.0')	
40			Moderately, Reddish Gray, Close Joint Spacing, Slightly Weathered, **SHALE**, 8-15 Degree Bedding.	(Bentonite 40.0' - 45.0')	1505
45			Auger Refusal at 40.0' Below Ground Surface (BGS) on 10/1/2009. Boring Terminated at 45.0' Below Ground Surface (BGS) on 10/1/2009.		1500

DRILLING CONTRACTOR **Tri-State Drilling**
DRILLING METHOD **3.25" HSA**
DRILLING EQUIPMENT **CME-75 Truck Rig**
DATE DRILLED **9/30/2009**

REMARKS:

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0905** SHEET **1** OF **2**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
0			Very Stiff, Brown to Dark Gray, Sandy **CLAY (CL)**, Firm to Soft.		
			ASH: Firm to Soft, Dark Gray, Sandy **SILT (ML)**, Moist. **NOTE:** Dry Below 3.0'.	(Bentonite 0.0' - 6.0')	
5				(Top of Sand at 3.0')	1569
				(Top of Screen at 8.0')	
10					1564
15			**ASH:** Very Loose to Loose, Dark Gray, Medium Silty **SAND (SM)**, Moist. **NOTE:** Dry Below 16.0.' **NOTE:** Finer Gradation Below 18.0'		1559
20					1554
25					1549
30					1544
35			**ASH:** Firm, Dark Gray, Sandy **SILT (ML)**, Ash, Moist.		1539
40			**ASH:** Loose to Very Loose, Dark Gray, Silty **SAND (SM)**, Ash, Moist to Wet.		1534
45	▼		**ASH:** Very Soft, Ash-Dark Gray, Sandy **SILT (ML)**, Wet.		1529

DRILLING CONTRACTOR	**Tri-State Drilling**
DRILLING METHOD	**3.25" HSA**
DRILLING EQUIPMENT	**CME-75 Truck Rig**
DATE DRILLED	**10/1/2009**

REMARKS:

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

MACTEC Engineering and Consulting
Abingdon Virginia

BORING NO.: **P-0905** SHEET **2** OF **2**
PROJECT: **AEP Glen Lynn Drilling**
LOCATION: **Glen Lyn, Virginia**
PROJECT NO.: **3050-09-0132**
LOGGED BY: **D. Vass** CHECKED BY: **R. Rasnake**

DEPTH FEET (bgs)	Water Level	STRATA	DESCRIPTION	WELL CONSTRUCTION DETAIL	ELEVATION (ft.)
55			**ASH:** Very Loose, Ash-Dark Gray, Fine Silty **SAND (SM)**, Wet. **NOTE:** Very Wet Below 52.0'. No Recovery		1519
60			Firm, Reddish Brown, Medium Clayey **SAND (SC)**, Trace of Rock Fragments, Wet.		1514
65			Very Dense, Gray, Highly Weathered **SHALE (HWR)**, with Silty Sand, Wet.	(Bottom of Screen at 68.0')	1509
70			Reddish Brown, Moderately Hard, Slightly Weathered, **SHALE**.	(Bentonite 69.0' - 74.0')	1504
75			Auge Refusal at 65.9' Below Ground Surface (BGS) on 10/6/2009. Boring Terminated at 74.0' Below Ground Surface (BGS) on 10/6/2009.		
80					
85					
90					
95					
100					
105					

ABINGDON BORING LOG AND WELL LOG AEP GLEN LYNN DRILLING.GPJ LOG A EWNN03.GDT 22/02/10

Appendix E

Photos of 2017 Field Explorations

Appendix E – Field Exploration Photos, Sep and Oct 2017



Track-mounted Acker Renegade drill rig.



Truck-mounted Simco 2800 drill rig.



GUS sampler without Shelby tube attached.



GUS sampler with Shelby tube attached.



Osterberg sampler without Shelby tube attached.



Osterberg sampler with Shelby tube attached and fully extended.



Osterberg sampler with Shelby tube attached and retracted.



GEI engineer monitoring CPT penetration.
CPT rods are visible on the trailer bed.



CPT rods being pushed by Simco 2800 drill rig.



Landfill cap at B108.



Layers from top to bottom at B108: woven geotextile, non-woven geotextile, non-woven geotextile, geonet, and PVC membrane.



Finer stacked ash from B108, S3, 6 to 8 ft.



Coarser stacked ash from B108, S13, 28 to 30 ft.



Sluiced ash from B116, S7, 32 to 34 ft.



Detail of layering in sluiced ash.



Transition from sluiced ash to alluvium at B116. Transition is at about El. 1499, NGVD 29.



Transition from sluiced ash to alluvium at B107. Transition is at about El. 1510, NGVD 29.



Sand-like alluvium at B113, S13, 28 to 30 ft.



Clay-like alluvium at B119, S23, 55 to 57 ft.



Rock core from B122. The right edge of the top picture overlaps the left edge of the bottom picture (note ruler). The cores are from about 72 to 82 ft (about El. 1480 to 1470, NGVD 29).

Appendix F

2017 GEI Boring Logs and Tube Sample Logs

BORING INFORMATION

NORTHING (ft): 390,431 **EASTING (ft):** 1,308,860
GROUND SURFACE EL. (ft): 1536.8 **DATE START/END:** 9/6/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 67.8 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B101

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/19	12-15-6-7		CLAY DIKE	S1 (0-1"): SILTY GRAVEL WITH SAND (GM); ~60% widely graded gravel, ~25% fine to coarse sand, ~15% nonplastic fines, gray. S1 (1"-10"): WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, ~25% gravel, red. S1 (10"-19"): SANDY SILT (ML); ~60% low plasticity fines, ~30% fine sand, ~10% gravel, reddish brown.
		S2	2.5 to 4.5	24/11	4-19-12-9			S2 (0-6"): SILT WITH SAND (ML); ~70% low plasticity fines, ~20% sand, ~10% gravel, reddish brown. S2 (6"-11"): WIDELY GRADED GRAVEL WITH SAND (GW): ~85% widely graded angular gravel, ~15% fine to coarse sand, brown.
	5	S3	5 to 7	24/1	6-7-8-10			S3: WIDELY GRADED GRAVEL (GW); similar to S2 (6"-11").
1530		S4	7.5 to 9.5	24/15	4-4-10-18			S4: LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, brown. Piece of gravel in shoe.
	10	S5	10 to 12	24/2	6-6-7-8			S5: LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% fine sand, brown.
		S6	12.5 to 14.5	24/8	7-6-4-5	Transition from dry to moist		S6: GRAVELLY LEAN CLAY WITH SAND (CL): ~65% low plasticity fines, ~20% widely graded angular gravel, ~15% sand, brown. 0-1": Gravel seam 4": Gravel seam
	15	S7	15 to 17	24/17	2-5-8-9			S7: LEAN CLAY WITH SAND (CL): ~80% low plasticity fines, ~20% fine sand, transitions to reddish brown with depth. LL = 27%, PL = 21%.
1520		S8	17.5 to 19.5	24/7	15-8-6-6			S8 (0-3"): LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, reddish brown. 3": Angular piece of gravel 4"-7": Pieces of wood
	20	S9	20 to 22	24/11	4-4-5-6			S9 (0-7"): CLAYEY SAND (SC); 77.5% fine to coarse sand, 20.8% low plasticity fines, 1.7% fine gravel [GRAIN SIZE ANALYSIS], orange. S9 (7"-11"): LEAN CLAY (CL); ~90% low plasticity fines, ~10% sand, brown.
		S10	22.5 to 24.5	24/19	3-6-10-10			S10: LEAN CLAY (CL); similar to S9 (7"-11"). 0-1": Sand seam.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 390,431 **EASTING (ft):** 1,308,860
GROUND SURFACE EL. (ft): 1536.8 **DATE START/END:** 9/6/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B101

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S11	24.5 to 26.5	24/7	3-6-10-14		CLAY DIKE	S11: LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% sand, brown. Piece of gravel in shoe.
1510		S12	27 to 29	24/17	1-2-4-7			S12: LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~10% medium to coarse sand, ~10% gravel, reddish brown. 0-1": Sand seam 7": Sand seam, softer.
	30	S13	29.5 to 31.5	24/21	4-7-12-20			S13: LEAN CLAY (CL); ~95% low plasticity fines, ~5% fine sand, red brown. 15"-21": Some gravel.
		S14	32 to 34	24/21	5-6-8-10			S14 (0-21"): LEAN CLAY (CL); ~90% low plasticity fines, ~10% sand, trace roots. S14 (21"-24"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine sand, brown.
	35	S15	34.5 to 36.5	24/22	4-9-13-13			S15 (0-11"): LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% fine sand, red-brown.
1500		S16	37 to 39	24/23	9-11-15-16		CLAY-LIKE ALLUVIUM	S15 (11"-19"): CLAYEY SAND (SC); ~70% fine to medium sand, ~30% low plasticity fines, brown. S15 (19"-22"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine sand, brown. S16: LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% sand. 0-13": Light brown. 13"-23": Brown-gray.
	40	S17	39.5 to 41.5	24/24	4-7-9-11			S17: LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, dark brown.
		S18	42 to 44	24/24	3-5-7-11			S18: LEAN CLAY (CL); ~95% medium plasticity fines, ~5% fine sand, dark brown.
	45	S19	44.5 to 46.5	24/24	4-6-10-12			S19: LEAN CLAY (CL); similar to S18. LL = 48%, PL = 21%.
1490		S20	47 to 49	24/24	2-5-8-10			S20: LEAN CLAY (CL); similar to S18.
	50	S21	49.5 to 51.5	24/24	3-5-8-8			S21: LEAN CLAY (CL); similar to S18.
		S22	52 to 54	24/24	2-2-3-4			S22 (0-9"): LEAN CLAY (CL); similar to S18. S22 (9"-30"): LEAN CLAY WITH SAND (CL); 71.6% medium plasticity fines, 28.4% fine sand [GRAIN SIZE ANALYSIS]. 16"-23": Sandier seam: ~60% fine sand, ~40% medium plasticity fines.
	55	S23	54.5	24/24	WOH-			S23 (0-21"): Gradual change from LEAN CLAY WITH SAND (CL);

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,431 **EASTING (ft):** 1,308,860
GROUND SURFACE EL. (ft): 1536.8 **DATE START/END:** 9/6/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B101

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
			to 56.5		WOH-4-30			~80% medium plasticity fines, ~15% fine sand, ~5% gravel, brown. to S23 (21"-24"): SANDY LEAN CLAY (CL); ~65% low plasticity fines, ~30% fine sand, ~5% gravel. 16"-17": Fine sand seam. 29": Piece of gravel.
1480		S24	57 to 57.8	9/9	8-50/3"	Transition from moist to wet		S24 (0-7"): NARROWLY GRADED SAND WITH CLAY (SP-SC); ~80% fine sand, ~20% nonplastic fines, gray. S24 (7"-9"): CLAYEY GRAVEL WITH SAND (GC); ~50% widely graded gravel, ~30% fine to coarse sand, ~20% nonplastic fines, gray with red.
		C1	57.8 to 67.8	120/118	36	Auger refusal at 58.2 ft	BEDROCK	C1: SHALE; pink, light to moderately weathered, fine-grained, medium hard, horizontal jointing every 2-4 inches, vertical joints from 61' to 64.3', no jointing from 64.4' to 66.8', ~0.1' highly weathered zone at 64.9' and 67.3'. 64.4' to 65.1': Color changes from pink to gray.
	60							
	65							
1470								Bottom of boring at depth 67.75 ft. Borehole grouted upon completion.
	70							
	75							
1460								
	80							
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 390,427 **EASTING (ft):** 1,308,866
GROUND SURFACE EL. (ft): 1536.6 **DATE START/END:** 9/8/2017 - 9/8/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 57.5 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas/M. Farren **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B101U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 4.25 inch / 7.5 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							CLAY DIKE	Cuttings similar to B101.
1530	5							
	10							
1520	15							
	20	U1	20.2 to 22.2	24/24	PUSH			U1 top: LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~10% fine sand, ~10% fine gravel up to 1/4 inch, brown. U1 bottom: LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, gray.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 390,427 **EASTING (ft):** 1,308,866
GROUND SURFACE EL. (ft): 1536.6 **DATE START/END:** 9/8/2017 - 9/8/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B101U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25						CLAY DIKE	
1510								
	30							
	35						CLAY-LIKE ALLUVIUM	
1500								
	40							
	45							
1490								
	50							
		U2	52.2 to 54.2	24/22	PUSH			U2 top: LEAN CLAY (CL); ~90% fines, ~10% fine sand. U2 bottom: LEAN CLAY WITH SAND (CL); ~80% fines, ~10% fine sand, ~10% fine gravel, brown. LL = 35%, PL = 18%.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,427 **EASTING (ft):** 1,308,866
GROUND SURFACE EL. (ft): 1536.6 **DATE START/END:** 9/8/2017 - 9/8/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B101U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1480	60	U3	55 to 57	24/24	OSTER-BERG			U3 top: SANDY LEAN CLAY (CL); ~70% fines, ~30% fine to coarse sand, brown. U3 bottom: SANDY LEAN CLAY (CL); ~55% fines, ~45% fine sand, dark brown. LL = 34%, PL = 20%.
								Bottom of boring at depth 57.5 ft. Borehole grouted upon completion.
1470	65							
	70							
	75							
1460	80							
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft):		**EASTING (ft):**	
GROUND SURFACE EL. (ft):	1508	**DATE START/END:**	10/17/2017 - 10/17/2017
VERT./HORIZ. DATUMS:	NGVD 1929/GLALHD	**DRILLING COMPANY:**	Terracon Consultants, Inc.
TOTAL DEPTH (ft):	28.6	**DRILLER NAME:**	W. Duggins
LOGGED BY:	M. Perez-Canals	**RIG TYPE:**	Acker Renegade Track Rig

BORING

B102

DRILLING INFORMATION

HAMMER TYPE:	Automatic	**CASING I.D./O.D.:**	NA/ NA	**CORE BARREL TYPE:**	NA
AUGER I.D./O.D.:	3.25 inch / 6.25 inch	**DRILL ROD O.D.:**	NM	**CORE BARREL I.D./O.D.:**	NA / NA
DRILLING METHOD:	Hollow Stem Auger				
WATER LEVEL DEPTHS (ft):	Not measured				

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Augered through Riprap	RIPRAP	0-3' Riprap
	5	S1	3.5 to 5.5	24/14	4-2-4-4	Qp = 3.0 tsf	CLAY DIKE	S1: LEAN CLAY WITH SAND (CL); ~70% medium plasticity fines, ~20% fine to coarse sand, ~10% fine rounded gravel, reddish brown, coarse gravel on top.
		S2	6 to 8	24/16	2-4-5-6	Qp = 4.0 tsf		S2: LEAN CLAY WITH SAND (CL); ~70% medium plasticity fines, ~20% fine to coarse sand, ~10% fine to medium gravel up to 1/2", reddish brown.
1500								
	10	S3	8.5 to 10.5	24/17	2-3-5-7	Qp = 2.5 tsf		S3: LEAN CLAY (CL); ~85% medium plasticity fines, ~10% fine sand, ~5% fine to medium gravel, reddish brown.
		S4	10.5 to 12.5	24/20	3-6-5-8	Qp = 3.75 tsf		S4: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~40% fine sand, reddish brown.
		S5	12.5 to 14.5	24/18	1-4-5-10			S5 (0-7"): LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% fine sand, reddish brown.
	15	S6	14.5 to 16.5	24/21	2-1-4-4	Qp = 1.25 tsf	CLAY-LIKE ALLUVIUM	S5 (7"-16"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~20% sand, brown. S5 (16"-18"): CLAYEY SAND (SC); ~70% fine sand, ~30% low plasticity fines, brown. S6 (0-6"): SANDY CLAY (CL); ~70% nonplastic fines, ~30% fine sand, brown. S6 (6"-21"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~20% fine sand, brown.
		S7	16.5 to 18.5	24/22	3-3-5-5	Qp = 1.25 tsf		S7: LEAN CLAY (CL); ~90% medium plasticity fines, ~10% fine sand, brown.
1490								
	20	S8	18.5 to 20.5	24/24	WOH-3-2-3	Qp = 0.75 tsf		S8: LEAN CLAY (CL); ~80% medium plasticity fines, ~10% fine sand, brown.
		S9	20.5 to 22.5	24/24	1-2-2-3	Qp = 1.0 tsf		S9: SANDY CLAY (CL); ~70% medium plasticity fines, ~30% fine sand, brown.
		S10	22.5 to 24.5	24/24	2-2-3-4	Qp = 0.5 tsf		S10: SANDY CLAY (CL); Similar to S9.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant

CITY/STATE: Glen Lyn, Virginia

GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): _____ EASTING (ft): _____

GROUND SURFACE EL. (ft): 1508 DATE START/END: 10/17/2017 - 10/17/2017

VERT./HORIZ. DATUMS: NGVD 1929/GLALHD DRILLING COMPANY: Terracon Consultants, Inc.

BORING B102

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S11	24.5 to 26.5	24/24	2-3-3-4			S11 (0-12"); SANDY CLAY (CL); Similar to S9. S11 (12"-24"): CLAYEY SAND (SC); ~60% fine sand, ~40% medium plasticity fines, gray.
		S12	26.5 to 28.4	23/23	1-3-12-50/5"			S12 (0-6"): CLAYEY SAND (SC); Similar to S11 (12"-24"). S12 (6"-18"): SANDY SILT (ML); 50.8% fines, 49.1% fine sand, 0.1% fine gravel [GRAIN SIZE ANALYSIS], brown. LL = NV, PL = NP.
1480								
		S13	28.5 to 28.6	1/0	50/1"			S12 (18"-23"): WEATHERED SHALE. S13: NO RECOVERY
	30							Bottom of boring at depth 28.58 ft. Borehole grouted upon completion.
	35							
1470								
	40							
	45							
1460								
	50							
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant

CITY/STATE: Glen Lyn, Virginia

GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 390,215 | **EASTING (ft):** 1,308,911
GROUND SURFACE EL. (ft): 1536.6 | **DATE START/END:** 9/17/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 49.0 | **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals | **RIG TYPE:** Acker Renegade Track Rig

BORING
B103

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** 3 inch/ 3.5 inch | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Mud rotary
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/12	2-2-3-2		SLUICED ASH	S1: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine to medium sand, gray. SLUICED ASH.
		S2	2 to 4	24/10	2-2-2-2			S2: SILT WITH SAND (ML); ~60% nonplastic fines, ~30% fine to coarse sand, ~10% fine gravel, gray. SLUICED ASH.
	5	S3	5 to 7	24/20	1-1-1-1	Wet		S3 (0-3"): SILT WITH SAND (ML); Similar to S2. SLUICED ASH. S3 (3"-20"): SILTY SAND (SM); ~80% nonplastic fines, ~20% fine sand, gray. SLUICED ASH.
1530		S4	7.5 to 9.5	24/17	1/12"-WOH-1			S4: SANDY SILT (ML); ~80% nonplastic fines, ~20% fine sand, gray. SLUICED ASH. 1": Red gravel fragments.
	10	S5	10 to 12	24/13	1/24"			S5: SANDY SILT (ML); ~85% nonplastic fines, ~15% fine sand, gray. SLUICED ASH. 1": One 1/2" piece of red gravel.
		S6	12.5 to 14.5	24/24	WOH			S6: SANDY SILT (ML); ~80% nonplastic fines, ~20% fine sand, gray. SLUICED ASH.
	15	S7	15 to 17	24/14	1/24"			S7: SANDY SILT (ML); Similar to S6. SLUICED ASH.
1520		S8	17.5 to 20	30/30	WOH/18"-1/12"			S8: SANDY SILT (ML); Similar to S6. SLUICED ASH.
	20	S9	20 to 24.3	51/30	WOR	Rods with sampler fell down hole to 24.26 feet		S9: SANDY SILT (ML); ~80% nonplastic fines, ~20% fine sand, gray. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,215 **EASTING (ft):** 1,308,911
GROUND SURFACE EL. (ft): 1536.6 **DATE START/END:** 9/17/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B103

Elev. (ft)	Depth (ft)	Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S10	25 to 27.5	30/30	WOR		SLUICED ASH	S10: SANDY SILT (ML); Similar to S9. SLUICED ASH.
1510								
	30	U1	29 to 31	24/24	GUS			U1: SLUICED ASH.
		U2	31.5 to 32.7	14/14	GUS			U2: SLUICED ASH.
	35	S11	34 to 38.2	50/30	WOH			S11: SILT (ML); 93.7% fines, 6.3% fine sand [GRAIN SIZE ANALYSIS], gray. LL = NV, PL = NP. SLUICED ASH.
1500								
	40	S12	38.5 to 40.5	24/19	WOH			S12: SANDY SILT (ML); ~80% nonplastic fines, ~20% fine sand, gray. SLUICED ASH.
		S13	40.5 to 42.5	24/20	WOH			S13 (0-12"): SANDY SILT (ML); Similar to S12. SLUICED ASH.
		S14	42.5 to 44.5	24/23	WOH/18"-2		SAND-LIKE ALLUVIUM	S13 (12"-20"): SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~40% fine sand, brown. S14: CLAYEY SAND (SC); 62.6% fine sand, 37.4% medium plasticity fines [GRAIN SIZE ANALYSIS], brown.
	45	U3	45.9 to 46.7	10/10	GUS			U3: CLAYEY SAND (SC); Similar to S14.
1490		S15	46.7 to 48	15/12	5-7-50/3"			S15: CLAYEY SAND WITH GRAVEL (SC); ~45% fine sand, ~40% medium plasticity fines, ~15% fine to coarse subangular gravel up to 1", brown.
		S16	49 to 49	0/0	50/0"			S16: NO RECOVERY Bottom of boring at depth 49 ft. Borehole grouted upon completion.
	50							
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,770 **EASTING (ft):** 1,309,176
GROUND SURFACE EL. (ft): 1545.4 **DATE START/END:** 9/14/2017 - 9/15/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 75.0 **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals **RIG TYPE:** Acker Renegade Track Rig

BORING
B105

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): ▼ 15.2 10/19/2017 9:45 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Hand auger to 4 feet to make sure no liner is present	EARTH FILL	
1540	5	S1	5 to 7	24/13	6-7-7-8			S1: SANDY LEAN CLAY (CL); ~70% low to medium plasticity fines, ~30% coarse sand, reddish brown.
		S2	7.5 to 9.5	24/12	3-2-3-2			S2: SANDY LEAN CLAY WITH GRAVEL (CL); ~65% low to medium plasticity fines, ~20% fine to coarse sand, ~15% fine to medium gravel up to 1", reddish brown.
	10	S3	10 to 12	24/15	2-2-9-7			S3 (0-8"): SANDY LEAN CLAY WITH GRAVEL (CL); Similar to S2, yellowish brown.
							STACKED ASH	S3 (8"-15"): SILTY SAND (SM); ~75% fine to medium sand, ~15% nonplastic fines, ~10% gravel, brown. STACKED ASH.
		S4	12.5 to 14.5	24/13	4-6-5-5	Wet		S4 (0-4"): SILTY SAND (SM); ~80% fine to coarse sand, ~15% nonplastic fines, ~5% fine gravel up to 1", gray brown. STACKED ASH. S4 (4"-13"): SILTY SAND (SM); ~70% fine sand, ~30% nonplastic fines, brown and gray. STACKED ASH.
1530	15	S5	15 to 17	24/23	1-1-1-1		SLUICED ASH	S5 (0-2"): SILT WITH SAND (ML); ~75% low to medium plasticity fines, ~20% fine to coarse sand, ~5% fine to medium gravel, brown. S5 (2"-23"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray. SLUICED ASH.
		S6	17.5 to 19.5	24/21	WOH-1/12"-1			S6: SILT (ML); Similar to S5 (2"-23"). SLUICED ASH.
	20	S7	20 to 22	24/25	WOH/12"-1/12"			S7: SILT (ML); Similar to S5 (2"-23"). SLUICED ASH.
		S8	22.5 to 24.5	24/24	WOH/24"			S8 (0-1"): SILT (ML); Similar to S5 (2"-23"). SLUICED ASH. S8 (1"-24"): SILT (ML); ~95% nonplastic fines, ~5% fine sand, gray. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,770 **EASTING (ft):** 1,309,176
GROUND SURFACE EL. (ft): 1545.4 **DATE START/END:** 9/14/2017 - 9/15/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B105

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25						SLUICED ASH	
1520		S9	25 to 27.5	30/30	WOH/30"			S9: SILT (ML); Similar to S8 (1"-24"). SLUICED ASH.
		S10	27.5 to 30	30/30	WOH/30"			S10: SILT (ML); Similar to S8 (1"-24"). SLUICED ASH.
	30	S11	30 to 32.5	30/30	WOH/30"			S11: SILT (ML); Similar to S8 (1"-24"). SLUICED ASH.
		S12	32.5 to 34.5	24/22	1/18"-1			S12: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray. SLUICED ASH.
	35							
1510		S13	35 to 37.5	30/30	WOH/30"			S13: SILT (ML); ~95% nonplastic fines, ~5% fine sand, gray. SLUICED ASH.
		S14	37.5 to 39.5	24/24	1/24"			S14 (0-20"): SILT (ML); Similar to S13. SLUICED ASH. S14 (14"-24"): SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, gray. SLUICED ASH.
	40	S15	40 to 42	24/20	1-1/12"-1			S15: SANDY SILT (ML); Similar to S14 (14"-24"). SLUICED ASH.
		S16	42.5 to 45	30/30	1/30"			S16: SILT (ML); 92.5% fines, 7.5% fine sand [GRAIN SIZE ANALYSIS]. LL = NV, PL = NP. SLUICED ASH.
	45							
1500		S17	45 to 47	24/26	WOH-1/18"			S17: SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, gray. SLUICED ASH.
		S18	47 to 49	24/21	WOH/18"-1			S18: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray. SLUICED ASH.
		S19	49 to 51	24/17	WOH-20-25-17			S19 (0-3"): SILT (ML); Similar to S18. SLUICED ASH.
	50						CLAY-LIKE ALLUVIUM	S19 (3"-11"): LEAN CLAY (CL); ~90% medium plasticity fines, ~10% fine to coarse sand, dark brown. S19 (11"-17"): Rock fragments.
		S20	51 to 53	24/6	7-8-10-14			S20 (0-3"): CLAYEY GRAVEL WITH SAND (GC); ~70% fine to medium gravel up to 1", ~20% medium plasticity fines, ~10% medium to coarse sand, gray. S20 (3"-6"): SANDY LEAN CLAY WITH GRAVEL (CL); ~55% medium plasticity fines, ~30% fine to medium sand, ~15% fine gravel, brown. 2" gravel on sampler tip.
		S21	53 to 55	24/14	9-7-4-3			S21 (0-6"): CLAYEY GRAVEL WITH SAND (GC); ~55% fine to coarse gravel up to 1.5", ~30% medium plasticity fines, ~15% fine to coarse sand, brown.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,770 **EASTING (ft):** 1,309,176
GROUND SURFACE EL. (ft): 1545.4 **DATE START/END:** 9/14/2017 - 9/15/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B105

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S22	55 to 57	24/7	3-5-8-9			S21 (6"-14"): CLAYEY SAND WITH GRAVEL (SC); 38% fine to medium sand, 31.5% fine gravel, 30.5% fines [GRAIN SIZE ANALYSIS], brown. LL = 32%, PL = 18%. S22: CLAYEY SAND WITH GRAVEL (SC); ~45% fine to medium sand, ~35% medium plasticity fines, ~20% fine to coarse gravel up to 1", brown. S23 (0-5"): CLAYEY SAND WITH GRAVEL (SC); 60% fine to medium sand, ~25% medium plasticity fines, ~15% fine to medium gravel, light brown.
		S23	57 to 59	24/11	3-9-10-3			
	60	S24	59 to 61	24/6	4-3-2-2		SAND-LIKE	S23 (5"-11"): SANDY LEAN CLAY (CL): ~60% medium plasticity fines, ~20% fine to medium sand, ~20% fine to medium gravel, light brown. S24: CLAYEY SAND (SC); ~60% fine to medium sand, ~30% medium plasticity fines, ~10% fine gravel up to 1/2", brown.
		S25	61 to 62	12/10	10-49-50/0"	61 - 63 ft. hard drilling 62 ft. spoon bouncing while sampling		S25: CLAYEY GRAVEL (GC); ~75% fine to coarse subangular gravel up to 1.5" (rock fragments), ~15% medium plasticity fines, ~10% fine to coarse sand, brown-red.
		S26	63 to 63.2	2/2	50/2"	3-inch casing down to 64 ft		S26: Rock fragments, red.
1480	65	C1	65 to 70	60/60	18	min/ft: 2, 2.5, 4, 3.75, 2	BEDROCK	C1: SHALE; moderately hard, mostly horizontal joints spaced <1" to 7" apart, some vertical joints are weathered and have oxidation, red.
	70	C2	70 to 75	60/59	42	min/ft: 3.5, 3, 2.75, 2.5, 2.25		C2:SHALE; Similar to C1. 30"-59": Joints spaced 4" to 16" apart, horizontal to 45°, slightly weathered.
1470	75							Bottom of boring at depth 75 ft. Drilled with Bio-Bore. Piezometer B105 installed upon completion.
	80							
1460	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,767 **EASTING (ft):** 1,309,170
GROUND SURFACE EL. (ft): 1545.4 **DATE START/END:** 9/16/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 56.4 **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals **RIG TYPE:** Acker Renegade Track Rig

BORING

B105U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1540	5					Use rotary wash w/ bentonite mud to drill to 23'	CLAY CAP	
	10						STACKED ASH	
1530	15						SLUICED ASH	
	20	U1	23 to	24/0	GUS			U1: Lost Recovery.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,767
GROUND SURFACE EL. (ft): 1545.4
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD

EASTING (ft): 1,309,170
DATE START/END: 9/16/2017 - 9/17/2017
DRILLING COMPANY: Terracon Consultants, Inc.

BORING
B105U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25		25				SLUICED ASH	
1520	25							
	30							
	35							
1510		U2	35.1 to 37.1	24/0	GUS			U2: Lost recovery.
		U3	37.7 to 39.7	24/13	GUS			U3: SLUICED ASH. Partial loss of recovered soil.
	40							
		U4	41 to 43	24/24	GUS			U4: SLUICED ASH.
1500	45							
	50						CLAY-LIKE ALLUVIUM	
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,767 **EASTING (ft):** 1,309,170
GROUND SURFACE EL. (ft): 1545.4 **DATE START/END:** 9/16/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B105U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		U5	55.2 to 56.4	15/20	GUS			U5: CLAYEY SAND WITH GRAVEL (SC).
								Bottom of boring at depth 56.4 ft. Borehole grouted upon completion.
	60							
1480	65							
	70							
1470	75							
	80							
1460	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,851 **EASTING (ft):** 1,309,298
GROUND SURFACE EL. (ft): 1545.3 **DATE START/END:** 9/6/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 66.3 **DRILLER NAME:** W. Duggins
LOGGED BY: N.Mazzella **RIG TYPE:** Acker Renegade Track Rig

BORING

B106

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 3 inch/ 3.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): ▼ 12.2 9/7/2017

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/13	6-7-6-4		EARTH FILL	S1: CLAYEY SAND (SC); ~60% fine to medium sand, ~30% nonplastic fines, ~10% fine gravel up to 1/4 inch, red.
		S2	2.5 to 4.5	24/12	6-10-9-9			S2: CLAYEY SAND (SC); Similar to S1.
1540	5	S3	5 to 7	24/12	4-3-6-6			S3: SANDY CLAY (CL); ~60% medium plasticity fines, ~30% fine to medium sand, ~10% fine gravel up to 1/4 inch, red.
		S4	7.5 to 9.5	24/19	WOH-2-4-7			S4 (0-12"): LEAN CLAY (CL); ~90% medium plasticity fines, ~10% fine sand, red. S4 (12"-19"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~15% fine to medium sand, ~5% fine gravel, brown/red.
	10	S5	10 to 12	24/14	7-7-7-7		SLUICED ASH	S5: NARROWLY GRADED SAND (SP); ~90% mostly fine sand, ~10% nonplastic fines, black, gray. SLUICED ASH.
		S6	12.5 to 14.5	24/16	3-2-3-2			S6: NARROWLY GRADED SAND (SP); Similar to S5. SLUICED ASH.
1530	15	S7	15 to 17	24/24	WOH-1/18"			S7: SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH.
		S8	17.5 to 19.5	24/14	WOH/24"			S8: SILT (ML); Similar to S7. SLUICED ASH.
	20	S9	20 to 22	24/21	WOH/24"			S9: SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand. SLUICED ASH.
		S10	22.5 to 24.5	24/17	WOH/24"			S10: SILT (ML); ~90% nonplastic fines, ~10% fine sand, black, sample is semi-liquid. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,851 **EASTING (ft):** 1,309,298
GROUND SURFACE EL. (ft): 1545.3 **DATE START/END:** 9/6/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B106

Elev. (ft)	Depth (ft)	Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S11	25 to 27	24/24	WOH/18"-1		SLUICED ASH	S11: SILT (ML); Similar to S10. SLUICED ASH.
1520		S12	27.5 to 29.5	24/24	WOH/24"			S12: SILT (ML); Similar to S10. SLUICED ASH.
	30	S13	30 to 32	24/24	WOH/18"			S13: SILT (ML); Similar to S10. SLUICED ASH.
		S14	32.5 to 34.5	24/24	WOH/18"			S14: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, black-gray. SLUICED ASH.
1510	35	S15	35 to 37	24/23	WOH/12"-2-1			S15 (0-12"): SILT (ML); ~90% nonplastic fines, ~10% fine to medium sand, black/gray. SLUICED ASH. S15 (12"-23"): SILTY SAND (SM); ~65% fine to medium sand, ~35% nonplastic fines, black/gray. SLUICED ASH.
		S16	37.5 to 39.5	24/24	WOH-1/18"			S16: SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH.
	40	S17	39.5 to 41.5	24/17	WOH/24"			S17: SILT (ML); Similar to S16. SLUICED ASH.
		S18	41.5 to 43.5	24/24	1/24"	Mud drilling pressure: 25 psi Marsh funnel: 36 sec Mud balance: 68.1 pcf		S18: SILT (ML); Similar to S16. SLUICED ASH.
		S19	43.5 to 45.5	24/23	WOH/24"			S19: SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH.
1500	45	S20	45.5 to 47.5	24/23	WOH/18"-1			S20: SILT (ML); Similar to S19. SLUICED ASH.
		S21	47.5 to 49.5	24/24	WOH/12"-1/12"	Mud drilling pressure: 25 psi		S21 (0-21"): SILT (ML); Similar to S19. SLUICED ASH. S21 (21"-24"): SANDY CLAY (CL); ~70% medium plasticity fines, ~30% fine sand, black/gray, roots in sample.
	50	S22	49.5 to 51.5	24/18	5-2-2-3	Pp = 2.75; Tv = 0.25, 0.25	CLAY-LIKE ALLUVIUM	S22: LEAN CLAY WITH SAND (CL); ~85% medium plasticity fines, ~15% fine sand, gray.
		S23	51.5 to 53.5	24/19	WOH-5-5-4	Pp = 1.5; Tv = 0.25		S23: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine to medium sand, gray to brown, trace roots.
		S24	54 to 56	24/13	1-3-2-35	Pp = 1.5; Tv = 0.45		S24: SANDY LEAN CLAY (CL); Similar to S23.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,851 **EASTING (ft):** 1,309,298
GROUND SURFACE EL. (ft): 1545.3 **DATE START/END:** 9/6/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B106

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S25	56.5 to 57.3	9/6	2-50/3"	Mud drilling pressure: 45 psi Marsh funnel: 56 sec Mud balance: 70 pcf	CLAY-LIKE ALLUVIUM	S25: CLAYEY SAND (SC); ~60% fine to medium sand, ~40% low plasticity fines, brown.
	60	S26	59 to 61	24/19	4-3-12-49			S26: CLAYEY SAND WITH GRAVEL (SC); 42.1% fine to coarse gravel up to 3/4 inch, 35.8% fine to coarse sand, 22.1% fines [GRAIN SIZE ANALYSIS], brown. LL = 31%, PL = 19%. 4": 1 inch of soft material.
		S27	61.5 to 62.6	13/4	9-15-50/1"			S27: NARROWLY GRADED GRAVEL (GP); ~90% fine gravel up to 1/2 inch, ~10% medium to coarse sand, brown.
1480	65	S28	64 to 64.8	9/5	7-50/3"		BEDROCK	S28: WEATHERED ROCK. Red weathered rock.
		S29	66 to 66.3	4/0	50/4"			S29: No recovery. Bottom of boring at depth 66.33 ft. Borehole grouted upon completion.
	70							
1470	75							
	80							
1460	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,855 | **EASTING (ft):** 1,309,306
GROUND SURFACE EL. (ft): 1545.5 | **DATE START/END:** 9/8/2017 - 9/8/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 52.9 | **DRILLER NAME:** W. Duggins
LOGGED BY: N.Mazzella | **RIG TYPE:** Acker Renegade Track Rig

BORING

B106U

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** 4 inch/ 4.5 inch | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1540	5						EARTH FILL	
	10							
1530	15						SLUICED ASH	
	20							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,855 **EASTING (ft):** 1,309,306
GROUND SURFACE EL. (ft): 1545.5 **DATE START/END:** 9/8/2017 - 9/8/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B106U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1520	25						SLUICED ASH	
	30							
1510	35	U1	35 to 37	24/4	GUS			U1 top: SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, black. SLUICED ASH. U1 bottom: SILTY SAND (SM); Similar to U1 top. SLUICED ASH.
		U2	38.1 to 40	24/14	GUS			U2 top: SILT (ML); ~80% nonplastic fines, ~20% fine sand, black. SLUICED ASH. U2 bottom: SILT (ML); Similar to U2 top. SLUICED ASH.
	40							
1500	45	U3	47 to 49	24/24	GUS			U3 top: SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH. U3 bottom: SILT (ML); Similar to U3 top. SLUICED ASH.
	50						CLAY-LIKE	
		U4	50.9 to 52.9	24/15	GUS			U4 top: SANDY CLAY (CL); ~70% low plasticity fines, ~30% mostly fine sand, gray.
	55							Bottom of boring at depth 52.91 ft. Borehole grouted upon completion.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,320 | **EASTING (ft):** 1,309,175
GROUND SURFACE EL. (ft): 1583.5 | **DATE START/END:** 10/15/2017 - 10/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 91.7 | **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals | **RIG TYPE:** Acker Renegade Track Rig

BORING
B107

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** 4 inch/ 4.5 inch | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Drilled to 5' for first sample.	CLAY CAP	
1580	5	S1	5 to 7	24/17	9-8-9-10		STACKED ASH	S1 (0-2"): LEAN CLAY WITH SAND (CL); ~85% medium plasticity fines, ~10% fine to coarse sand, ~5% fine gravel, reddish brown. S1 (2"-17"): SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand, dark gray. STACKED ASH.
	10	S2	10 to 12	24/18	5-27-8-8	Sampling spoon bent. Drill chatter 10'-11'. Spoon getting caught at 10'. Driller advanced casing past it. Cobble or boulder at 10'.		S2: SILT WITH SAND (ML); Similar to S1 (2"-17"). STACKED ASH.
1570	15	S3	15 to 17	24/13	7-7-8-10			S3: SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand, dark gray, fine gravel on top. STACKED ASH.
	20	S4	20 to 22	24/17	4-8-10-11			S4: SILT WITH SAND (ML); Similar to S3. LL = NV, PL = NP. STACKED ASH.
1560								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,320 **EASTING (ft):** 1,309,175
GROUND SURFACE EL. (ft): 1583.5 **DATE START/END:** 10/15/2017 - 10/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B107

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S5	25 to 27	24/17	4-6-10-11		STACKED ASH	S5: SILT WITH SAND (ML); Similar to S3. STACKED ASH.
	30	S6	30 to 32	24/13	3-4-5-5			S6: SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand, dark gray. STACKED ASH.
1550	35	S7	35 to 37	24/17	5-9-10-14			S7: SILT WITH SAND (ML); Similar to S6. STACKED ASH.
	40	S8	40 to 42	24/18	7-8-12-14			S8: SILT WITH SAND (ML); Similar to S6. STACKED ASH.
1540	45	S9	45 to 47	24/18	2-1-2-3	Sample wet.		S9 (0-7"): SILT WITH SAND (ML); Similar to S6. STACKED ASH.
							SLUICED ASH	S9 (7"-18"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. SLUICED ASH. Sample had long white fibers throughout.
	50	S10	50 to 52	24/18	WOH/12"-1/12"			S10: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. SLUICED ASH.
1530		U1	52 to 54	24/16	GUS	pH = 7		U1: SLUICED ASH.
	55	S11	54 to 56	24/24	WOH/24"	pH = 7		S11: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,320 **EASTING (ft):** 1,309,175
GROUND SURFACE EL. (ft): 1583.5 **DATE START/END:** 10/15/2017 - 10/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B107

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S12	56 to 58.5	30/30	WOH/30"	Sampler overdriven, pH = 8	SLUICED ASH	S12: SILT (ML); Similar to S11. SLUICED ASH.
	60	S13	58.5 to 60.5	24/19	WOH/12"-1-1	pH = 7		S13: SILT (ML); Similar to S11. Some layers are sandier. SLUICED ASH.
		S14	60.5 to 62.5	24/21	1/12"-1-1			S14: SILT (ML); ~90% fine sand, ~10% nonplastic fines, dark gray, layering. SLUICED ASH.
1520		S15	62.5 to 64.5	24/22	1/18"-2	pH = 7		S15: SILT (ML); ~90% fine sand, ~10% nonplastic fines, dark gray, layering. SLUICED ASH.
	65	S16	64.5 to 66.5	24/23	1/18"-1	pH = 7		S16: SILT (ML); Similar to S15. SLUICED ASH.
		S17	66.5 to 68.5	24/21	1/12"-1-1	pH = 7		S17: SILT (ML); Similar to S15. SLUICED ASH.
		S18	68.5 to 70.5	24/21	1/12"-2-2	pH = 7		S18: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. Siltier at top. SLUICED ASH.
	70	S19	70.5 to 72.5	24/19	WOH-1-1-3			S19: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. SLUICED ASH.
		S20	72.5 to 74.5	24/23	WOH/24			S20: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. Some layers siltier. SLUICED ASH.
1510		S21	74.5 to 76.5	24/22	1-2-8-7	Qp = 1.75 tsf		S21 (0-9"): SILT (ML); Similar to S20. SLUICED ASH.
	75						CLAY-LIKE ALLUVIUM	S21 (9"-22"): LEAN CLAY (CL); ~90% medium to high plasticity fines, ~10% fine sand, tan with yellow mottling.
		S22	76.5 to 78.5	24/22	3-4-5-6	Qp = 1.0 tsf		S22: LEAN CLAY (CL); ~95% medium to high plasticity fines, ~5% fine sand. (0-2") brown, (2"-3") ash mixed in, (3"-9") tan, (9"-12") gray-tan, (12"-22") brown.
		S23	78.5 to 80.5	24/24	WOH/12"-5-6	Qp = 0.5 tsf		S23: LEAN CLAY (CL); ~95% medium to high plasticity fines, ~5% fine gravel, brown.
	80	S24	80.5 to 82.5	24/12	WOR-8-5-5			S24 (0-5"): LEAN CLAY (CL); Similar to S23. S24 (5"-6"): SILTY GRAVEL (GM); ~50% medium gravel, ~40% medium plasticity fines, ~10% fine to coarse sand, brown. S24 (6"-12"): SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~20% fine to coarse sand, ~10% fine gravel, red and gray.
1500		S25	82.5 to 84.5	24/24	6-5-3-4			S25 (0-12"): LEAN CLAY WITH SAND (CL); ~85% medium plasticity fines, ~15% fine to coarse sand, brown. S25 (12"-24"): LEAN CLAY WITH SAND (CL); Similar to S25 (0-12") but very loose.
	85	S26	84.5 to 86.5	24/9	1-3-8-6			S26 (0-1"): LEAN CLAY WITH SAND (CL); Similar to S25 (12"-24"). S26 (1"-9"): SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~20% fine sand, ~10% fine gravel, brown.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,320 **EASTING (ft):** 1,309,175
GROUND SURFACE EL. (ft): 1583.5 **DATE START/END:** 10/15/2017 - 10/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B107

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S27	86.5 to 88.5	24/8	2-2-4-5		CLAY-LIKE ALLUVIUM	S27: SANDY CLAY WITH GRAVEL (CL); ~55% medium plasticity fines, ~30% fine sand, ~15% fine to coarse gravel up to 1", brown.
	90	S28	88.5 to 90.5	24/11	5-3-9-14			S28 (0-3"): SANDY CLAY WITH GRAVEL (CL); Similar to S27. S28 (3"-11"): CLAYEY GRAVEL WITH SAND (GC); ~50% fine to coarse gravel up to 1", ~30% medium plasticity fines, ~20% fine to coarse sand, brown.
		S29	90.5 to 91.7	14/11	18-39-50/2"			S29 (0-3"): CLAYEY GRAVEL WITH SAND (GC); Similar to S28 (3"-11").
1490								S29 (3"-11"): WEATHERED SHALE.
	95							Bottom of boring at depth 91.67 ft. Drilled with Bio-Bore. Piezometer B107 installed upon completion.
	100							
1480								
	105							
	110							
1470								
	115							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,092 **EASTING (ft):** 1,309,706
GROUND SURFACE EL. (ft): 1639.5 **DATE START/END:** 9/20/2017 - 9/20/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 35.5 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B108

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not Encountered.

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Hand dug down to cap at 20". Cap consisted of one layer of woven geotextile, two layers of nonwoven geotextile, one layer of geonet, one layer of PVC. HSA advanced to 2' prior to first sample.	CLAY CAP	CLAY CAP: SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~20% fine to coarse sand, ~5% widely graded gravel, ~5% cobbles up to 3", orange-brown.
		S1	2 to 4	24/24	3-7-7-9		STACKED ASH	S1: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, gray-black. STACKED ASH.
	5	S2	4 to 6	24/24	6-7-8-10			S2: SILT WITH SAND (ML); Similar to S1. LL = NV, PL = NP. STACKED ASH.
		S3	6 to 8	24/24	4-5-6-7			S3: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S4	8 to 10	24/24	4-5-8-8			S4: SILT WITH SAND (ML); Similar to S1. STACKED ASH. Sandier seam at 15".
1630	10	S5	10 to 12	24/24	4-4-5-6			S5: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S6	12 to 14	24/24	3-6-7-8			S6: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S7	14 to 16	24/19	4-5-4-4			S7 (0-7"): SILT WITH SAND (ML); Similar to S1. STACKED ASH. S7 (7"-19"): SILTY SAND (SM); ~70% fine to coarse sand, ~20% nonplastic fines, ~10% fine gravel, gray-black. STACKED ASH.
	15	S8	16 to 18	24/23	6-6-4-4			S8: SILTY SAND (SM); Similar to S7 (7"-19"). STACKED ASH.
		S9	18 to 20	24/19	4-4-3-3			S9: SILTY SAND (SM); Similar to S7 (7"-19"). STACKED ASH. 0-3" Finer sand seam.
1620	20	S10	20 to 22	24/19	2-2-2-2			S10: SILTY SAND (SM); ~70% fine to coarse sand, ~20% nonplastic fines, ~10% fine to medium gravel, gray. STACKED ASH.
		S11	22 to 24	24/19	6-7-6-4			S11: SILTY SAND (SM); Similar to S10. STACKED ASH. 12" Red clay chunk.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,092 **EASTING (ft):** 1,309,706
GROUND SURFACE EL. (ft): 1639.5 **DATE START/END:** 9/20/2017 - 9/20/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B108

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	U1	24 to 26	24/25	PUSH	Transition from dry to slightly moist.	STACKED ASH	U1 Top: SILTY SAND (SM); Similar to S10. STACKED ASH. U1 Bottom: SILTY SAND (SM); Similar to S10. STACKED ASH.
		S12	26 to 28	24/24	6-6-7-11			S12: SILTY SAND WITH GRAVEL (SM); ~70% fine sand, ~15% nonplastic fines, ~15% fine gravel, gray-black-orange. STACKED ASH.
		S13	28 to 30	24/20	6-7-2-3			S13: SILTY SAND (SM); 72.1% fine sand, 16.5% nonplastic fines, 11.4% fine gravel [GRAIN SIZE ANALYSIS], gray-black. STACKED ASH.
1610	30	S14	30 to 32	24/22	6-7-6-7			S14: SILTY SAND WITH GRAVEL (SM); ~70% fine to coarse sand, ~15% nonplastic fines, ~15% fine to coarse gravel up to 1", gray-brown-black. STACKED ASH.
		S15	32 to 34	24/23	6-8-8-10			S15: SILTY SAND WITH GRAVEL (SM); Similar to S14. STACKED ASH.
	35	U2	34 to 35.5	18/22	PUSH			U2 Top: SILTY SAND WITH GRAVEL (SM); Similar to S14. STACKED ASH. U2 Bottom: SILTY SAND WITH GRAVEL (SM); Similar to S14. STACKED ASH.
								Bottom of boring at depth 35.5 ft. Borehole grouted upon completion.
1600	40							
	45							
1590	50							
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,401 **EASTING (ft):** 1,309,864
GROUND SURFACE EL. (ft): 1572.3 **DATE START/END:** 9/19/2017 - 9/21/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 103.0 **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals **RIG TYPE:** Acker Renegade Track Rig

BORING
B109

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): ▼ 45.6 10/19/2017 10:10 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1570						Spun casing and washed ahead to 5' to get through cap.	CLAY CAP	
	5	S1	5 to 7	24/12	3-5-6-10			S1 (0-8"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray. ASH. S1 (8"-12"): SANDY LEAN CLAY WITH GRAVEL (CL); ~55% medium plasticity fines, ~30% fine to coarse sand, ~15% fine gravel, yellowish brown.
		S2	7.5 to 9.5	24/14	5-6-6-7			S2 (0-6"): SANDY LEAN CLAY WITH GRAVEL (CL); ~70% medium plasticity fines, ~15% fine to coarse sand, ~15% fine gravel, yellowish brown. 2"-3": ASH layer.
	10	S3	10 to 12	24/17	2-3-6-8		STACKED ASH	S2 (6"-14"): SILT WITH SAND (ML); ~85% nonplastic fines, ~15% sand, gray. STACKED ASH. S3: SILT WITH SAND (ML); Similar to S2 (6"-14"). STACKED ASH.
1560		S4	12.5 to 14.5	24/17	5-5-5-9			S4: SILT WITH SAND (ML); Similar to S2 (6"-14"). STACKED ASH.
	15	S5	15 to 17	24/15	2-4-8-8			S5: SILT WITH SAND (ML); Similar to S2 (6"-14"). STACKED ASH.
		S6	17.5 to 19.5	24/15	2-4-5-5			S6: SILT (ML); 88.4% fines, 11.6% fine sand [GRAIN SIZE ANALYSIS], gray. LL = NV, PL = NP. STACKED ASH.
	20	S7	20 to 22	24/14	4-5-6-6			S7: SILT (ML); Similar to S6. STACKED ASH.
1550		S8	22.5 to 24.5	24/18	5-7-9-9			S8: SILT (ML); Similar to S6. STACKED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,401 **EASTING (ft):** 1,309,864
GROUND SURFACE EL. (ft): 1572.3 **DATE START/END:** 9/19/2017 - 9/21/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B109

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S9	25 to 27	24/18	5-8-8-12		STACKED ASH	S9: SILT (ML); Similar to S6. STACKED ASH.
		S10	27.5 to 29.5	24/19	9-9-10-14			S10: SILT (ML); Similar to S6. STACKED ASH.
	30	S11	30 to 32	24/15	7-9-10-11			S11: SILT (ML); Similar to S6. STACKED ASH.
1540		S12	32.5 to 34.5	24/16	5-8-8-7			S12 (0-6"): SILT (ML); Similar to S6. STACKED ASH.
							SLUICED ASH	S12 (6"-16"): SILT(ML); ~90% nonplastic fines, ~10% mostly fine sand, gray, visible layering. SLUICED ASH.
	35	S13	35 to 37	24/14	2-3-3-3			S13: SILT (ML); Similar to S12. Layers have varying fines content. SLUICED ASH.
		S14	37.5 to 39.5	24/11	1-2-2-2			S14: SILT (ML); Similar to S12. Gray. SLUICED ASH. 6"-11": Interbedded layers have higher sand content.
	40	S15	40 to 42	24/17	1-1/12"-2	Water table appears to be at 40.6'		S15: SILT (ML); Similar to S12. SLUICED ASH.
1530		S16	42.5 to 44.5	24/20	1/12"-1/12"			S16: SILT (ML); Similar to S12. SLUICED ASH.
	45	S17	45 to 47	24/21	1/18"-2			S17: SILT (ML); Similar to S12. SLUICED ASH. 15"-21": More dense.
		S18	47.5 to 49.5	24/21	1/24"			S18: SILT (ML); 86.5% fines, 13.5% fine sand, [GRAIN SIZE ANALYSIS], gray. LL = NV, PL = NP. SLUICED ASH.
	50	S19	50 to 52	24/22	2-1-1-2			S19: SILT (ML); Similar to S18. SLUICED ASH.
1520		S20	52.5 to 54.5	24/24	1/12"-2-2			S20: SILT (ML); Similar to S18. Visible layering with varying fines content. SLUICED ASH.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,401 **EASTING (ft):** 1,309,864
GROUND SURFACE EL. (ft): 1572.3 **DATE START/END:** 9/19/2017 - 9/21/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B109

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S21	55 to 57	24/21	2-2-2-2		SLUICED ASH	S21 (0-9"): SILT (ML); Similar to S18. SLUICED ASH. S21 (9"-21"): SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, gray. Visible layering. SLUICED ASH.
		S22	57.5 to 59.5	24/21	2-1-1-2			S22: SILT WITH SAND (ML); Similar to S21 (9"-21"). SLUICED ASH.
	60	S23	60 to 62	24/24	1/24"			S23: SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand. SLUICED ASH.
1510		S24	62.5 to 64.5	24/21	1/24"			S24: SILT WITH SAND (ML); Similar to S23, gray. SLUICED ASH.
	65	S25	65 to 67	24/21	1/12"-2-1			S25: SILT WITH SAND (ML); Similar to S23, gray. SLUICED ASH.
		S26	67.5 to 69.5	24/20	1-2-2-3			S26: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, gray. SLUICED ASH.
	70	S27	70 to 72	24/23	1/18"-1			S27: SILT WITH SAND (ML); Similar S26. SLUICED ASH.
1500		S28	72.5 to 74.5	24/24	1/24"			S28: SILT WITH SAND (ML); Similar S26. SLUICED ASH.
	75	S29	75 to 77	24/13	1/18"-9			S29 (0-10"): SILT WITH SAND (ML); Similar S26. SLUICED ASH.
		S30	77.5 to 79.5	24/12	5-7-8-6		CLAY-LIKE	S29 (10"-13"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine sand, light brown. S30: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand. Subangular gravel up to 2" in sampler tip.
	80	S31	80 to 82	24/16	5-2-5-9		SAND-LIKE ALLUVIUM	S31: CLAYEY SAND (SC); 68.6% fine sand, 30.7% medium plasticity fines [GRAIN SIZE ANALYSIS], light brown.
1490		S32	82 to 84	24/4	11-4-22-13			S32: CLAYEY GRAVEL WITH SAND (GC); ~40% fine to medium angular gravel up to 1/2", ~30% fine sand, ~30% medium plasticity fines, brown.
	85	S33	84 to 86	24/8	39-12-14-34	Drill chatter		S33: CLAYEY GRAVEL (GC); ~70% gravel up to 1", ~20% fines, ~10% fine sand.
			86					S34: SANDY GRAVEL (GW); ~70% fine to coarse angular gravel

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,401 **EASTING (ft):** 1,309,864
GROUND SURFACE EL. (ft): 1572.3 **DATE START/END:** 9/19/2017 - 9/21/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B109

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S34	to 86.8	9/4	44-50/3"	Drill chatter		up to 1", ~20% fine to coarse sand, ~10% nonplastic fines, dark brown.
		C1	88 to 93	60/47	17	Drilled to 88' and telescoped 3" casing min/ft: 3.5, 4.0, 4.5, 4.0, 3.5 There was ~1' of bentonite at the top of the core.	BEDROCK	C1: SHALE; red, moderately hard, mostly horizontal joints up to 4" apart.
1480	90							
		C2	93 to 98	60/33		min/ft: 2.0, 2.25, 3, 2.75, 2.5		C2: SHALE; Similar to C1. The core barrel did not lock at bottom of the core run and the core did not go in. Driller had to break core up to recover it.
	95							
		C3	98 to 103	60/60	38	min/ft: 2.0, 2.0, 3.5, 4.0, 2.75		C3: SHALE; Similar to C1.
1470	100							
								Bottom of boring at depth 103 ft. Borehole grouted upon completion.
	105							
	110							
1460								
	115							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,396 | **EASTING (ft):** 1,309,873
GROUND SURFACE EL. (ft): 1572.1 | **DATE START/END:** 9/22/2017 - 9/28/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 82.3 | **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals | **RIG TYPE:** Acker Renegade Track Rig

BORING

B109U

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** 4 inch/ 4.5 inch | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1570	0						CLAY CAP	
	5							
	10						STACKED ASH	
1560		U1	14 to 16	24/11	GUS			
	15							
	20							
1550								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,396 **EASTING (ft):** 1,309,873
GROUND SURFACE EL. (ft): 1572.1 **DATE START/END:** 9/22/2017 - 9/28/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B109U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	U2	24.3 to 26.3	24/2	GUS	Drilled to 26.75' and attempted Osterberg but got stuck.	STACKED ASH	U2: STACKED ASH. Sample disturbed, saved in jars.
		U3	27.4 to 28.9	18/12	PUSH			U3: STACKED ASH.
	30							
1540								
	35						SLUICED ASH	
	40							
1530								
	45	U4	45.3 to 47.3	24/17	GUS			U4: SLUICED ASH.
	50							
1520								
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,396 **EASTING (ft):** 1,309,873
GROUND SURFACE EL. (ft): 1572.1 **DATE START/END:** 9/22/2017 - 9/28/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B109U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	60	U5	60.2 to 62.6	30/27	OSTER-BERG		SLUICED ASH	U5: SLUICED ASH.
1510								
	65							
		U6	68.6 to 71.1	30/7	OSTER-BERG			U6: SLUICED ASH. Disturbed.
	70							
1500								
		U7	72.4 to 74.8	30/28	OSTER-BERG			U7: SLUICED ASH. Disturbed, lost part of sample after measuring.
	75							
		U8	77.3 to 77.4	2/0	GUS	Drill chatter from 77.5' to 80'	SAND-LIKE ALLUVIUM	U8: No recovery, tube was dented and there were gravel pieces on sampler.
	80	U9	79.9 to 82.3	29/0	OSTER-BERG			U9: No recovery, tube was dented.
1490								
								Bottom of boring at depth 82.3 ft. Borehole grouted upon completion.
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,539 **EASTING (ft):** 1,309,944
GROUND SURFACE EL. (ft): 1542.6 **DATE START/END:** 9/14/2017 - 9/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 63.7 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B110

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): ▽ 47.1 9/14/2017

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/19	5-20-17-16		CLAY DIKE	S1 (0-13"): WIDELY GRADED GRAVEL WITH SILT AND SAND (GW-GM); ~70% fine to coarse gravel, ~20% fine to coarse sand, ~10% nonplastic fines, gray/black. FILL. S1 (13"-19"): SILTY GRAVEL (GM); ~50% fine gravel, ~30% low plasticity fines, ~20% fine to coarse sand, gray-brown.
1540		S2	2.5 to 4.5	24/22	7-14-25-25			S2 (0-10"): SILTY GRAVEL (GM); Similar to S1 (13"-19"). S2 (10"-22"): LEAN CLAY (CL); ~80% low plasticity fines, ~15% fine to coarse sand, ~5% gravel, reddish brown.
	5	S3	5 to 7	24/20	15-32-35-40		STACKED ASH	S3 (1"-3"): SILTY GRAVEL (GM); ~50% fine gravel, ~30% low plasticity fines, ~20% fine to coarse sand. S3 (3"-20"): SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, black. STACKED ASH.
		S4	7.5 to 9.5	24/18	9-8-7-7			S4 (0-9"): SANDY SILT (ML); Similar to S3 (3"-20"). STACKED ASH. S4 (9"-18"): LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, brown, trace roots.
	10	S5	10 to 12	24/21	3-6-9-12		CLAY DIKE	S5 (0-9"): LEAN CLAY (CL); Similar to S4 (9"-18"). S5 (9"-21"): GRAVELY LEAN CLAY (CL); ~60% medium plasticity fines, ~30% fine to coarse gravel, ~10% fine to coarse sand, reddish-brown.
1530		S6	12.5 to 14.5	24/21	3-5-6-7	Qp = 4.0 tsf, 1.5 tsf		S6: SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~25% fine sand, ~5% gravel, orange.
	15	S7	15 to 17	24/24	3-5-7-10	Qp = 2.75 tsf, 3.75 tsf		S7: SANDY LEAN CLAY (CL); Similar to S6. LL = 38%, PL = 20%.
		S8	17.5 to 19.5	24/8	5-6-10-15			S8: SANDY LEAN CLAY WITH GRAVEL (CL); ~60% medium plasticity fines, ~20% sand, ~20% gravel, gravel in shoe.
	20	S9	20 to 22	24/16	7-7-21-17	Qp = 4.0 tsf		S9 (0-13"): SANDY LEAN CLAY WITH GRAVEL (CL); Similar to S8. 3"-5": Gravel seam. S9 (13"-16"): NARROWLY GRADED GRAVEL (GP); ~80% angular gravel, ~20% fine sand, light brown.
1520		S10	22.5 to 24.5	24/21	7-6-9-14	Qp = 4.0 tsf, >4.5 tsf		S10: SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~25% fine sand, ~5% gravel, orange. 3"-5": Gray gravel seam.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,539 **EASTING (ft):** 1,309,944
GROUND SURFACE EL. (ft): 1542.6 **DATE START/END:** 9/14/2017 - 9/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B110

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							CLAY DIKE	21": Red rock in shoe.
	25	S11	25 to 27	24/20	12-13-14-15	Qp = >4.5 tsf, >4.5 tsf		S11 (0-7"): SANDY LEAN CLAY (CL); Similar to S10. S11 (7"-20"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine to medium sand, orange.
		S12	27.5 to 29.5	24/5	11-12-7-7			S12: SANDY LEAN CLAY (CL); ~50% medium plasticity fines, ~40% fine to coarse sand, ~10% fine gravel, orange.
	30	S13	30 to 32	24/15	5-7-8-9	Qp = 3.75 tsf, 4.25 tsf		S13 (0-2"): SANDY LEAN CLAY (CL); Similar to S12. S13 (2"-6"): SANDY LEAN CLAY (CL); ~50% low plasticity fines, ~40% fine to coarse sand, ~10% gravel, brown, roots. 6": 1/4" thick fine sand seam. S13 (6"-15"): SANDY LEAN CLAY (CL); ~50% low plasticity fines, ~40% fine to coarse sand, ~10% gravel, orange.
1510		S14	32.5 to 34.5	24/24	3-8-10-12			S14: SANDY LEAN CLAY (CL); Similar to S13 (6"-15"). 2"-5": Gravelly clay seam, gray/red. 17"-19": Gravelly clay seam, brown.
	35	S15	35 to 37	24/15	4-6-8-10			S15: CLAYEY SAND (SC); 52.2% fine sand, 47.5% low plasticity fines, 0.3% gravel [GRAIN SIZE ANALYSIS], orange.
		S16	37.5 to 39.5	24/21	4-6-8-9	Qp = 3.25 tsf, >4.5 tsf		S16 (0-1"): CLAYEY SAND (SC); Similar to S15. S16 (1"-21"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~20% fine to coarse sand, ~10% fine gravel, orange.
	40	S17	40 to 42	24/24	4-8-10-12	Qp = >4.5 tsf, >4.5 tsf		S17 (0-5"): SANDY LEAN CLAY (CL); Similar to S16 (1"-21"). S17 (5"-24"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~35% fine to medium sand, ~5% fine gravel, orange.
1500		S18	42.5 to 44.5	24/19	5-10-12-15	Spoon wet Qp = >4.5 tsf, >4.5 tsf		S18: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~35% fine to coarse sand, ~5% gravel. 7"-8": Gravel seam. 9"-11": Seam with ~80% low plasticity fines, ~20% fine to coarse sand.
	45	S19	45 to 47	24/24	6-9-9-10	Qp = 3.75 tsf, 2.5 tsf		S19 (0-10"): SANDY LEAN CLAY (CL); Similar to S18. S19 (10"-24"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~15% fine to coarse sand, ~5% gravel, orange.
		S20	47.5 to 49.5	24/24	4-4-7-12			S20 (0-4"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~35% fine sand, ~5% gravel, brown. S20 (4"-22"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~15% fine to coarse sand, ~5% gravel, orange.
	50	S21	50 to 52	24/23	5-5-5-5	Qp = 3.25 tsf, 1.5 tsf, 1.0 tsf	CLAY-LIKE ALLUVIUM	S20 (22"-24"): CLAYEY SAND (SC); ~60% fine to medium sand, ~40% low plasticity fines, brown-gray. S21: CLAYEY SAND (SC); ~55% fine to medium sand, ~45% medium plasticity fines, brown.
1490		S22	52 to 54	24/24	WOH-3-3-4			S22: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~35% fine to medium sand, ~5% gravel, brown/gray.
	55	S23	54 to 56	24/24	2-4-6-8	Qp = 1.75 tsf, 2.25 tsf, 1.50 tsf		S23: SANDY LEAN CLAY (CL); 61.3% fines, 37.1% fine to coarse sand, 1.6% fine gravel [GRAIN SIZE ANALYSIS]. LL = 34%, PL =

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,539 **EASTING (ft):** 1,309,944
GROUND SURFACE EL. (ft): 1542.6 **DATE START/END:** 9/14/2017 - 9/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B110

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							CLAY-LIKE ALLUVIUM	19%.
		S24	56 to 58	24/22	2-3-4-4	Qp = 2.5 tsf, 1.5 tsf		S24: SANDY LEAN CLAY (CL); Similar to S23.
		S25	58 to 60	24/24	1-3-5-4	Transition from moist to wet		S25 (0-12"): SANDY LEAN CLAY (CL); Similar to S23. S25 (12"-20"): SANDY LEAN CLAY WITH GRAVEL (CL); ~40% low plasticity fines, ~30% fine to coarse sand, ~30% fine to medium gravel, brown. S25 (20"-24"): CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, gray.
	60	S26	60 to 62	24/18	2-5-5-5			S26 (0-10"): SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~35% fine sand, ~5% gravel, brown/gray. S26 (10"-18"): GRAVELLY LEAN CLAY (CL); ~60% medium to high plasticity fines, ~30% fine gravel, ~10% fine to coarse sand, weathered root?, red/gray/yellow.
1480		S27	62 to 63.7	20/15	10-20-38-50/2"			S27 (0-9"): GRAVELLY LEAN CLAY (CL); Similar to S26 (10"-18") with increasing gravel content with depth. S27 (9"-15"): WIDELY GRADED GRAVEL WITH SILT (GW-GM); ~90% gravel, angular, ~10% nonplastic fines, horizontal jointing, gray. WEATHERED ROCK.
	65					Auger refusal at 63.7 ft		Bottom of boring at depth 63.67 ft. Borehole grouted upon completion.
	70							
1470								
	75							
	80							
1460								
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,535 **EASTING (ft):** 1,309,950
GROUND SURFACE EL. (ft): 1542.7 **DATE START/END:** 9/14/2017 - 9/15/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 60.1 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B110U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 4.25 inch / 7.5 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): ▽ 36.4 9/15/2017

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1540	0						CLAY DIKE	
	5						STACKED ASH	
	10						CLAY DIKE	
1530	15	U1-A	14.9 to 16.8	23/2	PUSH			U1-A: Little recovery (~2"), but disturbed. Tube has large dent.
		U1-B	17.3 to 18.5	15/6	PUSH			U1-B: ~6" recovery, steel cable present in sample.
	20							
1520								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,535 **EASTING (ft):** 1,309,950
GROUND SURFACE EL. (ft): 1542.7 **DATE START/END:** 9/14/2017 - 9/15/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B110U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25						CLAY DIKE	
	30							
1510		U2	33.6 to 34.2	7/2	PUSH			U2: SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~25% fine to coarse sand, ~5% gravel, brown.
	35	U2-A	36.3 to 37.2	10/11	PUSH			U2-A: SANDY LEAN CLAY (CL); ~60% fines, ~40% fine to coarse sand, light brown. LL = 35%, PL = 19%.
	40							
1500								
	45							
	50						CLAY-LIKE ALLUVIUM	
1490		U3	52.1 to 54.1	25/13	PUSH			U3 Top and Bottom: CLAYEY SAND (SC): ~60% fine to medium sand, ~35% low plasticity fines, ~5% gravel, brown.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,535
EASTING (ft): 1,309,950
GROUND SURFACE EL. (ft): 1542.7
DATE START/END: 9/14/2017 - 9/15/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD
DRILLING COMPANY: Terracon Consultants, Inc.

BORING B110U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							CLAY-LIKE ALLUVIUM	
		U4	58.1 to 60.1	24/20	OSTER-BERG			U4 Top: SILTY SAND (SM); ~60% fine to medium sand, ~40% low plasticity fines, brown. U4 Bottom: CLAYEY SAND (SC); ~60% fine to coarse sand, ~35% medium plasticity fines, ~5% gravel, dark brown.
	60							Bottom of boring at depth 60.11 ft. Borehole grouted upon completion.
1480								
	65							
	70							
1470								
	75							
	80							
1460								
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): | **EASTING (ft):**
GROUND SURFACE EL. (ft): 1542 | **DATE START/END:** 10/4/2017 - 10/4/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 16.0 | **DRILLER NAME:** C. Penton
LOGGED BY: J. Giampa | **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B110U-A

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** NA/ NA | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1540	0					Cuttings similar to B110	CLAY DIKE	
	5						STACKED ASH	
	10						CLAY DIKE	
1530		U1	13.7 to 16	28/18	PUSH			U1 Top: SANDY CLAY WITH GRAVEL, gray-brown. LL = 36%, PL = 21%.
	15							Bottom of boring at depth 16 ft. Borehole grouted upon completion.
	20							
1520								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,592 **EASTING (ft):** 1,309,992
GROUND SURFACE EL. (ft): 1509.1 **DATE START/END:** 10/18/2017 - 10/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 29.8 **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals **RIG TYPE:** Acker Renegade Track Rig

BORING

B111

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Augered through Riprap.	RIPRAP	0-3': RIPRAP
	5	S1	3.5 to 5.5	24/21	8-9-10-10	Qp = > 4.5 tsf	CLAY DIKE	S1: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~30% fine sand, ~10% fine gravel. (0-5") brown, (5-21") tan.
		S2	6 to 8	24/21	9-13-14-16			S2: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~30% fine sand, ~10% fine to medium gravel up to 1/2", tan.
1500	10	S3	8.5 to 10.5	24/21	7-9-10-13	Qp = > 4.5 tsf		S3: SANDY LEAN CLAY (CL); ~70% nonplastic fines, ~30% fine sand, tan. Gravel on top.
		S4	11 to 13	24/21	4-7-10-12	Qp = > 4.5 tsf		S4: SANDY LEAN CLAY (CL); ~70% nonplastic fines, ~30% fine to coarse sand, tan.
	15	S5	13.5 to 15.5	24/21	7-6-8-9	MoistQp = 3.0 tsf		S5: SANDY LEAN CLAY (CL); Similar to S4.
		S6	16 to 18	24/22	2-2-5-12			S6 (0-18"): LEAN CLAY WITH SAND (CL); ~80% nonplastic fines, ~20% fine sand, gray-brown.
1490		S7	18 to 20	24/21	4-6-6-8		CLAY-LIKE ALLUVIUM	S6 (18"-22"): SILTY SAND (SM); ~70% fine sand, ~30% nonplastic fines, brown. S7: SILTY SAND (SM); 53.4% fine sand, 45.7% low plasticity fines [GRAIN SIZE ANALYSIS], brown.
	20	S8	20 to 22	24/24	3-4-4-6	Qp = 2.5 tsf		S8: SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~30% fine sand, brown-gray.
		S9	22 to 24	24/24	1-2-2-2	Qp = 1.0 tsf		S9: LEAN CLAY WITH SAND (CL); ~85% medium plasticity fines, ~15% fine sand, brown-tan.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,592 **EASTING (ft):** 1,309,992
GROUND SURFACE EL. (ft): 1509.1 **DATE START/END:** 10/18/2017 - 10/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B111

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S10	24 to 26	24/24	1-1-2-2			S10 (0-10"): LEAN CLAY WITH SAND (CL); Similar to S9.
							SAND-LIKE ALLUVIUM	S10 (10"-24"); CLAYEY SAND (SC); ~60% fine sand, ~40% medium plasticity fines, tan.
		S11	26 to 28	24/24	WOH/18"-3	Wet		S11 (0-12"): CLAYEY SAND (SC); Similar to S10 (10"-24"). S11 (12"-24"): CLAYEY SAND (SC); 59.2% fine sand, 38.3% fines, 2.5% fine gravel [GRAIN SIZE ANALYSIS], tan. LL = 22%, PL = 16%.
1480		S12	28 to 29.8	22/14	3-7-19-50/4"			S12 (0-12"): CLAYEY GRAVEL WITH SAND (GC); ~50% fine to coarse gravel up to 1", ~30% medium plasticity fines, ~20% fine to coarse sand, tan. S12 (12"-14"): SHALE fragments.
	30							Bottom of boring at depth 29.83 ft. Borehole grouted upon completion.
	35							
1470								
	40							
	45							
1460								
	50							
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,644 **EASTING (ft):** 1,310,035
GROUND SURFACE EL. (ft): 1490.4 **DATE START/END:** 9/16/2017 - 9/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 8.0 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING B112

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1490		S1	0 to 2	24/23	2-3-3-4		SAND-LIKE ALLUVIUM	S1: SILTY SAND (SM); ~80% fine to medium sand, ~20% nonplastic fines, brown.
		S2	2 to 4	24/22	2-2-3-4			S2 (0-9"): SILTY SAND (SM); Similar to S1. S2 (9"-22"): CLAYEY SAND (SC); 70.3% fine to medium sand, 29.7% low plasticity fines [GRAIN SIZE ANALYSIS], reddish brown.
	5	S3	4 to 6	24/0	3-3-3-3			S3: NO RECOVERY.
		S4	6 to 8	24/17	3-3-4-4			S4 (0-13"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine to medium sand. S4 (13"-17"): LEAN CLAY (CL); ~90% medium plasticity fines, ~10% fine sand, dark brown. 14"-14.5" Sand seam.
								Bottom of boring at depth 8 ft. Borehole grouted upon completion.
1480	10							
	15							
1470	20							

NOTES: No recovery in S3. Instead of redriving with 3" SPT, driller instead drilled down to 6-8'. Due to short length of hole, field representative decided to abandon hole, move 3' SE and start again at 4' in B112A.

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,642 **EASTING (ft):** 1,310,039
GROUND SURFACE EL. (ft): 1490.6 **DATE START/END:** 9/16/2017 - 9/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 20.3 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B112A

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): ▽ 8.5 9/16/2017

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1490						Drilled to 4', set 4" HWT casing.	SAND-LIKE ALLUVIUM	
	5	S3	4 to 6	24/22	3-4-6-6			S3: CLAYEY SAND (SC); ~60% fine to medium sand, ~35% low plasticity fines, ~5% gravel, brown at top, reddish brown at bottom.
		S4	6 to 8	24/20	1-1-1-WOH			S4 (0-12"): CLAYEY SAND (SC); Similar to S3. S4 (12"-20"): LEAN CLAY (CL); ~95% medium plasticity fines, ~5% fine sand, 3/8" pieces of wood.
		S5	8 to 10	24/18	WOH-1-1-7	Marsh = 88s, Mud Balance = 9.4 lbs		S5: CLAYEY SAND (SC); ~60% fine to medium sand, ~35% low plasticity fines, ~5% gravel, gray-brown, weathered rock in shoe. at 3" and 12" ~3/4" thick medium plasticity clay layer. 9"-10" Softer seam. Wood pieces throughout.
	10	S6	10 to 10.3	4/4	50/4"	Refusal at 10.3'	BEDROCK	S6: WEATHERED SHALE; ~80% angular horizontally bedded gravel, ~20% medium plasticity fines, gray.
1480		C1	10.3 to 20.3	120/108	18			C1 (0-1.5'): SHALE; gray, few horizontal fractures, medium hard. C1 (1.5'-5.9'): CLAYSTONE; reddish brown, mostly subhorizontal fractures, 1.5'-2.5' highly fractured zone, weathered clayey seams 4.7-4.9', 5.9', semi-hard. C1 (5.9'-9'): SHALE; reddish gray at 5.9' to gray at 9', medium hard, subhorizontal fractures, weathered clayey seams at 5', 6.7'-6.8', 7.9', 8.1', 8.5-8.6', 9'.
	15					min/ft: 0.6, 1.5, 4.5, 3.3, 1.7, 3.4, 2, 2, 1.3, 2.2		
	20							
1470								Bottom of boring at depth 20.3 ft. Borehole grouted upon completion.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,641 **EASTING (ft):** 1,310,042
GROUND SURFACE EL. (ft): 1490.6 **DATE START/END:** 9/16/2017 - 9/16/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 9.8 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B112U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1490							SAND-LIKE ALLUVIUM	
	5	U1	6.2 to 8.3	26/21	PUSH			U1 Top: SILTY SAND (SM); ~80% fine to medium sand, ~20% nonplastic fines, brown. U1 Bottom: Not checked.
		U2	8.8 to 9.8	12/6	PUSH			U2 Top: Not thoroughly checked, but mostly fine to medium sand. U2 Bottom: Not checked.
	10							Bottom of boring at depth 9.81 ft. Borehole grouted upon completion.
1480								
	15							
	20							
1470								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,394 **EASTING (ft):** 1,310,385
GROUND SURFACE EL. (ft): 1523.8 **DATE START/END:** 9/16/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 44.0 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING B113

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/17	5-7-5-6		CLAY DIKE	S1 (0-10"): GRAVELLY LEAN CLAY (CL); ~50% low plasticity fines, ~40% fine to coarse gravel, ~10% fine to coarse sand, brown. FILL. S1 (10"-14"): SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand, gray. STACKED ASH. S1 (14"-17"): LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% fine sand, reddish brown. Roots throughout S1.
1520		S2	2.5 to 4.5	24/19	7-8-8-12			S2 (0-14") CLAYEY SAND (SC); ~60% fine sand, ~30% low plasticity fines, ~ 10% fine gravel, orange. S2 (14"-19") CLAYEY GRAVEL WITH SAND (GC); ~50% subangular gravel, ~30% low plasticity fines, ~20% fine to coarse sand, red-gray.
	5	S3	5 to 7	24/21	6-7-8-10			S3: CLAYEY GRAVEL WITH SAND (GC); Similar to S2 (14"-19").
		S4	7.5 to 9.5	24/14	12-12-6-8	Tough drilling		S4: CLAYEY GRAVEL WITH SAND (GC); Similar to S2 (14"-19"). 0-1" ~1" piece of gravel. Gravel in shoe.
	10	S5	10 to 12	24/17	5-9-10-13			S5 (0-7"): CLAYEY GRAVEL WITH SAND (GC); Similar to S2 (14"-19"). S5 (7"-17"): SANDY LEAN CLAY WITH GRAVEL (CL); ~70% low plasticity fines, ~15% fine to coarse sand, ~15% fine gravel, orange-brown.
		S6	12.5 to 14.5	24/21	4-5-6-9	Qp = >4.5 tsf, 3.25 tsf		S6: Gradual change from: SANDY LEAN CLAY WITH GRAVEL (CL); Similar to S5 (7"-17") to SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, orange-gray.
1510	15	S7	15 to 17	24/21	5-9-9-10	Qp = 3.0 tsf, 3.0 tsf		S7: CLAYEY SAND (SC-SM); 54.2% fine sand, 45.7% fines, 0.1% fine gravel [GRAIN SIZE ANALYSIS]. LL = 24%, PL = 18%.
		S8	17.5 to 19.5	24/24	4-6-6-8			S8: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand. 6"-8" Sandier seam, gray.
	20	S9	20 to 22	24/24	3-5-6-11	Qp = 4.25 tsf, 4.0 tsf		S9: CLAYEY SAND (SC); ~70% fine to medium sand, ~30% nonplastic fines. 4"-7" Sandier seam, gray.
		S10	22 to 24	24/22	8-8-7-7			S10: CLAYEY SAND (SC); Similar to S9, reddish brown at 0" to gray-brown at 22".
1500								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,394 **EASTING (ft):** 1,310,385
GROUND SURFACE EL. (ft): 1523.8 **DATE START/END:** 9/16/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B113

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S11	24 to 26	24/21	3-3-4-5		CLAY DIKE	S11 (0-3"): CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines. S11 (3"-15"): CLAYEY SAND (SC); 53.2% fine sand, 46.7% fines, 0.1% gravel [GRAIN SIZE ANALYSIS], gray-brown. LL = 26%, PL = 17%. S11 (15"-21"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine to medium sand, orange-brown. S12 (0-2"): SANDY LEAN CLAY (CL); Similar to S11 (15"-21"). S12 (2"-24"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine to medium sand, gray. S13 (0-6"): SANDY LEAN CLAY (CL); Similar to S12 (2"-24").
		S12	26 to 28	24/24	2-2-3-4			
		S13	28 to 30	24/22	8-6-6-5			
	30	S14	30 to 32	24/21	2-4-5-7		SAND-LIKE ALLUVIUM	S13 (6"-22"): SILTY SAND (SM); ~80% fine to medium sand, ~20% nonplastic fines, orange. Sand becomes finer with depth. S14 (0-18"): SILTY SAND (SM); ~75% fine to medium sand, ~20% nonplastic fines, ~5% gravel, orange brown. S14 (18"-21"): NARROWLY GRADED SAND (SP); ~100% fine to medium sand, light brown.
		S15	32 to 34	24/19	7-8-8-7			S15: NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% fine sand, ~10% nonplastic fines, light brown.
1490								
		S16	34 to 36	24/21	4-5-5-8			S16: SILTY SAND (SM); 72.2% fine sand, 27.8% fines [GRAIN SIZE ANALYSIS], light brown. LL = NV, PL = NP. Decreasing fines content with depth.
	35	S17	36 to 38	24/22	5-6-7-6			S17: CLAYEY SAND (SC); ~70% fine sand, ~30% low plasticity fines, light brown.
		S18	38 to 40	24/23	3-3-4-5			S18: CLAYEY SAND (SC); Similar to S17.
	40	S19	40 to 42	24/23	4-3-2-2			S19: Gradual change from: CLAYEY SAND (SC); 70.9% fine sand, 29.0% low plasticity fines, 0.1% fine gravel [GRAIN SIZE ANALYSIS]. to CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, light brown with dark brown spots.
		S20	42 to 44	24/18	1-6-16-32			S20 (0-8"): SANDY CLAY (CL); ~80% low plasticity fines, ~20% fine sand, tan.
1480						Auger refusal at 43.8 ft		S20 (8"-17"): CLAYEY GRAVEL WITH SAND (GC); ~50% fine to coarse angular gravel, ~30% fine to coarse sand, ~20% low plasticity fines, brown-gray-red-orange. S20 (17"-19"): WEATHERED SHALE; ~60% angular, horizontally bedded weathered shale, ~20% medium plasticity fines, ~20% fine to coarse sand, light gray.
	45							Bottom of boring at depth 44 ft. Borehole grouted upon completion.
	50							
1470								
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,393 **EASTING (ft):** 1,310,384
GROUND SURFACE EL. (ft): 1523.8 **DATE START/END:** 10/3/2017 - 10/4/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 35.1 **DRILLER NAME:** C. Penton
LOGGED BY: J. Giampa **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B113U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1520	5						CLAY DIKE	
1510	10							
1500	15							
	20							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,393 **EASTING (ft):** 1,310,384
GROUND SURFACE EL. (ft): 1523.8 **DATE START/END:** 10/3/2017 - 10/4/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B113U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	U1	23.8 to 25.7	23/19	PUSH		CLAY DIKE	U1 Top: SANDY CLAY (CL); ~60% low plasticity fines, ~40% fine to medium sand, gray. U1 Bottom: Not checked. U2 Top: CLAYEY SAND (SC); ~65% fine to medium sand, ~35% fines, gray. LL = 25%, PL = 20%. U2 Bottom: Not checked.
		U2	26.4 to 28.3	23/23	PUSH			
	30	U3	30 to 31.9	24/23	PUSH		SAND-LIKE ALLUVIUM	U3 Top: Not thoroughly inspected but looks like SILTY SAND. U3 Bottom: Not checked.
1490		U4	33.1 to 35.1	24/24	PUSH			U4 Top: Not thoroughly inspected but looks like NARROWLY GRADED SAND WITH SILT. U4 Bottom: Not checked.
	35							Bottom of boring at depth 35.08 ft. Borehole grouted upon completion.
	40							
1480								
	45							
	50							
1470								
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 388,831 **EASTING (ft):** 1,310,165
GROUND SURFACE EL. (ft): 1641.0 **DATE START/END:** 9/21/2017 - 9/21/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 37.0 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING B114

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not Encountered.

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1640						Hand dug down to and cut through liner at 36". Cap consisted of one layer of woven geotextile, two layers of nonwoven geotextile, one layer of geonet, one layer of PVC.	CLAY CAP	CLAY CAP: SANDY LEAN CLAY WITH GRAVEL (CL); ~70% low to medium plasticity fines, ~15% fine to coarse sand, ~10% fine to coarse gravel, ~5% cobbles up to 4", orange-brown.
		S1	3 to 5	24/23	3-5-7-7		STACKED ASH	S1: SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand, black-gray. STACKED ASH.
	5	S2	5 to 7	24/24	3-4-5-6			S2: SILT WITH SAND (ML); Similar to S1. STACKED ASH. Orange clay chunk at 7".
		S3	7 to 9	24/22	2-2-5-5			S3: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S4	9 to 11	24/23	3-3-4-5			S4: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
	10							
1630		S5	11 to 13	24/22	3-4-4-5			S5: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S6	13 to 15	24/24	3-3-4-5			S6: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
	15	S7	15 to 17	24/22	2-4-5-6			S7: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S8	17 to 19	24/24	3-6-8-10			S8: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S9	19 to 21	24/23	4-6-8-10			S9: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
	20							
1620		S10	21 to 23	24/24	4-8-10-12			S10: SILT WITH SAND (ML): Similar to S1. STACKED ASH.
		U1	23 to	24/24	PUSH			U1: SILT WITH SAND (ML); Similar to S1. STACKED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 388,831 **EASTING (ft):** 1,310,165
GROUND SURFACE EL. (ft): 1641.0 **DATE START/END:** 9/21/2017 - 9/21/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B114

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
			25					
	25	S11	25 to 27	24/22	3-5-5-7		STACKED ASH	S11: SILT WITH SAND (ML); Similar to S1. LL = NV, PL = NP. STACKED ASH.
		S12	27 to 29	24/22	3-4-5-5			S12: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
	30	S13	29 to 31	24/21	2-2-3-4			S13: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
1610		S14	31 to 33	24/23	3-4-5-6			S14: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
		S15	33 to 35	24/22	3-3-4-5			S15: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
	35	U2	35 to 37	24/26	PUSH			U2: SILT WITH SAND (ML); Similar to S1. STACKED ASH.
						Boring terminated at 37 ft		Bottom of boring at depth 37 ft. Borehole grouted upon completion.
	40							
1600								
	45							
	50							
1590								
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,096 | **EASTING (ft):** 1,310,430
GROUND SURFACE EL. (ft): 1569.6 | **DATE START/END:** 9/29/2017 - 9/30/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 100.0 | **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals | **RIG TYPE:** Acker Renegade Track Rig

BORING
B115

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** 4 inch/ 4.5 inch | **CORE BARREL TYPE:** NQ
AUGER I.D./O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** 1.875 inch / 3 inch
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): ▼ 61.5 10/19/2017 10:20 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Hand augered to 2' to find liner.	CLAY CAP	0-2': Clay Cap 2': 2 layers of geotextile, 1 layer of geogrid, 1 layer of PVC liner.
		S1	2.5 to 4.5	24/19	13-13-15-20		STACKED ASH	S1: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray. STACKED ASH. >1" clay and liner on top.
	5	S2	5 to 7	24/18	10-13-15-18			S2: SILT (ML); ~90% nonplastic fines, ~10% fine to coarse sand, gray with yellow and red mottling, fine gravel on top 1". STACKED ASH.
		S3	7.5 to 9.5	24/12	5-6-6-7			S3: SILT (ML); Similar to S2. STACKED ASH.
1560	10	S4	10 to 12	24/15	8-8-8-12			S4 (0-7"): SILT (ML); Similar to S2. STACKED ASH. S4 (7"-15"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray. Similar to S2. STACKED ASH.
		S5	12.5 to 14.5	24/0	7-6-9-8			S5: NO RECOVERY. Sampler tip material similar to S4 (7"-15") and one 1.5" piece of gravel.
	15	S6	15 to 17	24/18	3-5-9-9			S6: SILT (ML); ~90% nonplastic fines, ~10% fine sand with trace coarse sand, light gray. STACKED ASH.
		S7	17.5 to 19.5	24/18	10-13-15-20			S7: SILT (ML); 91.3% fines, 8.7% fine to medium sand [GRAIN SIZE ANALYSIS], gray with some yellow clay mottling. LL = NV, PL = NP. STACKED ASH.
1550	20	S8	20 to 22	24/13	5-4-3-4			S8: SILT (ML); Similar to S7. STACKED ASH.
		S9	22.5 to 24.5	24/14	1-2-3-5			S9: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, visible layering. STACKED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,096 **EASTING (ft):** 1,310,430
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 9/29/2017 - 9/30/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B115

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S10	25 to 27	24/14	4-4-5-7		STACKED ASH	S10: SILT (ML); ~90% nonplastic fines, ~10% fine sand, one piece of fine gravel, gray. STACKED ASH.
		S11	27.5 to 29.5	24/15	4-4-5-7			S11: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, visible layering. STACKED ASH.
1540	30	S12	30 to 32	24/16	13-13-11-12			S12 (0-11"): SILT WITH SAND (ML); ~80% nonplastic fines, ~15% fine to coarse sand, ~5% fine gravel, gray, interbedded thin layers of yellow fines. STACKED ASH.
							SLUICED ASH	S12 (11-16"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, thin interbedded layers of yellow fines. SLUICED ASH.
		S13	32.5 to 34.5	24/17	3-4-9-11			S13: SILT (ML); ~90% nonplastic fines, ~10% fine to medium sand, gray, visible layering. SLUICED ASH.
	35	S14	35 to 37	24/14	3-4-4-4			S14: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, visible layering. SLUICED ASH.
		S15	37.5 to 39.5	24/10	1-2-1-2			S15: SILT (ML); Similar to S14. SLUICED ASH.
1530	40	S16	40 to 42	24/11	1-2-2-4	41': Loss of drill fluid, pushed casing past this point		S16: SILT (ML); Similar to S14. SLUICED ASH.
		S17	42.5 to 44.5	24/14	3-4-5-5			S17 (0-7"): SILT (ML); Similar to S14. SLUICED ASH. S17 (7"-14"): SILT (ML); ~90% nonplastic fines, ~10% fine to medium sand, gray. SLUICED ASH.
	45	S18	45 to 47	24/14	3-4-5-6			S18: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, visible layering, some layers are sandier. SLUICED ASH.
		S19	47.5 to 49.5	24/14	3-3-4-6			S19: SILT (ML); Similar to S18. SLUICED ASH.
1520	50	S20	50 to 52	24/13	3-3-4-5			S20: SILT (ML); Similar to S18. SLUICED ASH.
		S21	52.5 to 54.5	24/15	2-3-3-5			S21: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, visible layering, some layers are sandier. SLUICED ASH.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,096 **EASTING (ft):** 1,310,430
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 9/29/2017 - 9/30/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B115

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S22	55 to 57	24/19	1-1-2-3	Wet	SLUICED ASH	S22: SILT (ML); Similar to S21. SLUICED ASH.
		S23	57.5 to 59.5	24/15	2-2-3-5			S23: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, visible layering. SLUICED ASH.
1510	60	S24	60 to 62	24/24	1-1-1-2			S24: SILT WITH SAND (ML); ~85% nonplastic fines, ~15% fine sand, gray, visible layering, some layers are sandier. SLUICED ASH.
		S25	62 to 64	24/22	1/12"-1-2			S25: SILT (ML); ~90% nonplastic fines, ~10% fine sand. SLUICED ASH.
	65	S26	64 to 66	24/21	1/18"-2			S26: SILT (ML); Similar to S25. SLUICED ASH.
		S27	66 to 68	24/24	WOH/24"			S27: SILT (ML); 92.1% fines, 7.9% fine sand [GRAIN SIZE ANALYSIS]. LL = NV, PL = NP. SLUICED ASH.
		S28	68 to 70	24/20	1/24"			S28 (0-4"): SILT (ML); ~90% nonplastic fines, ~10% fine to medium sand, gray, layering. SLUICED ASH. S28 (4"-20"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, layering. SLUICED ASH.
1500	70	S29	70 to 72.5	30/30	1/30"			S29: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, layering. SLUICED ASH.
		S30	73 to 75	24/20	WOH-1/12"-4			S30 (0-18"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, layering. SLUICED ASH.
	75	S31	75 to 77	24/18	2-4-4-4		SAND-LIKE ALLUVIUM	S30 (18"-20"): SILTY SAND (SM); ~85% fine to medium sand, ~15% nonplastic fines, dark brown. S31: SANDY LEAN CLAY (CL); ~65% medium plasticity fines, ~30% fine sand, ~5% fine rounded gravel, brown.
		S32	77 to 79	24/20	WOH/18"-3			S32 (0-10"): SANDY LEAN CLAY (CL); Similar to S31. S32 (10"-20"): CLAYEY SAND (SC); ~65% fine sand, ~35% medium plasticity fines, grayish brown.
1490	80	S33	79 to 81	24/20	1-2-1-2			S33: SILTY SAND (SM); 71.8% fine sand, 28.2% fines [GRAIN SIZE ANALYSIS], grayish brown. LL = 24%, PL = 22%.
		S34	81 to 83	24/9	3-4-7-12			S34 (0-2"): SILTY SAND (SM); Similar to S33. S34 (2"-9"): SILTY SAND (SM); ~80% fine sand, ~20% nonplastic fines, brown. Fine to medium gravel in the tip.
		S35	83 to 85	24/13	8-7-3-8			S35: SILTY SAND (SM); 60.7% sand, 26.3% nonplastic fines, 13.0% gravel [GRAIN SIZE ANALYSIS].
	85	S36	85 to 87	24/3	6-2-4-3			S36: CLAYEY GRAVEL WITH SAND (GC); ~40% medium plasticity fines, ~40% fine to coarse angular gravel up to 1", ~20% fine sand, brown.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,096 **EASTING (ft):** 1,310,430
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 9/29/2017 - 9/30/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B115

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S37	87 to 89	24/10	4-11-12-30	Drill chatter		S37 (0-7"): GRAVELLY LEAN CLAY WITH SAND (CL); ~50% fines, ~30% gravel, 20% sand.
							BEDROCK	S37 (7"-10"): Very dense gray-red weathered rock.
1480	90	S38	89 to 89.3	3/3	50/3"	Spoon bouncing on last inch		S38: Similar to S37 (7"-10").
		C1	91 to 95	48/48	54	Drilled to 91' to get through weathered rock min/ft: 3.75, 1.75, 1.5, 1.5		C1: Red and gray SHALE, moderately hard, horizontal joints spaced less than 1" to 10" apart, joints slightly weathered.
	95	C2	95 to 100	60/60	65	min/ft: 2, 1.5, 2, 1.75,1.25		C2: Red and gray SHALE, moderately hard, horizontal joints spaced less than 1" to 14" apart, joints slightly weathered. A section of weathered rock from 31" to 39".
1470	100							Bottom of boring at depth 100 ft. Piezometer B115 installed upon completion.
	105							
1460	110							
	115							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,093 **EASTING (ft):** 1,310,440
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/2/2017 - 10/4/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 83.4 **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals **RIG TYPE:** Acker Renegade Track Rig

BORING

B115U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							CLAY CAP	
	5						STACKED ASH	
1560	10							
	15							
1550	20	U1	20 to 22	23/12	PUSH			U1 Top: STACKED ASH. U1 Bottom: STACKED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,093 **EASTING (ft):** 1,310,440
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/2/2017 - 10/4/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B115U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25						STACKED ASH	
1540	30	U2	30 to 31.9	23/15	PUSH			U2 Top: STACKED ASH.
								U2 Bottom: STACKED ASH.
	35							
1530	40						SLUICED ASH	
	45							
1520	50							
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,093 **EASTING (ft):** 1,310,440
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/2/2017 - 10/4/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B115U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1510	60						SLUICED ASH	
	65	U3	65 to 67	24/15	GUS			U3 Top: SLUICED ASH. U3 Bottom: SLUICED ASH.
		U4	68.1 to 70.1	24/0	GUS			U4 Top: SLUICED ASH. U4 Bottom: SLUICED ASH.
1500	70	U5	71 to 73.1	24/18	GUS			U5 Top: SLUICED ASH. U5 Bottom: SLUICED ASH.
	75						SAND-LIKE ALLUVIUM	
		U6	78.4 to 80.4	24/24	GUS			U6 Top: SANDY CLAY (SC); gray. U6 Bottom: SANDY CLAY (SC); gray.
1490	80	U7	81.4 to 83.4	24/9	GUS			U7 Top: SP-SM. U7 Bottom: SP-SM.
	85							Bottom of boring at depth 83.43 ft. Borehole grouted upon completion.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,298 **EASTING (ft):** 1,310,475
GROUND SURFACE EL. (ft): 1538.1 **DATE START/END:** 9/17/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 57.8 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING B116

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Groundwater depth not measured.

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/18	4-5-6-8		FILL	S1: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~35% fine to coarse sand, ~5% gravel, dry, orange brown. 1/4" Ash seam at 9.5".
		S2	2 to 4	24/21	3-5-6-4			S2 (0-8"): SANDY LEAN CLAY (CL); Similar to S1. S2 (8"-17"): GRAVELLY LEAN CLAY (CL); ~70% low plasticity fines, ~25% fine gravel, ~5% fine to coarse sand, reddish brown.
	5	S3	4 to 6	24/17	2-3-3-4		STACKED ASH	S2 (17"-21"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. STACKED ASH. S3 (0-2"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~20% fine to coarse sand, ~10% gravel. S3 (2"-17"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. STACKED ASH.
		S4	6 to 8	24/18	3-2-2-3			S4 (0-2"): SILT (ML); Similar to S3 (2"-17"). STACKED ASH. S4 (2"-7"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine to medium sand, light brown. FILL. S4 (7"-18"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. STACKED ASH.
1530		S5	8 to 10	24/16	2-2-2-2			S5 (0-2"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine to medium sand, light brown. FILL S5 (2"-16"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. STACKED ASH.
	10	S6	10 to 12	24/15	2-2-2-2			S6: SILT (ML); 89.7% fines, 10.3% fine sand [GRAIN SIZE ANALYSIS]. LL = NV, PL = NP. STACKED ASH.
		S7	12 to 14	24/21	3-3-4-4			S7: SILT (ML); Similar to S6. STACKED ASH. Coarser with depth.
		S8	14 to 16	24/21	3-3-3-3		SLUICED ASH	S8: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, black and gray, depositional layers. SLUICED ASH.
	15	S9	16 to 18	24/22	2-3-4-7			S9: SILT WITH SAND (ML); Similar to S8. SLUICED ASH.
1520		S10	18 to 20	24/24	3-4-4-6			S10: SILT WITH SAND (ML); Similar to S8. SLUICED ASH.
	20	S11	20 to 22	24/21	3-3-3-4			S11: SILT WITH SAND (ML); Similar to S8. SLUICED ASH.
		S12	22 to 24	24/24	2-2-2-3			S12: SILT (ML); ~90% nonplastic fines, ~10% fine sand. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,298 **EASTING (ft):** 1,310,475
GROUND SURFACE EL. (ft): 1538.1 **DATE START/END:** 9/17/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B116

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S13	24 to 26	24/23	2-2-2-4		SLUICED ASH	S13: SILT (ML); Similar to S12. SLUICED ASH.
		S14	26 to 28	24/24	2-2-2-2			S14: SILT (ML); Similar to S12. SLUICED ASH.
1510		S15	28 to 30	24/23	2-2-3-3			S15: SILT (ML); Similar to S12. SLUICED ASH.
	30	S16	30 to 32	24/22	2-2-2-2			S16: SILT (ML); Similar to S12. SLUICED ASH.
		S17	32 to 34	24/24	1-1-1-1	Transition from moist to wet		S17: SILT (ML); Similar to S12. SLUICED ASH.
		S18	34 to 36	24/24	1-1-1-1			S18: SILT (ML); Similar to S12. SLUICED ASH.
	35	S19	36 to 38	24/23	WOH/24"			S19: SILT (ML); Similar to S12. SLUICED ASH.
1500		S20	38 to 40	24/24	WOH/24"			S20 (0-13"): SILT (ML); Similar to S12. SLUICED ASH. Light gray at bottom.
	40	S21	40 to 42	24/24	WOH-3-5-6		SAND-LIKE ALLUVIUM	S20 (13"-24"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~10% medium gravel, ~10% fine to coarse sand, light brown. S21 (0-11"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine to medium sand, light brown-gray. S21 (11"-22"): CLAYEY SAND (SC); ~60% fine to medium sand, ~40% low plasticity fines, light brown.
		S22	42 to 44	24/18	WOH-3-4-7			S22: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, gray-brown.
	45	S23	44 to 46	24/15	5-8-8-6			S23 (0-4"): CLAYEY SAND (SC); ~60% fine to medium sand, ~40% low plasticity fines. S23 (4"-5"): Piece of red gravel. S23 (5"-15"): CLAYEY SAND (SC); ~80% fine to medium sand, ~20% low plasticity fines, brown.
		S24	46 to 48	24/24	1-3-2-2			S24: Gradual change from: CLAYEY SAND (SC); Similar to S23 (5"-15") to SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, light brown.
1490		S25	48 to 50	24/21	WOH-1-3-4			S25: Gradual change from: SANDY LEAN CLAY (CL); Similar to S24 bottom to SILTY SAND (SM); ~55% fine to medium sand, ~45% nonplastic fines, light brown.
	50	S26	50 to 52	24/24	1-1-1-1			S26: SILTY SAND (SM); 51.0% fine sand, 49.0% fines [GRAIN SIZE ANALYSIS], light brown. LL = NV, PL = NP.
		S27	52 to 54	24/24	WOH/18"-3			S27 (0-14"): SILTY SAND (SM); Similar to S26. S27 (14"-24"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, light brown.
	55	S28	54 to 56	24/20	WOR-2-7-8			S28 (0-13"): SANDY LEAN CLAY (CL); Similar to S27 (14"-24") S28 (13"-20"): CLAYEY GRAVEL WITH SAND (GC); ~50% fine

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,298 **EASTING (ft):** 1,310,475
GROUND SURFACE EL. (ft): 1538.1 **DATE START/END:** 9/17/2017 - 9/17/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B116

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
								gravel, ~30% medium plasticity fines, ~20% fine to coarse sand, gray red.
		S29	56 to 57.4	17/11	10-38-50/5"			S29: CLAYEY GRAVEL WITH SAND (GC); Similar to S28 (13"-20"). Shoe is WEATHERED SHALE, horizontal layering.
1480						Auger refusal at 57.8 ft		Bottom of boring at depth 57.8 ft. Borehole grouted upon completion.
	60							
	65							
1470								
	70							
	75							
1460								
	80							
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,301 **EASTING (ft):** 1,310,471
GROUND SURFACE EL. (ft): 1538.0 **DATE START/END:** 9/18/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 49.6 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B116U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 4.25 inch / 7.5 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
							FILL	
	5						STACKED ASH	
1530								
	10					Cuttings similar to B116		
	15						SLUICED ASH	
1520								
	20							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,301 **EASTING (ft):** 1,310,471
GROUND SURFACE EL. (ft): 1538.0 **DATE START/END:** 9/18/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B116U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25						SLUICED ASH	
1510								
	30							
	35							
1500								
	40						SAND-LIKE ALLUVIUM	
	45	U1	43.6 to 46.1	30/9	OSTER-BERG			U1 top: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~40% fine to coarse sand, brown. U1 bottom: Not checked.
1490		U1A	47.1 to 49.5	30/22	OSTER-BERG			U1A top: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~35% fine to coarse sand, ~5% gravel, brown. U1A bottom: Not thoroughly checked, but sandy.
	50							Bottom of boring at depth 49.58 ft. Borehole grouted upon completion.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,212 **EASTING (ft):** 1,310,518
GROUND SURFACE EL. (ft): 1547.3 **DATE START/END:** 9/18/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 64.1 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING B117

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/21	36-27-18-14		FILL	S1: SILTY GRAVEL WITH SAND (GM); ~50% subangular fine to medium gravel, ~30% fine to coarse sand, ~20% nonplastic fines, gray. FILL.
		S2	2 to 4	24/16	4-10-10-12			S2 (0-8"): CLAYEY GRAVEL WITH SAND (GC); ~60% subangular fine to coarse gravel, ~25% medium plasticity fines, ~15% fine to coarse sand, brown.
	5	S3	4 to 6	24/21	20-22-24-25		STACKED ASH	S2 (8"-16"): SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, black. STACKED ASH. S3: SILTY SAND (SM); ~70% fine sand, ~30% nonplastic fines. STACKED ASH. Finer with depth.
1540		S4	6 to 8	24/20	3-5-5-5			S4: SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. STACKED ASH. 5"-7" Orange clayey sand seam.
		S5	8 to 10	24/24	4-14-18-20			S5 (0-15"): SILT (ML); Similar to S4. Black. STACKED ASH. S5 (15"-24"): SILTY SAND (SM); ~70% fine to coarse sand, ~30% nonplastic fines, black. STACKED ASH.
	10	S6	10 to 12	24/24	8-10-12-14			S6: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, black. STACKED ASH. 6"-7" Reddish orange clay seam.
		S7	12 to 14	24/24	3-4-4-4		SLUICED ASH	S7: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, gray and black depositional layers. SLUICED ASH.
		S8	14 to 16	24/23	2-2-2-2			S8: SILT WITH SAND (ML); Similar to S7. SLUICED ASH.
	15	S9	16 to 18	24/21	1-1-1-1			S9: SILT WITH SAND (ML); Similar to S7. SLUICED ASH. Finer towards 21".
1530		S10	18 to 20	24/22	1-2-1-2			S10 (0-8"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH. S10 (8"-22"): SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, gray and black depositional layers. SLUICED ASH.
	20	S11	20 to 22	24/23	2-2-2-2			S11: SILTY SAND (SM); Similar to S10 (8"-22"). SLUICED ASH.
		S12	22 to 24	24/24	1-2-2-2			S12: SILT (ML); ~90% nonplastic fines, ~10% fine sand. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,212 **EASTING (ft):** 1,310,518
GROUND SURFACE EL. (ft): 1547.3 **DATE START/END:** 9/18/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B117

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S13	24 to 26	24/24	1-1-2-1	Transition from dry to moist	SLUICED ASH	S13: SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, gray and black depositional layers. SLUICED ASH. 23"-24" SANDY CLAY seam.
1520		S14	26 to 28	24/24	3-4-5-5			S14: SILTY SAND (SM); Similar to S13. SLUICED ASH. 2"-5" SANDY CLAY seam.
		S15	28 to 30	24/23	2-3-4-4			S15: SILTY SAND (SM); Similar to S13. SLUICED ASH.
	30	S16	30 to 32	24/24	3-3-3-4			S16: SILTY SAND (SM); Similar to S13. SLUICED ASH.
		S17	32 to 34	24/24	2-4-4-4			S17: SILTY SAND (SM); Similar to S13. SLUICED ASH.
		S18	34 to 36	24/24	2-2-2-4			S18: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand. SLUICED ASH.
	35	S19	36 to 38	24/24	1-2-3-5			S19: SILT (ML); ~90% nonplastic fines, ~10% fine sand. SLUICED ASH.
1510		S20	38 to 40	24/22	1-2-4-5			S20: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand. SLUICED ASH.
	40	S21	40 to 42	24/24	1-2-2-3	Transition from moist to wet		S21: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
		S22	42 to 44	24/24	1-1-1-1			S22: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
	45	S23	44 to 46	24/22	1-1-1-1			S23: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
1500		S24	46 to 48	24/24	WOH/12"-1-1			S24: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
		S25	48 to 50	24/24	WOH/12"-1/12"			S25: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
	50	S26	50 to 52	24/24	WOH/12"-1-1			S26: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
		S27	52 to 54	24/24	WOR/12"-WOH/6"-1			S27: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.
	55	S28	54 to 56	24/24	WOR/12"-WOH/12"			S28: SILT WITH SAND (ML); Similar to S20. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,212 **EASTING (ft):** 1,310,518
GROUND SURFACE EL. (ft): 1547.3 **DATE START/END:** 9/18/2017 - 9/18/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B117

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S29	56 to 58	24/23	WOH/24"			S29 (0-20"): SILT WITH SAND (ML); Similar to S20. Light gray with depth. SLUICED ASH.
1490		S30	58 to 60	24/22	5-5-5-5		SAND-LIKE ALLUVIUM	S29 (20"-23"): CLAYEY SAND (SC); ~70% fine sand, ~30% low plasticity fines, light brown. S30: CLAYEY SAND (SC); 64.0% fine sand, 36.0% low plasticity fines [GRAIN SIZE ANALYSIS], light brown.
	60	S31	60 to 62	24/24	2-3-2-4			S31 (0-18"): CLAYEY SAND (SC); ~70% fine to medium sand, ~30% low plasticity fines, brown. S31 (18"-24"): CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, brown-red-gray.
		S32	62 to 64	24/18	1-1-2-1			S32 (0-5"): CLAYEY SAND (SC); ~80% fine sand, ~20% low plasticity fines, light brown. S32 (5"-12"): CLAYEY SAND WITH GRAVEL (SC); ~40% fine to coarse sand, ~30% low plasticity fines, ~30% fine gravel, orange. S32 (12"-18"): SANDY CLAY (CL); ~60% medium plasticity fines, ~30% fine sand, ~10% organics (roots), dark brown.
		S33	64 to 64.1	1/1	50/1"	Auger refusal at 64.0 ft		S33: WEATHERED SHALE; ~50% angular gravel, ~30% medium plasticity fines, ~20% fine to coarse sand, brown-gray. Bottom of boring at depth 64.1 ft. Borehole grouted upon completion.
	65							
1480								
	70							
	75							
1470								
	80							
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,227 **EASTING (ft):** 1,310,633
GROUND SURFACE EL. (ft): 1542.4 **DATE START/END:** 9/19/2017 - 9/19/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 61.4 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING B118

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NQ2
AUGER I.D./O.D.: 3.25 inch / 6.25 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 2 inch / 3 inch
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/22	7-9-12-12		FILL	S1: SANDY CLAY (CL); ~70% low plasticity fines, ~20% fine to coarse sand, ~10% gravel, red-brown. FILL. 0-1": Organic top soil.
1540		S2	2 to 4	24/20	5-6-5-4			S2 (0-11"): SANDY CLAY (CL); Similar to S1.
							STACKED ASH	S2 (11"-20"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. STACKED ASH.
		S3	4 to 6	24/20	2-2-2-1			S3: SILT (ML); Similar to S2 (11"-20"). STACKED ASH. 0-2" SANDY SILT seam.
	5							
		S4	6 to 8	24/21	2-3-3-4			S4: SILT (ML); Similar to S2 (11"-20"). STACKED ASH.
		S5	8 to 10	24/23	2-3-4-5			S5 (0-7"): SILT (ML); Similar to S2 (11"-20"). STACKED ASH.
							FILL	S5 (7"-17"): CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, orange-brown. Ash seam at 11". FILL.
	10						SLUICED ASH	S5 (17"-23"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH.
		S6	10 to 12	24/20	4-4-4-4			S6: SILT (ML); Similar to S5 (17"-23"). SLUICED ASH. 2"-3" SANDY CLAY seam.
1530		S7	12 to 14	24/22	2-2-3-3			S7: SILT (ML); Similar to S5 (17"-23"). SLUICED ASH. 0-2" SANDY CLAY seam.
		S8	14 to 16	24/22	1-2-2-3			S8: SILT (ML); Similar to S5 (17"-23"). SLUICED ASH.
	15							
		S9	16 to 18	24/21	1-2-2-3			S9: SILT (ML); Similar to S5 (17"-23"). SLUICED ASH.
		S10	18 to 20	24/23	1-2-2-3			S10: SILT (ML); Similar to S5 (17"-23"). SLUICED ASH.
	20							
		S11	20 to 22	24/21	2-3-3-4			S11 (0-4"): SILT (ML); Similar to S5 (17"-23"). SLUICED ASH. S11 (4"-21"): SILTY SAND (SM); 83.7% fine sand, 16.3% nonplastic fines [GRAIN SIZE ANALYSIS], gray. SLUICED ASH.
1520		S12	22 to 24	24/16	1-2-2-3			S12 (0-9"): SILTY SAND (SM); Similar to S11 (4"-21"). SLUICED ASH. S12 (9"-16"): SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, gray and black depositional layers. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,227 **EASTING (ft):** 1,310,633
GROUND SURFACE EL. (ft): 1542.4 **DATE START/END:** 9/19/2017 - 9/19/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B118

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S13	24 to 26	24/21	2-3-3-3		SLUICED ASH	S13: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand. SLUICED ASH. 1"-3": Sandier gray ash seam.
		S14	26 to 28	24/22	1-2-2-3			S14: SILT WITH SAND (ML); 77.6% fines, 22.4% fine sand [GRAIN SIZE ANALYSIS]. LL = NV, PL = NP. SLUICED ASH.
		S15	28 to 30	24/23	1-2-3-4			S15 (0-12"): SILT WITH SAND (ML); Similar to S14. SLUICED ASH. S15 (12"-23"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, black. SLUICED ASH.
	30	S16	30 to 32	24/22	2-3-3-3			S16 (0-7"): SILT (ML); Similar to S15 (12"-23"). SLUICED ASH. S16 (7"-22"): SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand, gray and black depositional layers. SLUICED ASH.
1510		S17	32 to 34	24/24	1-2-2-3			S17: SILT (ML); ~90% nonplastic fines, ~10% fine sand. SLUICED ASH.
		S18	34 to 36	24/23	1-1-2-4			S18: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand. SLUICED ASH. 0-2" and 20"-23": Finer ash seams.
	35	S19	36 to 38	24/23	1-1-3-4			S19 (0-14"): SILTY SAND (SM); Similar to S18. Gray with depth. SLUICED ASH.
		S20	38 to 40	24/23	4-7-8-8	Qp = 2.25 tsf, 4.0 tsf	SAND-LIKE ALLUVIUM	S19 (14"-18"): CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, orange-brown. S19 (18"-23"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, brown. S20: Gradual change from: CLAYEY SAND (SC); ~80% fine sand, ~20% low plasticity fines, brown. to CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, orange-brown.
	40	U1	40 to 40.7	8/0	PUSH			U1: No recovery.
1500		S21	42 to 44	24/24	6-9-11-22	Qp = 2.0 tsf, 3.0 tsf		S21: CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, dark brown.
	45	S22	44 to 46	24/24	12-18-17-13			S22: Gradual change from: CLAYEY SAND (SC); Similar to S21. to NARROWLY GRADED SAND (SP); ~100% fine to medium sand, light brown.
		U2	46.3 to 47.8	19/15	PUSH			U2 Top: SANDY CLAY (CL); ~60% low plasticity fines, ~40% fine sand, brown. U2 Bottom: NARROWLY GRADED SAND (SP); ~95% fine to medium sand, ~5% nonplastic fines.
		S23	48 to 50	24/21	5-5-4-5			S23: CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, dark brown.
	50	S24	50 to 52	24/24	4-4-5-5			S24: CLAYEY SAND (SC); Similar to S23. Gravelly seam at 15".
1490		S25	52 to 54	24/22	1-1-1-7	Wet		S25: SILTY SAND (SM); 65.1% fine sand, 34.9% fines [GRAIN SIZE ANALYSIS]. LL = NV, PL = NP.
	55	S26	54 to 56	24/20	2-3-4-6			S26: CLAYEY SAND (SC); 83.1% fine to medium sand, 16.9% low plasticity fines [GRAIN SIZE ANALYSIS], light brown.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 389,227 **EASTING (ft):** 1,310,633
GROUND SURFACE EL. (ft): 1542.4 **DATE START/END:** 9/19/2017 - 9/19/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B118

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S27	56 to 58	24/22	3-2-3-4		SAND-LIKE ALLUVIUM	S27: Gradual change from: CLAYEY SAND (SC); ~80% fine sand, ~20% medium plasticity fines. to CLAYEY SAND (SC); ~60% fine sand, ~40% low plasticity fines, brown/grey.
		S28	58 to 60	24/22	1-6-16-30			S28 (0-11"): CLAYEY SAND (SC); ~70% fine to coarse sand, ~20% low plasticity fines, ~10% gravel, brown. S28 (11"-22"): CLAYEY GRAVEL WITH SAND (GC); ~40% fine to medium angular gravel, ~30% medium plasticity fines, ~30% fine to coarse sand, brown/grey/red/yellow.
	60	S29	60 to 61.2	14/14	25-36-50/2"			S29: CLAYEY GRAVEL WITH SAND (GC); Similar to S28 (11"-22"). Increasing gravel with depth. WEATHERED SHALE in shoe.
1480						Auger refusal at 61.4'		Bottom of boring at depth 61.4 ft. Borehole grouted upon completion.
	65							
	70							
1470								
	75							
	80							
1460								
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft):	390,147	**EASTING (ft):**	1,309,132
GROUND SURFACE EL. (ft):	1537.7	**DATE START/END:**	9/7/2017 - 9/7/2017
VERT./HORIZ. DATUMS:	NGVD 1929/GLALHD	**DRILLING COMPANY:**	Terracon Consultants, Inc.
TOTAL DEPTH (ft):	60.5	**DRILLER NAME:**	C. Penton
LOGGED BY:	W. Lukas	**RIG TYPE:**	Simco 2800 Truck Mounted

BORING

B119

DRILLING INFORMATION

HAMMER TYPE:	Automatic	**CASING I.D./O.D.:**	NA/ NA	**CORE BARREL TYPE:**	NQ2
AUGER I.D./O.D.:	3.25 inch / 6.25 inch	**DRILL ROD O.D.:**	NM	**CORE BARREL I.D./O.D.:**	2 inch / 3 inch
DRILLING METHOD:	Hollow Stem Auger				
WATER LEVEL DEPTHS (ft):	Not measured				

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer

S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S1	0 to 2	24/21	7-14-8-4		CLAY DIKE	S1 (0-16"): WIDELY GRADED GRAVEL WITH SAND (GW); ~60% gravel, ~35% sand, ~5% nonplastic fines, gray. FILL S1 (16"-21"): SANDY LEAN CLAY (CL); ~65% low plasticity fines, ~30% sand, ~5% fine gravel, dark brown.
		S2	2.5 to 4.5	24/15	2-3-5-7			S2 (0-8"): SANDY LEAN CLAY (CL); similar to S1 (16"-21"). S2 (8"-15"): LEAN CLAY WITH GRAVEL (CL); ~80% medium plasticity fines, ~15% gravel, ~5% fine sand, reddish brown.
	5	S3	5 to 7	24/15	3-5-10-10			S3 (0-10"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~15% fine sand, ~5% gravel. S3 (10"-15"): GRAVELLY LEAN CLAY (CL); ~45% medium plasticity fines, ~35% gravel, ~10% sand, reddish brown.
1530		S4	7.5 to 9.5	24/14	5-5-3-6			S4 (0-4"): GRAVELLY LEAN CLAY (CL); similar to S3 (10"-15"). S4 (4"-14"): SANDY LEAN CLAY WITH GRAVEL (CL); ~60% low plasticity fines, ~20% fine to coarse sand, ~20% gravel up to 1 inch, reddish brown.
	10	S5	10 to 12	24/21	5-8-6-6			S5 (0-6"): SANDY LEAN CLAY WITH GRAVEL (CL); similar to S4 (4"-14"). S5 (6"-12"): CLAYEY GRAVEL (GC); ~60% gravel, ~30% low plasticity fines, ~10% sand, reddish brown. S5 (12"-21"): LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~15% fine sand, ~5% gravel, reddish brown.
		S6	12.5 to 14.5	24/19	4-6-12-14			S6 (0-14"): LEAN CLAY WITH SAND (CL); similar to S5 (12"-21"). S6 (14"-19"): CLAYEY GRAVEL WITH SAND (GC); ~70% subangular gravel, ~15% fine to coarse sand, ~15% low plasticity fines.
	15	S7	15 to 17	24/2	10-7-7-9			S7: LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~15% fine sand, ~5% gravel, reddish brown.
1520		S8	17.5 to 19.5	24/15	4-6-13-15	Qp > 4.5 tsf		S8: LEAN CLAY WITH SAND (CL); similar to S7. LL = 29%, PL = 17%. 13"-15": Gravel with sand seam.
	20	S9	20 to 22	24/24	3-6-10-12	Qp = 3.5 tsf, > 4.5 tsf		S9 (0-4"): GRAVELLY LEAN CLAY WITH SAND (CL); ~60% low plasticity fines, ~30% fine to coarse gravel, ~10% fine to coarse sand, brown. S9 (4"-24"): LEAN CLAY WITH SAND (CL); ~85% low plasticity fines, ~10% fine sand, ~5% gravel, brown.
		S10	22.5 to 24.5	24/19	5-5-9-10	Qp = 3.0 tsf, 4.5 tsf		S10: LEAN CLAY WITH SAND (CL); Similar to S9 (4"-24"). 3"-4": Sandy gravel seam.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant

CITY/STATE: Glen Lyn, Virginia

GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,147 **EASTING (ft):** 1,309,132
GROUND SURFACE EL. (ft): 1537.7 **DATE START/END:** 9/7/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B119

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S11	25 to 27	24/20	3-6-8-11	Qp = >4.5 tsf	CLAY DIKE	S11 (0-12"): LEAN CLAY WITH SAND (CL); Similar to S9 (4"-24"). S11 (12"-17"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~25% sand, ~5% gravel, brown. S11 (17"-20"): LEAN CLAY WITH GRAVEL (CL); ~75% low plasticity fines, ~15% fine gravel, ~10% fine sand, brown.
1510		S12	27.5 to 29.5	24/21	5-7-9-12	Qp > 4.5 tsf, 2.75 tsf		S12 (0-17"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, brown. S12 (17"-21"): LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~20% fine sand, dark brown.
	30	S13	30 to 32	24/23	3-8-8-10	Qp = 2.25 tsf		S13 (0-9"): LEAN CLAY WITH SAND (CL); Similar to S12 (17"-21") 8"-9": Gravel seam. S13 (9"-23"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, brown.
		S14	32.5 to 34.5	24/21	3-6-9-10	Qp > 4.5 tsf, > 4.5 tsf, = 2.5 tsf		S14: SANDY LEAN CLAY (CL); Similar to S13 (9"-23"). 3"-4": Red clay seam. 15"-17": Red clayey gravel seam.
	35	S15	35 to 37	24/18	5-8-15-11	Qp > 4.5 tsf, > 4.5 tsf		S15 (0-8"): LEAN CLAY WITH SAND (CL); ~75% medium plasticity fines, ~25% fine sand, red. S15 (8"-18"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine sand, brown. 15": Gravel seam.
1500		S16	37.5 to 39.5	24/24	5-7-8-11	Qp = 2.5 tsf, > 4.5 tsf, > 4.5 tsf	CLAY-LIKE ALLUVIUM	S16 (0-2"): SANDY LEAN CLAY (CL); Similar to S15 (8"-18"). S16 (2"-24"): Gradual change with depth from CLAYEY SAND (SC); ~70% fine sand, ~30% low plasticity fines, trace roots, dark brown. to SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, red.
	40	S17	40 to 42	24/23	5-7-10-12	Qp = 2.75 tsf, 3.75 tsf, > 4.5 tsf		S17: SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~40% fine sand, red. 13"-15": Clay seam, medium plasticity.
		S18	42.5 to 44.5	24/24	4-4-4-6	Qp = 2.75 tsf, > 4.5 tsf		S18 (0-7"): SANDY LEAN CLAY (CL); ~60% low plasticity fines, ~35% fine sand, ~5% gravel, dark brown. S18 (7"-19"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine sand, softer with depth, brown. S18 (19"-24"): LEAN CLAY WITH SAND (CL); ~80% low plasticity fines, ~20% fine sand, moist, dark brown.
	45	S19	45 to 47	24/24	1-3-6-9	Qp = 1.75 tsf, 2.5 tsf		S19: LEAN CLAY WITH SAND (CL); Similar to S18 (19"-24").
1490		S20	47.5 to 49.5	24/24	3-5-6-10	Qp = 2.25 tsf, 2.5 tsf, 2.25 tsf		S20: LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, reddish brown.
	50	S21	50 to 52	24/24	4-5-8-8	Qp = 1.25 tsf, 2.5 tsf		S21: LEAN CLAY (CL); Similar to S20. Higher plasticity towards top.
		S22	52.5 to 54.5	24/24	2-3-5-6	Qp = 1.25 tsf, 1.5 tsf		S22: LEAN CLAY (CL); Similar to S20.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,147 **EASTING (ft):** 1,309,132
GROUND SURFACE EL. (ft): 1537.7 **DATE START/END:** 9/7/2017 - 9/7/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B119

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S23	55 to 57	24/24	1-2-3-4		CLAY-LIKE ALLUVIUM	S23 (0-4"): LEAN CLAY (CL); Similar to S20. S23 (4"-24"): SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~30% fine sand.
1480		S24	57.5 to 59.5	24/8	20-22-15-9			S24: CLAYEY GRAVEL WITH SAND (GC); ~50% fine to coarse angular gravel, ~30% fine to coarse sand, ~20% low plasticity fines, brown.
	60	S25	60 to 60.5	6/2	50/5.5"	Auger refusal at 60.5 ft.		S25: WEATHERED LIMESTONE; gray.
								Bottom of boring at depth 60.5 ft. Borehole grouted upon completion.
	65							
1470								
	70							
	75							
1460								
	80							
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 390,143 **EASTING (ft):** 1,309,134
GROUND SURFACE EL. (ft): 1537.9 **DATE START/END:** 9/9/2017 - 9/9/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 56.9 **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B119U

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ NA **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 4.25 inch / 7.5 inch **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1530	5						CLAY DIKE	
	10							
	15							
1520	20	U1A	19.3 to 19.3	0/0	PUSH			U1A: No recovery.
		U1B	21.2 to 22.9	20/0	PUSH			U1B: No recovery.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,143
GROUND SURFACE EL. (ft): 1537.9
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD

EASTING (ft): 1,309,134
DATE START/END: 9/9/2017 - 9/9/2017
DRILLING COMPANY: Terracon Consultants, Inc.

BORING
B119U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	U1C	23.8 to 25.8	23/2	PUSH	Hit a rock while pushing U1C.	CLAY DIKE	U1C: SANDY LEAN CLAY (CL); ~70% low plasticity fines, ~25% fine to coarse sand, ~5% gravel.
1510	30							
	35							
1500	40						CLAY-LIKE ALLUVIUM	
	45							
1490	50							
	55	U2	54.3 to	30/0	PUSH			U2: No recovery.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 390,143
EASTING (ft): 1,309,134
GROUND SURFACE EL. (ft): 1537.9
DATE START/END: 9/9/2017 - 9/9/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD
DRILLING COMPANY: Terracon Consultants, Inc.

BORING B119U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
			56.9					
								Bottom of boring at depth 56.87 ft. Borehole grouted upon completion.
1480	60							
	65							
1470	70							
	75							
1460	80							
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

BORING INFORMATION

NORTHING (ft): 390,153 | **EASTING (ft):** 1,309,126
GROUND SURFACE EL. (ft): 1537.8 | **DATE START/END:** 9/20/2017 - 9/20/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 53.3 | **DRILLER NAME:** C. Penton
LOGGED BY: W. Lukas | **RIG TYPE:** Simco 2800 Truck Mounted

BORING

B119U-A

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** NA/ NA | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	5					Rough drilling.	CLAY DIKE	Cuttings similar to B119 and B119U.
1530								
	10					Rough drilling		
	15							
1520								
	20							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

NORTHING (ft): 390,153 **EASTING (ft):** 1,309,126
GROUND SURFACE EL. (ft): 1537.8 **DATE START/END:** 9/20/2017 - 9/20/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B119U-A

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	U1	23.9 to 25.3	17/16	PUSH		CLAY DIKE	U1 Top: LEAN CLAY (CL); ~85% medium plasticity fines, ~10% coarse sand, ~5% fine gravel, brown. U1 Bottom: LEAN CLAY (CL); ~90% fines, ~5% coarse sand, ~5% fine gravel, brown. LL = 41%, PL = 20%.
1510	30							
	35							Cuttings similar to B119 and B119U.
1500	40						CLAY-LIKE ALLUVIUM	
		U2	42.2 to 44.2	24/23	PUSH			U2 Top: LEAN CLAY (CL); ~90% medium plasticity fines, ~10% fine sand, red-brown. U2 Bottom: LEAN CLAY (CL); ~100% low to medium plasticity fines, dark brown.
1490	45							
	50							
		U3	51.2 to 53.3	25/24	PUSH			U3 Top: FAT CLAY (CH); ~100% medium to high plasticity fines, brown. U3 Bottom: LEAN CLAY (CL); ~100% medium plasticity fines, light brown.
	55							Bottom of boring at depth 53.3 ft. Borehole grouted upon completion.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,191 **EASTING (ft):** 1,310,260
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/4/2017 - 10/10/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 86.7 **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals **RIG TYPE:** Acker Renegade Track Rig

BORING

B120

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** 4 inch/ 4.5 inch **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft): ▽ 21.8 10/10/2017 8:20 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Hand auger to 2' to find liner. Found geotextile, geogrid, and PVC liner.	CAP	0-2': SILTY SAND WITH GRAVEL (SM); ~65% fine to medium sand, ~20% fine to medium gravel, ~15% nonplastic fines, brown. Classified cuttings.
		S1	2.5 to 4.5	24/19	8-10-11-14		STACKED ASH	S1: SILT WITH SAND (ML); ~70% nonplastic fines, ~20% fine sand, ~10% fine gravel, gray with red clay in some areas. STACKED ASH. Liner on top of sample.
	5	S2	5 to 7	24/18	8-9-11-11			S2: SILT WITH SAND (ML); ~70% nonplastic fines, ~25% fine sand, gray, yellow clay mottling. STACKED ASH.
		S3	7.5 to 9.5	24/17	8-8-10-11			S3: SANDY SILT (ML); ~70% nonplastic fines, ~25% fine sand, ~5% fine to medium gravel up to 1/2 inch, gray, red clay mottling and roots. STACKED ASH.
1560	10	S4	10 to 12	24/15	3-4-4-7		SLUICED ASH	S4: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, visible layering. SLUICED ASH.
		S5	12.5 to 14.5	24/14	4-6-5-7			S5: SILT (ML); Similar to S4. Gray, layering, thin yellow clay layers. SLUICED ASH.
	15	S6	15 to 17	24/14	2-4-4-6			S6: SILT (ML); Similar to S4. SLUICED ASH.
		S7	17.5 to 19.5	24/0	5-4-5-7	Redrive 3" SS sampler		S7: No recovery S7 REDRIVE: SILT (ML); Similar to S4. SLUICED ASH.
1550	20	S8	20 to 22	24/15	2-4-4-4			S8: SILT (ML); Similar to S4 with one 1" piece of gravel on sampler tip. SLUICED ASH.
		S9	22.5 to 24.5	24/17	3-3-3-7			S9: SILT (ML); Similar to S4. Gray, layering, thin layers of yellow clay, ~1" of clay on sampler tip. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,191 **EASTING (ft):** 1,310,260
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/4/2017 - 10/10/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B120

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S10	25 to 27	24/16	8-10-10-9		SLUICED ASH	S10: SILT (ML); Similar to S4. Gray, layering, thin layers of yellow clay in top 5". SLUICED ASH.
		S11	27.5 to 29.5	24/16	7-8-9-15	End casing at 28.1'		S11: SANDY SILT (ML); ~70% nonplastic fines, ~30% fine sand, gray, layering, one layer of yellow clay in bottom 5". SLUICED ASH.
1540	30	S12	30 to 32	24/12	3-4-4-6			S12: SILTY SAND (SM); ~75% fine to coarse sand, ~25% nonplastic fines, dark gray, one 1" clay layer on bottom. SLUICED ASH.
		S13	32.5 to 34.5	24/14	4-4-7-10			S13: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, layering, coarser on sampler tip. SLUICED ASH.
	35	S14	35 to 37	24/12	4-3-4-4			S14: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand. SLUICED ASH.
		S15	37.5 to 39.5	24/9	2-2-3-3			S15: SILT WITH SAND (ML); Similar to S14. Dark gray. SLUICED ASH.
1530	40	S16	40 to 42	24/14	2-2-3-4			S16: SILT WITH SAND (ML); Similar to S14. SLUICED ASH.
		S17	42.5 to 44.5	24/11	2-3-4-4			S17 (0-4"): SILT WITH SAND (ML); Similar to S14. Gray. SLUICED ASH. S17 (4"-11"): SILTY SAND (SM); ~60% fine sand, ~40% nonplastic fines, gray. SLUICED ASH.
	45	S18	45 to 47	24/17	1-2-3-2	Wet at 45'		S18: SILTY SAND (SM); ~80% fine sand, ~20% nonplastic fines, gray, layering, some layers sandier. SLUICED ASH.
		S19	47 to 49	24/19	1-2-3-5			S19: SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, layering. SLUICED ASH.
1520	50	S20	49 to 51	24/23	1/12"-3-2			S20: SILT WITH SAND (ML); ~80% nonplastic fines, ~20% fine sand. SLUICED ASH.
		S21	51 to 53	24/20	1-1-1-5			S21: SILT WITH SAND (ML); Similar to S20. Some interbedded layers are sandier. SLUICED ASH.
		S22	53 to 55	24/19	3-3-3-4			S22 (0-6"): SILT WITH SAND (ML); Similar to S20. Gray, layering. SLUICED ASH. S22 (6"-19"): SILT (ML); ~90% nonplastic fines, ~10% fine sand, gray, layering. SLUICED ASH.
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,191 **EASTING (ft):** 1,310,260
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/4/2017 - 10/10/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B120

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S23	55 to 57	24/18	2-1-4-11			S23 (0-14"): SILTY SAND (SM); Similar to S22 (6"-19"). SLUICED ASH.
		S24	57 to 58.8	21/19	3-6-9-50/3"	Spoon bouncing, possible boulder. Very hard drilling to get through.	CLAY DIKE	S23 (14"-18"): SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~30% fine sand, ~10% fine to medium gravel, brown with yellow and gray mottling, gravel in sampler tip. S24: SANDY LEAN CLAY (CL); ~60% fines, ~35% fine sand, ~5% fine gravel, yellowish brown, some roots, 1/4" layer of ash at 1" from top, shale in sampler tip. LL = 37%, PL = 20%.
1510		S25	59 to 59	0/0	50/0"			S25: No recovery. Shale in tip.
	60	S26	60 to 62	24/12	7-5-7-9	60' - broke through boulder Qp = 3.25 tsf		S26: CLAYEY SAND (SC); 53.2% fine sand, 46.6% fines, 0.2% fine gravel, brown. LL = 28%, PL = 15%.
		S27	62 to 64	24/17	2-3-7-10	Qp = 2.25 tsf		S27 (0-9"): GRAVELLY LEAN CLAY WITH SAND (CL); ~55% medium plasticity fines, ~30% fine to coarse gravel up to 1", ~15% fine to coarse sand, grayish brown. S27 (9"-17"): CLAYEY SAND (SC); ~65% fine sand, ~35% medium plasticity fines, yellowish brown.
		S28	64 to 66	24/11	11-10-10-13	Qp = 3.5 tsf	CLAY-LIKE ALLUVIUM	S28: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~35% fine sand, ~5% medium gravel up to 1/2", gray-brown.
	65	S29	66 to 68	24/12	1-1-3-9	Top Qp = 1.0 tsf Bottom Qp = 4.0 tsf		S29: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~30% fine sand, ~10% gravel, gray-brown, one piece of 1" gravel in tip.
		S30	68 to 70	24/15	5-6-5-9	Qp = 3.0 tsf		S30: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~35% fine sand, ~5% fine gravel, brown.
1500	70	S31	70 to 72	24/20	3-4-5-4	Qp = 1.5 tsf		S31: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~40% fine sand, brown-gray.
		S32	72 to 74	24/22	2-1-1-2	Qp = 0.5 tsf		S32: SANDY LEAN CLAY (CL); Similar to S31. Brown-gray.
		S33	74 to 76	24/24	1/12"-1-1			S33 (0-12"): SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~30% fine sand. S33 (12"-24"): CLAYEY SAND (SC); ~70% fine sand, ~30% medium plasticity fines, brown-gray. Gradual change in sand content.
	75	S34	76 to 78	24/20	WOH/12"-2-2			S34: CLAYEY SAND (SC); Similar to S33 (12"-24"). Gray.
		S35	78 to 80	24/11	WOH-4-6-9			S35: CLAYEY SAND (SC); ~70% fine sand, ~30% low plasticity fines.
1490	80	S36	80 to 82	24/20	6-6-7-6		SAND-LIKE ALLUVIUM	S36: CLAYEY SAND (SC); 74.0% fine sand, 26.0% low plasticity fines [GRAIN SIZE ANALYSIS]. Gradual change from gray-brown to brown.
		S37	82 to 84	24/14	3-4-6-12	Drill chatter		S37: CLAYEY SAND (SC); ~70% fine sand, ~30% low plasticity fines, brown. Medium gravel in tip.
	85	S38	84 to 86	24/13	2-5-17-50	Drill chatter		S38 (0-5"): GRAVELLY LEAN CLAY WITH SAND (CL); ~50% medium plasticity fines, ~30% fine to coarse gravel, ~20% fine sand, brown. S38 (5"-11"): CLAYEY GRAVEL WITH SAND (GC); ~50% fine to coarse gravel, ~30% medium plasticity fines, ~20% fine to coarse
			86					

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,191 **EASTING (ft):** 1,310,260
GROUND SURFACE EL. (ft): 1569.6 **DATE START/END:** 10/4/2017 - 10/10/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B120

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S39	to 86.7	8/8	40-50/2"			sand, brown. S38 (11"-13"): WEATHERED SHALE. S39: LEAN CLAY WITH GRAVEL (CL); ~80% medium plasticity fines, ~20% fine gravel. WEATHERED SHALE. Bottom of boring at depth 86.7 ft. Drilled with Bio-Bore. Borehole grouted upon completion.
1480	90							
	95							
1470	100							
	105							
1460	110							
	115							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,466 | **EASTING (ft):** 1,309,909
GROUND SURFACE EL. (ft): 1551.8 | **DATE START/END:** 10/11/2017 - 10/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 81.8 | **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals | **RIG TYPE:** Acker Renegade Track Rig

BORING
B122

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** 4 inch/ 4.5 inch | **CORE BARREL TYPE:** HQ
AUGER I.D./O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** 2.5 inch / 3.78 inch
DRILLING METHOD: Rotary - Wash
WATER LEVEL DEPTHS (ft):

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
						Drilled to 5' for first sample.	CLAY CAP	
1550								
	5	S1	5 to 7	24/21	4-6-6-8		STACKED ASH	S1: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray. STACKED ASH.
	10	S2	10 to 12	24/16	5-5-3-3			S2: SILTY SAND WITH GRAVEL (SM); ~60% fine to coarse sand, ~25% nonplastic fines, ~15% fine to medium gravel up to 1/2", a few balls of low plasticity fines up to 1/2", dark gray. STACKED ASH.
1540								
	15	S3	15 to 17	24/15	2-2-2-2		SLUICED ASH	S3: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. SLUICED ASH.
	20	S4	20 to 22	24/20	1/18"-1	Wet		S4: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering, some layers are siltier. SLUICED ASH.
1530								

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,466 **EASTING (ft):** 1,309,909
GROUND SURFACE EL. (ft): 1551.8 **DATE START/END:** 10/11/2017 - 10/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B122

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25	S5	25 to 27	24/19	1/24"		SLUICED ASH	S5: SILT (ML); Similar to S4. SLUICED ASH.
	30	S6	30 to 32	24/23	1/12"-1-1			S6: SILT (ML); Similar to S4. SLUICED ASH.
1520	35	S7	35 to 37	24/21	1-1/12"-1			S7: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering, some layers are sandier. SLUICED ASH.
	40	S8	40 to 42	24/22	WOH/18"-1			S8: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering. SLUICED ASH.
1510	45	S9	45 to 47	24/24	WOH/18"-1			S9: SILT (ML); Similar to S8. SLUICED ASH.
		S10	47 to 49	24/21	WOH/18"-1			S10: SILT (ML); Similar to S8. SLUICED ASH.
	50	S11	49 to 51	24/22	WOH/24"			S11: SILT (ML); Similar to S8. SLUICED ASH.
1500		S12	51 to 53	24/20	WOH/12"-1/12"			S12: SILT (ML); ~90% nonplastic fines, ~10% fine sand, dark gray, layering, some layers sandier. SLUICED ASH.
	55	S13	53 to 55	24/19	WOH/24"	pH = 7		S13: SILT (ML); Similar to S12. SLUICED ASH.

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700665 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,466 **EASTING (ft):** 1,309,909
GROUND SURFACE EL. (ft): 1551.8 **DATE START/END:** 10/11/2017 - 10/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B122

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
		S14	55 to 57	24/20	WOH/12"-4-6		CLAY-LIKE ALLUVIUM	S14 (0-4"): LEAN CLAY (CL); 90% medium plasticity fines, ~10% fine sand, tab. Mixed sandy clay and ASH. S14 (4"-20"); CLAYEY SAND (SC); ~55% fine sand, ~45% medium plasticity fines, brown.
		S15	57 to 59	24/19	5-7-7-8	Qp = 2.25 tsf		S15: CLAYEY SAND (SC); 53.3% fine sand, 46.7% fines [GRAIN SIZE ANALYSIS], brown with brown-gray areas. LL = 27%, PL = 17%.
	60	S16	59 to 61	24/16	2-3-3-3			S16: SANDY LEAN CLAY (CL); ~60% fines, ~40% fine sand, brown-tan mottling, a little coarse sand in some areas. LL = 30%, PL = 18%.
1490		S17	61 to 63	24/18	2-2-3-3	Qp = 0.75 tsf		S17: CLAYEY SAND (SC); ~55% fine sand, ~45% medium plasticity fines, brown.
		S18	63 to 65	24/22	1-1-2-3	Qp = 1.5 tsf		S18: SANDY LEAN CLAY (CL); ~60% medium plasticity fines, ~40% fine sand, tan, some fine gravel on tip.
	65	S19	65 to 67	24/13	WOH-15-26-21	Significant drill chatter		S19 (0-11"); LEAN CLAY WITH SAND (CL); ~80% medium plasticity fines, ~20% fine sand.
							WEATHERED BEDROCK	S19 (11"-13"): WEATHERED SHALE.
		S20	67 to 69	24/14	19-21-33-33			S20: CLAYEY GRAVEL WITH SAND (GC); ~60% fine to coarse gravel up to 1", ~25% medium plasticity fines, ~15% fine to coarse sand, brown.
	70	S21	69 to 71	24/14	24-17-27-31			S21: CLAYEY GRAVEL WITH SAND (GC); Similar to S20.
		S22	71 to 71	0/0	50/0"		BEDROCK	S22: NO RECOVERY
1480		C1	71.8 to 76.8	60/58	28	min/ft: 3, 3.25, 2.5, 3.25, 1.75		C1: Red SHALE, moderately hard, mostly horizontal joints spaced 0 to 4", moderately weathered.
	75							
		C2	76.8 to 81.8	60/59	42	min/ft: 2, 2.5, 5.75, 2.5, 3.75		C2: Red SHALE, moderately hard, mostly horizontal joints spaced 0 to 6", slightly weathered.
	80							
1470								Bottom of boring at depth 81.8 ft. Drilled with Bio-Bore. Piezometer B122 installed upon completion.
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

BORING INFORMATION

NORTHING (ft): 389,472 | **EASTING (ft):** 1,309,899
GROUND SURFACE EL. (ft): 1551.8 | **DATE START/END:** 10/13/2017 - 10/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD | **DRILLING COMPANY:** Terracon Consultants, Inc.
TOTAL DEPTH (ft): 61.0 | **DRILLER NAME:** W. Duggins
LOGGED BY: M. Perez-Canals | **RIG TYPE:** Acker Renegade Track Rig

BORING

B122U

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** NA/ NA | **CORE BARREL TYPE:** NA
AUGER I.D./O.D.: 3.25 inch / 6.25 inch | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** NA / NA
DRILLING METHOD: Hollow Stem Auger
WATER LEVEL DEPTHS (ft): ▼ 25.3 10/19/2017 10:05 am

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D.= Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140-lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
1550							CLAY CAP	
	5	U1	5.8 to 8.2	29/20	PUSH		STACKED ASH	U1: STACKED ASH. A piece of white woven geotextile was found in the bottom of the sample.
	10	U2	9 to 11	24/27	PUSH		STACKED ASH	U2: STACKED ASH.
1540	15						SLUICED ASH	
1530	20							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,472
GROUND SURFACE EL. (ft): 1551.8
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD

EASTING (ft): 1,309,899
DATE START/END: 10/13/2017 - 10/14/2017
DRILLING COMPANY: Terracon Consultants, Inc.

BORING B122U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	25						SLUICED ASH	
	30							
1520								
	35							
	40							
1510								
	45	U3	44.9 to 46.9	24/24	GUS	pH = 8		U3: SLUICED ASH.
	50							
1500								
	55							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

NORTHING (ft): 389,472 **EASTING (ft):** 1,309,899
GROUND SURFACE EL. (ft): 1551.8 **DATE START/END:** 10/13/2017 - 10/14/2017
VERT./HORIZ. DATUMS: NGVD 1929/GLALHD **DRILLING COMPANY:** Terracon Consultants, Inc.

BORING B122U

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Sample Information: Depth (ft)	Sample Information: Pen./ Rec. (in)	Sample Information: Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Layer Name	Soil and Rock Description
	60	U4	59.1 to 61	23/15	GUS		CLAY-LIKE ALLUVIUM	U4 Top: SANDY LEAN CLAY (CL); ~70% medium plasticity fines, ~30% fine sand, tan-brown.
1490								Bottom of boring at depth 61.01 ft. Piezometer B122U installed upon completion.
	65							
	70							
1480								
	75							
	80							
1470								
	85							

NOTES:

PROJECT NAME: Seismic Stability Evaluation for Ash Landfill and West Pond at Glen Lyn Plant
CITY/STATE: Glen Lyn, Virginia
GEI PROJECT NUMBER: 1700685

GEI Consultants

GEI WOBURN STD 5-NORTH-EAST-LAYER NAME 1700685 GLEN LYN 2017.GPJ 3/1/18

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/8/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUKAS / M. FARREN		
Boring ID:	B101Z		
Sample ID:	UD1		
Top Depth (ft):	20.24		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 37
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.96 %

Drilling Data
Casing I.D.: ~~HSA~~ 4.25 in
Casing Depth: 20.40 ft
Length of Rods and Tooling (*R2*): 5.25 + 2.65 = 28.14 ft
Rod Stickup (*R1*): 7.90 ft
Hole Depth (*R2* - *R1*): 20.24 ft

PENETRATION DATA

Time Tube Pushed: 12:13 Time Tube Pulled: 12:43 Rest Time: 30 min

	Before Push		After Push	
Distance Tube Sticks out from ~~sampler~~ casing:	2.65	ft (*D1*)	0.64	ft (*D2*)
Distance from casing to mark on drill rods:	NA	ft	NA	ft

Discharge pressure: NA - pushed w/ rods psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: no packer

	1	2	3			
Soil before trimming:	Sticking out from bottom of tube			=>	0	mm (Y)
Soil after timming:				=>	0	mm
Packer after trimming:	No Packer → just cap			=>		mm

Trimmings: full USCS
LEAN CLAY with SAND (CL) ~80% low plasticity fines, ~10% fine sand, ~10% fine gravel, brown.

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: full (inverted)

	1	2	3			
Soil before trimming:	139	160	156	=>	152	mm (X)
Soil after leveling:	160	154	156	=>	157	mm
Packer Disc:	CLAY SAMPLE - NM			=>		mm

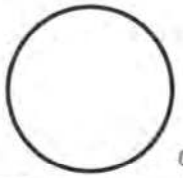
Fluid Above Soil? Y / (N) if Y how much: mm

Trimmings: full USCS
LEAN CLAY (CL); ~90% low plasticity fines, ~10% fine sand, gray.

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 606.6 mm 23.88 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 610 mm 24.02 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: NA % - clay
+ expansion, - compression

Describe condition of cutting edge:



Notes: Sample in clay dike, free push piston

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/8/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENDON
GEI Rep.	WILLIAMS / M. FARREN	**Boring ID:**	B101U
		Sample ID:	U2
		Top Depth (ft):	52.21

PRE SAMPLING INFORMATION

Tube Data
Tube No: 9
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.96 %

Drilling Data
Casing I.D.: 4.25 (HSA) in
Casing Depth: 52.50 ft
Length of Rods and Tooling (*R2*): 5572.5+.64 58.14 ft
Rod Stickup (*R1*): 5.93 ft
Hole Depth (*R2* - *R1*): 52.21 ft 3.15

PENETRATION DATA

Time Tube Pushed: 1407 Time Tube Pulled: 1427 Rest Time: 20

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.78	ft (*D1*)	0.74	ft (*D2*)
Distance from casing to mark on drill rods:	NA	ft	NA	ft

Discharge pressure: NA psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	8	14	13	=>	11.7	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS
SANDY LEAN CLAY
~40% low plasticity fines
~30% fine sand
brown

Top of Tube

Distance from ~~bottom~~ TOP of tube to: Top Packer Type: full (inverted)

	1	2	3			
Soil before trimming:	97	100	98	=>	98	mm (*X*)
Soil after leveling:	114	114	118	=>	115	mm
Packer Disc:	NM			=>		mm
Fluid Above Soil?	(Y) / N	~62mm if Y how much:			36	mm

Trimmings: full USCS
SANDY LEAN CLAY
~40% low plasticity fines
~30% fine sand
brown

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 622 mm 24.48 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 652 mm 25.7 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:
Good

Notes: Free push, fondation clay
Testing free push above Osterberg depth.
Full head on hole

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/8/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUCAS		
Boring ID:	B10U		
Sample ID:	U3		
Top Depth (ft):	55.0		

PRE SAMPLING INFORMATION

Tube Data
- Tube No: G7
- Tube Length (*L*): 36 in
- Tube O.D.: 3.0 in
- Clearance Ratio (CR) 0.3 %

Drilling Data
- Casing I.D.: 4.25 in
- Casing Depth: ~55 ft
- Length of Rods and Tooling (*R2*): 58.80 ft
- Rod Stickup (*R1*): 3.80 ft
- Hole Depth (*R2* - *R1*): 55.00 ft

PENETRATION DATA

Time Tube Pushed: 1544 Time Tube Pulled: 1614 Rest Time: 30

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.49	ft (*D1*)	2.53	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft 2.01

Discharge pressure: 190 psi for x / minute

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	~8			=>	~8	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

SANDY LEAN CLAY
~55% low plasticity fines
~45% sand, dark brown

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: full (unvented)

	1	2	3			
Soil before trimming:	0.95'	0.85'	0.96'	=>	291	mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / (N) if Y how much: mm

Trimmings: full USCS

SANDY LEAN CLAY
~70% low plasticity fines
~30% widely graded sand, brown

PENETRATION AND RECOVERY

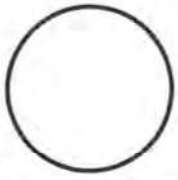
Penetration, $P = D2 - D1$: 622 mm 24.48 in

~~Gross~~ NET Recovery, $R = L-X-Y$: 615 mm 24.2 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ % + expansion, - compression

Describe condition of cutting edge:

Good



Notes:

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/18/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Perez - Conrad		
Boring ID:	B103		
Sample ID:	U1		
Top Depth (ft):	29		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 83
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.4 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 23.38 ft
Length of Rods and Tooling (*R2*): 32.9, 35.72 ft
Rod Stickup (*R1*): 4, 29.02 ft
Hole Depth (*R2* - *R1*): 28.9, 29.02 ft

PENETRATION DATA

5.72' - sampler

Time Tube Pushed: 8:29 Time Tube Pulled: 9:09 Rest Time: 40 min.
34s

	Before Push		After Push	
Distance Tube Sticks out from sampler:	.07	ft (*D1*)	2.07	ft (*D2*)
Distance from casing to mark on drill rods:	3.19	ft	3.20	ft

Discharge pressure: 50 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Vented Cap only

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (Y)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Trimmings: full USCS
ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: half vented packer

	1	2	3			
Soil before trimming:	151	150	151	=>	151	mm (X)
Soil after leveling:	—	—	—	=>		mm
Packer Disc:	144	145	144	=>	144	mm

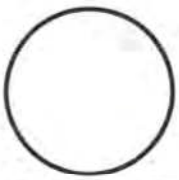
Fluid Above Soil? Y / N if Y how much: mm

Trimmings: full USCS
ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 609.6 mm 24.0 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 611 mm 24.06 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: +0.23~~ %
+ expansion, - compression

Describe condition of cutting edge:



Notes:

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/18/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Daggins
GEI Rep.	M. Perez - Canals		
Boring ID:	B103		
Sample ID:	U2		
Top Depth (ft):	31.5		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 93
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.44 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 23.38 ft
Length of Rods and Tooling (*R2*): 35.9, 37.74 ft
Rod Stickup (*R1*): 4.4', 6.2 ft
Hole Depth (*R2* - *R1*): 31.5, 31.54 ft

Sampler = 5.74'

PENETRATION DATA

Time Tube Pushed: 9:42 Time Tube Pulled: 10:24 Rest Time: _____
2/5

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	1.26	ft (*D2*)
Distance from casing to mark on drill rods:	2.69	ft	2.69	ft

Discharge pressure: 45 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Trimmings: full USCS
ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: half Packer

	1	2	3			
Soil before trimming:	15.6"	15.6"	15.6"	=>	15.6"	mm (*X*)
Soil after leveling:	—	—	—	=>	—	mm too low to measure w mm ruler
Packer Disc:	15.24"	15.24"	15.24"	=>	15.24"	mm

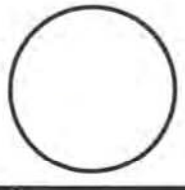
Fluid Above Soil? Y / N if Y how much: 15.6" mm

Trimmings: full USCS
ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: — mm 14.28 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: — mm 14.4 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: 0.84~~ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: Stopped push because we got water return, but GUS was not fully extended when we got it out.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/18/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M Perez-Canals		
Boring ID:	103		
Sample ID:	U3		
Top Depth (ft):	45.8		

S = 5.73'

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 61
- Tube Length (*L*): 30 in
- Tube O.D.: 3" in
- Clearance Ratio (CR) 0.76 %

Drilling Data
- Casing I.D.: 4" in
- Casing Depth: 23.38 ft
- Hole Depth (*R2* - *R1*): 45.82, 45.94 ft
- Length of Rods and Tooling (*R2*): 50.9, 50.73 ft
- Rod Stickup (*R1*): 5.08, 4.79 ft

PENETRATION DATA

Time Tube Pushed: 12:02 (58°) Time Tube Pulled: 12:32 Rest Time: 30

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	0.89	ft (*D2*)
Distance from casing to mark on drill rods:	1.27	ft	1.27	ft

Discharge pressure: 300 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3		
Soil before trimming:	0	0	0	=>	0 mm (*Y*)
Soil after timming:	—	—	—	=>	_____ mm
Packer after trimming:	—	—	—	=>	_____ mm

Trimmings: full USCS: SC

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full Packer

	1	2	3		
Soil before trimming:	20.04"	20.04"	20.04"	=>	20.04" mm (*X*)
Soil after leveling:	—	—	—	=>	_____ mm
Packer Disc:	_____	_____	_____	=>	_____ mm

to deep to measure w/ mm ruler

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS:

PENETRATION AND RECOVERY

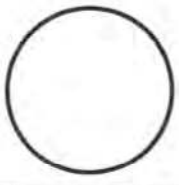
Penetration, *P* = *D2* - *D1*: _____ mm 9.84 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 9.96 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: 1.31 %~~

\+ expansion, - compression

Describe condition of cutting edge:



Notes: Stopped without water return because pressure got too high. Did not get full push

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/16/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	Willie Duggins
GEI Rep.	M. Pierce-Canals		
Boring ID:	B105U		
Sample ID:	U1		
Top Depth (ft):	25'		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 89
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.3 %

Drilling Data
Casing I.D.: 4 in
Casing Depth: 18.45 ft
Length of Rods and Tooling (*R2*): 25.9 ft 28.23
Rod Stickup (*R1*): 2.9 ft 5.23
Hole Depth (*R2* - *R1*): 23 ft

PENETRATION DATA

Time Tube Pushed: 11:18 Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.065	ft (*D1*)	2.1	ft (*D2*)
Distance from casing to mark on drill rods:	1.63	ft	1.63	ft

Discharge pressure: 60 psi 10s

Sample Started failing

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	~10 in	~10 in	~10 in	=>	_____	mm (*Y*)
Soil after timming:				=>	_____	mm
Packer after trimming:				=>	_____	mm

Trimmings: full USCS
ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:	14.1	13.8	14.1	=>	_____	mm (*X*)
Soil after leveling:	no leveling			=>	_____	mm
Packer Disc:	13.3	13.0	13.2	=>	_____	mm

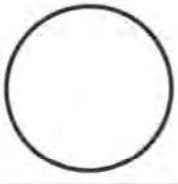
Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS
ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm _____ in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: Sample slid down because we did not put packer in far enough, I jared sample.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/15/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M P-C		
Boring ID:	B105U		
Sample ID:	U2		
Top Depth (ft):	35		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 80
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.32 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 28.1 ft
Length of Rods and Tooling (*R2*): 38.4, 39.76 ft
Rod Stickup (*R1*): 3.35, 4.7 ft
Hole Depth (*R2* - *R1*): 35.05, 35.06 ft

Tube + Sampler 5.76

PENETRATION DATA

Time Tube Pushed: 12:43 Time Tube Pulled: _____ Rest Time: _____

25 s

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.065	ft (*D1*)		ft (*D2*)
Distance from casing to mark on drill rods:	1.04	ft	1.04	ft

Discharge pressure: 60 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

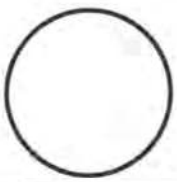
Penetration, *P* = *D2* - *D1*: _____ mm _____ in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Sample fell out of the tube. We placed cap but did not tape it.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/16/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Daggins
GEI Rep.	M. Pina Canals	**Boring ID:**	B105A
		Sample ID:	U3
		Top Depth (ft):	37.5

PRE SAMPLING INFORMATION

Tube Data
Tube No: 90
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) .34 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 28.1 ft
Length of Rods and Tooling (*R2*): 40.9, 43.26 ft
Rod Stickup (*R1*): 3.3, 5.6 ft
Hole Depth (*R2* - *R1*): 37.6, 37.66 ft

PENETRATION DATA

Time Tube Pushed: 1:45 Time Tube Pulled: 2:15 Rest Time: 30
24 s

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.065	ft (*D1*)	2.07	ft (*D2*)
Distance from casing to mark on drill rods:	1.96	ft	1.96	ft

Discharge pressure: 80 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	~19.9	19.9	19.8	=>	~199	mm (Y)
Soil after timming:				=>		mm
Packer after trimming:	21.3	21.3	21.2	=>	213	mm

Packer = 1.40cm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:	15.1	15.1	15.2	=>	151	mm (X)
Soil after leveling:	NA	NA	NA	=>		mm
Packer Disc:	14.3	14.5	14.2	=>	143	mm

Fluid Above Soil? Y (N) if Y how much: _____ mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

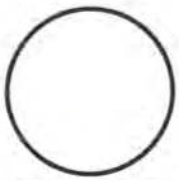
Penetration, *P* = *D2* - *D1*: 611 mm 24.06 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 322 mm 12.68 in

~~$\Delta V/V = [(R/P)(1+CR/100^2) - 1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Soil probably fell of the tube.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date:

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Perez - Canals	**Boring ID:**	105U
		Sample ID:	U4
		Top Depth (ft):	41

PRE SAMPLING INFORMATION

Tube Data
Tube No: 8
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.36 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 28.1 ft
Length of Rods and Tooling (*R2*): 45.9, 45.76 ft
Rod Stickup (*R1*): 4.9, 4.25 ft
Hole Depth (*R2 - R1*): 41, 41.01 ft

PENETRATION DATA

Time Tube Pushed: 3:00 Time Tube Pulled: 3:30 Rest Time: 30 min.
29s

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	2.06	ft (*D2*)
Distance from casing to mark on drill rods:	1.10	ft	1.2	ft

Discharge pressure: 120 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: No Packer just cap

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>		mm
Packer after trimming:	—	—	—	=>		mm

Trimmings: full USCS
ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: half vented

	1	2	3			
Soil before trimming:	14.9	14.9	4.8	=>	149	mm (*X*)
Soil after leveling:	—	—	—	=>		mm
Packer Disc:	13.8	14.0	14.0	=>	140	mm

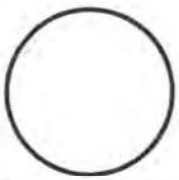
Fluid Above Soil? Y / N if Y how much: mm

Trimmings: full USCS
ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 607 mm 23.88 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 613 mm 24.13 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: 0.99~~ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: Soil was coming out the bottom, put a cap and had to duck tape it

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/17/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	
GEI Rep.		**Boring ID:**	105U
		Sample ID:	U5
		Top Depth (ft):	55.2

PRE SAMPLING INFORMATION

Tube Data
Tube No: 60
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.65 %

Drilling Data
Casing I.D.: 4 in
Casing Depth: 52.94 ft
Length of Rods and Tooling (*R2*): 58.4 60.75 ft
Rod Stickup (*R1*): 3.35 5.55 ft
Hole Depth (*R2* - *R1*): 55.05, 55.2 ft

5.75 sampler

PENETRATION DATA

Time Tube Pushed: 9:03 Time Tube Pulled: 9:33 Rest Time: 30 mins.
31⁵

	Before Push		After Push	
Distance Tube Sticks out from sampler:	.07	ft (*D1*)	1.28	ft (*D2*)
Distance from casing to mark on drill rods:	1.90	ft	1.90	ft

Discharge pressure: 120 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Taped yellow

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (Y)
Soil after timming:	NA	NA	NA	=>		mm
Packer after trimming:	NA	NA	NA	=>		mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full packer

	1	2	3			
Soil before trimming:	25.6	25.5	25.5	=>	255	mm (X)
Soil after leveling:	NA	NA	NA	=>	NA	mm
Packer Disc:	24.1	23.9	24.1	=>	240	mm

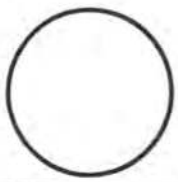
Fluid Above Soil? (Y) / N if Y how much: 255 mm

Trimmings: full USCS

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 369 mm 14.52 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 507 mm 19.96 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: Stopped push because we had water return, but when we removed sampler there was only a partial push. The amount of soil measured and the GUS Sampler stickout do not match.

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/20/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	K. PENTON
GEI Rep.	W. LUKAS	**Boring ID:**	B108
		Sample ID:	U1
		Top Depth (ft):	~24'

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 69
- Tube Length (*L*): 30 in
- Tube O.D.: 3.0 in
- Clearance Ratio (CR): 0.41 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 23.96 ft
- Length of Rods and Tooling (*R2*): 28.14 ft (+0.62 +2.5)
- Rod Stickup (*R1*): 4.37 ft (1.37 +0.25 +2.75)
- Hole Depth (*R2* - *R1*): 23.77 ft

PENETRATION DATA

Time Tube Pushed: 1548 Time Tube Pulled: 1608 Rest Time: 20

	Before Push	After Push
Distance Tube Sticks out from sampler:	2.75 ft (*D1*)	0.76 ft (*D2*)
Distance from casing to mark on drill rods:	ft	ft
Discharge pressure: ____ psi		

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	/		/	=>	~3	mm (*Y*)
Soil after timming:	/			=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS: Not checked

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Half

	1	2	3			
Soil before trimming:	10.5	11.5	12.4	=>	115	mm (*X*)
Soil after leveling:	121	122	119	=>	121	mm
Packer Disc:	112	111	107	=>	111	mm

Fluid Above Soil? Y / (N) if Y how much: ____ mm

Trimmings: full USCS: STACKED ASTI ~80% m-f, ~20% f-c sand, dark, moist

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 607 mm 23.9 in

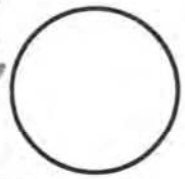
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 644 mm 25.4 in

~~$\Delta V/V = [(R/P)(1+CR/100^2) - 1] \times 100$: 6.3 %~~

\+ expansion, - compression

Describe condition of cutting edge:

Dented with lots of small cuts



Notes: Tough pushing.

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/20/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUCAS	**Boring ID:**	B108
		Sample ID:	UT
		Top Depth (ft):	~34'

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 70
- Tube Length (*L*): 30 in
- Tube O.D.: 30 in
- Clearance Ratio (CR): 0.48 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: ~~23.96~~ 0.33 ft
- Hole Depth (*R2* - *R1*): 33.92 ft
- Length of Rods and Tooling (*R2*): 38.14 +0.64+2.5 ft
- Rod Stickup (*R1*): 4.22 ~~4.37~~ 0.25 ft

PENETRATION DATA

Time Tube Pushed: 1640 Time Tube Pulled: 1700 Rest Time: 20

	Before Push	After Push
Distance Tube Sticks out from sampler:	2.60 ft (*D1*)	1.08 ft (*D2*)
Distance from casing to mark on drill rods:	– ft	– ft
Discharge pressure: – psi		

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3		
Soil before trimming:				=>	~3 mm (*Y*)
Soil after timming:	–	–	–	=>	– mm
Packer after trimming:	–	–	–	=>	– mm

Trimmings: full USCS: Not checked

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Half

	1	2	3		
Soil before trimming:	200	205	215	=>	207 mm (*X*)
Soil after leveling:	225	226	225	=>	225 mm
Packer Disc:	215	217	215	=>	215 mm

Fluid Above Soil? Y / (N) if Y how much: ___ mm

Trimmings: full USCS: STACKED ASH: ~70% npf ~20% f-c sand ~10% fine gravel

PENETRATION AND RECOVERY

Penetration, $P = D2 - D1$: 463 mm 18.2 in

~~Gross~~ NET Recovery, $R = L - X - Y$: 552 mm 21.7 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: 19.2 %~~

+ expansion, - compression

Describe condition of cutting edge:



Some small dents streaking along length of tube

Notes:

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/22/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W Duggins
GEI Rep.	M. Ross Carroll		
Boring ID:	B109U		
Sample ID:	U1		
Top Depth (ft):	14.3		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 74
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.41 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 7.47 ft
Length of Rods and Tooling (*R2*): 17.9, 18.76 ft
Rod Stickup (*R1*): 3.6, 4.82 ft
Hole Depth (*R2* - *R1*): 14.3, 13.94 ft

PENETRATION DATA

Sampler 5.76'

Time Tube Pushed: 11:03 Time Tube Pulled: 11:26 Rest Time: 23

395

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.06	ft (*D1*)	2.06	ft (*D2*)
Distance from casing to mark on drill rods:	0.026	ft	2.026	ft

Discharge pressure: 300 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full pack

	1	2	3			
Soil before trimming:	299	297	296	=>	297	mm (*Y*)
Soil after timming:	—	—	—	=>		mm
Packer after trimming:	292	292	293	=>	292	mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: half pack

	1	2	3			
Soil before trimming:	165	179	189	=>	178	mm (*X*)
Soil after leveling:	192	192	194	=>	193	mm
Packer Disc:	186	184	185	=>	185	mm

Fluid Above Soil? Y / (N) if Y how much: ____ mm

Trimmings: full USCS

CL

PENETRATION AND RECOVERY

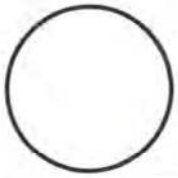
Penetration, $P = D2 - D1$: 610 mm 24.0 in

~~Gross~~ NET Recovery, $R = L-X-Y$: 272 mm 10.71 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ ____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Stopped push because it reached max safe pressure.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date:

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. DUGGINS
GEI Rep.	M. PEREZ-CANALS		
Boring ID:	B109U		
Sample ID:	U2		
Top Depth (ft):	24		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 72
Tube Length (*L*): _____ in
Tube O.D.: _____ in
Clearance Ratio (CR) .48 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 7.47 ft
Length of Rods and Tooling (*R2*): 279, 28.76 ft
Rod Stickup (*R1*): 3.69, 4.50 ft
Hole Depth (*R2* - *R1*): 24.24, 24.26 ft

PENETRATION DATA

Time Tube Pushed: 12:04 Time Tube Pulled: 12:30 Rest Time: _____
37'

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.05	ft (*D1*)	2.05	ft (*D2*)
Distance from casing to mark on drill rods:	.54	ft	0.56	ft

Discharge pressure: _____ psi Pressure gauge not working

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3		
Soil before trimming:	18"	18"	18"	=>	_____ mm (*Y*)
Soil after timming:				=>	_____ mm
Packer after trimming:				=>	_____ mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3		
Soil before trimming:				=>	_____ mm (*X*)
Soil after leveling:				=>	_____ mm
Packer Disc:				=>	_____ mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

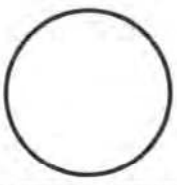
Penetration, *P* = *D2* - *D1*: _____ mm _____ in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: _____ %~~

+ expansion, - compression

Describe condition of cutting edge:



Notes: Sample was disturbed, when we removed it from the CUS the top was disturbed. I jared the sample.

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/27/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	M. Doggett
GEI Rep.	M. Perez Canals		
Boring ID:	109U		
Sample ID:	U3		
Top Depth (ft):	27		

DirectPush - 3.46

PRE SAMPLING INFORMATION

Tube Data
Tube No: 69
Tube Length (*L*): 36 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.3 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 23.45 ft
Length of Rods and Tooling (*R2*): 309, 33.46 ft
Rod Stickup (*R1*): 3.55, 6.05 ft
Hole Depth (*R2* - *R1*): 2235, 27.41' ft

PENETRATION DATA

Time Tube Pushed: 9:04 Time Tube Pulled: 9:25 Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	—	ft (*D1*)	—	ft (*D2*)
Distance from casing to mark on drill rods:	3.46	ft	1.96	ft

Discharge pressure: 8940 ~~psi~~ lbs

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	0	0	0	=>	_____	mm (*Y*)
Soil after timming:	_____	_____	_____	=>	_____	mm
Packer after trimming:	_____	_____	_____	=>	_____	mm

Trimmings: full USCS: Ash

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:	1.5'	1.56'	1.56'	=>	18.48 in ~~mm~~	(*X*)
Soil after leveling:	—	—	—	=>	_____	mm
Packer Disc:	1.38'	1.37'	1.37'	=>	_____	mm

Fluid Above Soil? (Y) / N if Y how much: 18.48 in ~~mm~~

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

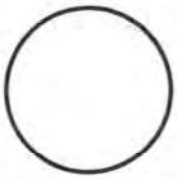
Penetration, *P* = *D2* - *D1*: _____ mm 18 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 11.52 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ _____ %

\+ expansion, - compression

Describe condition of cutting edge:



Notes: Stopped pushing because the load was to high and could crush the tube. The top of the tube was filled with water

GEI Consultants

$\sigma^2_{0.4}$

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/27/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Perez Canals	**Boring ID:**	109U
		Sample ID:	U4
		Top Depth (ft):	45'

GUS-576

PRE SAMPLING INFORMATION

Tube Data
Tube No: 75
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.37 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 23.45 ft
Length of Rods and Tooling (*R2*): 50.9, 50.76 ft
Rod Stickup (*R1*): 5.61, 5.45 ft
Hole Depth (*R2* - *R1*): 45.29, 45.31 ft

PENETRATION DATA

Time Tube Pushed: 10:14 Time Tube Pulled: 11:05 Rest Time: _____
50s

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	2.07	ft (*D2*)
Distance from casing to mark on drill rods:	1.57	ft	1.57	ft

Discharge pressure: 200 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full vented

	1	2	3			
Soil before trimming:	178	172	172	=>	174	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:	193	187	187	=>	189	mm

Trimmings: full USCS
ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:	150	149	147	=>	149	mm (*X*)
Soil after leveling:	—	—	—	=>		mm
Packer Disc:	136	138	140	=>	138	mm

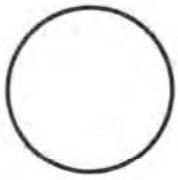
Fluid Above Soil? Y / N (N circled) if Y how much: _____ mm

Trimmings: full USCS
ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 610 mm 24 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 439 mm 17.3 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: The bottom of the ash was not flush and I put packer quickly without doing exact measurement. To get bottom of soil measurement I substructed the packer thickness.

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/27/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. DUGGINS
GEI Rep.	M. PEREZ-CANALS		
Boring ID:	B109U		
Sample ID:	U5		
Top Depth (ft):	60		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 52
Tube Length (*L*): 36 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.4 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 58.38 ft
Length of Rods and Tooling (*R2*): 63.4, 63.67 ft
Rod Stickup (*R1*): 3.25, 3.52 ft
Hole Depth (*R2* - *R1*): 60.15, 60.15 ft

OST - 3.67

PENETRATION DATA

Time Tube Pushed: 1:07 (445) Time Tube Pulled: 1:50 Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.47	ft (*D1*)	2.96	ft (*D2*)
Distance from casing to mark on drill rods:	2.03	ft	2.02	ft

Discharge pressure: 145 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full vented

	1	2	3			
Soil before trimming:	~110	~110	~110	=>	110	mm (Y)
Soil after timming:				=>		mm
Packer after trimming:	91	95	95	=>	94	mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Poly vented

	1	2	3			
Soil before trimming:	130	129	131	=>	130	mm (X)
Soil after leveling:				=>		mm
Packer Disc:	126	124	126	=>	125	mm

Fluid Above Soil? Y / (N) if Y how much: _____ mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

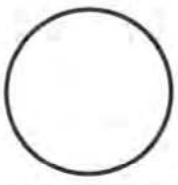
Penetration, *P* = *D2* - *D1*: 759.5 mm 29.9 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 679.4 mm 26.7 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes:

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/27/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W Duggan
GEI Rep.	M. Perez Canals		
Boring ID:	109U		
Sample ID:	U6		
Top Depth (ft):	68.5		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 68
Tube Length (*L*): 36 in
Tube O.D.: 3" in
Clearance Ratio (CR) .3 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 68.01 ft
Length of Rods and Tooling (*R2*): 72.9, 73.66 ft
Rod Stickup (*R1*): 4.31, 5.1 ft
Hole Depth (*R2* - *R1*): 68.59, 68.56 ft

OST - 3.66'

PENETRATION DATA

Time Tube Pushed: 3:15 (32s) Time Tube Pulled: 4:02 Rest Time: 47 min

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.47	ft (*D1*)	2.96	ft (*D2*)
Distance from casing to mark on drill rods:	1.16	ft	1.16	ft

Discharge pressure: 135 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full vented

	1	2	3			
Soil before trimming:	~23"	~23"	~23"	=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:	~21"	~21"	~21"	=>		mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type:

	1	2	3			
Soil before trimming:	150	150	151	=>	150	mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:	141	142	142	=>		mm

Fluid Above Soil? Y / N if Y how much: mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: mm 29.9 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: mm 7.1 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Last 4 in of soil the driller measured ~23" from bottom, the packer was placed at 21" because it was the most we could go w/our tools, probably disturbed.

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/27/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggin
GEI Rep.	M. Penn Canals		
Boring ID:	B109U		
Sample ID:	U7		
Top Depth (ft):	72.3		

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 46
- Tube Length (*L*): 36 in
- Tube O.D.: 3 in
- Clearance Ratio (CR): 0.4 %

Drilling Data
- Casing I.D.: 4" in
- Casing Depth: 68.01 ft
- Hole Depth (*R2* - *R1*): 72.32, 72.35 ft
- Length of Rods and Tooling (*R2*): 75.9, 76.6 ft
- Rod Stickup (*R1*): 3.58, 4.31 ft

OST - 3.66

PENETRATION DATA

Time Tube Pushed: 4:51 (35s) Time Tube Pulled: 5:44 Rest Time: 53 min

	Before Push		After Push	
Distance Tube Sticks out from sampler:	.43	ft (*D1*)	2.97	ft (*D2*)
Distance from casing to mark on drill rods:	2.39	ft	2.38	ft

Discharge pressure: 215 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	50	50	50	=>	_____	mm (*Y*)
Soil after timming:				=>	_____	mm
Packer after trimming:	40	40	40	=>	_____	mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:	150	149	149	=>	_____	mm (*X*)
Soil after leveling:				=>	_____	mm
Packer Disc:				=>	_____	mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

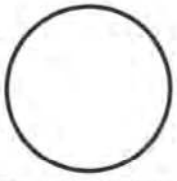
Penetration, *P* = *D2* - *D1*: _____ mm 29.9 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 29.1 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Got good recovery but did not tape cap before removing vacuum. Sample slid of bottom. Kept tube but it's disturbed.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 9/28/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M Perez Canals		
Boring ID:	B-109U		
Sample ID:	U8		
Top Depth (ft):	77.3		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 79
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.75 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 68.01 ft
Length of Rods and Tooling (*R2*): 80.9, 82.72 ft
Rod Stickup (*R1*): 3.62, 5.45 ft
Hole Depth (*R2* - *R1*): 77.28, 77.27 ft

GUS - 5.72

PENETRATION DATA

Time Tube Pushed: 8:27 44s Time Tube Pulled: 8:58 Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.08	ft (*D1*)	0.21	ft (*D2*)
Distance from casing to mark on drill rods:	1.54	ft	1.54	ft

Discharge pressure: 150 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: 1 2 3 Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS
No Recovery

Top of Tube

Distance from ~~bottom~~ top of tube to: 1 2 3 Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS
No Recovery

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm 1.56 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 0 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: We got water return but sampler did not extend. It vents when pressure is too high.

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date:

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Ruiz-Camilo		
Boring ID:	B-109U		
Sample ID:	U9		
Top Depth (ft):	80.3		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 57
Tube Length (*L*): 36 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.4 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 68.01 ft
Length of Rods and Tooling (*R2*): 83.4, 86.15 ft
Rod Stickup (*R1*): 3.14, 6.25 ft
Hole Depth (*R2* - *R1*): 80.26, 79.9 ft

OST - 3.65

PENETRATION DATA

Time Tube Pushed: 10:55 (44") Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.47	ft (*D1*)	2.97	ft (*D2*)
Distance from casing to mark on drill rods:	2.32	ft	2.31	ft

Discharge pressure: 250 psi Should have pressure

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: 1 2 3 Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS: No Recovery

Top of Tube

Distance from ~~bottom~~ top of tube to: 1 2 3 Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS: No Recovery

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm 28.6 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 0 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: The osterberg was stuck in gravel 0.36 above bottom of hole. We decided to push anyway. Got no recovery and tube was dented.

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/14/17

Project	Glen Lyn Ash Landfill and West Pond			**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP	**Boring ID:**	B1102
Contractor	Terracon	**Driller**	C. Benton	**Sample ID:**	U1-A
GEI Rep.	W. Lukes			**Top Depth (ft):**	~15'

PRE SAMPLING INFORMATION

Tube Data
Tube No: 39
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.96 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 14.97 ft (15' - 0.28' + 0.46')
Hole Depth (*R2* - *R1*): 14.86 ft

Length of Rods and Tooling (*R2*): 20' + 0.64' (adapter tube) + 2.5' = 23.14 ft
Rod Stickup (*R1*): 5.68 + 2.6 = -8.78 ft

PENETRATION DATA

Time Tube Pushed: 1554 Time Tube Pulled: 1610 Rest Time: 16

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.60	ft (*D1*)	0.68	ft (*D2*)
Distance from casing to mark on drill rods:	NA	ft	NA	ft

Discharge pressure: NA psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm _____ in

~~Gross~~ NET Recovery, *R* = *L* -*X*-*Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ _____ %

+ expansion, - compression

Describe condition of cutting edge:

Big dent and rip in side



Notes: ~~Free~~ Push in clay part of dike
- Rig lifted during push

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/14/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. Lucas	**Boring ID:**	B110U
		Sample ID:	TU1-B
		Top Depth (ft):	~17.5'

PRE SAMPLING INFORMATION

Tube Data
Tube No: 5
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.82 %

Drilling Data
Casing I.D.: ~~NSA~~ 4.25 in
Casing Depth: 17.43 ft
Length of Rods and Tooling (*R2*): 20+0.64+2.5 = 23.14 ft
Rod Stickup (*R1*): 3.22+2.63 5.85 ft
Hole Depth (*R2* - *R1*): 17.29 ft

PENETRATION DATA

Time Tube Pushed: 1625 Time Tube Pulled: 1645 Rest Time: 20 m

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.63	ft (*D1*)	1.41	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3		
Soil before trimming:				=>	mm (*Y*)
Soil after timming:				=>	mm
Packer after trimming:				=>	mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3		
Soil before trimming:				=>	mm (*X*)
Soil after leveling:				=>	mm
Packer Disc:				=>	mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

75% mpl, 20% f-c sand, 5% gravel, brown, moist

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm _____ in 1.22'

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Free Push
- Difficult push, stopped @1.22'
- Twisted metal cable and gravel @ bottom of tube

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/15/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. Lukas		
Boring ID:	B1102		
Sample ID:	U2		
Top Depth (ft):	~34'		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 7
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.89 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 33.74 ft
35+0.64 -1.92+0.22
Hole Depth (*R2* - *R1*): 33.61 ft

Length of Rods and Tooling (*R2*): 35+0.64+2.5 = 38.14 ft
Rod Stickup (*R1*): 1.92+2.61 4.53 ft

PENETRATION DATA

Time Tube Pushed: 823 Time Tube Pulled: 842 Rest Time: 19

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.61	ft (*D1*)	1.99	ft (*D2*) → 0.62
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

SANDY LEAN CLAY
~70% fines, ~25% f-c sand, ~5% gravel
brown, wet

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm _____ in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: - Rig lifted after 0.62' of push.
~1" of recovery

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/15/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. Lukas		
Boring ID:	B110U		
Sample ID:	U2-A		
Top Depth (ft):	~36		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 78
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.4 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 36.34 ft
Length of Rods and Tooling (*R2*): 40+0.64+2.5 = 43.14 ft
Rod Stickup (*R1*): 4.31+2.51 6.82 ft
Hole Depth (*R2* - *R1*): 36.32 ft

PENETRATION DATA

Time Tube Pushed: 852 Time Tube Pulled: 915 Rest Time: 23 min

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.51	ft (*D1*)	1.66	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	~0			=>	0	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS
Not tested

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: FULL

	1	2	3			
Soil before trimming:	~1.55			=>	472	mm (*X*)
Soil after leveling:	1.58	1.56	1.58	=>	482	mm
Packer Disc:				=>		mm

Fluid Above Soil? (Y) / N if Y how much: 396 mm ~1.3'

Trimmings: full USCS
SANDY LEAN CLAY: ~60% fines, ~40% fine sand, light brown, wet

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 259 mm 10.2 in 0.85'
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 290 mm 11.4 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:
Small dent



Notes: - Free Push
- Tube stopped @10.2"

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/15/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C Penton
GEI Rep.	W. Lukas	**Boring ID:**	B110U
		Sample ID:	U3
		Top Depth (ft):	~52

PRE SAMPLING INFORMATION

Tube Data
Tube No: 6
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.88 %

Drilling Data
Casing I.D.: ~~HSA~~ 4.25 in
Casing Depth: 52.11 ft
3.54 - 0.26
Hole Depth (*R2* - *R1*): 52.09 ft
Length of Rods and Tooling (*R2*): 55 + 0.64 + 2.5 = 58.14 ft
Rod Stickup (*R1*): 3.54 + 2.51 = 6.05 ft

PENETRATION DATA

Time Tube Pushed: 959 Time Tube Pulled: 1025 Rest Time: 26

	Before Push	After Push
Distance Tube Sticks out from sampler:	2.51 ft (*D1*)	0.45 ft (*D2*)
Distance from casing to mark on drill rods:	ft	ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full

	1	2	3			
Soil before trimming:	0.27	0.25	0.25	=>	76	mm (*Y*)
Soil after timming:	Same as above			=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS
Same as top

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	~1.15			=>	351	mm (*X*)
Soil after leveling:	1.21	1.19	1.21	=>	369	mm
Packer Disc:				=>		mm

Fluid Above Soil? (Y) / N if Y how much: _____ mm

Trimmings: full USCS
CLAYEY SAND: ~60% fm sand ~35% lpf brown, ~5% gravel wet

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 628 mm 24.7 in 2.06'
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 335 mm 13.2 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ _____ %
+ expansion, - compression

Describe condition of cutting edge:
Good

Notes: - Free push
- Good pish, able to go 2'

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~~GUS~~/Osterberg Tube Sample Record

Date: 9/15/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. WILKES	**Boring ID:**	B1104
		Sample ID:	U4
		Top Depth (ft):	~58

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 59
- Tube Length (*L*): 30 in
- Tube O.D.: 3.0 in
- Clearance Ratio (CR) 0.4% %

Drilling Data
- Casing I.D.: 4.25 in
- Casing Depth: 58.70 ft
- Length of Rods and Tooling (*R2*): 60+3.8' = 63.8' ft
- Rod Stickup (*R1*): 1.95+3.76=5.71 ft
- Hole Depth (*R2* - *R1*): 58.09 ft

PENETRATION DATA

Time Tube Pushed: 1108 Time Tube Pulled: 1139 Rest Time: 31 min

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.43	ft (*D1*)	2.45	ft (*D2*)
Distance from casing to mark on drill rods:	3.76	ft	3.76	ft

Discharge pressure: 180 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	10.05			=>	15	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

CLAYEY SAND: ~60% f-c sand, ~35% mpt, ~5% gravel, dark brown, wet

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	0.81	0.81	0.81	=>	247	mm (*X*)
Soil after leveling:	0.88	0.88	0.86	=>	268	mm
Packer Disc:				=>		mm

Fluid Above Soil? (Y) / N if Y how much: mm

Trimmings: full USCS

SILTY SAND: ~60% f-m sand, ~40% lpf, brown, wet

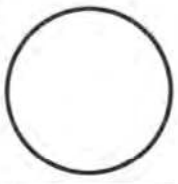
PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 616 mm 24.2' in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 500 mm 19.7 in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~ % + expansion, - compression

Describe condition of cutting edge: Good



Notes:

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HSA LENGTH : 15' +2"
ROD LENGTH : 15'

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/4/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	S. GIAMPA	**Boring ID:**	B110 U-A
		Sample ID:	U1
		Top Depth (ft):	14

PRE SAMPLING INFORMATION (PUSH)

Tube Data
- Tube No: 50
- Tube Length (*L*): 36 in
- Tube O.D.: 3 in
- Clearance Ratio (CR) 0.4 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 13.48 ft
- CASING STICKUP: 1.69 FT
- Hole Depth (*R2* - *R1*): 13.66, 15.90 ft (LENGTH OF TUBE + BIT ATTACH: 3.65 FT)

Length of Rods and
- Tooling (*R2*): 18.65 ft
- Rod Stickup (*R1*): 4.99, 2.75 ft

PENETRATION DATA

Time Tube Pushed: 0823 Time Tube Pulled: 0843 Rest Time: ____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.5	ft (*D1*)	0.15	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft	—	ft

Discharge pressure: ~1000 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: ____

	1	2	3		
Soil before trimming:	0	0	0	=>	0 mm (*Y*)
Soil after timming:	—	—	—	=>	____ mm
Packer after trimming:	—	—	—	=>	____ mm

Trimmings: full USCS



Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: ____

	1	2	3		
Soil before trimming:	460.2	466.3	457.2	=>	461.2 mm (*X*)
Soil after leveling:	—	—	—	=>	— mm
Packer Disc:	423.7	423.7	420.6	=>	422.6 mm

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS

TOO DEEP TO INSPECT. LOOKS LIKE SANDY FILL W/ 1/2" GRAVEL PIECES ON TOP SURFACE

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 716.3 mm 28.2 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 453.2 mm 17.84 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge:

GOOD

SOIL FLOSH WHEN EXTRACTED

Notes: TOTAL PUSH = 2.35 FT

USED 3.25" ID HSA

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/16/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. Benton
GEI Rep.	W. Lukas	**Boring ID:**	B112U
		Sample ID:	U1
		Top Depth (ft):	~6'

PRE SAMPLING INFORMATION

Tube Data
Tube No: 84
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.62 %

Drilling Data
Casing I.D.: 3.25 in
Casing Depth: 6.50 ft
Length of Rods and Tooling (*R2*): 13.14 ft (10+0.64+2.5)
Rod Stickup (*R1*): 4.08+2.90=6.98 ft
Hole Depth (*R2* - *R1*): 6.16 ft

PENETRATION DATA

Time Tube Pushed: 1256 Time Tube Pulled: 1316 Rest Time: 20

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.90	ft (*D1*)	0.73	ft (*D2*)
Distance from casing to mark on drill rods:	NA	ft	NA	ft

Discharge pressure: NA psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:	~75			=>	75	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS
Not checked, Some sand so taped quickly

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	15.4cm	17.2cm	16.4cm	=>	163	mm (*X*)
Soil after leveling:	17.7cm	17.7cm	17.9cm	=>	177	mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS
80% f-m sand
20% npf

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 661 mm 26.0 in 2.17'
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 524 mm 20.6 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$:~~ _____ %
+ expansion, - compression

Describe condition of cutting edge:

GOOD

Notes:

54, 0.65% 2.79 1.58

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/16/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	WILKINS		
Boring ID:	B122		
Sample ID:	U2		
Top Depth (ft):	~8'		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 54
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.65 %

Drilling Data
Casing I.D.: 3.25 in
Casing Depth: 8.74 ft
Length of Rods and Tooling (*R2*): 13.73 ft (RODS 64+7.79)
Rod Stickup (*R1*): 1.84 + 2.59 ft
Hole Depth (*R2* - *R1*): 8.80 ft

PENETRATION DATA

Time Tube Pushed: _____ Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.59	ft (*D1*)	1.58	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	~0			=>	0	mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS
Not tested b/c pretty clean sand

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	2.01'	2.03'	1.98'	=>	612	mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS
Not tested, too deep

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 308 mm 12.1 in 1.01

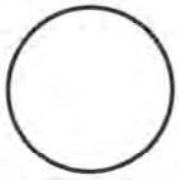
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 150 mm 5.9 in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:

Good



Notes:

GEI Consultants

PUSH

HSA LENGTH: 25' + 0.166'
ROD LENGTH: 25'

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	GEI Proj. No.	1700685
Proj. Location	Glen Lyn, VA	Owner	AEP
Contractor	Terracon	Driller	C. PENTON
GEI Rep.	J. GIAMPA	Boring ID:	B113U
		Sample ID:	U1
		Top Depth (ft):	24

PRE SAMPLING INFORMATION (PUSH)

Tube Data
- Tube No: 64
- Tube Length (*L*): 30 in
- Tube O.D.: 3 in
- Clearance Ratio (CR) 0.97 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 24.35 ft
- CASING STICKUP = 1.31 FT
- Hole Depth (*R2* - *R1*): 23.98, 25.72 ft
- Length of Rods and Tooling (*R2*): +TUBE 28.11 ft
- Rod Stickup (*R1*): 4.33, 2.39 ft
- LENGTH TUBE + DRILL ATTACH. = 3.11'

PENETRATION DATA

Time Tube Pushed: 1348 Time Tube Pulled: 1408 Rest Time: ____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	—	ft (*D1*)	—	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft	—	ft

Discharge pressure: ~500 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: CAP

	1	2	3		
Soil before trimming:	0	0	0	=>	0 mm (Y)
Soil after timming:	—	—	—	=>	____ mm
Packer after trimming:	—	—	—	=>	____ mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: ____

	1	2	3		
Soil before trimming:	293	288	280	=>	287 mm (X)
Soil after leveling:	280	281	281	=>	280.7 mm
Packer Disc:	265	266	265	=>	265.3 mm

Fluid Above Soil? Y (N) if Y how much: — mm

Trimmings: full USCS

SANDY CLAY
~60%, LPF, ~40% F-M SAND, GRAY

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 591.3 mm 23.28 in Δ HOLE DEPTH

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 475 mm 18.70 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge:

GOOD

SOIL — FLUSH WHEN EXTRACTED

Notes: TOP DISTURBED FROM TRIMMING

TOTAL PUSH = 1.94 FT

USED 3.25 IN HSA

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HSA LENGTH : 30.16 FT
ROD LENGTH : 30.0 FT

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. DENTON
GEI Rep.	J. GIAMPA		
Boring ID:	B1130		
Sample ID:	UZ		
Top Depth (ft):	26.5		

PRE SAMPLING INFORMATION (PUSH)

Tube Data
- Tube No: 95
- Tube Length (*L*): 30 in
- Tube O.D.: 3 in
- Clearance Ratio (CR) 0.59 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 26.25 ft (CASING STICKUP: 3.91 FT)
- Hole Depth (*R2* - *R1*): 26.42, 28.22 ft
- Length of Rods and Tooling (*R2*): + TUBE 33.11 ft
- Rod Stickup (*R1*): 6.69, 4.895 ft

LENGTH TUBE + DRILL ATTACH. = 3.11 FT

PENETRATION DATA

Time Tube Pushed: 1425 Time Tube Pulled: 1445 Rest Time: ____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	—	ft (*D1*)	—	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft	—	ft

Discharge pressure: ~600 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: CAP

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>		mm
Packer after trimming:	—	—	—	=>		mm

Trimmings: full USCS

—

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: PACKER / CAP

	1	2	3			
Soil before trimming:	190	182	188	=>	186.7	mm (*X*)
Soil after leveling:	185	186	185	=>	185.3	mm
Packer Disc:	170	171	169	=>	170	mm

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS

CLAYEY SAND
~25% F-M SAND
~75% CPF, gray.

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 579.12 mm 22.8 in Δ HOLE DEPTH

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 575.3 mm 22.6 in

~~$\Delta V/V = [(R/P)(1+GR/400^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge: GOOD

SOIL FLUSH WHEN EXTRACTED

Notes: TOP DISTURBED FROM TRIMMING
TOTAL PUSH ≈ 1.80 FT DUE TO SPIKE IN PRESSURE. DID NOT WANT TO BEND TUBE.
USED 3.25" HSA

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HSA LENGTH: 30 FT
ROD LENGTH: 30 FT

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	GEI Proj. No.	1700685
Proj. Location	Glen Lyn, VA	Owner	AEP
Contractor	Terracon	Driller	C. PENTON
GEI Rep.	J. GIAMPA		
Boring ID:	B113U		
Sample ID:	U3		
Top Depth (ft):	30		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 55
Tube Length (*L*): 36 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.3 %

Drilling Data
Casing I.D.: 3.25 in
Casing Depth: 29.75 ft
CASING STICKUP: 0.41 FT
Hole Depth (*R2* - *R1*): 29.96, 31.92 ft
Length of Rods and Tooling (*R2*): 33.64 ft
Rod Stickup (*R1*): 3.68, 1.72 ft
LENGTH TUBE + DRILL ATTACH. = 3.64 FT

PENETRATION DATA

Time Tube Pushed: 1459 Time Tube Pulled: 1530 Rest Time: —

	Before Push		After Push	
Distance Tube Sticks out from sampler:	—	ft (*D1*)	—	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft	—	ft

Discharge pressure: ~800 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: CAP

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Trimmings: full USCS



Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: PACKER/CAP

	1	2	3			
Soil before trimming:	320	314	322	=>	318.6	mm (*X*)
Soil after leveling:	308	310	309	=>	309	mm
Packer Disc:	297	295	295	=>	295.6	mm

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS

NOT INSPECTED TOO DEEP; LOOKS LIKE SILTY SAND

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 597.4 mm 23.52 in Δ HOLE DEPTH

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 595.8 mm 23.416 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ _____ %

+ expansion, - compression

Describe condition of cutting edge:

SLIGHTLY DAMAGED AFTER PUSH

SOIL FLUSH WHEN EXTRUDED

Notes: TOP DISTURBED FROM TRIMMING
TOTAL PUSH = 1.96 FT
USED 3.25" HSA

GEI Consultants

HSA LENGTH : 35.16 FT
ROD LENGTH : 35 FT

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/13/17

Project	Glen Lyn Ash Landfill and West Pond	GEI Proj. No.	1700685
Proj. Location	Glen Lyn, VA	Owner	AEP
Contractor	Terracon	Driller	C. PENTON
GEI Rep.	J. GIAMPA	Boring ID:	B113U
		Sample ID:	U4
		Top Depth (ft):	33

PRE SAMPLING INFORMATION (PUSH)

Tube Data
- Tube No: 58
- Tube Length (*L*): 36 in
- Tube O.D.: 3 in
- Clearance Ratio (CR): 0.3 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 32.81 ft
- CASING STICKUP: 2.35 FT
- Hole Depth (*R2* - *R1*): 33.08, 35.08 ft
- Length of Rods and Tooling (*R2*): 38.64 ft
- Rod Stickup (*R1*): 5.56, 3.56 ft
- LENGTH TUBE + DRILL ATTACH : 3.64 FT

PENETRATION DATA

Time Tube Pushed: 1545 Time Tube Pulled: 1615 Rest Time: ____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.0	ft (*D1*)	0	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft		ft

Discharge pressure: ~700 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: CAP

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Trimmings: full USCS: —

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: HALF PACKER / CAP

	1	2	3			
Soil before trimming:	292	292	296	=>	293.3	mm (*X*)
Soil after leveling:	288	289	290	=>	289	mm
Packer Disc:	281	282	282	=>	281.6	mm

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS: LOOKS LIKE NARROWLY GRADED SAND w/ SILT

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 609.6 mm 24.0 in (Δ HOLE DEPTH)

~~Gross~~ Recovery, *R* = *L*-*X*-*Y*: 621.1 mm 24.45 in (NET) (? DUE TO MOUND NEAR TUBE WALL)

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge: GOOD

SOIL FLUSH WHEN EXTRACTED

Notes: TOP DISTURBED FROM TRIMMING
TOTAL PUSH @ 2.0 FT
USED 3.25" HSA

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/21/17

Project	Glen Lyn Ash Landfill and West Pond	GEI Proj. No.	1700685
Proj. Location	Glen Lyn, VA	Owner	AEP
Contractor	Terracon	Driller	C. PENTON
GEI Rep.	W. LUCAS	Boring ID:	B114
		Sample ID:	U1
		Top Depth (ft):	~25

PRE SAMPLING INFORMATION

Tube Data
Tube No: 71
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.44 %

Drilling Data
Casing I.D.: 3.25 in
Casing Depth: 23.30 ft (0.33)
Length of Rods and Tooling (*R2*): 25+0.64+2.5 = 28.14 ft
Rod Stickup (*R1*): 5.12 ft (2.03 + 0.25)
Hole Depth (*R2* - *R1*): 23.02 ft

PENETRATION DATA

Time Tube Pushed: 1047 Time Tube Pulled: 1107 Rest Time: 20

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.84	ft (*D1*)	0.86	ft (*D2*)
Distance from casing to mark on drill rods:	-	ft	-	ft
Discharge pressure:	-	psi		

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to:

	1	2	3		
Soil before trimming:				=> ~3	mm (*Y*)
Soil after timming:	-	-	-	=> -	mm
Packer after trimming:	-	-	-	=> -	mm

Bottom Packer Type: None

Trimmings: full USCS: Not checked

Bottom edge very uneven, up to 10mm inside tube.

Top of Tube

Distance from ~~bottom~~ top of tube to:

	1	2	3		
Soil before trimming:	146	146	151	=> 148	mm (*X*)
Soil after leveling:	153	153	154	=> 153	mm
Packer Disc:	141	142	141	=> 141	mm

Top Packer Type: Half

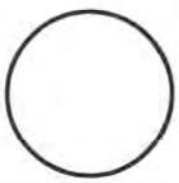
Trimmings: full USCS: STACKED AGG, ~80% agg, ~20% fine sand, black, slightly moist.

Fluid Above Soil? Y / (N) if Y how much: - mm

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 604 mm 23.8 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 611 mm 24.1 in
~~$\Delta V/V = [(R/P)(1+GR/100^2) - 1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge: Good



Notes: Tough probing, but full P achieved.

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/21/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUKAS	**Boring ID:**	B114
		Sample ID:	42
		Top Depth (ft):	~35'

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 74
- Tube Length (*L*): 30 in
- Tube O.D.: 3.0 in
- Clearance Ratio (CR): 0.22 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 35.16 ft (0.33)
- Hole Depth (*R2* - *R1*): 34.83 ft
- Length of Rods and Tooling (*R2*): 38.14 ft (0.64)
- Rod Stickup (*R1*): 3.15 ft (0.17 0.25)

PENETRATION DATA

Time Tube Pushed: 1141 Time Tube Pulled: 1210 Rest Time: 29m

	Before Push	After Push
Distance Tube Sticks out from sampler:	2.73 ft (*D1*)	0.92 ft (*D2*)
Distance from casing to mark on drill rods:	— ft	— ft
Discharge pressure: — psi		

POST SAMPLING MEASUREMENTS

Distance from bottom of tube to: Bottom Packer Type: None

Bottom

	1	2	3			
Soil before trimming:				=>	-5	mm (*Y*)
~~Soil after timming~~:	Soil was ≈10 mm out			=>		mm
~~Packer after trimming~~:	tube when pulled, gently pushed back in to ≈5mm.			=>		mm

Trimmings: full USCS: Not checked

Distance from ~~bottom~~ top of tube to: Top Packer Type: Half

Top of Tube

	1	2	3			
Soil before trimming:	97	95	102	=>	98	mm (*X*)
Soil after leveling:	106	105	106	=>	106	mm
Packer Disc:	97	98	98	=>	98	mm

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS: STACKED ASH, ~80% npf, ~20% fine sand, black, slightly moist.

PENETRATION AND RECOVERY

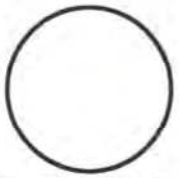
Penetration, *P* = *D2* - *D1*: 613 mm 24.1 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 669 mm 26.3 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ ____ %

+ expansion, - compression

Describe condition of cutting edge: Good



Notes: Tough push.

GEI consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/2/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Pena Canals		
Boring ID:	B-115U		
Sample ID:	U1		
Top Depth (ft):	20		

S = 3.45 (Direct Push)

PRE SAMPLING INFORMATION

Tube Data
Tube No: 54
Tube Length (*L*): 36 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.36%

Drilling Data
Casing I.D.: 4" in
Casing Depth: ~~17.76~~ ft
Hole Depth (*R2* - *R1*): 20.09, 20.02 ft

Length of Rods and Tooling (*R2*): 23.4, 23.45 ft
Rod Stickup (*R1*): 3.31, 3.43 ft

PENETRATION DATA

Time Tube Pushed: 5:42 Time Tube Pulled: 6:01 Rest Time: ____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.59	ft (*D1*)	0.66	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft	—	ft

Discharge pressure: 16400 psi/lbs

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None, cap

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (Y)
Soil after timming:	—	—	—	=>		mm
Packer after trimming:	—	—	—	=>		mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Half vented

	1	2	3			
Soil before trimming:	2.01'	2.03'	2.01'	=>	24.2	~~mm~~ in (X)
Soil after leveling:	—	—	—	=>		mm
Packer Disc:	1.88'	1.94'	1.95'	=>	2308	~~mm~~ in

Fluid Above Soil? (Y) / N if Y how much: 21.2 ~~mm~~ in

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

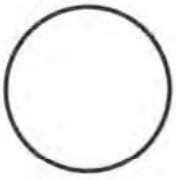
Penetration, *P* = *D2* - *D1*: ____ mm 23.16 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: ____ mm 11.9 in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Pushed only 1.93' because the load was too high.

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggin
GEI Rep.	M. Perry Conaty		
Boring ID:	B115U		
Sample ID:	U2		
Top Depth (ft):	30		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 101
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.64 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 28 ft
Length of Rods and Tooling (*R2*): 33.4, 35.45 ft
Rod Stickup (*R1*): 3.42, 5.5 ft
Hole Depth (*R2* - *R1*): 29.98', 29.95' ft

PENETRATION DATA

S-295 (Direct Push)

Time Tube Pushed: 8:19 Time Tube Pulled: 9:39 Rest Time: 20 mins

	Before Push		After Push	
Distance Tube Sticks out from sampler:	—	ft (*D1*)	—	ft (*D2*)
Distance from casing to mark on drill rods:	2.23	ft	0.28	ft

Discharge pressure: 1500 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: NONE CAP

	1	2	3		
Soil before trimming:	0	0	0	=>	mm (Y)
Soil after timming:	—	—	—	=>	mm
Packer after trimming:	—	—	—	=>	mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: bladder

	1	2	3		
Soil before trimming:	1.24'	1.24'	1.16'	=>	14.52 ~~mm~~ in (X)
Soil after leveling:	—	—	—	=>	mm
Packer Disc:	1.14	1.15	1.15	=>	13.76 ~~mm~~ in
Fluid Above Soil?	(Y) / N	if Y how much:			11.52 ~~mm~~ in

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

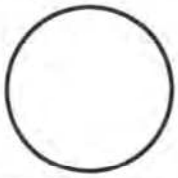
Penetration, *P* = *D2* - *D1*: _____ mm 23.4 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 15.48 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes:

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggin
GEI Rep.	M. Perez-Canals		
Boring ID:	B115U		
Sample ID:	U3		
Top Depth (ft):	67		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 98
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.48 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 58.3 ft
Length of Rods and Tooling (*R2*): 68.4, 70.69 ft
Rod Stickup (*R1*): 3.34, 5.72 ft
Hole Depth (*R2* - *R1*): 65.06, 64.97 ft

GUS – 5.69'

PENETRATION DATA

Time Tube Pushed: 10:52 Time Tube Pulled: 11:35 Rest Time: 43 min
44 secs

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.08	ft (*D1*)	2.09	ft (*D2*)
Distance from casing to mark on drill rods:	2.47	ft	2.47	ft

Discharge pressure: 300 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Vented Packer

	1	2	3			Trimmings: full USCS
Soil before trimming:	230	—	—	=>	230 mm (*Y*)	ASH
Soil after timming:	—	—	—	=>	mm	
Packer after trimming:	218	218	223	=>	220 mm	

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: half vented

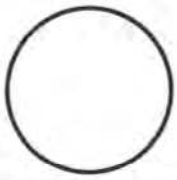
	1	2	3			Trimmings: full USCS
Soil before trimming:	143	143	143	=>	143 mm (*X*)	ASH
Soil after leveling:	—	—	—	=>	mm	
Packer Disc:	135	134	134	=>	134 mm	

Fluid Above Soil? Y / (N) if Y how much: mm

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 613 mm 24.12 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 389 mm 15.31 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: %
+ expansion, - compression

Describe condition of cutting edge:



Notes: Push stopped because pressure was too high

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond			**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP	**Boring ID:**	B115U
Contractor	Terracon	**Driller**	W. Duggins	**Sample ID:**	U4
GEI Rep.	M. Pena - Canals			**Top Depth (ft):**	68'

PRE SAMPLING INFORMATION

Tube Data
Tube No: 100
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.44 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 58.3 ft
Length of Rods and Tooling (*R2*): 71.9, 73.21 ft
Rod Stickup (*R1*): 3.75, 5.1 ft
Hole Depth (*R2* - *R1*): 68.15', 68.11' ft

GUS - 5.71

PENETRATION DATA

Time Tube Pushed: 12:24 (19s) Time Tube Pulled: 13:30 Rest Time: 66 mins

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.08	ft (*D1*)	2.1	ft (*D2*)
Distance from casing to mark on drill rods:	1.85	ft	1.85	ft

Discharge pressure: 250 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Vented Packer

	1	2	3			
Soil before trimming:	—	—	—	=>	—	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Sample moving down.

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Vented half packer

	1	2	3			
Soil before trimming:	1.0'	1.0'	1.0'	=>	—	mm (*X*)
Soil after leveling:	—	—	—	=>	—	mm
Packer Disc:	—	—	—	=>	—	mm

Fluid Above Soil? Y / N if Y how much: — mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: — mm 24.24 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: — mm — in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: — %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Sample disturbed. The bottom was moving down and the top moved up when it was removed from sampler and then slid down.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date:

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Rene Camulo		
Boring ID:	B115U		
Sample ID:	U5		
Top Depth (ft):	71		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 96
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.52 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 58.3 ft
Length of Rods and Tooling (*R2*): 75.9, 75.7' ft
Rod Stickup (*R1*): 4.89, 4.67' ft
Hole Depth (*R2* - *R1*): 70.01, 71.03' ft

GUS - 5.70

PENETRATION DATA

Time Tube Pushed: 13:47 (15:3) Time Tube Pulled: 14:30 Rest Time: 43 mins

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	2.09	ft (*D2*)
Distance from casing to mark on drill rods:	1.41	ft	1.47	ft

Discharge pressure: 250 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full vented

	1	2	3			
Soil before trimming:	162	160	162	=>	161	mm (*Y*)
Soil after timming:	—	—	—	=>		mm
Packer after trimming:	177	175	177	=>	176	mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Poly packer

	1	2	3			
Soil before trimming:	140	141	139	=>	140	mm (*X*)
Soil after leveling:	—	—	—	=>		mm
Packer Disc:	129	130	131	=>	130	mm

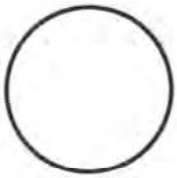
Fluid Above Soil? Y / (N) if Y how much: ____ mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 616 mm 24.24 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 461 mm 18.15 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: Bottom of soil calculated by subtracting packer thickness.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggin
GEI Rep.	M. Rice Corals		
Boring ID:	B-115U		
Sample ID:	U6		
Top Depth (ft):	78.4		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 94
Tube Length (*L*): 30 in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.54 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 58.3 ft
Length of Rods and Tooling (*R2*): 82.9, 85.71 ft
Rod Stickup (*R1*): 4.58, 7.29 ft
Hole Depth (*R2* - *R1*): 78.32, 78.42 ft

GUS - 5.73'

PENETRATION DATA

Time Tube Pushed: 15:15 (445) Time Tube Pulled: 16:00 Rest Time: 45 min

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	2.05	ft (*D2*)
Distance from casing to mark on drill rods:	4	ft	4	ft

Discharge pressure: 320 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: No packer

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>		mm
Packer after trimming:	—	—	—	=>		mm

Trimmings: full USCS
SC
gravel

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full packer

	1	2	3			
Soil before trimming:	156	160	157	=>	158	mm (*X*)
Soil after leveling:	157	160	159	=>	159	mm
Packer Disc:	143	145	145	=>	144	mm

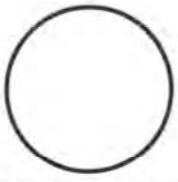
Fluid Above Soil? Y / (N) if Y how much: mm

Trimmings: full USCS
SC
gravel

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 604 mm 23.76 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 604 mm 23.78 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: 0 %~~
+ expansion, - compression

Describe condition of cutting edge:



Notes: Driller stopped the push because pressure was too high.

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 10/3/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggan
GEI Rep.	M. Puig Canals		
Boring ID:	B115U		
Sample ID:	U7		
Top Depth (ft):	81.4		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 94
Tube Length (*L*): 30" in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.56 %

Drilling Data
Casing I.D.: 4" in
Casing Depth: 58.3 ft
Length of Rods and Tooling (*R2*): 85.9, 85.72 ft
Rod Stickup (*R1*): 4.5, 4.32 ft
Hole Depth (*R2* - *R1*): 81.4, 81.4 ft

GUS - 5.72'

PENETRATION DATA

Time Tube Pushed: 16:33 (34s) Time Tube Pulled: 17:00 Rest Time: 27 min

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	2.10	ft (*D2*)
Distance from casing to mark on drill rods:	1.07	ft	1.07	ft

Discharge pressure: 320 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full packer

	1	2	3			
Soil before trimming:	1.23'	—	—	=>	14.76 in ~~mm~~ (*Y*)	
Soil after timming:	—	—	—	=>	____ mm	
Packer after trimming:	0.88'	—	—	=>	10.56 in ~~mm~~	

Trimmings: full USCS: SP-SM

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: ____

	1	2	3			
Soil before trimming:	156	159	161	=>	159	mm (*X*)
Soil after leveling:	164	166	166	=>	165	mm
Packer Disc:	150	151	152	=>	151	mm

Fluid Above Soil? Y / (N) if Y how much: ____ mm

Trimmings: full USCS: SP-SM

PENETRATION AND RECOVERY

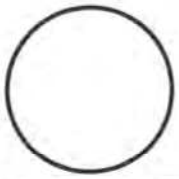
Penetration, *P* = *D2* - *D1*: ____ mm 24.36 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: ____ mm 8.98 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Push stopped because pressure got too high.

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/18/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUCAS	**Boring ID:**	B116U
		Sample ID:	U1
		Top Depth (ft):	~44'

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 65
- Tube Length (*L*): 36 in
- Tube O.D.: 3.0 in
- Clearance Ratio (CR) 0.3 %

Drilling Data
- Casing I.D.: 4.25 in
- Casing Depth: 49.10 ft
- Length of Rods and Tooling (*R2*): 45 + 3.65' = 48.65 ft
- Rod Stickup (*R1*): 43.61 - 38.54 = 5.04 ft
- Hole Depth (*R2* - *R1*): 43.61 ft

PENETRATION DATA

Time Tube Pushed: 859 Time Tube Pulled: 919 Rest Time: 20

	Before Push	After Push
Distance Tube Sticks out from sampler:	0.47 ft (*D1*)	2.98 ft (*D2*)
Distance from casing to mark on drill rods:	ft	ft
Discharge pressure: 170 psi		

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3		
Soil before trimming:	~0			=> 0	mm (*Y*)
Soil after timming:				=>	mm
Packer after trimming:				=>	mm

Trimmings: full USCS: Not checked

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type:

	1	2	3		
Soil before trimming:				=>	mm (*X*)
Soil after leveling:				=>	mm
Packer Disc:				=>	mm

Fluid Above Soil? Y / N if Y how much: mm

Trimmings: full USCS: SANDY CLAY ~60% mpt, ~40% fine sand, brown, wet

PENETRATION AND RECOVERY

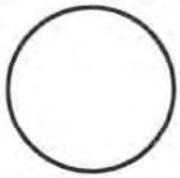
Penetration, *P* = *D2* - *D1*: mm in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: mm ~9 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ %

+ expansion, - compression

Describe condition of cutting edge: Good



Notes:

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/18/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	
GEI Rep.		**Boring ID:**	B116U
		Sample ID:	U1-A
		Top Depth (ft):	~47'

PRE SAMPLING INFORMATION

Tube Data
Tube No: 64
Tube Length (*L*): 36 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.3 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 47.34 ft
Length of Rods and Tooling (*R2*): 50 + 3.31 = 53.31 ft
Rod Stickup (*R1*): 2.94 + 3.31 = 6.25 ft
Hole Depth (*R2* - *R1*): 47.06 ft

PENETRATION DATA

Time Tube Pushed: 946 Time Tube Pulled: 1010 Rest Time: 24

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.47	ft (*D1*)	2.95	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: 180 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full ≈15mm

	1	2	3			
Soil before trimming:	NM			=>		mm (*Y*)
Soil after timming:	NM			=>	~196	mm
Packer ~~after trimming~~:	180	180	181	=>	181	mm

Trimmings: full USCS
Not checked but sandy

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	152	154	152	=>	152	mm (*X*)
Soil after leveling:	156	157	158	=>	157	mm
Packer Disc:	NM			=>		mm

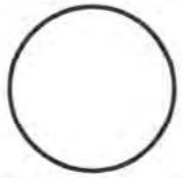
Fluid Above Soil? Y / (N) if Y how much: mm

Trimmings: full USCS
SANDY LEAN CLAY: ~60% fines, ~35% fine sand, ~5% fine gravel, brown, wet

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 756 mm 29.8 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 566 mm 22.3 in
~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~ %
+ expansion, - compression

Describe condition of cutting edge:
Good



Notes:

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/19/17

Project	Glen Lyn Ash Landfill and West Pond	GEI Proj. No.	1700685
Proj. Location	Glen Lyn, VA	Owner	AEP
Contractor	Terracon	Driller	C. PENTON
GEI Rep.	W. LUKAS	Boring ID:	B118
		Sample ID:	U1
		Top Depth (ft):	~40

PRE SAMPLING INFORMATION

Tube Data
Tube No: 91
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.51 %

Drilling Data
Casing I.D.: 3.25 in
Casing Depth: 39.38 ft
Length of Rods and Tooling (*R2*): 40+0.64+2.5 = 43.14 ft
Rod Stickup (*R1*): 0.28+2.6 = 2.88 ft
Hole Depth (*R2* - *R1*): 39.26 ft

PENETRATION DATA

Time Tube Pushed: 1108 Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.68	ft (*D1*)	2.02	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft
Discharge pressure: _____ psi				

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 201 mm 7.9 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm 0 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:

Two small dents

Notes: Push cut short due to tube refusal

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/19/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUCAS	**Boring ID:**	B118
		Sample ID:	U2
		Top Depth (ft):	~46

PRE SAMPLING INFORMATION

Tube Data
Tube No: 85
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.86 %

Drilling Data
Casing I.D.: 4.25" in
Casing Depth: 46.160 ft
Length of Rods and Tooling (*R2*): 53.14 ft (50+2.5=20.64)
Rod Stickup (*R1*): 3.98+2.85=6.83 ft
Hole Depth (*R2* - *R1*): 46.31 ft

PENETRATION DATA

Time Tube Pushed: 1204 Time Tube Pulled: 1238 Rest Time: 34

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.85	ft (*D1*)	1.31	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	1.28'	1.27'	1.28'	=>	~3mm	mm (*Y*)
Soil after timming:	1.35'	1.36'	1.36'	=>		mm
Packer after trimming:	~5			=>		mm

Trimmings: full USCS
~95% f-m sand, ~5% nplf, dry

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	1.28'	1.27'	1.28'	=>	390	mm (*X*)
Soil after leveling:	1.35'	1.36'	1.36'	=>	415	mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / (N) if Y how much: _____ mm

Trimmings: full USCS
~60% lpf, ~40% fine sand, dry, brown

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 469 mm 18.5 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 369 mm 14.5 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:
Good

Notes:

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date:

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	N. LUKAS	**Boring ID:**	B/19U
		Sample ID:	U1-A
		Top Depth (ft):	

PRE SAMPLING INFORMATION

Tube Data
Tube No: 1
Tube Length (*L*): 30" in
Tube O.D.: 3" in
Clearance Ratio (CR) 0.84 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 19.75 ft
Length of Rods and Tooling (*R2*): 20', 0.69', 2.51' / 23.14 ft
Rod Stickup (*R1*): 2.94+0.9=3.84 ft
Hole Depth (*R2* - *R1*): 19.30 ft

PENETRATION DATA

Time Tube Pushed: 820 Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:		ft (*D1*)		ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3		
Soil before trimming:				=>	mm (*Y*)
Soil after timming:				=>	mm
Packer after trimming:				=>	mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3		
Soil before trimming:				=>	mm (*X*)
Soil after leveling:				=>	mm
Packer Disc:				=>	mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: _____ mm _____ in

~~Gross~~ NET Recovery, *R* = *L* - *X* - *Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~: _____ %

+ expansion, - compression

Describe condition of cutting edge:

Multiple small dents



Notes:
- Rig lifted due to ground
- Drilling down more

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/9/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUKAS		
Boring ID:	B119U		
Sample ID:	U1-B		
Top Depth (ft):	21.24		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 47
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.88 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 21.57 ft
Length of Rods and Tooling (*R2*): 28.14 ft (25+0.64+2.5)
Rod Stickup (*R1*): 4.08+2.85=6.90 ft
Hole Depth (*R2* - *R1*): 21.24 ft

PENETRATION DATA

Time Tube Pushed: 8:40 Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.85	ft (*D1*)	1.20	ft (*D2*) w/g lift
Distance from casing to mark on drill rods:	NA	ft	NA	ft

Discharge pressure: NA psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

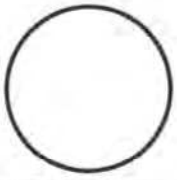
Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 503 mm 19.8 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100.$~~ _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes:

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/9/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUKAS	**Boring ID:**	B1192
		Sample ID:	121-C
		Top Depth (ft):	23.84

PRE SAMPLING INFORMATION

Tube Data
Tube No: 8
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.93 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: 24.03 ft (1.62 0.26)
Hole Depth (*R2* - *R1*): 23.84 ft
Length of Rods and Tooling (*R2*): 25+0.64+2.5 = 28.14 ft
Rod Stickup (*R1*): 4.30 ft

PENETRATION DATA

Time Tube Pushed: 906 Time Tube Pulled: _____ Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.68	ft (*D1*)	0.745	ft (*D2*)
Distance from casing to mark on drill rods:	NA	ft	NA	ft

Discharge pressure: NA psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: _____

	1	2	3		
Soil before trimming:				=>	mm (*Y*)
Soil after timming:				=>	mm
Packer after trimming:				=>	mm

Trimmings: full USCS

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: _____

	1	2	3		
Soil before trimming:				=>	mm (*X*)
Soil after leveling:				=>	mm
Packer Disc:				=>	mm

Fluid Above Soil? Y / N if Y how much: _____ mm

Trimmings: full USCS

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 590 mm 23.2 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: _____ mm _____ in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$:~~ _____ %

+ expansion, - compression

Describe condition of cutting edge:



Notes: Hit rock, Recovered ~ 2" soil

GEI Consultants

~~GUS~~/Osterberg Tube Sample Record

Date: 9/9/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. Lukos	**Boring ID:**	B1924
		Sample ID:	U2
		Top Depth (ft):	54.34

PRE SAMPLING INFORMATION

Tube Data
Tube No: 66
Tube Length (*L*): 36 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.52 %

Drilling Data
Casing I.D.: 4.25 in
Casing Depth: ____ ft
Hole Depth (*R2* - *R1*): 54.34 ft
Length of Rods and Tooling (*R2*): 55 + 3.80 = 58.80 ft
Rod Stickup (*R1*): 4.46 = 0.7 + 3.76 ft

PENETRATION DATA

Time Tube Pushed: 1034 Time Tube Pulled: 1056 Rest Time: 22

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.485	ft (*D1*)	2.47	ft (*D2*)
Distance from casing to ~~mark on~~ top of drill rods:	3.76	ft	3.52	ft
Discharge pressure: 190 psi for 15 seconds			2.53"	

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: ____

	1	2	3			
Soil before trimming:				=>		mm (*Y*)
Soil after timming:				=>		mm
Packer after trimming:				=>		mm

Trimmings: full USCS: Small trace on piston face

LEAN CLAY: ~90% medium plastic fines ~10% fine to medium sand, brown

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: ____

	1	2	3			
Soil before trimming:				=>		mm (*X*)
Soil after leveling:				=>		mm
Packer Disc:				=>		mm

Fluid Above Soil? Y / N if Y how much: ____ mm

Trimmings: full USCS:

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: ____ mm ____ in
~~Gross~~ NET Recovery, *R* = *L* -*X*-*Y*: 0 mm 0 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %
+ expansion, - compression

Describe condition of cutting edge:

DNE LONG DENT



Notes: Pressure hose broke off would push
No recovery

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/20/17

Project	Glen Lyn Ash Landfill and West Pond	GEI Proj. No.	1700685
Proj. Location	Glen Lyn, VA	Owner	AEP
Contractor	Terracon	Driller	C. PENTON
GEI Rep.	W. LUCAS	Boring ID:	B1192-A
		Sample ID:	U1
		Top Depth (ft):	~24'

PRE SAMPLING INFORMATION

Tube Data

Tube No: 86
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.7 %

Drilling Data

Casing I.D.: 3.25 in
Casing Depth: 24.29 ft
1.29
Hole Depth (*R2* - *R1*): 23.88 ft

Length of Rods and Tooling (*R2*): 25 + 0.64 + 2.5 = 28.14 ft
Rod Stickup (*R1*): 4.26 ft
1.29 + 0.25 + 2.72

PENETRATION DATA

Time Tube Pushed: 900 Time Tube Pulled: 920 Rest Time: 20

	Before Push	After Push
Distance Tube Sticks out from sampler:	2.72 ft (*D1*)	1.32 ft (*D2*)
Distance from casing to mark on drill rods:	ft	ft
Discharge pressure: — psi		

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:				=>	~3	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Trimmings: full USCS: LEAN CLAY: ~90% mpt, ~5% coarse sand, ~5% ground, brown, moist.

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full

	1	2	3			
Soil before trimming:	1.15'	1.15'	1.16'	=>	351	mm (*X*)
Soil after leveling:	1.20'	1.19'	1.20'	=>	366	mm
Packer Disc:	—	—	—	=>	—	mm

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS: LEAN CLAY: ~85% mpt, ~10% coarse sand, ~5% fine gravel, brown, moist

PENETRATION AND RECOVERY

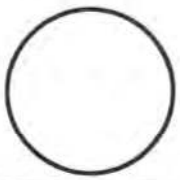
Penetration, $P = D2 - D1$: 427 mm 16.8 in

~~Gross~~ NET Recovery, $R = L - X - Y$: 408 mm 16.1 in

~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge: Good



Notes: - Tube refusal @16.8" pushed.
- Edge is clean, refusal due to stiff clay.

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/20/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUKAS	**Boring ID:**	BH22-A
		Sample ID:	UT
		Top Depth (ft):	~42

PRE SAMPLING INFORMATION

Tube Data
- Tube No: 72
- Tube Length (*L*): 30 in
- Tube O.D.: 3.0 in
- Clearance Ratio (CR) 0.65 %

Drilling Data
- Casing I.D.: 3.25 in
- Casing Depth: 42.30 ft (0.33)
- Hole Depth (*R2* - *R1*): 42.16 ft
- Length of Rods and Tooling (*R2*): 48.14 ft (45+06+12.5)
- Rod Stickup (*R1*): 5.98 ft (3.03 2.70)

PENETRATION DATA

Time Tube Pushed: 947 Time Tube Pulled: 1009 Rest Time: ____

	Before Push	After Push
Distance Tube Sticks out from sampler:	2.70 ft (*D1*)	0.92 ft (*D2*)
Distance from casing to mark on drill rods:	– ft	– ft
Discharge pressure: – psi		

POST SAMPLING MEASUREMENTS

Distance from bottom of tube to:

Bottom Packer Type: None

Bottom	1	2	3		
Soil before trimming:				=> 20 mm (*Y*)	
Soil after timming:	–	–	–	=> – mm	Scissors check →
Packer after trimming:	–	–	–	=> – mm	

Trimmings: full USCS

LEAN CLAY: ~100% fmpf, dark brown, moist

Distance from ~~bottom~~ top of tube to:

Top Packer Type: Full

Top of Tube	1	2	3		
Soil before trimming:	189	187	184	=> 187 mm (*X*)	
Soil after leveling:	195	194	196	=> 195 mm	
Packer Disc:	–	–	–	=> ____ mm	

Fluid Above Soil? Y / (N) if Y how much: ____ mm

Trimmings: full USCS

LEAN CLAY: ~90% mpf, ~10% fine sand, red-brown, moist

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 604 mm 23.8 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 575 mm 22.6 in

~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~: ____ %

+ expansion, - compression

Describe condition of cutting edge:

Good

Notes:

87 6.44

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 9/20/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	C. PENTON
GEI Rep.	W. LUKAS	**Boring ID:**	B119U-A
		Sample ID:	U3
		Top Depth (ft):	~51'

PRE SAMPLING INFORMATION

Tube Data
Tube No: 87
Tube Length (*L*): 30 in
Tube O.D.: 3.0 in
Clearance Ratio (CR) 0.69 %

Drilling Data
Casing I.D.: 3.25 in
Casing Depth: 51.13 ft (0.33)
Hole Depth (*R2* - *R1*): 51.19 ft

Length of Rods and Tooling (*R2*): 58.14 ft (+0.64+2.5)
Rod Stickup (*R1*): 6.95 ft (0.25) 4.15

PENETRATION DATA

Time Tube Pushed: 1030 Time Tube Pulled: 1052 Rest Time: _____

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.55	ft (*D1*)	0.46	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			Trimmings: full USCS
Soil before trimming:				=>	~0 mm (*Y*)	LEAN CLAY: ~100% mpt, light brown, moist.
Soil after timming:	—	—	—	=>	— mm	
Packer after trimming:	—	—	—	=>	— mm	

Top of Tube

Distance from ~~bottom of~~ top of tube to: Top Packer Type: FULL

	1	2	3			Trimmings: full USCS
Soil before trimming:	157	126	144	=>	142 mm (*X*)	FAT CLAY: ~100% M-H plastic, thus, brown, wet.
Soil after leveling:	154	153	152	=>	153 mm	
Packer Disc:	—	—	—	=>	— mm	

Fluid Above Soil? (Y) / N if Y how much: _____ mm ~57mm

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 637 mm 25.1 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 620 mm 24.4 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~: _____ %
+ expansion, - compression

Describe condition of cutting edge:

Good

Notes: -Teeth holes visible in top of sample

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/13/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M Perez Canals		
Boring ID:	B122U		
Sample ID:	U1		
Top Depth (ft):	6'		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 109
Tube Length (*L*): 36 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.56 %

Drilling Data Acker
Casing I.D.: 3.25 in
Casing Depth: 5.86 ft
Hole Depth (*R2* - *R1*): 5.86, 5.77 ft
Length of Rods and Tooling (*R2*): 7.52, 8.44 ft
Rod Stickup (*R1*): 1.66, 2.67 ft

Direct push sampler - 3.44'

PENETRATION DATA

Time Tube Pushed: 8:58 Time Tube Pulled: 9:06 Rest Time: 10

	Before Push		After Push	
Distance Tube Sticks out from sampler:	3.19	ft (*D1*)	0.74	ft (*D2*)
Distance from casing to mark on drill rods:	—	ft		ft

Discharge pressure: 1300 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3		
Soil before trimming:	0	0	0	=>	0 mm (*Y*)
Soil after timming:	—	—	—	=>	— mm
Packer after trimming:	—	—	—	=>	— mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: half crated

	1	2	3		
Soil before trimming:	1.33'	1.34'	1.29'	=>	1.32' ~~mm~~ (*X*)
Soil after leveling:	—	—	—	=>	— ~~mm~~
Packer Disc:	1.24'	1.24'	1.24'	=>	1.24' ~~mm~~

Fluid Above Soil? Y / (N) if Y how much: — mm

Trimmings: full USCS: CL

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: — mm 29.4 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: — mm 20.16 in
~~$\Delta V/V = [(R/P)(1+GR/100^2)-1] \times 100$~~ _____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: There was a piece of woven geotextile at bottom of ash.

GEI Consultants

PUSH

~~GUS/Osterberg~~ Tube Sample Record

Date: 10/13/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Perry Cowell		
Boring ID:	B122U		
Sample ID:	U2		
Top Depth (ft):	9'		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 104
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) -51 %

Drilling Data Augers
Casing I.D.: 3.75 in
Casing Depth: 9.07 ft
Hole Depth (*R2* - *R1*): 9.07, 9.04 ft

Length of Rods and Tooling (*R2*): 10.52, 12.94 ft
Rod Stickup (*R1*): 1.45, 3.9 ft

Direct Push sample-2 9 4

PENETRATION DATA

Time Tube Pushed: 9:31 Time Tube Pulled: 9:42 Rest Time: 11

	Before Push		After Push	
Distance Tube Sticks out from sampler:	2.12	ft (*D1*)	2.14	ft (*D2*)
Distance from casing to mark on drill rods:		ft		ft

Discharge pressure: _____ psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	—	—	—	=>	—	mm

Trimmings: full USCS: ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Hydraulic

	1	2	3			
Soil before trimming:	63	63	73	=>	66	mm (*X*)
Soil after leveling:	75	78	76	=>	77	mm
Packer Disc:	68	69	71	=>	69	mm

Fluid Above Soil? Y / (N) if Y how much: _____ mm

Trimmings: full USCS: ASH

PENETRATION AND RECOVERY

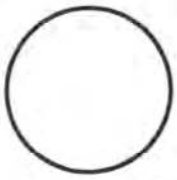
Penetration, *P* = *D2* - *D1*: 604 mm 23.76 in

~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 696 mm 27.40 in

~~$\Delta V/V = [(R/P)(1+CR/100^2) - 1] \times 100$: 15.24 %~~

\+ expansion, - compression

Describe condition of cutting edge:



Notes:

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 10/13/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggin
GEI Rep.	M. Perez Canals		
Boring ID:	B122U		
Sample ID:	U3		
Top Depth (ft):	44.5		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 105
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.43 %

Drilling Data Augers
Casing I.D.: 3.25 in
Casing Depth: 44.53 ft
Length of Rods and Tooling (*R2*): 45.52, 50.71 ft
Rod Stickup (*R1*): 0.99, 5.82 ft
Hole Depth (*R2* - *R1*): Augers 44.53, 44.89 ft

PENETRATION DATA

Gus - 5.71'

Time Tube Pushed: 10:37 Time Tube Pulled: 11:17 Rest Time: 40

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.07	ft (*D1*)	2.06	ft (*D2*)
Distance from casing to mark on drill rods:	2.56	ft	2.56	ft

Discharge pressure: 125 psi

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: None

	1	2	3			
Soil before trimming:	0	0	0	=>	0	mm (*Y*)
Soil after timming:	–	–	–	=>	–	mm
Packer after trimming:	–	–	–	=>	–	mm

Trimmings: full USCS
ASH

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type:

	1	2	3			
Soil before trimming:	152	154	165	=>	157	mm (*X*)
Soil after leveling:	–	–	–	=>	–	mm
Packer Disc:	141	141	142	=>	141	mm

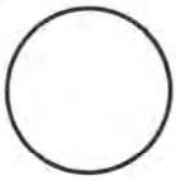
Fluid Above Soil? Y / N if Y how much: ____ mm

Trimmings: full USCS
ASH

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 607 mm 23.88 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 605 mm 23.82 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$: -0.33~~ %
+ expansion, - compression

Describe condition of cutting edge:



Notes: pH = 8

GEI Consultants

GUS/~~Osterberg~~ Tube Sample Record

Date: 10/13/17

Project	Glen Lyn Ash Landfill and West Pond	**GEI Proj. No.**	1700685
Proj. Location	Glen Lyn, VA	**Owner**	AEP
Contractor	Terracon	**Driller**	W. Duggins
GEI Rep.	M. Perez Cassels		
Boring ID:	B122U		
Sample ID:	U4		
Top Depth (ft):	59		

PRE SAMPLING INFORMATION

Tube Data
Tube No: 103
Tube Length (*L*): 30 in
Tube O.D.: 3 in
Clearance Ratio (CR) 0.57 %

Drilling Data
Casing I.D.: Avg 3.25 in
Casing Depth: 59.06 ft
Length of Rods and Tooling (*R2*): 60.52, 60.71 ft
Rod Stickup (*R1*): 1.46, 1.65 ft
Hole Depth (*R2* - *R1*): auger 59.06, 59.06 ft

PENETRATION DATA

GUS - 5.71

Time Tube Pushed: 12:01 Time Tube Pulled: 12:32 Rest Time: 31

	Before Push		After Push	
Distance Tube Sticks out from sampler:	0.06	ft (*D1*)	2.01	ft (*D2*)
Distance from casing to mark on drill rods:	3.16	ft	3.16	ft

Discharge pressure: 350 psi Stopped at 350

POST SAMPLING MEASUREMENTS

Bottom

Distance from bottom of tube to: Bottom Packer Type: Full Unvented

	1	2	3			
Soil before trimming:	205	205	206	=>	205	mm (*Y*)
Soil after timming:	—	—	—	=>	—	mm
Packer after trimming:	179	175	174	=>	176	mm

Trimmings: full USCS

C1

Top of Tube

Distance from ~~bottom~~ top of tube to: Top Packer Type: Full Vented

	1	2	3			
Soil before trimming:	177	170	172	=>	173	mm (*X*)
Soil after leveling:	172	181	176	=>	176	mm
Packer Disc:	152	153	158	=>	154	mm

Fluid Above Soil? Y / N (circled) if Y how much: ____ mm

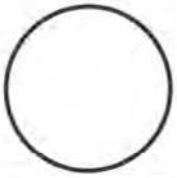
Trimmings: full USCS

C1

PENETRATION AND RECOVERY

Penetration, *P* = *D2* - *D1*: 594 mm 23.4 in
~~Gross~~ NET Recovery, *R* = *L*-*X*-*Y*: 384 mm 15.12 in
~~$\Delta V/V = [(R/P)(1+CR/100^2)-1] \times 100$~~ ____ %
+ expansion, - compression

Describe condition of cutting edge:



Notes:

GEI Consultants

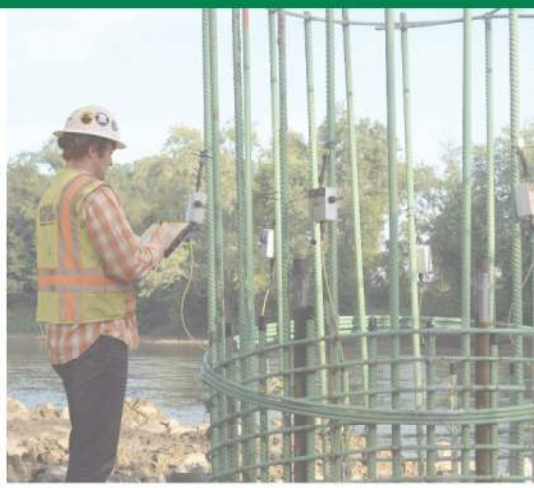
Appendix G

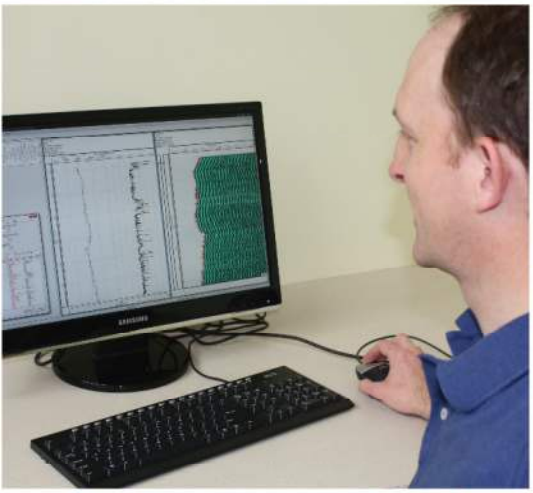
2017 Hammer Energy Testing Report

- **GRL Engineers, Inc. (2017). "Report on Standard Penetration Test Energy Measurements, Glen Lyn, Virginia," prepared for Terracon Consultants, September 19.**



















GRL engineers, inc.

Dynamic Measurements and Analyses

Job No. 179047-1

Report on: Standard Penetration Test Energy Measurements
Glen Lyn, Virginia

Prepared for Terracon Consultants
By Scott D. Webster, P.E. and Joel S. Webster, E.I.

September 19, 2017

September 19, 2017

Mr. Scott Rist
Terracon Consultants
2401 Brentwood Road, Suite 107
Raleigh, NC 27604

Re: Standard Penetration Test Energy Measurements
Glen Lyn, Virginia GRL Job No. 179047-1

Dear Mr. Rist;

This report presents results of energy measurements obtained on September 7, 2017 during Standard Penetration Test (SPT) sampling. Two automatic hammers, one mounted on an Acker Renegade drill rig and the other mounted on a Simco 2800 HS (HT), both owned by Terracon Consultants were tested. AW-J drill rod was used by the contractor to obtain soil samples. GRL Engineers, Inc. collected the dynamic measurements using an 8G Model Pile Driving Analyzer® and an instrumented AW-J rod subsection. This report describes the testing procedures and summarizes the test results. Appendix A describes our measurement and analysis methods, Appendix B contains the calibrations and certificates, and Appendix C contains a summary of the field data.

PURPOSE AND SCOPE OF WORK

At the request of Terracon Consultants, GRL Engineers conducted SPT energy measurements in accordance with ASTM D4633-10 during SPT sampling in Glen Lyn, Virginia. Specifically, we provided SPT energy measurements during sampling events at two and a half and five-foot intervals between 25 and 65.5 feet below the existing ground surface. All of the SPT samples were driven for a total of four, 6 inch increments, or 2.0 feet.

EQUIPMENT

Drilling and SPT Hammer Equipment

Acker Renegade Track Mounted (Serial Number 019192-0)

SPT energy measurements were made on an automatic hammer mounted on an Acker Renegade drill rig. The drilling method used to advance the boring was mud rotary drilling. Energy measurements for this drill rig were collected at a borehole located in Glen Lyn, VA. SPT energy measurements were performed at 2.5-foot sampling intervals between 56.5 and 65.5 feet. A total of four energy measurement events were performed for this drill rig.

Simco 2800 HS (HT) Truck Mounted (Serial Number 072068)

SPT energy measurements were made on an automatic hammer mounted on a Simco 2800 HS (HT) drill rig. The drilling method used to advance the boring was hollow stem auger. Energy measurements for this drill rig were collected at a borehole located in Glen Lyn, VA. SPT energy measurements were performed at 5-foot sampling intervals between 25 and 52 feet. A total of six energy measurement events were performed for this drill rig.

Instrumentation

An 8G Model Pile Driving Analyzer (PDA) data acquisition system manufactured by Pile Dynamics, Inc. was used to collect and process the dynamic measurements of force and velocity. A two foot long subsection of standard AW rod with J tapered threads (S/N 168 AWJ) was instrumented with two full bridge foil resistance strain gages and two piezoresistive accelerometers mounted in the midpoint location of the instrumented rod.

Analog signals from the strain gages and accelerometers were conditioned, digitized, processed and stored by the PDA. Output from the PDA for each recorded impact included the maximum calculated energy transfer, (EFV); the energy transfer ratio, (ETR); the maximum calculated rod force, (FMX); maximum rod top velocity, (VMX); the hammer operating rate, (BPM); the final displacement, (DFN); and the force/velocity proportionality, (FVP).

MEASUREMENTS AND CALCULATIONS

FV Energy Method (EFV)

Energy transfer to the PDA gage location was computed by the PDA using the EFV method and the force, F(t), and velocity, v(t), records as follows:

$$EFV = \int_a^b F(t) \cdot v(t) dt$$

The time "a" corresponds to the start of the record when the energy transfer begins, and "b" is the time at which energy transferred to the rod reaches a maximum value. The EFV Method is currently recognized in ASTM D4633-10, and is the theoretically correct result; therefore, no other energy calculation methods are reported.

Corrected SPT number (N_{60})

While the primary purpose of SPT energy testing is to calculate the maximum transferred energy of each hammer blow, the overall average energy transfer value can be used to calculate the corrected SPT number (N_{60}). To adjust the SPT N-values for hammer performance, the following correction as suggested by Seed for N-value adjustment to 60 percent transfer efficiency (e.g. 210 foot-pounds) was used:

$$N_{60} = \left(\frac{E_m}{210}\right) N_m$$

Where:

N_{60} = Corrected N-value
E_m = overall average measured energy transfer (EFV)
N_m =number of blows for last 12 inches of sampler penetration

A general introduction to dynamic SPT testing methods is included in Appendix A. References for more detailed descriptions of our testing and analysis methods are available upon request.

Any cross-sectional area difference between the GRL rod subsection and the drill rods, any loose connections or changes in area at section joints, or any cross-sectional area differences between the individual drill rod sections could result in stress wave reflections that could influence the energy transfer. The EFV transferred energy calculation method, utilizing both force and velocity records, is theoretically correct and gives energy transfer results that are not significantly affected by cross-sectional area changes or loose connectors. The EFV results are included in Appendix C for all records collected and accepted after checking them for consistency.

RESULTS

Upon return to the office, the records collected by the PDA were checked for consistency and accuracy. For example, records from very weak startup or final impacts were not included in average results. Appendix C contains a representative plot of force and normalized velocity versus time, as well as tables of PDA results for all hammer blows at each dynamically monitored sampling depth. The results include the EFV (transferred energy by the FV method, as recommended by ASTM D4633-10), ETR (energy transfer efficiency for the EFV method), BPM (hammer operating rate), FMX (maximum rod top force) and VMX (maximum rod top velocity). The tables show statistical summaries for the middle two 6 inch increments over which the SPT N value is calculated. At the end of each table is a statistical evaluation of these results which include the average and standard deviation.

The table below and Tables 1 and 2 summarize the average transferred energy values calculated by the EFV method. The records consist of averaged hammer blows from the middle 12 inches (i.e. N value) at each dynamically monitored sampling depth. The Energy Transfer Ratio (ETR) is defined as the ratio of maximum transferred energy EFV divided by the theoretical hammer potential energy of 350 foot-pounds (i.e., computed from the 140 pound SPT hammer and the standard 30 inch drop as specified by ASTM D1586-99).

Drill Rig	Avg. EFV (ft-lbs)	Avg. ETR (%)	Range of EFV (ft-lbs)	Range of ETR (%)
Acker Renegade S/N 019192-0	307	88	303 – 310	87 – 89
Simco 2800 S/N 072068	299	85	285 – 315	82 – 90

CONCLUSIONS

Based upon the dynamic test data obtained, the following conclusions are presented:

1. Loose connections in the drill string were sometimes observed in the force and velocity records. However, energy transfer values calculated using the EFV equation are not adversely affected by the connectors and therefore are considered a better indication of transferred energy.

2. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 303 to 310 ft-lbs for the Acker Renegade, SN 019192-0 drill rig. This corresponds to a transfer efficiency ranging from 87 to 89% of the SPT hammer energy of 350 ft-lbs.

3. Dynamic measurements of the transferred energy to the drill rods using the EFV equation ranged from 285 to 315 ft-lbs for the Simco 2800 HS(HT), SN 072068 drill rig. This corresponds to a transfer efficiency ranging from 82 to 90% of the SPT hammer energy of 350 ft-lbs.

4. The average transferred energy (EFV) and energy transfer ratio (ETR) for the Acker Renegade and Simco 2800 HS(HT) drill rigs tested was as follows:

   Acker Renegade, SN 019192-0: Average EFV = 307 ft-lbs; Average ETR = 88%

   Simco 2800 HS(HT), SN 072068: Average EFV = 299 ft-lbs; Average ETR = 85%

Please review both ASTM D4633-10 and ASTM D1586-99 prior to applying these test results. The energy calibrations reported herein are valid for the same hammer/drill rig, with the same drill operator, same anvil dimensions, and same drilling methods.

We appreciate the opportunity to be of assistance to you on this project. Please contact our office should you have any questions regarding this submittal, require additional information, or if we may be of further service.

Sincerely,

GRL Engineers, Inc.

Joel S. Webster, E.I.

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SDW:JSW:dms

Summary of SPT Energy Measurements
Terracon Acker Renegade - S/N 019192-0
Glen Lyn, VA - September 7, 2017

Soil Sample	Reported Sample Depth (feet)	Reported Rod Length[1] (feet)	Reported Blow Count (blows/6")	SPT Field N Value	Average Energy Transfer To Rod[2] (ft-lbs)	Average Energy Transfer Ratio[3] (%)	SPT Hammer Operating Rate (blows / min.)	SPT N Value Corrected for 60% Energy[4] N60
Boring 1 - Acker Auto Hammer - AW-J Rod								
25	56.5 - 58.5	59.0	2-50/3"	50	305	87	53.0	73
26	59.0 - 61.0	62.0	4-3-12-49	15	303	87	49.5	22
27	61.5 - 63.5	63.0	9-15-50/1"	65	307	88	54.7	95
28	63.5 - 65.5	69.0	7-50/3"	50	310	89	53.9	74
			Average		**307**	**88**	**53.6**	
			Standard Deviation		**8**	**2.3**	**0.83**	

1) Below the testing gage location. Add 1.0 foot for total rod length.
2) Average energy transfer over second and third increment from FV Method.
3) Energy calculated by FV method divided by 350 ft-lbs (140 pound ram dropped 2.5 feet).
4) SPT N value corrected for 60% energy using the Seed Correction Method.

Summary of SPT Energy Measurements
Terracon Simco 2800 HS(HT) - S/N 072068
Glen Lyn, VA - September 7, 2017

Soil Sample	Reported Sample Depth (feet)	Reported Rod Length[1] (feet)	Reported Blow Count (blows/6")	SPT Field N Value	Average Energy Transfer To Rod[2] (ft-lbs)	Average Energy Transfer Ratio[3] (%)	SPT Hammer Operating Rate (blows / min.)	SPT N Value Corrected for 60% Energy[4] N60
Boring 2 - Simco Auto Hammer - AW-J Rod								
11	25.0 - 27.0	31.0	3-6-8-11	14	285	82	40.0	19
13	30.0 - 32.0	34.0	3-8-8-10	16	290	83	40.6	22
15	35.0 - 37.0	39.0	5-8-15-11	23	295	84	45.0	32
17	40.0 - 42.0	44.0	5-7-10-12	17	305	87	43.2	25
19	45.0 - 47.0	49.0	1-3-6-6	9	311	89	41.6	13
21	50.0 - 52.0	54.0	4-5-8-8	13	315	90	48.5	20
			Average		**299**	**85**	**43.3**	
			Standard Deviation		**3**	**0.864**	**0.16**	

1) Below the testing gage location. Add 1.0 foot for total rod length.
2) Average energy transfer over second and third increment from FV Method.
3) Energy calculated by FV method divided by 350 ft-lbs (140 pound ram dropped 2.5 feet).
4) SPT N value corrected for 60% energy using the Seed Correction Method.

Appendix A

An Introduction into SPT Dynamic Pile Testing

APPENDIX A
AN INTRODUCTION INTO SPT DYNAMIC PILE TESTING

The following has been written by GRL Engineers, Inc. and may only be copied with its written permission.

1. BACKGROUND

The Standard Penetration Test is frequently conducted as an in-situ assessment of soil strength. This test requires that a 140 lb weight is dropped 30 inches onto a drive rod at whose bottom a sampler is usually installed. The sampler is driven for 18 inches; the number of blows required for the last 12 inches of driving is the so-called N-value. The N-value may be used as a strength indicator for foundation design or as a means of assessing the liquefaction potential of soils.

Obviously, the SPT hammer efficiency is an important consideration when using the N-values for design purposes. Measurements have indicated that the energy in the drive rod is sometimes only 30% and and may reach 90% of the potential or rated energy of the SPT hammer (E-rated = 0.35 kip-ft or 0.475 kJ). The type of hammer used to drive the rod is the main reason for these variations. On the average, the energy in the drive rod is 60% of the standard rated energy.

Because of the variability of energy, methods based on N-values are considered unreliable. However, measurements during SPT testing using the Case Method can be done on a routine basis and these measurements yield the transferred energy values. With measured energy, EMX, known, an adjustment of the measured N-value, N_m, can be made as follows.

$$N_{60} = N_m [E_m / (0.6E_r)] \quad (1)$$

Thus, if the measured energy value is equal to the normally expected transferred energy of 60% of E-rated then the adjusted and measured N-values are identical. On the other hand, if the measured energy is only 30% then the adjusted blow count will be reduced by 50%.

2. DYNAMIC TESTING AND ANALYSIS METHODS APPLIED TO SPT

The Case Method of dynamic pile testing, named after the Case Institute of Technology where it was developed between 1964 and 1975, requires that a substantial ram mass (e.g. a pile driving hammer) impacts the pile top such that the pile undergoes at least a small permanent set. Thus, the method is also referred to as a "High Strain Method". The Case Method requires dynamic measurements on the pile or shaft under the ram impact and then a calculation of various quantities. Conveniently, for SPT applications, the measurements and analyses are done by a single piece of equipment: the SPT Analyzer. The Pile Driving Analyzer® (PDA) is also suitable to perform these measurements and data processing.

A related analysis method is the "Wave Equation Analysis" which calculates a relationship between bearing capacity, pile stresses, transferred energy and field blow count. The GRLWEAP™ program performs this analysis and provides a complete set of helpful information and input data. This program can be used very effectively to simulate the SPT driving process.

3. MEASUREMENTS

GRL uses equipment manufactured by Pile Dynamics, Inc. The system includes either an SPT-Analyzer™ (SPTA) or a Pile Driving Analyzer® (PDA), an instrumented rod section and two accelerometers. SPT energy testing is very closely related to and borrows procedures from dynamic pile testing. Those interested in the basis of the SPT energy testing method may obtain extensive literature on dynamic pile testing from GRL Engineers, Inc.

3.1 SPT Analyzer or Pile Driving Analyzer

The basis for the results calculated by the SPTA or PDA are strain and acceleration measured in an instrumented rod section. These signals are converted to rod top force, F(t), and rod top velocity, v(t). The SPTA or PDA conditions, calibrates and displays these signals and immediately computes average pile force and velocity thereby eliminating bending effects. The product of these two

measurements is then integrated over time which yields the energy transferred to the instrumented section as a function of time (see Section 4.1).

For convenience and accuracy, strain measurements are usually taken on an instrumented section of SPT drive rod. Ideally, the section properties of the instrumented rod and those of the drive rod are the same, however, using subs, other sections can also be utilized.

For the instrumented section, PDI provides a force calibration in such a way that the output of the instrumented rod is directly calculated without the need for an accurate elastic modulus or cross sectional area of the rod section.

The acceleration measurements are often demanding in the SPT environment, because of high frequency and high acceleration motion components. An experienced measurement engineer, therefore, has to evaluate the quality of this data before final conclusions are drawn from the numerical results calculated by SPTA or PDA.

SPTA or PDA records are taken while the standard N-value is acquired in the conventional manner. This then allows a direct correlation between N-value and average transferred energy.

3.2 HPA

The SPT hammer's ram velocity may be directly obtained using radar technology in the Hammer Performance Analyzer™. The impact velocity results can be automatically processed with a PC or recorded on a strip chart. HPA measurements yield a hammer kinetic energy, but not the energy transferred to the drive rod.

4 RECORD EVALUATION BY SPTA OR PDA

4.1 HAMMER PERFORMANCE

The PDA calculates the energy transferred to the pile top from:

$$E(t) = {}_o\int^t F(\tau)v(\tau)\, d\tau \qquad (2)$$

The maximum of the E(t) curve is often called **ENTHRU or EMX;** it is the most important quantity for an overall evaluation of the performance of a hammer and driving system. **EMX** allows for a classification of the hammer's performance when presented as, e_T, the rated transfer efficiency, also called energy transfer ratio (**ETR**) or global efficiency.

$$e_T = EMX/E_R \qquad (3)$$

where E_R is the hammer manufacturer's rated energy value or 0.35 kip-ft (0.475 kJ) in the case of the SPT hammer.

Often in the SPT literature one finds also reference to the EF2 energy. This evaluation is based on assumed proportionality between force and velocity (see also Section 5):

$$v(t) = F(t) / Z \qquad (4)$$

where Z = EA/c is the pile impedance, E is the elastic modulus, A is the cross sectional area and c is the speed of the stress wave in the pile material..

Combining equations 2 and 4 leads to

$$EF(t) = {}_o\int^t F(\tau)^2 / Z\, d\tau \qquad (5)$$

The EF2 transferred energy value is the EF-value at the time t = 2L/c, where L is the drive rod length and c is the stress wave speed in steel (16,800 ft/s or 5,124 m/s). Since the force is easier to measure than both force and velocity, Equation 5 is preferred by some test engineers. However, the EF method is fraught with errors and certain correction factors have to be applied to make it approximately correct. Among the error sources are the following:

- Proportionality is often violated prior to time 2L/c. The proportionality between force and velocity in a downward traveling wave only holds if the wave does not encounter a disturbance prior to reflecting off the pile toe. Such disturbances include a change in cross sectional area, an open or loose splice or joint, or resistance along the shaft.

- Using only one force measurement precludes a data quality check based on the proportionality between force and velocity. Thus, a force measurement that is for some reason in error may not be detectable, which will lead to errors in the EF2 value. Data quality checks will be discussed further in Section 5.

The use if EF2 is therefore not recommended but it is often included in result presentations for the sake of completeness.

4.2 STRESSES

During SPT monitoring, it is also of interest to monitor compressive stresses at both the top of the drive rod and at its bottom.

At the pile top (location of sensors) the maximum compression stress averaged over the rod's cross section, **CSX**, is directly obtained from the measurements. Note that this stress value refers to the instrumented section. If the rod has a different cross sectional area then the stress in the rod will be different from CSX.

The SPTA or PDA can also calculate, in an approximate manner, the force at the rod bottom, **CFB**. To obtain the corresponding stress, this force value should be divided by the appropriate cross sectional area, e.g. by the rod area just above the sampler or by the sampler area itself. Of course, non-uniform stress components as they might occur at the sampler tip due to a sloping rock are not considered in this calculation.

5. DATA QUALITY CHECKS

Quality data is the first and foremost requirement for accurate dynamic testing results. It is therefore important that the measurement engineer performing SPTA or PDA tests has the experience necessary to recognize measurement problems and take appropriate corrective action should problems develop. Fortunately, dynamic pile testing allows for certain data quality checks because two independent measurements are taken that have to conform to the so-called proportionality relationship.

As long as there is only a wave traveling in one direction, as is the case during impact when only a downward traveling wave exists in the rod, force and velocity measured at its top are proportional

$$F = v\,Z \qquad (5)$$

where Z is again the pile impedance, Z = EA/c. This relationship can also be expressed in terms of stress

$$\sigma = F/A = v\,(E/c) \qquad (6)$$

or strain

$$\epsilon = \sigma/E = v / c \qquad (7)$$

This means that the early portion of strain times wave speed must be equal to the velocity unless the proportionality is affected by high friction near the pile top or by a pile cross sectional change not far below the sensors. Checking the proportionality is an excellent means of assuring meaningful measurements but is only truly meaningful for perfectly uniform rods. Open or loose splices, for example, will lead to a non-proportionality. For SPT rods it is fortunate that usually no soil resistance acts along the shaft and for that reason, proportionality can exist until the stress wave returns from sampler top or rod bottom unless connectors are not sufficiently tightened or have a significant mass.

Velocity data quality can also be checked by looking at the final displacement, DFN, which is calculated from the acceleration by double integration. If the calculated final displacement is much higher or lower than indicated by the N-value, the accelerometer attachment may be loose or the sensor may be faulty. If major drift in the velocity is observed, the EMX value may be in error, even though proportionality from impact to time 2L/c exists. In this case, it may be useful to evaluate the energy transferred to the drill rod at time 2L/c, which is calculated by the PDA or SPTA as the E2E quantity.

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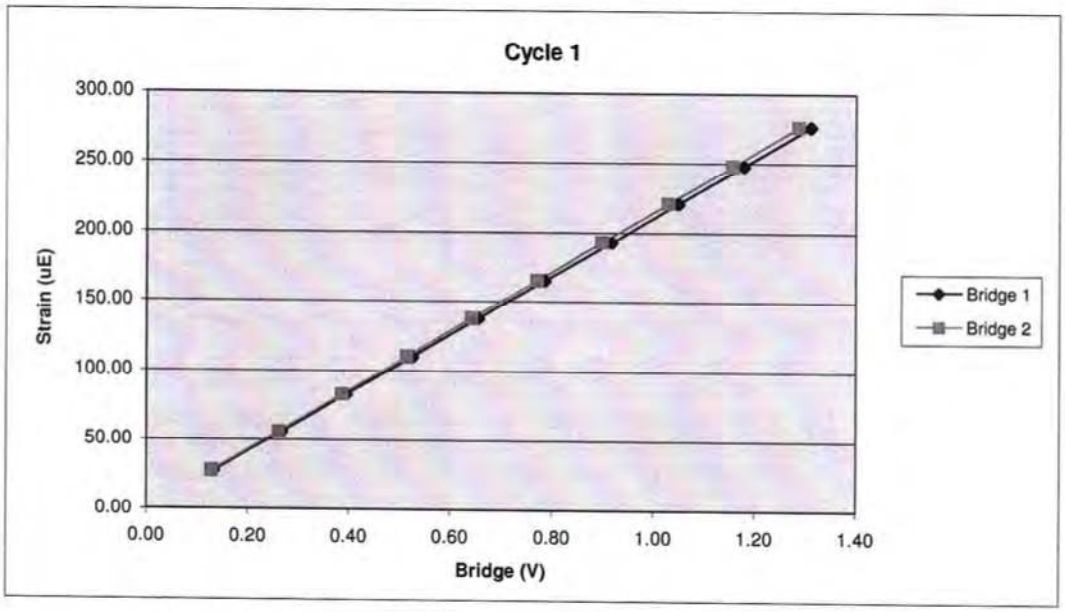
APPENDIX B

Instrumentation Calibration Information

168AWJ		Cycle 1		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	985.12	27.81	0.13	0.13
3	1999.42	55.96	0.27	0.26
4	2962.46	82.88	0.39	0.39
5	3948.57	110.23	0.52	0.51
6	4934.08	137.55	0.65	0.64
7	5929.06	165.07	0.79	0.77
8	6918.72	192.89	0.92	0.90
9	7919.02	220.92	1.05	1.03
10	8900.20	247.97	1.18	1.16
11	9910.36	276.00	1.31	1.29

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7574.02**	**Force Calibration (lb/V)**	**7709.66**
Offset	-21.90	Offset	-11.13
Correlation	0.999999	Correlation	0.999999
Strain Calibration (µE/V)	**210.70**	**Strain Calibration (µE/V)**	**214.48**
Offset	-0.24	Offset	0.06
Correlation	0.999999	Correlation	0.999998

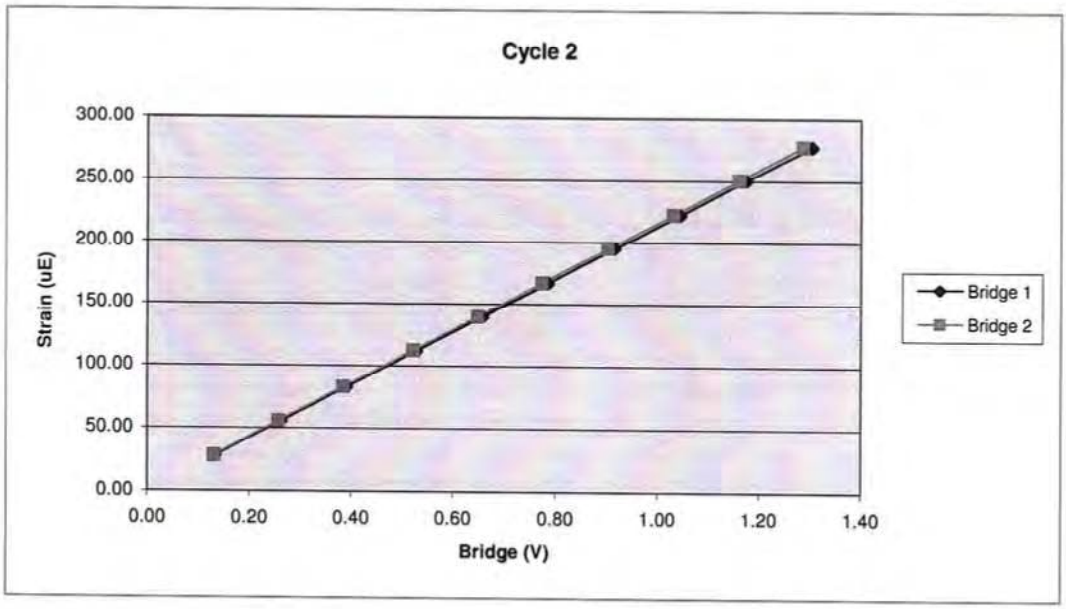
Force Strain Calibration	
EA (Kips)	**35946.33**
Offset	-13.36
Correlation	0.999999



168AWJ		Cycle 2		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	982.95	28.05	0.13	0.13
3	1974.19	55.76	0.26	0.26
4	2953.39	82.87	0.39	0.38
5	4000.42	112.22	0.53	0.52
6	4972.13	139.35	0.66	0.65
7	5950.75	167.00	0.79	0.77
8	6945.33	194.94	0.92	0.90
9	7917.84	222.00	1.04	1.03
10	8919.91	250.27	1.17	1.16
11	9896.36	277.50	1.30	1.29

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7606.16**	**Force Calibration (lb/V)**	**7700.14**
Offset	**-19.82**	Offset	**-11.88**
Correlation	**0.999999**	Correlation	**0.999998**
Strain Calibration (µE/V)	**213.01**	**Strain Calibration (µE/V)**	**215.64**
Offset	**-0.22**	Offset	**0.00**
Correlation	**0.999997**	Correlation	**0.999997**

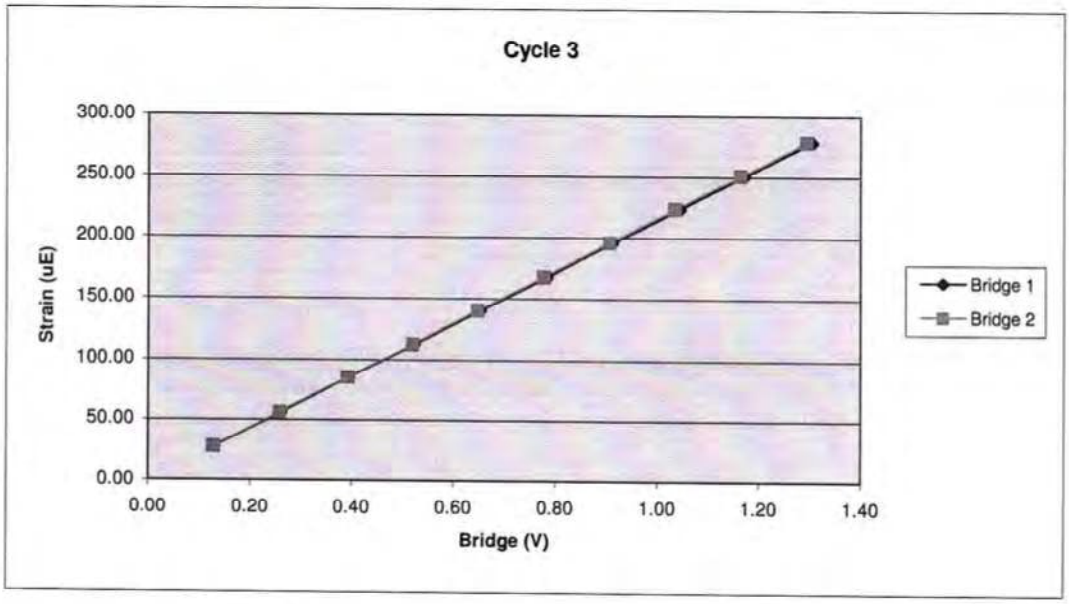
Force Strain Calibration	
EA (Kips)	**35708.56**
Offset	**-11.96**
Correlation	**0.999998**



168AWJ		Cycle 3		
Sample	**Force (lb)**	**Strain (µE)**	**Bridge 1 (V)**	**Bridge 2 (V)**
1	0.00	0.00	0.00	0.00
2	976.84	27.67	0.13	0.13
3	1972.21	55.77	0.26	0.26
4	3006.62	85.22	0.39	0.39
5	3988.79	112.54	0.52	0.52
6	4966.61	140.12	0.65	0.65
7	5959.03	167.81	0.78	0.78
8	6952.23	195.83	0.91	0.91
9	7951.15	223.79	1.04	1.03
10	8937.66	250.72	1.17	1.16
11	9937.17	278.64	1.30	1.29

Bridge 1		**Bridge 2**	
Force Calibration (lb/V)	**7629.36**	**Force Calibration (lb/V)**	**7688.81**
Offset	**-3.45**	Offset	**-7.58**
Correlation	**0.999997**	Correlation	**0.999999**
Strain Calibration (µE/V)	**213.70**	**Strain Calibration (µE/V)**	**215.36**
Offset	**0.65**	Offset	**0.53**
Correlation	**0.999990**	Correlation	**0.999994**

Force Strain Calibration	
EA (Kips)	**35701.55**
Offset	**-26.47**
Correlation	**0.999992**



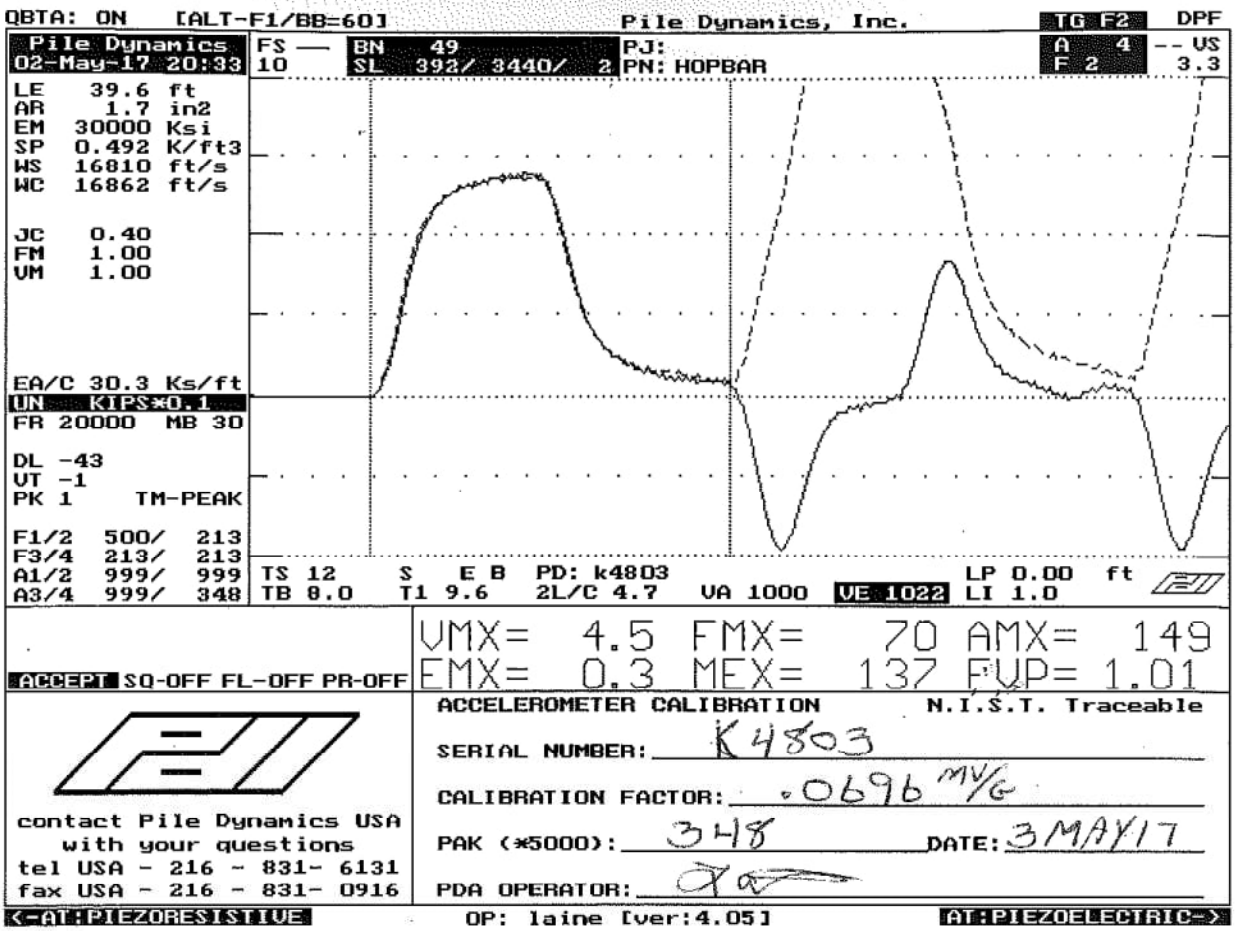
Bridge Excitation (V) 5
Shunt Resitor (ohm) 60.4k

Calibration Factors	168AWJ		
Bridge 1 (µE/V)	212.47	Bridge 2 (µE/V)	215.16
EA Factor (Kips)	35785.48	Area (in^2)	1.19

Calibrated by: David Bu
Calibrated Date: 9/21/2015

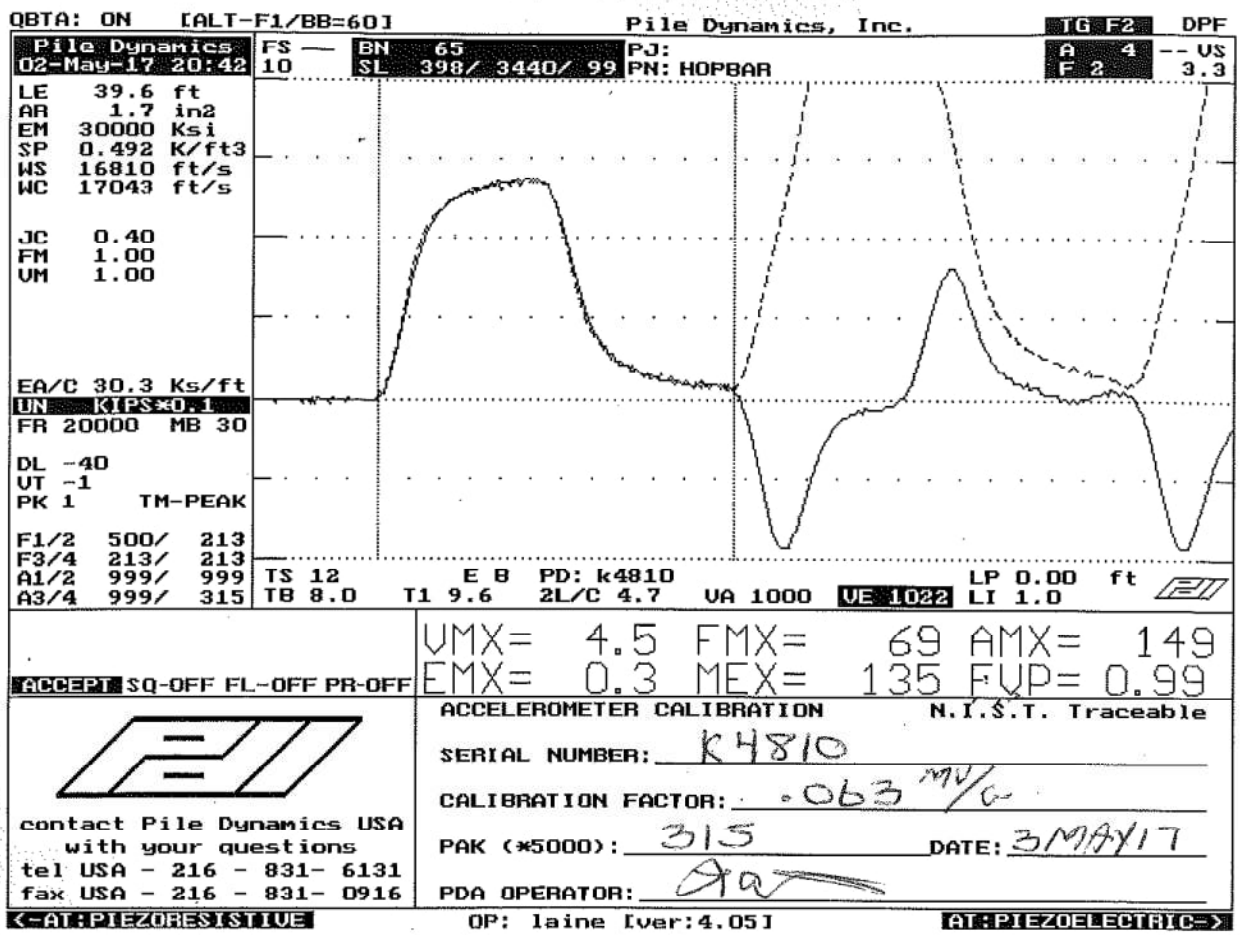
Pile Dynamics Inc
30725 Aurora Rd
Solon, OH 44139

Traceable to N.I.S.T.



Smart Sensor

Smart Chip Programmed By K.M.W. **on** 3MAY17 **CRC Value** 5869



Smart Sensor

Smart Chip Programmed By J.M.W. **on** 3MAY17 **CRC Value** 9E7A

Appendix C

SPT Calibration Results

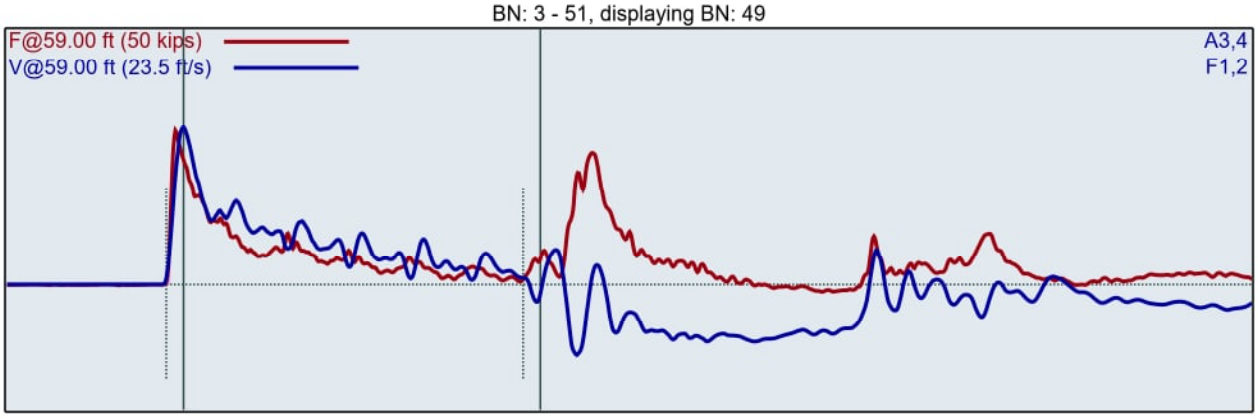
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Acker Renegade (SN 019192-0)
JW
AR: 1.19 in^2
LE: 59.00 ft
WS: 16807.9 ft/s

SS 25 (56.5-58.5)
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

BN: 3 - 51, displaying BN: 49



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	LP	FMX	VMX	BPM	EFV	ETR	DFN	FVP
	ft	kips	ft/s	bpm	ft-lb	(%)	in	[]
3	57.01	30	15.1	52.2	319	91.0	0.06	0.79
4	57.01	31	15.1	53.1	314	89.6	0.06	0.74
5	57.02	31	16.0	53.1	329	93.9	0.06	0.71
6	57.02	32	14.7	54.0	313	89.5	0.06	0.74
7	57.03	33	15.4	53.9	324	92.7	0.06	0.72
8	57.03	31	14.5	53.8	298	85.1	0.06	0.78
9	57.04	33	15.6	54.4	321	91.6	0.06	0.70
10	57.04	30	15.3	52.8	304	87.0	0.06	0.67
11	57.05	32	15.1	54.0	304	86.9	0.06	0.70
12	57.05	32	15.3	53.8	314	89.7	0.06	0.69
13	57.06	32	14.5	54.2	303	86.5	0.06	0.73
14	57.06	31	14.4	52.8	298	85.3	0.06	0.78
15	57.07	33	15.0	54.3	313	89.4	0.06	0.72
16	57.07	31	14.3	53.8	296	84.6	0.06	0.76
17	57.08	31	15.8	53.7	312	89.1	0.06	0.66
18	57.08	33	15.2	53.9	311	88.7	0.06	0.71
19	57.09	33	14.6	53.7	310	88.4	0.06	0.78
20	57.09	33	14.7	54.0	313	89.4	0.06	0.77
21	57.10	33	14.0	53.7	311	88.8	0.06	0.80
22	57.10	31	14.0	53.8	298	85.1	0.06	0.85
23	57.11	29	14.1	53.7	296	84.7	0.06	0.81
24	57.11	31	13.9	47.6	300	85.7	0.06	0.86
25	57.12	32	14.1	45.2	304	87.0	0.06	0.78
26	57.12	30	14.8	44.4	311	88.8	0.06	0.81
27	57.13	30	14.4	47.2	298	85.2	0.06	0.85
28	57.13	30	14.3	52.1	294	84.0	0.06	0.86
29	57.14	32	14.5	54.0	307	87.7	0.06	0.83
30	57.14	30	14.6	53.5	300	85.6	0.06	0.85
31	57.15	29	14.9	53.5	305	87.0	0.06	0.82
32	57.15	29	14.7	53.5	300	85.7	0.06	0.84
33	57.16	29	14.7	53.8	298	85.2	0.06	0.82
34	57.16	28	14.7	53.4	293	83.8	0.06	0.82

35	57.17	30	14.5	54.1	306	87.4	0.06	0.79
36	57.17	29	14.7	53.3	303	86.5	0.06	0.83
37	57.18	29	14.7	53.5	294	83.9	0.06	0.82
38	57.18	29	14.5	53.5	299	85.4	0.06	0.80
39	57.19	31	14.8	53.5	307	87.6	0.06	0.76
40	57.19	30	15.2	53.8	309	88.4	0.06	0.75
41	57.20	30	14.9	53.6	307	87.6	0.06	0.76
42	57.20	29	15.1	54.1	309	88.2	0.06	0.78
43	57.21	29	14.7	53.5	307	87.7	0.06	0.76
44	57.21	29	14.9	53.6	302	86.2	0.06	0.77
45	57.22	30	14.1	53.5	298	85.1	0.06	0.81
46	57.22	30	13.9	53.5	287	82.1	0.06	0.81
47	57.23	30	14.4	54.6	306	87.3	0.06	0.80
48	57.23	30	14.3	53.3	303	86.6	0.06	0.77
49	57.24	30	14.4	53.7	298	85.1	0.06	0.79
50	57.24	30	14.3	53.5	297	84.8	0.06	0.78
51	57.25	31	13.6	53.8	293	83.7	0.06	0.77
	Average	31	14.7	53.0	305	87.1	0.06	0.78
	Std Dev	1	0.5	2.1	8	2.4	0.00	0.05
	Maximum	33	16.0	54.6	329	93.9	0.06	0.86
	Minimum	28	13.6	44.4	287	82.1	0.06	0.66

N-value: 49

Sample Interval Time: 54.46 seconds.

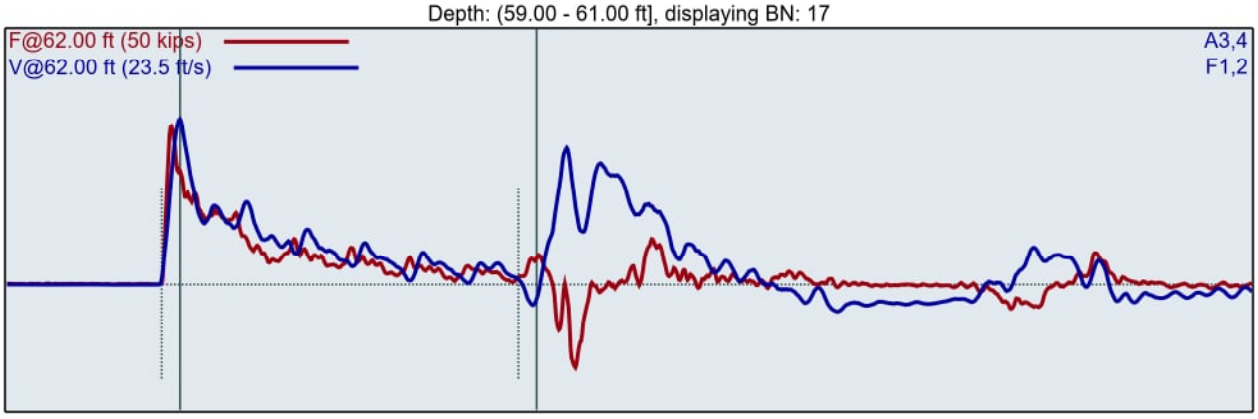
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Acker Renegade (SN 019192-0)
JW
AR: 1.19 in^2
LE: 62.00 ft
WS: 16807.9 ft/s

SS 26 (59-61)
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (59.00 - 61.00 ft], displaying BN: 17



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
1	59.13	31	15.6	1.9	304	87.0	1.50	0.76
2	59.25	32	15.9	48.9	315	90.1	1.50	0.75
3	59.38	31	15.4	47.8	292	83.4	1.50	0.75
4	59.50	31	15.6	47.4	293	83.8	1.50	0.73
5	59.67	32	16.1	48.1	314	89.6	2.00	0.71
6	59.83	32	16.2	48.3	316	90.1	2.00	0.70
7	60.00	31	16.1	48.9	332	94.9	2.00	0.72
8	60.04	32	15.5	49.3	303	86.5	0.50	0.72
9	60.08	31	15.8	49.6	312	89.2	0.50	0.72
10	60.13	30	15.2	49.6	292	83.5	0.50	0.72
11	60.17	31	15.4	49.6	298	85.2	0.50	0.72
12	60.21	31	14.9	49.9	287	81.9	0.50	0.72
13	60.25	31	15.4	49.9	301	86.0	0.50	0.71
14	60.29	31	15.2	49.9	298	85.1	0.50	0.71
15	60.33	31	15.2	49.9	299	85.4	0.50	0.71
16	60.38	30	15.1	49.9	297	84.9	0.50	0.71
17	60.42	31	15.2	49.7	301	86.0	0.50	0.69
18	60.46	30	15.3	50.1	305	87.0	0.50	0.68
19	60.50	29	14.9	49.8	285	81.5	0.50	0.66
20	60.51	31	15.8	50.0	302	86.2	0.13	0.65
21	60.52	31	15.9	50.1	300	85.6	0.12	0.65
22	60.53	31	16.0	50.0	299	85.6	0.12	0.63
23	60.54	30	16.0	50.2	295	84.2	0.13	0.62
24	60.55	31	16.3	50.0	303	86.6	0.13	0.61
25	60.56	30	16.1	50.3	293	83.8	0.13	0.61
26	60.57	31	15.1	50.3	300	85.8	0.13	0.72
27	60.58	31	14.5	50.7	286	81.7	0.13	0.70
28	60.59	31	14.2	50.4	299	85.6	0.12	0.74
29	60.60	31	13.9	50.4	292	83.5	0.13	0.70
30	60.61	31	14.5	50.4	285	81.4	0.12	0.67
31	60.63	31	14.7	50.5	291	83.3	0.13	0.72
32	60.64	30	14.2	50.6	287	82.0	0.12	0.73

33	60.65	30	14.8	50.6	285	81.5	0.12	0.70
34	60.66	30	14.4	50.5	288	82.3	0.13	0.75
35	60.67	29	14.0	50.6	282	80.4	0.12	0.77
36	60.68	30	14.8	50.6	285	81.4	0.12	0.67
37	60.69	31	14.7	50.5	295	84.4	0.13	0.74
38	60.70	31	15.9	50.6	303	86.5	0.12	0.56
39	60.71	30	15.3	50.5	293	83.8	0.12	0.67
40	60.72	29	14.7	50.3	289	82.5	0.13	0.71
41	60.73	30	15.3	50.5	305	87.0	0.12	0.71
42	60.74	30	15.5	50.6	306	87.3	0.12	0.68
43	60.75	30	15.0	50.3	298	85.1	0.12	0.71
44	60.76	30	15.5	50.6	303	86.5	0.12	0.68
45	60.77	31	15.9	50.5	307	87.8	0.13	0.67
46	60.78	31	15.1	50.3	314	89.7	0.12	0.73
47	60.79	30	15.4	50.6	309	88.2	0.12	0.74
48	60.80	30	14.8	50.3	297	85.0	0.13	0.74
49	60.81	30	14.7	50.5	306	87.5	0.12	0.76
50	60.82	30	14.5	50.5	296	84.6	0.13	0.76
51	60.83	30	14.7	50.8	299	85.4	0.12	0.74
52	60.84	29	14.8	50.4	299	85.5	0.12	0.72
53	60.85	31	14.9	50.3	308	87.9	0.13	0.73
54	60.86	30	14.5	50.7	291	83.2	0.13	0.78
55	60.88	30	15.0	50.5	302	86.4	0.13	0.72
56	60.89	31	15.2	50.8	312	89.1	0.12	0.67
57	60.90	30	14.7	50.6	302	86.3	0.13	0.76
58	60.91	30	14.8	50.5	298	85.1	0.13	0.67
59	60.92	30	14.7	50.4	292	83.3	0.13	0.67
60	60.93	31	15.1	50.6	302	86.2	0.13	0.70
61	60.94	31	14.9	50.5	304	86.9	0.13	0.66
62	60.95	31	18.6	50.5	315	90.0	0.12	0.46
63	60.96	28	16.0	50.6	287	82.0	0.13	0.42
64	60.97	28	16.6	50.4	295	84.4	0.13	0.39
65	60.98	28	16.4	50.4	293	83.7	0.13	0.39
66	60.99	28	16.2	50.4	286	81.7	0.12	0.38
67	61.00	28	16.6	50.5	292	83.5	0.12	0.38
	Average	31	15.4	49.5	303	86.5	0.80	0.71
	Std Dev	1	0.4	0.6	12	3.3	0.60	0.02
	Maximum	32	16.2	50.1	332	94.9	2.00	0.72
	Minimum	29	14.9	48.1	285	81.5	0.50	0.66

N-value: 15

Sample Interval Time: 79.06 seconds.

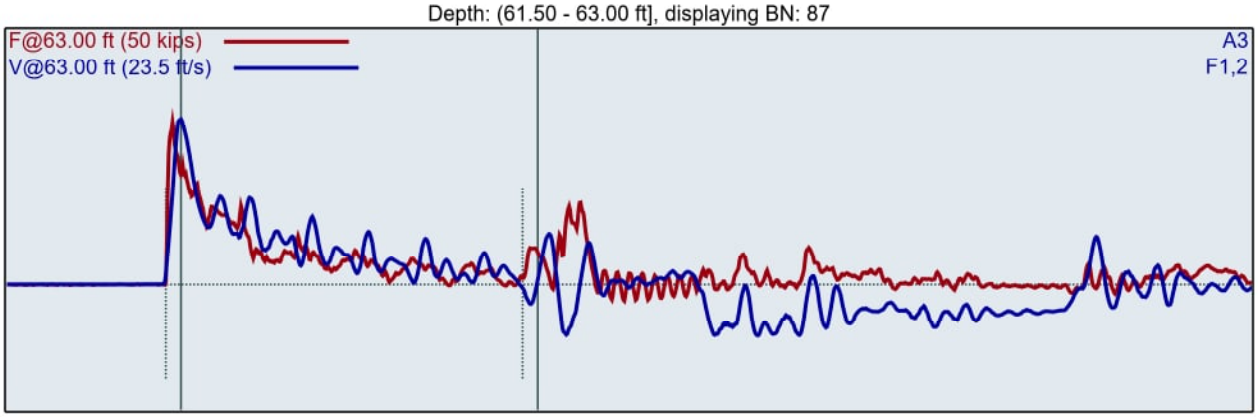
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Acker Renegade (SN 019192-0)
JW
AR: 1.19 in^2
LE: 63.00 ft
WS: 16807.9 ft/s

SS 27 (61.5-63.5)
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (61.50 - 63.00 ft], displaying BN: 87



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
1	61.56	30	15.3	1.9	295	84.4	0.67	0.76
2	61.61	31	15.4	55.0	299	85.4	0.67	0.75
3	61.67	31	15.3	53.5	300	85.7	0.67	0.74
4	61.72	31	15.2	53.9	298	85.1	0.67	0.75
5	61.78	30	13.8	55.0	293	83.8	0.67	0.73
6	61.83	31	17.2	54.3	343	98.1	0.67	0.62
7	61.89	29	14.2	53.5	291	83.2	0.67	0.77
8	61.94	30	15.3	55.1	319	91.2	0.67	0.69
9	62.00	30	14.8	54.3	300	85.8	0.67	0.69
10	62.03	30	14.9	54.4	298	85.1	0.40	0.69
11	62.07	29	14.6	54.8	299	85.5	0.40	0.73
12	62.10	31	14.5	53.6	301	86.0	0.40	0.68
13	62.13	31	15.5	55.8	316	90.2	0.40	0.68
14	62.17	29	14.6	53.5	305	87.2	0.40	0.77
15	62.20	30	16.2	54.7	319	91.3	0.40	0.69
16	62.23	30	14.5	54.0	307	87.6	0.40	0.69
17	62.27	31	16.2	54.6	318	90.9	0.40	0.64
18	62.30	31	15.5	54.6	315	90.0	0.40	0.65
19	62.33	31	15.6	54.2	314	89.8	0.40	0.67
20	62.37	30	15.1	54.4	315	89.9	0.40	0.67
21	62.40	29	15.8	54.6	313	89.4	0.40	0.68
22	62.43	30	15.3	54.9	308	87.9	0.40	0.70
23	62.47	30	15.4	54.8	311	88.9	0.40	0.69
24	62.50	30	15.3	54.6	315	90.1	0.40	0.67
25	62.50	30	16.0	54.8	316	90.4	0.02	0.69
26	62.50	30	14.6	54.7	308	87.9	0.02	0.71
27	62.50	30	14.1	54.7	296	84.5	0.02	0.69
28	62.51	30	12.9	54.9	286	81.6	0.01	0.80
29	62.51	29	14.8	54.7	306	87.5	0.02	0.72
30	62.51	29	14.8	54.7	306	87.4	0.02	0.72
31	62.51	30	14.6	54.7	300	85.6	0.02	0.65
32	62.51	30	14.3	55.0	303	86.5	0.02	0.75

33	62.51	29	15.3	54.8	310	88.4	0.01	0.69
34	62.51	32	15.2	54.6	314	89.8	0.01	0.68
35	62.51	29	14.6	54.8	305	87.2	0.02	0.74
36	62.52	29	15.0	54.5	301	85.9	0.02	0.72
37	62.52	29	13.3	54.9	291	83.1	0.02	0.78
38	62.52	27	16.0	55.0	315	90.0	0.02	0.69
39	62.52	30	15.7	55.1	316	90.2	0.02	0.62
40	62.52	31	13.9	54.3	295	84.3	0.02	0.73
41	62.52	29	15.8	55.1	317	90.6	0.02	0.68
42	62.52	32	15.8	54.8	321	91.8	0.02	0.69
43	62.52	30	14.1	54.4	299	85.4	0.02	0.80
44	62.53	31	16.0	54.8	320	91.4	0.02	0.66
45	62.53	30	16.2	54.9	321	91.8	0.02	0.68
46	62.53	30	13.6	54.5	294	84.1	0.02	0.73
47	62.53	29	16.1	55.1	318	90.7	0.02	0.66
48	62.53	30	13.4	54.7	300	85.8	0.01	0.79
49	62.53	30	13.3	54.4	296	84.6	0.01	0.80
50	62.53	30	14.2	54.8	301	86.0	0.02	0.73
51	62.53	29	14.2	54.8	297	84.7	0.01	0.71
52	62.54	30	14.8	55.1	316	90.2	0.01	0.70
53	62.54	31	14.6	54.8	311	88.8	0.02	0.69
54	62.54	31	15.0	54.3	305	87.2	0.02	0.67
55	62.54	29	15.3	54.9	305	87.3	0.01	0.66
56	62.54	30	15.0	55.2	306	87.4	0.02	0.67
57	62.54	29	15.4	54.7	311	88.9	0.02	0.65
58	62.54	29	13.4	54.3	296	84.5	0.01	0.77
59	62.54	30	15.8	54.9	320	91.5	0.02	0.67
60	62.55	29	15.6	54.8	314	89.8	0.01	0.67
61	62.55	30	15.7	54.6	313	89.4	0.02	0.63
62	62.55	29	14.8	54.7	306	87.5	0.02	0.69
63	62.55	30	14.9	54.7	309	88.3	0.02	0.68
64	62.55	29	15.0	54.8	308	88.0	0.01	0.70
65	62.55	28	15.1	54.3	302	86.3	0.02	0.72
66	62.55	30	14.2	54.8	303	86.6	0.02	0.66
67	62.56	30	15.2	54.7	308	88.0	0.01	0.68
68	62.56	30	14.8	54.6	311	88.7	0.02	0.69
69	62.56	30	14.4	54.4	291	83.0	0.01	0.69
70	62.56	30	14.5	54.9	303	86.6	0.02	0.69
71	62.56	31	14.6	54.9	309	88.2	0.02	0.72
72	62.56	32	14.9	54.6	309	88.3	0.01	0.69
73	62.56	32	15.3	55.0	316	90.3	0.02	0.67
74	62.56	32	15.0	54.7	309	88.2	0.01	0.66
75	62.57	32	14.7	54.4	306	87.5	0.01	0.69
76	62.57	31	13.6	54.8	295	84.3	0.02	0.80
77	62.57	31	14.3	54.4	306	87.5	0.02	0.70
78	62.57	31	13.9	54.9	303	86.6	0.01	0.79
79	62.57	30	15.4	54.8	309	88.3	0.01	0.67
80	62.57	31	15.7	54.4	312	89.1	0.02	0.65
81	62.57	30	15.2	54.6	307	87.6	0.02	0.69
82	62.57	31	16.1	55.1	316	90.2	0.01	0.65
83	62.58	31	15.6	54.4	315	90.1	0.01	0.69
84	62.58	32	14.9	54.5	305	87.1	0.01	0.67
85	62.58	32	14.8	54.9	305	87.3	0.02	0.68
86	62.58	32	15.4	54.8	309	88.3	0.01	0.67
87	62.58	32	15.2	54.8	307	87.6	0.02	0.66
88	62.58	31	15.6	54.5	311	88.9	0.01	0.64
89	62.58	31	15.5	54.7	305	87.2	0.02	0.67

GRL Engineers, Inc.

SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Average	30	15.0	54.7	307	87.9	0.09	0.70
Std Dev	1	0.8	0.3	8	2.2	0.15	0.04
Maximum	32	16.2	55.8	321	91.8	0.40	0.80
Minimum	27	12.9	53.5	286	81.6	0.01	0.62

N-value: 80

Sample Interval Time: 96.60 seconds.

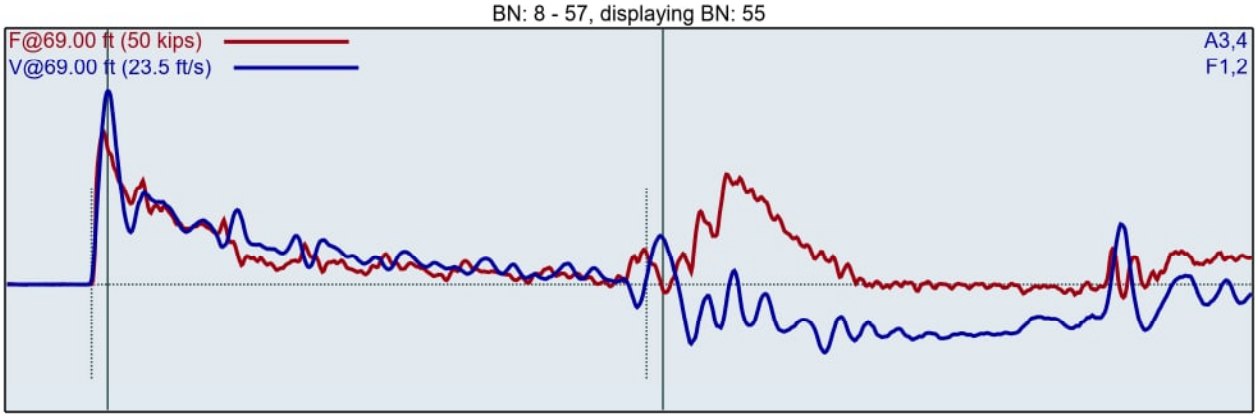
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Acker Renegade (SN 019192-0)
JW
AR: 1.19 in^2
LE: 69.00 ft
WS: 16807.9 ft/s

SS 28 (63.5-65.5)
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

BN: 8 - 57, displaying BN: 55



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
8	64.01	31	17.1	53.7	305	87.1	0.06	0.69
9	64.01	30	17.0	52.9	302	86.2	0.06	0.70
10	64.02	32	17.1	54.0	314	89.7	0.06	0.67
11	64.02	29	17.2	53.7	300	85.7	0.06	0.71
12	64.03	29	16.9	53.8	298	85.2	0.06	0.73
13	64.03	31	17.7	53.2	315	90.0	0.06	0.69
14	64.04	31	17.7	54.1	316	90.4	0.06	0.70
15	64.04	29	17.0	54.2	300	85.7	0.06	0.73
16	64.05	28	17.0	52.7	297	84.8	0.06	0.73
17	64.05	30	17.5	54.3	311	88.9	0.06	0.67
18	64.06	31	17.8	53.6	313	89.5	0.06	0.67
19	64.06	32	18.0	53.7	323	92.2	0.06	0.66
20	64.07	30	17.9	53.6	312	89.1	0.06	0.67
21	64.07	30	17.6	53.7	311	88.9	0.06	0.70
22	64.08	31	17.9	53.8	311	88.7	0.06	0.67
23	64.08	31	18.1	54.4	323	92.3	0.06	0.68
24	64.09	31	17.8	53.8	309	88.2	0.06	0.66
25	64.09	31	18.1	53.5	314	89.7	0.06	0.66
26	64.10	28	17.5	53.9	299	85.5	0.06	0.72
27	64.10	31	17.6	54.2	307	87.6	0.06	0.66
28	64.11	32	18.4	53.8	318	90.8	0.06	0.66
29	64.11	31	17.8	54.1	306	87.5	0.06	0.67
30	64.12	31	18.2	54.1	311	88.7	0.06	0.68
31	64.12	30	17.8	54.2	305	87.1	0.06	0.65
32	64.13	31	17.6	53.9	301	86.1	0.06	0.67
33	64.13	30	18.0	53.8	305	87.1	0.06	0.67
34	64.14	30	17.8	54.3	307	87.8	0.06	0.65
35	64.14	30	17.7	53.9	297	84.9	0.06	0.67
36	64.15	31	17.6	54.0	306	87.5	0.06	0.65
37	64.15	31	18.3	53.8	317	90.5	0.06	0.64
38	64.16	30	17.9	54.0	305	87.2	0.06	0.70
39	64.16	31	17.9	54.2	313	89.3	0.06	0.65

40	64.17	31	18.0	53.9	312	89.1	0.06	0.65
41	64.17	31	17.7	53.6	306	87.3	0.06	0.64
42	64.18	31	18.1	53.9	314	89.6	0.06	0.65
43	64.18	31	17.8	53.9	310	88.5	0.06	0.66
44	64.19	32	18.1	54.1	316	90.2	0.06	0.65
45	64.19	31	17.9	54.0	315	89.9	0.06	0.66
46	64.20	31	18.3	53.9	322	91.9	0.06	0.66
47	64.20	29	17.9	53.8	309	88.2	0.06	0.70
48	64.21	30	17.8	54.1	313	89.5	0.06	0.71
49	64.21	31	17.8	54.2	315	90.0	0.06	0.67
50	64.22	30	17.8	53.9	305	87.2	0.06	0.66
51	64.22	31	17.8	53.9	307	87.7	0.06	0.67
52	64.23	31	18.1	54.0	323	92.1	0.06	0.67
53	64.23	31	18.0	54.0	309	88.4	0.06	0.67
54	64.24	31	18.0	54.1	319	91.1	0.06	0.66
55	64.24	30	17.8	53.8	312	89.1	0.06	0.70
56	64.25	31	17.8	54.1	312	89.2	0.06	0.66
57	64.25	31	18.2	54.1	320	91.3	0.06	0.65
	Average	31	17.8	53.9	310	88.6	0.06	0.67
	Std Dev	1	0.4	0.3	7	1.9	0.00	0.02
	Maximum	32	18.4	54.4	323	92.3	0.06	0.73
	Minimum	28	16.9	52.7	297	84.8	0.06	0.64

N-value: 50

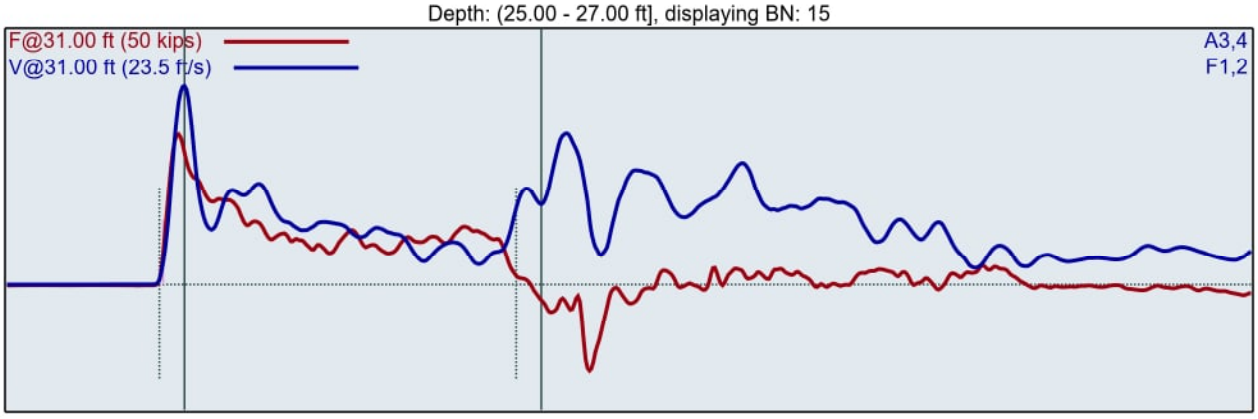
Sample Interval Time: 54.49 seconds.

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Simco 2800 HS(HT) SN 072068
JW Test date: 9/7/2017
AR: 1.19 in^2 SP: 0.492 k/ft3
LE: 31.00 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (25.00 - 27.00 ft], displaying BN: 15



FMX: Maximum Force
VMX: Maximum Velocity
BPM: Blows/Minute
EFV: Maximum Energy

ETR: Energy Transfer Ratio - Rated
DFN: Final Displacement
FVP: Force/Velocity Proportionality

BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
1	3	25.17	29	17.1	1.9	281	80.4	2.00	0.75
2	3	25.33	28	17.1	39.5	284	81.1	2.00	0.76
3	3	25.50	28	17.6	39.7	286	81.6	2.00	0.72
4	6	25.58	29	17.9	39.9	286	81.7	1.00	0.68
5	6	25.67	29	17.9	39.9	284	81.2	1.00	0.68
6	6	25.75	29	18.2	40.0	287	82.0	1.00	0.71
7	6	25.83	29	18.2	40.1	286	81.6	1.00	0.68
8	6	25.92	30	18.3	39.9	285	81.4	1.00	0.69
9	6	26.00	29	18.2	40.0	285	81.4	1.00	0.68
10	8	26.06	29	17.9	40.2	285	81.4	0.75	0.70
11	8	26.13	29	17.9	40.1	287	82.1	0.75	0.70
12	8	26.19	29	17.9	40.0	287	81.9	0.75	0.70
13	8	26.25	29	18.1	40.1	284	81.2	0.75	0.70
14	8	26.31	29	18.1	40.0	288	82.4	0.75	0.66
15	8	26.38	29	18.2	40.1	284	81.0	0.75	0.67
16	8	26.44	29	17.9	40.1	283	81.0	0.75	0.71
17	8	26.50	29	18.1	40.0	284	81.1	0.75	0.69
18	10	26.55	29	18.2	40.0	287	81.9	0.60	0.72
19	10	26.60	29	18.2	40.1	287	82.0	0.60	0.69
20	10	26.65	29	18.1	40.1	288	82.2	0.60	0.68
21	10	26.70	29	18.3	40.1	289	82.6	0.60	0.70
22	10	26.75	29	18.1	40.1	296	84.6	0.60	0.70
23	10	26.80	30	18.3	40.3	288	82.3	0.60	0.69
24	10	26.85	29	18.3	39.9	293	83.6	0.60	0.70
25	10	26.90	29	17.9	40.2	286	81.8	0.60	0.70
26	10	26.95	29	18.3	40.2	289	82.7	0.60	0.70
27	10	27.00	28	17.7	40.2	291	83.1	0.60	0.68

GRL Engineers, Inc.

SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Average	29	18.1	40.0	285	81.5	0.86	0.69
Std Dev	0	0.1	0.1	1	0.4	0.12	0.01
Maximum	30	18.3	40.2	288	82.4	1.00	0.71
Minimum	29	17.9	39.9	283	81.0	0.75	0.66
		N-value: 14					

Sample Interval Time: 39.02 seconds.

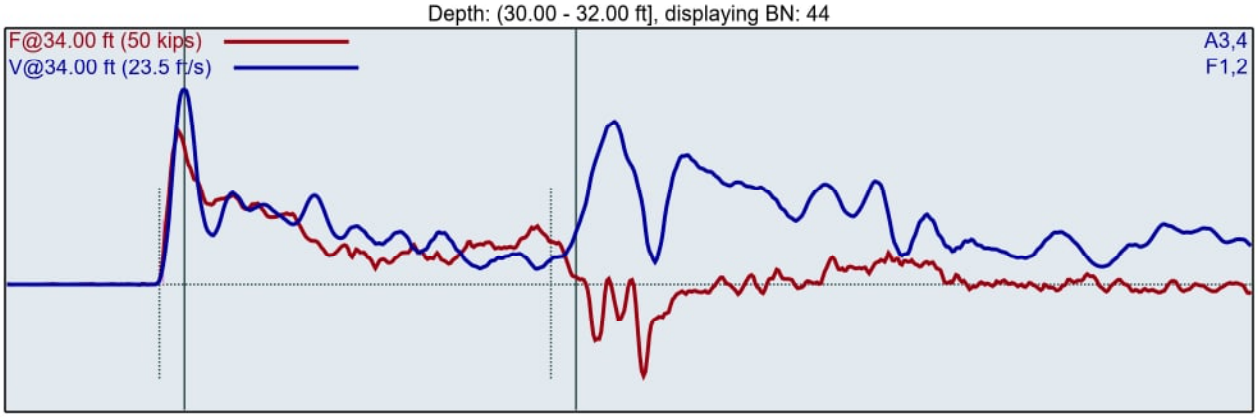
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Simco 2800 HS(HT)
JW
AR: 1.19 in^2
LE: 34.00 ft
WS: 16807.9 ft/s

SN 072068
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (30.00 - 32.00 ft], displaying BN: 44



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
28	3	30.17	29	19.6	1.9	287	81.9	2.00	0.71
29	3	30.33	30	20.1	40.0	297	84.8	2.00	0.70
30	3	30.50	30	19.0	40.4	290	82.8	2.00	0.72
31	8	30.56	29	18.0	40.3	286	81.7	0.75	0.71
32	8	30.63	29	18.1	40.6	285	81.5	0.75	0.71
33	8	30.69	29	18.0	40.5	287	82.1	0.75	0.72
34	8	30.75	30	18.3	40.4	292	83.5	0.75	0.69
35	8	30.81	30	18.4	40.3	293	83.7	0.75	0.70
36	8	30.88	30	18.1	40.7	288	82.4	0.75	0.72
37	8	30.94	30	18.2	40.5	293	83.7	0.75	0.70
38	8	31.00	30	18.4	40.6	294	84.0	0.75	0.70
39	8	31.06	30	18.0	40.7	290	82.8	0.75	0.71
40	8	31.13	30	18.0	40.6	292	83.5	0.75	0.70
41	8	31.19	30	18.1	40.5	296	84.6	0.75	0.70
42	8	31.25	30	18.2	40.8	290	82.8	0.75	0.70
43	8	31.31	30	18.0	40.3	291	83.2	0.75	0.71
44	8	31.38	30	17.9	40.9	288	82.4	0.75	0.70
45	8	31.44	30	18.0	40.5	289	82.6	0.75	0.72
46	8	31.50	29	17.4	40.6	290	82.9	0.75	0.72
47	10	31.55	29	18.0	40.4	293	83.8	0.60	0.71
48	10	31.60	29	17.9	40.7	289	82.7	0.60	0.71
49	10	31.65	30	18.3	40.7	290	82.8	0.60	0.68
50	10	31.70	29	17.6	40.4	291	83.2	0.60	0.73
51	10	31.75	29	17.8	40.7	289	82.7	0.60	0.71
52	10	31.80	29	17.8	40.3	289	82.5	0.60	0.71
53	10	31.85	29	17.8	40.8	287	82.0	0.60	0.71
54	10	31.90	29	17.9	40.6	290	82.9	0.60	0.70
55	10	31.95	29	17.7	40.7	286	81.7	0.60	0.69
56	10	32.00	29	17.8	40.5	288	82.3	0.60	0.70
		Average	30	18.1	40.6	290	83.0	0.75	0.71
		Std Dev	0	0.2	0.2	3	0.8	0.00	0.01
		Maximum	30	18.4	40.9	296	84.6	0.75	0.72
		Minimum	29	17.4	40.3	285	81.5	0.75	0.69

N-value: 16

Sample Interval Time: 41.43 seconds.

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

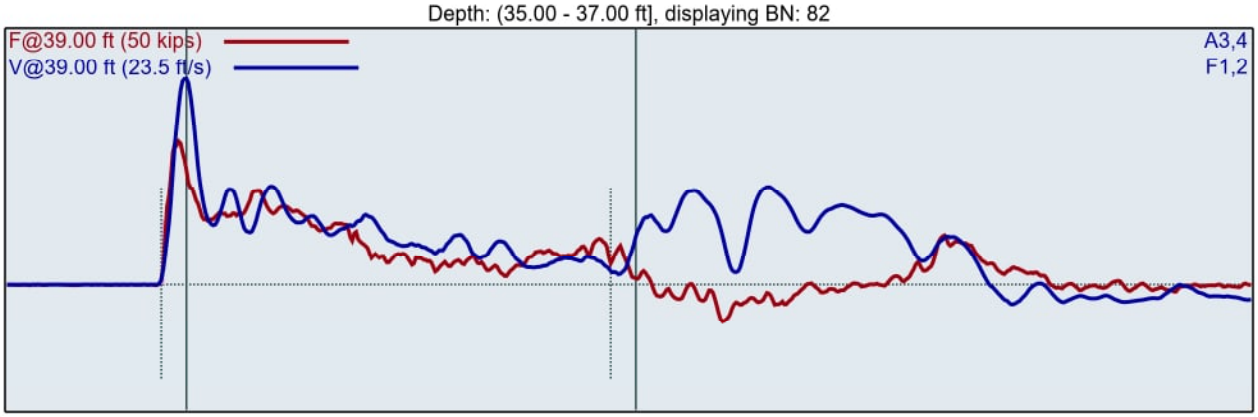
Simco 2800 HS(HT)
JW

SN 072068
Test date: 9/7/2017

AR: 1.19 in^2
LE: 39.00 ft
WS: 16807.9 ft/s

SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (35.00 - 37.00 ft], displaying BN: 82



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
57	5	35.10	27	18.8	1.9	278	79.6	1.19	0.59
58	5	35.20	28	18.8	44.3	292	83.4	1.20	0.60
59	5	35.30	28	19.2	44.4	295	84.4	1.20	0.56
60	5	35.40	28	18.8	44.9	292	83.6	1.20	0.60
61	5	35.50	26	18.4	44.6	294	84.1	1.20	0.65
62	8	35.56	28	19.1	45.1	294	84.0	0.75	0.59
63	8	35.63	27	18.8	45.0	295	84.2	0.75	0.61
64	8	35.69	27	18.8	44.9	294	84.1	0.75	0.62
65	8	35.75	27	19.0	45.1	296	84.5	0.75	0.62
66	8	35.81	27	19.0	45.0	296	84.6	0.75	0.59
67	8	35.88	28	18.8	45.0	294	84.0	0.75	0.59
68	8	35.94	27	18.8	45.0	297	84.8	0.75	0.61
69	8	36.00	27	18.6	45.0	295	84.4	0.75	0.57
70	15	36.03	28	18.6	44.9	295	84.2	0.40	0.64
71	15	36.07	28	18.8	45.1	295	84.1	0.40	0.61
72	15	36.10	28	18.6	44.9	294	84.1	0.40	0.60
73	15	36.13	28	18.7	45.1	294	84.1	0.40	0.63
74	15	36.17	27	18.5	45.1	294	84.1	0.40	0.59
75	15	36.20	26	17.8	45.1	290	82.9	0.40	0.61
76	15	36.23	26	18.1	45.0	294	83.9	0.40	0.58
77	15	36.27	27	18.6	45.0	295	84.3	0.40	0.58
78	15	36.30	27	18.3	45.1	292	83.5	0.40	0.56
79	15	36.33	28	18.5	45.1	292	83.3	0.40	0.62
80	15	36.37	27	18.6	44.9	300	85.7	0.40	0.56
81	15	36.40	28	18.6	45.2	296	84.5	0.40	0.62
82	15	36.43	28	18.9	44.9	295	84.2	0.40	0.55
83	15	36.47	28	18.6	45.0	295	84.4	0.40	0.58
84	15	36.50	29	19.3	44.7	302	86.2	0.40	0.60
85	11	36.55	28	19.3	45.1	301	86.1	0.55	0.57
86	11	36.59	30	20.2	44.6	309	88.2	0.55	0.55
87	11	36.64	29	19.4	45.2	302	86.4	0.55	0.60
88	11	36.68	28	19.4	45.2	300	85.9	0.55	0.57
89	11	36.73	29	19.7	44.9	299	85.6	0.55	0.55
90	11	36.77	29	19.7	44.9	301	86.0	0.55	0.58
91	11	36.82	29	19.7	45.0	298	85.2	0.54	0.56
92	11	36.86	29	19.9	44.9	300	85.6	0.55	0.56

93	11	36.91	29	19.9	45.0	300	85.6	0.54	0.55
94	11	36.95	30	20.0	44.9	303	86.5	0.55	0.54
95	11	37.00	29	20.0	44.9	303	86.6	0.54	0.53
		Average	27	18.7	45.0	295	84.3	0.52	0.60
		Std Dev	0	0.3	0.1	2	0.7	0.17	0.02
		Maximum	29	19.3	45.2	302	86.2	0.75	0.64
		Minimum	26	17.8	44.7	290	82.9	0.40	0.55
				N-value: 23					

Sample Interval Time: 50.79 seconds.

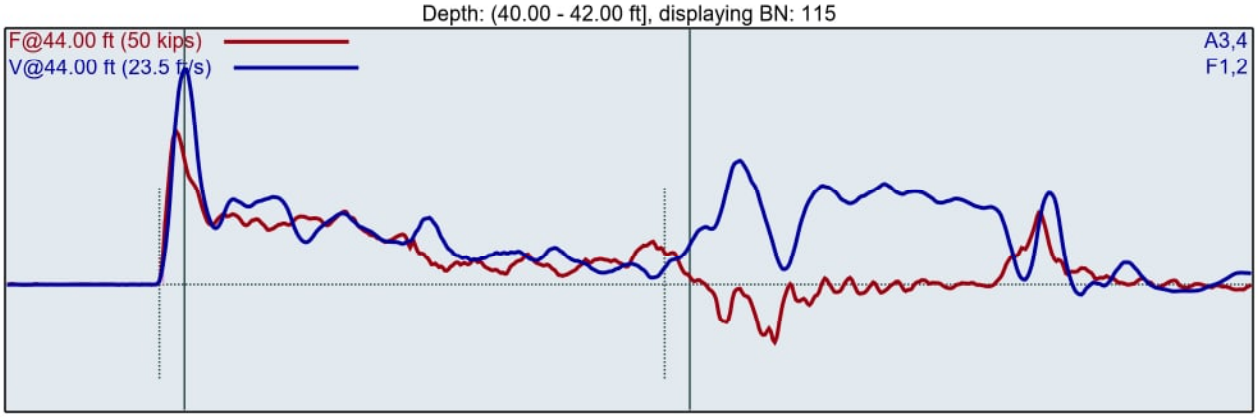
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Simco 2800 HS(HT)
JW
AR: 1.19 in^2
LE: 44.00 ft
WS: 16807.9 ft/s

SN 072068
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (40.00 - 42.00 ft], displaying BN: 115



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
96	5	40.10	28	19.1	1.9	291	83.0	1.20	0.61
97	5	40.20	29	19.0	42.8	298	85.1	1.20	0.54
98	5	40.30	29	19.5	42.9	298	85.3	1.20	0.59
99	5	40.40	29	19.4	43.0	301	86.0	1.20	0.60
100	5	40.50	29	19.7	43.1	304	86.8	1.20	0.54
101	7	40.57	29	19.6	43.3	301	86.0	0.86	0.59
102	7	40.64	29	19.6	43.2	300	85.7	0.86	0.58
103	7	40.71	30	19.7	43.0	307	87.6	0.86	0.56
104	7	40.79	29	19.3	43.1	303	86.5	0.86	0.61
105	7	40.86	29	19.5	43.4	306	87.3	0.86	0.60
106	7	40.93	28	19.1	43.2	297	85.0	0.86	0.61
107	7	41.00	29	19.7	43.1	307	87.7	0.86	0.55
108	10	41.05	29	19.6	42.9	309	88.3	0.60	0.58
109	10	41.10	29	19.4	43.2	298	85.2	0.60	0.57
110	10	41.15	29	19.4	43.1	305	87.0	0.60	0.56
111	10	41.20	29	19.6	43.3	300	85.8	0.60	0.57
112	10	41.25	29	19.7	43.0	308	88.1	0.60	0.59
113	10	41.30	29	19.7	43.3	307	87.7	0.60	0.55
114	10	41.35	30	19.6	43.3	306	87.5	0.60	0.57
115	10	41.40	30	19.8	42.9	308	88.1	0.60	0.58
116	10	41.45	29	19.6	43.5	305	87.1	0.60	0.59
117	10	41.50	30	19.9	43.1	310	88.6	0.60	0.57
118	12	41.54	29	19.8	43.3	307	87.7	0.50	0.57
119	12	41.58	30	20.0	43.1	310	88.5	0.50	0.56
120	12	41.63	30	19.8	43.3	310	88.5	0.50	0.56
121	12	41.67	30	19.7	43.4	305	87.3	0.50	0.55
122	12	41.71	30	19.9	43.2	307	87.8	0.50	0.55
123	12	41.75	30	20.0	43.3	310	88.5	0.50	0.56
124	12	41.79	30	20.0	43.1	312	89.1	0.50	0.57
125	12	41.83	30	20.0	43.3	311	88.9	0.50	0.55
126	12	41.88	30	19.9	43.3	309	88.4	0.50	0.55
127	12	41.92	30	20.0	43.3	311	89.0	0.50	0.53
128	12	41.96	29	19.9	43.3	307	87.8	0.50	0.57
129	12	42.00	30	20.0	43.2	309	88.2	0.50	0.54

GRL Engineers, Inc.

SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Average	29	19.6	43.2	305	87.0	0.71	0.58
Std Dev	0	0.2	0.2	4	1.1	0.13	0.02
Maximum	30	19.9	43.5	310	88.6	0.86	0.61
Minimum	28	19.1	42.9	297	85.0	0.60	0.55

N-value: 17

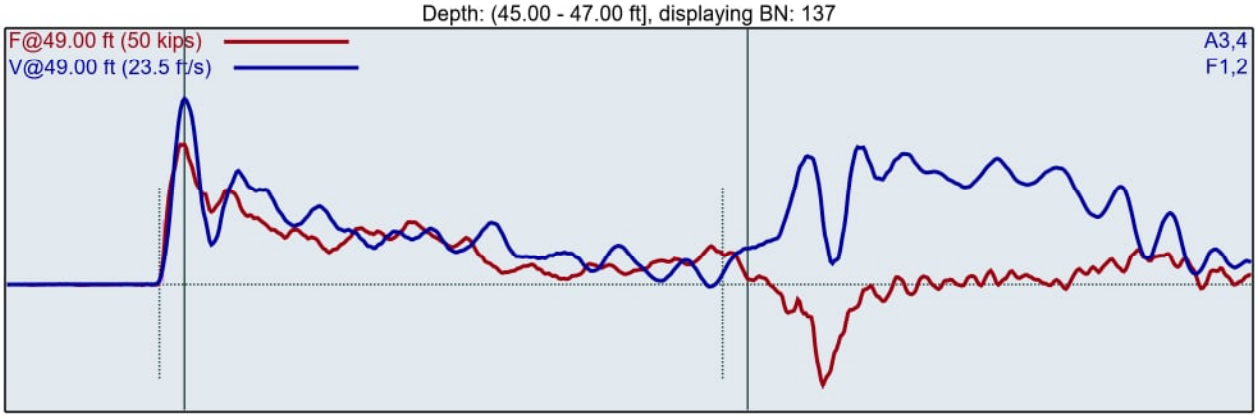
Sample Interval Time: 45.86 seconds.

GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Simco 2800 HS(HT) SN 072068
JW Test date: 9/7/2017
AR: 1.19 in^2 SP: 0.492 k/ft3
LE: 49.00 ft EM: 30000 ksi
WS: 16807.9 ft/s

Depth: (45.00 - 47.00 ft], displaying BN: 137



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
130	1	45.50	30	18.7	1.9	307	87.7	6.00	0.68
131	3	45.67	30	18.1	41.3	307	87.6	2.00	0.71
132	3	45.83	29	17.7	41.4	313	89.6	2.00	0.77
133	3	46.00	28	17.5	41.4	309	88.2	2.00	0.75
134	6	46.08	29	17.1	41.9	308	88.1	1.00	0.79
135	6	46.17	28	17.0	41.8	315	89.9	1.00	0.76
136	6	46.25	28	17.1	41.5	316	90.3	1.00	0.76
137	6	46.33	27	17.1	41.8	311	89.0	1.00	0.75
138	6	46.42	27	16.6	41.6	310	88.6	1.00	0.77
139	6	46.50	28	17.0	41.7	308	87.9	1.00	0.73
140	6	46.58	27	17.1	41.6	314	89.6	1.00	0.75
141	6	46.67	27	17.0	41.8	308	87.9	1.00	0.72
142	6	46.75	27	17.0	41.5	305	87.0	1.00	0.73
143	6	46.83	26	17.0	41.7	306	87.5	1.00	0.69
144	6	46.92	28	17.9	41.8	299	85.4	1.00	0.65
145	6	47.00	27	17.5	41.8	303	86.5	1.00	0.69
		Average	28	17.3	41.6	311	88.8	1.33	0.75
		Std Dev	1	0.4	0.2	3	0.9	0.47	0.02
		Maximum	30	18.1	41.9	316	90.3	2.00	0.79
		Minimum	27	16.6	41.3	307	87.6	1.00	0.71
				N-value: 9					

Sample Interval Time: 21.57 seconds.

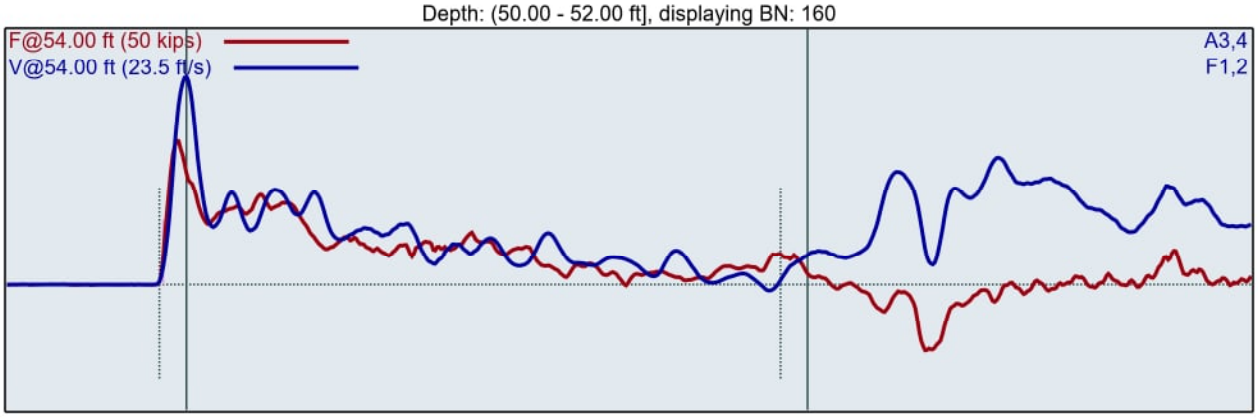
GRL Engineers, Inc.
SPT Analyzer Results

PDA-S Ver. 2017.18 - Printed: 9/12/2017

Simco 2800 HS(HT)
JW
AR: 1.19 in^2
LE: 54.00 ft
WS: 16807.9 ft/s

SN 072068
Test date: 9/7/2017
SP: 0.492 k/ft3
EM: 30000 ksi

Depth: (50.00 - 52.00 ft], displaying BN: 160



BL#	BC /6"	LP ft	FMX kips	VMX ft/s	BPM bpm	EFV ft-lb	ETR (%)	DFN in	FVP []
146	4	50.13	29	19.9	1.9	314	89.8	1.50	0.62
147	4	50.25	28	19.2	48.1	319	91.3	1.50	0.61
148	4	50.38	28	19.0	48.3	322	92.0	1.50	0.62
149	4	50.50	27	18.4	48.4	319	91.2	1.50	0.64
150	5	50.60	27	18.5	48.4	324	92.6	1.20	0.62
151	5	50.70	27	18.5	48.7	324	92.5	1.20	0.63
152	5	50.80	27	18.8	48.5	316	90.2	1.20	0.63
153	5	50.90	26	18.5	48.5	319	91.1	1.20	0.59
154	5	51.00	26	18.3	48.6	316	90.3	1.20	0.64
155	8	51.06	27	19.1	48.8	315	90.0	0.75	0.61
156	8	51.13	27	19.2	48.2	316	90.3	0.75	0.61
157	8	51.19	27	19.1	48.7	311	89.0	0.75	0.61
158	8	51.25	27	18.9	48.4	306	87.5	0.75	0.61
159	8	51.31	27	18.9	48.4	315	89.9	0.75	0.55
160	8	51.38	28	19.1	48.5	310	88.5	0.75	0.54
161	8	51.44	29	19.5	48.6	313	89.6	0.75	0.54
162	8	51.50	29	19.5	48.4	314	89.7	0.75	0.52
163	8	51.56	29	19.6	48.8	316	90.3	0.75	0.53
164	8	51.63	30	19.5	48.3	314	89.6	0.75	0.55
165	8	51.69	28	19.4	48.7	319	91.1	0.75	0.54
166	8	51.75	30	20.0	48.7	318	91.0	0.75	0.53
167	8	51.81	30	20.1	48.5	323	92.2	0.75	0.54
168	8	51.88	30	20.1	48.6	318	90.9	0.75	0.54
169	8	51.94	31	20.2	48.5	325	92.7	0.75	0.53
170	8	52.00	30	19.9	48.6	320	91.4	0.75	0.52
		Average	27	18.9	48.5	315	90.1	0.92	0.59
		Std Dev	1	0.4	0.2	5	1.4	0.22	0.04
		Maximum	29	19.5	48.8	324	92.6	1.20	0.64
		Minimum	26	18.3	48.2	306	87.5	0.75	0.52
				N-value: 13					

Sample Interval Time: 29.73 seconds.

Appendix H

2017 GEI CPT Logs and Shear Wave Velocity Data

- CPT Notes
- CPT Logs, GEI Consultants, Inc., September 2017
- Fig. H-1 – Comparison of Regular and Fast-Push CPT q_t Values
- Fig. H-2 – Comparison of Regular and Fast-Push CPT q_t Values
- Soil Shear Wave Velocities by Layer

General Notes for SCPT Logs

Definitions:

q_c = measured cone tip resistance (tsf)
f_s = measure sleeve friction (tsf)
u_2 = measure pore pressure at u_2 position of cone (tsf)
u_0 = estimated hydrostatic pore pressure (tsf)
a = net area ratio of cone; for this cone a = 0.8
σ_{v0} = vertical total stress (tsf) – based on assumed soil unit weight of 120 pcf.
σ'_{v0} = vertical effective stress (tsf) – based on assumed unit weight of 120 pcf, and u_0.
p_a = atmospheric pressure (for unit normalization)

Corrected Tip Resistance, q_t (tsf)

$q_t = q_c + u_2(1 - a)$

Friction Ratio, R_f (%)

$R_f = (f_s / q_t) \times 100$

SBT F_r Normalized (1990), Normalized Soil Behavior Type based on F_r ($F_r = f_s / (q_t - \sigma_{v0}) \times 100$) is from the figure and table below from Robertson (1990)

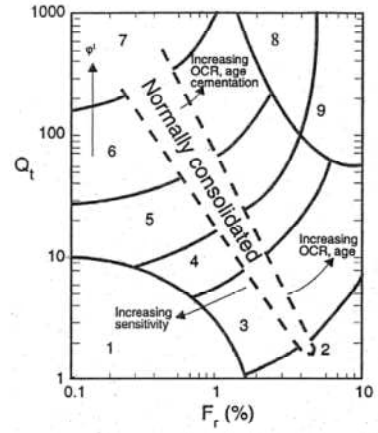


Figure: Normalized Soil Behavior Types based on F_r (Robertson, 1990)

SBT zone	SBT Description
1	Sensitive fine-grained
2	Clay – organic soil
3	Clays: clay to silty clay
4	Silt mixtures: clayey silt & silty clay
5	Sand mixtures: silty sand to sandy silt
6	Sands: clean sands to silty sands
7	Dense sand to gravelly sand
8	Stiff sand to clayey sand*
9	Stiff fine-grained*

*Overconsolidated or cemented

Estimated Water Depth: Water depths are based on nearby piezometers and observations made in nearby borings.

Reference

Robertson, P.K., (1990) "Soil classification using the cone penetration test." *Canadian Geotechnical Journal*, 46, 1-19.

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

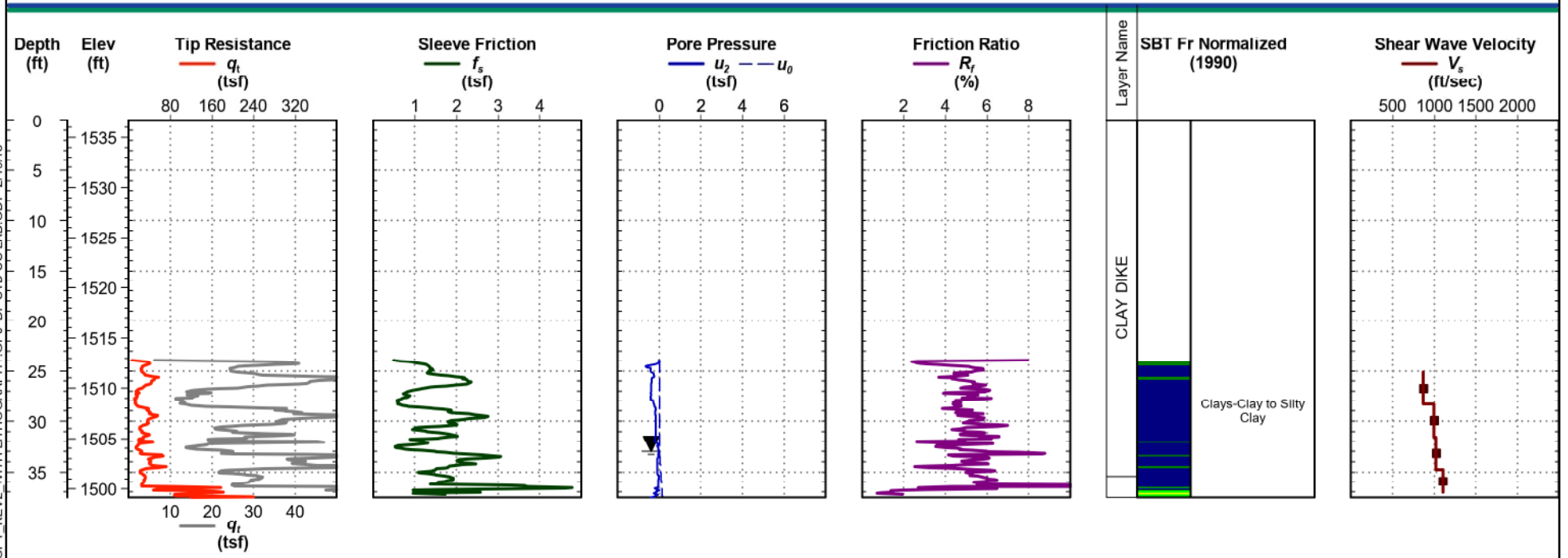
Cone Penetration Test

SCPT-101

Date: Sep. 30, 2017
Estimated Water Depth: 33 ft
Rig/Operator: CAP

Northing: 390,433.7 ft
Easting: 1,308,854.3 ft
Notes: Pre-augered to 24 ft. Shallow refusal.

Ground Surface Elevation: 1,536.7 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-101.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

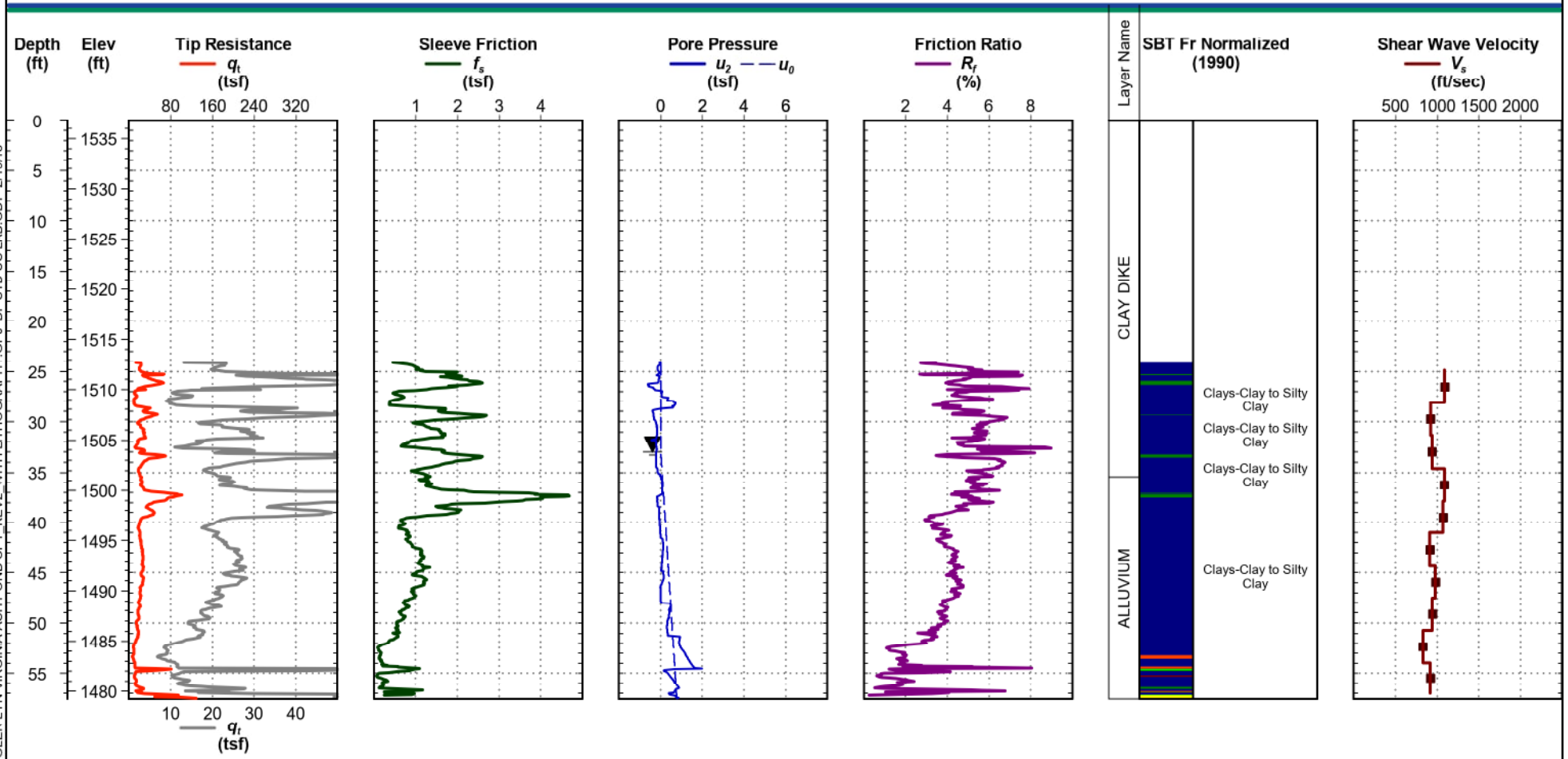
Cone Penetration Test

SCPT-101a

Date: Sep. 30, 2017
Estimated Water Depth: 33 ft
Rig/Operator: CAP

Northing: 390,436.5 ft
Easting: 1,308,849.9 ft
Notes: Pre-augered to 24 ft.

Ground Surface Elevation: 1,536.8 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-101a.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

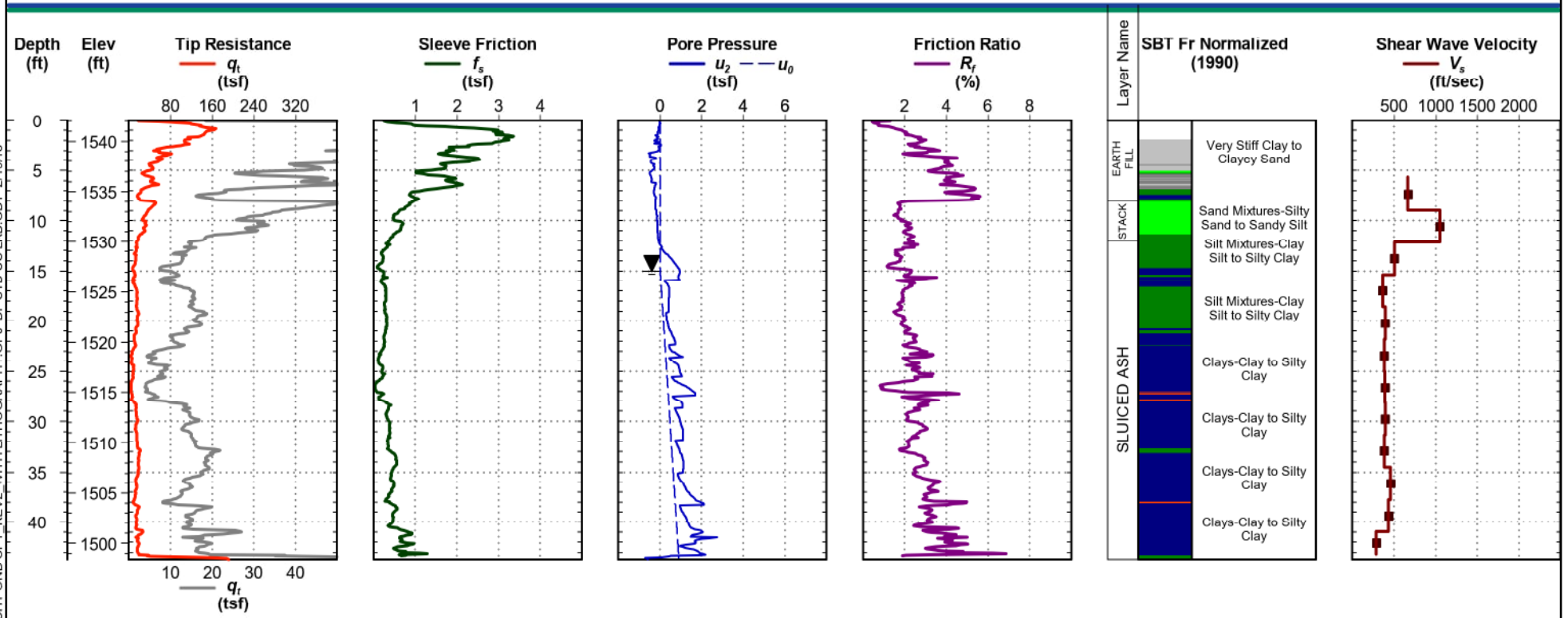
Cone Penetration Test

SCPT-104

Date: Sep. 29, 2017
Estimated Water Depth: 15 ft
Rig/Operator: CAP

Northing: 389,632.2 ft
Easting: 1,308,970.0 ft
Notes:

Ground Surface Elevation: 1,542.1 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-104.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

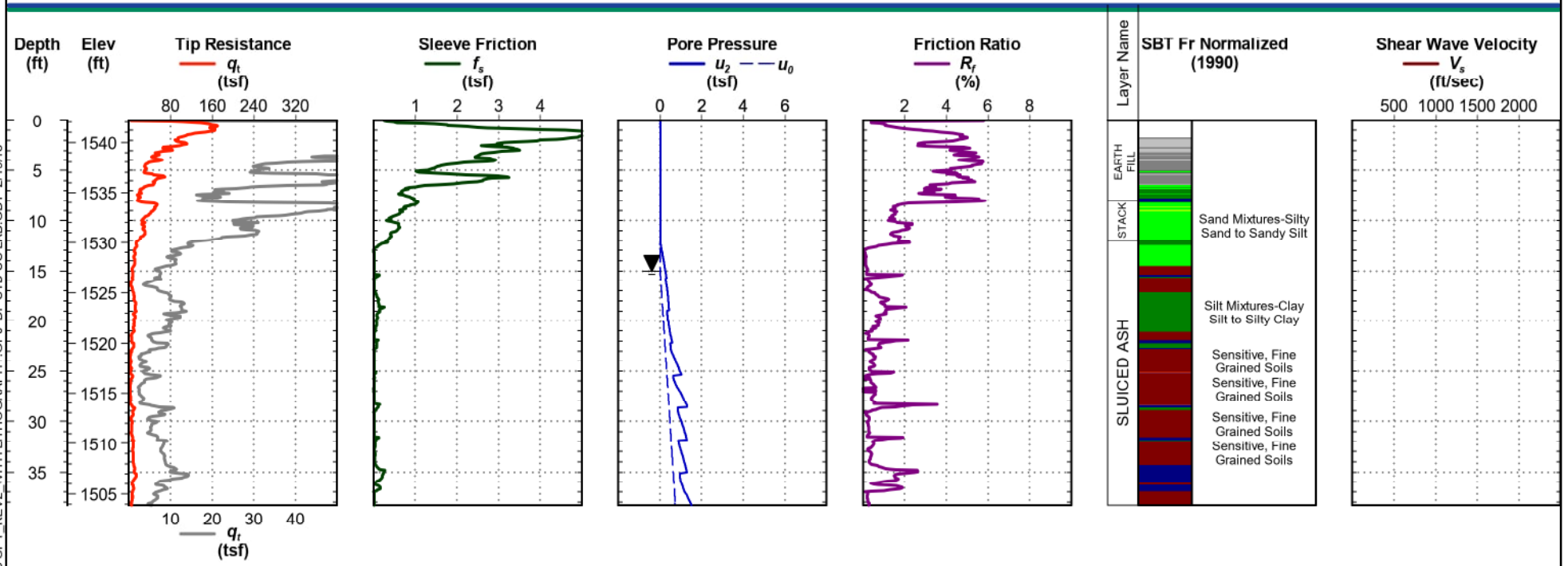
Cone Penetration Test

CPT-104F

Date: Sep. 29, 2017
Estimated Water Depth: 15 ft
Rig/Operator: CAP

Northing: 389,634.0 ft
Easting: 1,308,973.2 ft
Notes: Rapid Penetration CPT.

Ground Surface Elevation: 1,542.2 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-104a.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

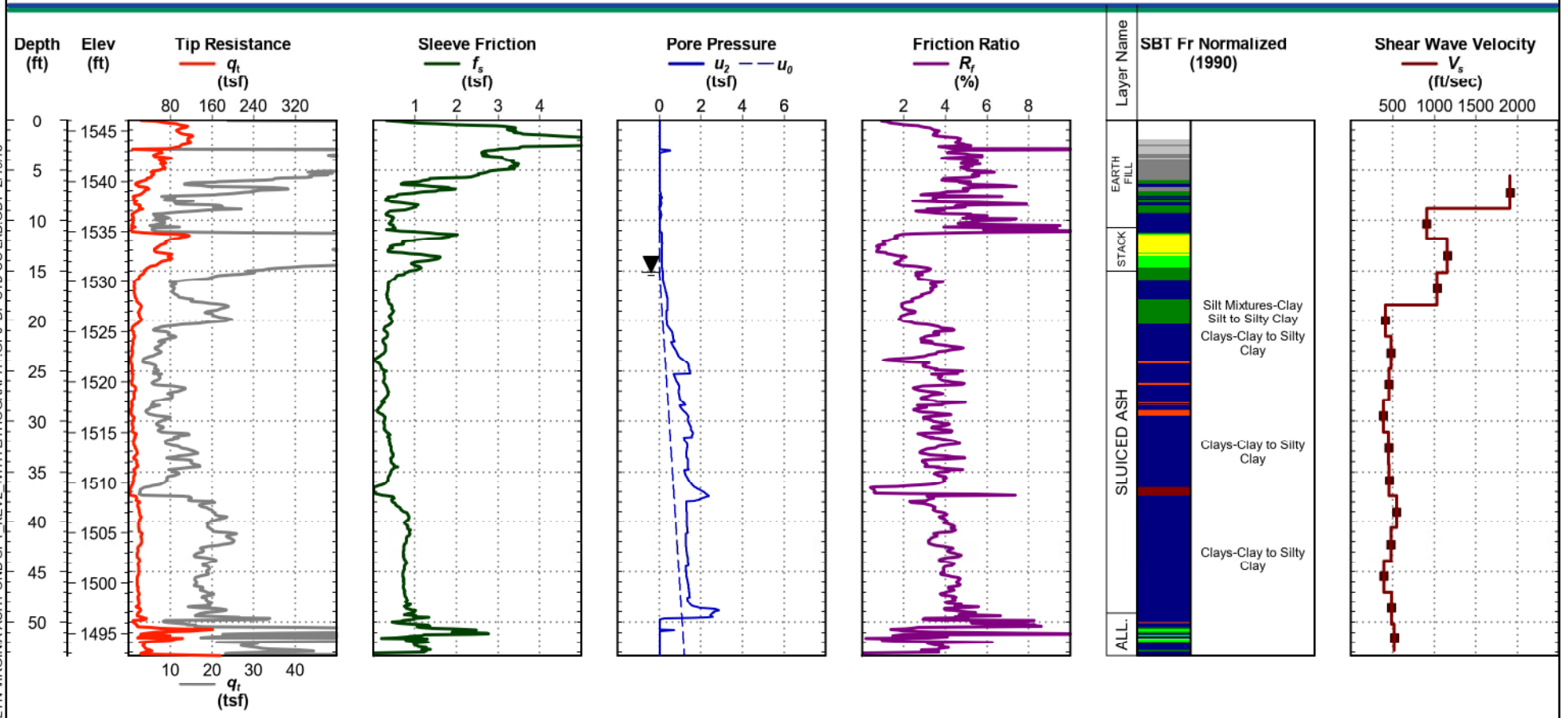
Cone Penetration Test

SCPT-105

Date: Sep. 28, 2017
Estimated Water Depth: 15.1 ft
Rig/Operator: CAP

Northing: 389,763.8 ft
Easting: 1,309,180.1 ft
Notes:

Ground Surface Elevation: 1,546.1 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-105.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

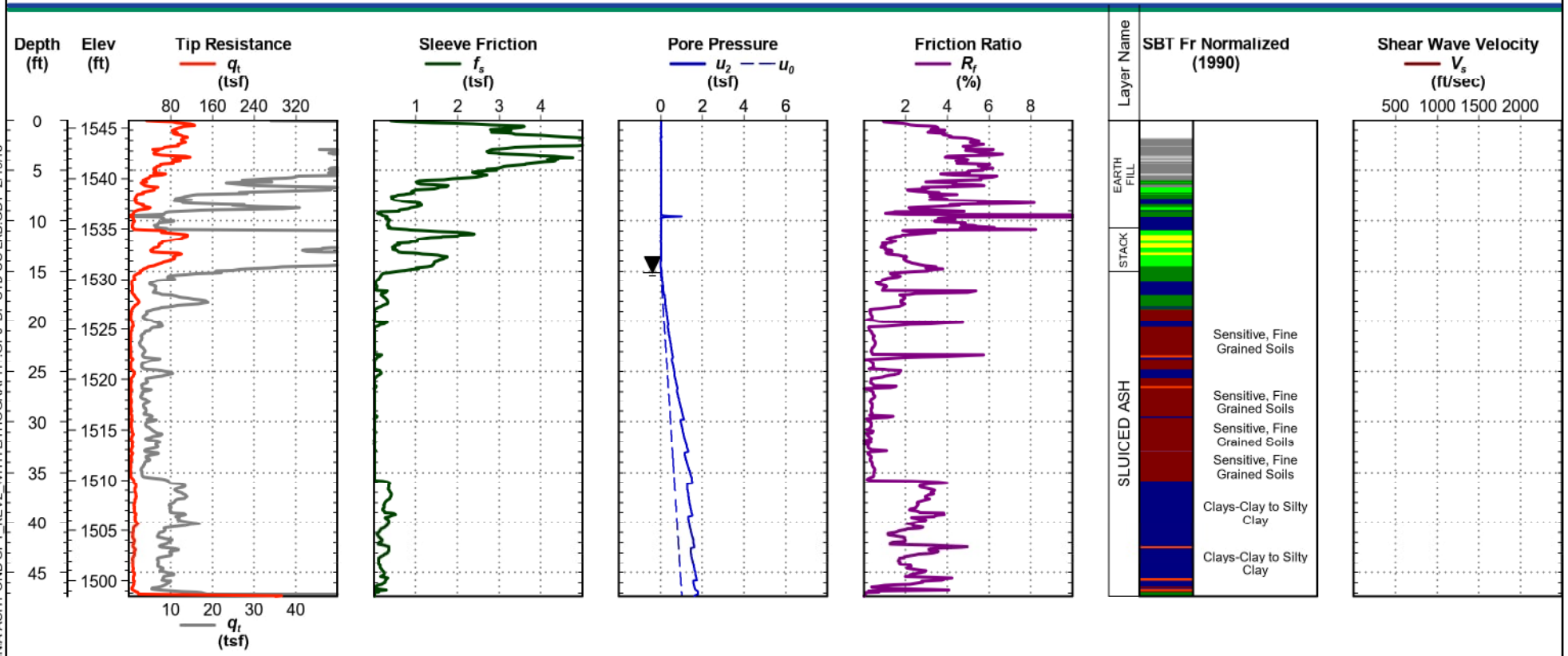
Cone Penetration Test

CPT-105F

Date: Sep. 28, 2017
Estimated Water Depth: 15.1 ft
Rig/Operator: CAP

Northing: 389,761.9 ft
Easting: 1,309,177.2 ft
Notes: Rapid Penetration CPT.

Ground Surface Elevation: 1,545.8 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-105a.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

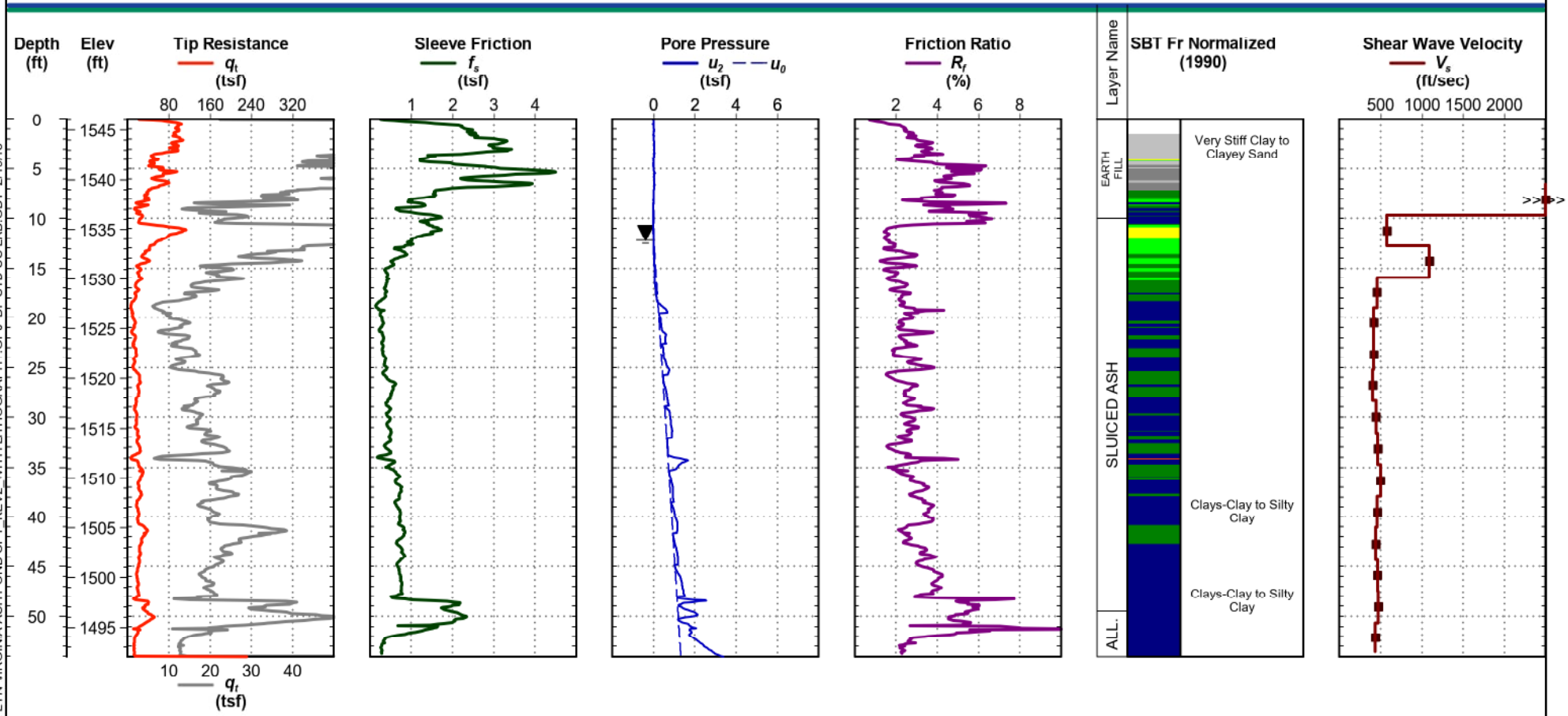
Cone Penetration Test

SCPT-106

Date: Sep. 28, 2017
Estimated Water Depth: 12.2 ft
Rig/Operator: CAP

Northing: 389,846.7 ft
Easting: 1,309,307.4 ft
Notes:

Ground Surface Elevation: 1,546.1 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-106.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

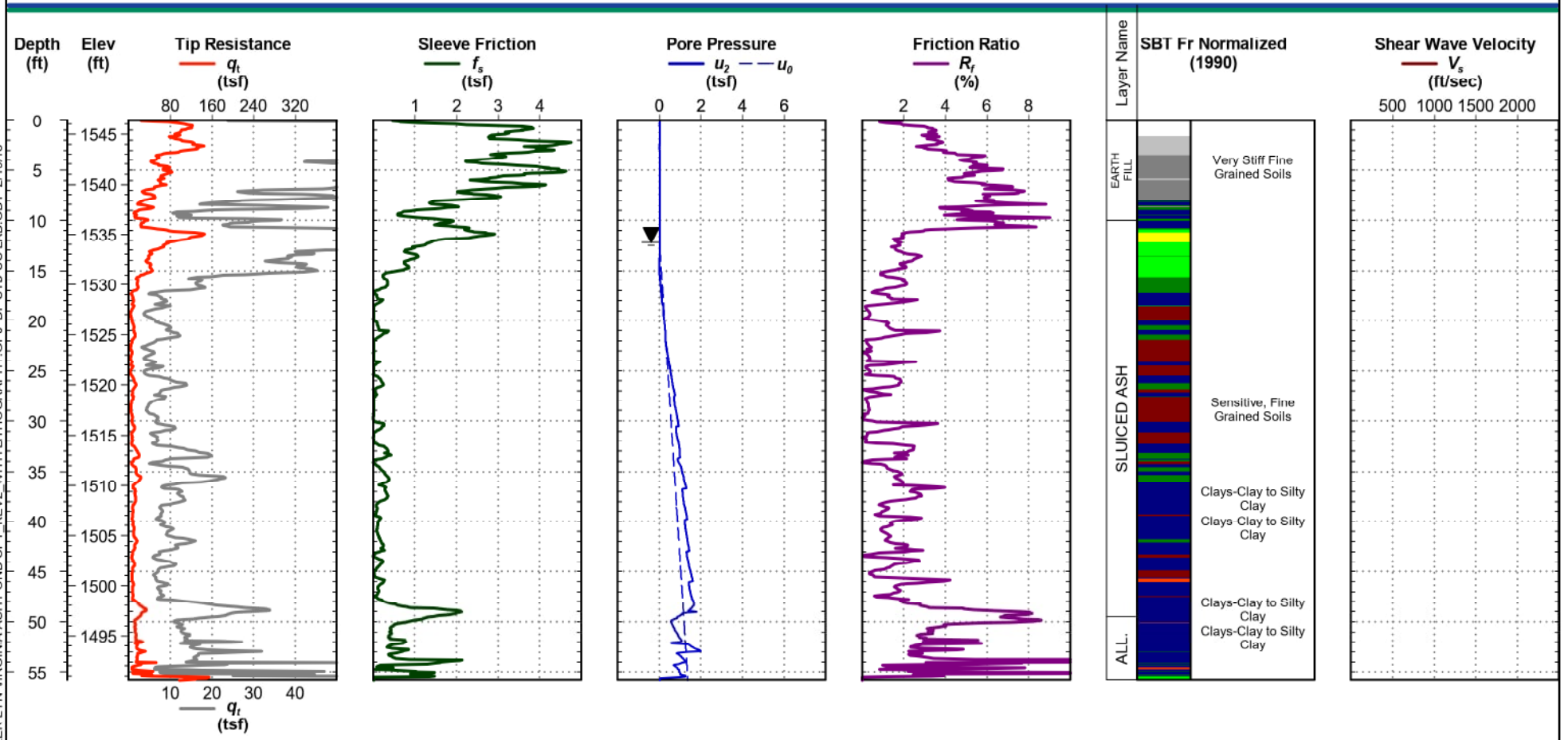
Cone Penetration Test

CPT-106F

Date: Sep. 28, 2017
Estimated Water Depth: 12.2 ft
Rig/Operator: CAP

Northing: 389,844.0 ft
Easting: 1,309,303.6 ft
Notes: Rapid Penetration CPT.

Ground Surface Elevation: 1,546.4 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-106a.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

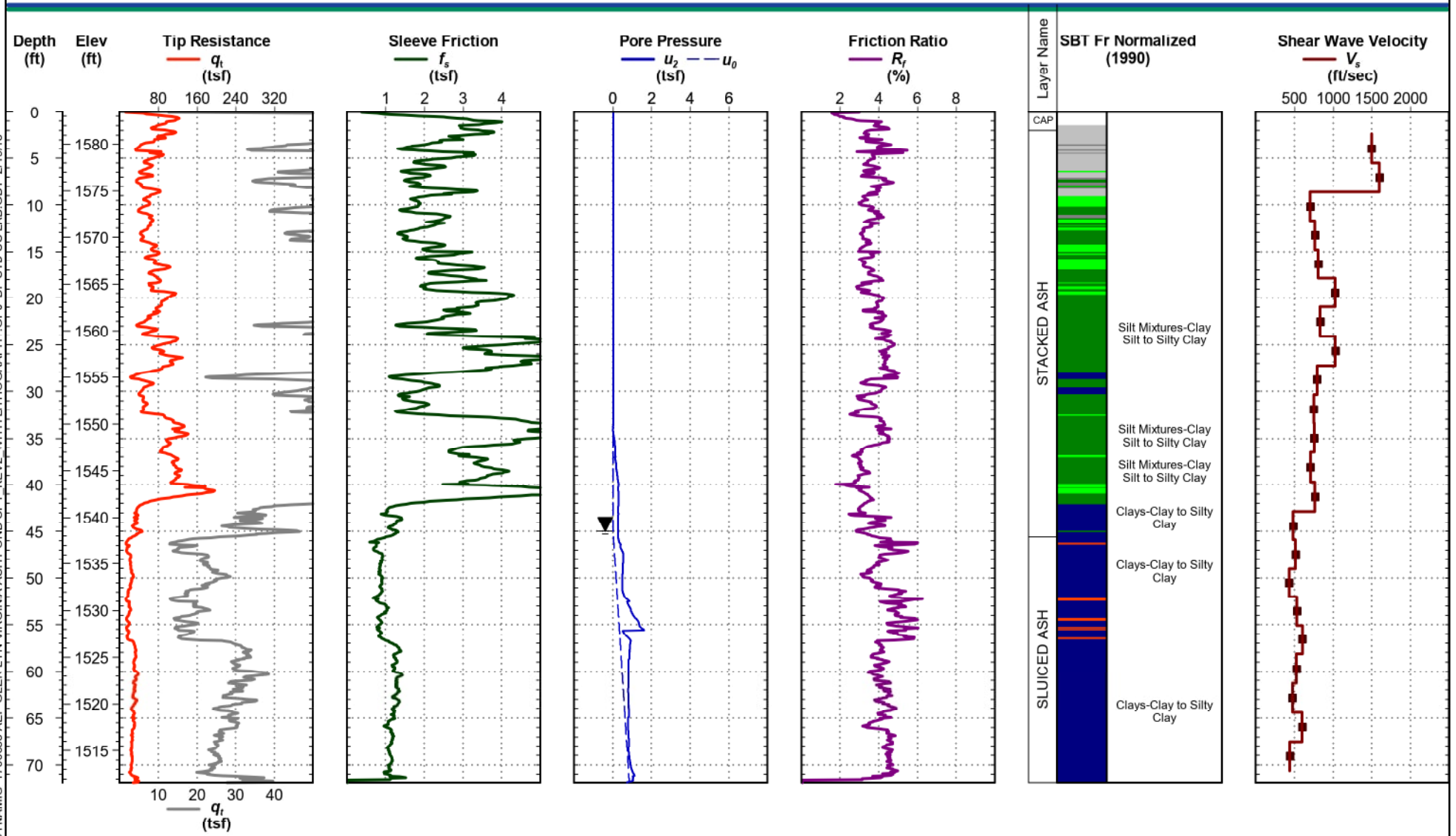
Cone Penetration Test

SCPT-107

Date: Oct. 2, 2017
Estimated Water Depth: 45 ft
Rig/Operator: CAP

Northing: 389,324.8 ft
Easting: 1,309,173.1 ft
Notes:

Ground Surface Elevation: 1,583.5 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-107.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

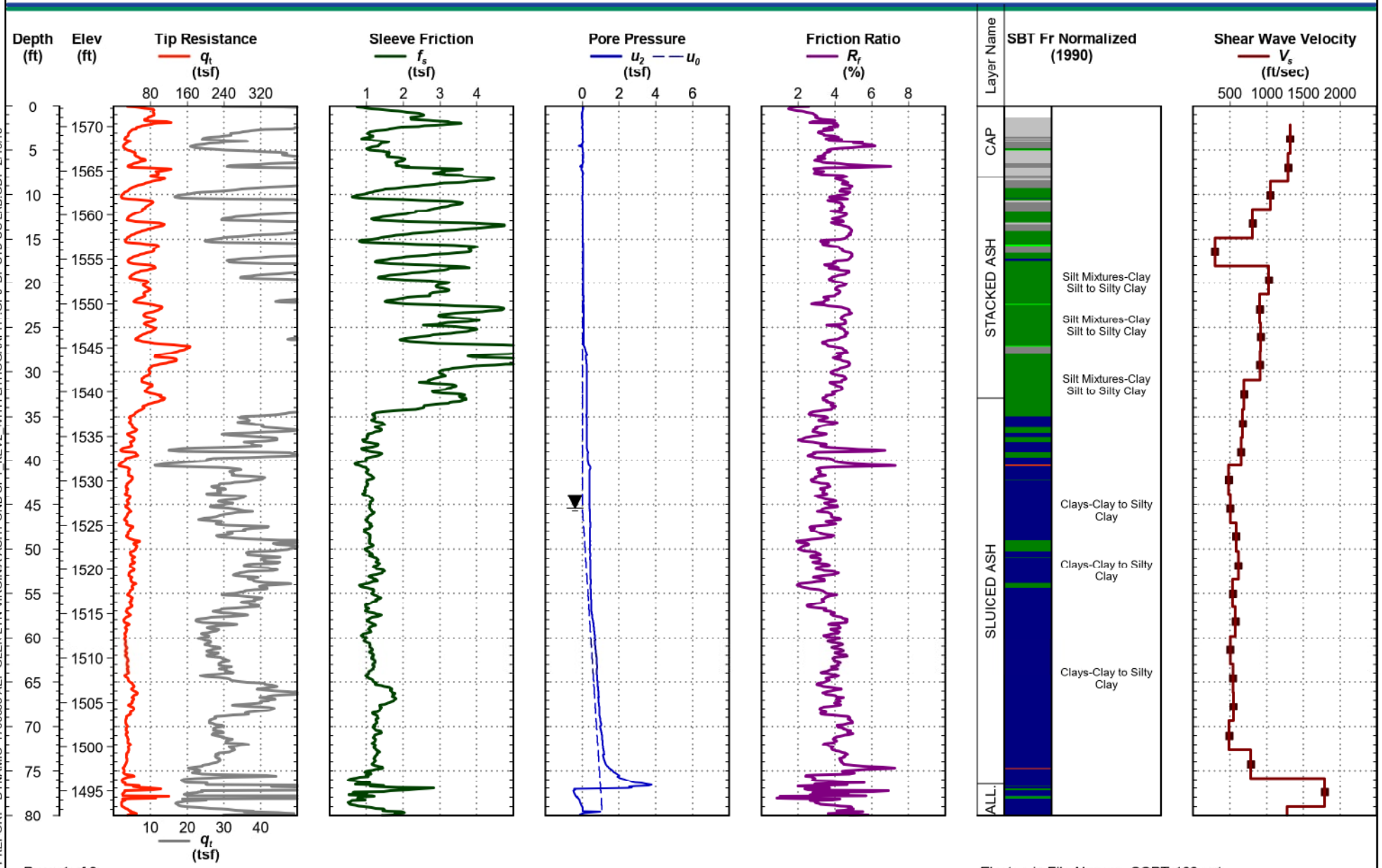
Cone Penetration Test

SCPT-109

Date: Oct. 1, 2017
Estimated Water Depth: 45.4 ft
Rig/Operator: CAP

Northing: 389,404.1 ft
Easting: 1,309,856.6 ft
Notes:

Ground Surface Elevation: 1,572.3 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-109.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

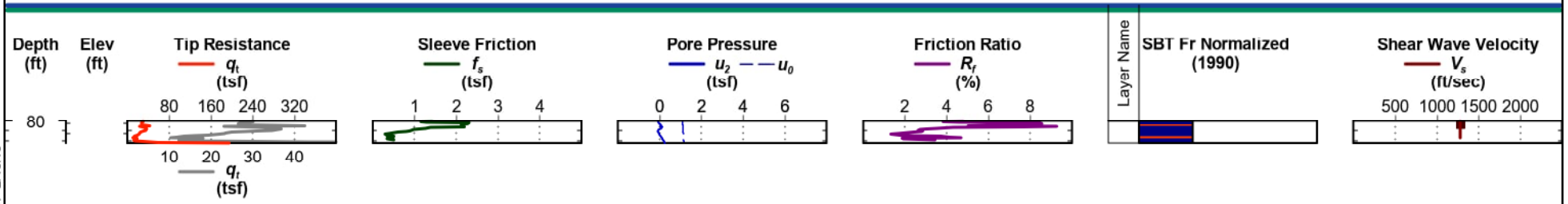
Cone Penetration Test

SCPT-109

Date: Oct. 1, 2017
Estimated Water Depth: 45.4 ft
Rig/Operator: CAP

Northing: 389,404.1 ft
Easting: 1,309,856.6 ft
Notes:

Ground Surface Elevation: 1,572.3 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



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CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

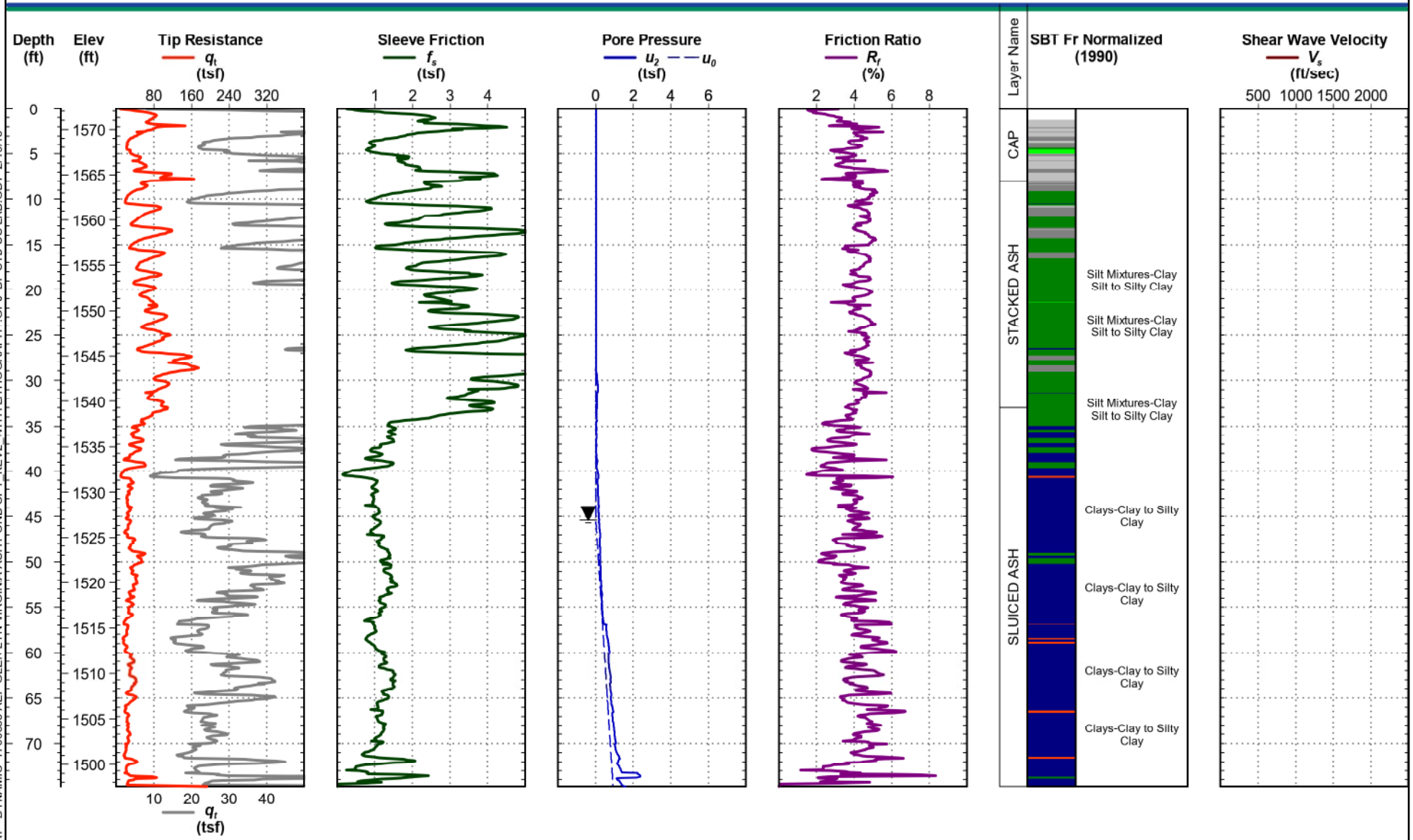
Cone Penetration Test

CPT-109F

Date: Oct. 2, 2017
Estimated Water Depth: 45.4 ft
Rig/Operator: CAP

Northing: ft
Easting: ft
Notes: Rapid Penetration CPT.

Ground Surface Elevation: 1,572.3 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-109a.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

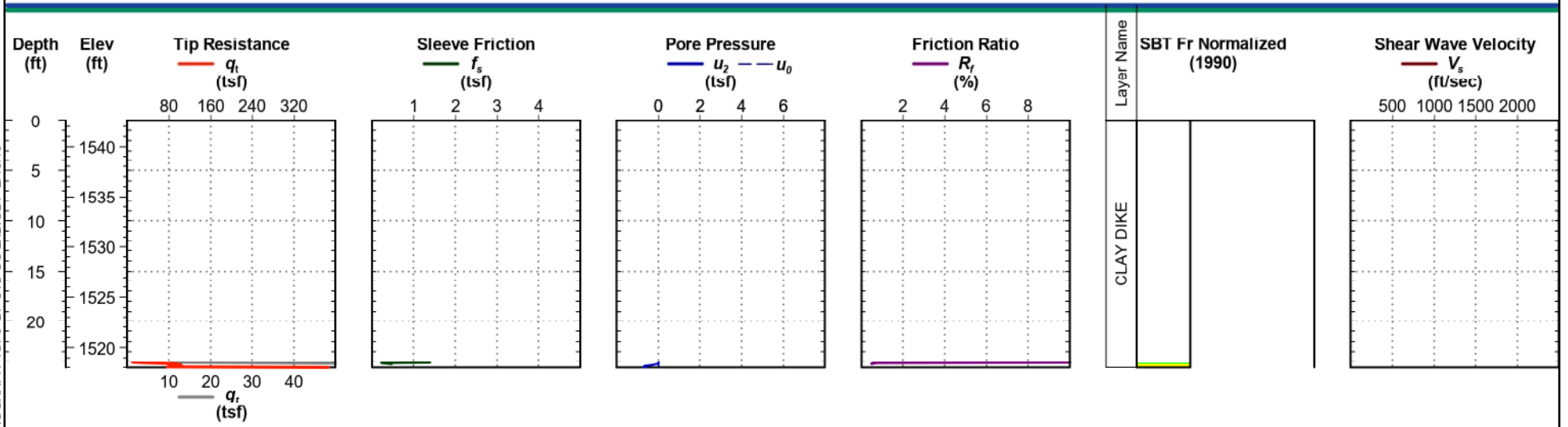
Cone Penetration Test

SCPT-110

Date: Sep. 30, 2017
Estimated Water Depth: 42.5 ft
Rig/Operator: CAP

Northing: 389,545.3 ft
Easting: 1,309,939.9 ft
Notes: Pre-augered to 24 ft. Shallow refusal.

Ground Surface Elevation: 1,542.6 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



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CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

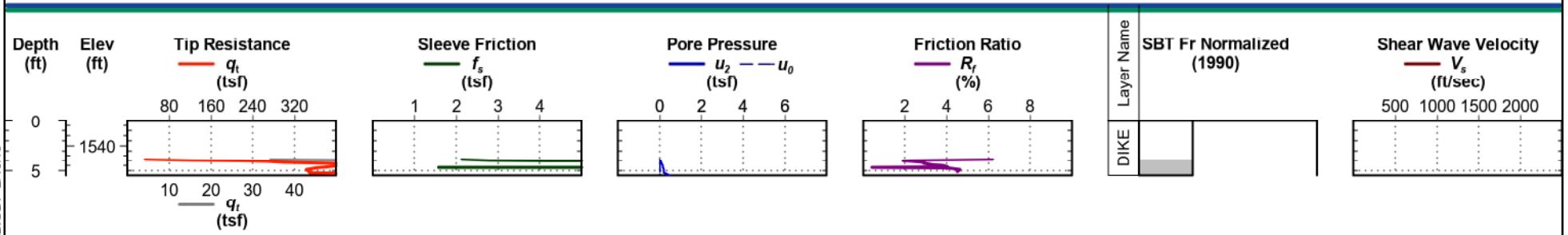
Cone Penetration Test

SCPT-110a

Date: Sep. 30, 2017
Estimated Water Depth: 42.5 ft
Rig/Operator: CAP

Northing: 389,546.7 ft
Easting: 1,309,938.0 ft
Notes: Pre-augered to 3 ft. Shallow refusal.

Ground Surface Elevation: 1,542.5 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



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CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

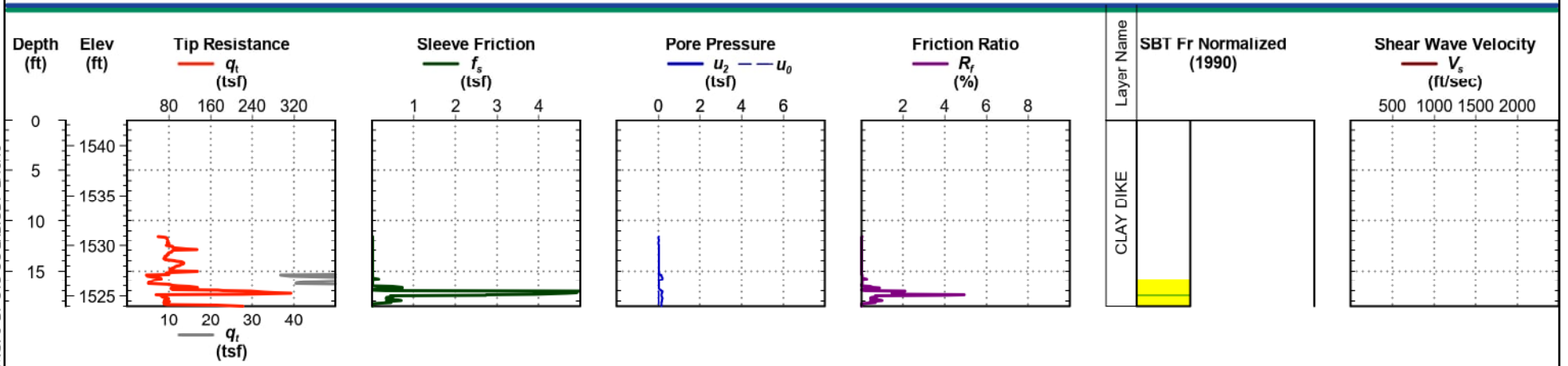
Cone Penetration Test

SCPT-110b

Date: Sep. 30, 2017
Estimated Water Depth: 42.5 ft
Rig/Operator: CAP

Northing: 389,546.7 ft
Easting: 1,309,938.0 ft
Notes: Pre-augered to 12 ft. Shallow refusal.

Ground Surface Elevation: 1,542.5 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-110b.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

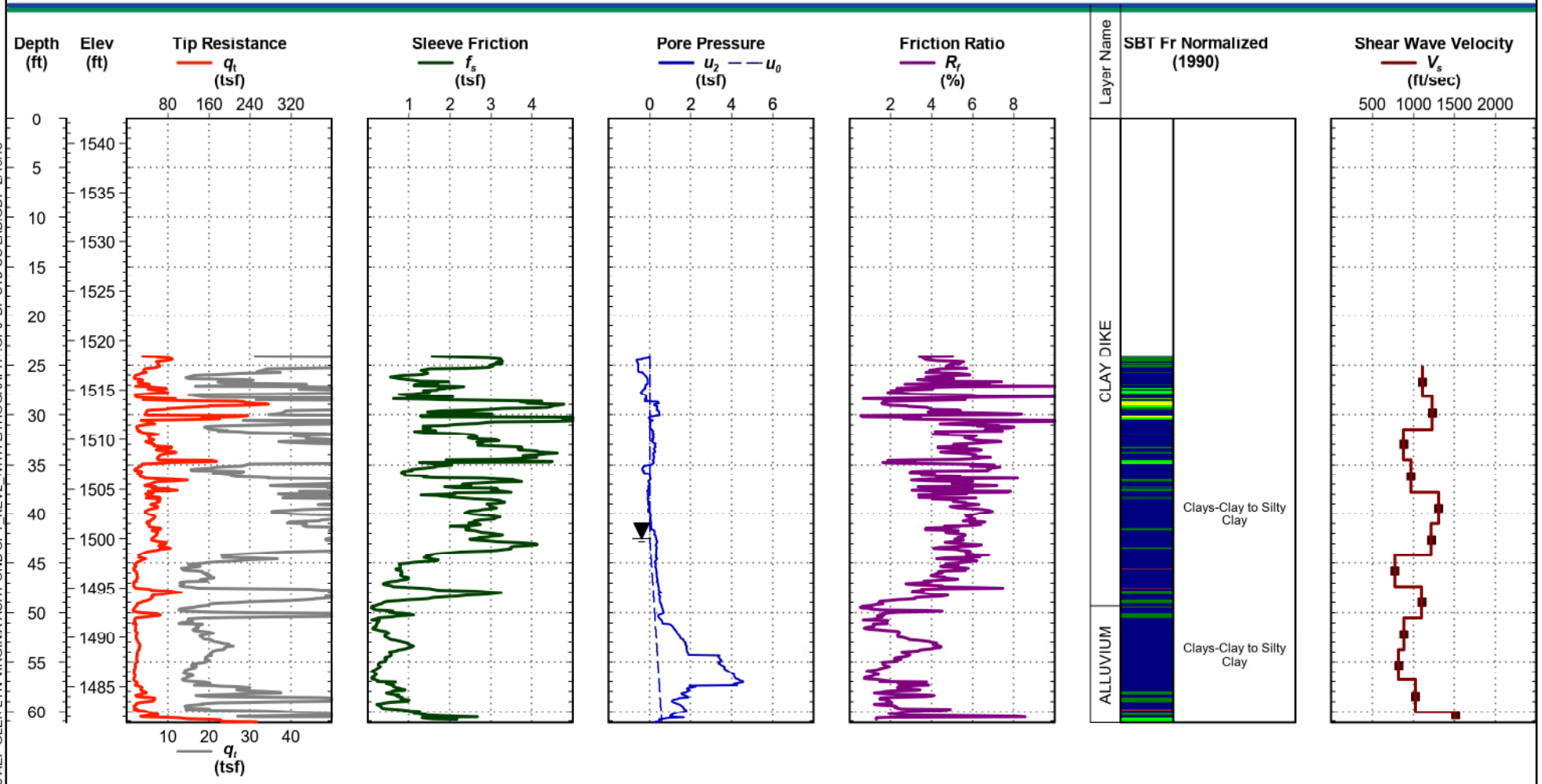
Cone Penetration Test

SCPT-110c

Date: Sep. 30, 2017
Estimated Water Depth: 42.5 ft
Rig/Operator: CAP

Northing: 389,546.7 ft
Easting: 1,309,938.0 ft
Notes: Pre-augered to 24 ft.

Ground Surface Elevation: 1,542.5 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-110c.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

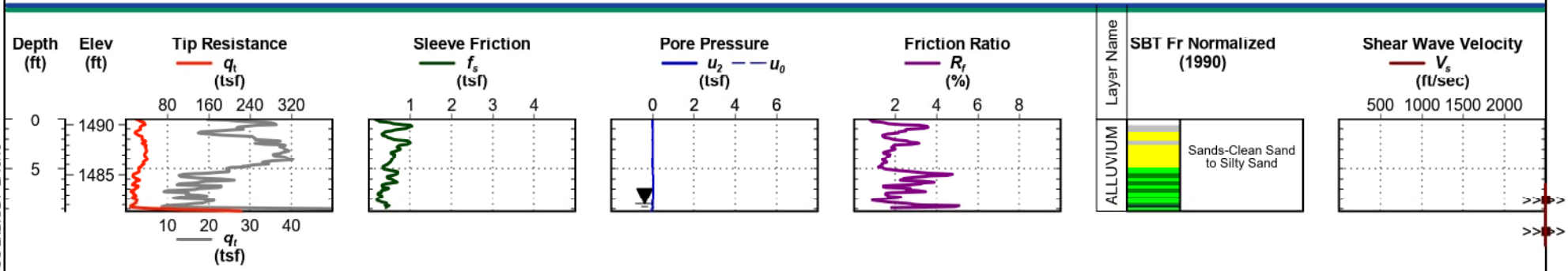
Cone Penetration Test

SCPT-112

Date: Sep. 28, 2017
Estimated Water Depth: 8.5 ft
Rig/Operator: CAP

Northing: ft
Easting: ft
Notes: Short test. Bedrock at 9 ft.

Ground Surface Elevation: 1,490.6 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



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CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

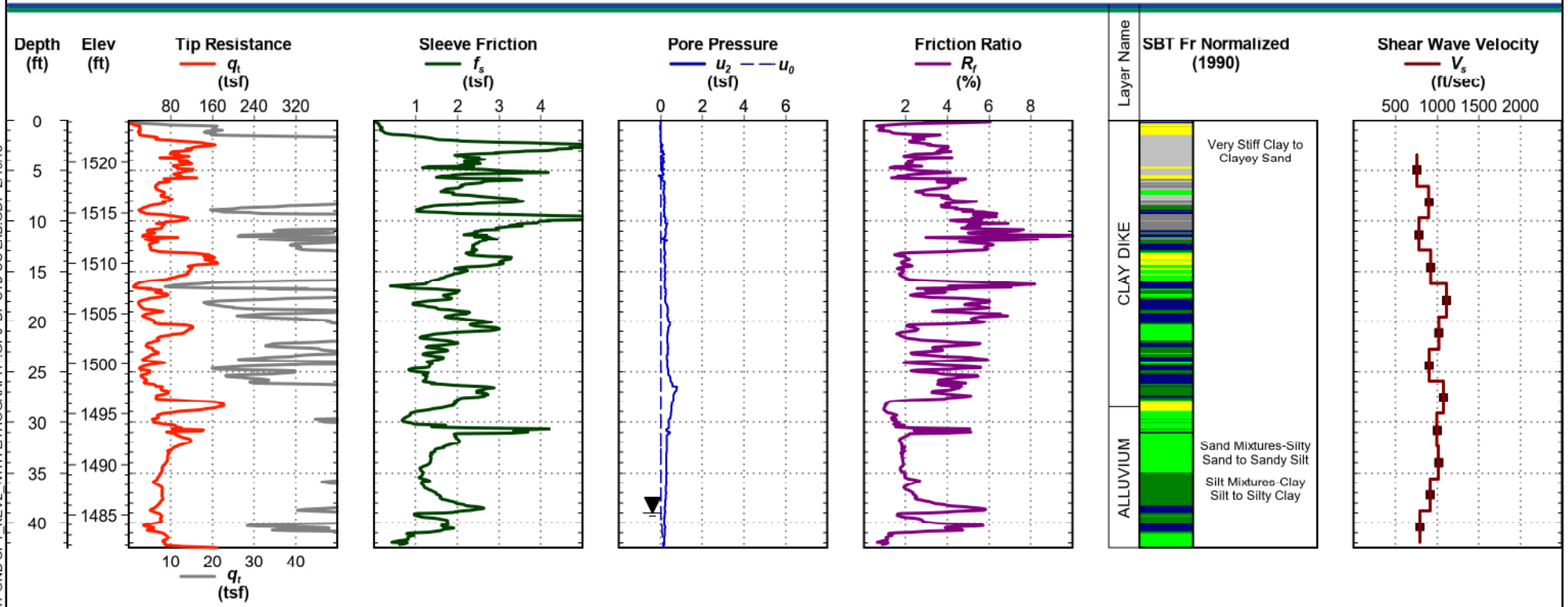
Cone Penetration Test

SCPT-113

Date: Sep. 27, 2017
Estimated Water Depth: 39 ft
Rig/Operator: CAP

Northing: 389,385.8 ft
Easting: 1,310,385.7 ft
Notes:

Ground Surface Elevation: 1,524.2 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-113.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

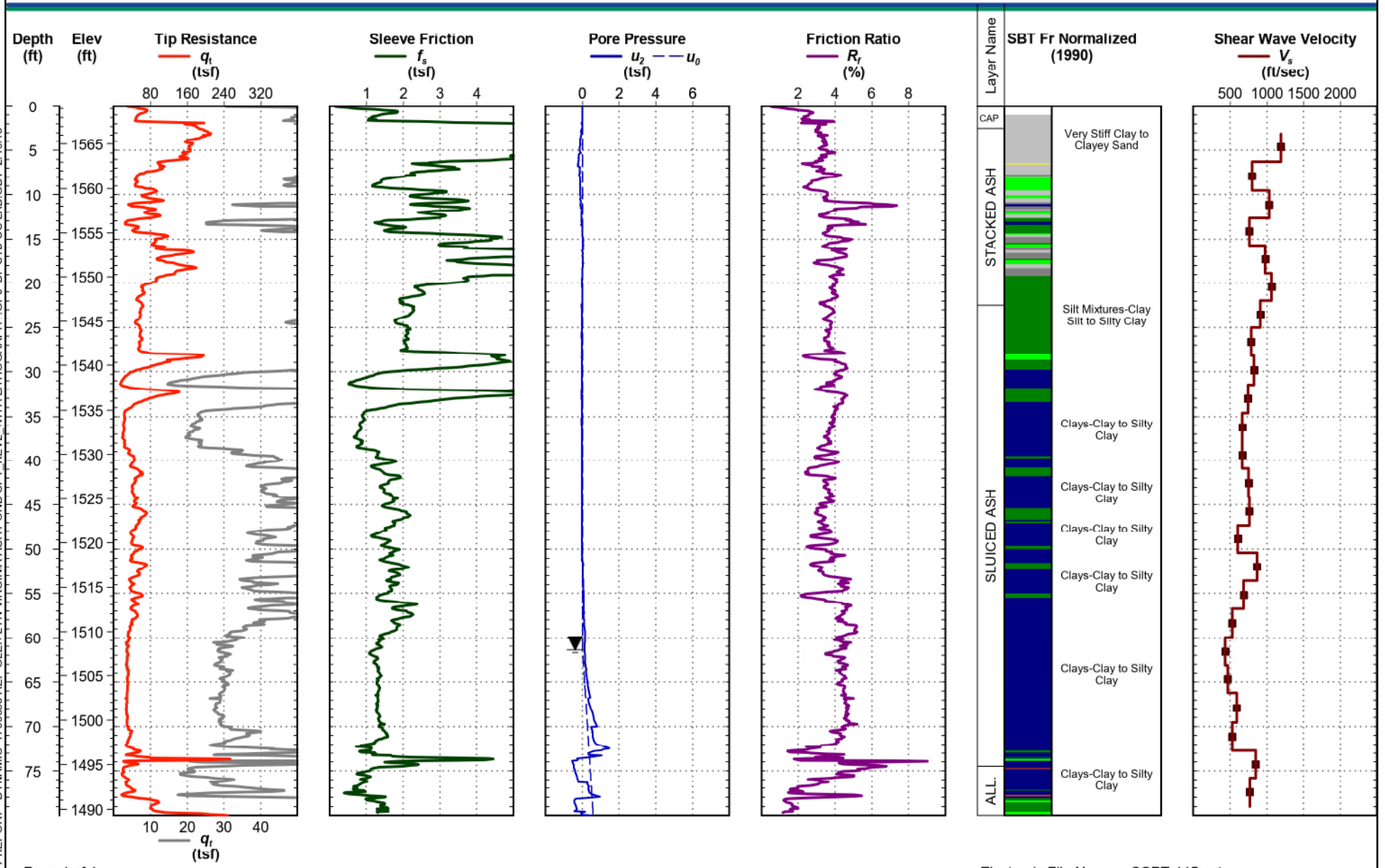
Cone Penetration Test

SCPT-115

Date: Oct. 1, 2017
Estimated Water Depth: 61.4 ft
Rig/Operator: CAP

Northing: 389,087.8 ft
Easting: 1,310,444.5 ft
Notes:

Ground Surface Elevation: 1,569.3 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-115.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

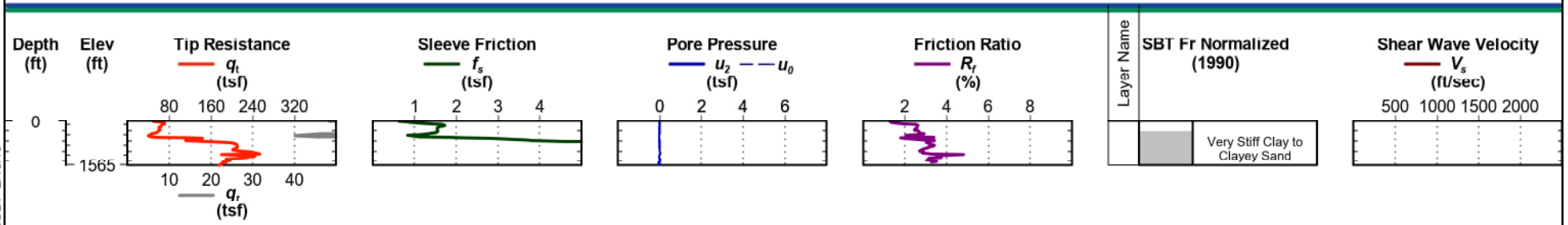
Cone Penetration Test

CPT-115F

Date: Oct. 1, 2017
Estimated Water Depth: 61.4 ft
Rig/Operator: CAP

Northing: 389,092.0 ft
Easting: 1,310,441.3 ft
Notes: Rapid Penetration CPT. Shallow refusal.

Ground Surface Elevation: 1,569.4 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



Electronic File Name: SCPT-115a.cpt

CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

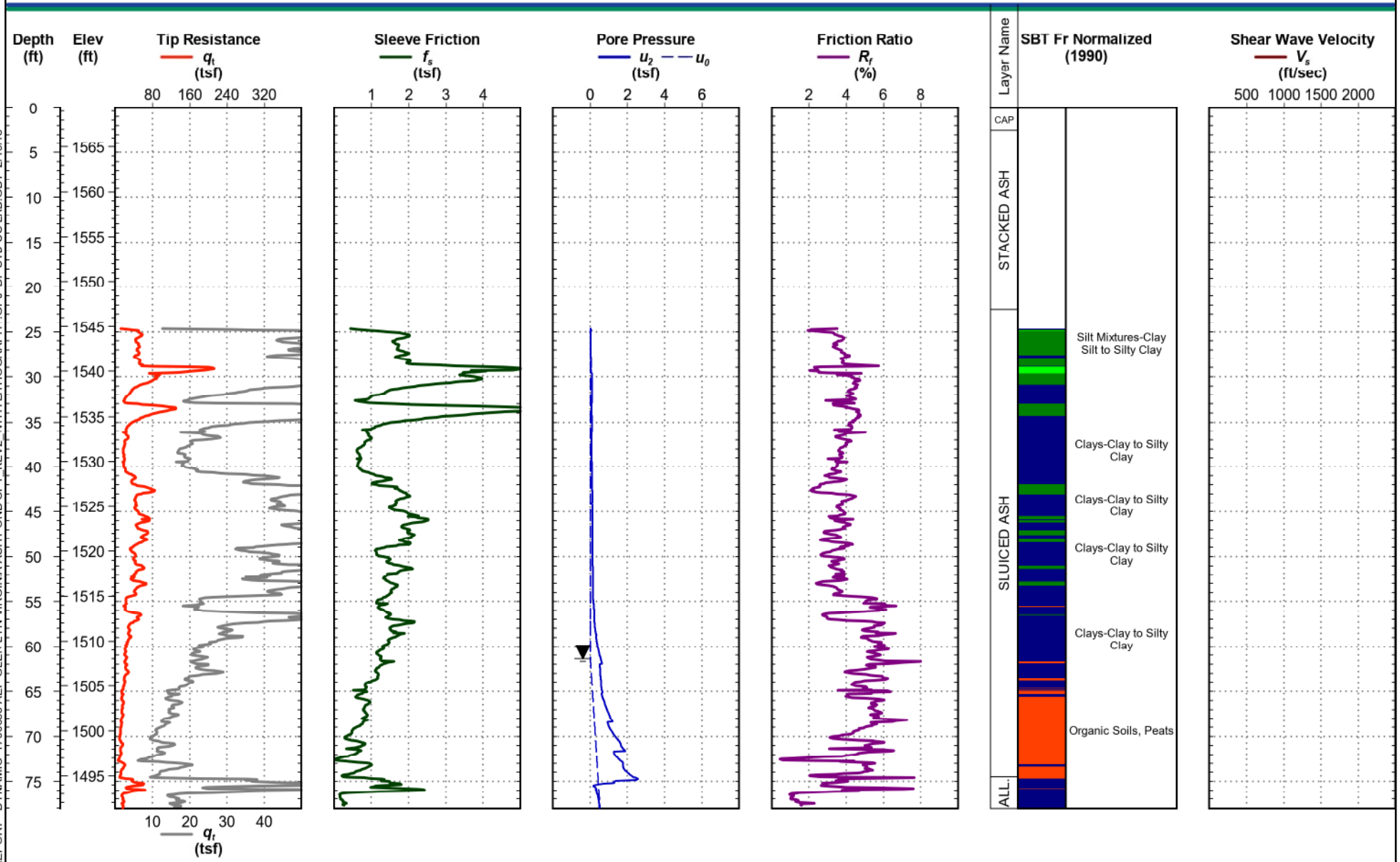
Cone Penetration Test

CPT-115F-A

Date: Oct. 1, 2017
Estimated Water Depth: 61.4 ft
Rig/Operator: CAP

Northing: 389,092.0 ft
Easting: 1,310,441.3 ft
Notes: Rapid Penetration CPT. Pre-augered to 24 ft.

Ground Surface Elevation: 1,569.4 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-115b.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

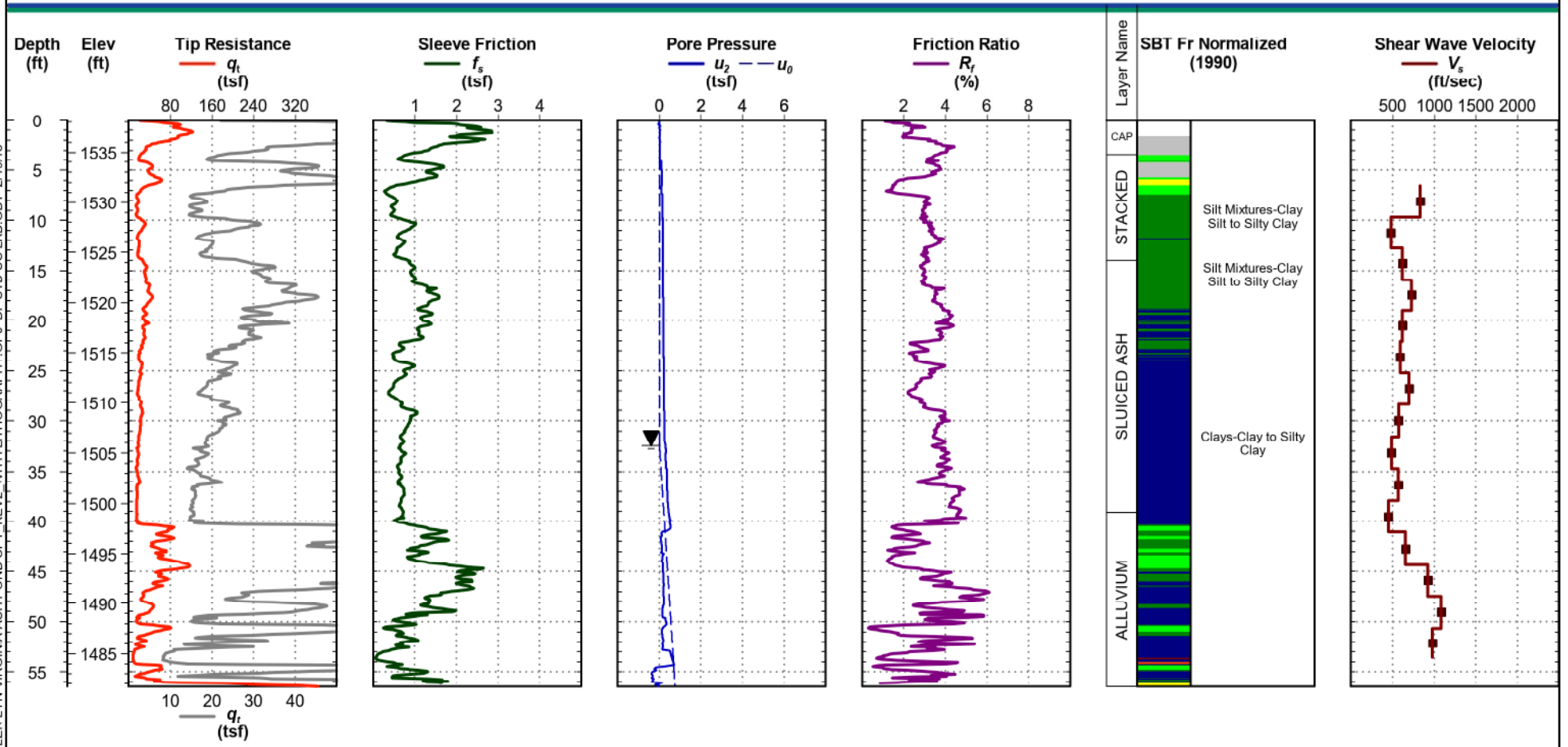
Cone Penetration Test

SCPT-116

Date: Sep. 27, 2017
Estimated Water Depth: 32.5 ft
Rig/Operator: CAP

Northing: 389,294.9 ft
Easting: 1,310,481.6 ft
Notes:

Ground Surface Elevation: 1,538.2 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



Electronic File Name: SCPT-116.cpt

CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

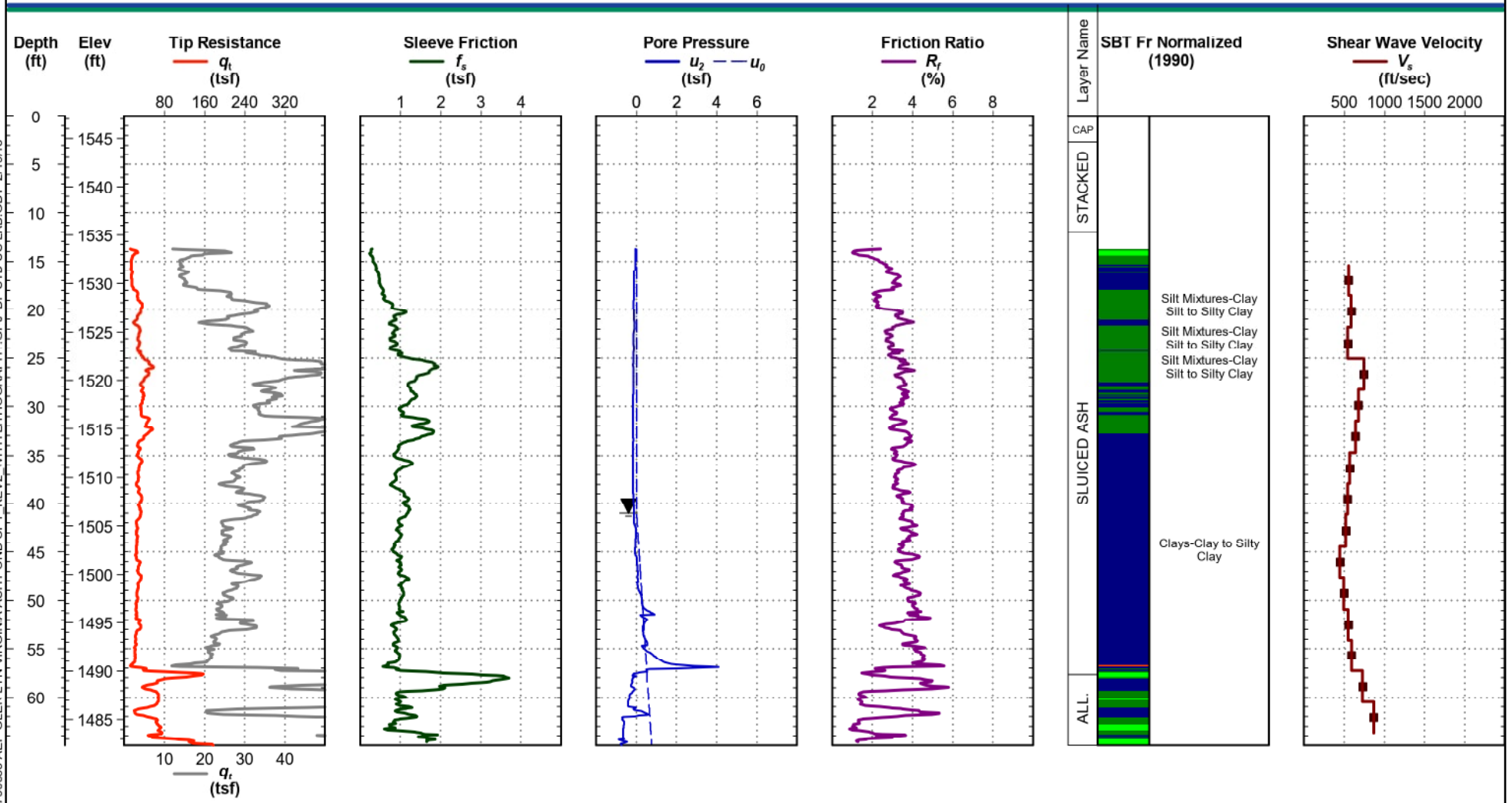
Cone Penetration Test

SCPT-117

Date: Oct. 1, 2017
Estimated Water Depth: 41 ft
Rig/Operator: CAP

Northing: 389,218.1 ft
Easting: 1,310,511.6 ft
Notes: Pre-augered to 23.5 ft.

Ground Surface Elevation: 1,547.3 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-117.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

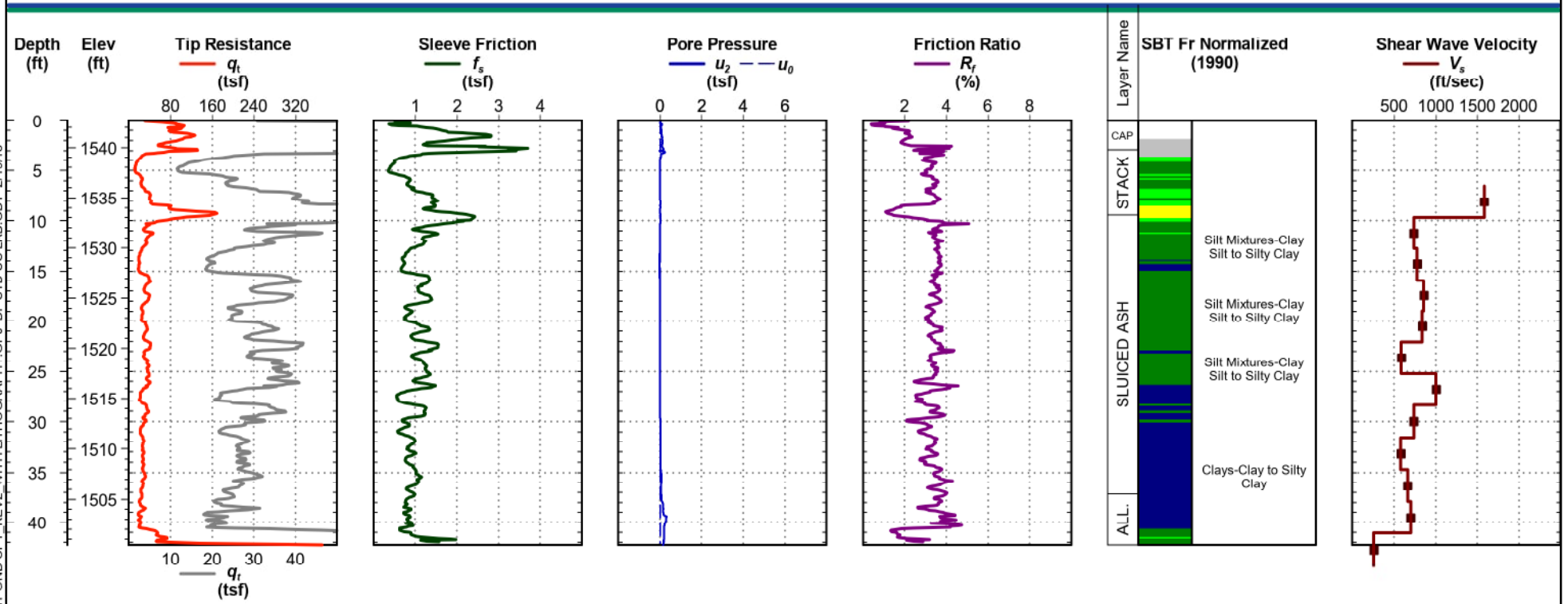
Cone Penetration Test

SCPT-118

Date: Sep. 27, 2017
Estimated Water Depth: 53 ft
Rig/Operator: CAP

Northing: 389,220.7 ft
Easting: 1,310,642.6 ft
Notes:

Ground Surface Elevation: 1,542.7 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT 118.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

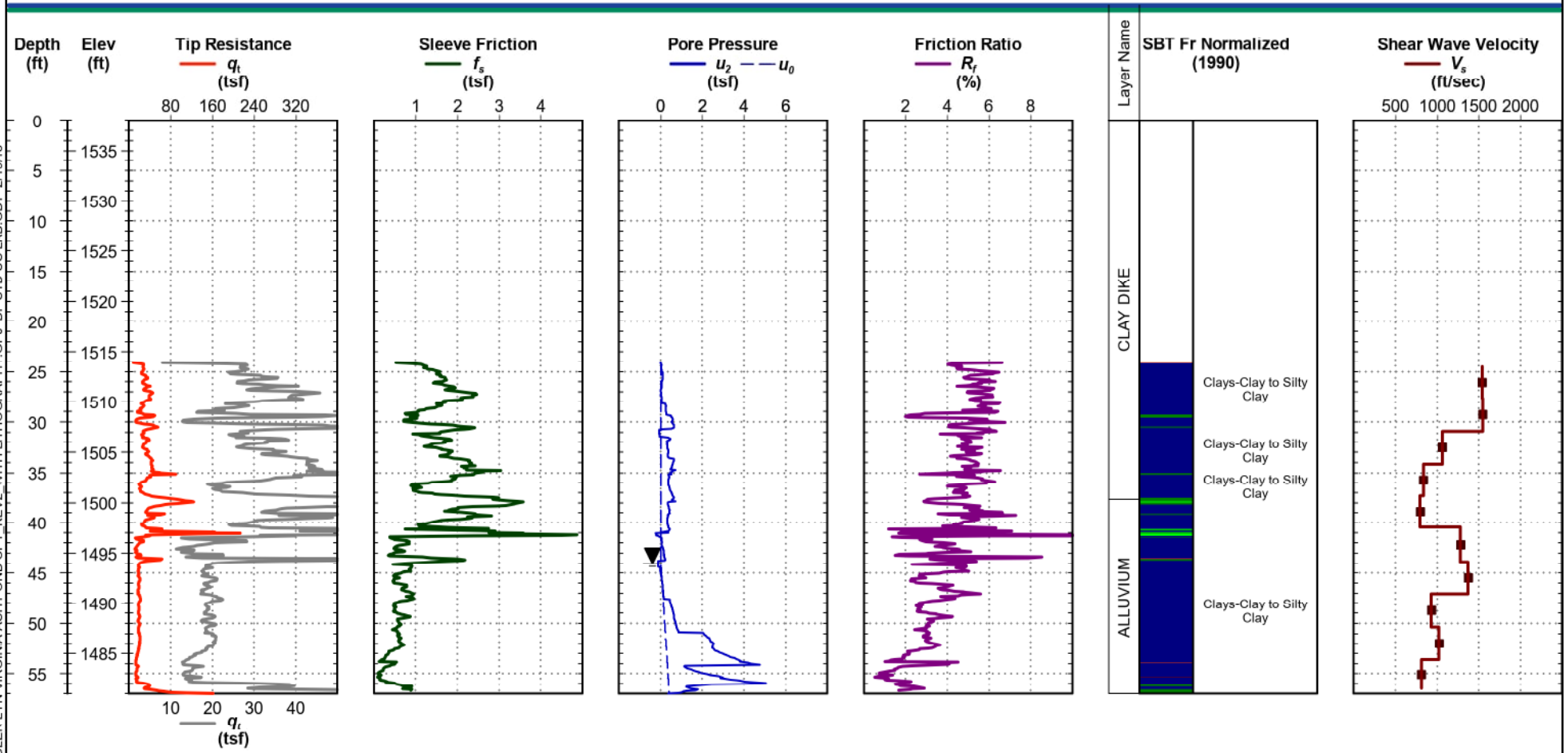
Cone Penetration Test

SCPT-119

Date: Sep. 29, 2017
Estimated Water Depth: 44 ft
Rig/Operator: CAP

Northing: 390,139.3 ft
Easting: 1,309,137.9 ft
Notes: Pre-augered to 24 ft.

Ground Surface Elevation: 1,538.0 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-119.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

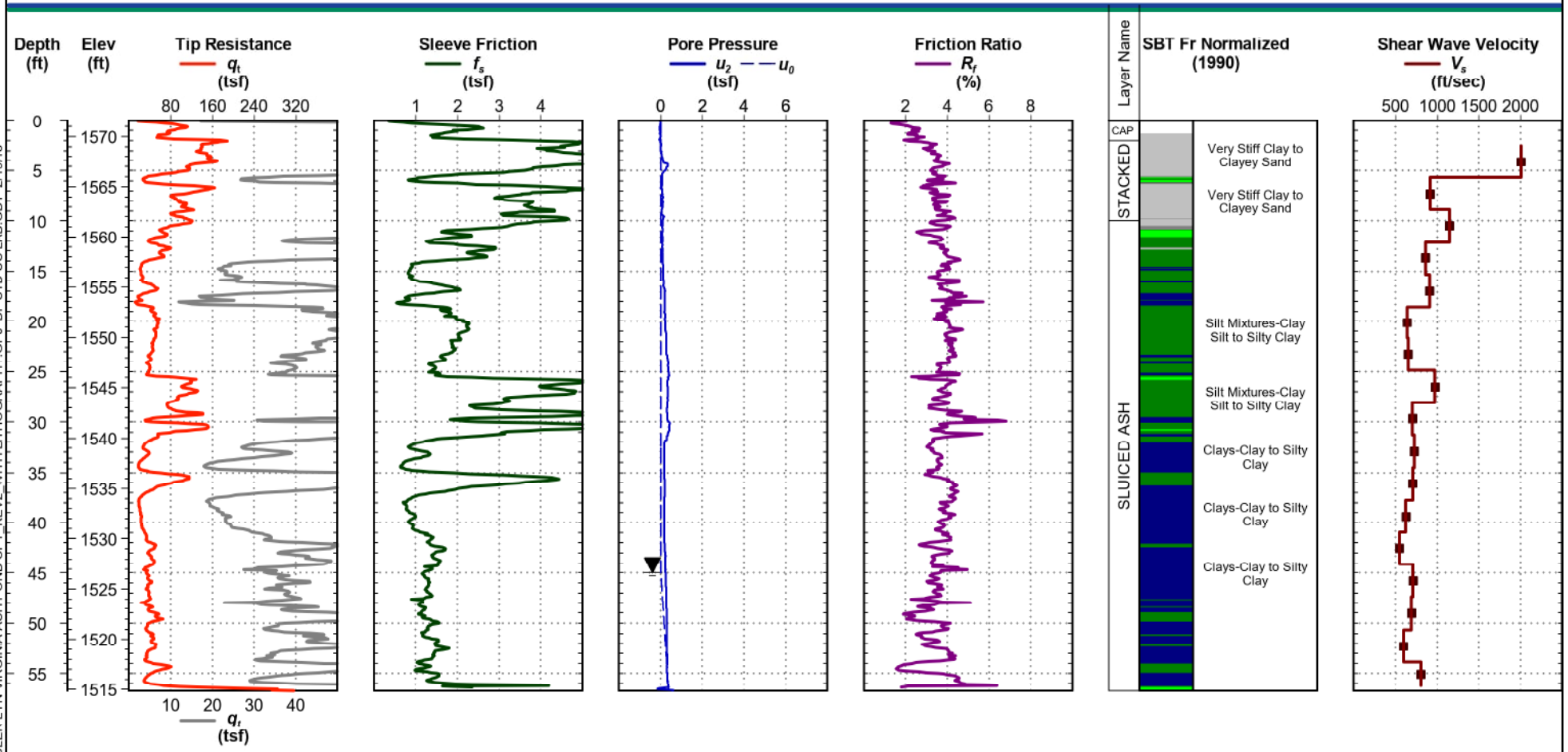
Cone Penetration Test

SCPT-120

Date: Oct. 2, 2017
Estimated Water Depth: 45 ft
Rig/Operator: CAP

Northing: 389,174.6 ft
Easting: 1,310,271.8 ft
Notes: Shallow refusal.

Ground Surface Elevation: 1,571.6 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-120.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

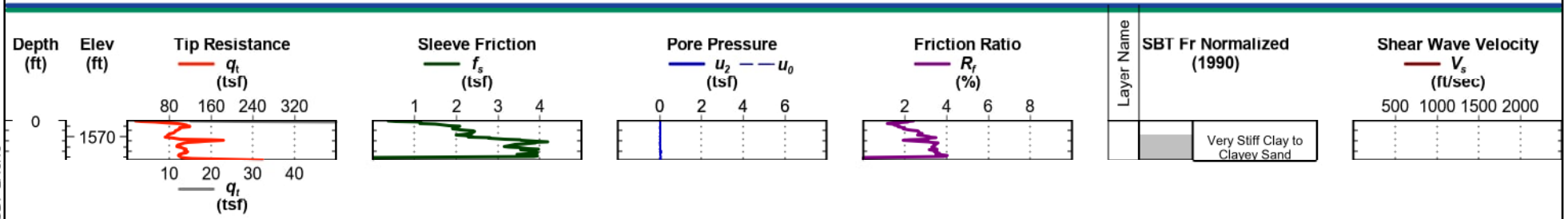
Cone Penetration Test

SCPT-120a

Date: Oct. 2, 2017
Estimated Water Depth: 45 ft
Rig/Operator: CAP

Northing: 389,173.2 ft
Easting: 1,310,275.7 ft
Notes: Shallow refusal.

Ground Surface Elevation: 1,571.6 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



Electronic File Name: SCPT-120a.cpt

CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

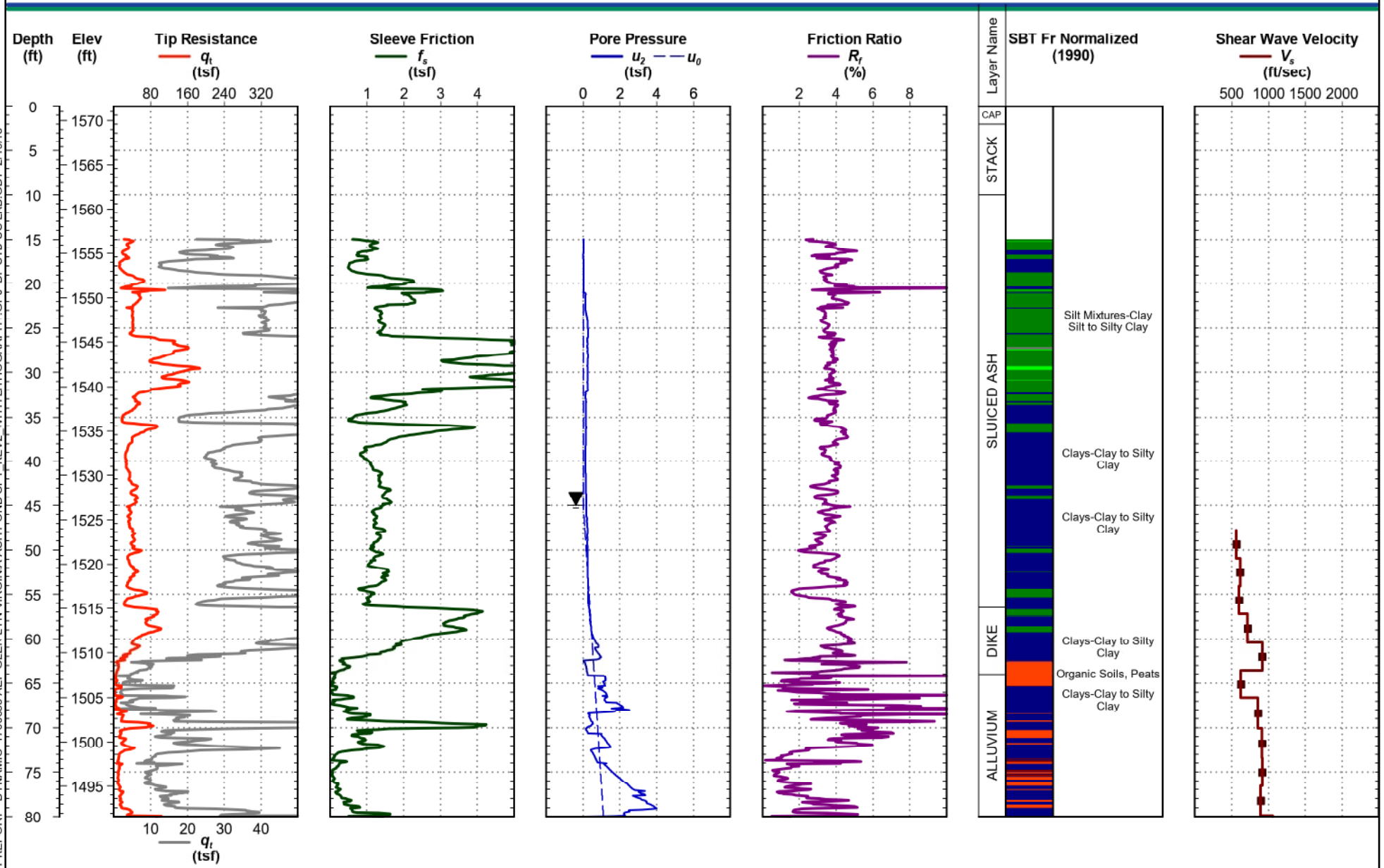
Cone Penetration Test

SCPT-120b

Date: Oct. 2, 2017
Estimated Water Depth: 45 ft
Rig/Operator: CAP

Northing: 389,173.2 ft
Easting: 1,310,275.7 ft
Notes: Pre-augered to 15 ft.

Ground Surface Elevation: 1,571.6 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-120b.cpt

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

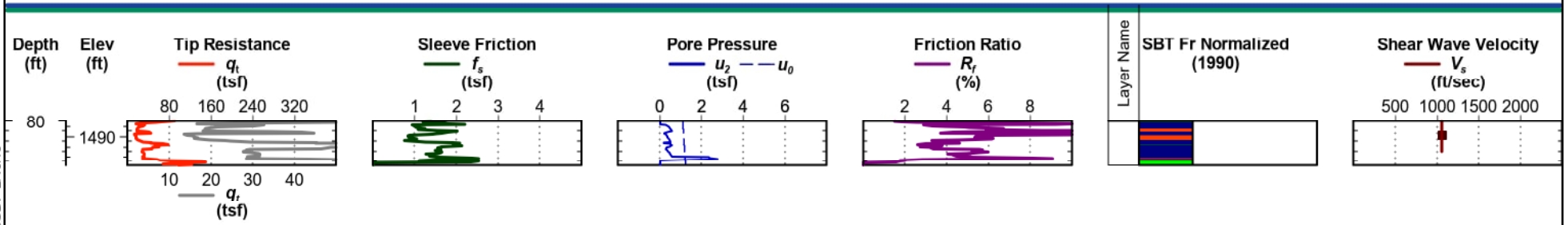
Cone Penetration Test

SCPT-120b

Date: Oct. 2, 2017
Estimated Water Depth: 45 ft
Rig/Operator: CAP

Northing: 389,173.2 ft
Easting: 1,310,275.7 ft
Notes: Pre-augered to 15 ft.

Ground Surface Elevation: 1,571.6 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD



Electronic File Name: SCPT-120b.cpt

CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

GEI Consultants

American Electric Power
Fly Ash Landfill (Glen Lyn,Virginia)
Project Number :1700685

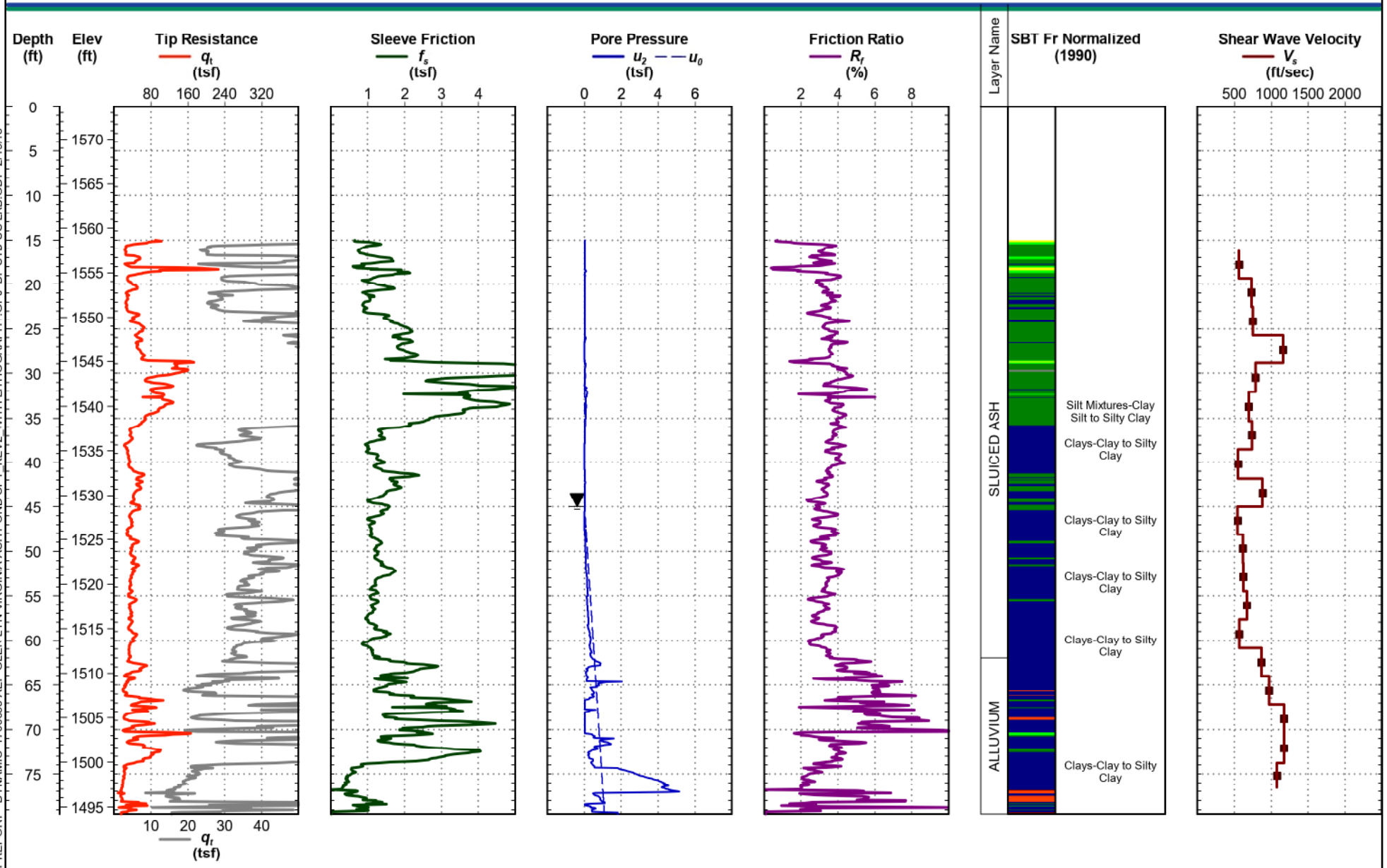
Cone Penetration Test

SCPT-121a

Date: Oct. 3, 2017
Estimated Water Depth: 45 ft
Rig/Operator: CAP

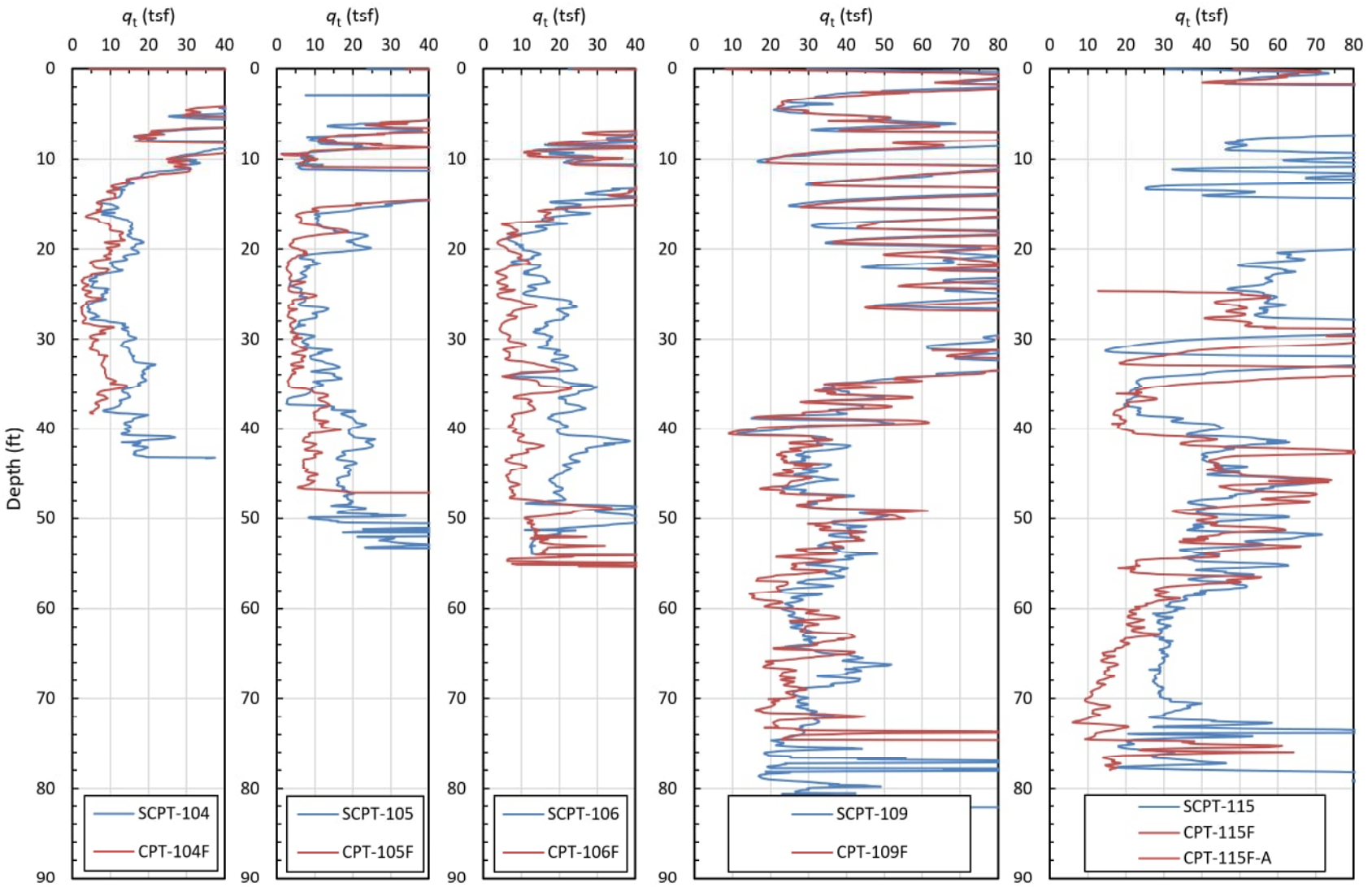
Northing: 389,190.2 ft
Easting: 1,310,217.3 ft
Notes: Pre-augered to 15 ft.

Ground Surface Elevation: 1,573.7 ft
Vertical/Horizontal Datum: NGVD29/GLFLHD

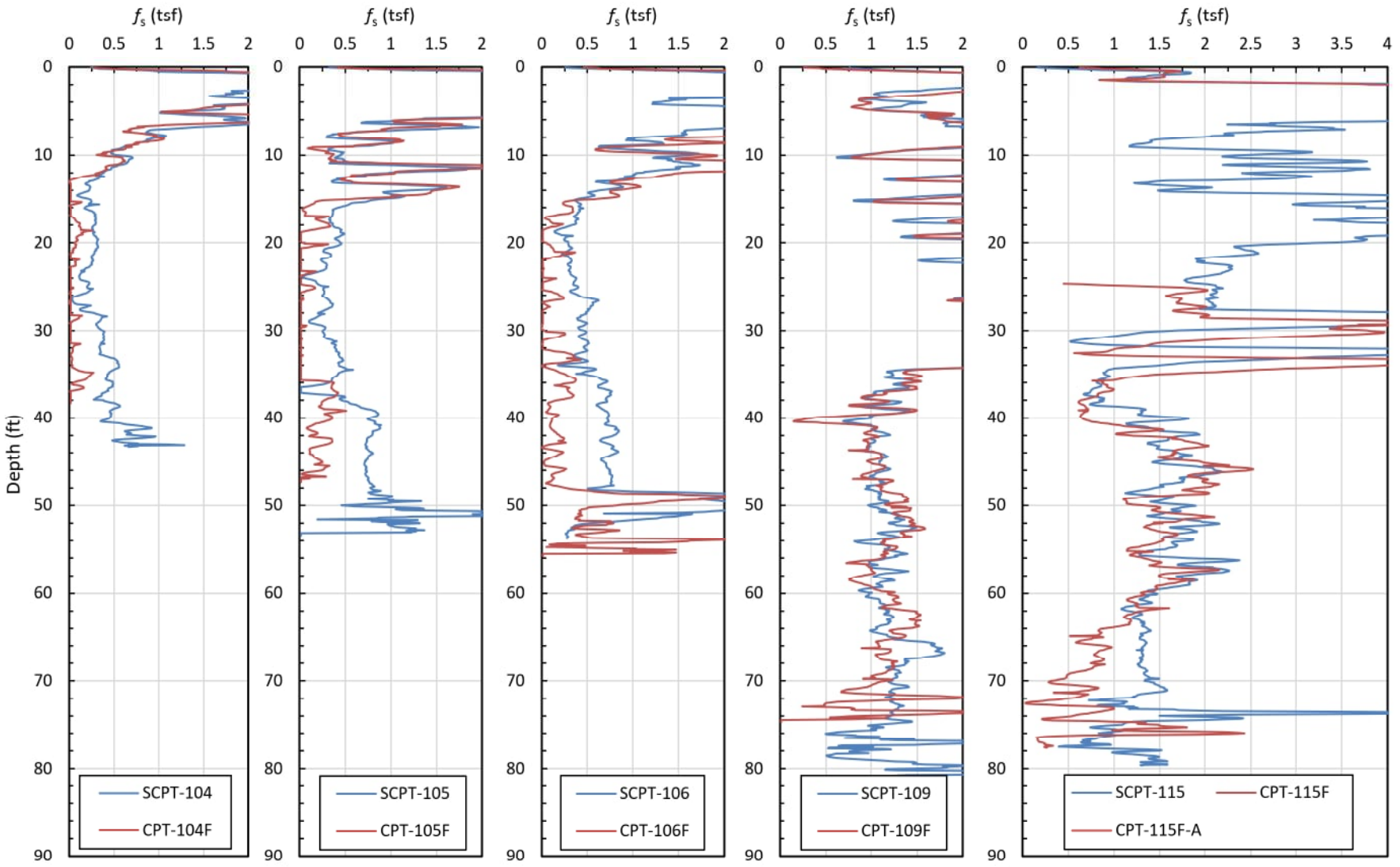


CPT REPORT - DYNAMIC 1700685 AEP GLEN LYN VIRGINIA ASH POND CPT_REV2_WITH LITHOGRAPHY.GPJ DF STD US LAB.GDT 2/19/18

Electronic File Name: SCPT-121a.cpt



Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	COMPARISON OF q_t FOR STANDARD AND FAST-PUSH CPT SOUNDINGS
American Electric Power Columbus, Ohio	Project 1700685	March 2018 Fig. H-1



Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

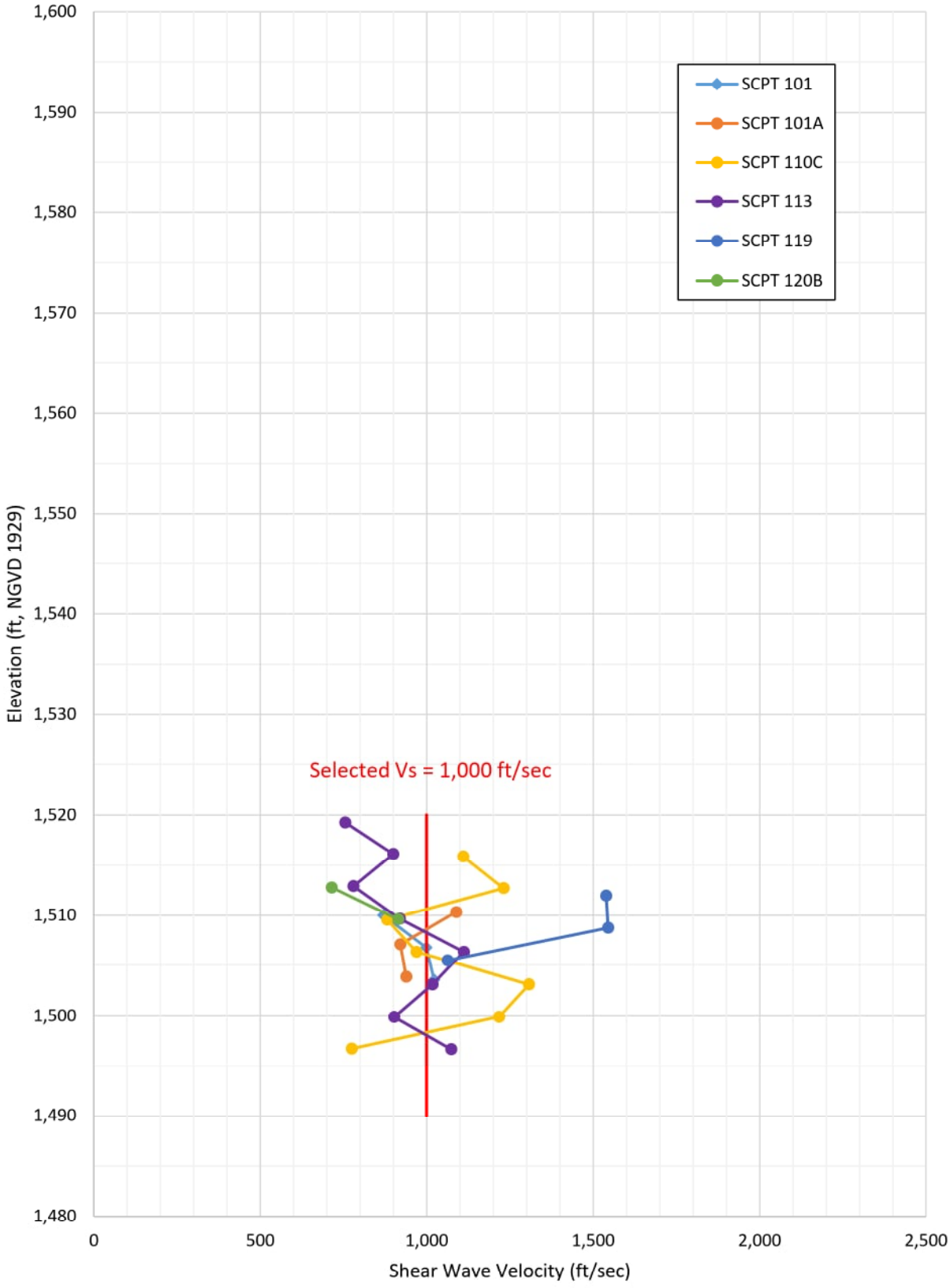
GEI Consultants

Project 1700685

COMPARISON OF f_s FOR STANDARD AND FAST-PUSH CPT SOUNDINGS

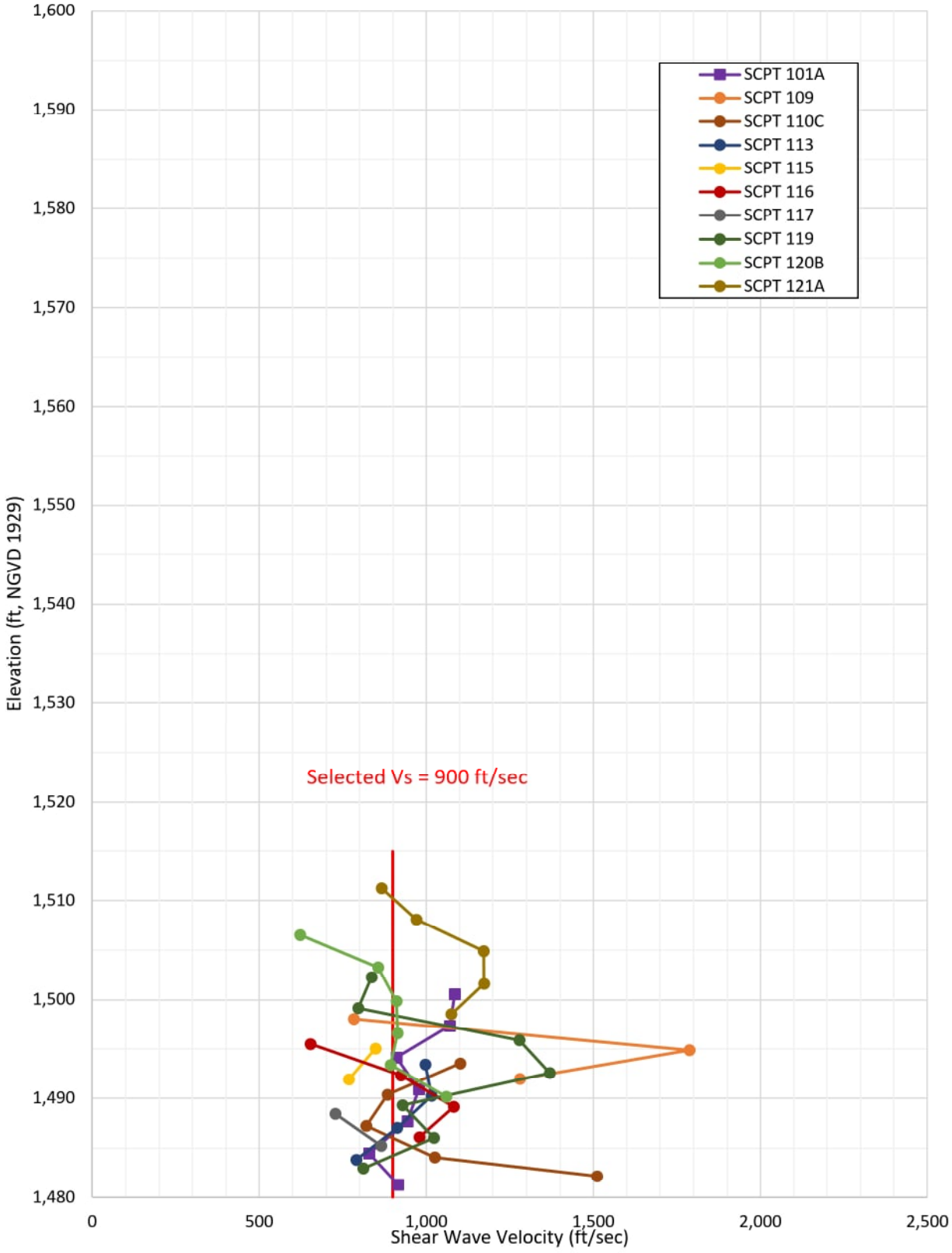
March 2018

Fig. H-2



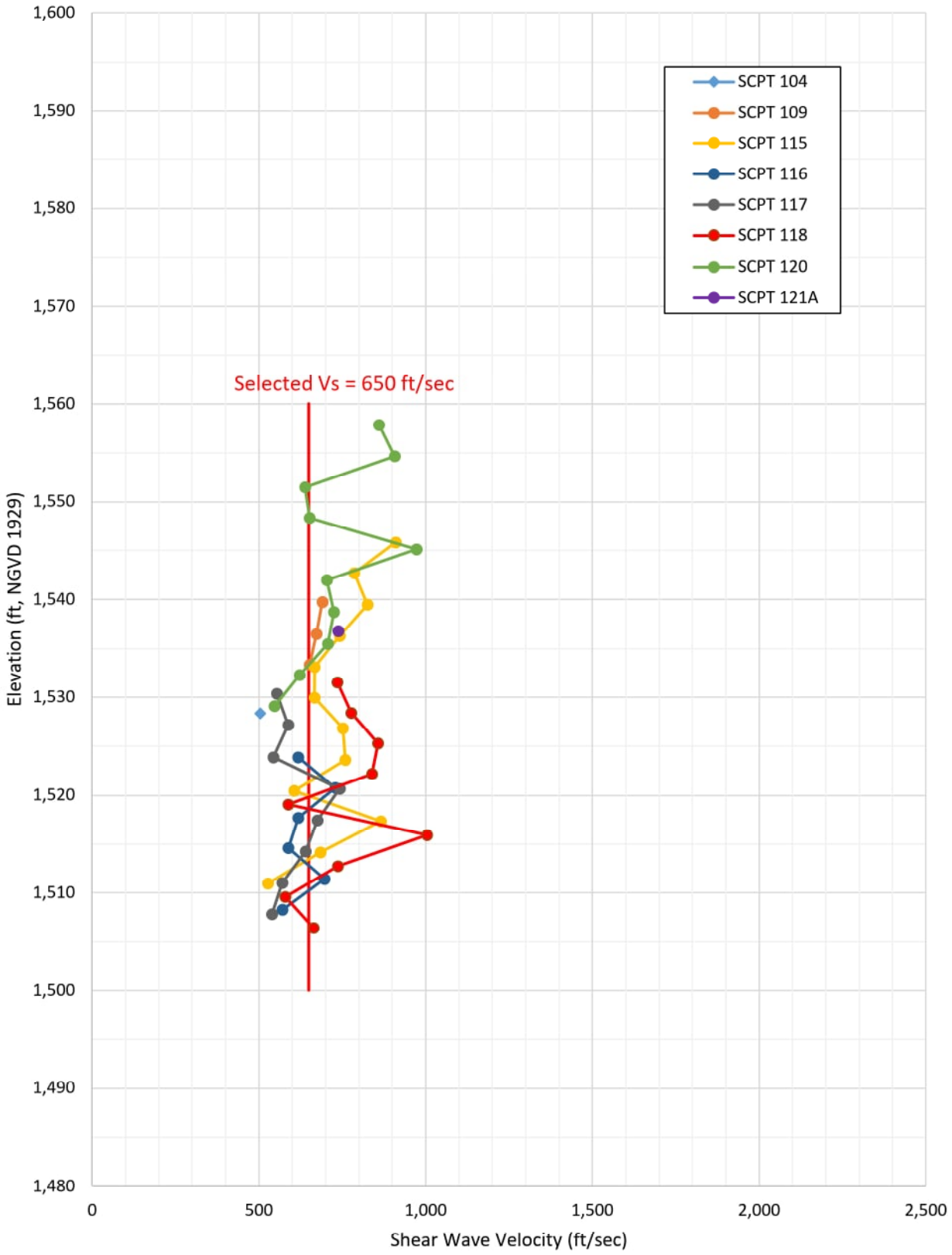
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	SHEAR WAVE VELOCITIES IN CLAY DIKE
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. H-1

B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\5 Analyses\Soil Parameters\Shear Wave Velocity\[Soil Shear Wave Velocities by Layer.xlsx]Sluiced Ash above WT Plot GEI



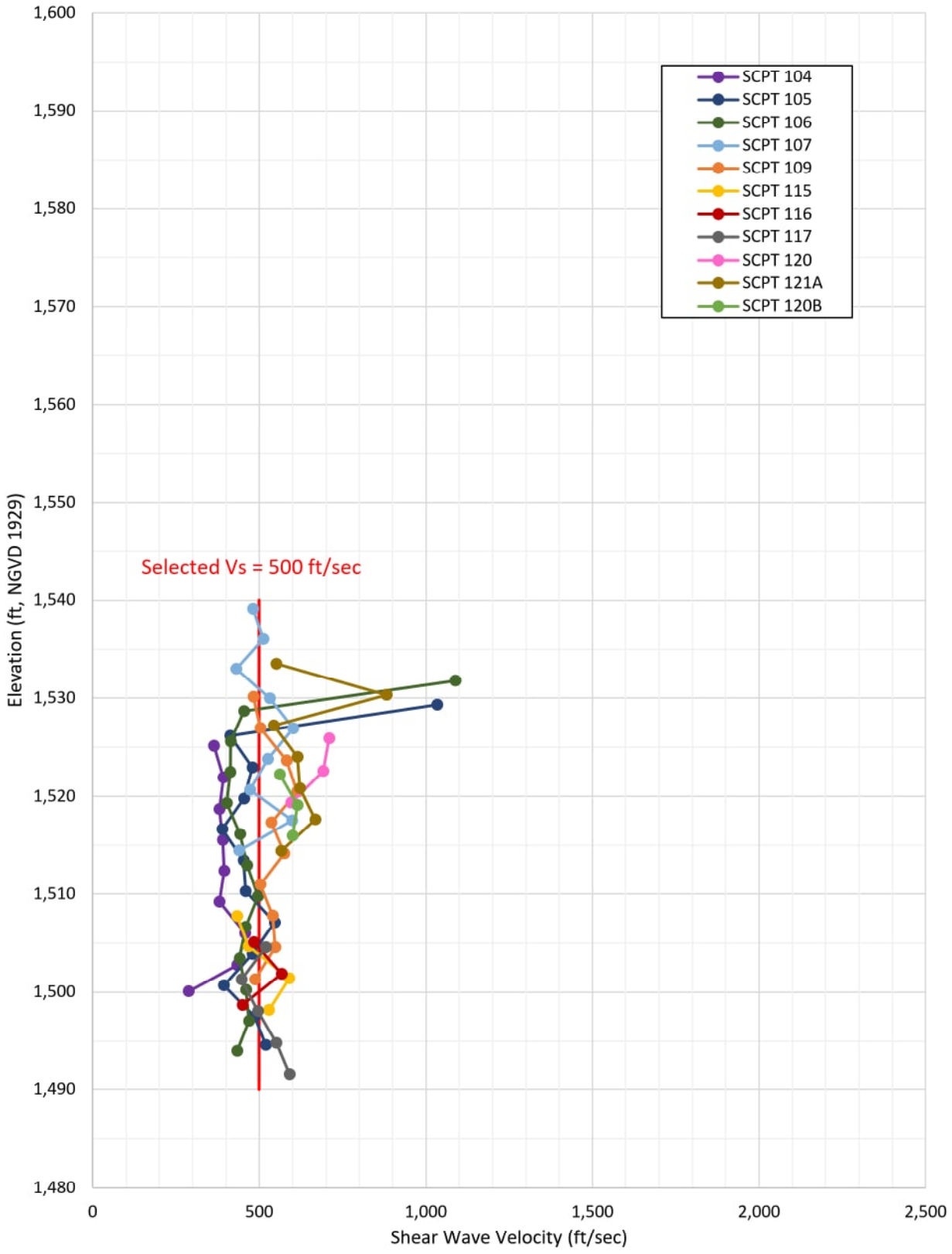
B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\5 Analyses\Soil Parameters\Shear Wave Velocity\[Soil Shear Wave Velocities by Layer.xlsx]Sluiced Ash above WT Plot GEI

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	SHEAR WAVE VELOCITIES IN ALLUVIUM
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. H-2



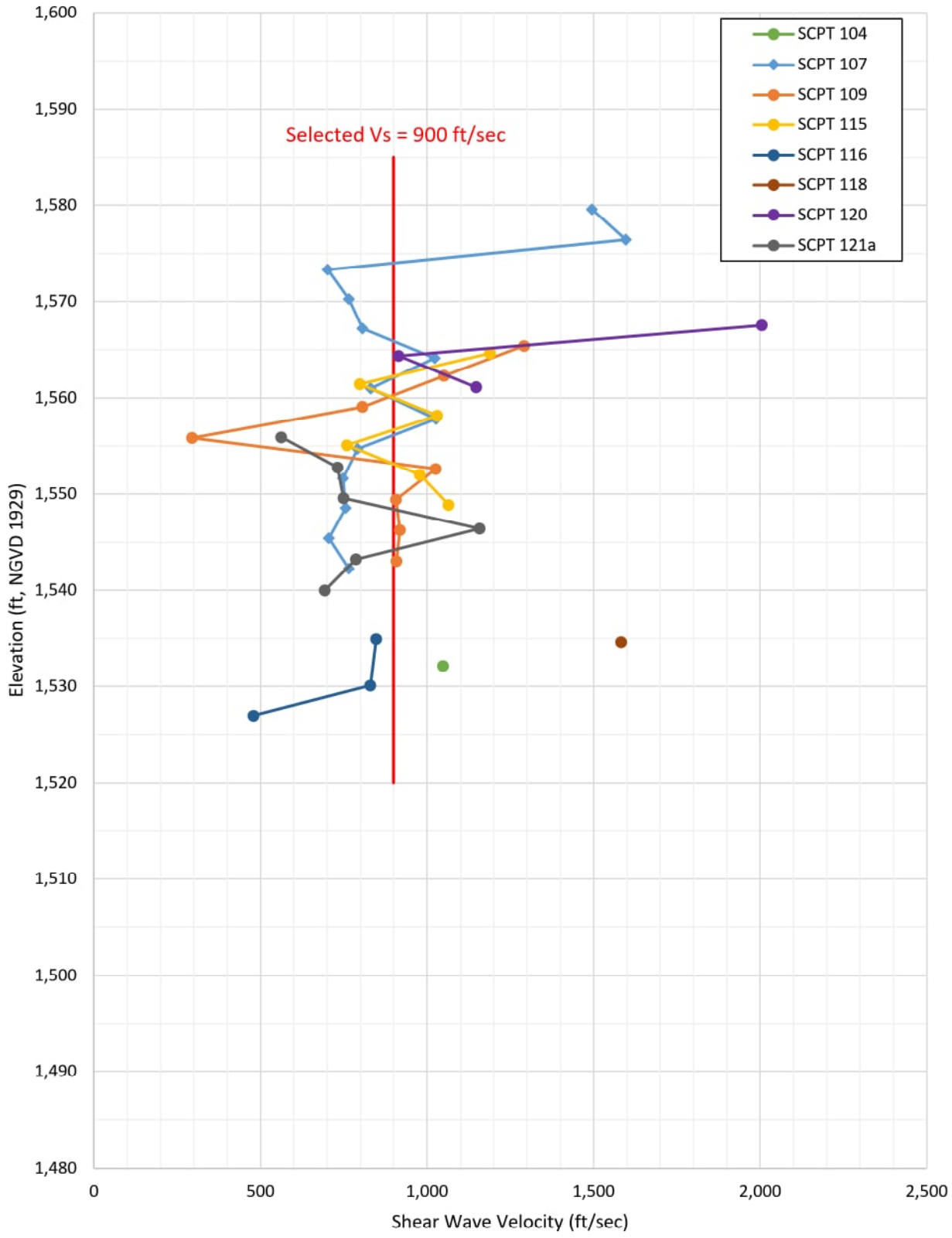
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	SHEAR WAVE VELOCITIES IN SLUICED ASH ABOVE THE WATER TABLE
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. H-3

B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\5 Analyses\Soil Parameters\Shear Wave Velocity\[Soil Shear Wave Velocities by Layer.xlsx]Sluiced Ash above WT Plot GEI



Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	SHEAR WAVE VELOCITIES IN SLUICED ASH BELOW THE WATER TABLE
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. H-4

B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\5 Analyses\Soil Parameters\Shear Wave Velocity\[Soil Shear Wave Velocities by Layer.xlsx]Sluiced Ash above WT Plot GEI



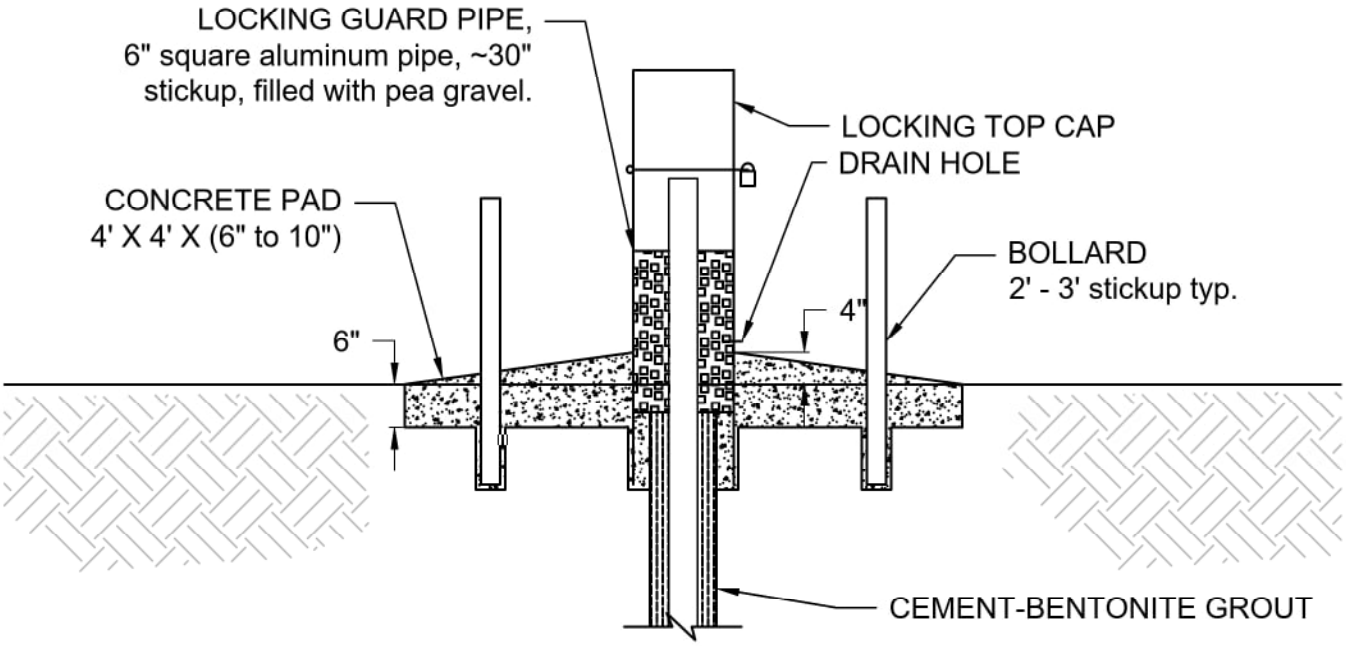
Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	SHEAR WAVE VELOCITIES IN STACKED ASH
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. H-5

B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\5 Analyses\Soil Parameters\Shear Wave Velocity\[Soil Shear Wave Velocities by Layer.xlsx]Sluiced Ash above WT Plot GEI

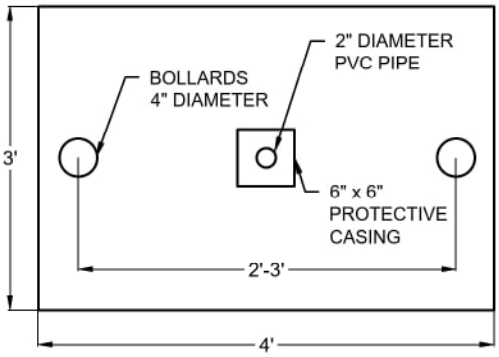
Appendix I

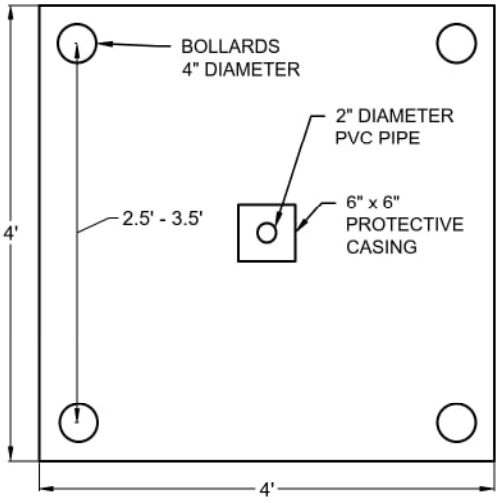
2017 GEI Piezometer Installation Logs

- **Fig. I-1 – Open Standpipe Piezometer, Typical Protection Detail**
- **Piezometer Installation Logs**



SECTION DETAIL





NOTES:

1. NOT TO SCALE

2 AND 4 BOLLARD PLAN VIEW

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	Open Standpipe Piezometer Typical Protection Detail
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. I-1

B:\Working\AEP\1700685 Seismic Stability, Glen Lyn Plant\9 Field Explorations\1 Planning\Well Details.dwg - 3/15/2018

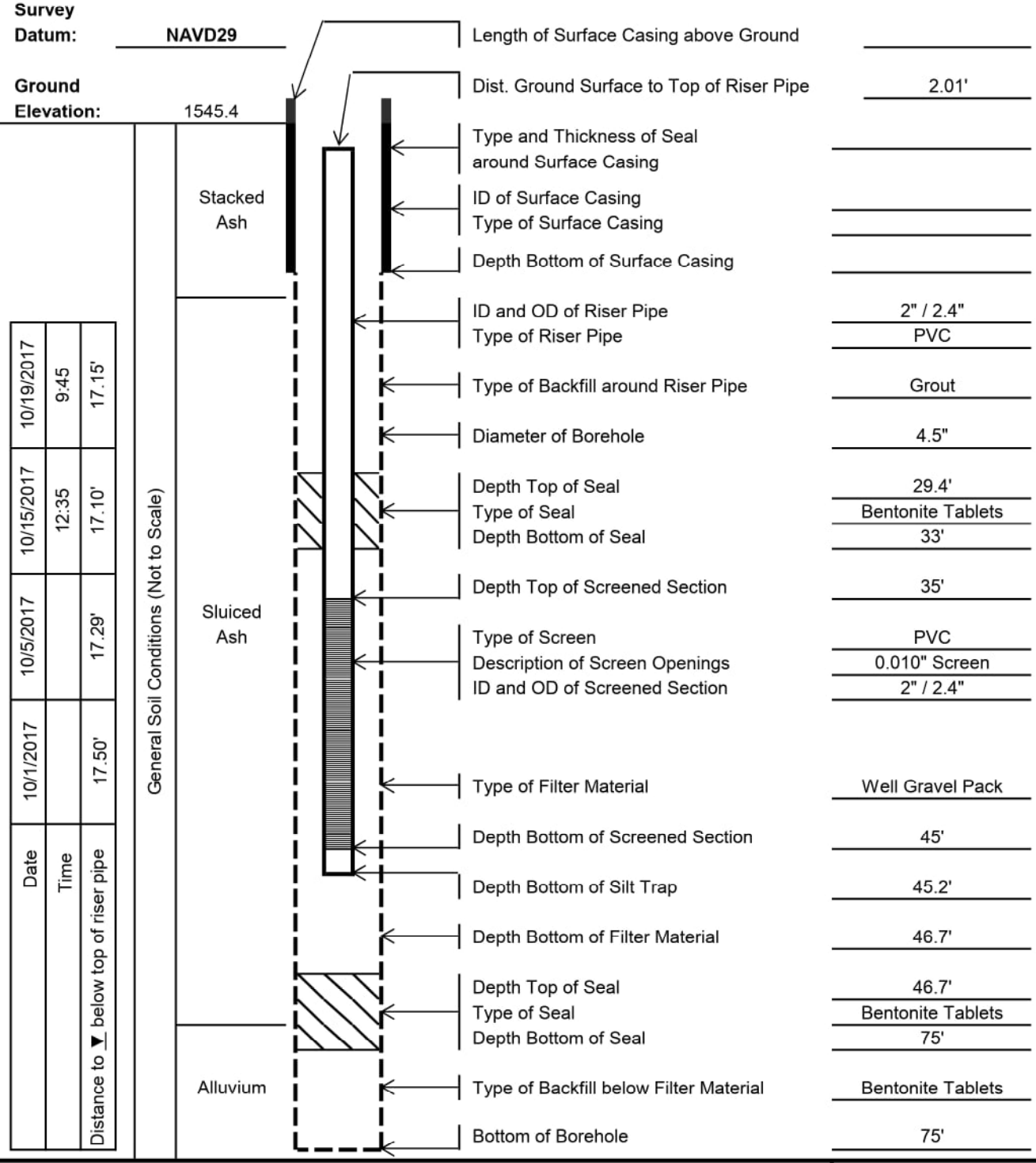
Groundwater Well Installation Log

B105

Project	Glen Lyn West Pond and Landfill	**GEI Proj. No.**	1700685
City / Town	Glen Lyn, Virginia	**Location**	See Plan
Client	AEP		
Contractor	Terracon		
Driller	W. Duggins	**GEI Rep.** M. Perez-Canals	**Install Date** 9/15/2017

Survey Datum: NAVD29

Ground Elevation: 1545.4



Date	Time	Distance to ▼ below top of riser pipe
10/19/2017	9:45	17.15'
10/15/2017	12:35	17.10'
10/5/2017		17.29'
10/1/2017		17.50'

Length of Surface Casing above Ground	
Dist. Ground Surface to Top of Riser Pipe	2.01'
Type and Thickness of Seal around Surface Casing	
ID of Surface Casing	
Type of Surface Casing	
Depth Bottom of Surface Casing	
ID and OD of Riser Pipe	2" / 2.4"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5"
Depth Top of Seal	29.4'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	33'
Depth Top of Screened Section	35'
Type of Screen	PVC
Description of Screen Openings	0.010" Screen
ID and OD of Screened Section	2" / 2.4"
Type of Filter Material	Well Gravel Pack
Depth Bottom of Screened Section	45'
Depth Bottom of Silt Trap	45.2'
Depth Bottom of Filter Material	46.7'
Depth Top of Seal	46.7'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	75'
Type of Backfill below Filter Material	Bentonite Tablets
Bottom of Borehole	75'

Notes:
Depths are measured from ground surface at time of installation.

GEI Consultants

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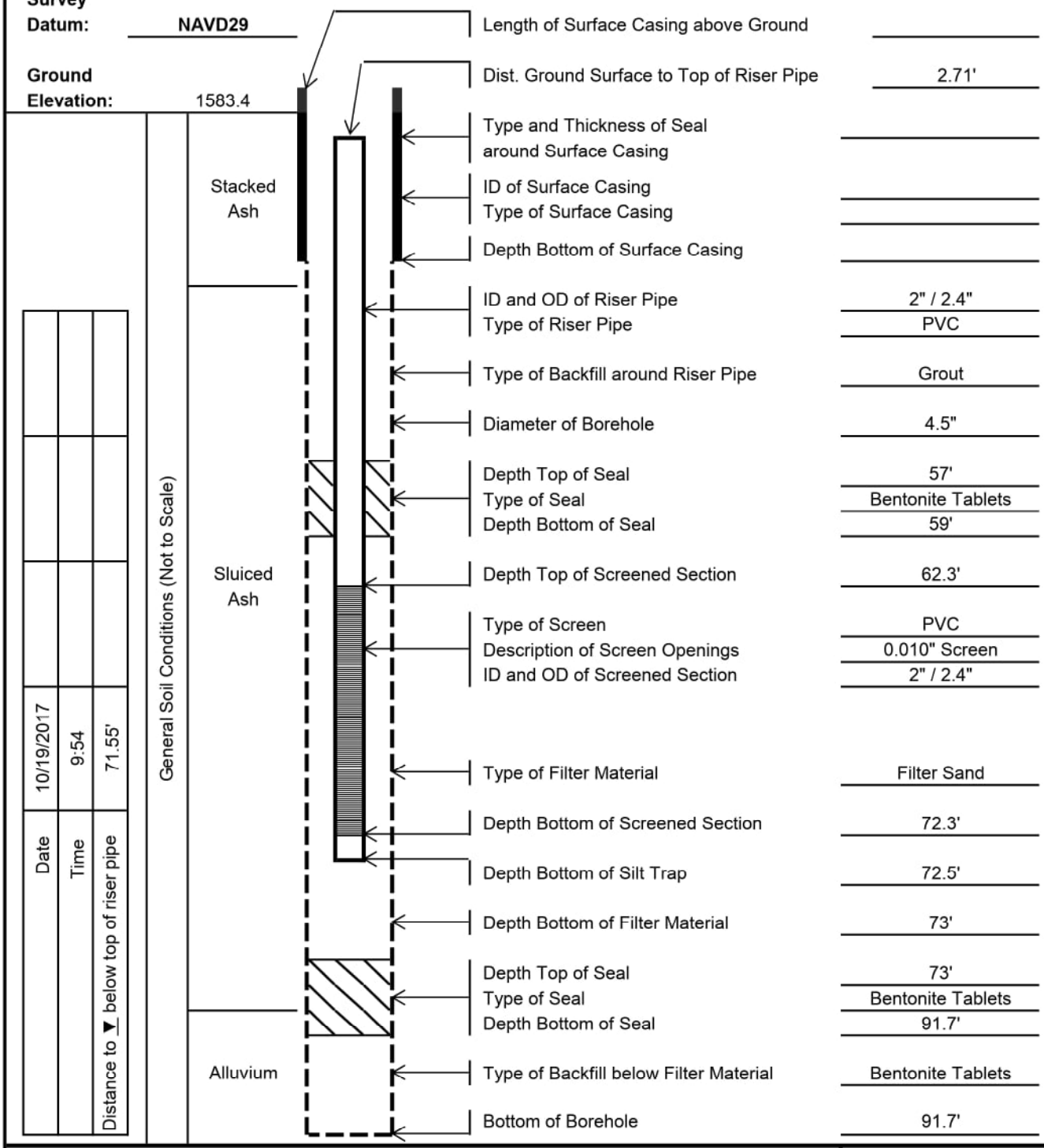
Groundwater Well Installation Log

B107

Project	Glen Lyn West Pond and Landfill	**GEI Proj. No.**	1700685
City / Town	Glen Lyn, Virginia	**Location**	See Plan
Client	AEP		
Contractor	Terracon		
Driller	W. Duggins	**GEI Rep.** M. Perez-Canals	**Install Date** 10/16 - 10/17/2017

Survey Datum: NAVD29

Ground Elevation: 1583.4



Length of Surface Casing above Ground	
Dist. Ground Surface to Top of Riser Pipe	2.71'
Type and Thickness of Seal around Surface Casing	
ID of Surface Casing	
Type of Surface Casing	
Depth Bottom of Surface Casing	
ID and OD of Riser Pipe	2" / 2.4"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5"
Depth Top of Seal	57'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	59'
Depth Top of Screened Section	62.3'
Type of Screen	PVC
Description of Screen Openings	0.010" Screen
ID and OD of Screened Section	2" / 2.4"
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	72.3'
Depth Bottom of Silt Trap	72.5'
Depth Bottom of Filter Material	73'
Depth Top of Seal	73'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	91.7'
Type of Backfill below Filter Material	Bentonite Tablets
Bottom of Borehole	91.7'

Notes:
Depths are measured from ground surface at time of installation.

GEI Consultants

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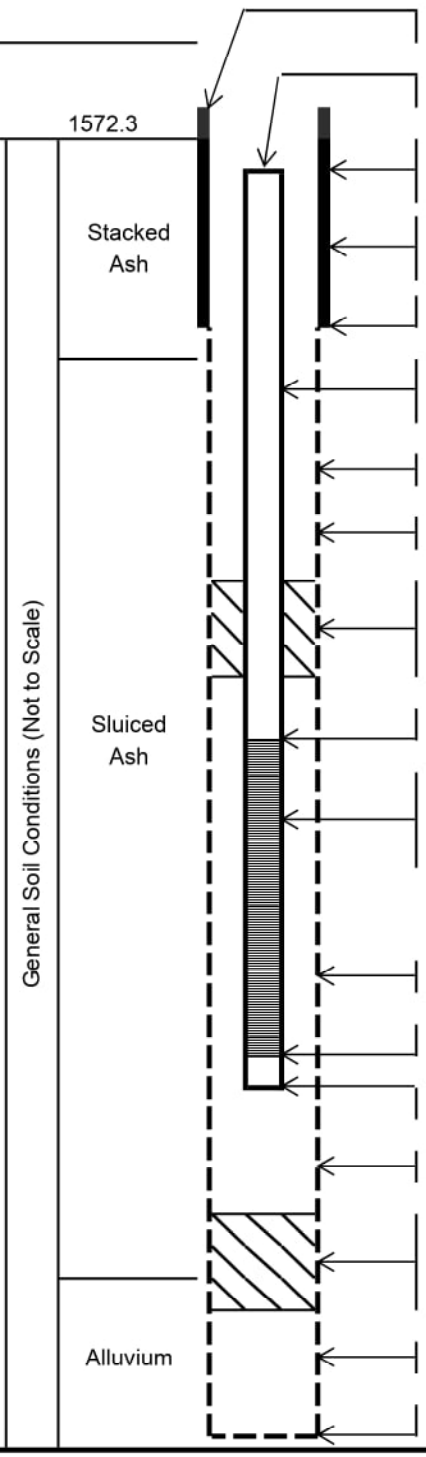
Groundwater Well Installation Log

B109

Project	Glen Lyn West Pond and Landfill	**GEI Proj. No.**	1700685
City / Town	Glen Lyn, Virginia	**Location**	See Plan
Client	AEP		
Contractor	Terracon		
Driller	W. Duggins	**GEI Rep.** M. Perez-Canals	**Install Date** 9/21/2017

Survey Datum: _____

Ground Elevation: 1572.3



Date	Time	Distance to ▼ below top of riser pipe
9/28/2017	11:50	47.42'
10/5/2017		47.51'
10/15/2017	12:35	47.55'
10/19/2017	10:10	47.68'

Length of Surface Casing above Ground	
Dist. Ground Surface to Top of Riser Pipe	2.14'
Type and Thickness of Seal around Surface Casing	
ID of Surface Casing	
Type of Surface Casing	
Depth Bottom of Surface Casing	
ID and OD of Riser Pipe	2" / 2.4"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5"
Depth Top of Seal	49'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	51'
Depth Top of Screened Section	53.8'
Type of Screen	PVC
Description of Screen Openings	0.010" Screen
ID and OD of Screened Section	2" / 2.4"
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	73.8'
Depth Bottom of Silt Trap	74'
Depth Bottom of Filter Material	75.17'
Depth Top of Seal	75.17'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	103
Type of Backfill below Filter Material	Bentonite Tablets
Bottom of Borehole	103

Notes:
Depths are measured from ground surface at time of installation.

GEI Consultants

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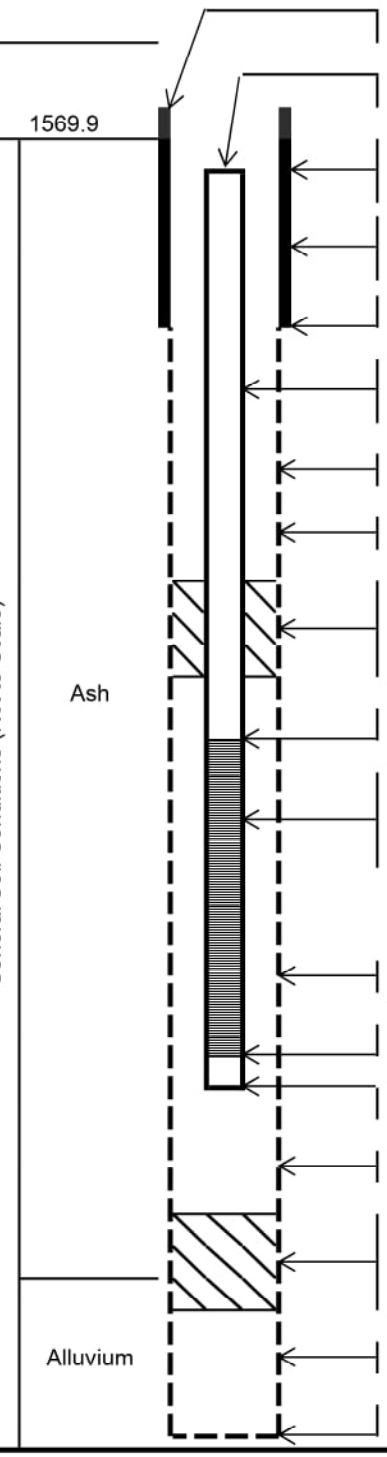
Groundwater Well Installation Log

B115

Project	Glen Lyn West Pond and Landfill	**GEI Proj. No.**	1700685
City / Town	Glen Lyn, Virginia	**Location**	See Plan
Client	AEP		
Contractor	Terracon		
Driller	W. Duggins	**GEI Rep.** M. Perez-Canals	**Install Date** 9/30/2017

Survey Datum: _____

Ground Elevation: 1569.9



Date	Time	Distance to ▼ below top of riser pipe
10/4/2017	9:20	63.25'
10/5/2017		63.46'
10/15/2017	12:35	63.41'
10/19/2017	10:20	63.59'

Length of Surface Casing above Ground	
Dist. Ground Surface to Top of Riser Pipe	2.02'
Type and Thickness of Seal around Surface Casing	
ID of Surface Casing	
Type of Surface Casing	
Depth Bottom of Surface Casing	
ID and OD of Riser Pipe	2" / 2.4"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5"
Depth Top of Seal	37.85'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	47.9'
Depth Top of Screened Section	50'
Type of Screen	PVC
Description of Screen Openings	0.010" Screen
ID and OD of Screened Section	2" / 2.4"
Type of Filter Material	Filter Sand (#20)
Depth Bottom of Screened Section	70'
Depth Bottom of Silt Trap	70.2'
Depth Bottom of Filter Material	70.6'
Depth Top of Seal	70.6'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	100'
Type of Backfill below Filter Material	Bentonite Tablets
Bottom of Borehole	100'

Notes: The top seal was extended to 37.85' due to loss of circulation around 40' during drilling. Depths are measured from ground surface at time of installation.

GEI Consultants

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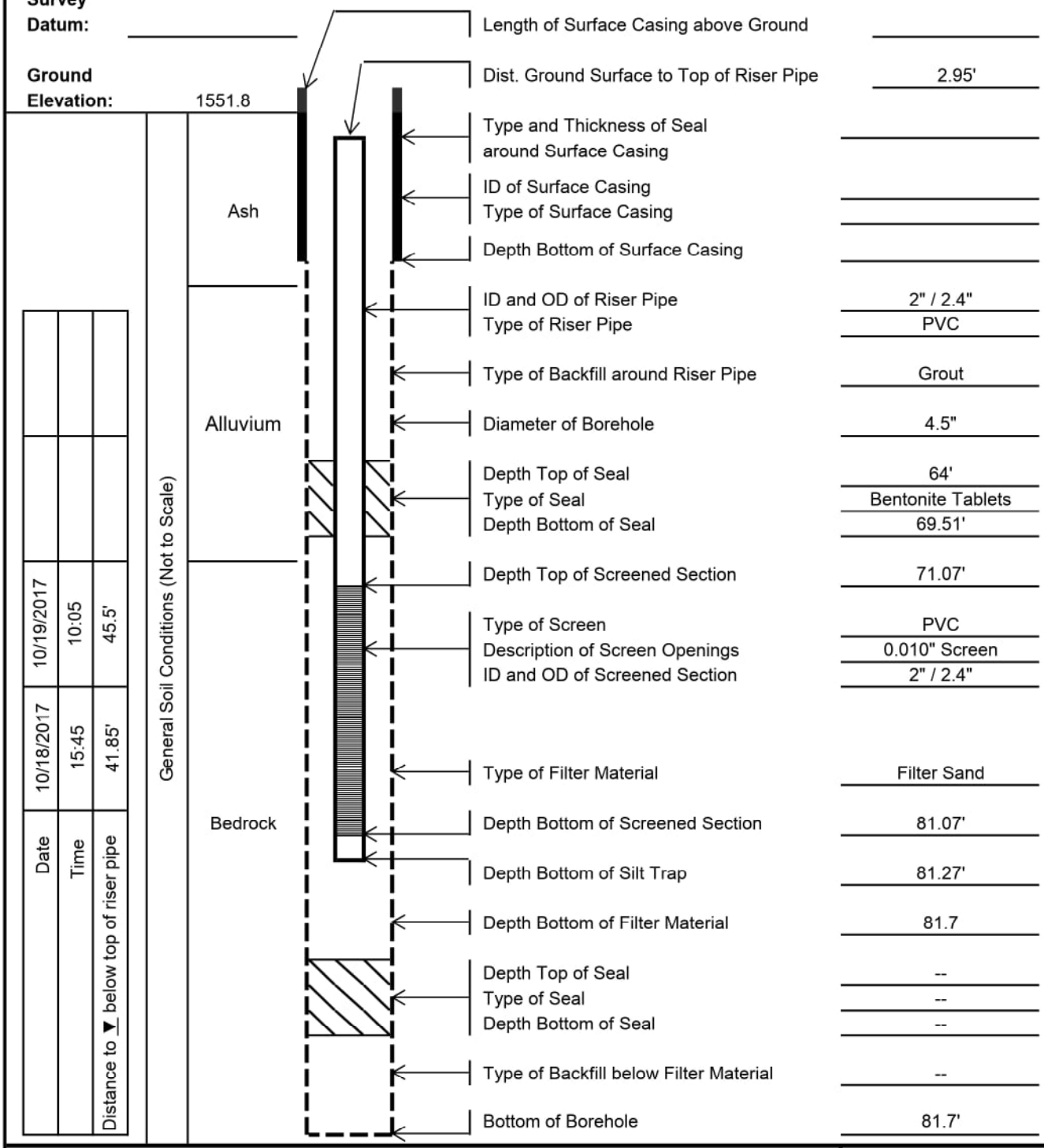
Groundwater Well Installation Log

B122

Project	Glen Lyn West Pond and Landfill	**GEI Proj. No.**	1700685
City / Town	Glen Lyn, Virginia	**Location**	See Plan
Client	AEP		
Contractor	Terracon		
Driller	W. Duggins	**GEI Rep.** M. Perez-Canals	**Install Date** 10/15/2017

Survey Datum:

Ground Elevation: 1551.8



Date	Time	Distance to ▼ below top of riser pipe
10/18/2017	15:45	41.85'
10/19/2017	10:05	45.5'

Length of Surface Casing above Ground	
Dist. Ground Surface to Top of Riser Pipe	2.95'
Type and Thickness of Seal around Surface Casing	
ID of Surface Casing	
Type of Surface Casing	
Depth Bottom of Surface Casing	
ID and OD of Riser Pipe	2" / 2.4"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5"
Depth Top of Seal	64'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	69.51'
Depth Top of Screened Section	71.07'
Type of Screen	PVC
Description of Screen Openings	0.010" Screen
ID and OD of Screened Section	2" / 2.4"
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	81.07'
Depth Bottom of Silt Trap	81.27'
Depth Bottom of Filter Material	81.7
Depth Top of Seal	--
Type of Seal	--
Depth Bottom of Seal	--
Type of Backfill below Filter Material	--
Bottom of Borehole	81.7'

Notes:
Depths are measured from ground surface at time of installation.

GEI Consultants

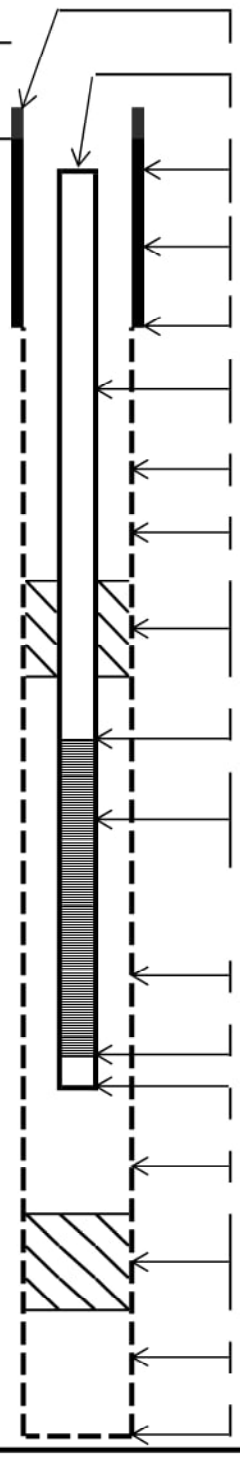
Groundwater Well Installation Log

B122U

Project	Glen Lyn West Pond and Landfill	**GEI Proj. No.**	1700685
City / Town	Glen Lyn, Virginia	**Location**	See Plan
Client	AEP		
Contractor	Terracon		
Driller	W. Duggins	**GEI Rep.** M. Perez-Canals	**Install Date** 10/14/2017

Survey Datum: _____

Ground Elevation: 1551.8



Date	Time	Distance to ▼ below top of riser pipe
10/18/2017	15:45	26.0'
10/19/2017	10:05	26.0'

Length of Surface Casing above Ground	
Dist. Ground Surface to Top of Riser Pipe	2.95'
Type and Thickness of Seal around Surface Casing	
ID of Surface Casing	
Type of Surface Casing	
Depth Bottom of Surface Casing	
ID and OD of Riser Pipe	2" / 2.4"
Type of Riser Pipe	PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5"
Depth Top of Seal	30'
Type of Seal	Bentonite Tablets
Depth Bottom of Seal	38.5'
Depth Top of Screened Section	40.77'
Type of Screen	PVC
Description of Screen Openings	0.010" Screen
ID and OD of Screened Section	2" / 2.4"
Type of Filter Material	Filter Sand
Depth Bottom of Screened Section	50.77'
Depth Bottom of Silt Trap	50.97'
Depth Bottom of Filter Material	51'
Depth Top of Seal	--
Type of Seal	--
Depth Bottom of Seal	--
Type of Backfill below Filter Material	--
Bottom of Borehole	51'

Notes:
Depths are measured from ground surface at time of installation.

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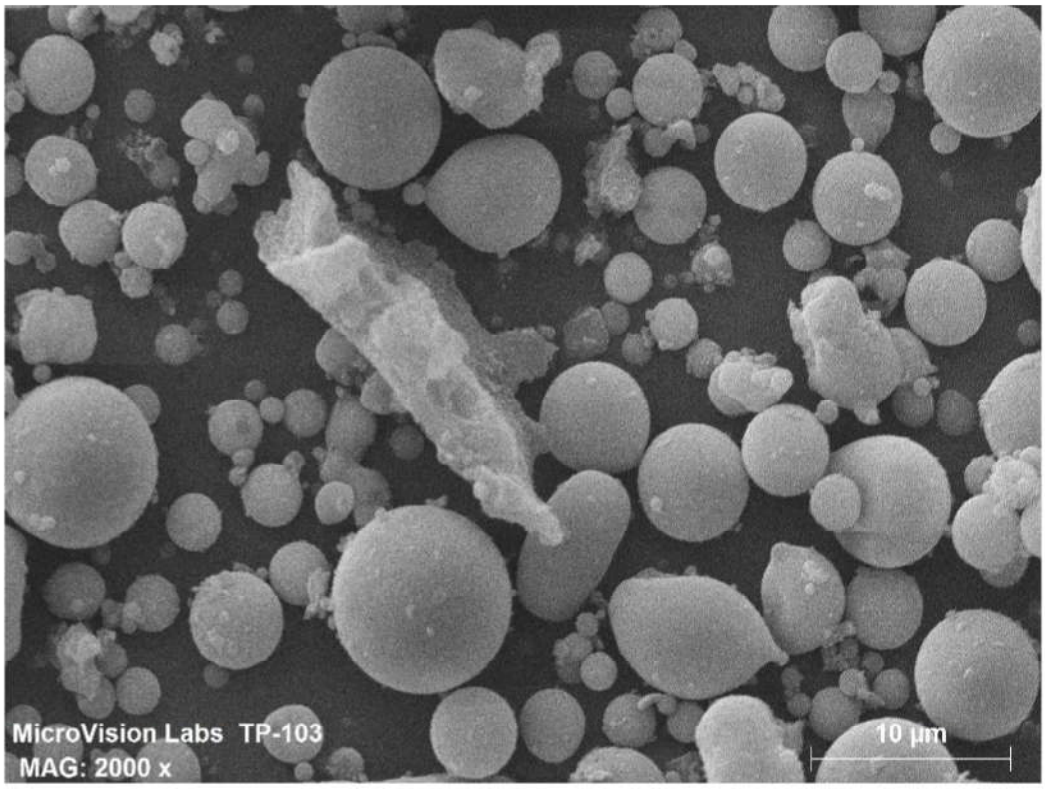
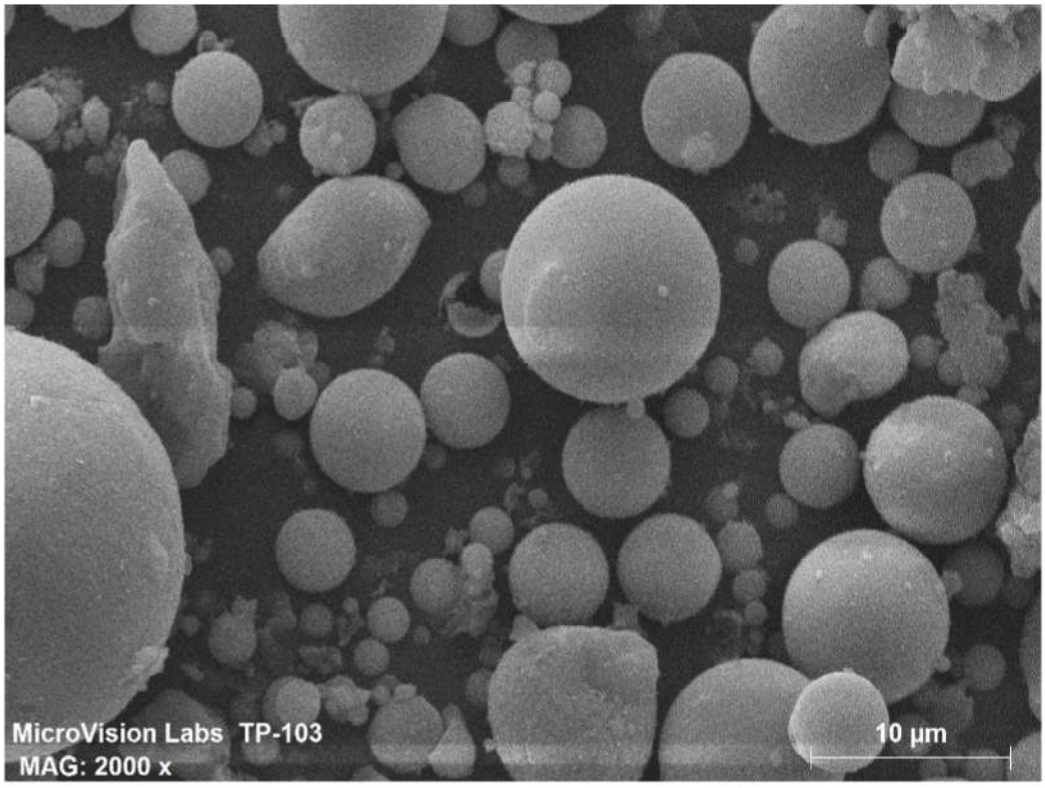
M:\Drafting\Office\Forms\Well Install Log Blank Form

Appendix J

Electron Microscope Photos, Gradation Test Reports, and Atterberg Limits Test Reports

- GEI Electron Microscope Photos – TP103 and B109
- GEI Gradation Test Reports
- GEI Atterberg Limits Test Reports


MicroVision Labs TP-103
MAG: 2000 x
10 µm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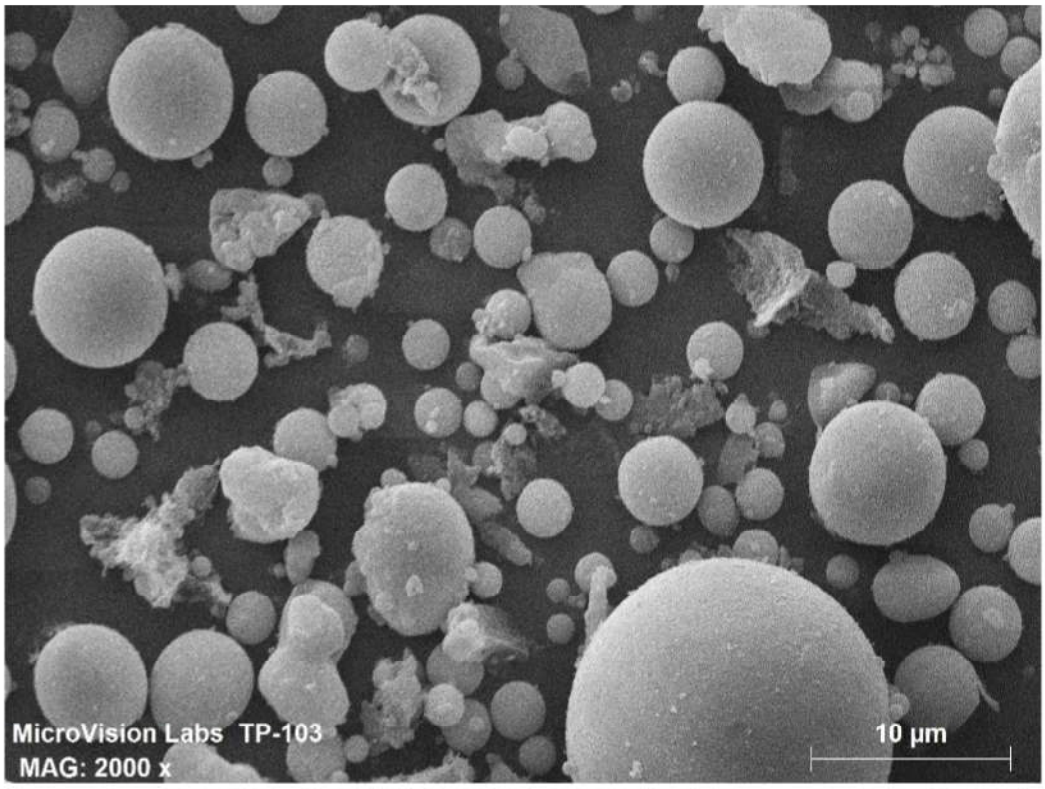
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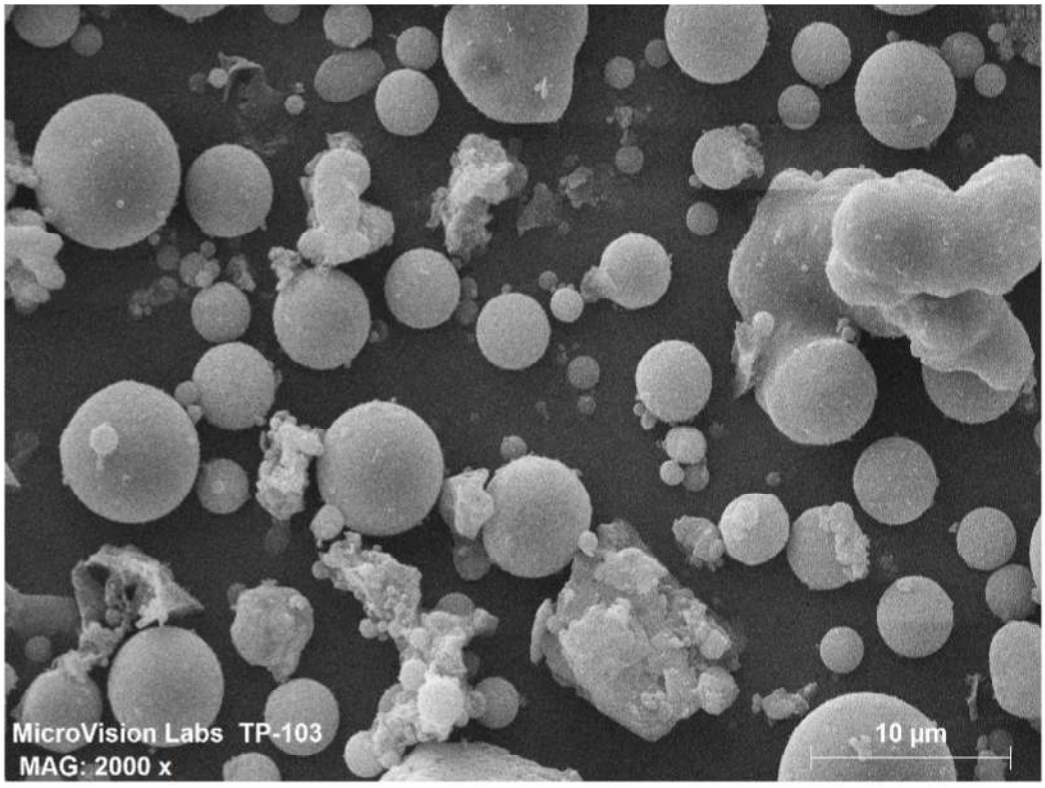
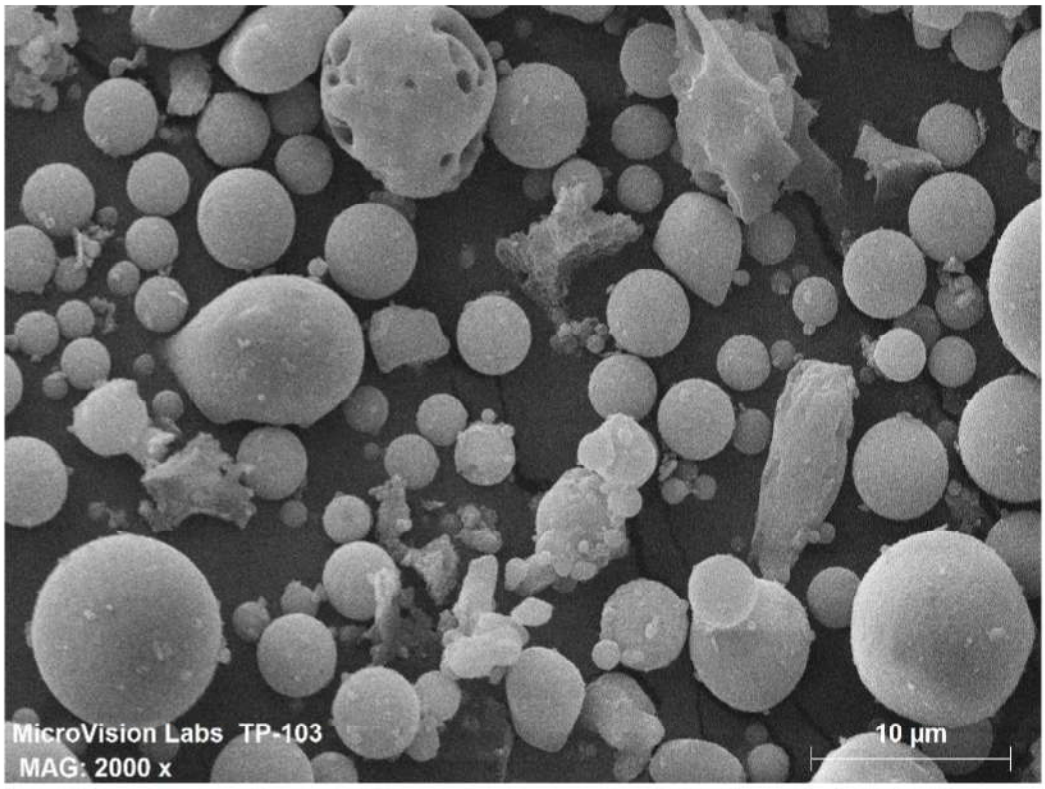

MicroVision Labs TP-103
MAG: 2000 x
10 µm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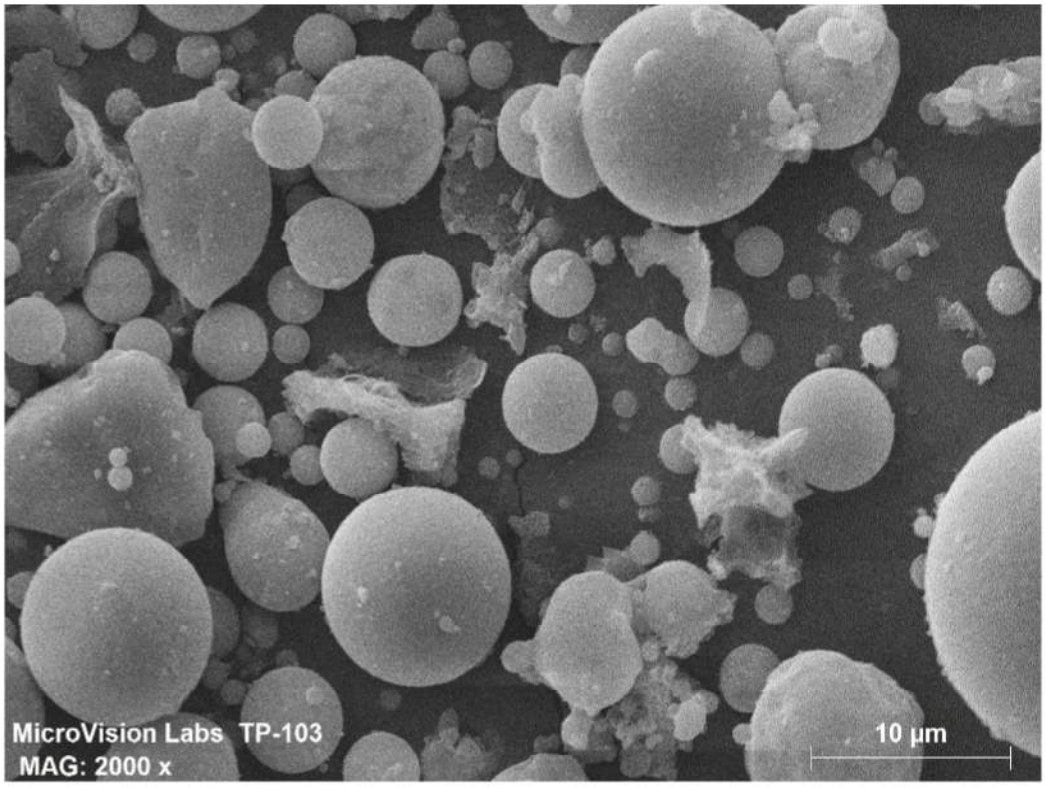
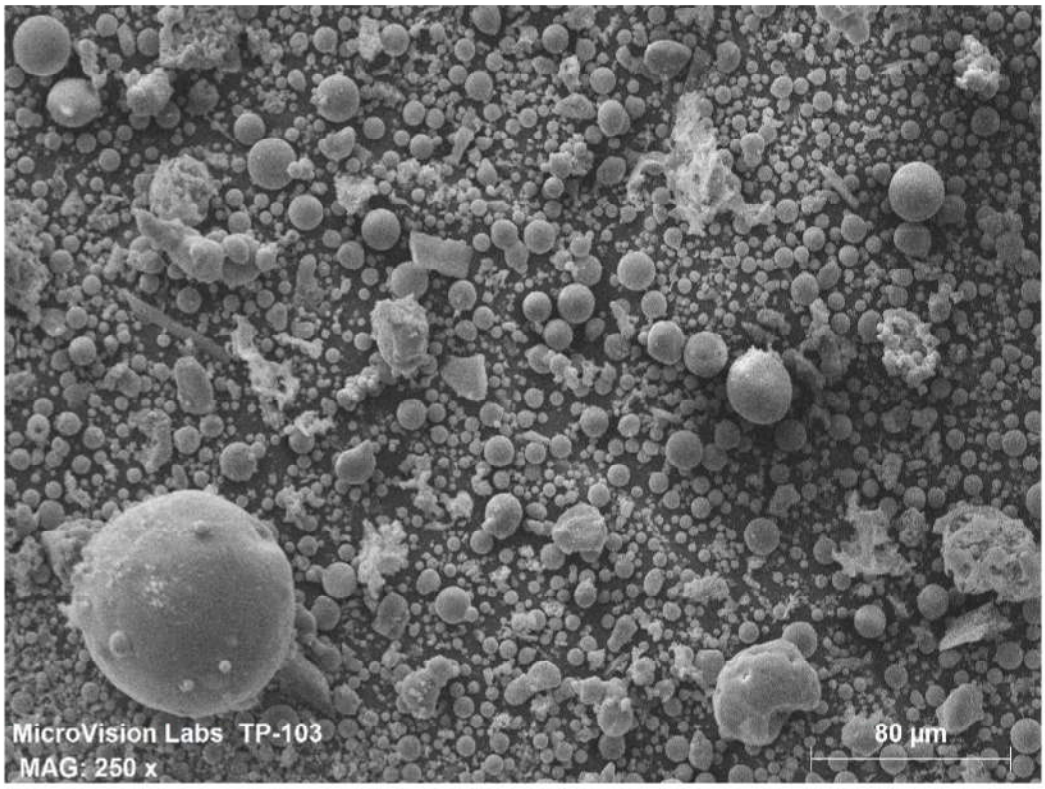
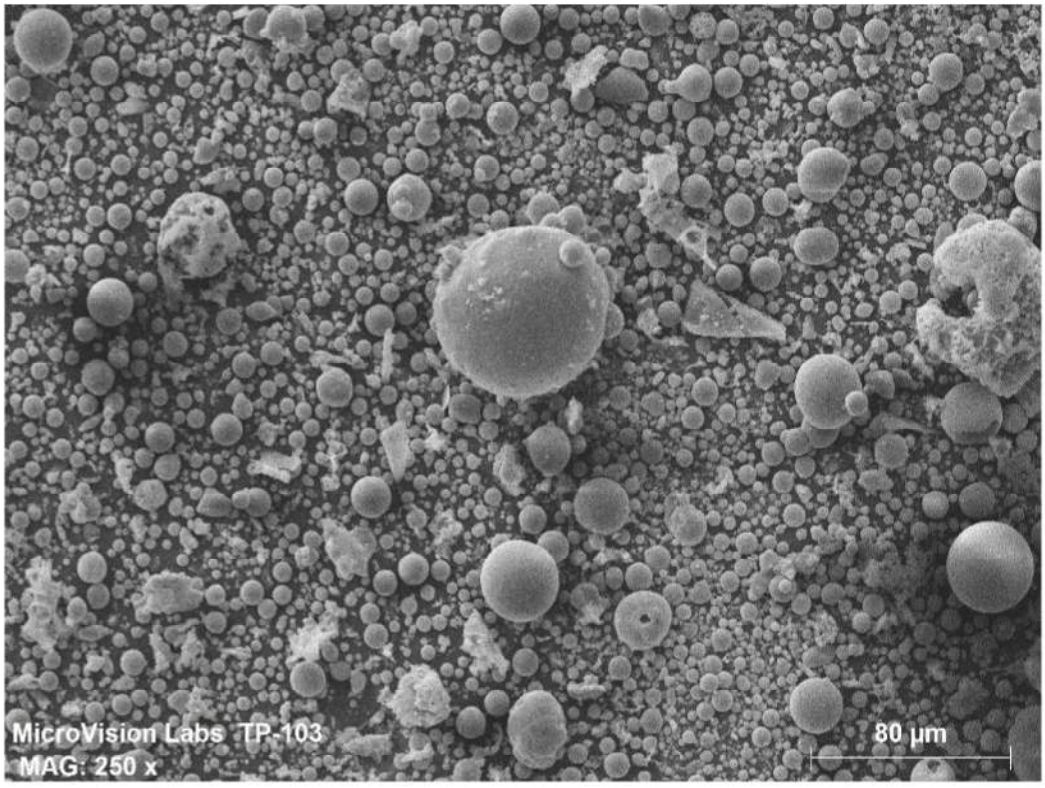
10 µm


MicroVision Labs TP-103
MAG: 2000 x
10 µm


MicroVision Labs TP-103
MAG: 250 x
80 µm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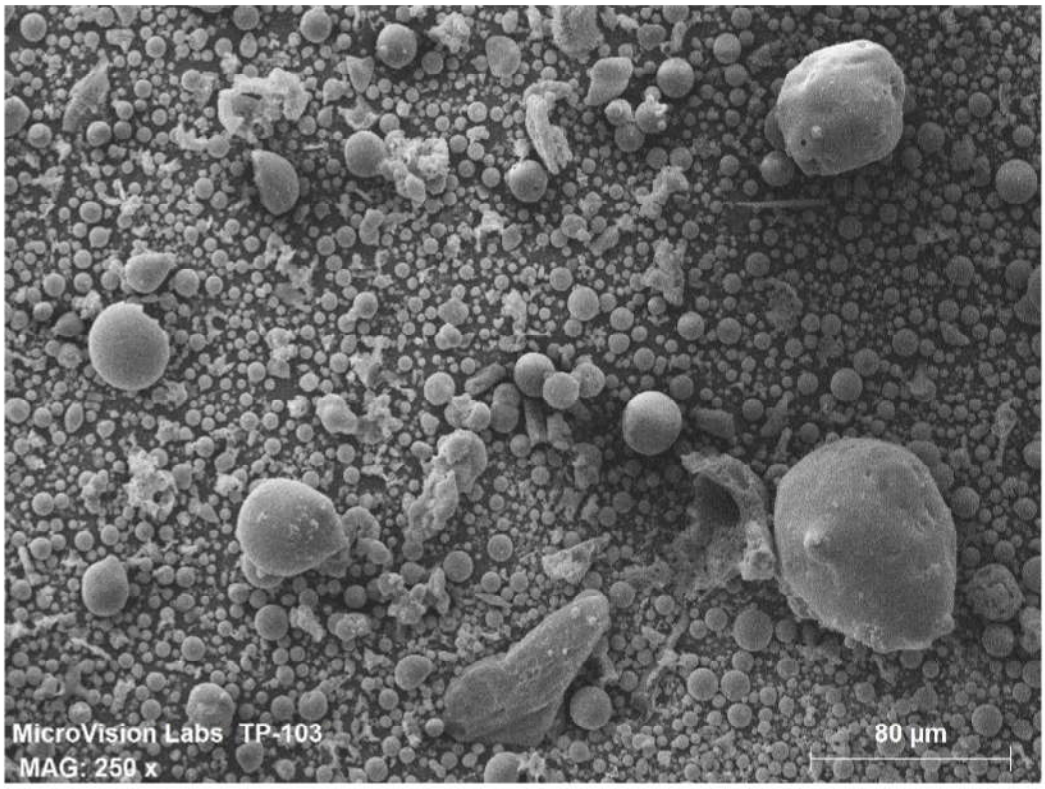
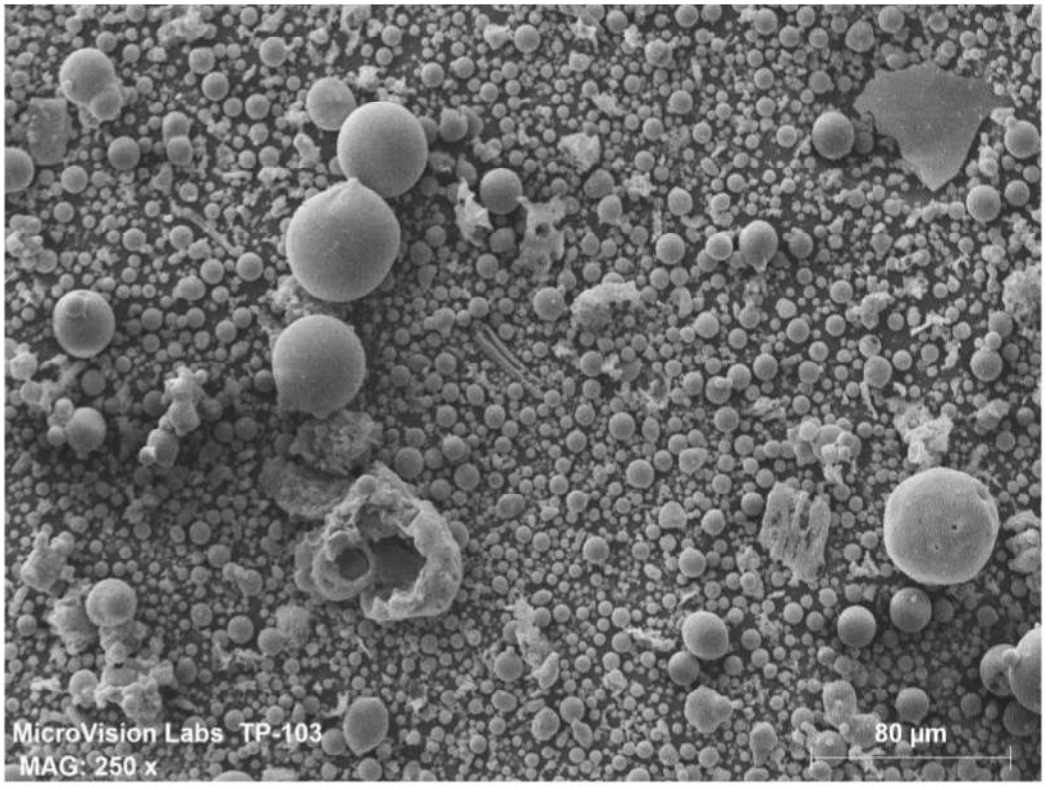

MicroVision Labs TP-103
MAG: 250 x
80 µm


MicroVision Labs TP-103
MAG: 250 x
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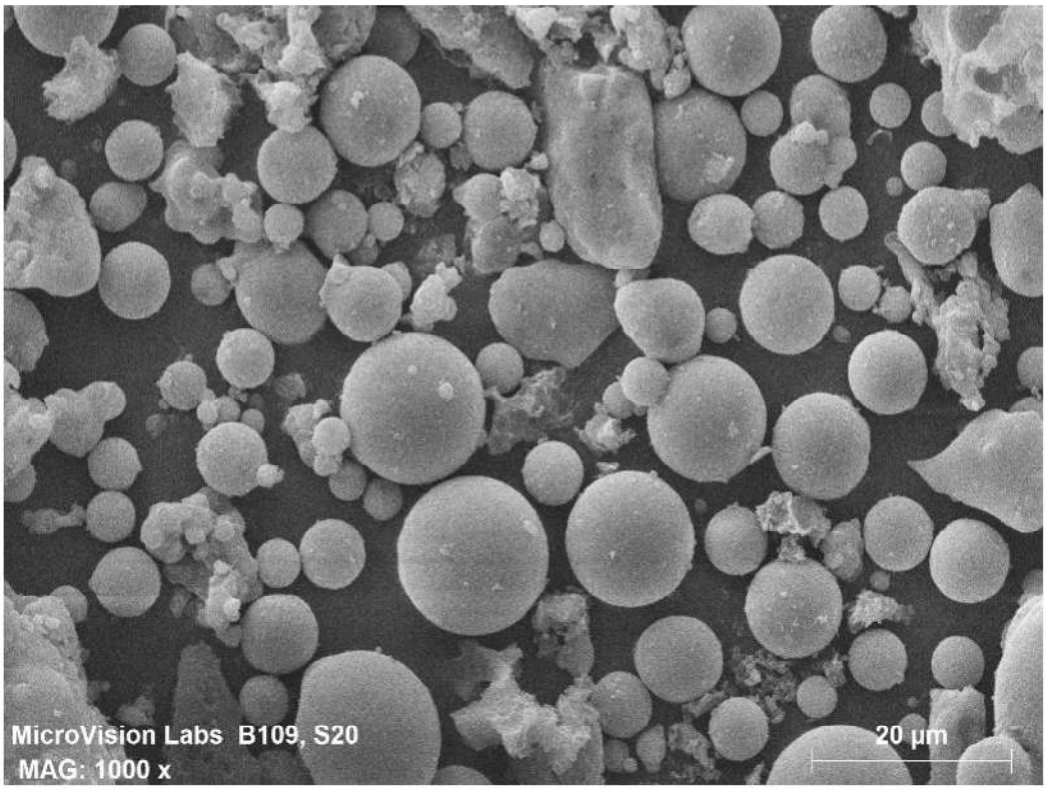
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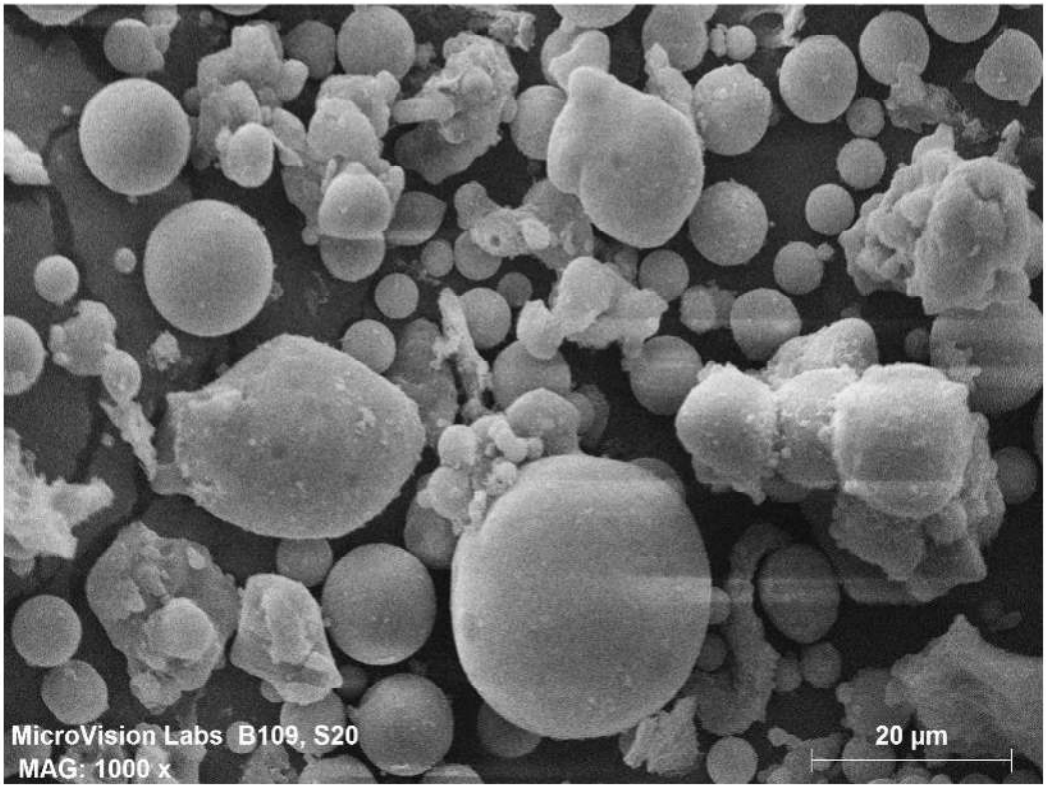
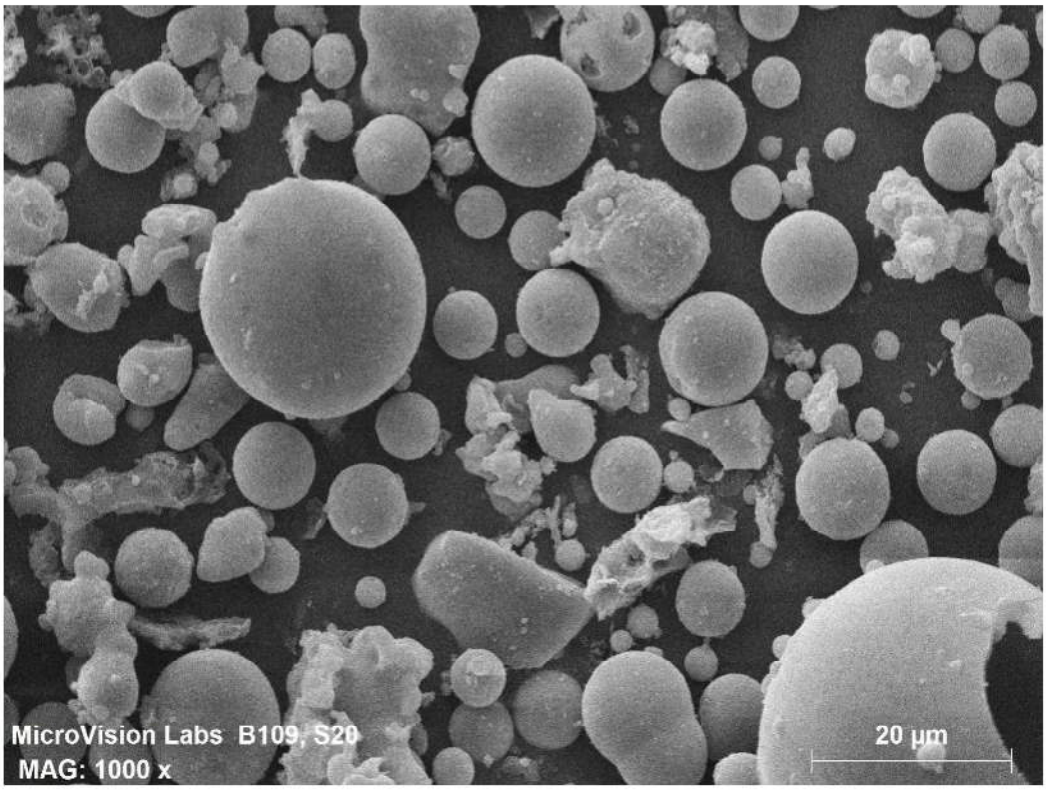
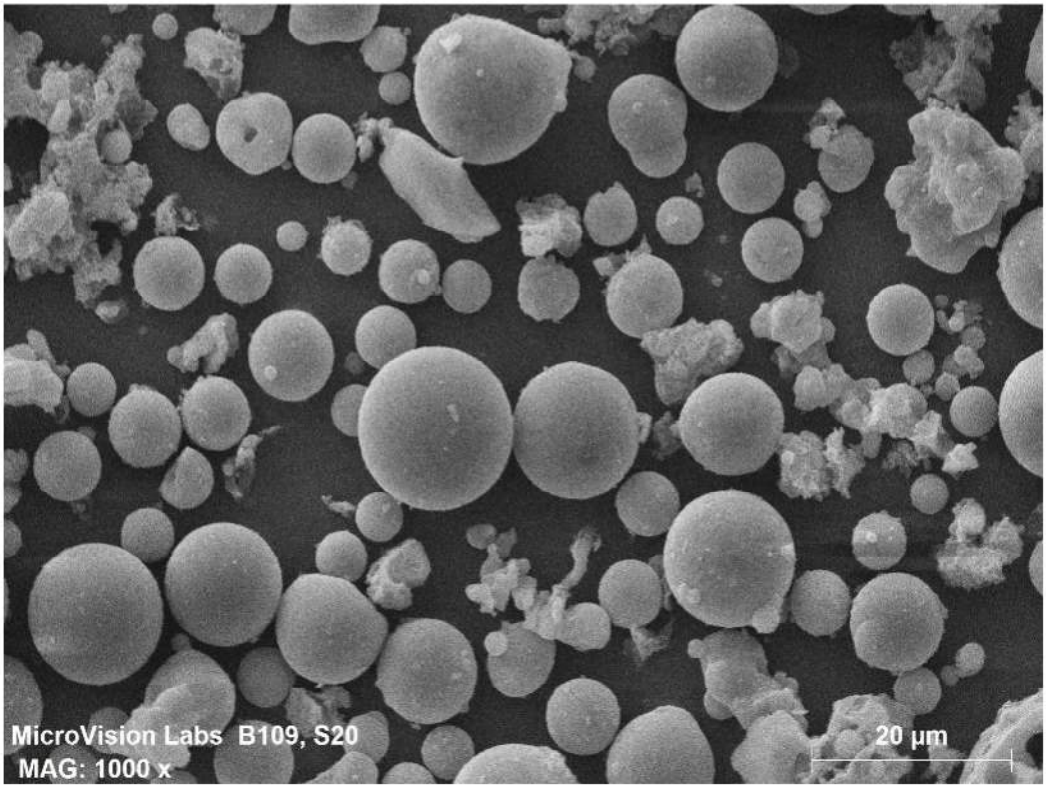
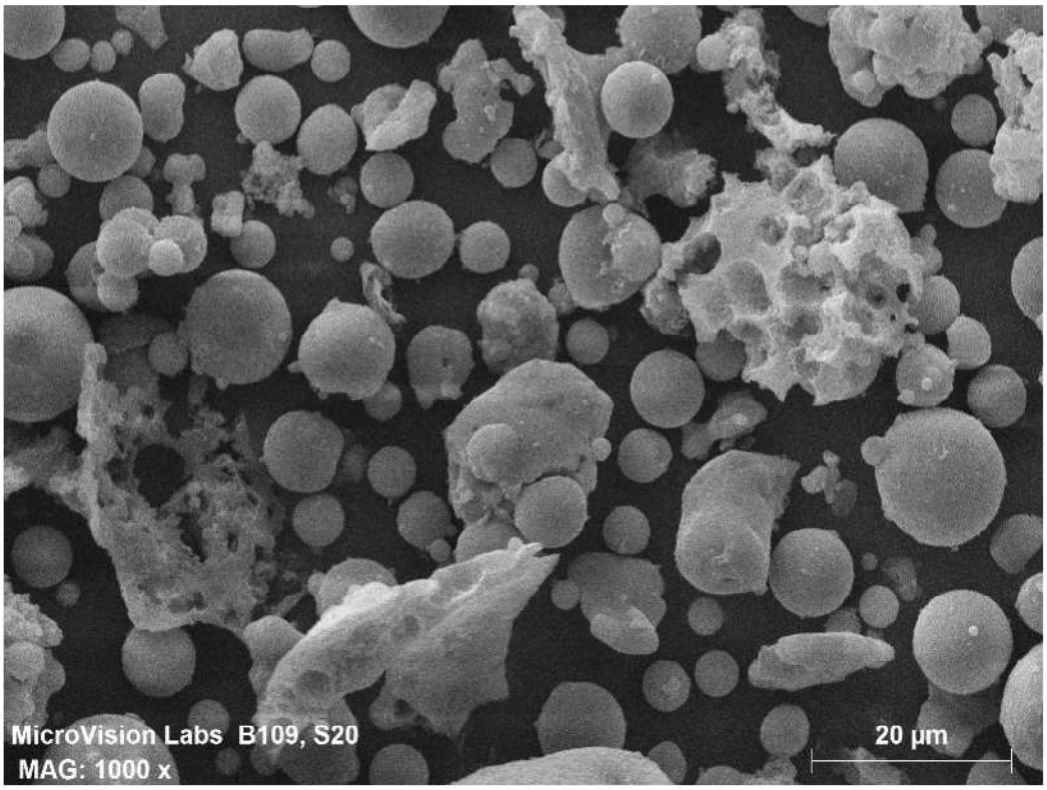
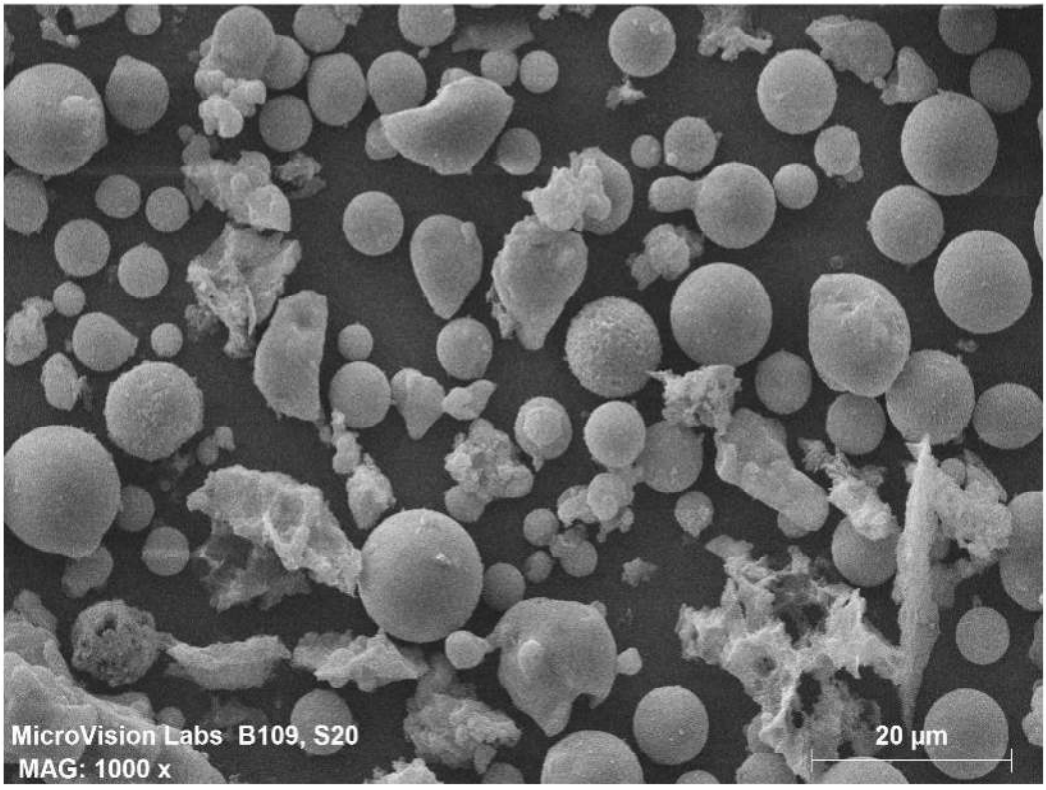
MAG: 1000 x
20 µm

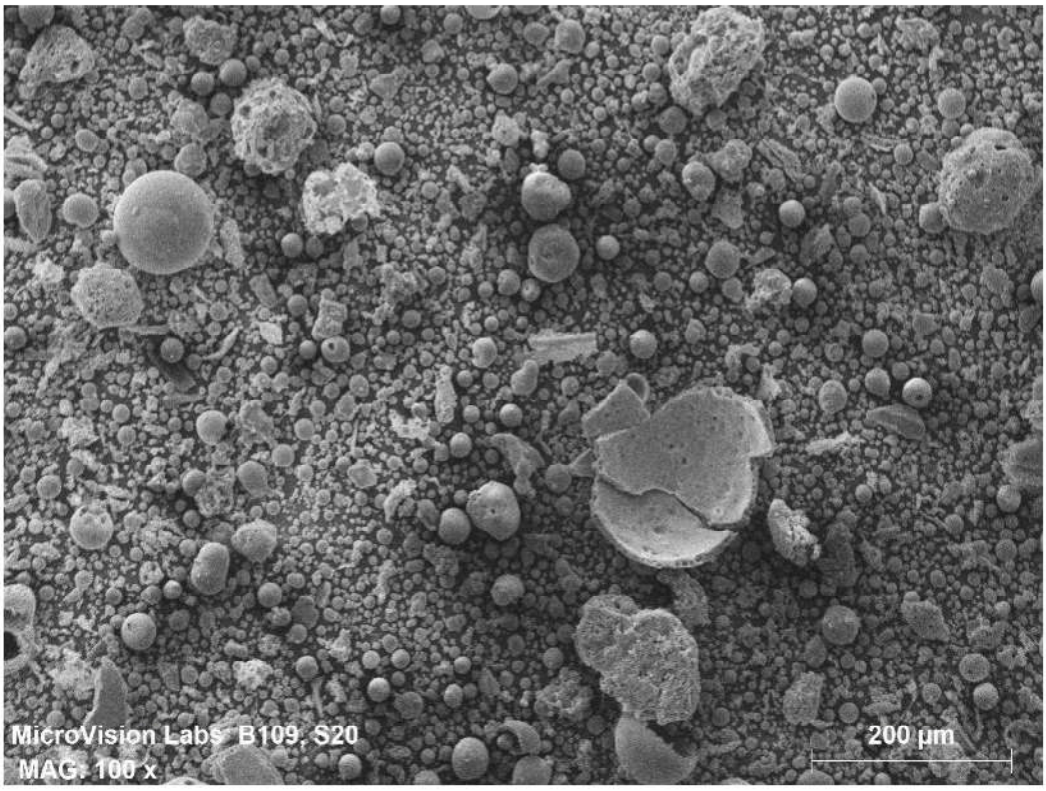

MicroVision Labs B109, S20
MAG: 1000 x
20 µm

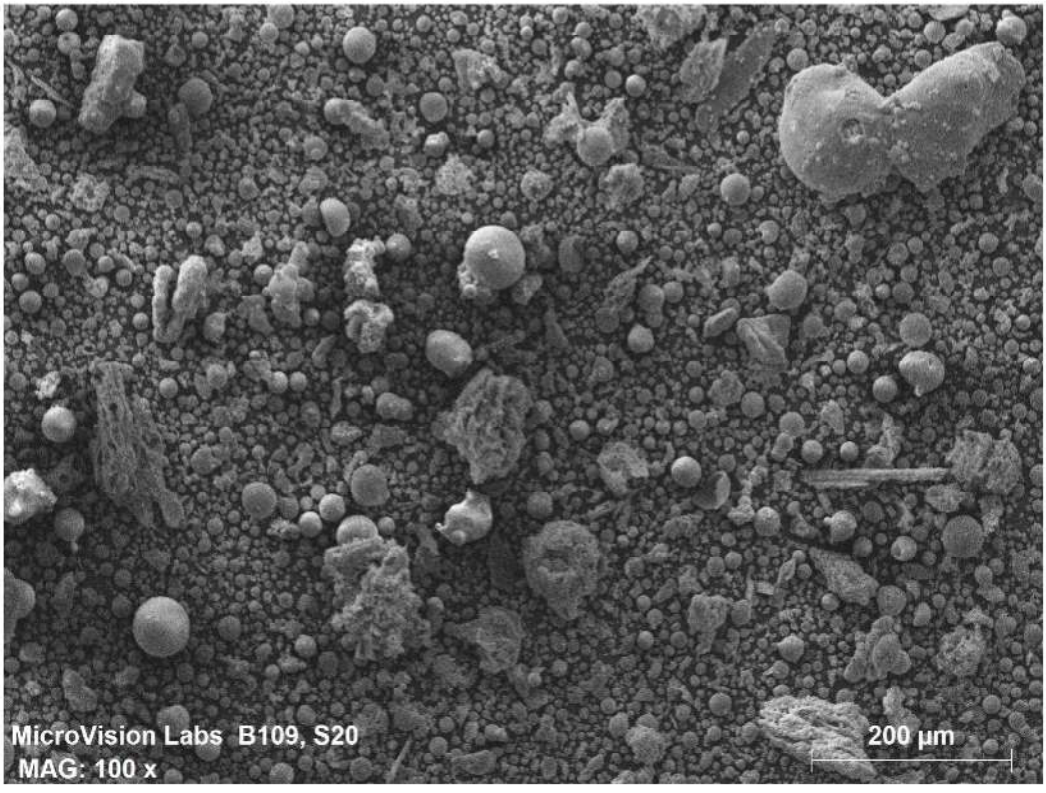

MicroVision Labs B109, S20
MAG: 1000 x
20 µm

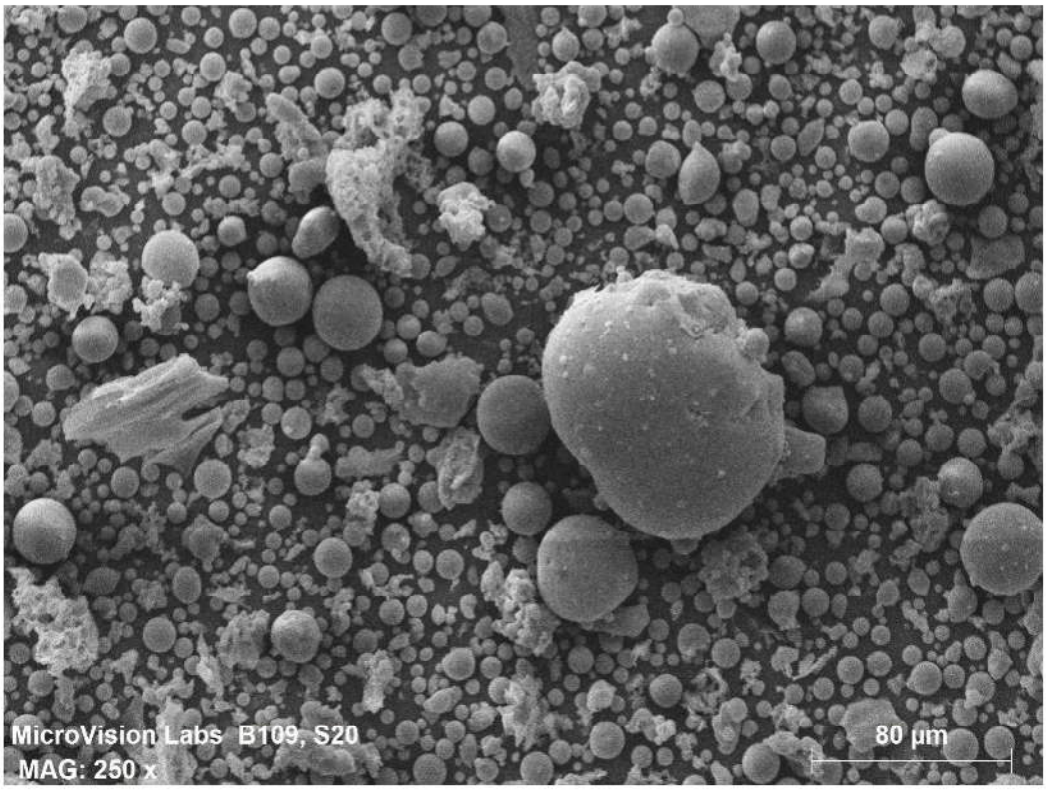

MicroVision Labs B109, S20
MAG: 1000 x
20 µm

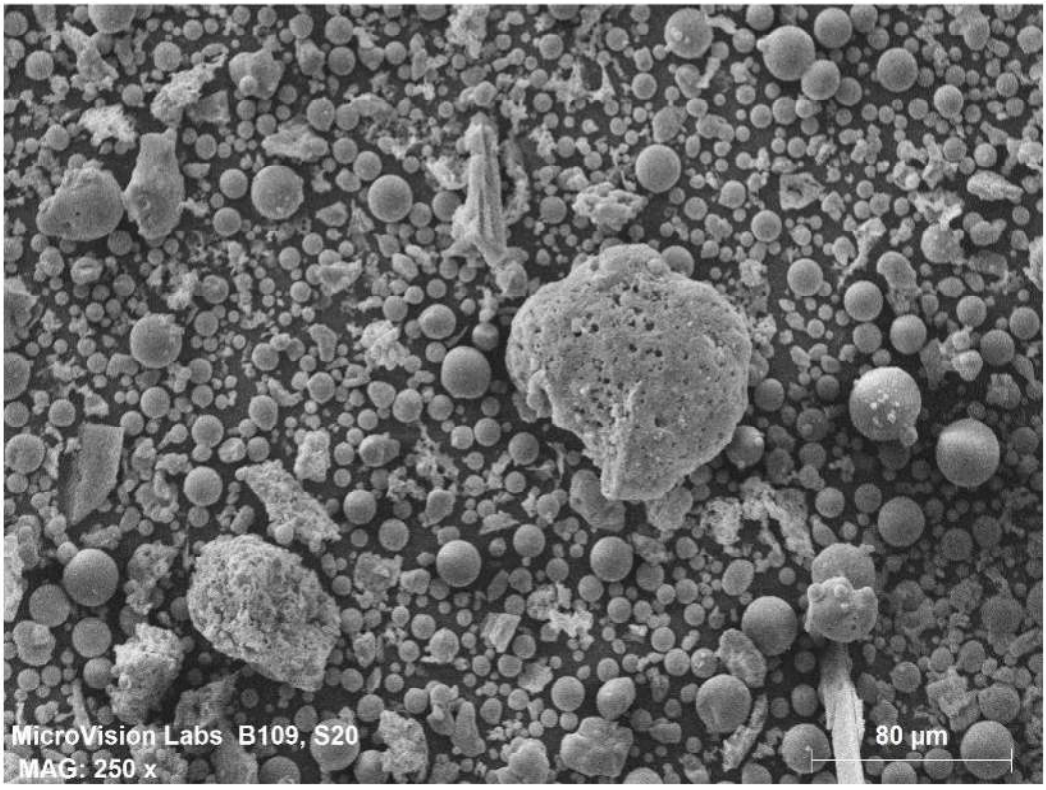

MicroVision Labs B109, S20
MAG: 1000 x
20 µm

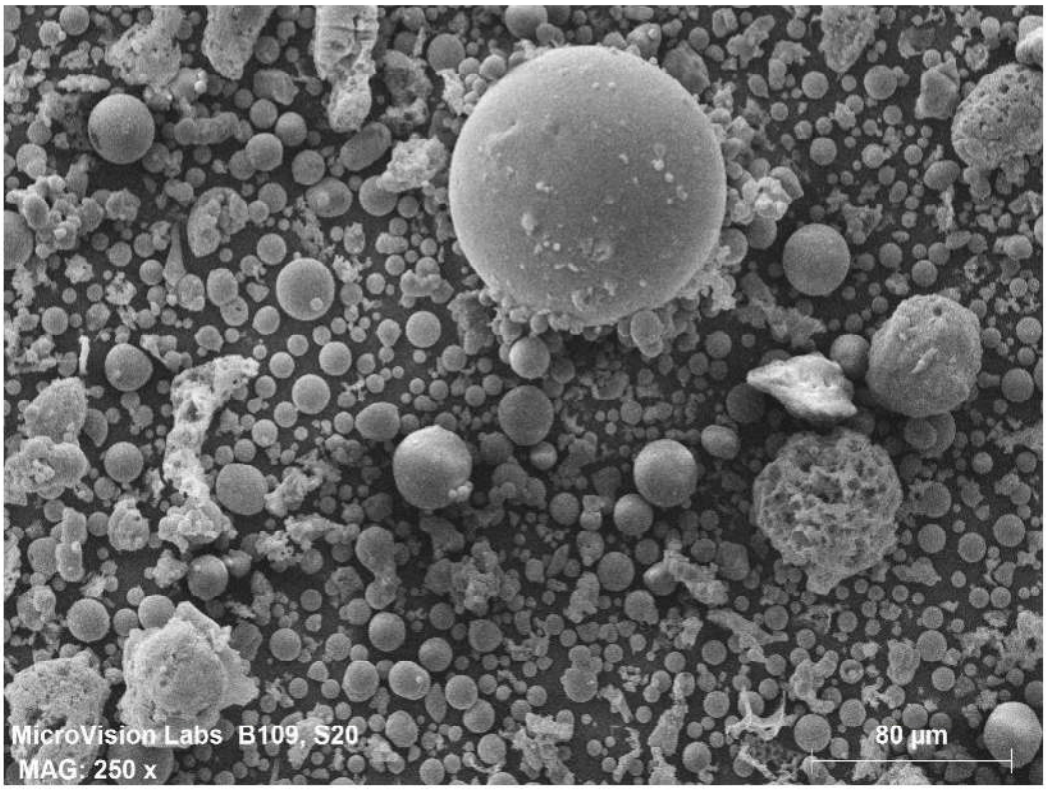

MicroVision Labs B109, S20
MAG: 1000 x
20 µm


MicroVision Labs B109, S20
MAG: 100 x
200 µm

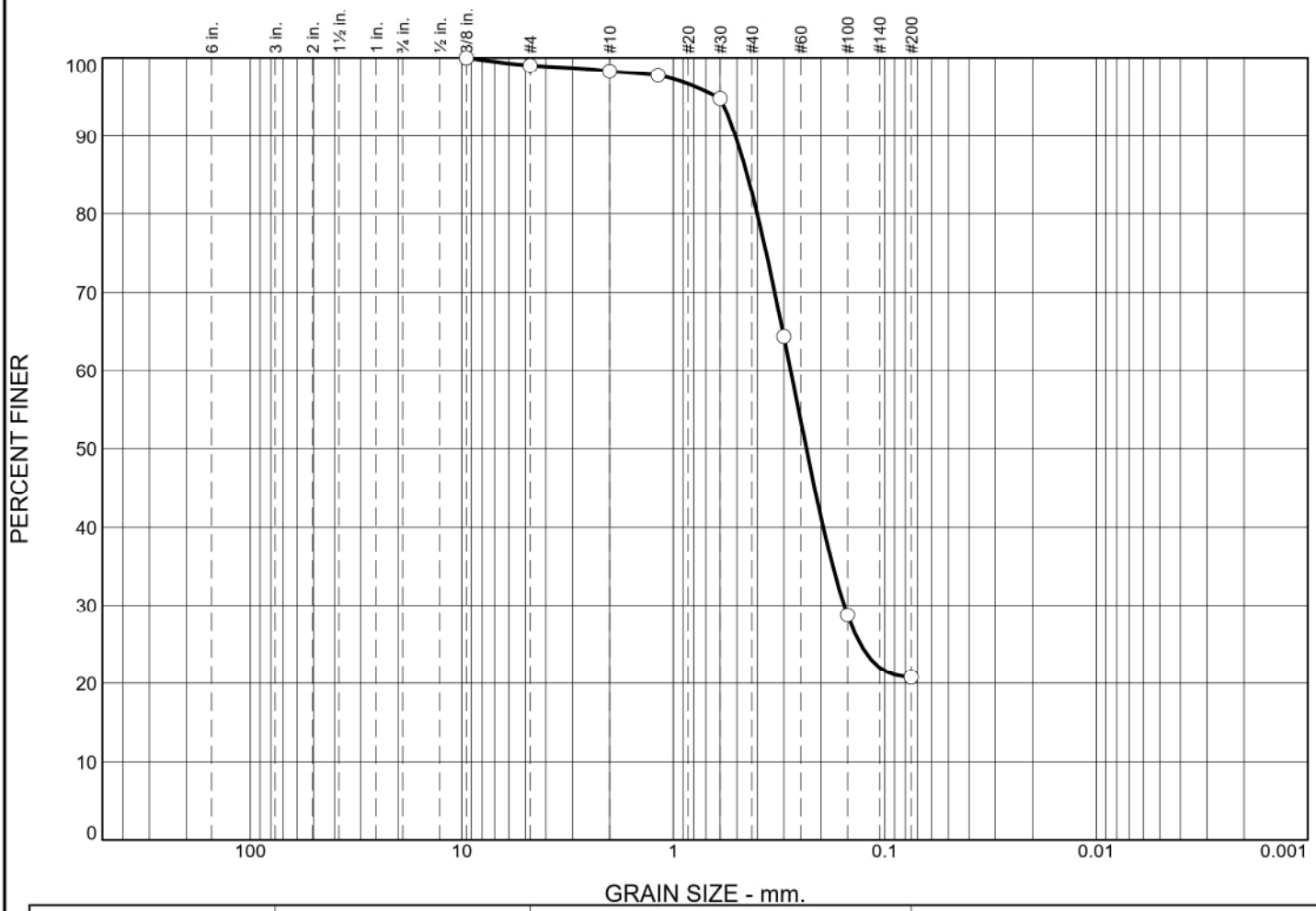

MicroVision Labs B109, S20
MAG: 100 x
200 µm


MicroVision Labs B109, S20
MAG: 250 x
80 µm


MicroVision Labs B109, S20
MAG: 250 x
80 µm


MicroVision Labs B109, S20
MAG: 250 x
80 µm

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.7	15.5	62.0	20.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.4470	0.2785	0.2347	0.1557				

	Material Description	USCS	AASHTO
○	Clayey SAND	SC	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B101 **Depth:** 20-22 ft **Sample Number:** S9 (0-7 in)

Remarks:

○ As Rec'd WC = 16.3%

Clay Dike

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: MPC **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B101
Depth: 20-22 ft
Sample Number: S9 (0-7 in)
Material Description: Clayey SAND
Liquid Limit: -
Plastic Limit: -
USCS Classification: SC
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 16.3%
Clay Dike
Tested by: MPC
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
82.30	0.00	220.40	3/8	220.40	100.0
			#4	221.20	99.0
			#10	221.81	98.3
			#16	222.22	97.8
			#30	224.69	94.8
			#50	249.74	64.3
			#100	279.06	28.7
			#200	285.62	20.8

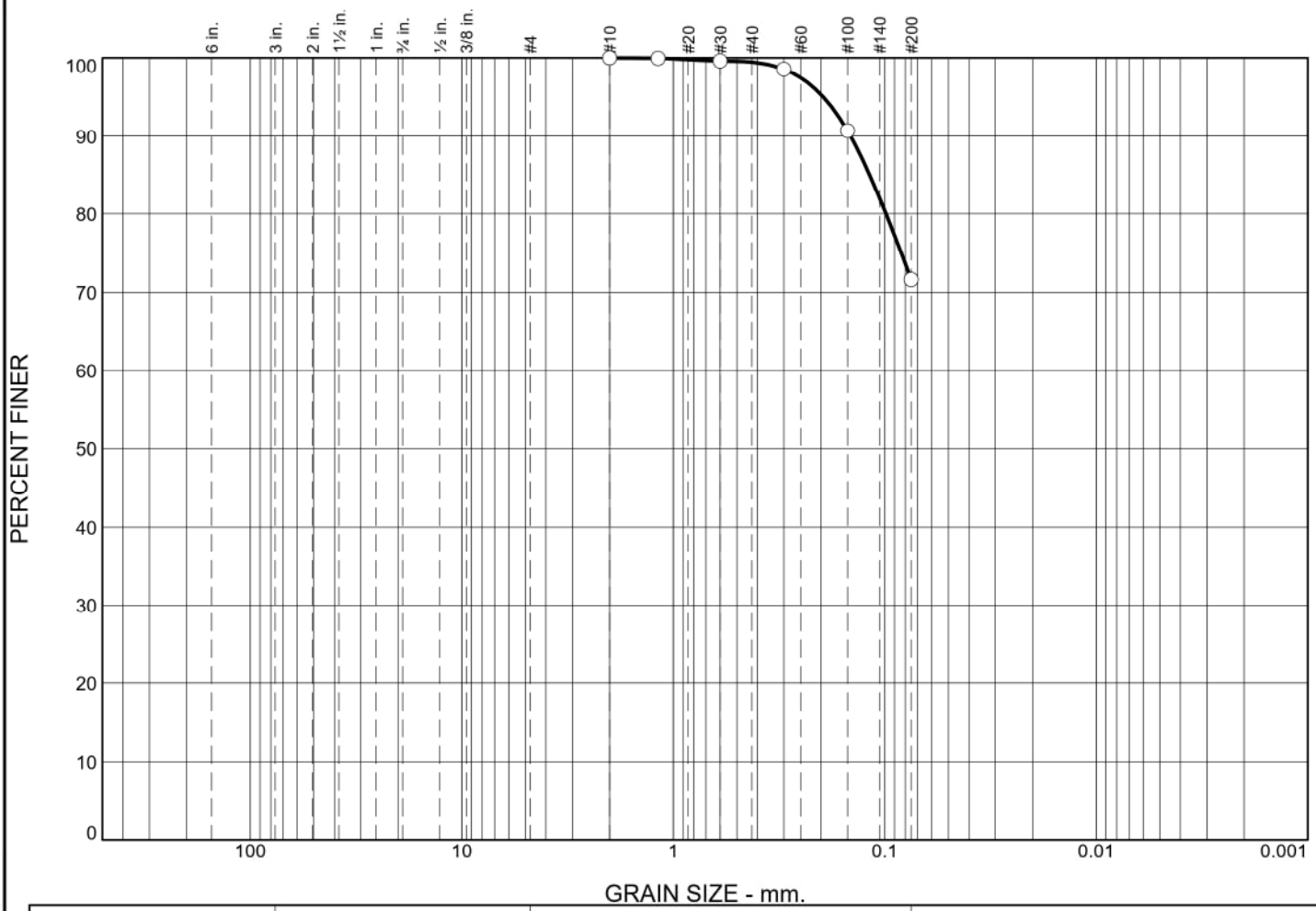
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	1.0	1.0	0.7	15.5	62.0	78.2			20.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.1557	0.2347	0.2785	0.4009	0.4470	0.5079	0.6206

Fineness Modulus
1.17

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.5	27.9	71.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.1180							

	Material Description	USCS	AASHTO
○	LEAN CLAY with Sand	CL	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source:** B101 **Depth:** 52-54 ft **Sample No.:** S22 (23-30 in)

Remarks:

○ As Rec'd WC = 26.8%

Clayey Alluvium

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: EF/WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B101
Depth: 52-54 ft
Sample Number: S22 (23-30 in)
Material Description: LEAN CLAY with Sand
Liquid Limit: -
Plastic Limit: -
USCS Classification: CL
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 26.8%
Clayey Alluvium
Tested by: EF/WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
85.41	0.00	204.98	#10	204.98	100.0
			#16	205.02	100.0
			#30	205.31	99.6
			#50	206.22	98.5
			#100	212.96	90.7
			#200	229.22	71.6

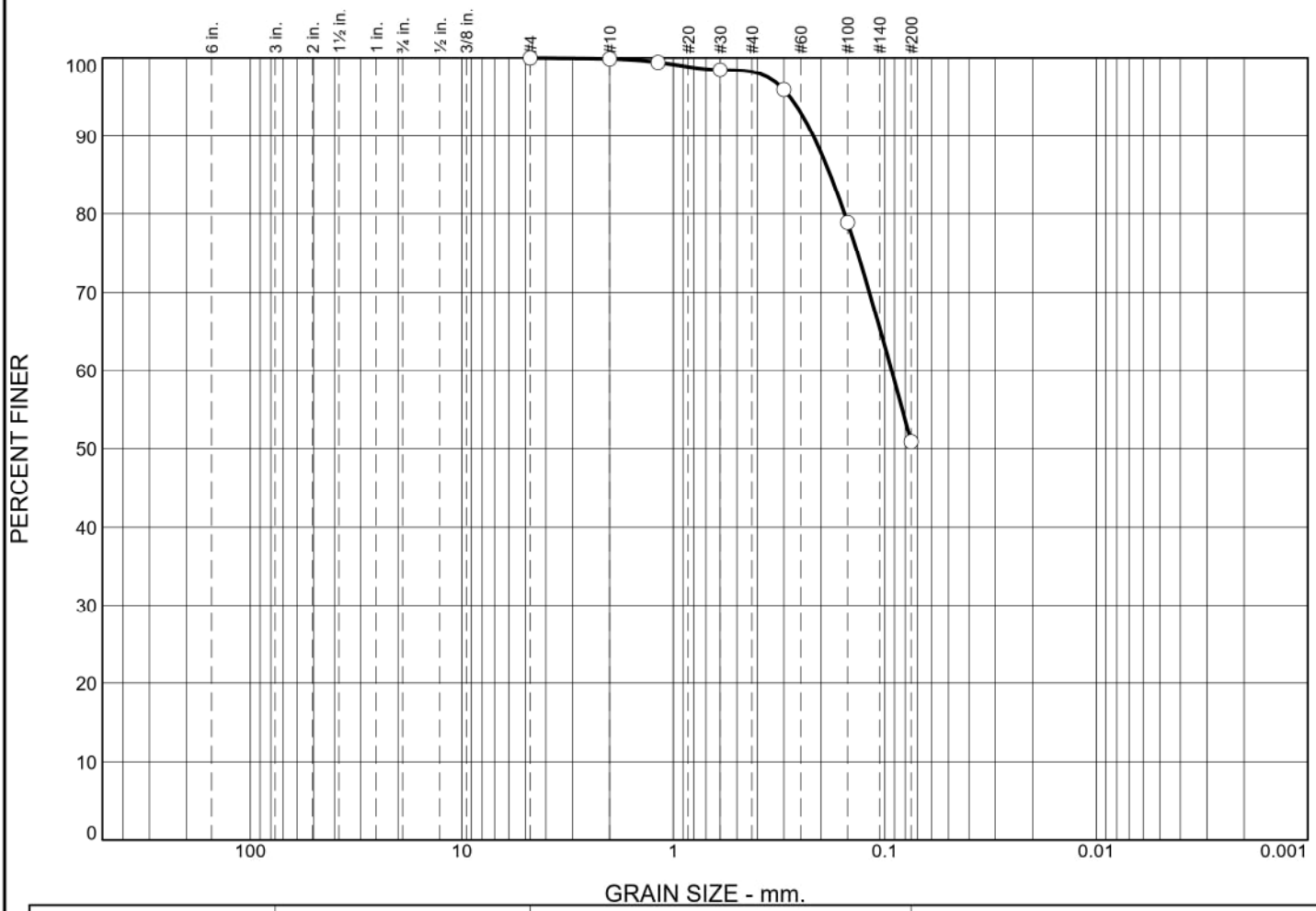
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.5	27.9	28.4			71.6

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0987	0.1180	0.1453	0.1956

Fineness Modulus
0.11

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	1.7	47.4	50.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.1810	0.0928						

	Material Description	USCS	AASHTO
○	Sandy SILT	ML	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source:** B102 **Depth:** 26.5-28.4 ft **Sample No.:** S12 (6-18 in)

Remarks:

○ As Rec'd WC = 40 %
Clayey Alluvium

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: MPC **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B102
Depth: 26.5-28.4 ft
Sample Number: S12 (6-18 in)
Material Description: Sandy SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: A-4(0)
Testing Remarks: As Rec'd WC = 40 %
Clayey Alluvium
Tested by: MPC
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
60.84	0.00	191.79	#4	191.79	100.0
			#10	191.86	99.9
			#16	192.13	99.4
			#30	192.73	98.5
			#50	194.27	95.9
			#100	204.63	78.9
			#200	221.70	50.8

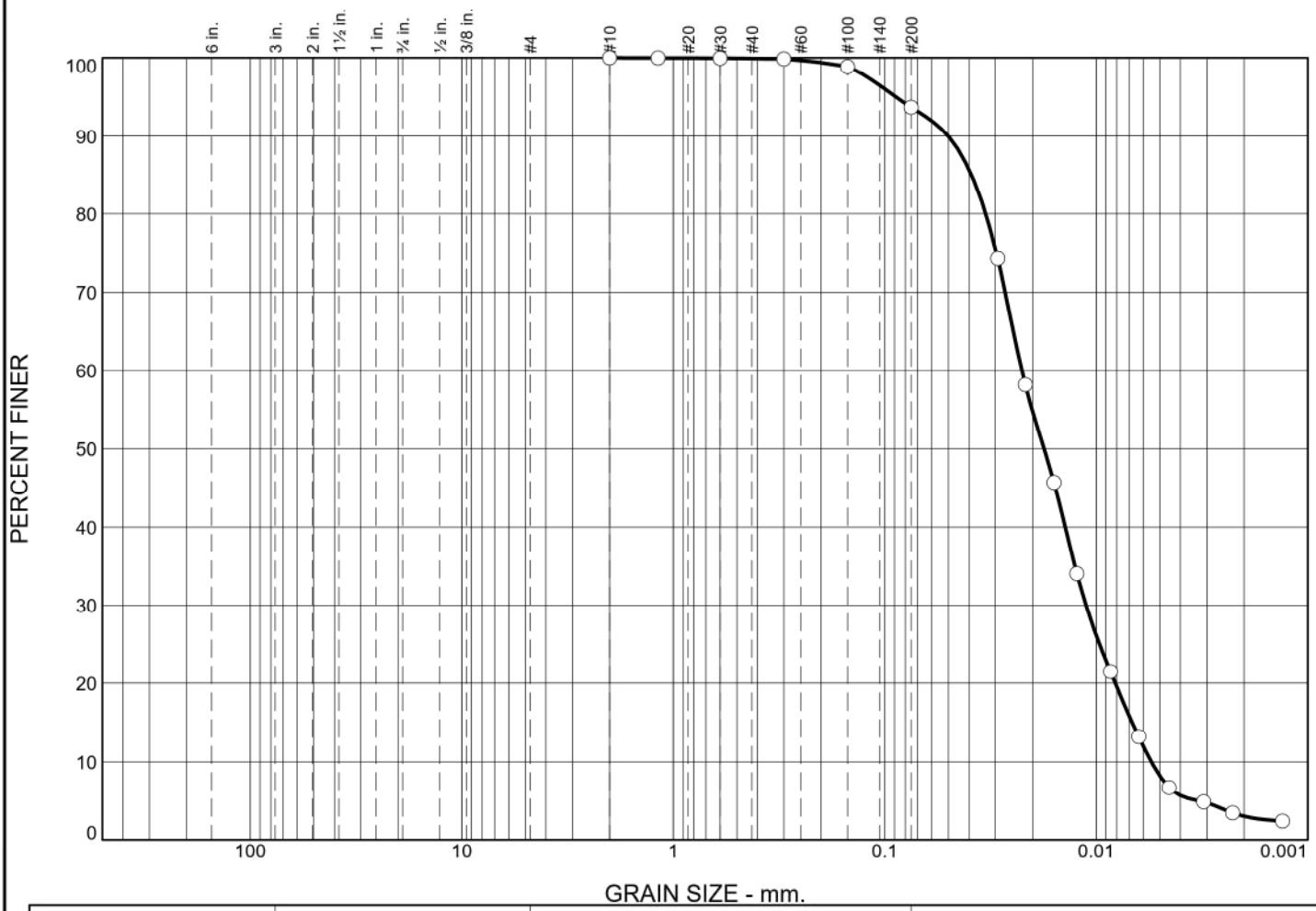
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	1.7	47.4	49.2			50.8

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
					0.0928	0.1549	0.1810	0.2177	0.2804

Fineness Modulus
0.27

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	6.2	85.5	8.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0389	0.0225	0.0177	0.0112	0.0068	0.0055	1.01	4.10

	Material Description	USCS	AASHTO
○	SILT	ML	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B103 **Depth:** 34 - 38.2 ft **Sample Number:** S11

Remarks:

○ As Rec'd WC = 70.4%
Sluiced ASH

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: EF/WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B103
Depth: 34 - 38.2 ft
Sample Number: S11
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: A-4(0)
Burmister: Si, t.fS
Testing Remarks: As Rec'd WC = 70.4%
Sluiced ASH
Tested by: EF/WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
38.96	0.00	372.02	#10	372.02	100.0
			#16	372.03	100.0
			#30	372.04	99.9
			#50	372.08	99.8
			#100	372.46	98.9
			#200	374.49	93.7

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =38.96
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.3	1.0220	1.0184	0.0129	22.7	10.3	0.0292	74.2
4.00	22.4	1.0180	1.0144	0.0129	18.7	11.3	0.0217	58.2
8.00	22.5	1.0149	1.0113	0.0128	15.6	12.2	0.0158	45.7
14.00	22.5	1.0120	1.0084	0.0128	12.7	12.9	0.0124	34.0
31.00	22.4	1.0089	1.0053	0.0129	9.6	13.8	0.0086	21.5
60.00	22.1	1.0069	1.0033	0.0129	7.6	14.3	0.0063	13.2
120.00	22.0	1.0053	1.0017	0.0129	6.0	14.7	0.0045	6.7
263.00	20.9	1.0050	1.0012	0.0131	5.7	14.8	0.0031	4.9
480.00	22.6	1.0044	1.0009	0.0128	5.1	14.9	0.0023	3.4
1438.00	22.2	1.0042	1.0006	0.0129	4.9	15.0	0.0013	2.4

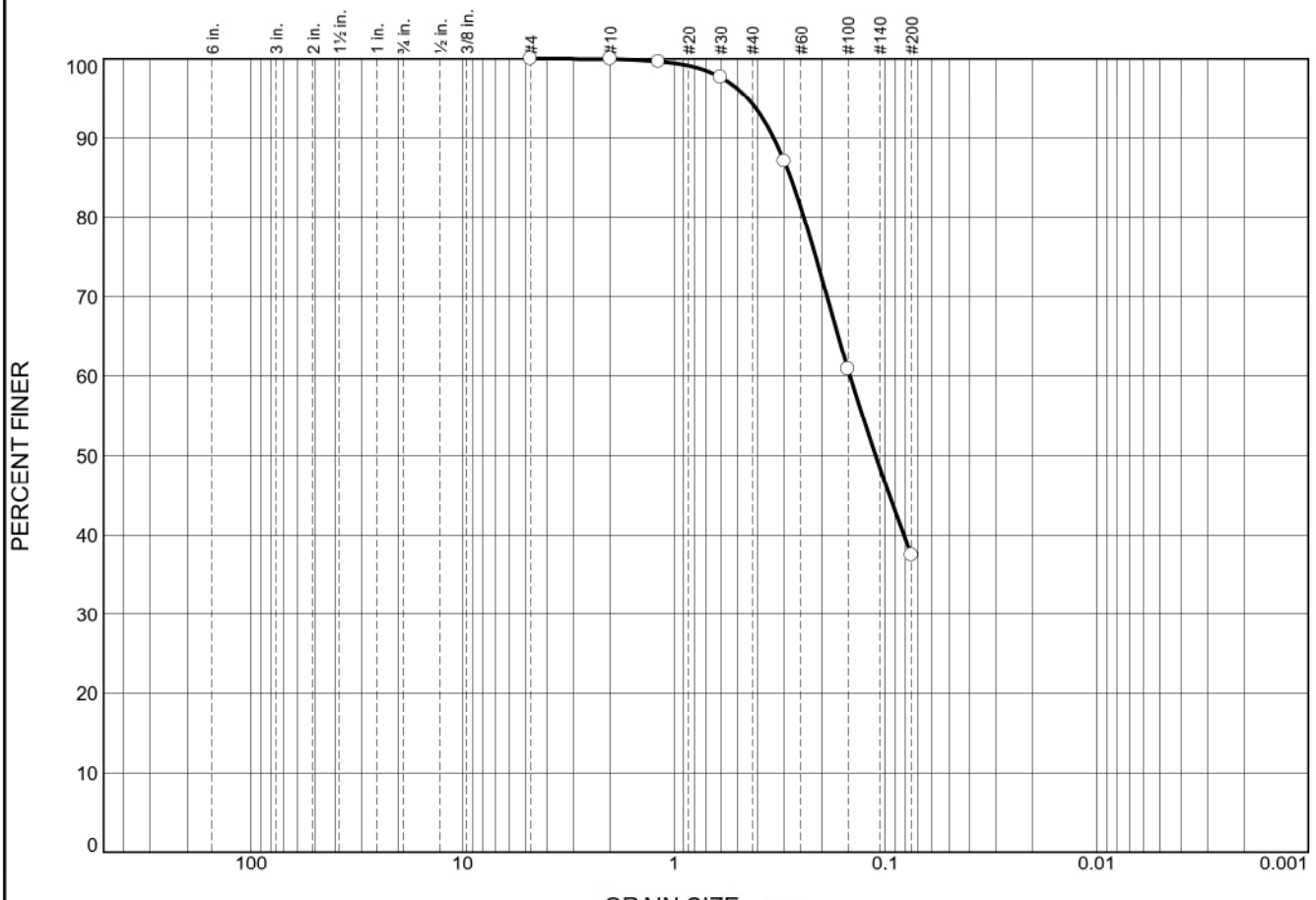
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.1	6.2	6.3	85.5	8.2	93.7

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0055	0.0068	0.0081	0.0112	0.0177	0.0225	0.0333	0.0389	0.0503	0.0885

Fineness Modulus	C_u	C_c
0.01	4.10	1.01

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.1	5.6	56.9	37.4	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2806	0.1468	0.1110					

Material Description	USCS	AASHTO
○ SANDY SILT	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B103 **Depth:** 42.5 - 44.5 ft **Sample Number:** S14

Remarks:

○Sand-like Alluvium
As Rec'd WC = 24.8%

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B103
Depth: 42.5 - 44.5 ft **Sample Number:** S14
Material Description: Sandy Alluvium
Testing Remarks: As Rec'd WC = 24.8%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 310.08
Tare Wt. = 220.39
Minus #200 from wash = 34.1%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
356.44	220.39	220.39	#4	220.40	100.0
			#10	220.46	99.9
			#16	220.90	99.6
			#30	223.59	97.6
			#50	238.05	87.0
			#100	273.69	60.8
			#200	305.59	37.4

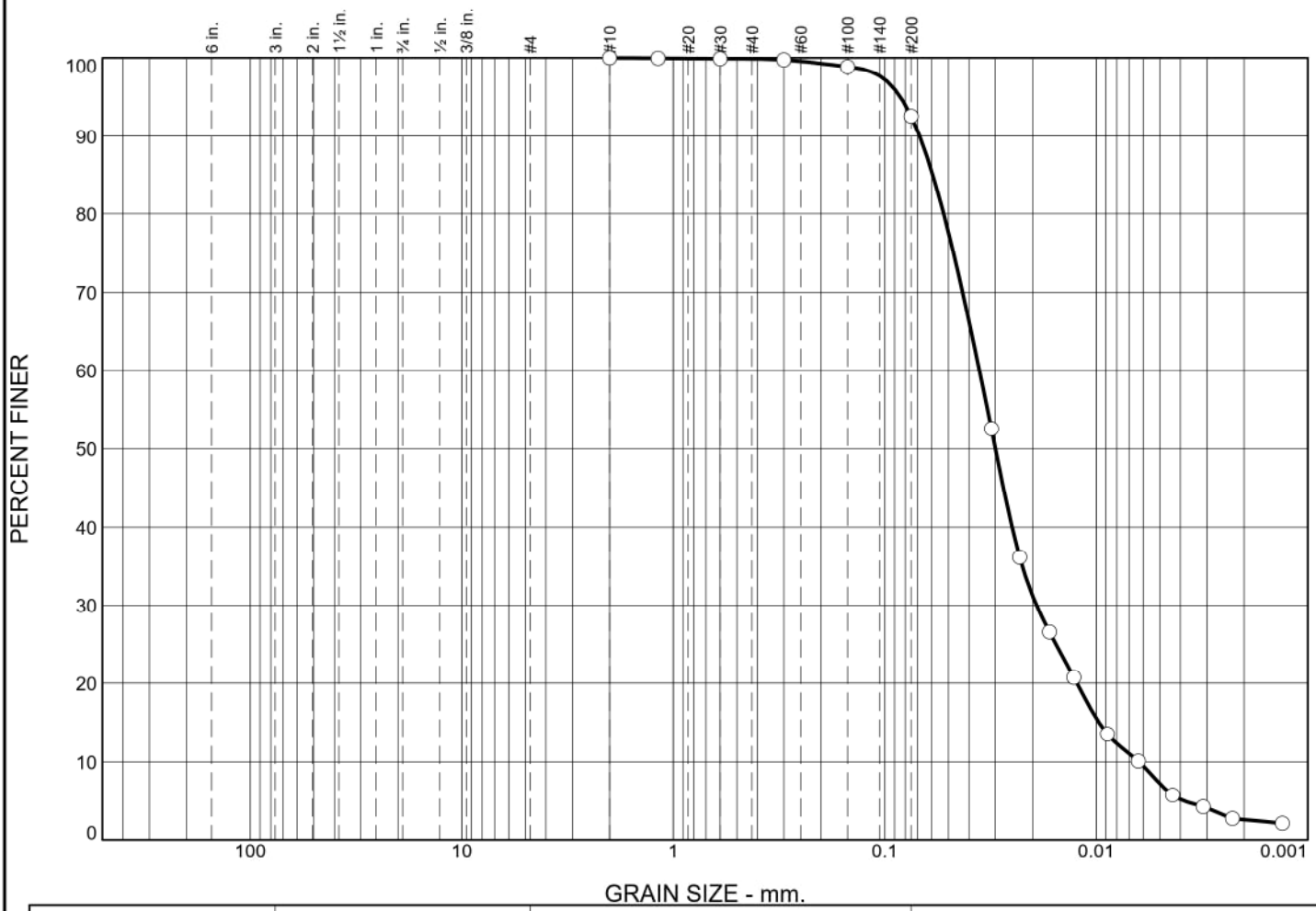
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
				0.1	5.6	56.9	62.6			37.4

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
					0.0815	0.1110	0.1468	0.2428	0.2806	0.3367	0.4480

Fineness Modulus
0.55

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	7.4	85.3	7.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0593	0.0357	0.0300	0.0192	0.0097	0.0063	1.64	5.69

	Material Description	USCS	AASHTO
○	SILT	ML	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B105 **Depth:** 42.5 - 45 ft **Sample Number:** S16

Remarks:

○ As Rec'd WC = 78.3%

Sluiced ASH

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Figure

Tested By: EF/WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B105
Depth: 42.5 - 45 ft
Sample Number: S16
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: -
Burmister: Si, t.fS
Testing Remarks: As Rec'd WC = 78.3%
Sluiced ASH
Tested by: EF/WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
37.71	0.00	198.74	#10	198.74	100.0
			#16	198.76	99.9
			#30	198.78	99.9
			#50	198.84	99.7
			#100	199.17	98.9
			#200	201.56	92.5

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =37.71
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.3	1.0162	1.0126	0.0129	16.9	11.8	0.0313	52.5
4.00	22.7	1.0122	1.0087	0.0128	12.9	12.9	0.0230	36.1
8.00	22.7	1.0099	1.0064	0.0128	10.6	13.5	0.0166	26.5
14.00	22.7	1.0085	1.0050	0.0128	9.2	13.9	0.0128	20.7
30.00	22.6	1.0068	1.0033	0.0128	7.5	14.3	0.0089	13.6
60.00	22.4	1.0060	1.0024	0.0129	6.7	14.5	0.0063	10.1
130.00	22.1	1.0050	1.0014	0.0129	5.7	14.8	0.0044	5.7
261.00	21.0	1.0048	1.0010	0.0131	5.5	14.8	0.0031	4.2
480.00	22.6	1.0042	1.0007	0.0128	4.9	15.0	0.0023	2.7
1436.00	22.3	1.0041	1.0005	0.0129	4.8	15.0	0.0013	2.1

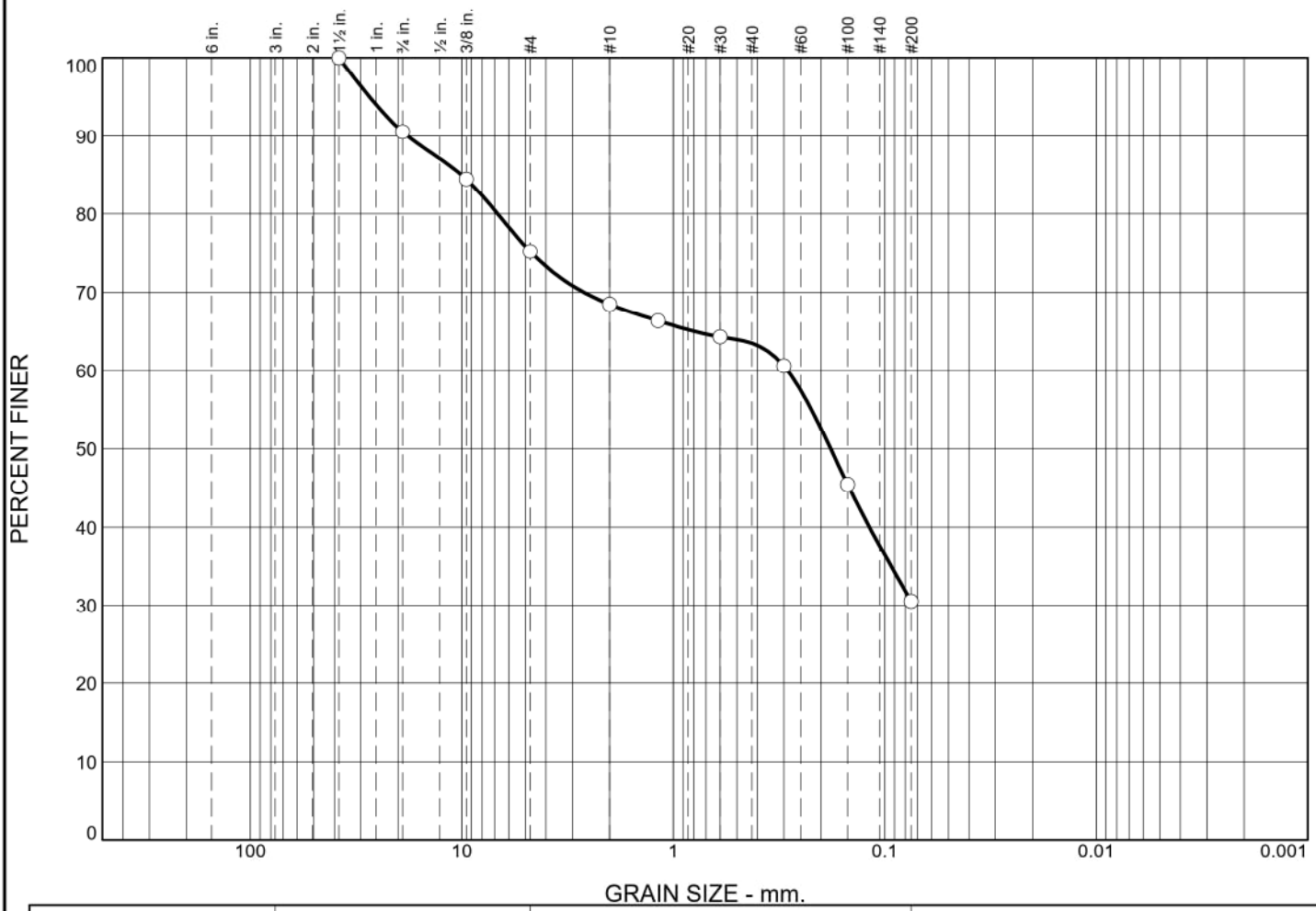
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.1	7.4	7.5	85.3	7.2	92.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0063	0.0097	0.0123	0.0192	0.0300	0.0357	0.0527	0.0593	0.0685	0.0844

Fineness Modulus	C_u	C_c
0.02	5.69	1.64

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	9.5	15.3	6.7	5.0	33.0	30.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	32	18	10.0372	0.2881	0.1804					

	Material Description	USCS	AASHTO
○	Clayey SAND with Gravel	SC	A-2-6(1)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B105 **Depth:** 53-55 ft **Sample Number:** S21 (6-14 in)

Remarks:

○ As Rec'd WC = 18.4%
Sandy Alluvium

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B105
Depth: 53-55 ft
Sample Number: S21 (6-14 in)
Material Description: Clayey SAND with Gravel
Liquid Limit: 32
Plastic Limit: 18
USCS Classification: SC
AASHTO Classification: A-2-6(1)
Testing Remarks: As Rec'd WC = 18.4%
Sandy Alluvium
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
153.87	0.00	220.81	1.5	220.81	100.0
			3/4	235.39	90.5
			3/8	244.74	84.4
			#4	259.01	75.2
			#10	269.30	68.5
			#16	272.54	66.4
			#30	275.72	64.3
			#50	281.44	60.6
			#100	304.70	45.5
			#200	327.75	30.5

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	9.5	15.3	24.8	6.7	5.0	33.0	44.7			30.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.1804	0.2881	6.7664	10.0372	18.0639	27.2926

Fineness Modulus
2.44

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	16.7	16.3	9.1	11.5	24.3	22.1	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	31	19	21.4476	2.6776	0.6206	0.1513				

	Material Description	USCS	AASHTO
○	Clayey SAND with Gravel	SC	A-2-6(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B106 **Depth:** 59 - 61 ft **Sample Number:** S26

Remarks:

○ As Rec'd WC = 14.5%

Sandy Alluvium

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B106
Depth: 59 - 61 ft
Sample Number: S26
Material Description: Clayey SAND with Gravel
Liquid Limit: 31
Plastic Limit: 19
USCS Classification: SC
AASHTO Classification: A-2-6(0)
Testing Remarks: As Rec'd WC = 14.5%
Sandy Alluvium
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
185.83	0.00	214.19	1.5	214.19	100.0
			3/4	245.26	83.3
			3/8	251.25	80.1
			#4	275.50	67.0
			#10	292.39	57.9
			#16	299.03	54.3
			#30	307.61	49.7
			#50	322.36	41.8
			#100	344.52	29.9
			#200	359.02	22.1

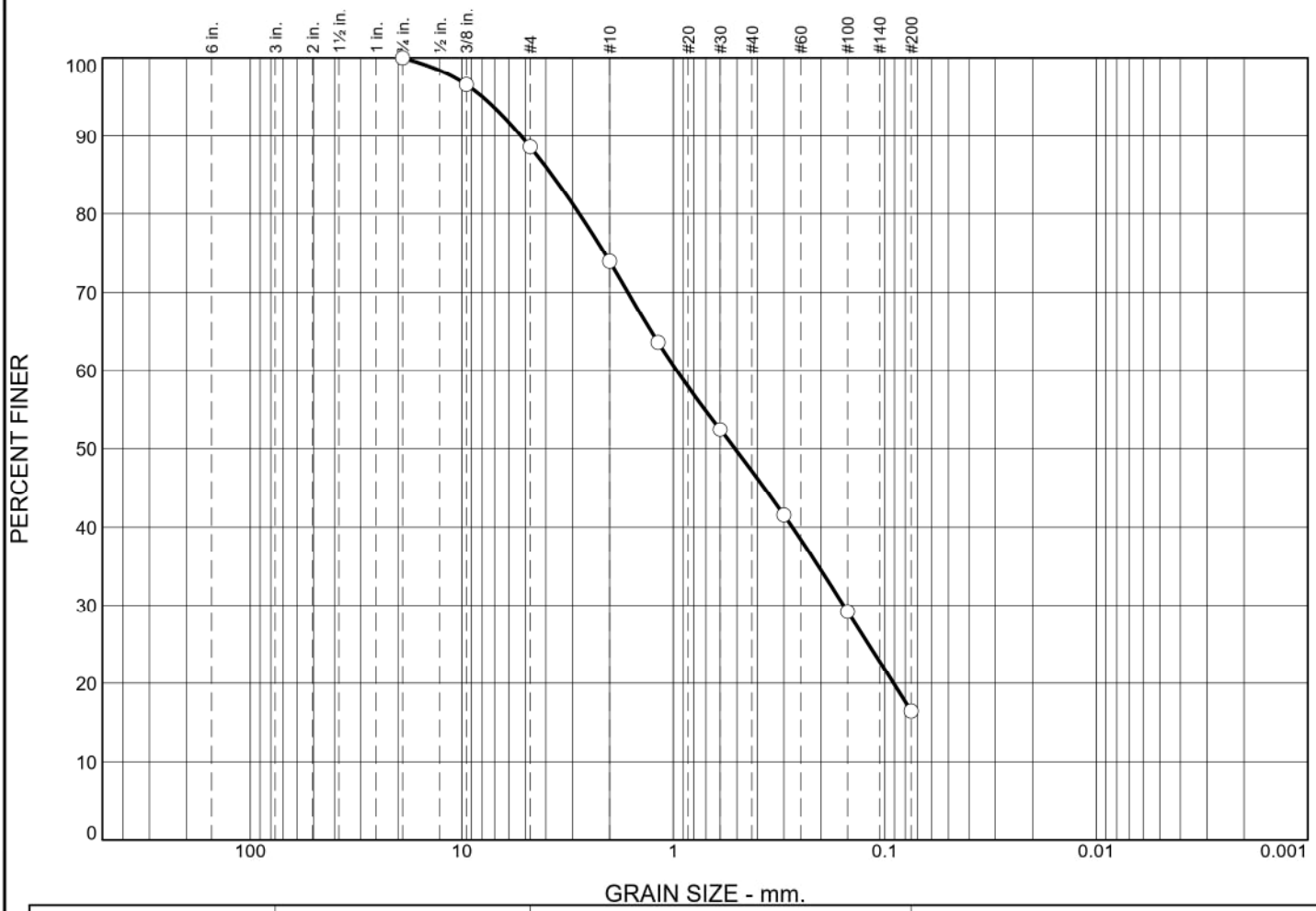
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	16.7	16.3	33.0	9.1	11.5	24.3	44.9			22.1

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.1513	0.6206	2.6776	9.4721	21.4476	26.9494	32.2686

Fineness Modulus
3.35

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	11.4	14.7	26.8	30.6	16.5

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	3.7504	0.9631	0.5119	0.1569				

Material Description	USCS	AASHTO
○ Silty SAND. STACKED ASH.	SM	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B108 **Depth:** 28 - 30 ft **Sample Number:** S13

Remarks:

○ As Rec'd WC = 9.4%
Stacked ASH

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Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B108
Depth: 28 - 30 ft
Sample Number: S13
Material Description: Silty SAND. STACKED ASH.
Liquid Limit: -
Plastic Limit: -
USCS Classification: SM
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 9.4%
Stacked ASH
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
71.99	0.00	203.11	3/4	203.11	100.0
			3/8	205.57	96.6
			#4	211.33	88.6
			#10	221.90	73.9
			#16	229.31	63.6
			#30	237.36	52.4
			#50	245.17	41.6
			#100	254.10	29.2
			#200	263.22	16.5

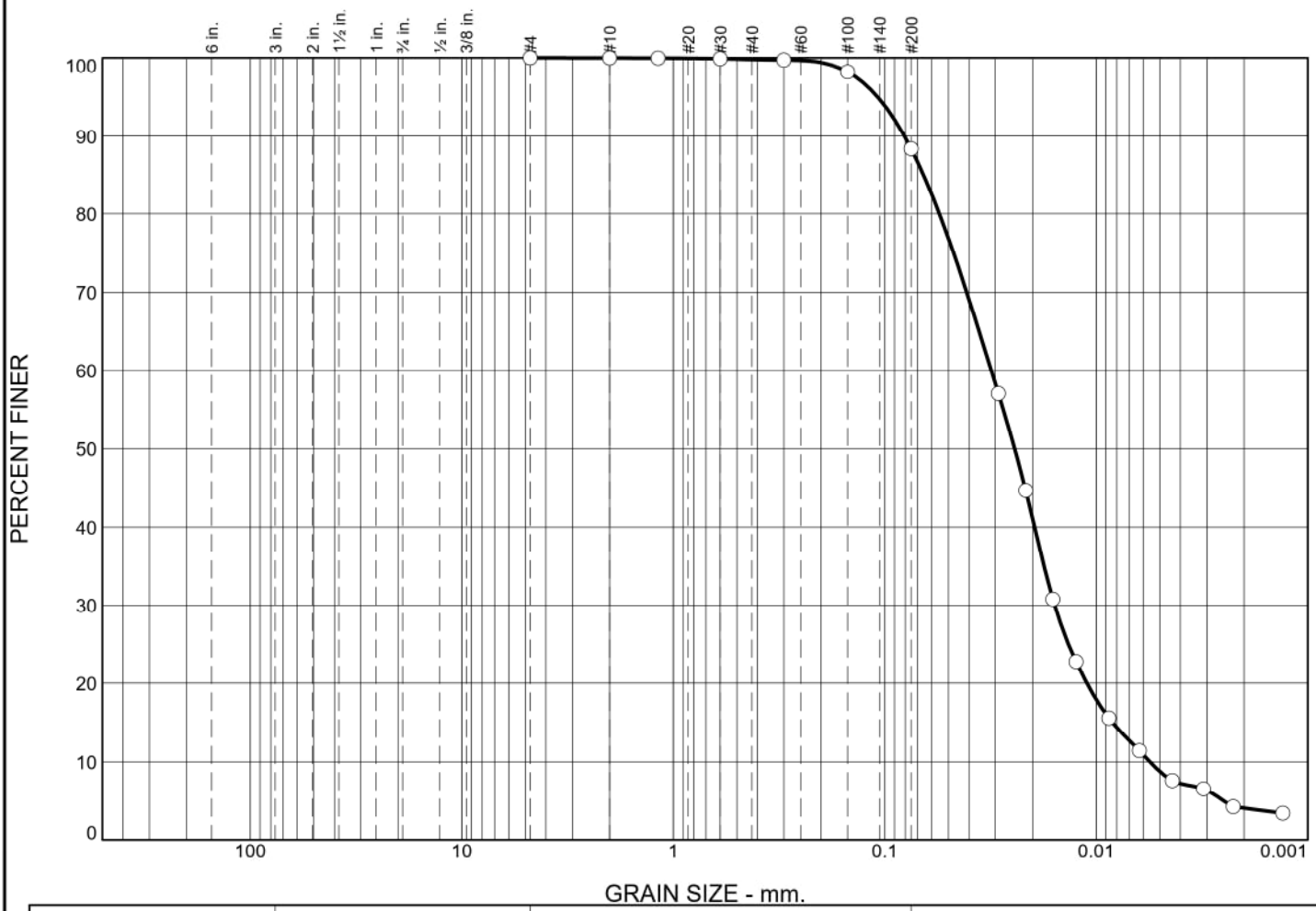
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	11.4	11.4	14.7	26.8	30.6	72.1	16.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
		0.0909	0.1569	0.5119	0.9631	2.7823	3.7504	5.2529	7.9754

Fineness Modulus
2.51

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	11.4	79.7	8.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0656	0.0314	0.0243	0.0157	0.0084	0.0056	1.42	5.63

	Material Description	USCS	AASHTO
○	SILT	ML	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B109 **Depth:** 17.5 - 19.5 ft **Sample Number:** S6

Remarks:

○ As Rec'd WC = 33.6%
Sluiced ASH

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Woburn, MA 01801

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Figure

Tested By: EF/WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B109
Depth: 17.5 - 19.5 ft
Sample Number: S6
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: -
Burmister: Si, l.fS
Testing Remarks: As Rec'd WC = 33.6%
Sluiced ASH
Tested by: EF/WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
50.91	0.00	188.91	#4	188.91	100.0
			#10	188.92	100.0
			#16	188.93	100.0
			#30	188.97	99.9
			#50	189.05	99.7
			#100	189.82	98.2
			#200	194.84	88.4

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =50.91
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.8	1.0220	1.0185	0.0128	22.7	10.3	0.0290	57.1
4.00	22.8	1.0180	1.0145	0.0128	18.7	11.3	0.0216	44.7
8.00	22.7	1.0135	1.0100	0.0128	14.2	12.5	0.0160	30.8
14.00	22.7	1.0109	1.0074	0.0128	11.6	13.2	0.0125	22.7
30.00	22.6	1.0086	1.0051	0.0128	9.3	13.8	0.0087	15.6
60.00	22.3	1.0073	1.0037	0.0129	8.0	14.2	0.0063	11.4
127.00	22.0	1.0061	1.0025	0.0129	6.8	14.5	0.0044	7.6
257.00	21.0	1.0059	1.0021	0.0131	6.6	14.5	0.0031	6.5
480.00	22.7	1.0049	1.0014	0.0128	5.6	14.8	0.0023	4.2
1432.00	22.3	1.0047	1.0011	0.0129	5.4	14.9	0.0013	3.4

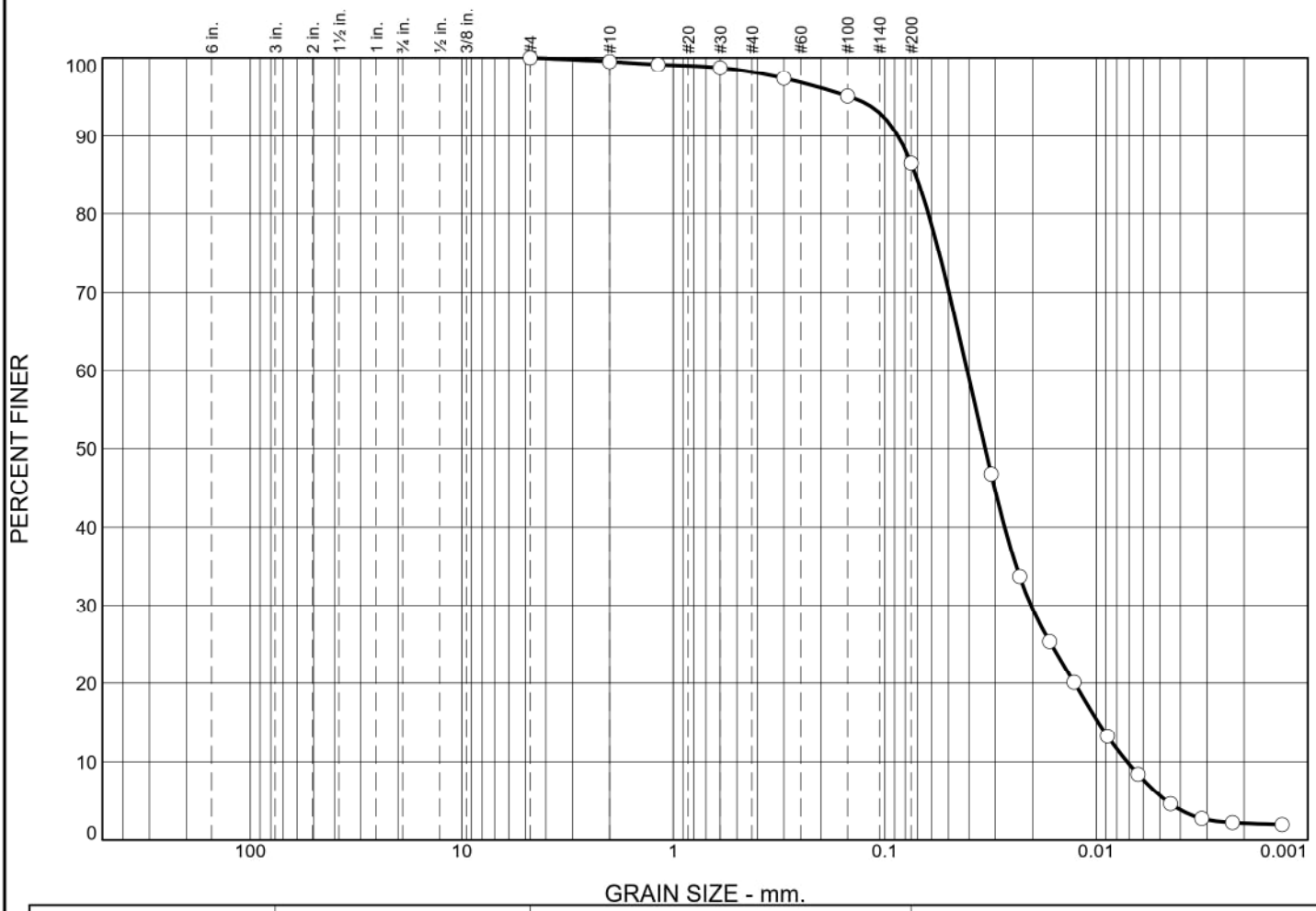
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.2	11.4	11.6	79.7	8.7	88.4

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0056	0.0084	0.0111	0.0157	0.0243	0.0314	0.0552	0.0656	0.0808	0.1082

Fineness Modulus	C_u	C_c
0.02	5.63	1.42

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.5	1.3	11.7	80.8	5.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0714	0.0408	0.0335	0.0204	0.0098	0.0071	1.43	5.71

	Material Description	USCS	AASHTO
○	SILT	ML	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B109 **Depth:** 47.5 - 49 ft **Sample Number:** S18

Remarks:

○ As Rec'd WC = 68.9%

Sluiced ASH

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B109
Depth: 47.5 - 49 ft
Sample Number: S18
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: A-4(0)
Burmister: Si, l.mfS
Testing Remarks: As Rec'd WC = 68.9%
Sluiced ASH
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
39.44	0.00	204.49	#4	204.49	100.0
			#10	204.68	99.5
			#16	204.83	99.1
			#30	204.99	98.7
			#50	205.52	97.4
			#100	206.42	95.1
			#200	209.81	86.5

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 99.5
Weight of hydrometer sample =39.44
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.9	1.0153	1.0118	0.0128	16.0	12.1	0.0314	46.8
4.00	22.8	1.0120	1.0085	0.0128	12.7	12.9	0.0230	33.7
8.00	22.8	1.0099	1.0064	0.0128	10.6	13.5	0.0166	25.3
14.00	22.7	1.0086	1.0051	0.0128	9.3	13.8	0.0127	20.1
30.00	22.6	1.0069	1.0034	0.0128	7.6	14.3	0.0089	13.3
60.00	22.4	1.0057	1.0021	0.0129	6.4	14.6	0.0063	8.4
125.00	22.0	1.0048	1.0012	0.0129	5.5	14.8	0.0045	4.6
255.00	20.8	1.0045	1.0007	0.0131	5.2	14.9	0.0032	2.7
480.00	22.6	1.0041	1.0006	0.0128	4.8	15.0	0.0023	2.2
1430.00	22.2	1.0041	1.0005	0.0129	4.8	15.0	0.0013	2.0

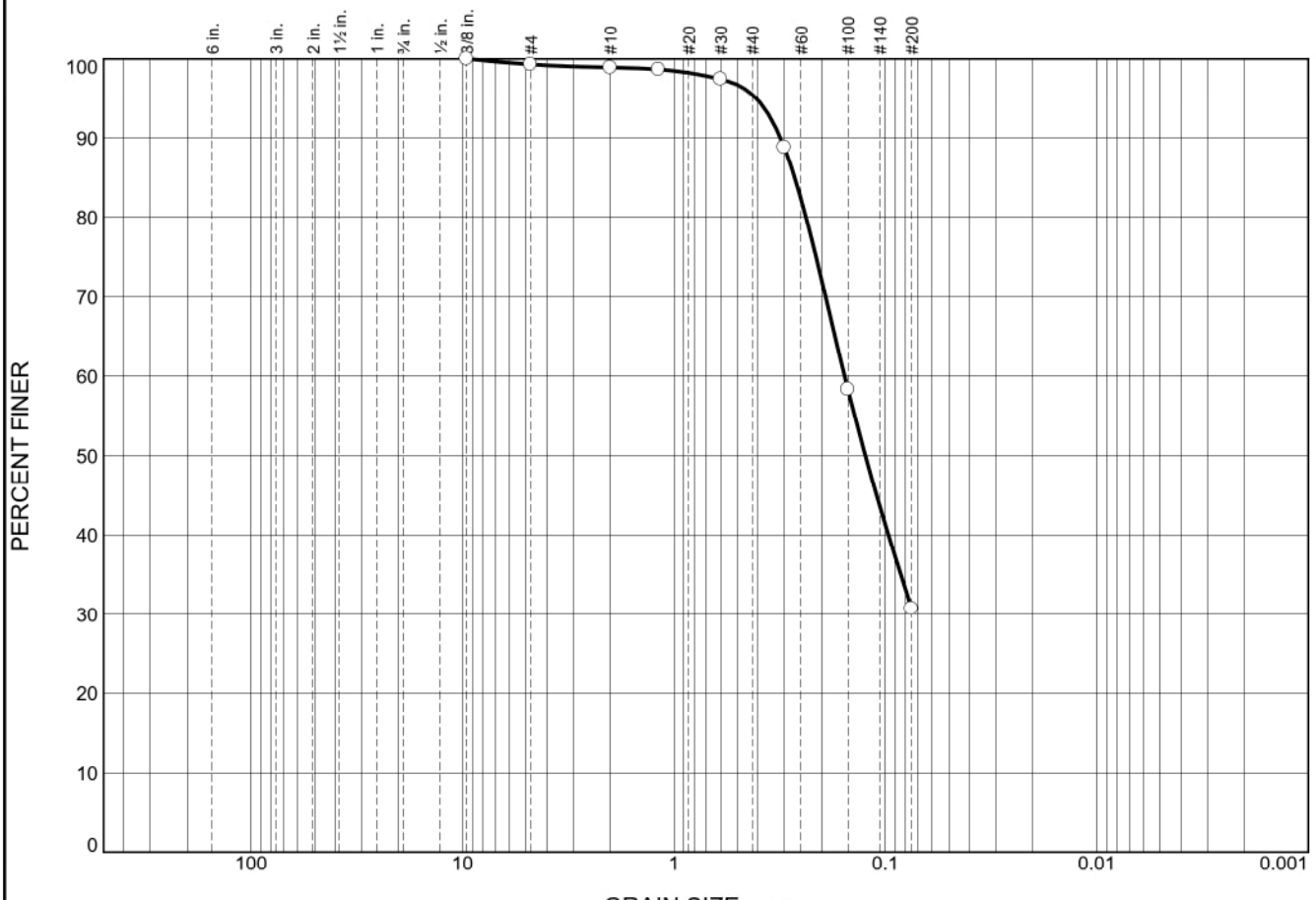
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.5	1.3	11.7	13.5	80.8	5.7	86.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0071	0.0098	0.0127	0.0204	0.0335	0.0408	0.0622	0.0714	0.0867	0.1460

Fineness Modulus	C_u	C_c
0.10	5.71	1.43

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.4	3.4	64.8	30.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2683	0.1558	0.1243					

Material Description	USCS	AASHTO
○ Silty SAND	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B109 **Depth:** 80 - 82 ft **Sample Number:** S31

Remarks:

○Sand-like Alluvium

As Rec'd WC = 25.7%

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B109
Depth: 80 - 82 ft
Sample Number: S31
Material Description: Silty SAND
USCS Classification: SM
Testing Remarks: Sandy Alluvium
As Rec'd WC = 25.7%
Tested by: WGL
Checked by: EF

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 309.09
Tare Wt. = 204.46
Minus #200 from wash = 24.8%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
343.57	204.46	204.46	3/8	204.48	100.0
			#4	205.46	99.3
			#10	206.00	98.9
			#16	206.35	98.6
			#30	208.07	97.4
			#50	220.06	88.8
			#100	262.55	58.2
			#200	300.91	30.7

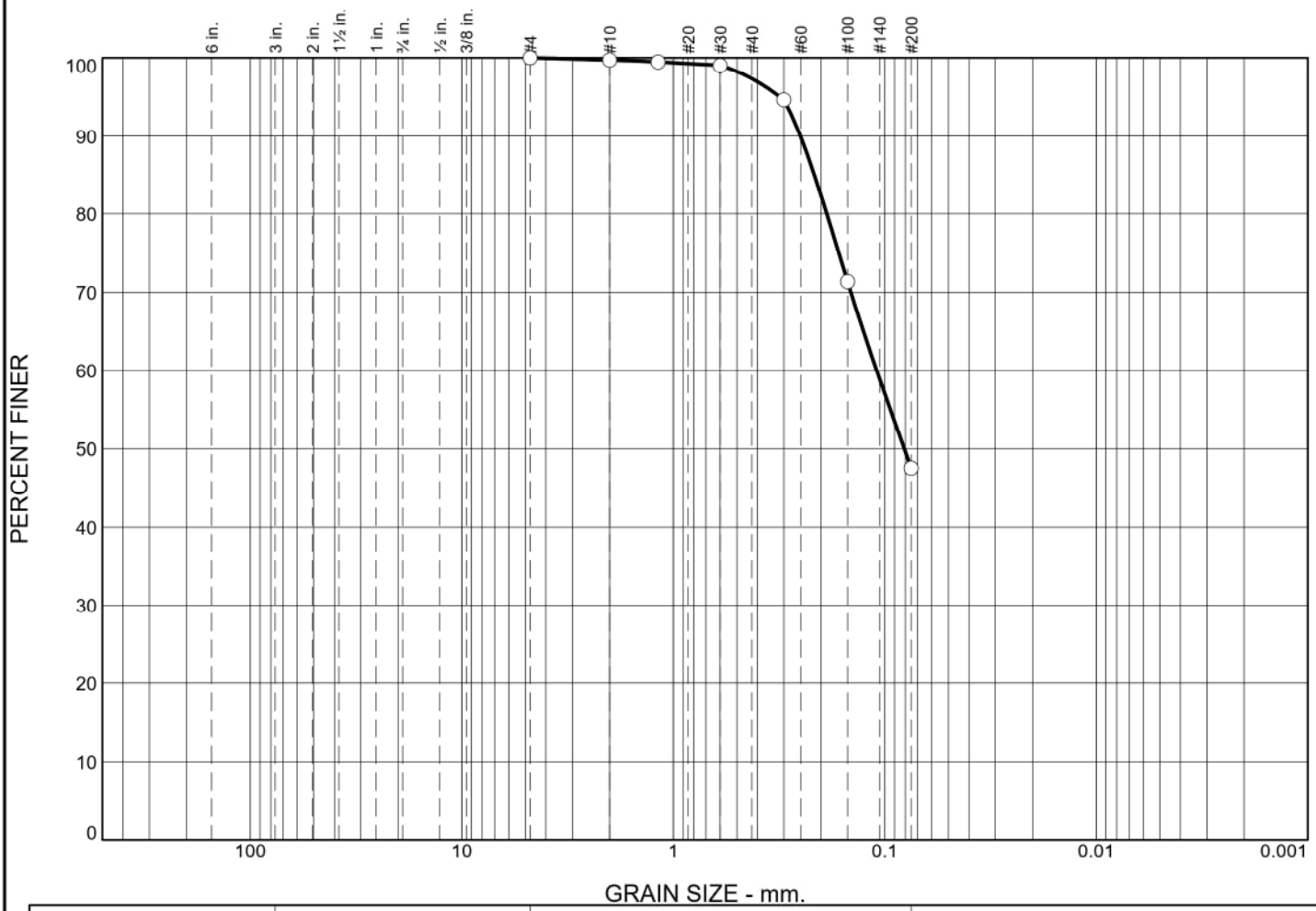
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
				0.4	3.4	64.8	68.6			30.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
					0.0965	0.1243	0.1558	0.2373	0.2683	0.3130	0.4077

Fineness Modulus
0.59

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.3	2.4	49.8	47.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.2154	0.1092	0.0809					

	Material Description	USCS	AASHTO
○	Clayey SAND	SC	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B110 **Depth:** 35 - 37 ft **Sample Number:** S15

Remarks:

○ As Rec'd WC = 17.3%

Clay Dike

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B110
Depth: 35 - 37 ft
Sample Number: S15
Material Description: Clayey SAND
Liquid Limit: -
Plastic Limit: -
USCS Classification: SC
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 17.3%
Clay Dike
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
134.10	0.00	188.84	#4	188.84	100.0
			#10	189.21	99.7
			#16	189.55	99.5
			#30	190.14	99.0
			#50	196.06	94.6
			#100	227.27	71.3
			#200	259.21	47.5

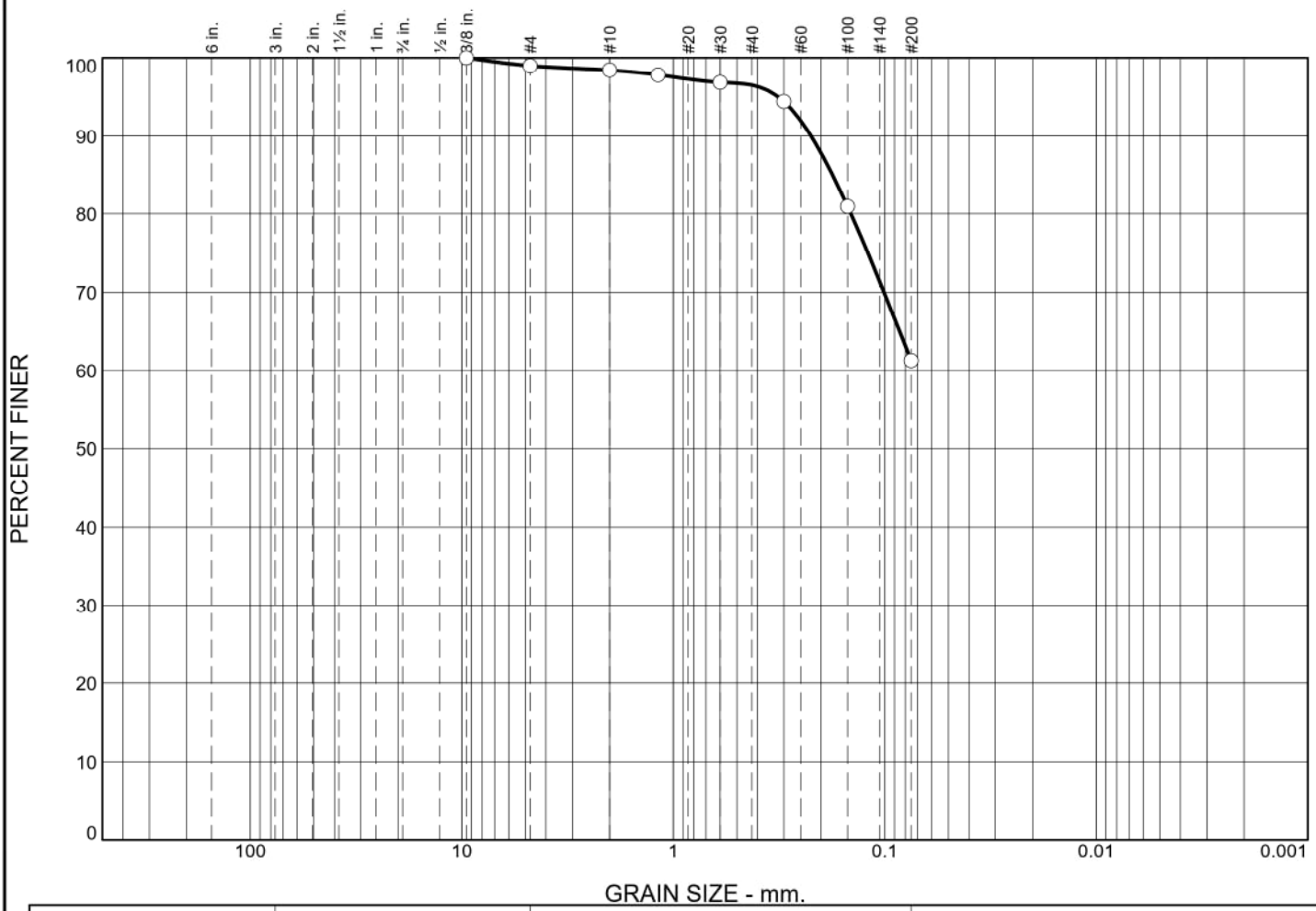
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.3	2.4	49.8	52.5			47.5

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0809	0.1092	0.1881	0.2154	0.2506	0.3130

Fineness Modulus
0.36

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.6	1.9	35.2	61.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	34	19	0.1768							

	Material Description	USCS	AASHTO
○	Sandy LEAN CLAY	CL	A-6(7)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B110 **Depth:** 54 - 56 ft **Sample Number:** S23

Remarks:

○ As Rec'd WC = 21.4%
Clayey Alluvium

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B110
Depth: 54 - 56 ft
Sample Number: S23
Material Description: Sandy LEAN CLAY
Liquid Limit: 34
Plastic Limit: 19
USCS Classification: CL
AASHTO Classification: A-6(7)
Testing Remarks: As Rec'd WC = 21.4%
Clayey Alluvium
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
127.01	0.00	205.41	3/8	205.41	100.0
			#4	206.69	99.0
			#10	207.40	98.4
			#16	208.18	97.8
			#30	209.39	96.9
			#50	212.49	94.4
			#100	229.62	80.9
			#200	254.57	61.3

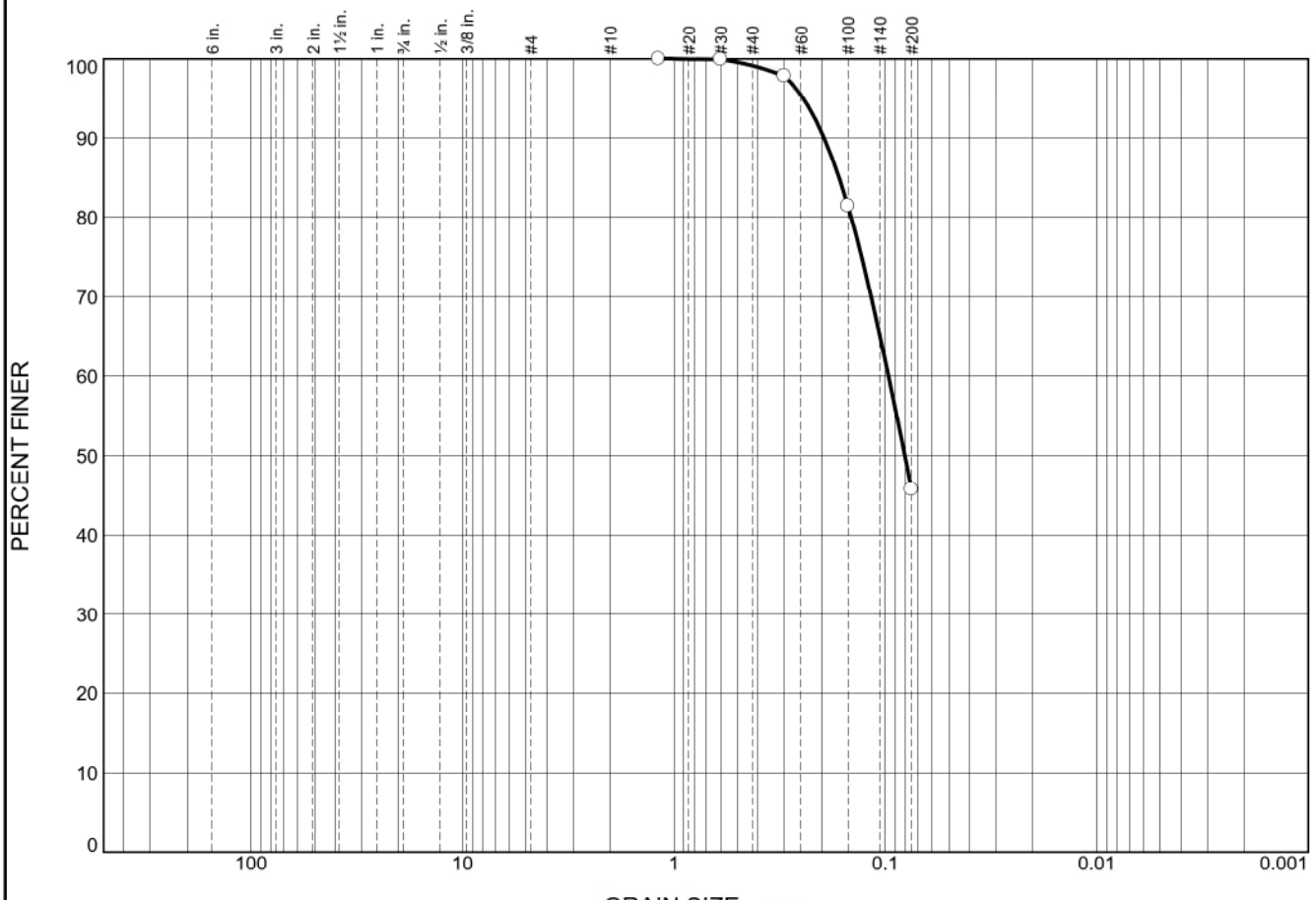
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	1.0	1.0	0.6	1.9	35.2	37.7			61.3

D_{10}	D_{15}	D_{20}	D_{30}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.1447	0.1768	0.2233	0.3183

Fineness Modulus
0.32

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○						53.4	45.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1655	0.0965	0.0808					

Material Description	USCS	AASHTO
○ SILTY SAND	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B111 **Depth:** 16 - 18 ft **Sample Number:** S7

Remarks:

○Sand-like Alluvium

As Rec'd WC = 16.7%

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B111
Depth: 16 - 18 ft **Sample Number:** S7
Material Description: SILTY SAND
USCS Classification: SM
Testing Remarks: Sand-like Alluvium
As Rec'd WC = 16.7%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 278.41
Tare Wt. = 220.79
Minus #200 from wash = 39.3%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
315.72	220.79	220.79	#16	220.80	100.0
			#30	220.88	99.9
			#50	222.86	97.8
			#100	238.48	81.4
			#200	272.31	45.7

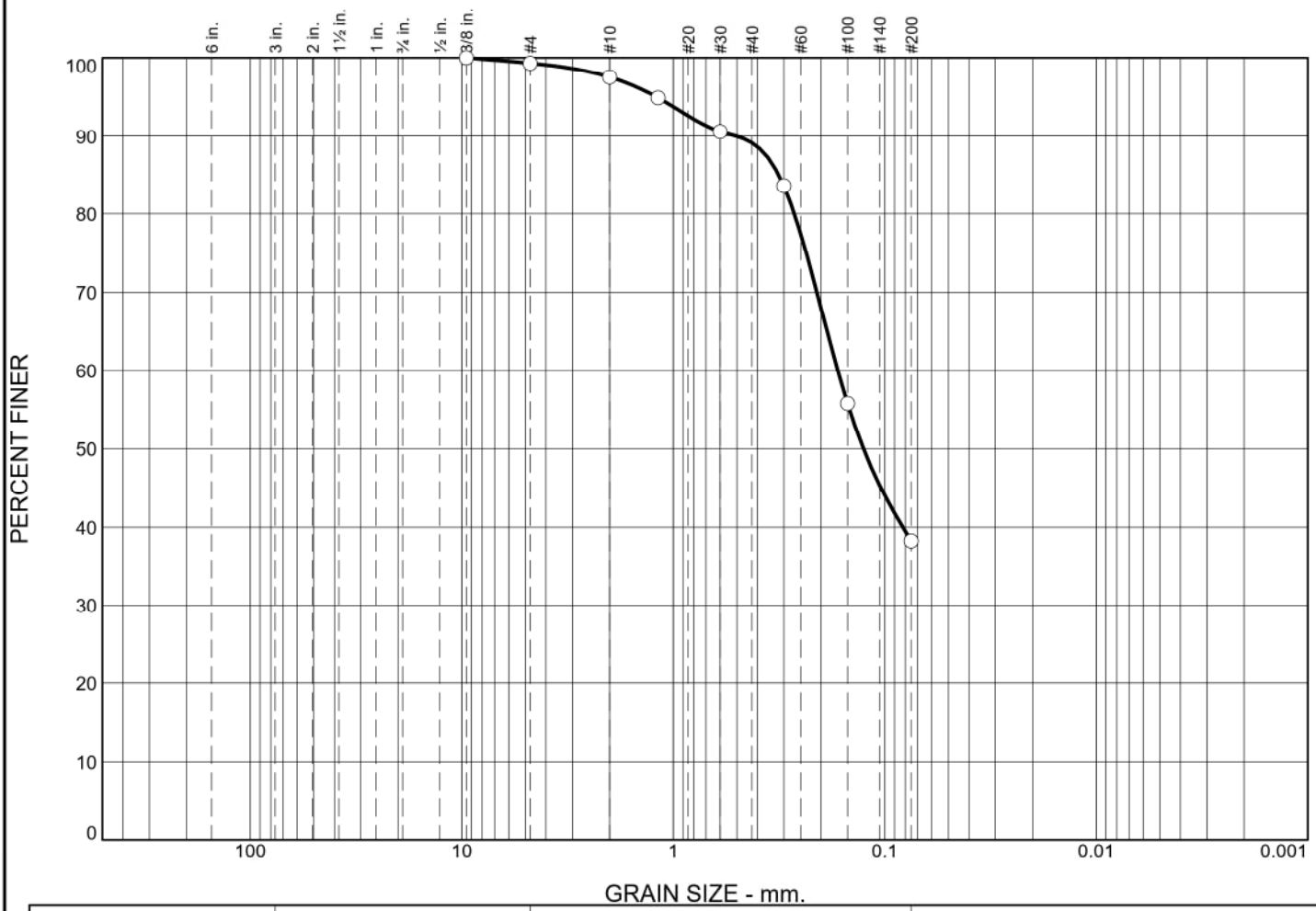
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
						53.4				45.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0808	0.0965	0.1450	0.1655	0.1949	0.2445

Fineness Modulus
0.21

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.7	1.8	8.4	50.8	38.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	22	16	0.3174	0.1668	0.1261					

	Material Description	USCS	AASHTO
○	Silty SAND	SC-SM	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source:** B111 **Depth:** 26 - 28 ft **Sample No.:** S11 (12 - 24 in)

Remarks:

○ As Rec'd WC = 24.7%
Sandy Alluvium

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B111
Depth: 26 - 28 ft
Sample Number: S11 (12 - 24 in)
Material Description: Silty SAND
Liquid Limit: 22
Plastic Limit: 16
USCS Classification: SC-SM
AASHTO Classification: A-4(0)
Testing Remarks: As Rec'd WC = 24.7%
Sandy Alluvium
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
198.78	0.00	198.70	3/8	198.70	100.0
			#4	200.08	99.3
			#10	203.59	97.5
			#16	208.85	94.9
			#30	217.48	90.6
			#50	231.33	83.6
			#100	286.63	55.8
			#200	321.42	38.3

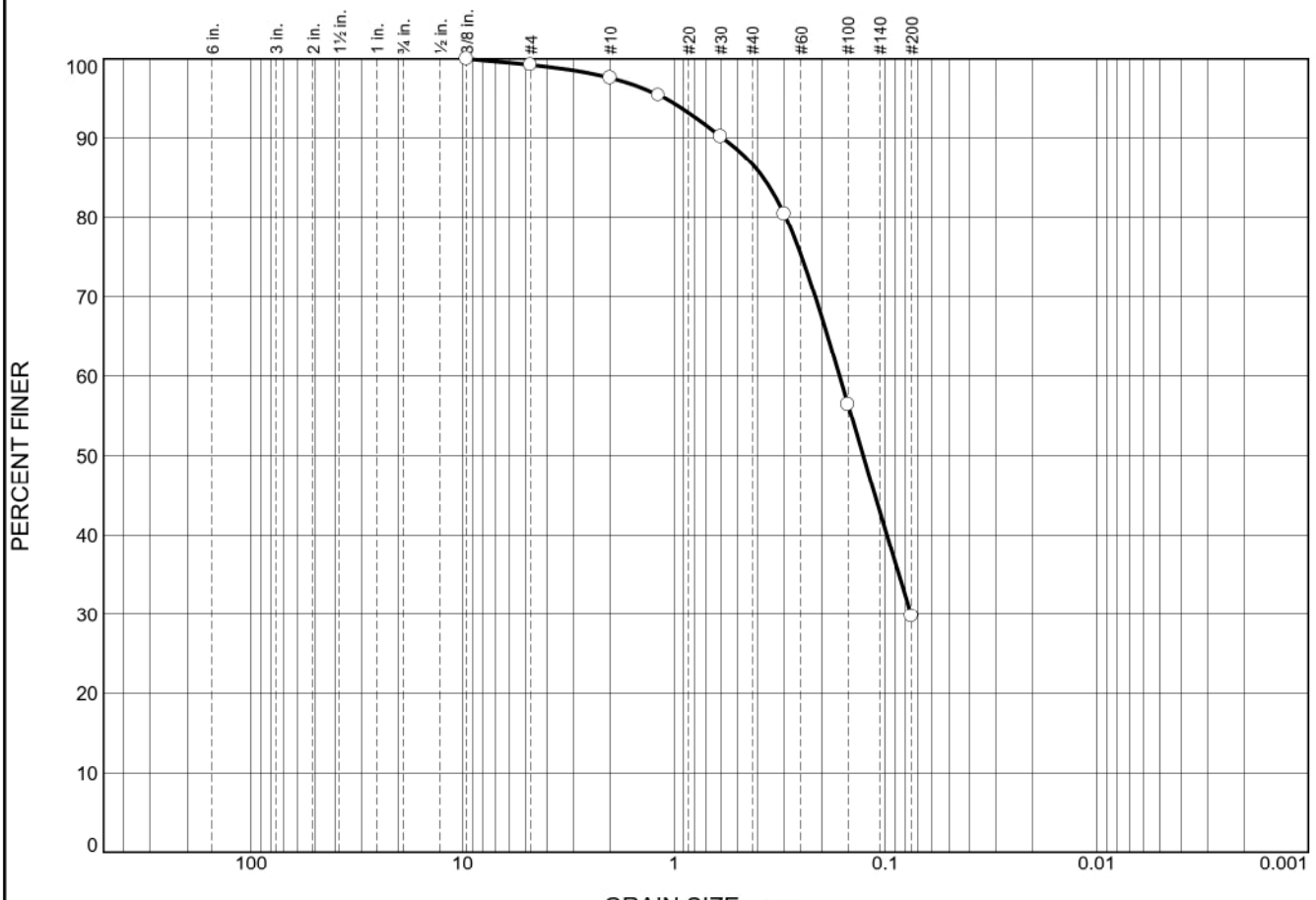
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.7	0.7	1.8	8.4	50.8	61.0			38.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
					0.0821	0.1261	0.1668	0.2678	0.3174	0.5089	1.1993

Fineness Modulus
0.78

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				1.6	10.9	57.0	29.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3786	0.1645	0.1273	0.0756				

Material Description	USCS	AASHTO
○ SILTY SAND	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B112 **Depth:** 2 - 4' **Sample Number:** S2 (9"-22")

Remarks:

○Sand-like Alluvium
As Rec'd WC = 20.2%

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B112
Depth: 2 - 4'
Sample Number: S2 (9"-22")
Material Description: Sandy Alluvium
Testing Remarks: As Rec'd WC = 20.2%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 284.79
Tare Wt. = 198.68
Minus #200 from wash = 25.0%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
313.55	198.68	198.68	3/8	198.73	100.0
			#4	199.59	99.2
			#10	201.44	97.6
			#16	203.98	95.4
			#30	209.98	90.2
			#50	221.24	80.4
			#100	248.77	56.4
			#200	279.42	29.7

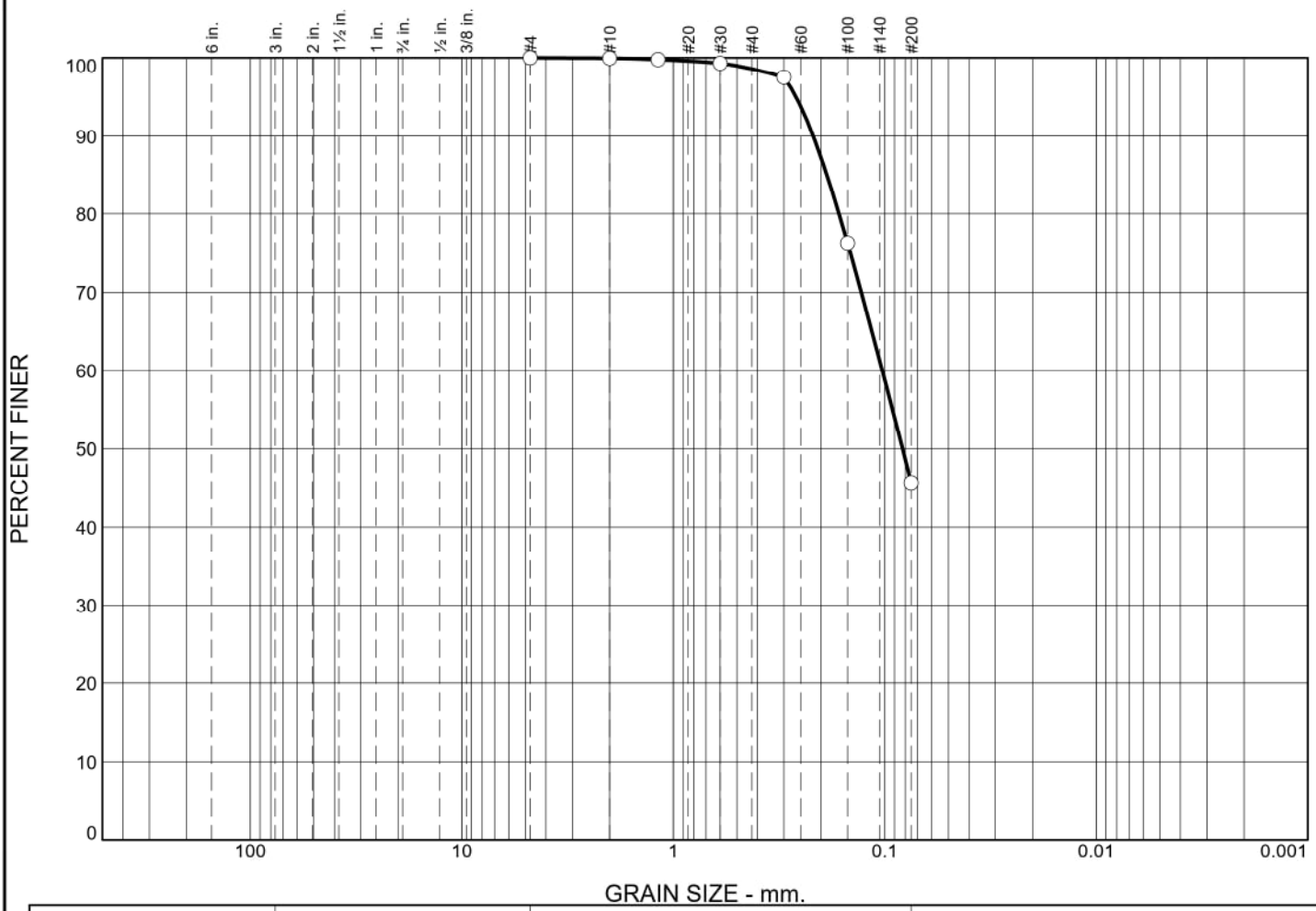
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
				1.6	10.9	57.0	69.5			29.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0756	0.0982	0.1273	0.1645	0.2957	0.3786	0.5890	1.1077

Fineness Modulus
0.80

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	1.3	52.9	45.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	24	18	0.1880	0.1028	0.0824					

	Material Description	USCS	AASHTO
○	Clayey SAND	SC-SM	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B113 **Depth:** 15 - 17 ft **Sample Number:** S7

Remarks:

○ As Rec'D WC = 12.7%

Clay Dike

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 15 - 17 ft
Sample Number: S7
Material Description: Clayey SAND
Liquid Limit: 24
Plastic Limit: 18
USCS Classification: SC-SM
AASHTO Classification: A-4(0)
Testing Remarks: As Rec'D WC = 12.7%
Clay Dike
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
144.53	0.00	204.48	#4	204.48	100.0
			#10	204.56	99.9
			#16	204.80	99.8
			#30	205.48	99.3
			#50	208.06	97.5
			#100	238.80	76.3
			#200	282.96	45.7

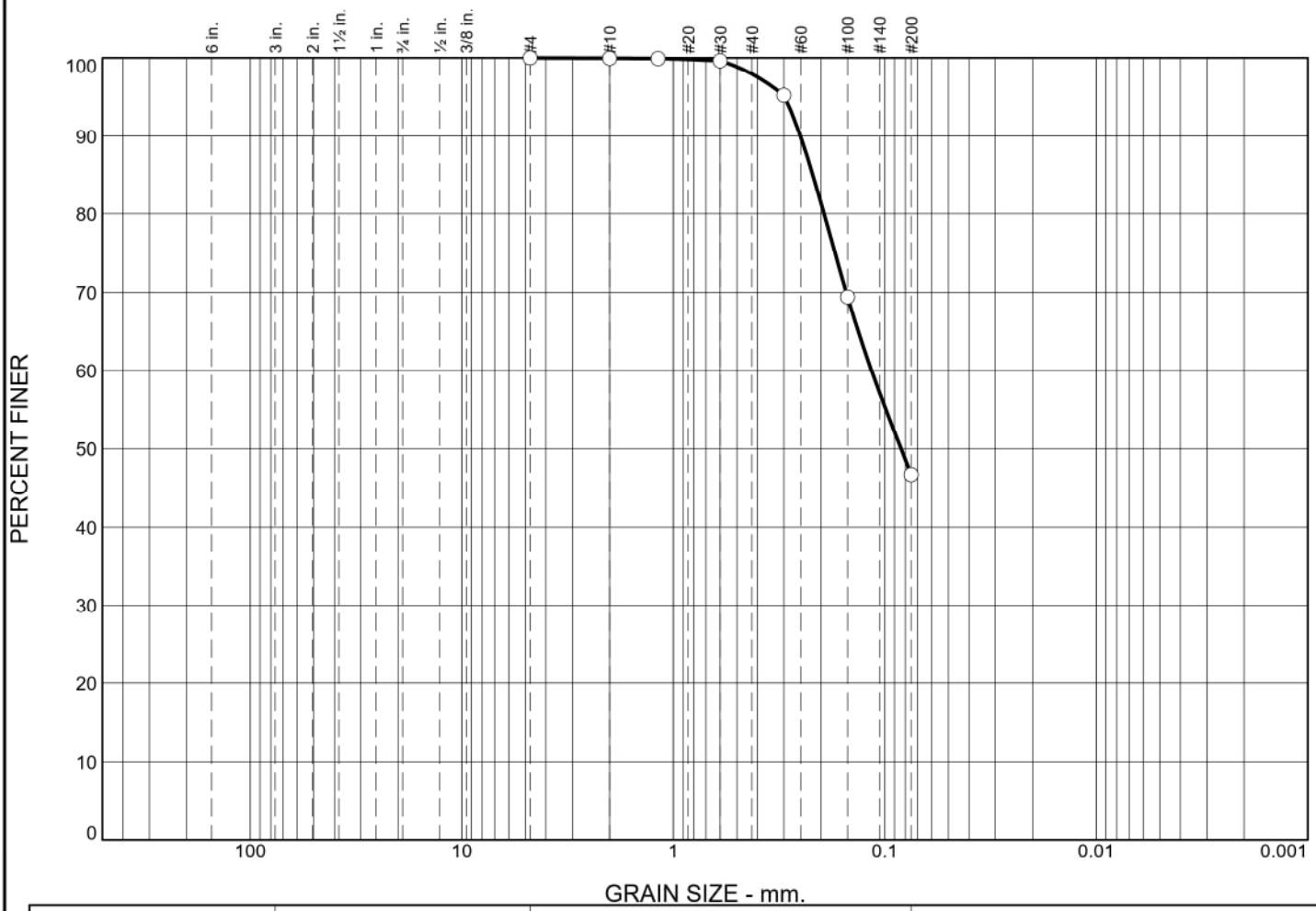
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	1.3	52.9	54.3			45.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0824	0.1028	0.1647	0.1880	0.2181	0.2626

Fineness Modulus
0.27

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	2.0	51.2	46.7	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	26	17	0.2190	0.1155	0.0838					

Material Description	USCS	AASHTO
○ Clayey SAND	SC	A-4(1)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source:** B113 **Depth:** 24 - 26 ft **Sample No.:** S11 (3 - 15 in)

Remarks:

○ As Rec'd WC = 15.0%

Clay Dike

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 24 - 26 ft
Sample Number: S11 (3 - 15 in)
Material Description: Clayey SAND
Liquid Limit: 26
Plastic Limit: 17
USCS Classification: SC
AASHTO Classification: A-4(1)
Testing Remarks: As Rec'd WC = 15.0%
Clay Dike
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
119.79	0.00	204.04	#4	204.04	100.0
			#10	204.10	99.9
			#16	204.14	99.9
			#30	204.49	99.6
			#50	209.78	95.2
			#100	240.67	69.4
			#200	267.85	46.7

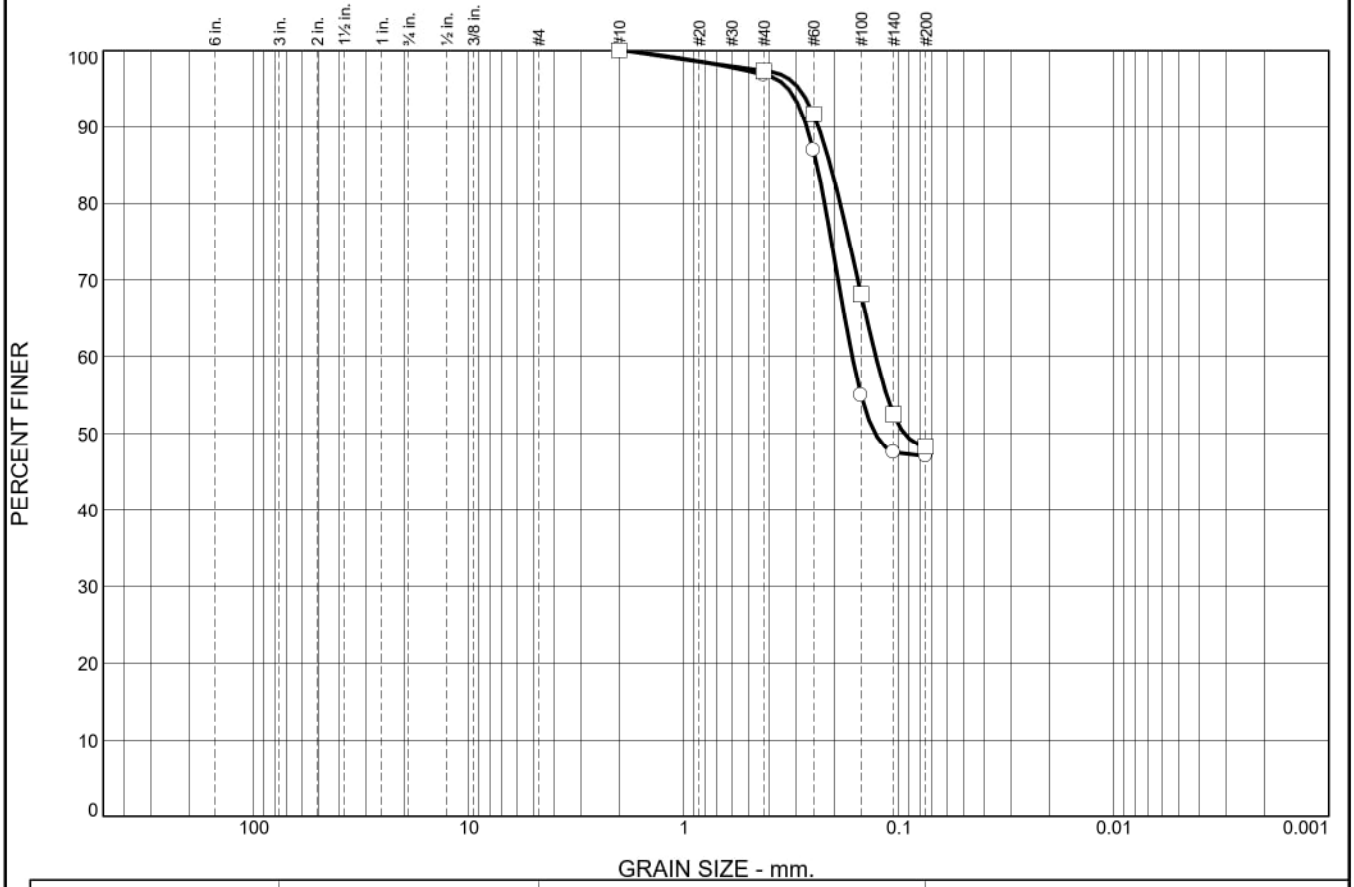
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	2.0	51.2	53.3			46.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0838	0.1155	0.1937	0.2190	0.2507	0.2973

Fineness Modulus
0.36

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	3.2	49.7	47.1	
□	0.0	0.0	0.0	0.0	2.7	49.0	48.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	24	19	0.2411	0.1650	0.1290					
□	25	20	0.2089	0.1282	0.0943					

Material Description	USCS	AASHTO
○ Brown greenish homogenous moist silty, clayey sand	SC-SM	A-4(0)
□ Brown greenish homogenous moist silty, clayey sand	SC-SM	A-4(0)

Project No. **Client:** GEI Consultants, Inc.

Project: GEI 001

Remarks:

○ **Source:** B113-U2 **Depth:** 26.42' - 28.22' **Sample No.:** 1 (17 psi)

□ **Source:** B113-U2 **Depth:** 26.42' - 28.22' **Sample No.:** 2 (35 psi)

VirginiaTech

English Geotechnical Lab

Figure

Tested By: Bernardo Castellanos, PhD **Checked By:** Thomas L. Brandon, PhD

GRAIN SIZE DISTRIBUTION TEST DATA

1/30/2018

Client: GEI Consultants, Inc.
Project: GEI 001
Location: B113-U2
Depth: 26.42' - 28.22'
Sample Number: 1 (17 psi)
Material Description: Brown greenish homogenous moist silty, clayey sand
Liquid Limit: 24
Plastic Limit: 19
USCS Classification: SC-SM
AASHTO Classification: A-4(0)
Tested by: Bernardo Castellanos, PhD
Checked by: Thomas L. Brandon, PhD

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
481.64	0.00	#10	0.00	0.00	100.0
		#40	57.46	41.85	96.8
96.02	0.00	#60	100.85	91.06	86.9
		#100	139.37	107.67	54.9
		#140	115.01	107.66	47.5
		#200	105.96	105.48	47.1

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	3.2	49.7	52.9			47.1

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.1290	0.1650	0.2219	0.2411	0.2686	0.3285

Fineness Modulus
0.55

GRAIN SIZE DISTRIBUTION TEST DATA

1/30/2018

Client: GEI Consultants, Inc.
Project: GEI 001
Location: B113-U2
Depth: 26.42' - 28.22'
Sample Number: 2 (35 psi)
Material Description: Brown greenish homogenous moist silty, clayey sand
Liquid Limit: 25
Plastic Limit: 20
USCS Classification: SC-SM
AASHTO Classification: A-4(0)
Tested by: Bernardo Castellanos, PhD
Checked by: Thomas L. Brandon, PhD

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Sieve Opening Size	Weight Retained (grams)	Sieve Weight (grams)	Percent Finer
574.13	0.00	#10	0.00	0.00	100.0
		#40	57.46	41.85	97.3
105.55	0.00	#60	97.21	91.07	91.6
		#100	133.13	107.68	68.2
		#140	124.74	107.71	52.5
		#200	110.02	105.46	48.3

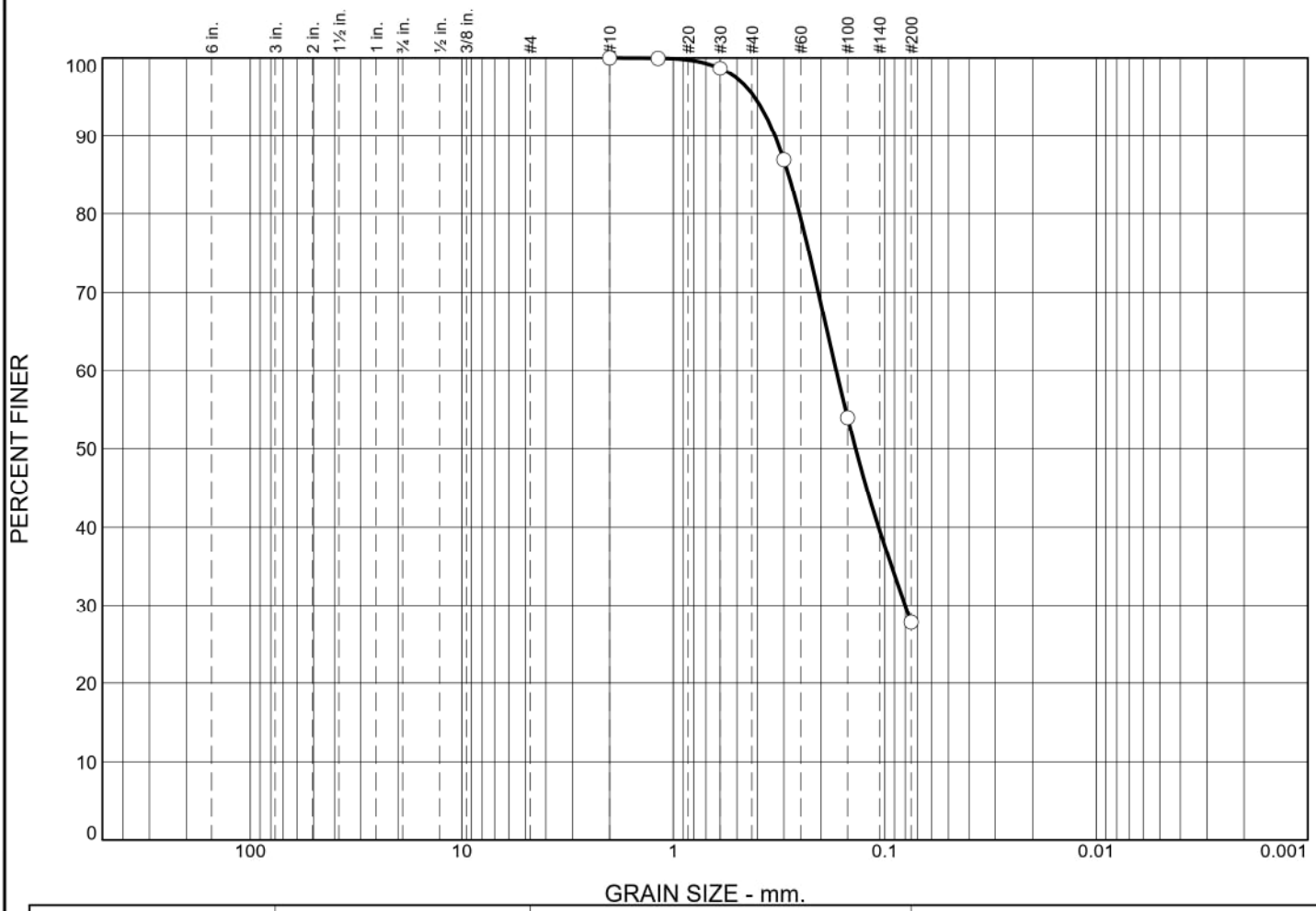
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	2.7	49.0	51.7			48.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0943	0.1282	0.1878	0.2089	0.2374	0.2924

Fineness Modulus
0.40

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	4.6	67.6	27.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.2847	0.1697	0.1374	0.0801				

	Material Description	USCS	AASHTO
○	Silty SAND	SM	A-2-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B113 **Depth:** 34 - 36 ft **Sample Number:** S16

Remarks:

○ As Rec'd WC = 12.2%

Sandy Alluvium

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400 Unicorn Park Drive
Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 34 - 36 ft
Sample Number: S16
Material Description: Silty SAND
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: SM
AASHTO Classification: A-2-4(0)
Testing Remarks: As Rec'd WC = 12.2%
Sandy Alluvium
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
105.60	0.00	206.20	#10	206.20	100.0
			#16	206.25	100.0
			#30	207.62	98.7
			#50	219.99	86.9
			#100	254.82	54.0
			#200	282.45	27.8

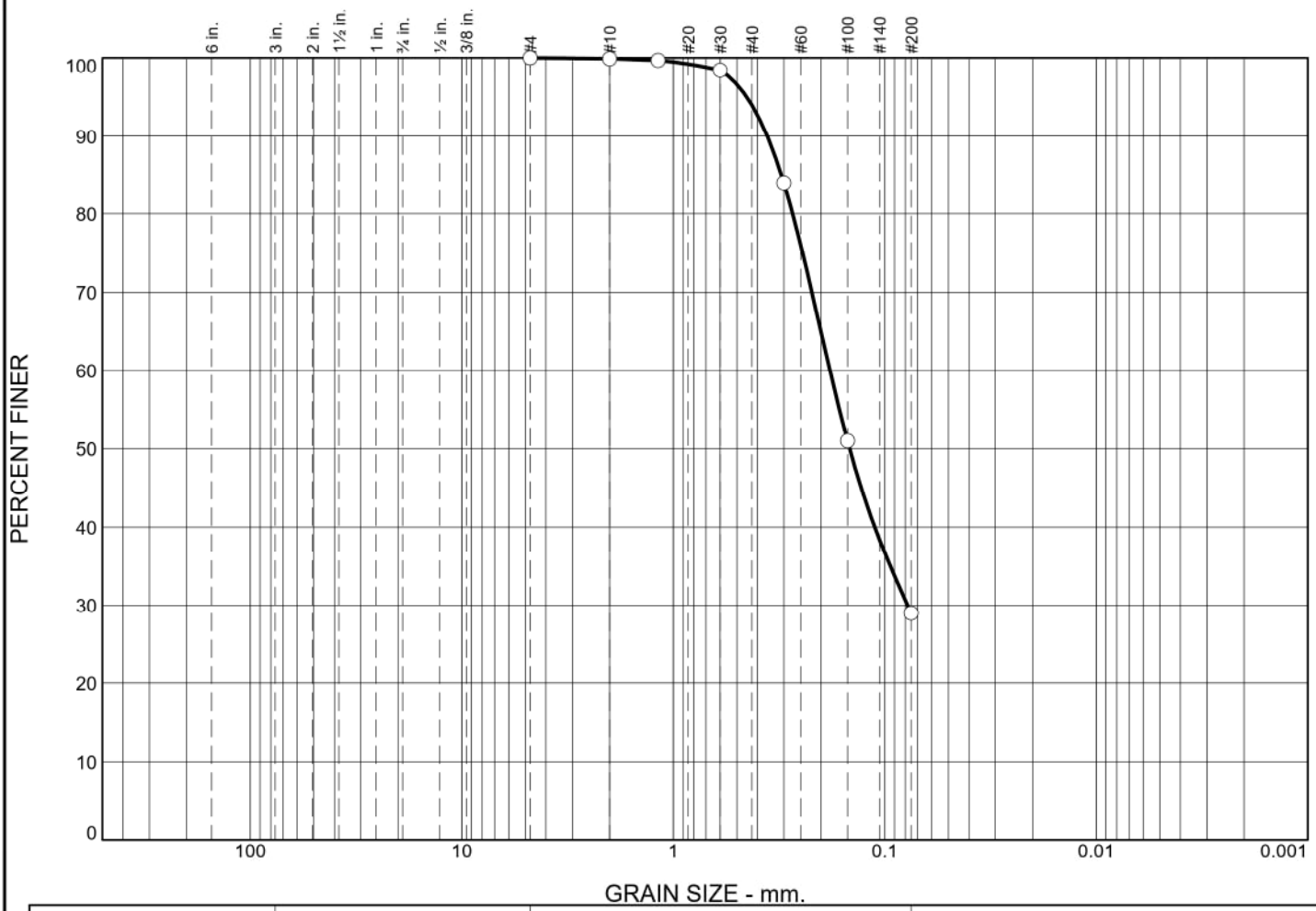
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	4.6	67.6	72.2			27.8

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0801	0.1070	0.1374	0.1697	0.2530	0.2847	0.3301	0.4134

Fineness Modulus
0.60

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.1	6.0	64.9	29.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.3082	0.1816	0.1466	0.0780				

	Material Description	USCS	AASHTO
○	Silty SAND	SM	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B113 **Depth:** 40 - 42 ft **Sample Number:** S19 (Top)

Remarks:

○ As Rec'd WC = 21.1%

Sandy Alluvium

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 40 - 42 ft
Sample Number: S19 (Top)
Material Description: Silty SAND
Liquid Limit: -
Plastic Limit: -
USCS Classification: SM
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 21.1%
Sandy Alluvium
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
118.13	0.00	199.25	#4	199.25	100.0
			#10	199.38	99.9
			#16	199.63	99.7
			#30	201.12	98.4
			#50	218.17	84.0
			#100	257.17	51.0
			#200	283.15	29.0

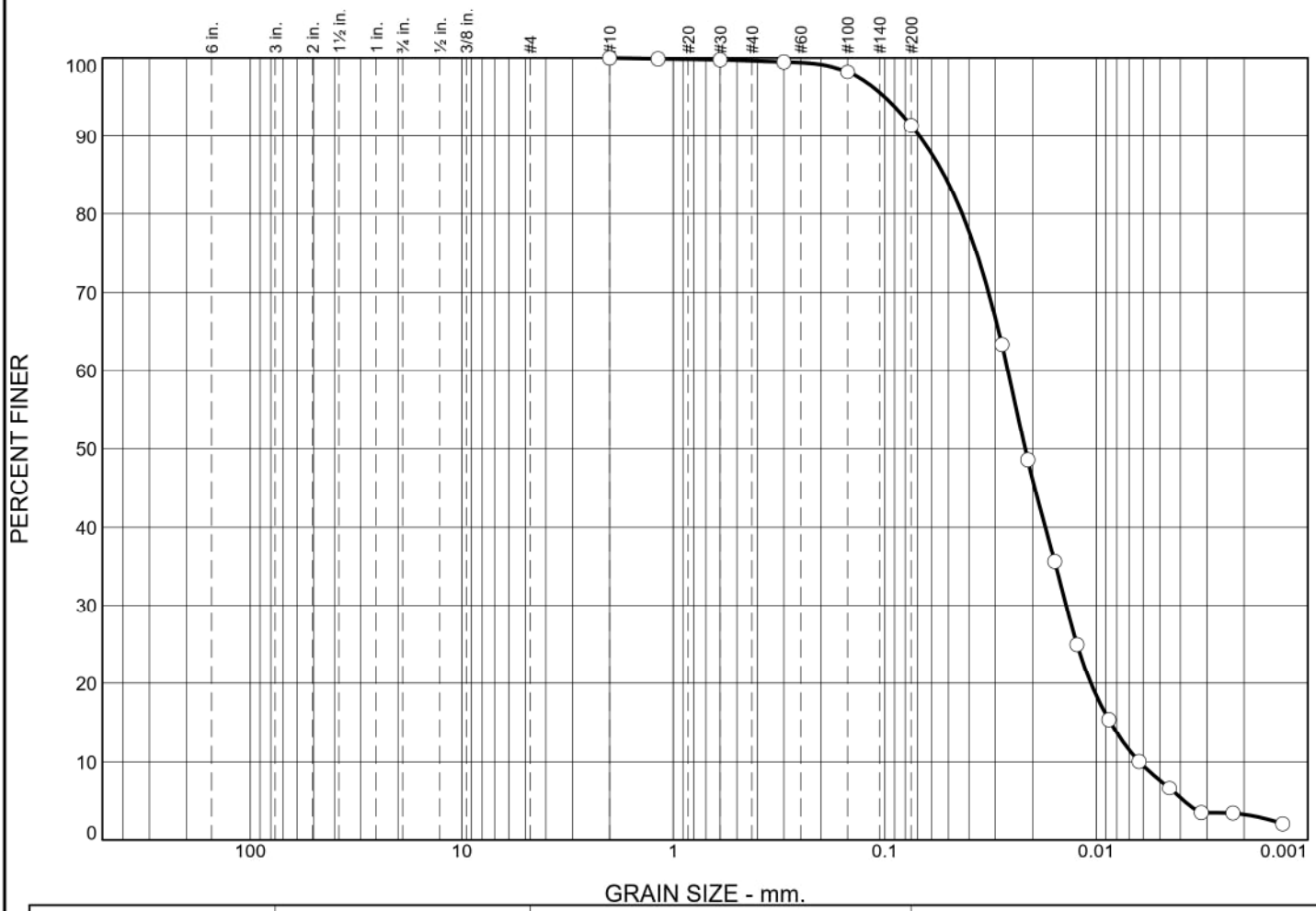
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.1	6.0	64.9	71.0			29.0

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0780	0.1115	0.1466	0.1816	0.2725	0.3082	0.3597	0.4500

Fineness Modulus
0.67

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.4	8.3	83.6	7.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0525	0.0262	0.0217	0.0139	0.0085	0.0063	1.18	4.19

	Material Description	USCS	AASHTO
○	SILT	ML	--

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B115 **Depth:** 17.5 - 19.5 ft **Sample Number:** S7

Remarks:

○ As Rec'd WC = 29.2%

Sluiced ASH

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Woburn, MA 01801

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Figure

Tested By: EF/WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 17.5 - 19.5 ft
Sample Number: S7
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: --
Burmister: Si, t.fS
Testing Remarks: As Rec'd WC = 29.2%
Sluiced ASH
Tested by: EF/WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
53.28	0.00	204.06	#10	204.06	100.0
			#16	204.12	99.9
			#30	204.18	99.8
			#50	204.33	99.5
			#100	205.02	98.2
			#200	208.68	91.3

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =53.28
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.7	1.0250	1.0215	0.0128	25.7	9.5	0.0279	63.3
4.00	22.7	1.0200	1.0165	0.0128	20.7	10.8	0.0211	48.6
8.00	22.6	1.0156	1.0121	0.0128	16.3	12.0	0.0157	35.6
14.00	22.6	1.0120	1.0085	0.0128	12.7	12.9	0.0123	24.9
30.00	22.4	1.0088	1.0052	0.0129	9.5	13.8	0.0087	15.4
60.00	22.3	1.0070	1.0034	0.0129	7.7	14.3	0.0063	10.1
120.00	21.9	1.0059	1.0022	0.0129	6.6	14.5	0.0045	6.6
251.00	20.7	1.0050	1.0012	0.0131	5.7	14.8	0.0032	3.5
480.00	22.6	1.0047	1.0012	0.0128	5.4	14.9	0.0023	3.4
1440.00	22.2	1.0043	1.0007	0.0129	5.0	15.0	0.0013	2.0

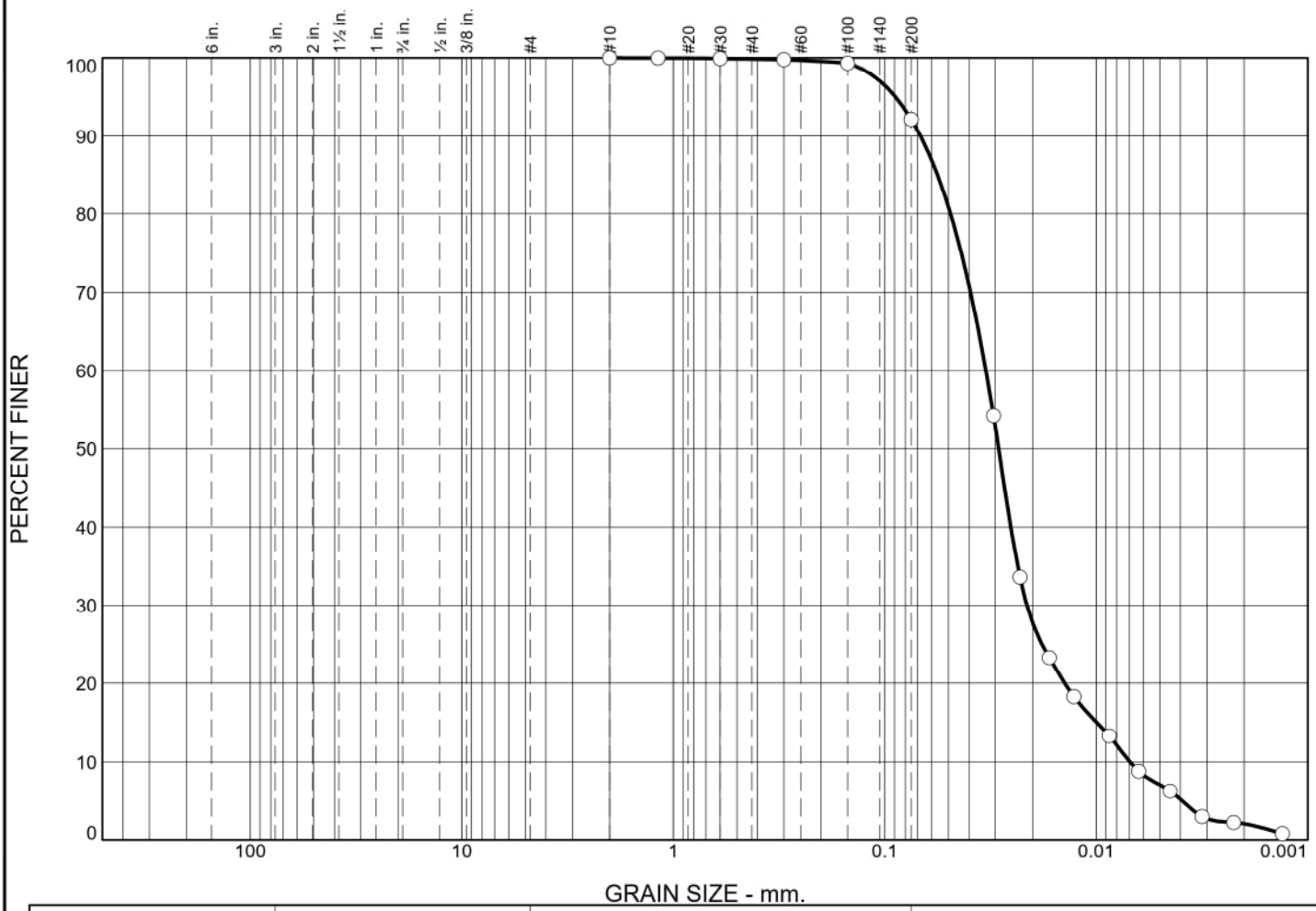
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.4	8.3	8.7	83.6	7.7	91.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0039	0.0063	0.0085	0.0106	0.0139	0.0174	0.0217	0.0262	0.0430	0.0525	0.0687	0.1004

Fineness Modulus	C_u	C_c
0.03	4.19	1.18

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.2	7.7	85.0	7.1

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0563	0.0332	0.0289	0.0213	0.0099	0.0069	1.97	4.79

	Material Description	USCS	AASHTO
○	SILT	ML	--

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B115 **Depth:** 66 - 68 ft **Sample Number:** S27

Remarks:

○ As Rec'd WC = 76.3%
SLUICED ASH

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400 Unicorn Park Drive
Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** NM

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 66 - 68 ft
Sample Number: S27
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: --
Burmister: Si, t.fS
Testing Remarks: As Rec'd WC = 76.3%
SLUICED ASH
Tested by: WGL
Checked by: NM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
41.12	0.00	183.43	#10	183.43	100.0
			#16	183.44	100.0
			#30	183.47	99.9
			#50	183.52	99.8
			#100	183.71	99.3
			#200	186.67	92.1

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =41.12
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.8	1.0177	1.0142	0.0128	18.4	11.4	0.0306	54.2
4.00	22.8	1.0123	1.0088	0.0128	13.0	12.9	0.0230	33.6
8.00	22.8	1.0096	1.0061	0.0128	10.3	13.6	0.0167	23.3
14.00	22.8	1.0083	1.0048	0.0128	9.0	13.9	0.0128	18.3
31.00	22.8	1.0070	1.0035	0.0128	7.7	14.3	0.0087	13.3
60.00	22.9	1.0058	1.0023	0.0128	6.5	14.6	0.0063	8.8
120.00	23.1	1.0051	1.0016	0.0128	5.8	14.8	0.0045	6.3
240.00	23.9	1.0041	1.0008	0.0126	4.8	15.0	0.0032	3.0
480.00	23.9	1.0039	1.0006	0.0126	4.6	15.1	0.0022	2.2
1440.00	22.3	1.0038	1.0002	0.0129	4.5	15.1	0.0013	0.8

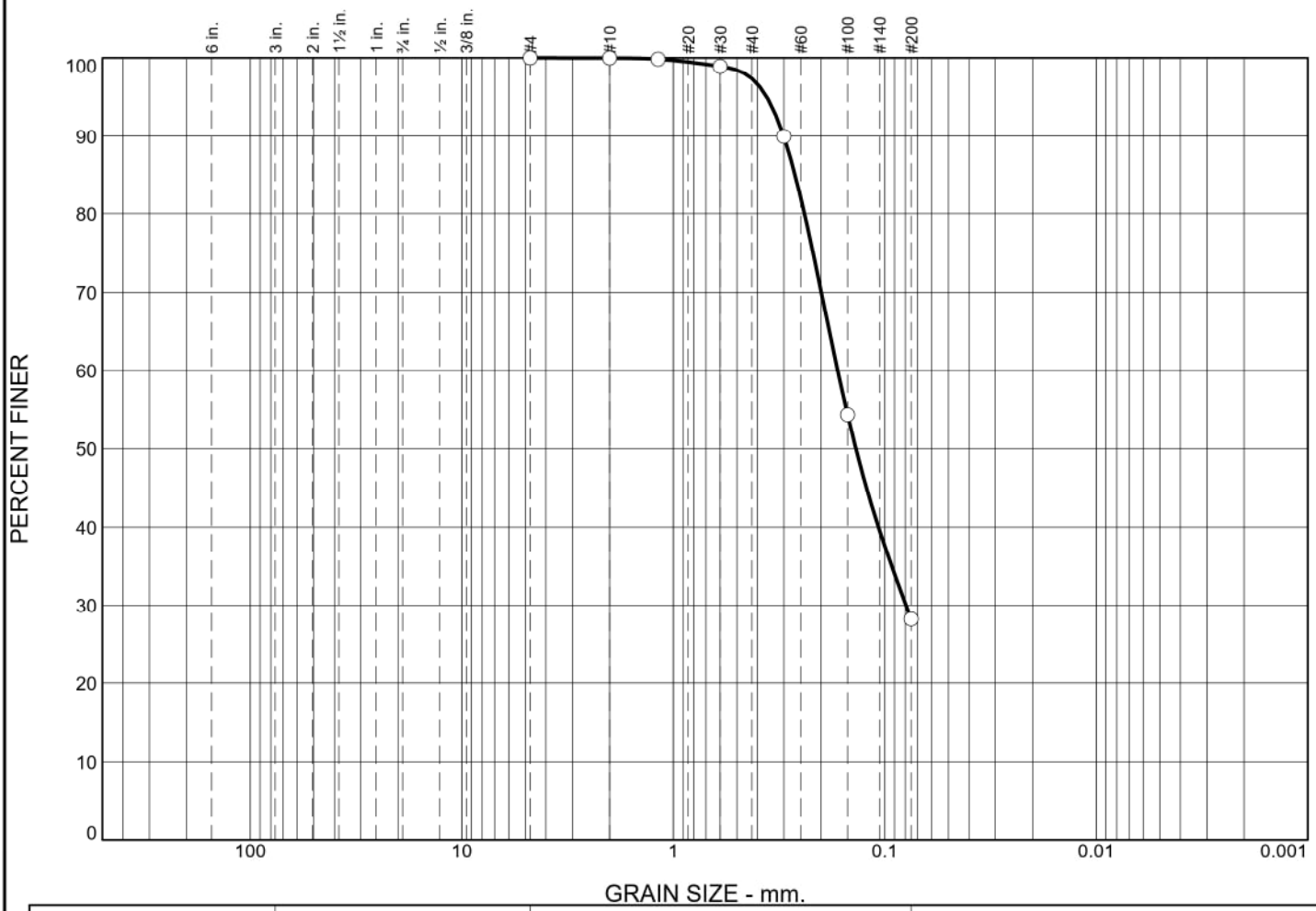
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.2	7.7	7.9	85.0	7.1	92.1

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0039	0.0069	0.0099	0.0141	0.0213	0.0254	0.0289	0.0332	0.0488	0.0563	0.0678	0.0890

Fineness Modulus	C_u	C_c
0.01	4.79	1.97

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	2.7	69.1	28.2

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	24	22	0.2657	0.1671	0.1370	0.0794				

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B115 **Depth:** 79 - 81 ft **Sample Number:** S33

Remarks:

○ As Rec'd WC = 27.0%

Clayey Alluvium

GEI Consultants, Inc.
400 Unicorn Park Drive
Woburn, MA 01801

GEI Consultants

Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 79 - 81 ft
Sample Number: S33
Material Description: Silty SAND
Liquid Limit: 24
Plastic Limit: 22
USCS Classification: SM
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 27.0%
Clayey Alluvium
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
194.91	0.00	191.79	#4	191.79	100.0
			#10	191.84	100.0
			#16	192.12	99.8
			#30	193.91	98.9
			#50	211.41	89.9
			#100	280.79	54.3
			#200	331.72	28.2

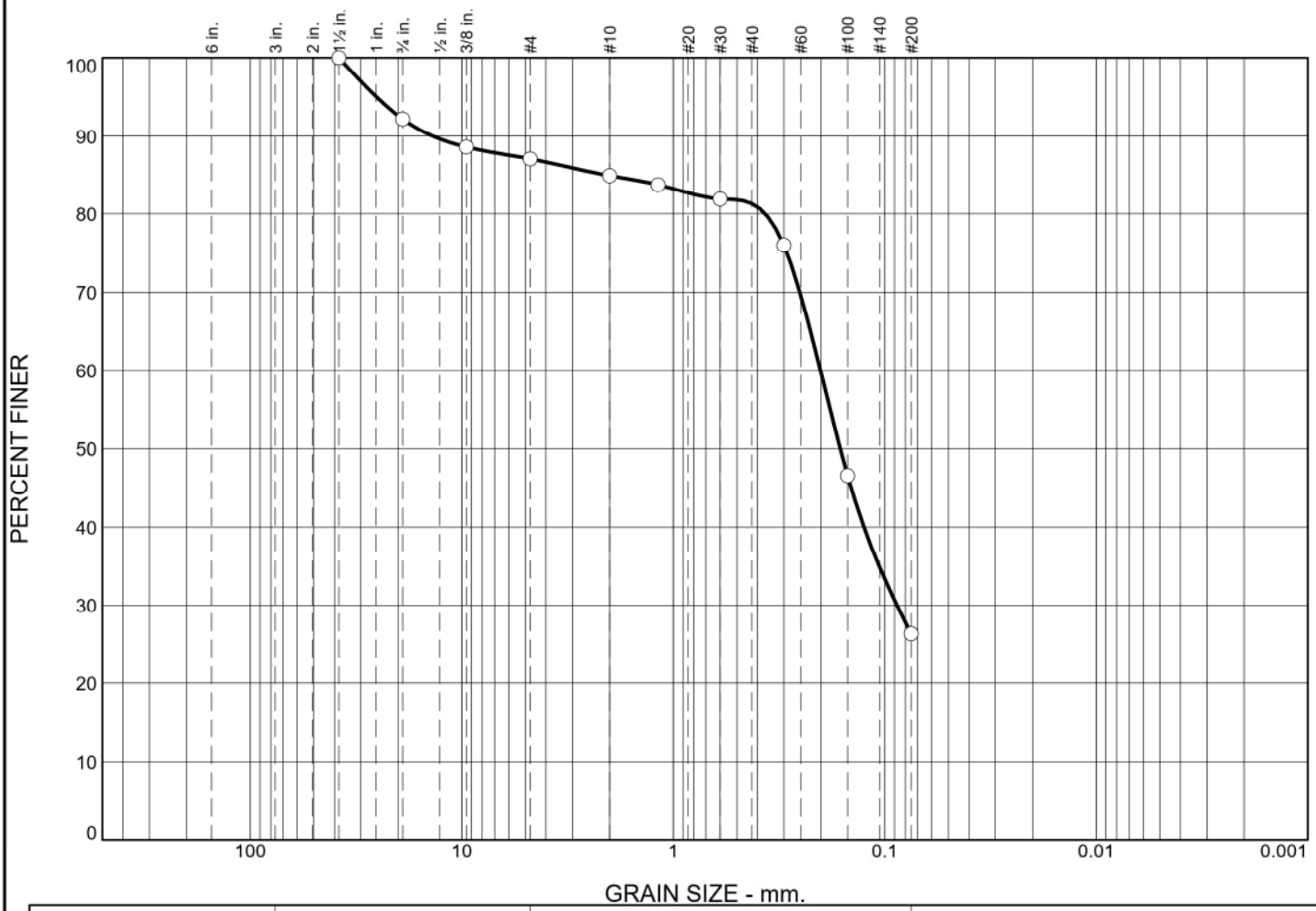
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	0.0	0.0	0.0	2.7	69.1	71.8	28.2

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0794	0.1071	0.1370	0.1671	0.2397	0.2657	0.3006	0.3618

Fineness Modulus
0.57

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	7.8	5.2	2.1	3.6	55.0	26.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	2.1064	0.2014	0.1624	0.0876				

Material Description	USCS	AASHTO
○ Silty SAND	SM	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B115 **Depth:** 83 - 85 ft **Sample Number:** S35

Remarks:

○ As Rec'd WC = 20.1%

Sandy Alluvium

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 83 - 85 ft
Sample Number: S35
Material Description: Silty SAND
Liquid Limit: -
Plastic Limit: -
USCS Classification: SM
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 20.1%
Sandy Alluvium
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
238.04	0.00	203.83	1.5	203.83	100.0
			3/4	222.49	92.2
			3/8	231.04	88.6
			#4	234.67	87.0
			#10	239.81	84.9
			#16	242.57	83.7
			#30	246.90	81.9
			#50	261.01	76.0
			#100	330.94	46.6
			#200	379.20	26.3

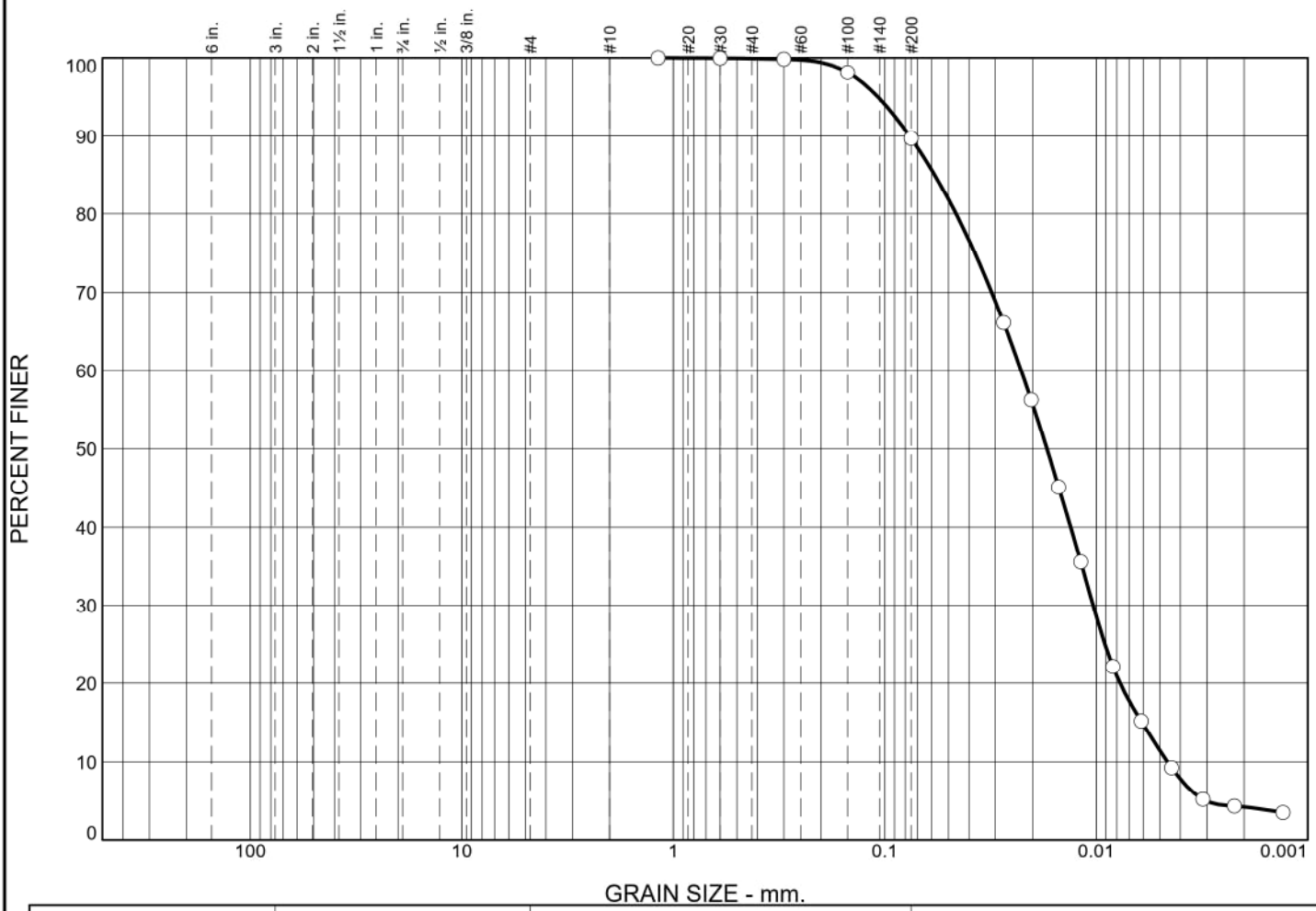
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	7.8	5.2	13.0	2.1	3.6	55.0	60.7	26.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0876	0.1254	0.1624	0.2014	0.3678	2.1064	13.7982	25.3189

Fineness Modulus
1.59

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.1	10.2	78.3	11.4

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0581	0.0227	0.0171	0.0104	0.0061	0.0046	1.03	4.92

	Material Description	USCS	AASHTO
○	SILT	ML	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B116 **Depth:** 10 - 12 ft **Sample Number:** S6

Remarks:

○ As Rec'd WC = 21.8%
DRY STACKED ASH

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** NM

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B116
Depth: 10 - 12 ft
Sample Number: S6
Material Description: SILT
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: A-4(0)
Burmister: Si, l.fS
Testing Remarks: As Rec'd WC = 21.8%
DRY STACKED ASH
Tested by: WGL
Checked by: NM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
53.90	0.00	217.45	#16	217.45	100.0
			#30	217.47	100.0
			#50	217.54	99.8
			#100	218.45	98.1
			#200	223.01	89.7

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =53.9
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.8	1.0262	1.0227	0.0128	26.9	9.2	0.0274	66.1
4.00	22.8	1.0228	1.0193	0.0128	23.5	10.1	0.0203	56.2
8.00	22.8	1.0190	1.0155	0.0128	19.7	11.1	0.0151	45.2
14.00	22.8	1.0157	1.0122	0.0128	16.4	12.0	0.0118	35.5
31.00	22.8	1.0111	1.0076	0.0128	11.8	13.2	0.0083	22.1
60.00	23.0	1.0087	1.0052	0.0128	9.4	13.8	0.0061	15.2
120.00	23.3	1.0066	1.0032	0.0127	7.3	14.4	0.0044	9.2
240.00	23.9	1.0051	1.0018	0.0126	5.8	14.8	0.0031	5.2
480.00	23.9	1.0048	1.0015	0.0126	5.5	14.8	0.0022	4.3
1440.00	22.2	1.0048	1.0012	0.0129	5.5	14.8	0.0013	3.5

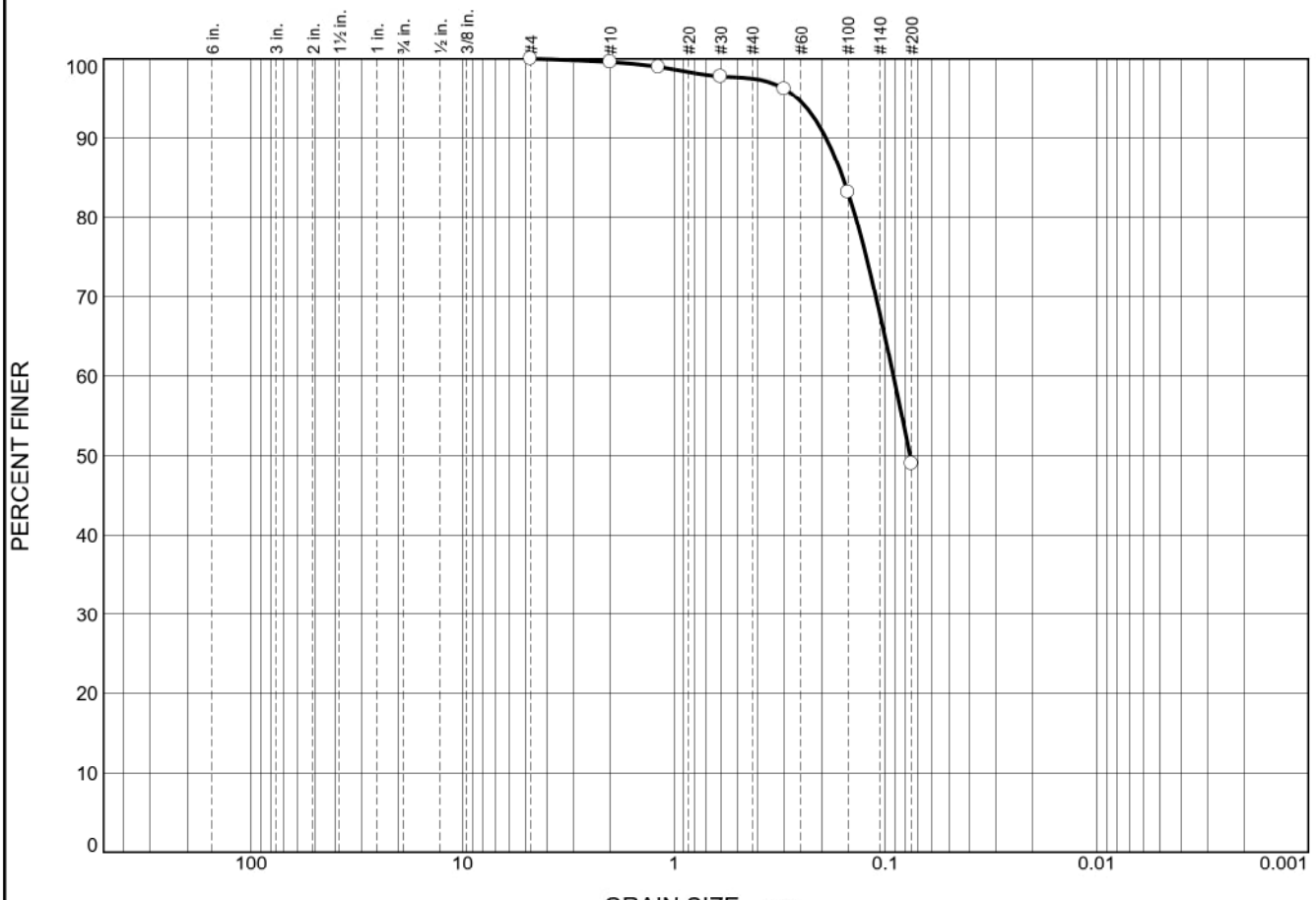
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.1	10.2	10.3	78.3	11.4	89.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0030	0.0046	0.0061	0.0077	0.0104	0.0132	0.0171	0.0227	0.0460	0.0581	0.0764	0.1078

Fineness Modulus	C_u	C_c
0.02	4.92	1.03

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.4	2.1	48.5	49.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.1587	0.0914	0.0763					

Material Description	USCS	AASHTO
○ SILTY SAND	SM	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B116 **Depth:** 50-52 ft **Sample Number:** S26

Remarks:

○Sand-like Alluvium
As Rec'd WC = 25.5%

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Woburn, MA 01801

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B116
Depth: 50-52 ft
Sample Number: S26
Material Description: SILTY SAND
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: SM
AASHTO Classification: A-4(0)
Testing Remarks: As Rec'd WC = 25.5%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 253.22
Tare Wt. = 191.78
Minus #200 from wash = 41.6%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
296.90	191.78	191.78	#4	191.80	100.0
			#10	192.24	99.6
			#16	192.87	99.0
			#30	194.13	97.8
			#50	195.77	96.2
			#100	209.54	83.1
			#200	245.39	49.0

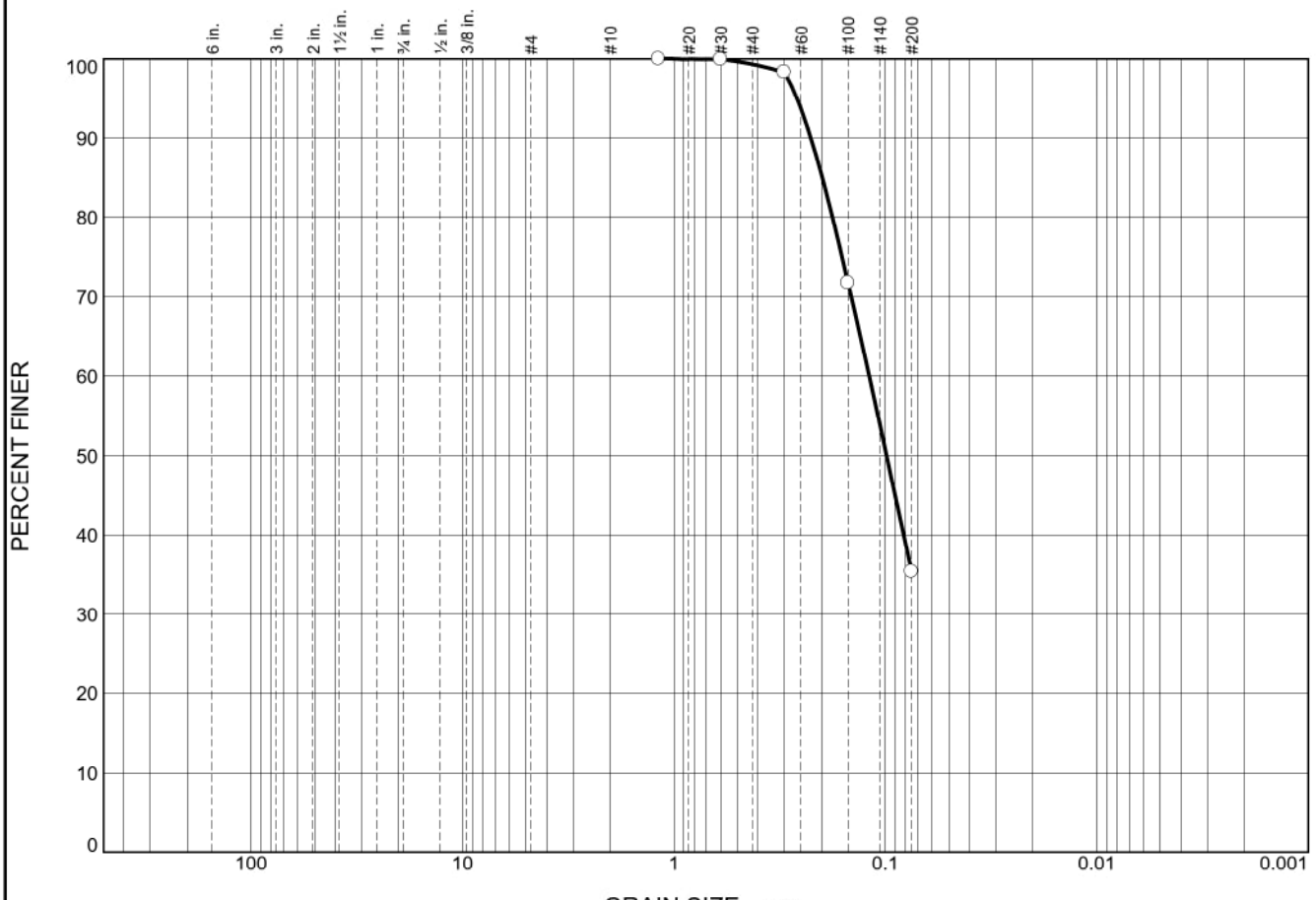
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
				0.4	2.1	48.5	51.0			49.0

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0763	0.0914	0.1381	0.1587	0.1908	0.2606

Fineness Modulus
0.24

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○						64.0	35.3	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.1987	0.1191	0.0986					

Material Description	USCS	AASHTO
○ SILTY SAND	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B117 **Depth:** 58 - 60 ft **Sample Number:** S30

Remarks:

○Sand-like Alluvium

As Rec'd WC = 21.2%

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B117
Depth: 58 - 60 ft **Sample Number:** S30
Material Description: SILTY SAND
USCS Classification: SM
Testing Remarks: Sand-like Alluvium
As Rec'd WC = 21.2%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 289.86
Tare Wt. = 230.62
Minus #200 from wash = 30.4%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
315.72	230.61	230.61	#16	230.62	100.0
			#30	230.68	99.9
			#50	232.08	98.3
			#100	254.64	71.8
			#200	285.64	35.3

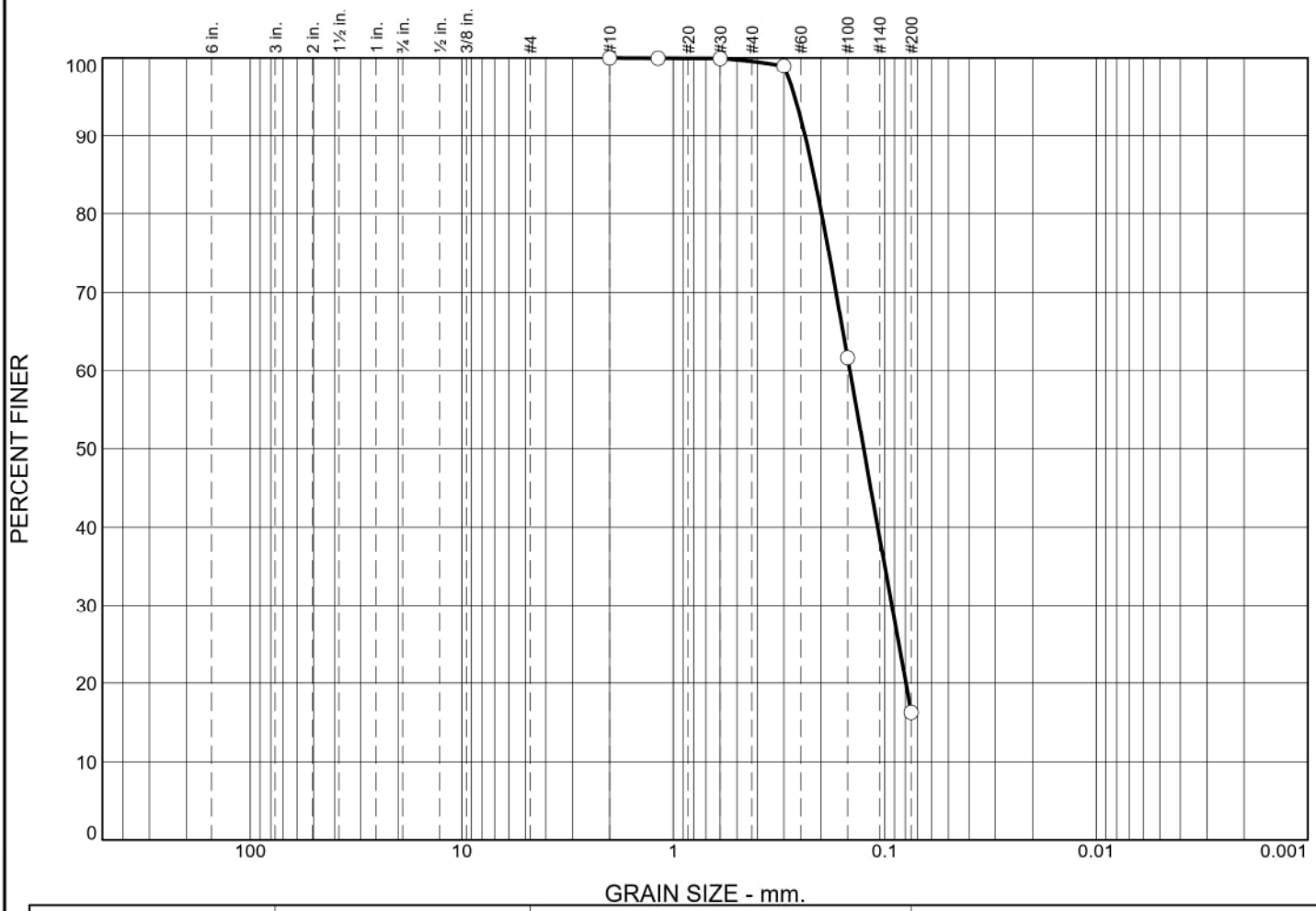
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
						64.0				35.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
					0.0818	0.0986	0.1191	0.1778	0.1987	0.2250	0.2616

Fineness Modulus
0.30

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.0	0.4	83.3	16.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	-	-	0.2166	0.1463	0.1258	0.0926				

	Material Description	USCS	AASHTO
○	Silty SAND	SM	-

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source:** B118 **Depth:** 20 - 22 ft **Sample No.:** S11 (4 - 21 in)

Remarks:

○ As Rec'd WC = 3.9%

Coarser gray layer of Sluiced ASH

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B118
Depth: 20 - 22 ft
Sample Number: S11 (4 - 21 in)
Material Description: Silty SAND
Liquid Limit: -
Plastic Limit: -
USCS Classification: SM
AASHTO Classification: -
Testing Remarks: As Rec'd WC = 3.9%
Coarser gray layer of Sluiced ASH
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
30.00	0.00	362.98	#10	362.98	100.0
			#16	362.99	100.0
			#30	363.00	99.9
			#50	363.29	99.0
			#100	374.48	61.7
			#200	388.08	16.3

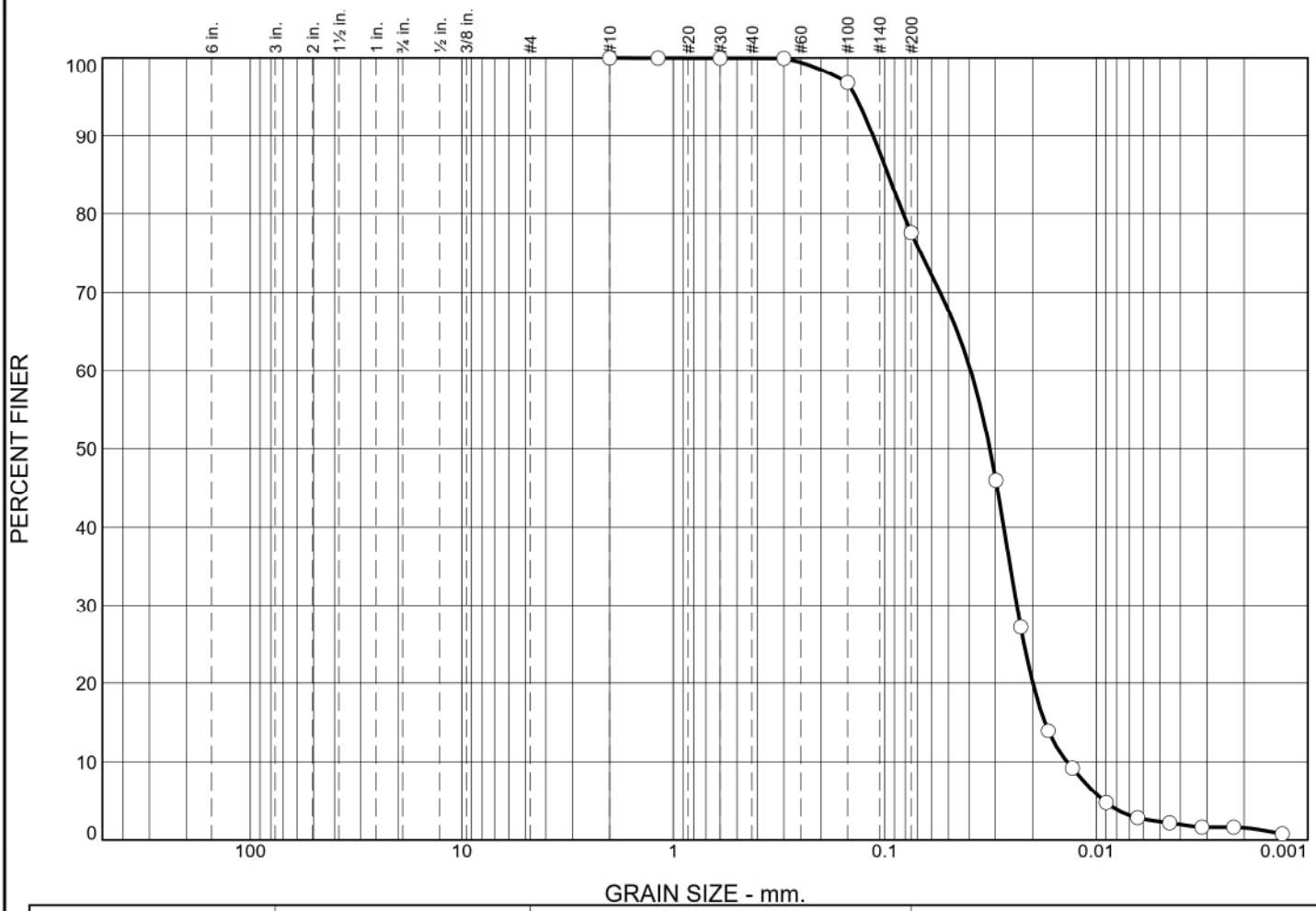
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	0.0	0.0	0.0	0.4	83.3	83.7	16.3

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0794	0.0926	0.1080	0.1258	0.1463	0.1989	0.2166	0.2380	0.2661

Fineness Modulus
0.39

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	0.0	22.4	75.3	2.3

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.0963	0.0393	0.0319	0.0238	0.0175	0.0137	1.05	2.86

Material Description	USCS	AASHTO
○ SILT with Sand	ML	A-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B118 **Depth:** 26 - 28 ft **Sample Number:** S14

Remarks:

○ As Rec'd WC = 18.8%

SLUICED ASH

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** NM

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B118
Depth: 26 - 28 ft
Sample Number: S14
Material Description: SILT with Sand
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: ML
AASHTO Classification: A-4(0)
Burmister: Si, s.fS
Testing Remarks: As Rec'd WC = 18.8%
SLUICED ASH
Tested by: WGL
Checked by: NM

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
55.90	0.00	190.54	#10	190.54	100.0
			#16	190.55	100.0
			#30	190.56	100.0
			#50	190.57	99.9
			#100	192.32	96.8
			#200	203.07	77.6

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100.0
Weight of hydrometer sample =55.9
Automatic temperature correction
Composite correction (fluid density and meniscus height) at 20 deg. C = -3.89
Meniscus correction only = 0.7
Specific gravity of solids = 2.75
Hydrometer type = 151H
Hydrometer effective depth equation: L = 16.294964 - 0.2645 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	22.7	1.0199	1.0164	0.0128	20.6	10.8	0.0299	46.0
4.00	22.7	1.0132	1.0097	0.0128	13.9	12.6	0.0228	27.2
8.00	22.7	1.0085	1.0050	0.0128	9.2	13.9	0.0169	14.0
14.00	22.7	1.0068	1.0033	0.0128	7.5	14.3	0.0130	9.2
30.00	22.8	1.0052	1.0017	0.0128	5.9	14.7	0.0090	4.7
60.00	22.9	1.0045	1.0010	0.0128	5.2	14.9	0.0064	2.8
120.00	23.3	1.0042	1.0008	0.0127	4.9	15.0	0.0045	2.2
240.00	23.9	1.0039	1.0006	0.0126	4.6	15.1	0.0032	1.6
480.00	23.9	1.0039	1.0006	0.0126	4.6	15.1	0.0022	1.6
1440.00	22.1	1.0039	1.0003	0.0129	4.6	15.1	0.0013	0.8

Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.0	0.0	22.4	22.4	75.3	2.3	77.6

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
0.0092	0.0137	0.0175	0.0199	0.0238	0.0274	0.0319	0.0393	0.0817	0.0963	0.1135	0.1372

Fineness Modulus	C_u	C_c
0.03	2.86	1.05

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.1	6.3	58.7	34.9

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	NV	NP	0.2950	0.1566	0.1199					

	Material Description	USCS	AASHTO
○	Silty SAND	SM	A-2-4(0)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B118 **Depth:** 52 - 54 ft **Sample Number:** S25

Remarks:

○ As Rec'd WC = 23.0%

Sandy Alluvium

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Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B118
Depth: 52 - 54 ft
Sample Number: S25
Material Description: Silty SAND
Liquid Limit: NV
Plastic Limit: NP
USCS Classification: SM
AASHTO Classification: A-2-4(0)
Testing Remarks: As Rec'd WC = 23.0%
Sandy Alluvium
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
145.79	0.00	380.82	#4	380.82	100.0
			#10	380.91	99.9
			#16	381.31	99.7
			#30	384.41	97.5
			#50	401.92	85.5
			#100	441.65	58.3
			#200	475.72	34.9

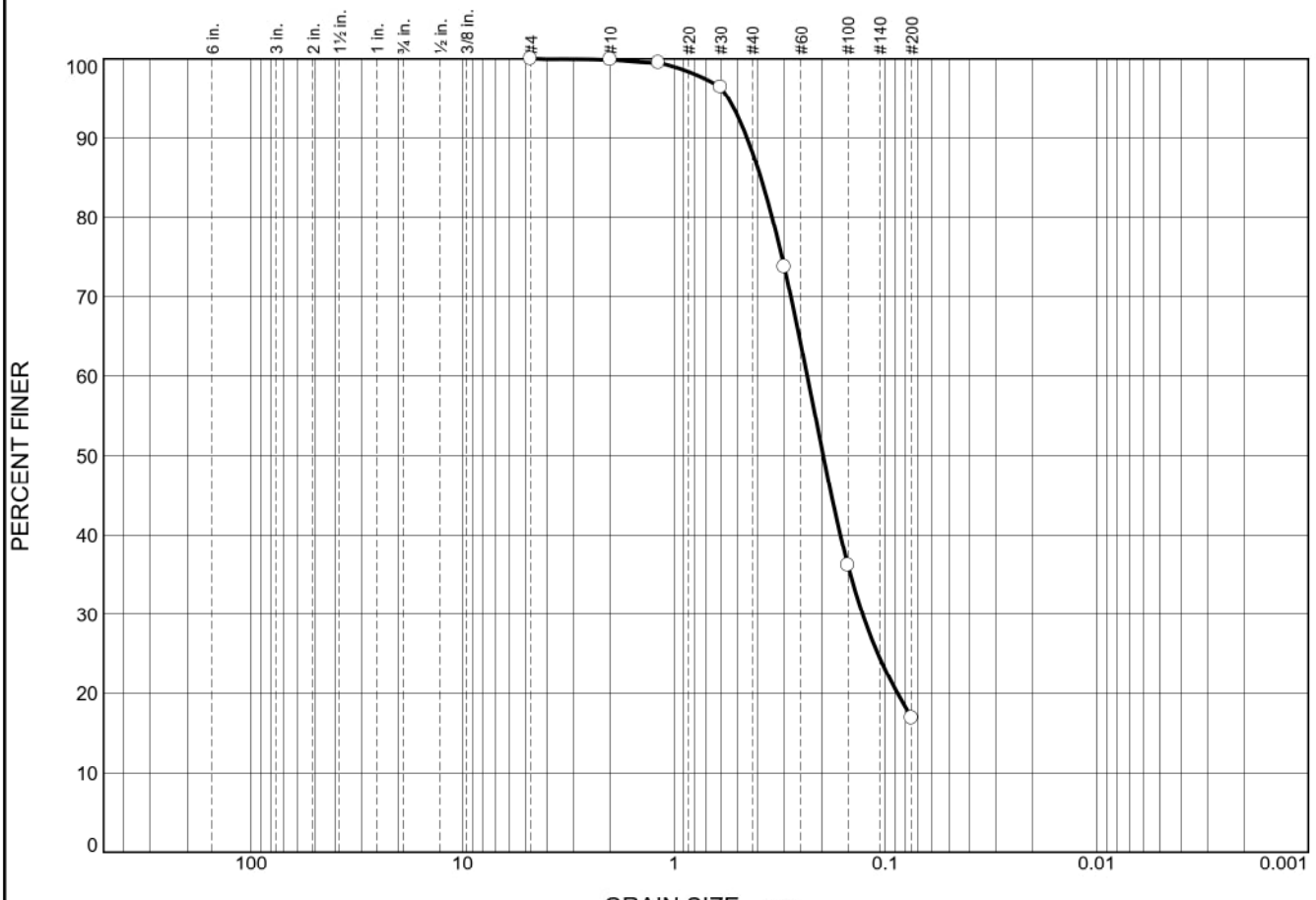
Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	0.0	0.0	0.1	6.3	58.7	65.1	34.9

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
					0.0884	0.1199	0.1566	0.2553	0.2950	0.3542	0.4675

Fineness Modulus
0.59

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.1	11.7	71.3	16.9	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3880	0.2339	0.1966	0.1282				

Material Description	USCS	AASHTO
○ SILTY SAND	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source:** B118 **Depth:** 54 - 56 ft **Sample No.:** S26 (Jar 4/4)

Remarks:

○Sand-like Alluvium

As Rec'd WC = 23.9%

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B118
Depth: 54 - 56 ft
Sample Number: S26 (Jar 4/4)
Material Description: SILTY SAND
Testing Remarks: Sand-like Alluvium
As Rec'd WC = 23.9%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 308.49
Tare Wt. = 229.80
Minus #200 from wash = 15.7%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
323.15	229.80	229.80	#4	229.81	100.0
			#10	229.92	99.9
			#16	230.29	99.5
			#30	233.14	96.4
			#50	254.33	73.7
			#100	289.45	36.1
			#200	307.35	16.9

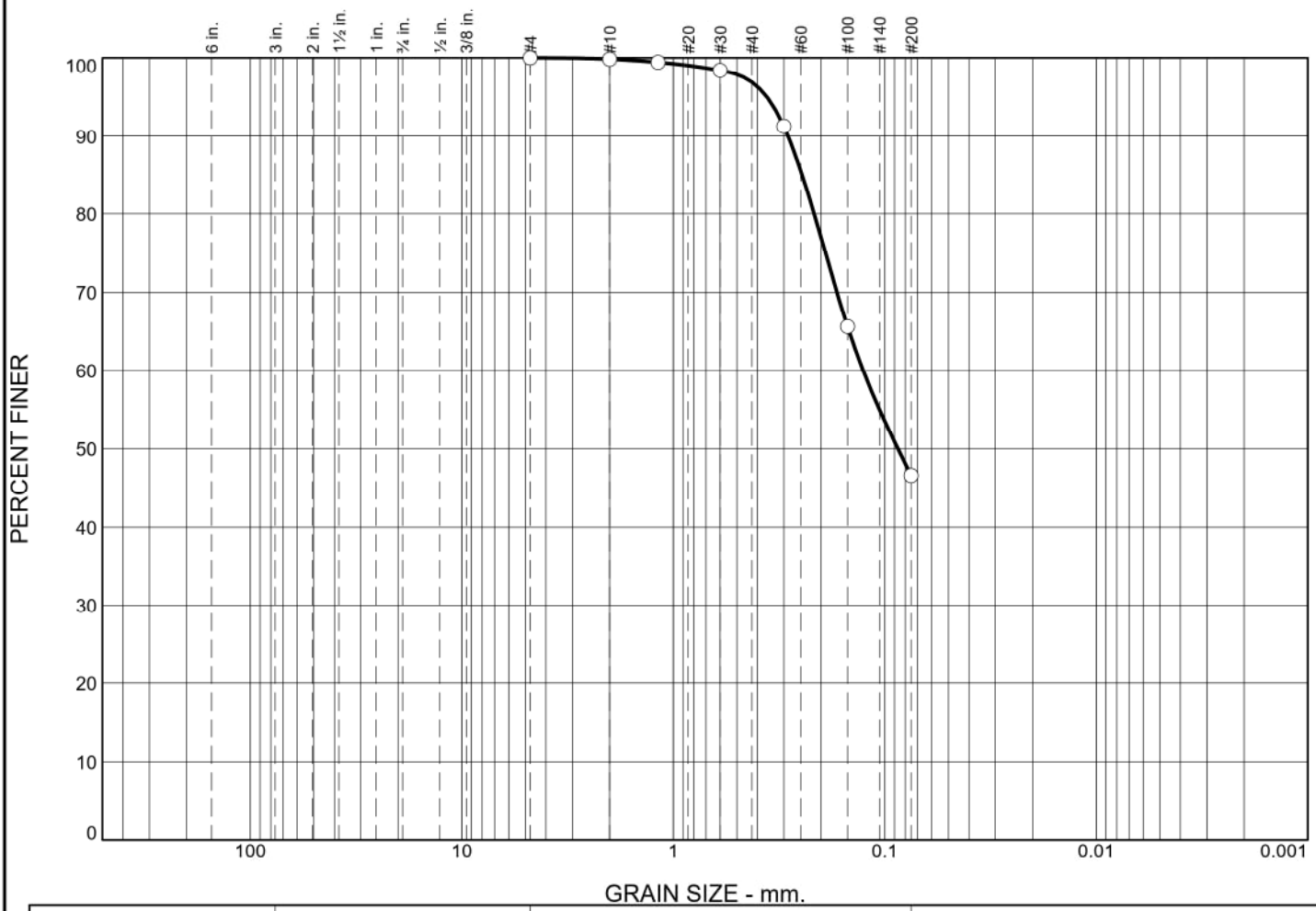
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
				0.1	11.7	71.3	83.1			16.9

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0875	0.1282	0.1631	0.1966	0.2339	0.3428	0.3880	0.4505	0.5526

Fineness Modulus
0.94

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.2	2.9	50.3	46.6	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	28	15	0.2461	0.1265	0.0867					

Material Description	USCS	AASHTO
○ Clayey SAND	SC	A-6(3)

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B120 **Depth:** 60 - 62 ft **Sample Number:** S26

Remarks:

○ As Rec'd WC = 17.3%

Clay Dike

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Woburn, MA 01801

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Figure

Tested By: WGL **Checked By:** EF

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B120
Depth: 60 - 62 ft
Sample Number: S26
Material Description: Clayey SAND
Liquid Limit: 28
Plastic Limit: 15
USCS Classification: SC
AASHTO Classification: A-6(3)
Testing Remarks: As Rec'd WC = 17.3%
Clay Dike
Tested by: WGL
Checked by: EF

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
105.39	0.00	203.84	#4	203.84	100.0
			#10	204.01	99.8
			#16	204.44	99.4
			#30	205.53	98.4
			#50	213.07	91.2
			#100	240.06	65.6
			#200	260.10	46.6

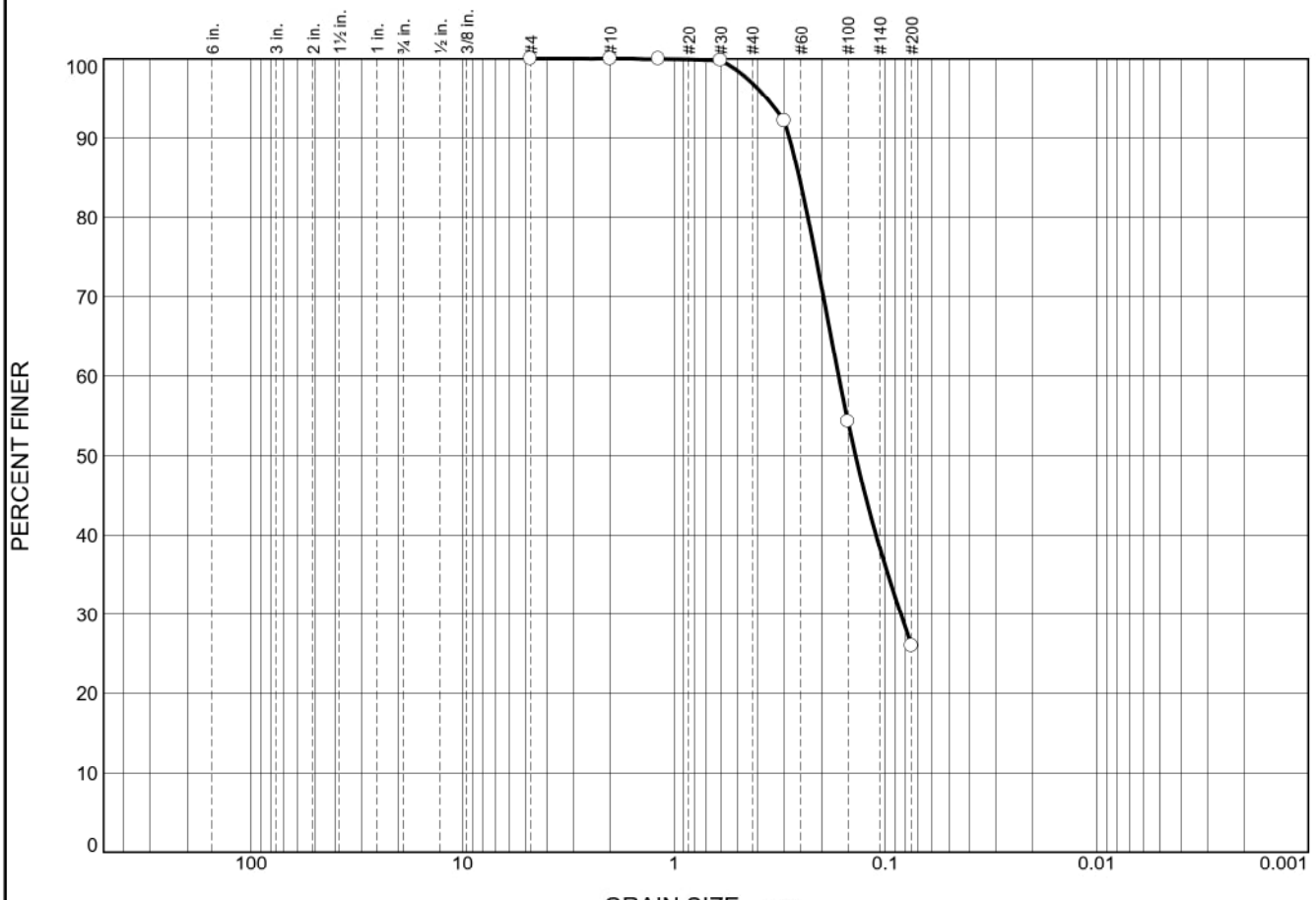
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	0.0	0.0	0.2	2.9	50.3	53.4			46.6

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0867	0.1265	0.2158	0.2461	0.2867	0.3610

Fineness Modulus
0.45

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○				0.0	3.1	70.9	26.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.2549	0.1662	0.1383	0.0844				

Material Description	USCS	AASHTO
○ SILTY SAND	SM	

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B120 **Depth:** 80 - 82 ft **Sample Number:** S36

Remarks:

○Sand-like Alluvium

As Rec'd WC = 25.3%

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Figure

Tested By: WGL

GRAIN SIZE DISTRIBUTION TEST DATA

2/20/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B120
Depth: 80 - 82 ft
Sample Number: S36
Material Description: SILTY SAND
USCS Classification: SM
Testing Remarks: Sand-like Alluvium
As Rec'd WC = 25.3%
Tested by: WGL

Sieve Test Data

Post #200 Wash Test Weights (grams): **Dry Sample and Tare =** 281.48
Tare Wt. = 191.79
Minus #200 from wash = 21.7%

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
306.35	191.78	191.78	#4	191.79	100.0
			#10	191.80	100.0
			#16	191.83	100.0
			#30	192.05	99.8
			#50	200.79	92.1
			#100	244.25	54.2
			#200	276.60	26.0

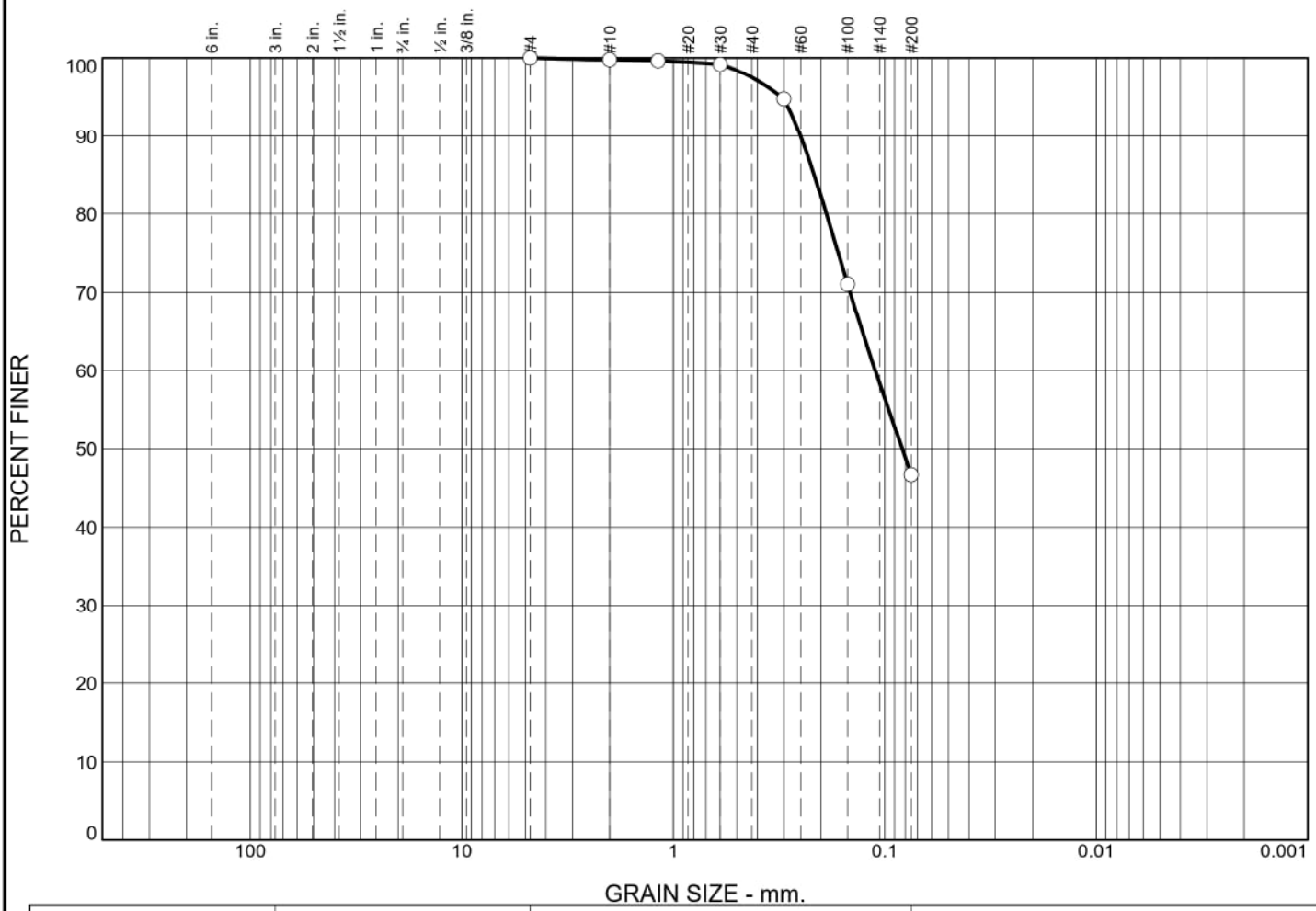
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
				0.0	3.1	70.9	74.0			26.0

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
				0.0844	0.1106	0.1383	0.1662	0.2322	0.2549	0.2839	0.3634

Fineness Modulus
0.54

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines
		Coarse	Fine	Coarse	Medium	Fine	
○	0.0	0.0	0.0	0.2	2.3	50.8	46.7

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	27	17	0.2157	0.1109	0.0827					

	Material Description	USCS	AASHTO
○	Clayey SAND	SC	--

Project No. 1700685 **Client:** American Electric Power

Project: Glen Lyn Seismic Stability Evaluation

○ **Source of Sample:** B122 **Depth:** 57 - 59 ft **Sample Number:** S15

Remarks:

○ As Rec'd WC = 18.4%
Clayey Alluvium

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Figure

Tested By: WGL **Checked By:** DJA

GRAIN SIZE DISTRIBUTION TEST DATA

1/19/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B122
Depth: 57 - 59 ft
Sample Number: S15
Material Description: Clayey SAND
Liquid Limit: 27
Plastic Limit: 17
USCS Classification: SC
AASHTO Classification: --
Testing Remarks: As Rec'd WC = 18.4%
Clayey Alluvium
Tested by: WGL
Checked by: DJA

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
116.66	0.00	364.77	#4	364.77	100.0
			#10	365.03	99.8
			#16	365.18	99.6
			#30	365.72	99.2
			#50	370.90	94.7
			#100	398.57	71.0
			#200	426.92	46.7

Fractional Components

Cobbles	Gravel			Sand				Fines
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	
0.0	0.0	0.0	0.0	0.2	2.3	50.8	53.3	46.7

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
						0.0827	0.1109	0.1888	0.2157	0.2502	0.3084

Fineness Modulus
0.36

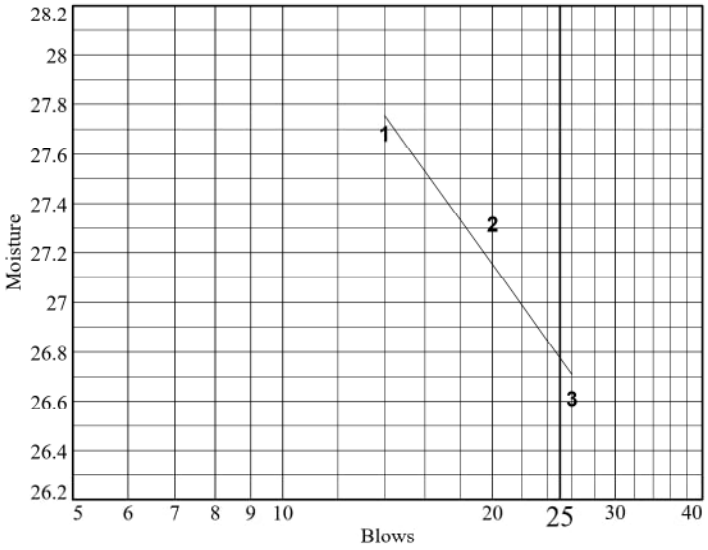
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B101
Depth: 15 - 17 ft **Sample Number:** S7
Material Description: LEAN CLAY/SILT
USCS: CL-ML
Tested by: NM **Checked by:** EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.02	24.16	25.53			
Dry+Tare	20.52	21.42	22.56			
Tare	11.49	11.39	11.40			
# Blows	14	20	26			
Moisture	27.7	27.3	26.6			



Liquid Limit= 27
Plastic Limit= 21
Plasticity Index= 6
Natural Moisture= 17.4
Liquidity Index= -0.6

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	28.80	29.01			
Dry+Tare	27.61	27.72			
Tare	21.82	21.49			
Moisture	20.6	20.7			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
40.87	36.58	11.94	17.4

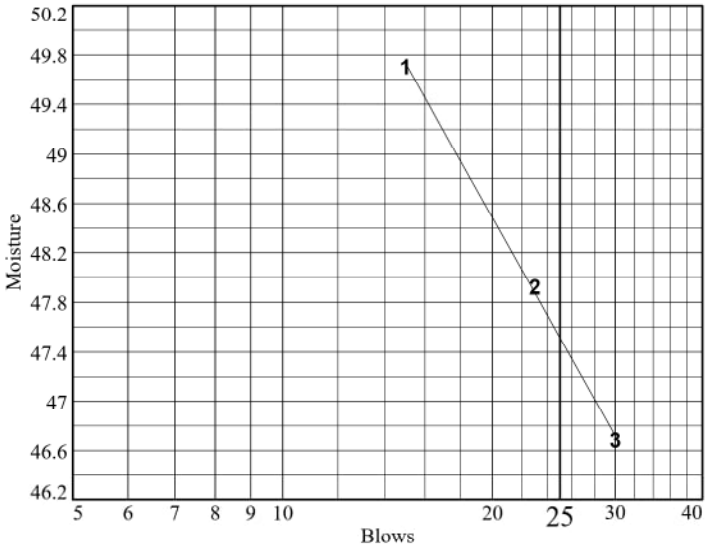
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B101
Depth: 44.5 - 46.5 ft **Sample Number:** S19
Material Description: LEAN CLAY
USCS: CL
Tested by: NM **Checked by:** EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	24.37	26.40	29.14			
Dry+Tare	20.06	21.54	23.50			
Tare	11.39	11.40	11.42			
# Blows	15	23	30			
Moisture	49.7	47.9	46.7			



Liquid Limit= 48
Plastic Limit= 21
Plasticity Index= 27
Natural Moisture= 23.4
Liquidity Index= 0.1

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.08	18.40			
Dry+Tare	16.92	17.18			
Tare	11.30	11.41			
Moisture	20.6	21.1			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
43.17	39.09	21.63	23.4

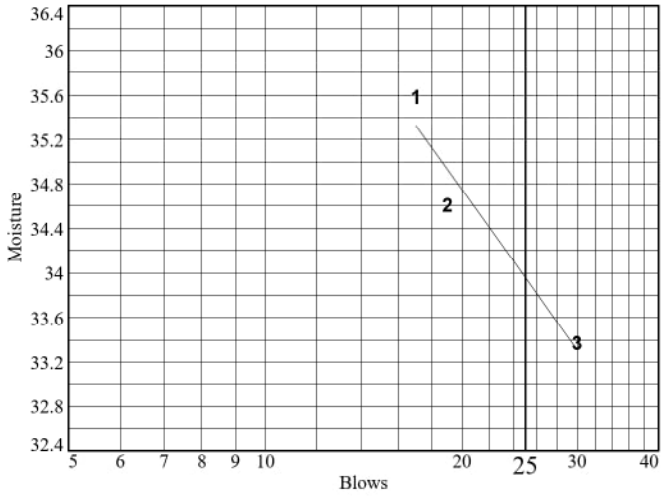
LIQUID AND PLASTIC LIMIT TEST DATA

3/1/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B101U
Depth: 56 ft
Sample Number: U3
Material Description: LEAN CLAY
USCS: CL
AASHTO: -
Tested by: EF/AH
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.43	26.13	28.18			
Dry+Tare	20.27	22.34	22.84			
Tare	11.39	11.39	6.84			
# Blows	17	19	30			
Moisture	35.6	34.6	33.4			



Liquid Limit= 34
Plastic Limit= 20
Plasticity Index= 14
Natural Moisture= 28.1
Liquidity Index= 0.6

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.72	17.78			
Dry+Tare	16.65	16.71			
Tare	11.3	11.32			
Moisture	20.0	19.9			

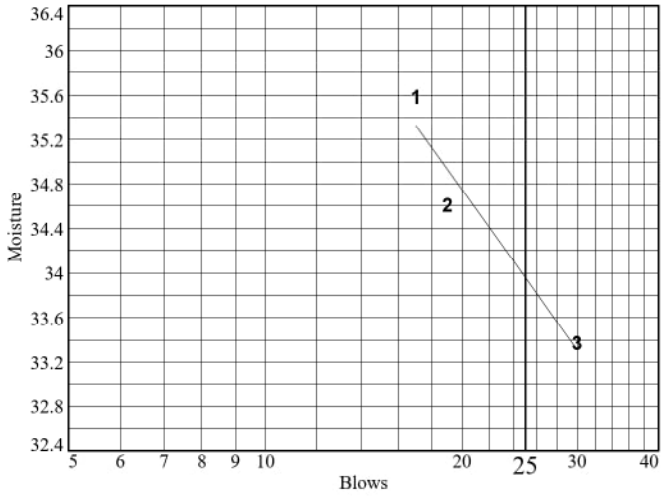
LIQUID AND PLASTIC LIMIT TEST DATA

3/1/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B101U
Depth: 56 ft
Sample Number: U3
Material Description: LEAN CLAY
USCS: CL
AASHTO: -
Tested by: EF/AH
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.43	26.13	28.18			
Dry+Tare	20.27	22.34	22.84			
Tare	11.39	11.39	6.84			
# Blows	17	19	30			
Moisture	35.6	34.6	33.4			



Liquid Limit= 34
Plastic Limit= 20
Plasticity Index= 14
Natural Moisture= 28.1
Liquidity Index= 0.6

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.72	17.78			
Dry+Tare	16.65	16.71			
Tare	11.3	11.32			
Moisture	20.0	19.9			

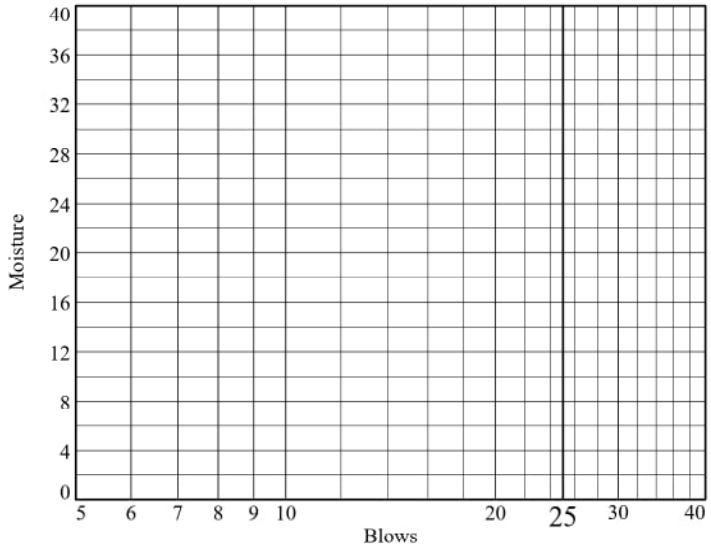
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B102
Depth: 26.5-28.4 ft
Sample Number: S12 (6-18 in)
Material Description: Sandy SILT
USCS: ML
AASHTO: A-4(0)
Tested by: MP
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 35.7

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
50.84	43.17	21.66	35.7

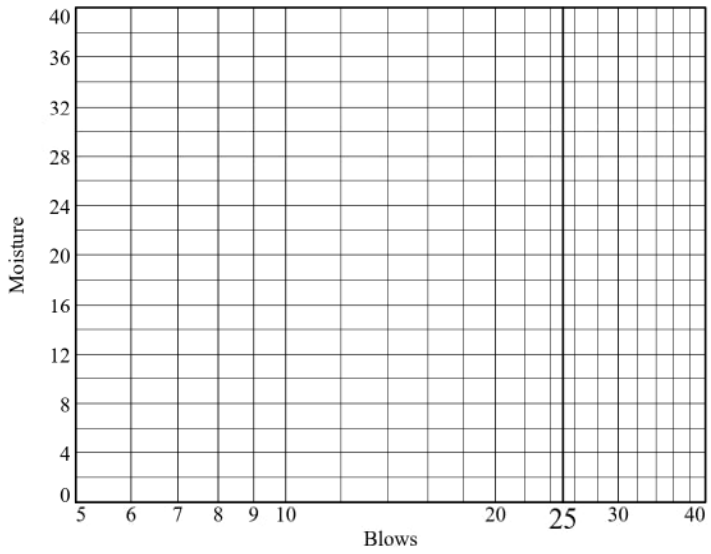
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B103
Depth: 34 - 38.2 ft
Sample Number: S11
Material Description: SILT
USCS: ML
AASHTO: A-4(0)
Burmister: Si, t.fS
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 52.4

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
50.45	40.47	21.41	52.4

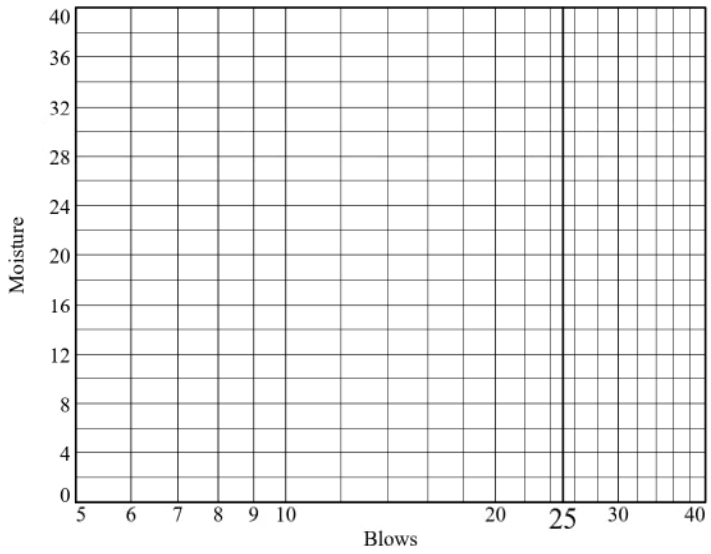
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B105
Depth: 42.5 - 45 ft
Sample Number: S16
Material Description: SILT
USCS: ML
AASHTO: -
Burmister: Si, t.fS
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 74.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
57.8	46.66	31.65	74.2

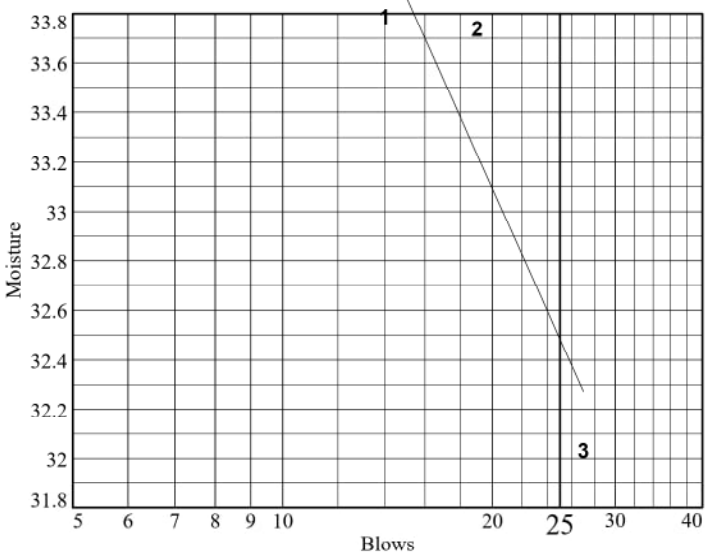
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B105
Depth: 53-55 ft
Sample Number: S21 (6-14 in)
Material Description: Clayey SAND with Gravel
USCS: SC
AASHTO: A-2-6(1)
Tested by: WGL/NEM
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	24.81	36.7	36.19			
Dry+Tare	21.36	32.84	32.57			
Tare	11.15	21.4	21.27			
# Blows	14	19	27			
Moisture	33.8	33.7	32.0			



Liquid Limit= 32
Plastic Limit= 18
Plasticity Index= 14
Natural Moisture= 23.0
Liquidity Index= 0.4

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	27.78	27.6			
Dry+Tare	26.83	26.7			
Tare	21.56	21.55			
Moisture	18.0	17.5			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
48.81	43.66	21.29	23.0

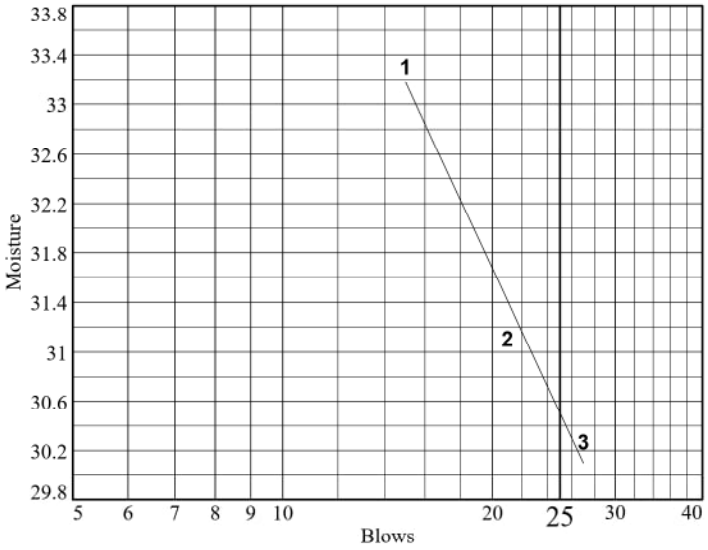
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B106
Depth: 59 - 61 ft
Sample Number: S26
Material Description: Clayey SAND with Gravel
USCS: SC
AASHTO: A-2-6(0)
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	29.04	26.96	30.01			
Dry+Tare	24.74	23.27	25.69			
Tare	11.83	11.41	11.42			
# Blows	15	21	27			
Moisture	33.3	31.1	30.3			



Liquid Limit= 31
Plastic Limit= 19
Plasticity Index= 12
Natural Moisture= 22.1
Liquidity Index= 0.3

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	37.96	37.78			
Dry+Tare	36.94	36.76			
Tare	31.58	31.37			
Moisture	19.0	18.9			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
53.26	49.4	31.94	22.1

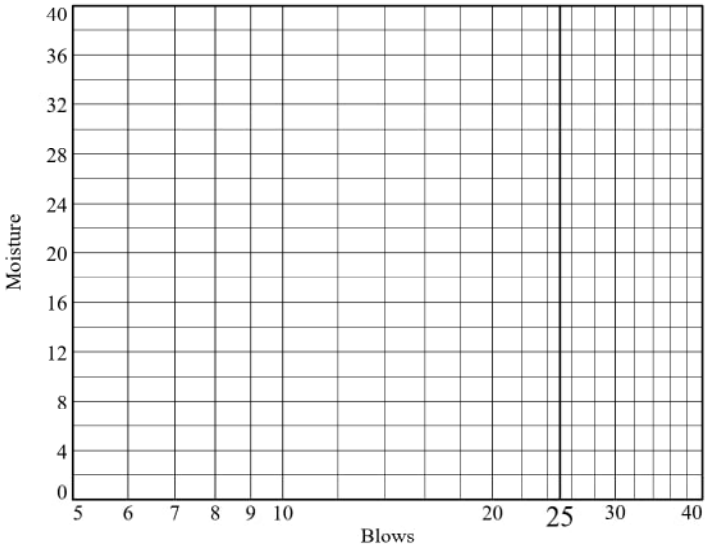
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B107
Depth: 20-22 ft **Sample Number:** S4
Material Description: SILT
USCS: ML
Tested by: WGL **Checked by:** EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 33.6

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
50.34	45.58	31.43	33.6

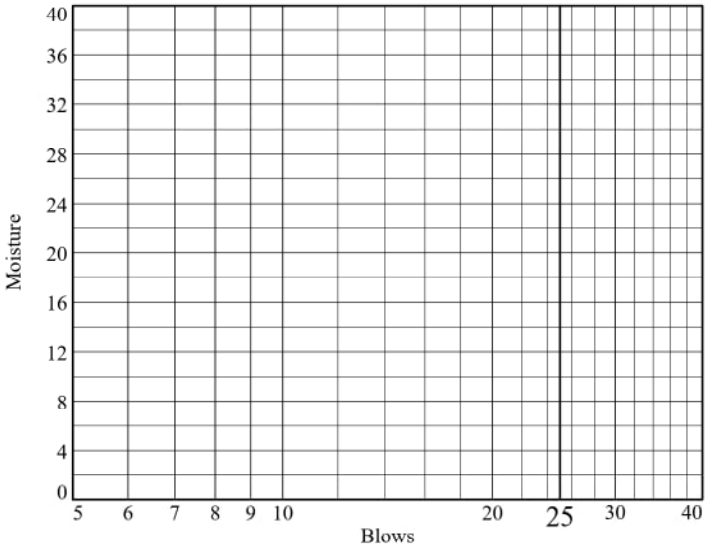
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B108
Depth: 4 - 6 ft
Sample Number: S2
Material Description: SILT
USCS: ML
Tested by: NM
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 15.9

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
53.96	50.88	31.54	15.9

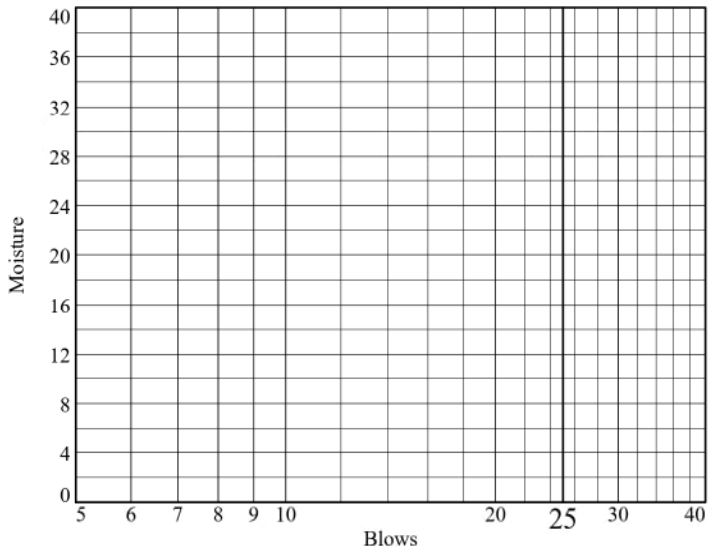
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B109
Depth: 17.5 - 19.5 ft
Sample Number: S6
Material Description: SILT
USCS: ML
AASHTO: A-4(0)
Burmister: Si, l.fS
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 33.7

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
52.75	47.34	31.3	33.7

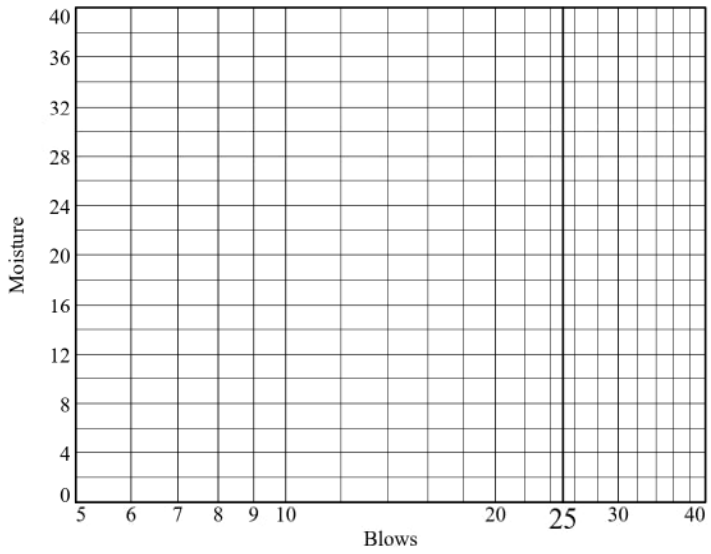
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B109
Depth: 47.5 - 49 ft
Sample Number: S18
Material Description: SILT
USCS: ML
AASHTO: A-4(0)
Burmister: Si, l.mfS
Tested by: EF
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 73.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
47.89	40.92	31.40	73.2

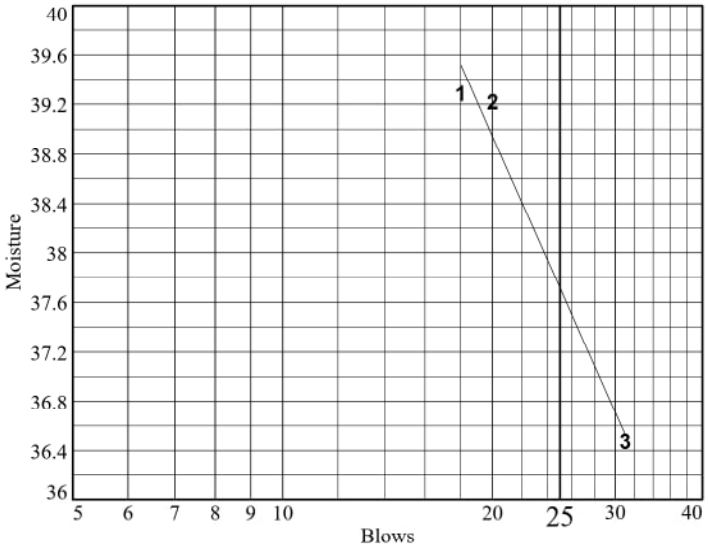
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B110
Depth: 15 - 17 ft
Sample Number: S7
Material Description: Lean CLAY
USCS: CL
AASHTO: -
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	35.18	26.12	36.69			
Dry+Tare	31.29	21.97	32.59			
Tare	21.39	11.39	21.35			
# Blows	18	20	31			
Moisture	39.3	39.2	36.5			



Liquid Limit= 38
Plastic Limit= 20
Plasticity Index= 18
Natural Moisture= 20.7
Liquidity Index= 0.0

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	23.78	38.3	18.33		
Dry+Tare	22.73	37.10	17.16		
Tare	17.29	31.43	11.43		
Moisture	19.3	21.2	20.4		

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
39.26	34.52	11.67	20.7

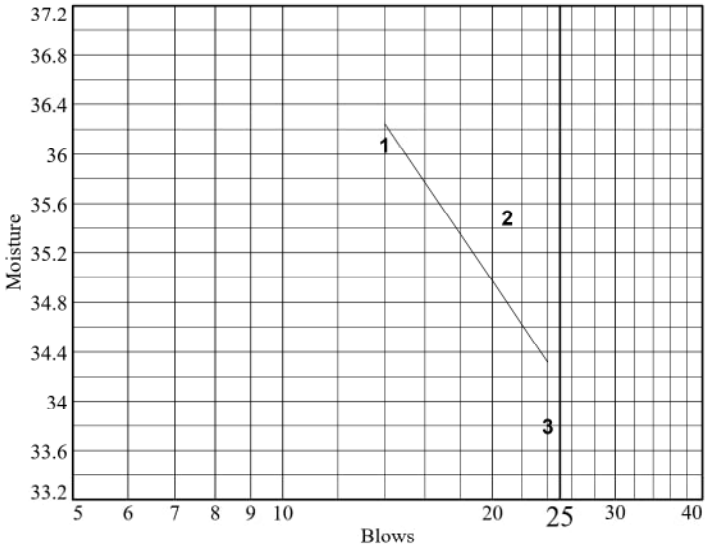
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B110
Depth: 54 - 56 ft
Sample Number: S23
Material Description: Sandy LEAN CLAY
USCS: CL
AASHTO: A-6(7)
Tested by: MPC/WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	36.37	25.98	37.77			
Dry+Tare	32.47	22.3	33.64			
Tare	21.66	11.93	21.42			
# Blows	14	21	24			
Moisture	36.1	35.5	33.8			



Liquid Limit= 34
Plastic Limit= 19
Plasticity Index= 15
Natural Moisture= 22.5
Liquidity Index= 0.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	38.51	40.74			
Dry+Tare	37.43	39.29			
Tare	31.58	31.64			
Moisture	18.5	19.0			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
59.91	54.66	31.33	22.5

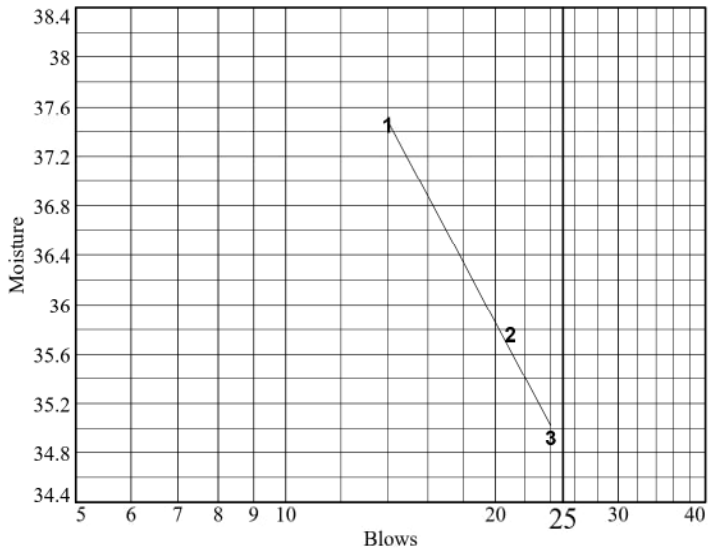
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B110U
Depth: 36.8 ft
Sample Number: U2-A
Material Description: Lean CLAY
Clay Dike cutting from R'3
USCS: CL
AASHTO: --
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.72	23.12	21.83			
Dry+Tare	19.63	20.03	17.95			
Tare	11.38	11.39	6.84			
# Blows	14	21	24			
Moisture	37.5	35.8	34.9			



Liquid Limit= 35
Plastic Limit= 19
Plasticity Index= 16
Natural Moisture= 20
Liquidity Index= 0.1

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.63	14.11			
Dry+Tare	17.49	12.99			
Tare	11.49	7.01			
Moisture	19.0	18.7			

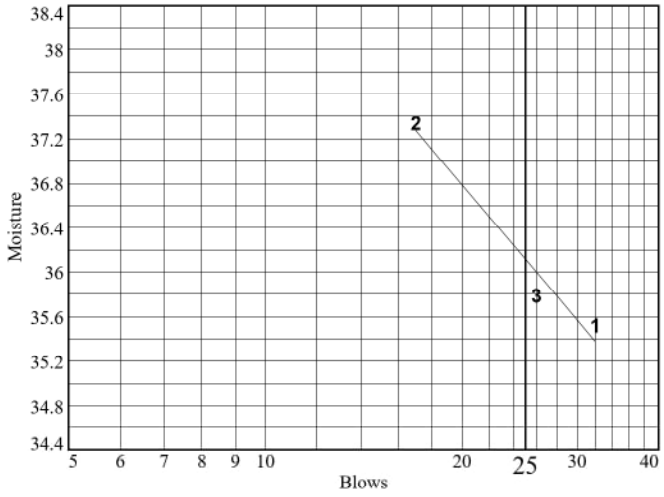
LIQUID AND PLASTIC LIMIT TEST DATA

1/31/2018

Client: GEI Consultants, Inc.
Project: GEI 001
Location: B110UA-U1
Depth: 16 ft **Sample Number:** 1 (10 psi)
Material Description: Brown, moist, hard and homogenous lean clay
USCS: CL
Tested by: Bernardo Castellanos, PhD **Checked by:** Thomas L. Brandon, PhD

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	27.99	30.30	30.54			
Dry+Tare	23.77	25.18	25.44			
Tare	11.89	11.47	11.19			
# Blows	32	17	26			
Moisture	35.5	37.3	35.8			



Liquid Limit= 36
Plastic Limit= 21
Plasticity Index= 15

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.53	18.74			
Dry+Tare	17.43	17.58			
Tare	12.07	11.94			
Moisture	20.5	20.6			

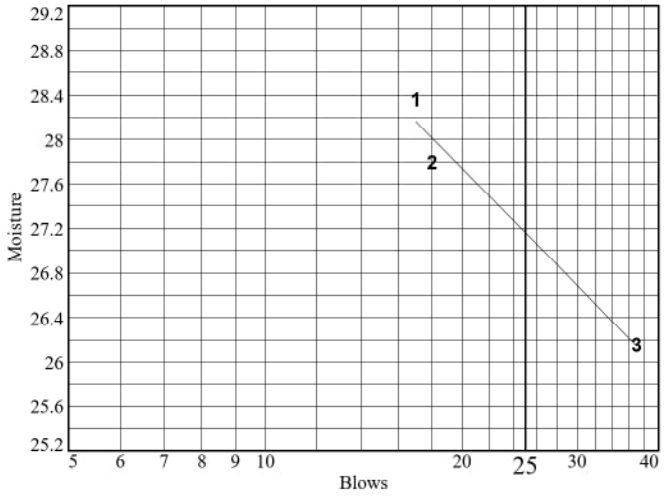
LIQUID AND PLASTIC LIMIT TEST DATA

3/5/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B111
Depth: 18 - 20 ft. **Sample Number:** S7
Material Description: CLAYEY SAND
USCS: SC
Tested by: AH **Checked by:** EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	31.54	34.86	29.66			
Dry+Tare	27.09	29.75	25.88			
Tare	11.40	11.37	11.43			
# Blows	17	18	37			
Moisture	28.4	27.8	26.2			



Liquid Limit= 27
Plastic Limit= 20
Plasticity Index= 7
Natural Moisture= 16.7
Liquidity Index= -0.5

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.77	17.67			
Dry+Tare	16.71	16.60			
Tare	11.42	11.43			
Moisture	20.0	20.7			

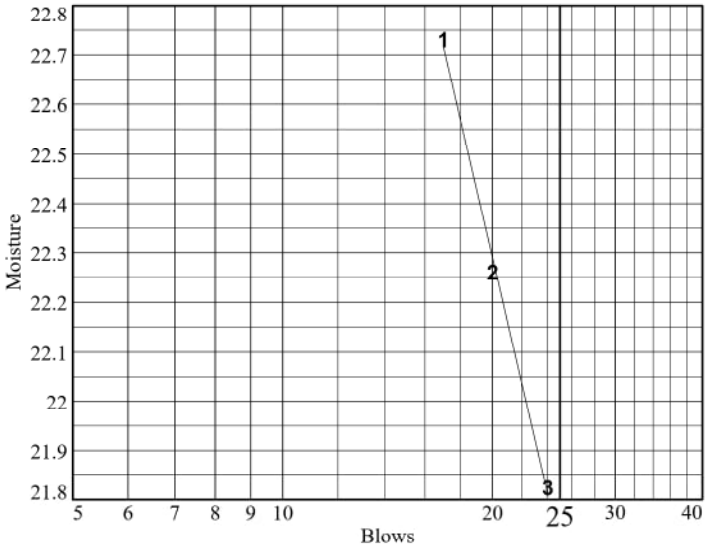
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B111
Depth: 26 - 28 ft
Sample Number: S11 (12 - 24 in)
Material Description: Silty SAND
USCS: SC-SM
AASHTO: A-4(0)
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	45.2	25.62	34.58			
Dry+Tare	42.67	23.14	32.26			
Tare	31.54	12	21.63			
# Blows	17	20	24			
Moisture	22.7	22.3	21.8			



Liquid Limit= 22
Plastic Limit= 16
Plasticity Index= 6
Natural Moisture= 25.7
Liquidity Index= 1.6

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	13.95	17.99			
Dry+Tare	12.99	17.12			
Tare	7.01	11.32			
Moisture	16.1	15.0			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
52.06	47.94	31.9	25.7

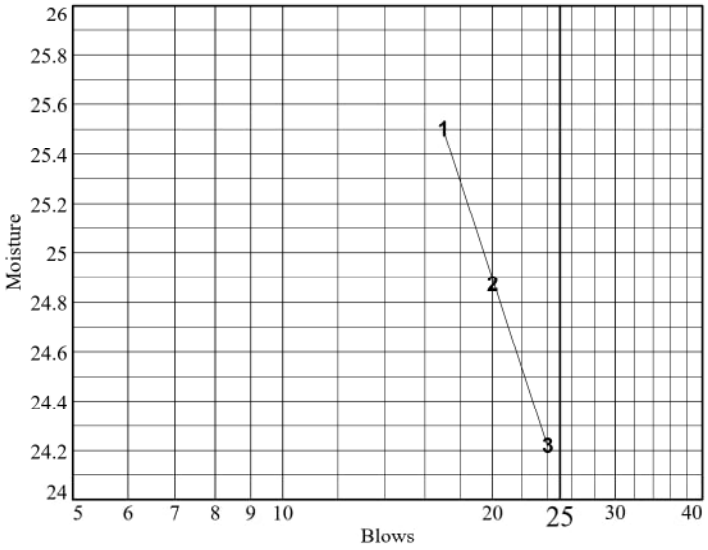
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 15 - 17 ft
Sample Number: S7
Material Description: Clayey SAND
USCS: SC-SM
AASHTO: A-4(0)
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.81	21.59	24.13			
Dry+Tare	21.29	19.55	21.63			
Tare	11.41	11.35	11.31			
# Blows	17	20	24			
Moisture	25.5	24.9	24.2			



Liquid Limit= 24
Plastic Limit= 18
Plasticity Index= 6
Natural Moisture= 15.6
Liquidity Index= -0.4

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.1	18.48			
Dry+Tare	17.1	17.42			
Tare	11.82	11.42			
Moisture	18.9	17.7			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
64.56	60.03	30.91	15.6

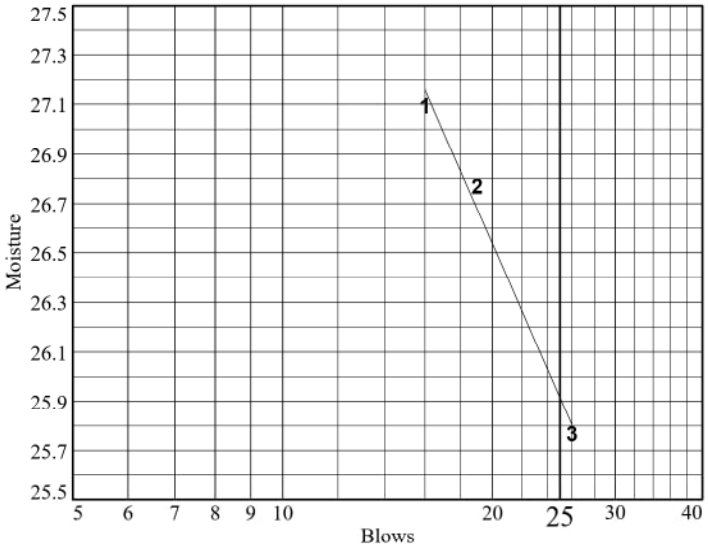
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 24 - 26 ft
Sample Number: S11 (3 - 15 in)
Material Description: Clayey SAND
USCS: SC
AASHTO: A-4(1)
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.19	24.08	22.81			
Dry+Tare	20.67	21.4	20.47			
Tare	11.37	11.39	11.39			
# Blows	16	19	26			
Moisture	27.1	26.8	25.8			



Liquid Limit= 26
Plastic Limit= 17
Plasticity Index= 9
Natural Moisture= 19.5
Liquidity Index= 0.3

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.59	17.97			
Dry+Tare	16.69	17.02			
Tare	11.42	11.48			
Moisture	17.1	17.1			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
62.98	57.83	31.48	19.5

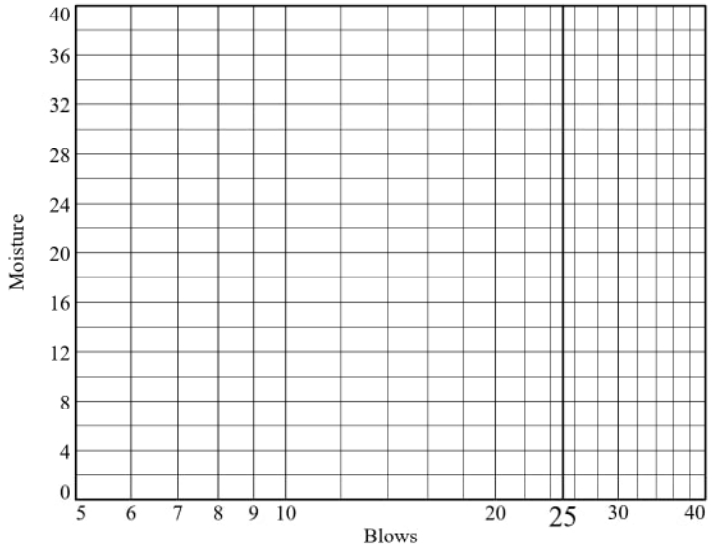
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B113
Depth: 34 - 36 ft
Sample Number: S16
Material Description: Silty SAND
USCS: SM
AASHTO: A-2-4(0)
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 12.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
47.41	45.68	31.54	12.2

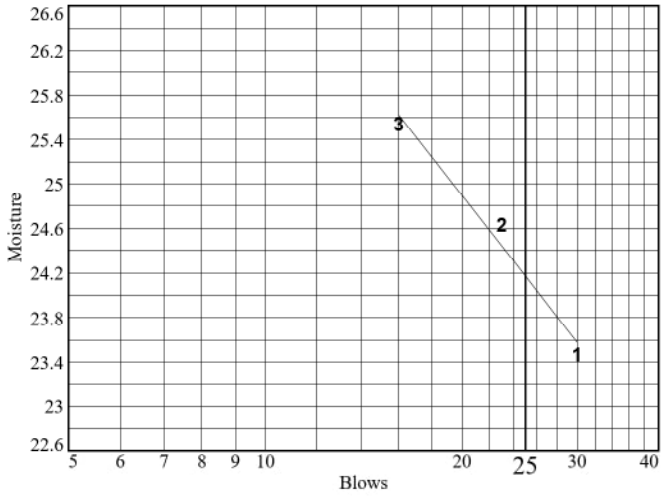
LIQUID AND PLASTIC LIMIT TEST DATA

1/30/2018

Client: GEI Consultants, Inc.
Project: GEI 001
Location: B113-U2
Depth: 26.42' - 28.22'
Sample Number: 1 (17 psi)
Material Description: Brown greenish homogenous moist silty, clayey sand
%<#40: 96.8
USCS: SC-SM
AASHTO: A-4(0)
Tested by: Bernardo Castellanos
Checked by: Thomas L. Brandon

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	29.09	28.11	33.45			
Dry+Tare	25.68	24.90	29.10			
Tare	11.15	11.87	12.07			
# Blows	30	23	16			
Moisture	23.5	24.6	25.5			



Liquid Limit= 24
Plastic Limit= 19
Plasticity Index= 5

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.28	18.84			
Dry+Tare	17.28	17.75			
Tare	12.07	11.91			
Moisture	19.2	18.7			

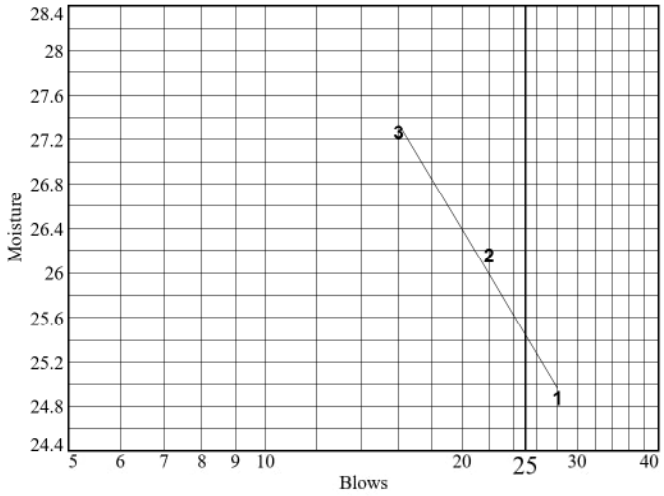
LIQUID AND PLASTIC LIMIT TEST DATA

1/30/2018

Client: GEI Consultants, Inc.
Project: GEI 001
Location: B113-U2
Depth: 26.42' - 28.22'
Sample Number: 2 (35 psi)
Material Description: Brown greenish homogenous moist silty, clayey sand
%<#40: 97.3
USCS: SC-SM
AASHTO: A-4(0)
Tested by: Bernardo Castellanos
Checked by: Thomas L. Brandon

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	31.01	34.42	33.21			
Dry+Tare	27.06	29.78	28.49			
Tare	11.18	12.04	11.18			
# Blows	28	22	16			
Moisture	24.9	26.2	27.3			



Liquid Limit= 25
Plastic Limit= 20
Plasticity Index= 5

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.28	18.51			
Dry+Tare	16.25	17.33			
Tare	11.18	11.48			
Moisture	20.3	20.2			

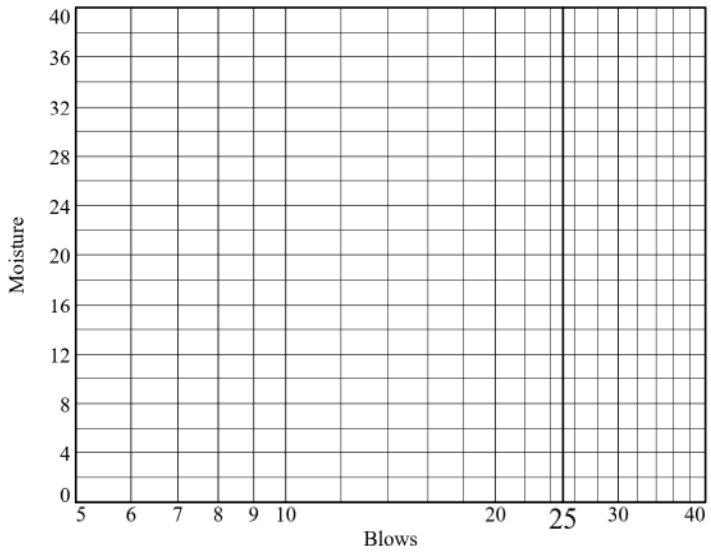
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B114
Depth: 25 - 27 ft
Sample Number: S11
Material Description: SILT
Dry Stacked Ash
USCS: ML
AASHTO: --
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 24.4

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
34.23	31.71	21.39	24.4

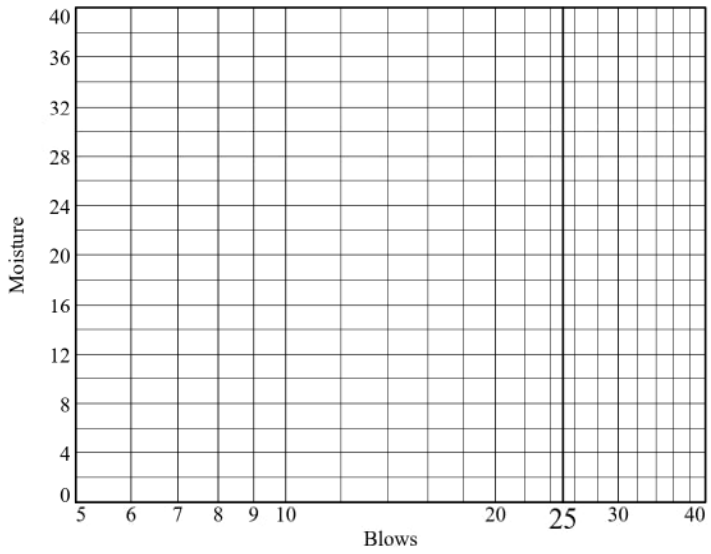
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 17.5 - 19.5 ft
Sample Number: S7
Material Description: SILT
USCS: ML
AASHTO: --
Burmister: Si, t.fS
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 31.3

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
29.2	27.33	21.35	31.3

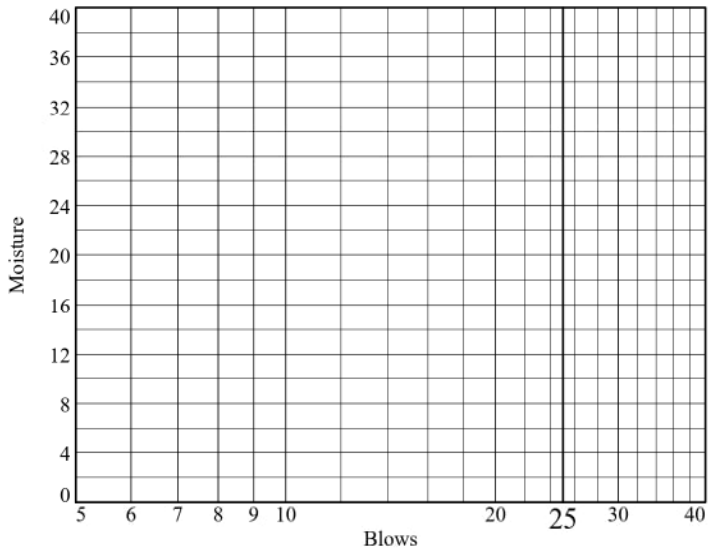
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 66 - 68 ft
Sample Number: S27
Material Description: SILT
USCS: ML
AASHTO: --
Burmister: Si, t.fS
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 70.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
38.54	31.58	21.66	70.2

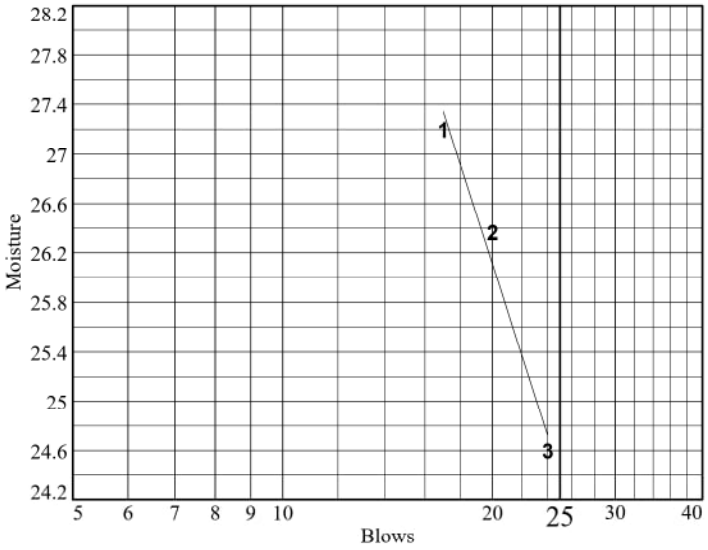
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B115
Depth: 79 - 81 ft
Sample Number: S33
Material Description: Silty SAND
USCS: SM
AASHTO: A-2-4(0)
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	22.69	20.19	23.86			
Dry+Tare	20.28	18.36	21.4			
Tare	11.42	11.42	11.4			
# Blows	17	20	24			
Moisture	27.2	26.4	24.6			



Liquid Limit= 24
Plastic Limit= 22
Plasticity Index= 2
Natural Moisture= 23.1
Liquidity Index= 0.6

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.06	17.7			
Dry+Tare	16.95	16.62			
Tare	11.94	11.67			
Moisture	22.2	21.8			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
63.15	57.18	31.33	23.1

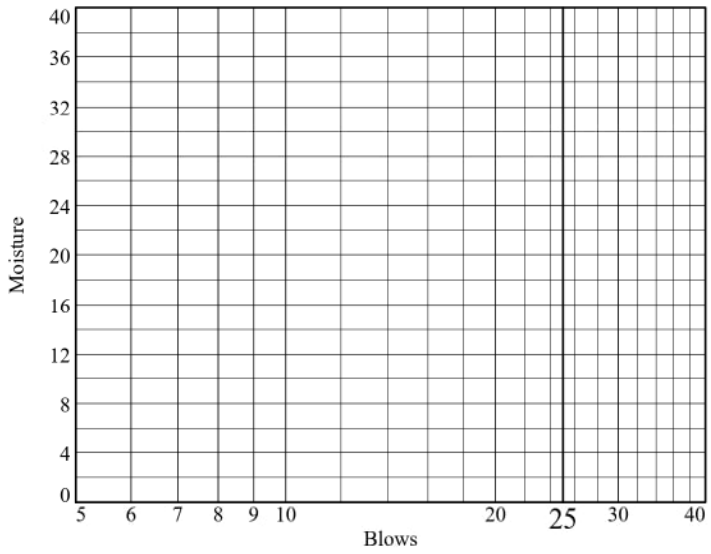
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B116
Depth: 10 - 12 ft **Sample Number:** S6
Material Description: SILT
USCS: ML
Burmister: Si, l.fS
Tested by: EF **Checked by:** WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 14.5

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
33.48	31.95	21.42	14.5

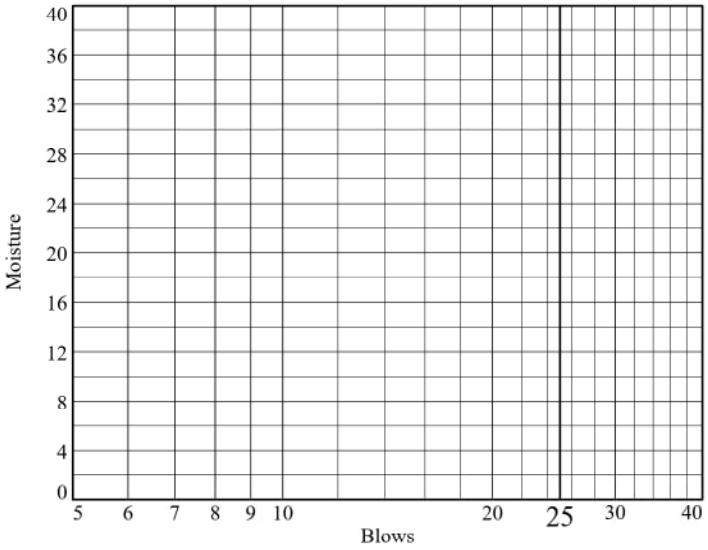
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B116
Depth: 50-52 ft **Sample Number:** S26
Material Description: SILT
USCS: ML
Tested by: WGL **Checked by:** EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 26.4

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
64.37	55.42	21.47	26.4

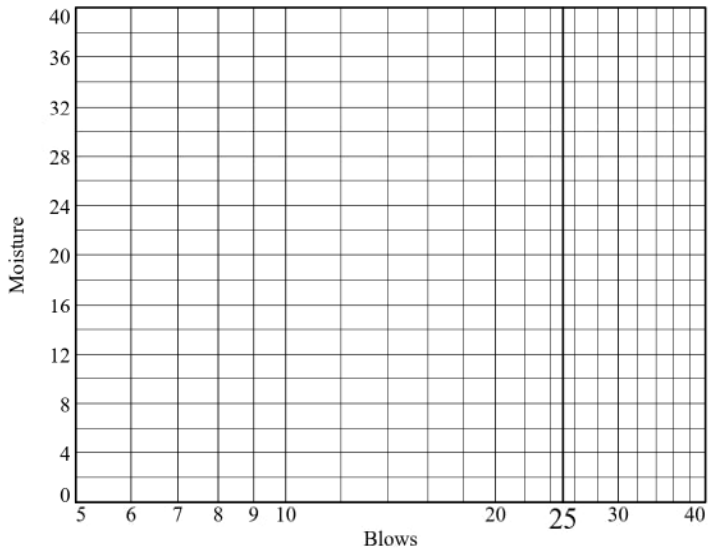
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B118
Depth: 26 - 28 ft
Sample Number: S14
Material Description: SILT with Sand
USCS: ML
AASHTO: A-4(0)
Burmister: Si, s.fS
Tested by: MPC/NM
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 31.5

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
44.79	41.60	31.47	31.5

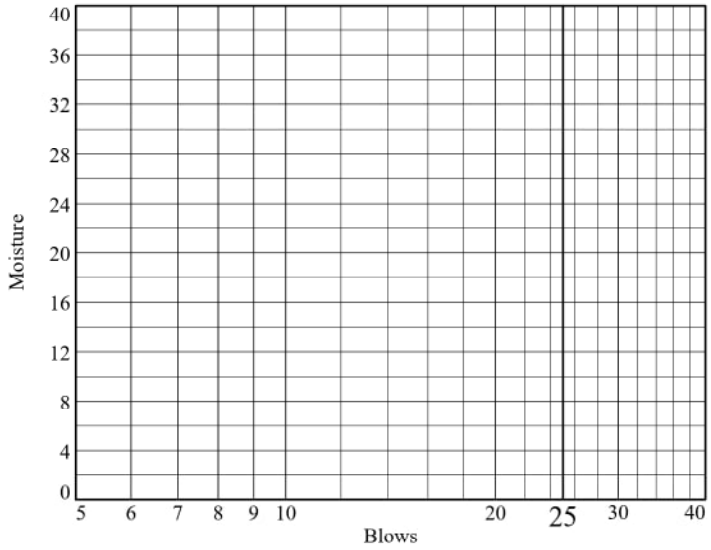
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B118
Depth: 52 - 54 ft
Sample Number: S25
Material Description: Silty SAND
USCS: SM
AASHTO: A-2-4(0)
Tested by: WGL
Checked by: EF

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare						
Dry+Tare						
Tare						
# Blows						
Moisture						



Liquid Limit= NV
Plastic Limit= NP
Plasticity Index= NP
Natural Moisture= 19.0

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare					
Dry+Tare					
Tare					
Moisture					

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
45.08	42.97	31.89	19.0

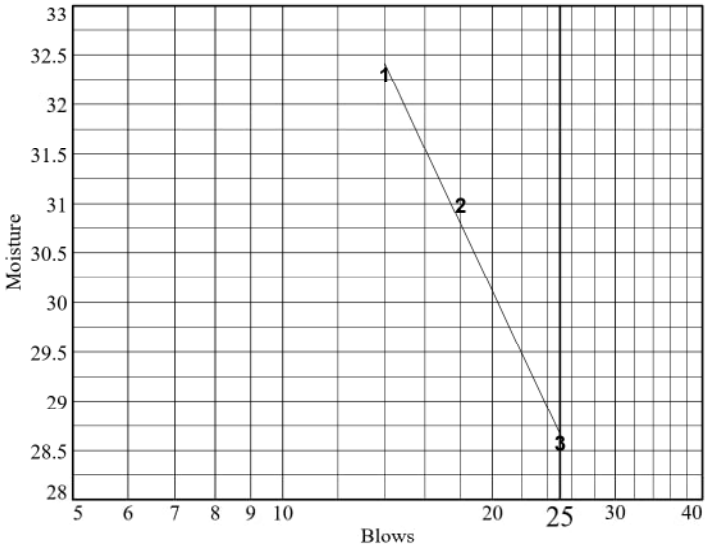
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B119
Depth: 17.5-19.5 ft
Sample Number: S8 (0-13 in)
Material Description: LEAN CLAY
USCS: CL
AASHTO: -
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	24.17	28.12	26.97			
Dry+Tare	21.03	24.11	23.5			
Tare	11.31	11.17	11.36			
# Blows	14	18	25			
Moisture	32.3	31.0	28.6			



Liquid Limit= 29
Plastic Limit= 17
Plasticity Index= 12
Natural Moisture= 15.6
Liquidity Index= -0.1

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	27.78	18.14			
Dry+Tare	26.86	17.13			
Tare	21.55	11.4			
Moisture	17.3	17.6			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
52.3	49.47	31.33	15.6

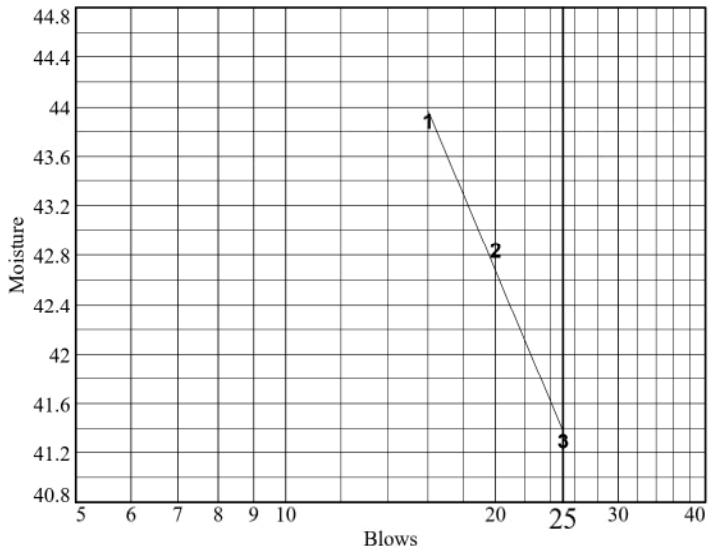
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B119U-A
Depth: 25.1 ft
Sample Number: U1
Material Description: Lean CLAY
Clay Dike
USCS: CL
AASHTO: --
Tested by: WGL
Checked by: NEM

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.21	23.39	27.97			
Dry+Tare	19.62	19.8	23.13			
Tare	11.44	11.42	11.41			
# Blows	16	20	25			
Moisture	43.9	42.8	41.3			



Liquid Limit= 41
Plastic Limit= 20
Plasticity Index= 21
Natural Moisture= 24
Liquidity Index= 0.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.07	18.27			
Dry+Tare	16.95	17.16			
Tare	11.41	11.73			
Moisture	20.2	20.4			

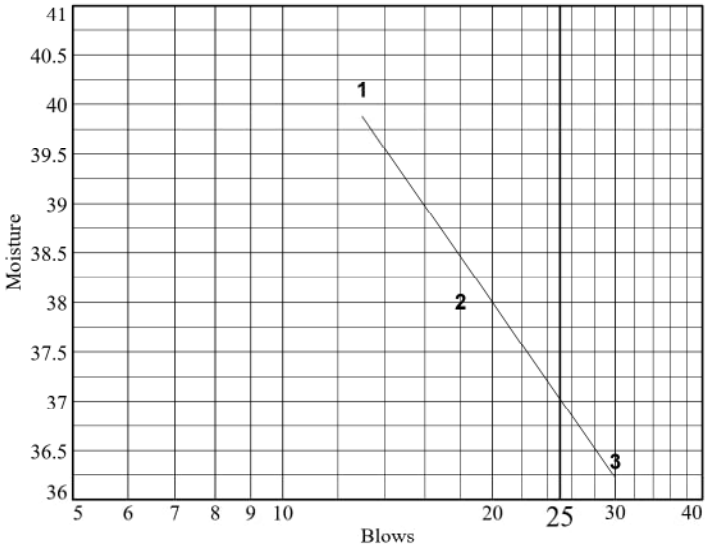
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B120
Depth: 57 - 59 ft
Sample Number: S24
Material Description: Lean CLAY
USCS: CL
AASHTO: --
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	26.05	26.55	23.31			
Dry+Tare	21.85	22.38	18.96			
Tare	11.39	11.41	7.01			
# Blows	13	18	30			
Moisture	40.2	38.0	36.4			



Liquid Limit= 37
Plastic Limit= 20
Plasticity Index= 17
Natural Moisture= 23.6
Liquidity Index= 0.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	18.09	17.89			
Dry+Tare	17.02	16.83			
Tare	11.93	11.43			
Moisture	21.0	19.6			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
59.13	53.74	30.90	23.6

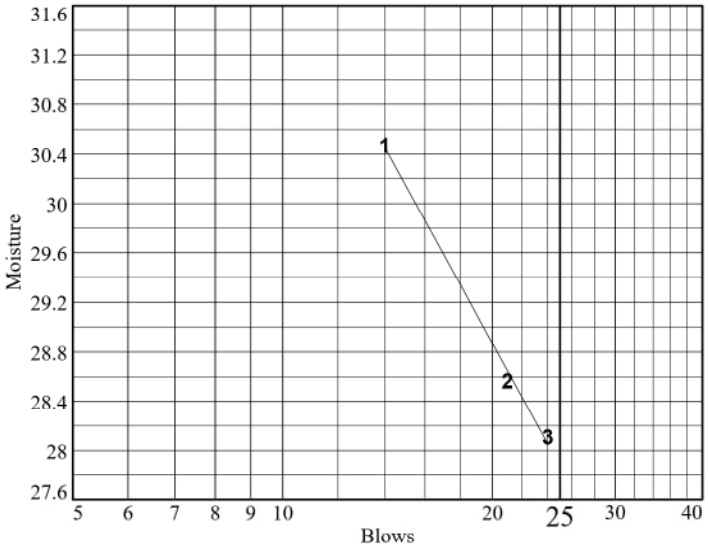
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B120
Depth: 60 - 62 ft
Sample Number: S26
Material Description: Clayey SAND
USCS: SC
AASHTO: A-6(3)
Tested by: WGL/EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	23.75	24.15	24.58			
Dry+Tare	20.87	21.45	21.67			
Tare	11.42	12	11.32			
# Blows	14	21	24			
Moisture	30.5	28.6	28.1			



Liquid Limit= 28
Plastic Limit= 15
Plasticity Index= 13
Natural Moisture= 17.1
Liquidity Index= 0.2

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.56	18.2			
Dry+Tare	16.75	17.29			
Tare	11.43	11.48			
Moisture	15.2	15.7			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
62.58	58.01	31.3	17.1

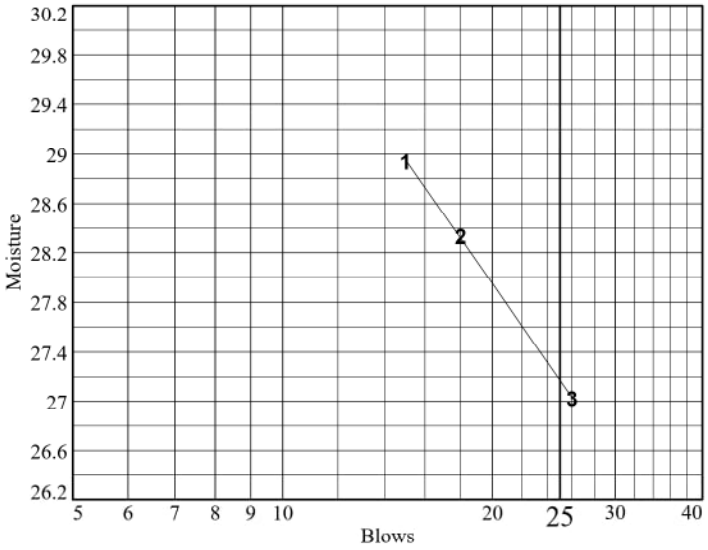
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B122
Depth: 57 - 59 ft
Sample Number: S15
Material Description: Clayey SAND
USCS: SC
AASHTO: --
Tested by: EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	27.94	40.02	39.82			
Dry+Tare	24.23	35.88	35.95			
Tare	11.41	21.27	21.63			
# Blows	15	18	26			
Moisture	28.9	28.3	27.0			



Liquid Limit= 27
Plastic Limit= 17
Plasticity Index= 10
Natural Moisture= 19.8
Liquidity Index= 0.3

Plastic Limit Data

Run No.	1	2	3	4	
Wet+Tare	17.59	18.23			
Dry+Tare	16.72	17.3			
Tare	11.42	11.72			
Moisture	16.4	16.7			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
48.85	45.98	31.48	19.8

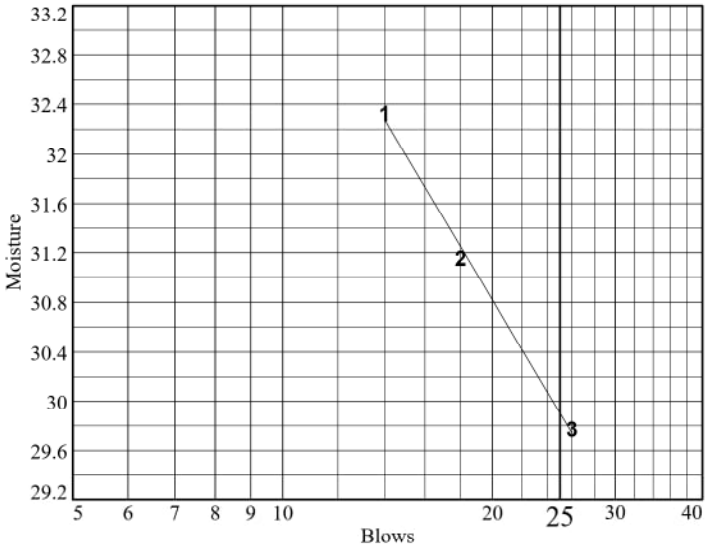
LIQUID AND PLASTIC LIMIT TEST DATA

1/25/2018

Client: American Electric Power
Project: Glen Lyn Seismic Stability Evaluation
Project Number: 1700685
Location: B122
Depth: 59-61 ft
Sample Number: S16
Material Description: LEAN CLAY
USCS: CL
AASHTO: -
Tested by: WGL/EF
Checked by: WGL

Liquid Limit Data

Run No.	1	2	3	4	5	6
Wet+Tare	21.93	23.45	23.32			
Dry+Tare	19.35	20.58	20.53			
Tare	11.37	11.37	11.16			
# Blows	14	18	26			
Moisture	32.3	31.2	29.8			



Liquid Limit= 30
Plastic Limit= 18
Plasticity Index= 12
Natural Moisture= 20.9
Liquidity Index= 0.2

Plastic Limit Data

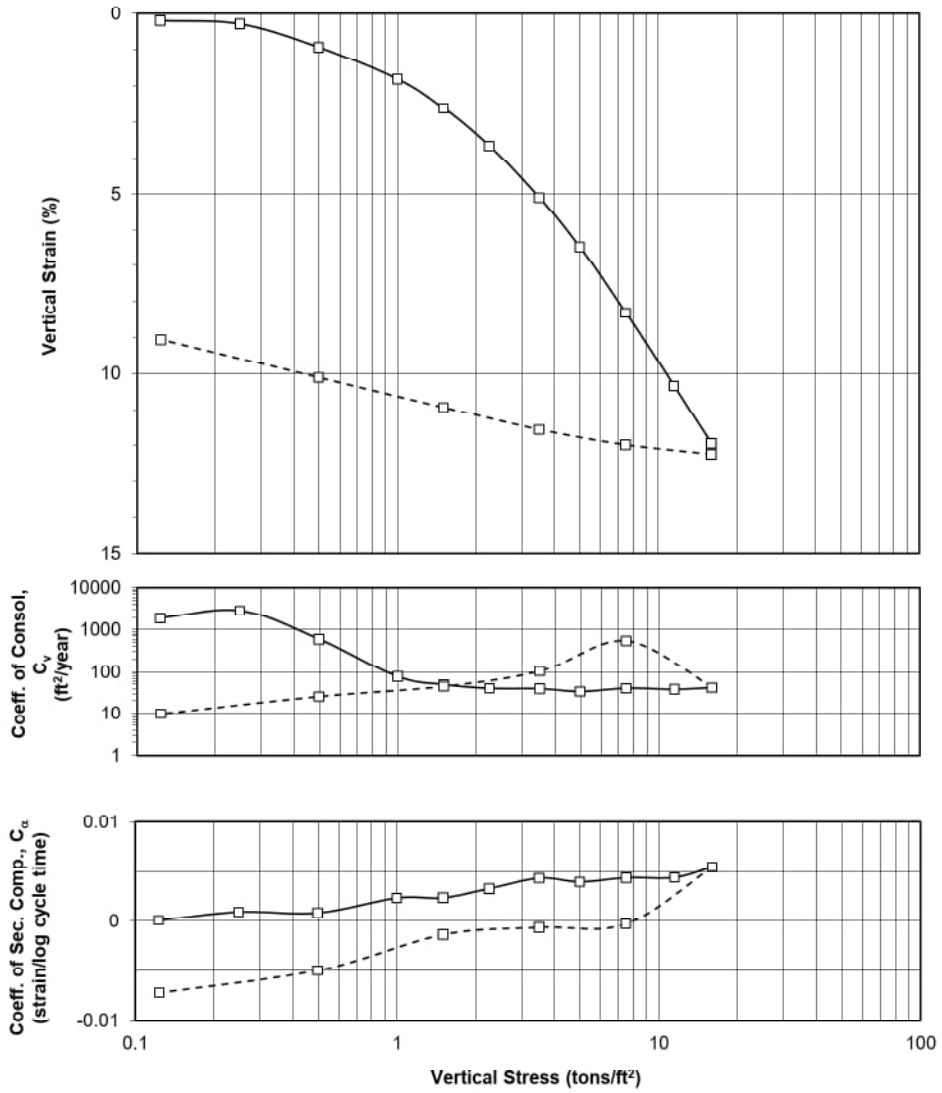
Run No.	1	2	3	4	
Wet+Tare	17.59	17.86			
Dry+Tare	16.66	16.88			
Tare	11.45	11.41			
Moisture	17.9	17.9			

Natural Moisture Data

Wet+Tare	Dry+Tare	Tare	Moisture
67.64	61.36	31.34	20.9

Appendix K

GEI Consolidation Tests – Clay-like Alluvium



SAMPLE INFORMATION

Boring:	B101U
Sample:	U3
Depth:	55.2 ft
Test:	C1
Type:	2.8-inch-diameter Shelby tube specimen
Description:	LEAN CLAY with SAND (CL)

SPECIMEN INFORMATION

(Note: Initial and final states refer to specimen conditions at start and end of test)

Initial height:	0.88	inch
Diameter:	2.50	inch

Initial water content:	26.8	%
Initial total unit weight:	122.5	pcf
Initial dry unit weight:	96.6	pcf
Initial void ratio:	0.757	
Initial degree of saturation:	96	%
Final water content:	22.0	%
Final total unit weight:	129.5	pcf
Final dry unit weight:	106.1	pcf
Final void ratio:	0.600	
Final degree of saturation:	100	% (assumed specific gravity = 2.72)

TEST SUMMARY

Estimated preconsolidation stress (tsf):	2.3 (range = 2.0 to 2.5)
Compression Ratio (strain per log cycle stress):	0.111
Compression Index (void ratio per log cycle stress):	0.195
Swell Ratio (strain per log cycle stress):	0.017
Swell Index (void ratio per log cycle stress):	0.030
Recompression Ratio (strain per log cycle stress):	0.025
Recompression Index (void ratio per log cycle stress):	0.044

REMARKS

Test Date: 12/11/17
Tested By: W. Lukas
Checked By: D. Aghjayan

LEGEND:
□ End of primary
○ End of stage
——— Loading
– – – – – Unloading

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

ONE DIMENSIONAL
CONSOLIDATION TEST

August 2018 Fig.K-1

3/15/2018

PROJECT:	Glen Lyn Seismic Stability						
PROJECT NO.:	1700685	SPECIMEN DESCRIPTION:	LEAN CLAY with SAND (CL)				
BORING:	B101U		2.8-inch-diameter Shelby tube specimen				
SAMPLE:	U3		G (est.)	LL	PL	PI	
TEST:	C1		2.72	0	0	0	
DEPTH, ft:	55.2						
BY:	W. Lukas	Initial height:	0.88 inch	Final height:	0.80 inch		
TEST DATE:	12/11/17	Initial water content:	26.78 %	Final water content:	22.01 %		
		Initial dry density:	96.65 pcf	Final dry density:	106.12 pcf		
EQUIPMENT:		Initial total density:	122.53 pcf	Final total density:	129.48 pcf		
Load Frame No.:	Geocomp	Initial saturation:	96 %	Final saturation:	100 %		
Ring Diameter:	2.50 inch	Initial void ratio:	0.757	Final void ratio:	0.600		
DCDT Calibration:	1 mm			Final strain:	8.925 %		
Initial DCDT reading:	-5.382514 mm						
Final DCDT reading:	-3.27 mm						

Load No.	Load (tsf)	d100 (inch)	t100 Strain (%)	t100 Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	cv (ft²/year)	Calpha (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)	Machine compliance (mm)	Extrusion compliance (mm)
setup	0.00	-	0	-	-	-	-	-	-	-	-	
1	0.12	0.0017	0.19	0.754	0.209	0.753	1923.4973	0.0001	63.35	9.16E-07	0.026009092	
2	0.25	0.0025	0.29	0.752	0.494	0.748	2899.2530	0.0009	135.14	6.47E-07	0.055919548	
3	0.50	0.0081	0.92	0.741	0.971	0.740	604.4288	0.0009	39.36	4.63E-07	0.105275913	
4	1.00	0.0159	1.81	0.725	1.937	0.723	77.1329	0.0024	56.25	4.14E-08	0.153453643	
5	1.50	0.0231	2.63	0.711	2.716	0.709	49.6321	0.0024	61.23	2.45E-08	0.191166826	
6	2.25	0.0323	3.67	0.692	3.787	0.690	40.2231	0.0033	72.01	1.69E-08	0.231480919	
7	3.50	0.0448	5.10	0.667	5.259	0.665	39.3347	0.0044	87.62	1.35E-08	0.283499103	
8	5.00	0.0570	6.48	0.643	6.656	0.640	33.9663	0.0040	108.60	9.44E-09	0.326414105	
9	7.50	0.0730	8.30	0.611	8.465	0.608	40.3918	0.0044	137.57	8.86E-09	0.374530925	
10	11.50	0.0910	10.34	0.575	10.548	0.572	38.2321	0.0044	195.26	5.91E-09	0.434351836	
11	16.00	0.1051	11.94	0.547	12.241	0.542	41.7488	0.0055	282.26	4.46E-09	0.490271384	
12	7.50	0.1054	11.98	0.547	11.950	0.547	548.6366	-0.0003	22078.97	7.50E-10	0.409643199	
13	3.50	0.1017	11.55	0.554	11.514	0.555	104.2851	-0.0006	946.65	3.32E-09	0.347221378	
14	1.50	0.0962	10.93	0.565	10.861	0.566	44.7811	-0.0014	322.28	4.19E-09	0.280898194	
15	0.50	0.0890	10.12	0.579	9.943	0.582	25.5680	-0.0049	122.29	6.31E-09	0.200270008	
16	0.12	0.0797	9.05	0.598	8.925	0.600	9.7888	-0.0072	35.32	8.36E-09	0.11313955	

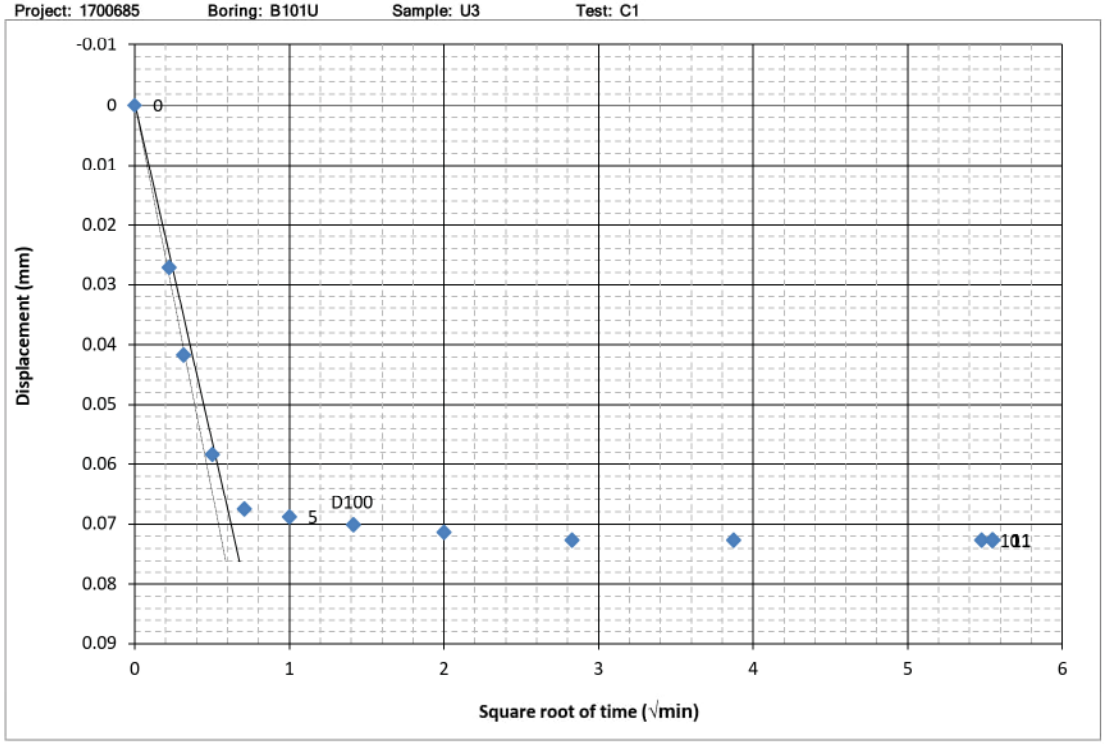
Cout	(UNIT)out				
0.3937	inch	1	cm	0.3937	inch
0.155	in²	1	cm²	0.155	in²
1.02408	tsf	1	ksc	1.0241	tsf
62.428	pcf	1	g/cm³	62.428	pcf
33944.7	ft²/year	1	cm²/sec	33945	ft²/year
2.1E+09	ft/year	1000	cm/sec	2E+09	ft/year

BORING: B101U SAMPLE: U3

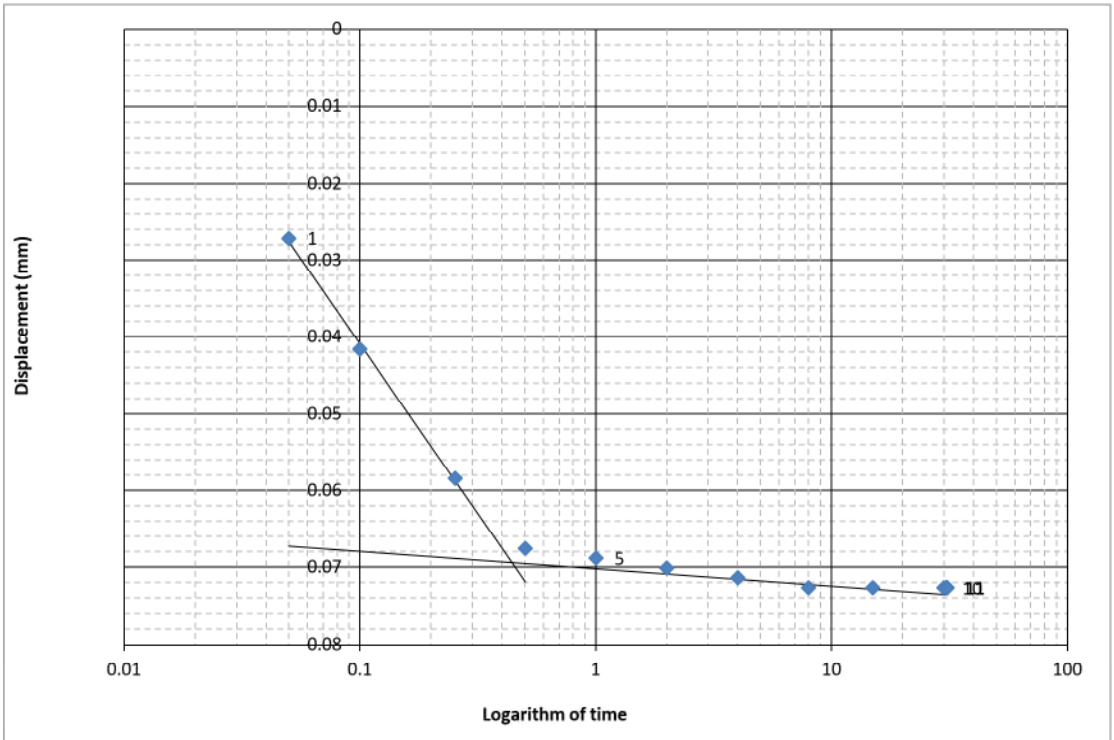
CHECK VERSION ONLY Ho(mm) 22.352

GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS					
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary	Load
mm	mm	mm	mm	mm	min	mm	min	mm	min	mm	Slope	#
-5.3825	-5.3099	-5.3829	-5.3495	-5.323	0.28352	-5.3161	0.0723	-5.348	0.44257	-5.3131	0.00225	1
-5.3099	-5.2161	-5.3097	-5.2874	-5.27	0.18219	-5.2651	0.0478	-5.2861	0.27618	-5.2624	0.02121	2
-5.2161	-5.0602	-5.2046	-5.1723	-5.147	0.22756	-5.14	0.2274	-5.1378	10.0965	-5.071	0.01918	3
-5.0602	-4.796	-4.9892	-4.9142	-4.854	6.21223	-4.8392	1.7531	-4.9067	12.0492	-4.8242	0.05286	4
-4.796	-4.5842	-4.7726	-4.6997	-4.641	8.54585	-4.6269	2.6799	-4.6881	20.2852	-4.6037	0.05326	5
-4.5842	-4.3045	-4.5582	-4.4516	-4.366	12.1992	-4.345	3.2455	-4.4444	21.6041	-4.3306	0.07395	6
-4.3058	-3.9235	-4.2734	-4.1227	-4.002	12.8254	-3.9721	3.2348	-4.1168	20.6599	-3.9601	0.09741	7
-3.9235	-3.5684	-3.9008	-3.7492	-3.628	16.7376	-3.5975	3.635	-3.7545	19.6402	-3.6082	0.08902	8
-3.5684	-3.1158	-3.5402	-3.3695	-3.233	9.88397	-3.1987	2.9532	-3.347	21.3061	-3.1538	0.09834	9
-3.1158	-2.5905	-3.0729	-2.8592	-2.688	12.2703	-2.6456	2.9909	-2.8545	17.3601	-2.6362	0.09901	10
-2.5905	-2.1562	-2.5504	-2.3767	-2.238	12.7576	-2.2029	2.6289	-2.3872	13.7047	-2.2239	0.12362	11
-2.1562	-2.3018	-2.2464	-2.2618	-2.274	0.32379	-2.2771	0.1961	-2.2712	3.43782	-2.2959	-0.0062	12
-2.3018	-2.4618	-2.3678	-2.4047	-2.434	3.36239	-2.4417	1.0397	-2.4103	8.0567	-2.4528	-0.0144	13
-2.4618	-2.6739	-2.5136	-2.5776	-2.629	8.27547	-2.6416	2.4482	-2.5857	17.6571	-2.6577	-0.0304	14
-2.6739	-2.9599	-2.7172	-2.8123	-2.888	16.2184	-2.9074	4.3542	-2.8192	27.1105	-2.9213	-0.1101	15
-2.9599	-3.2746	-2.9901	-3.1339	-3.249	62.8936	-3.2776	11.615	-3.118	60.0029	-3.2459	-0.1609	16

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	0	3	1	7
Second Point	2	4	3	9

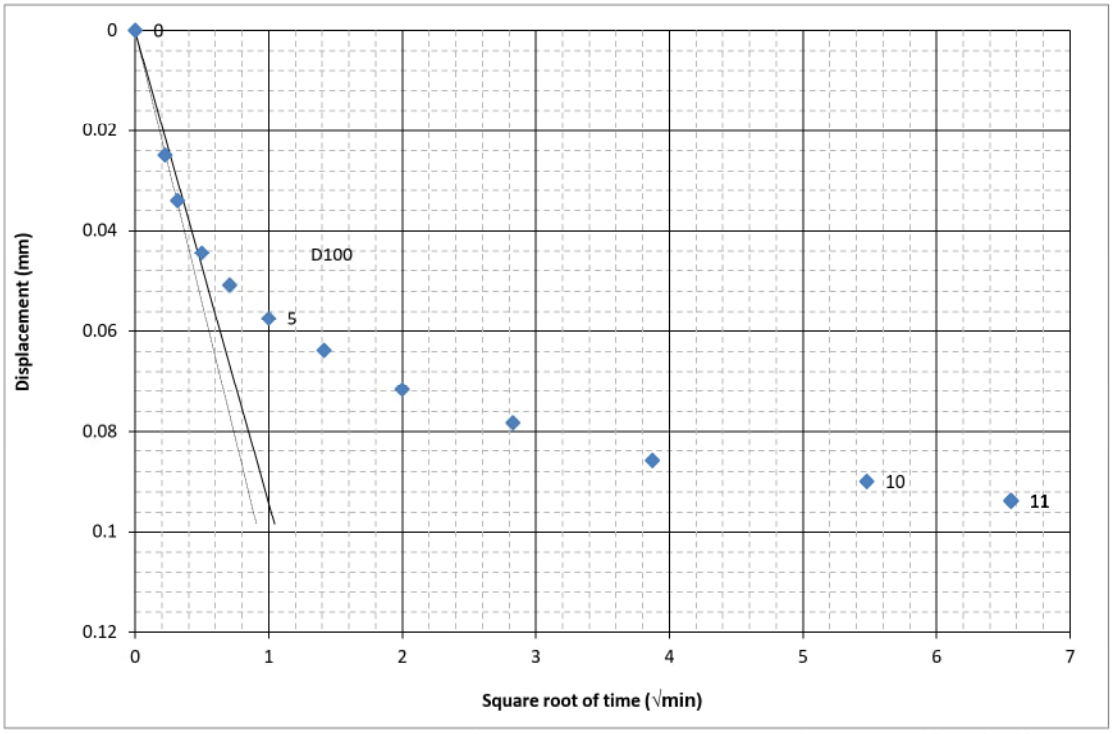


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.0726	-0.0004	0.0330	0.0597	0.28	0.0664	0.07	0.0345	0.44	0.0694	0.0022
Absolute	-5.3825	-5.3099	-5.3829	-5.3495	-5.3228	0.28	-5.3161	0.07	-5.3480	0.44	-5.3131	0.0022

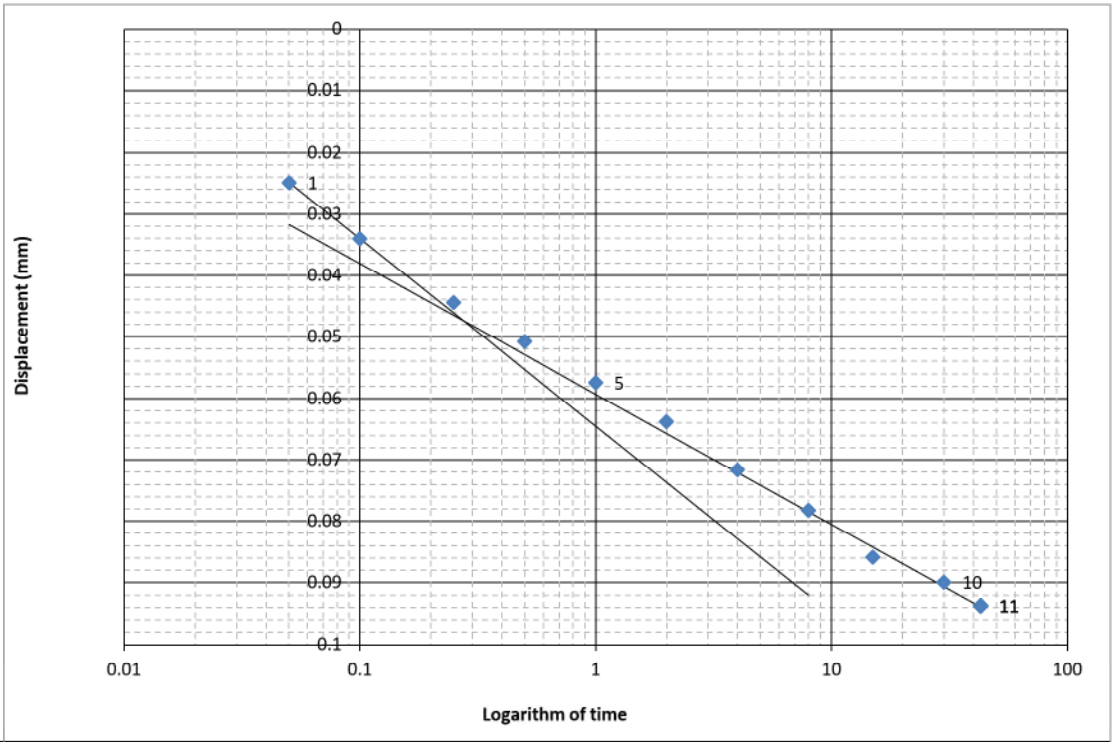
Load: 1
0.12 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.027
2	0.1	0.042
3	0.3	0.058
4	0.5	0.068
5	1.0	0.069
6	2.0	0.070
7	4.0	0.071
8	8.0	0.073
9	15.0	0.073
10	30.0	0.073
11	30.8	0.073
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	0	2	1	7
Second Point	2	3	2	11

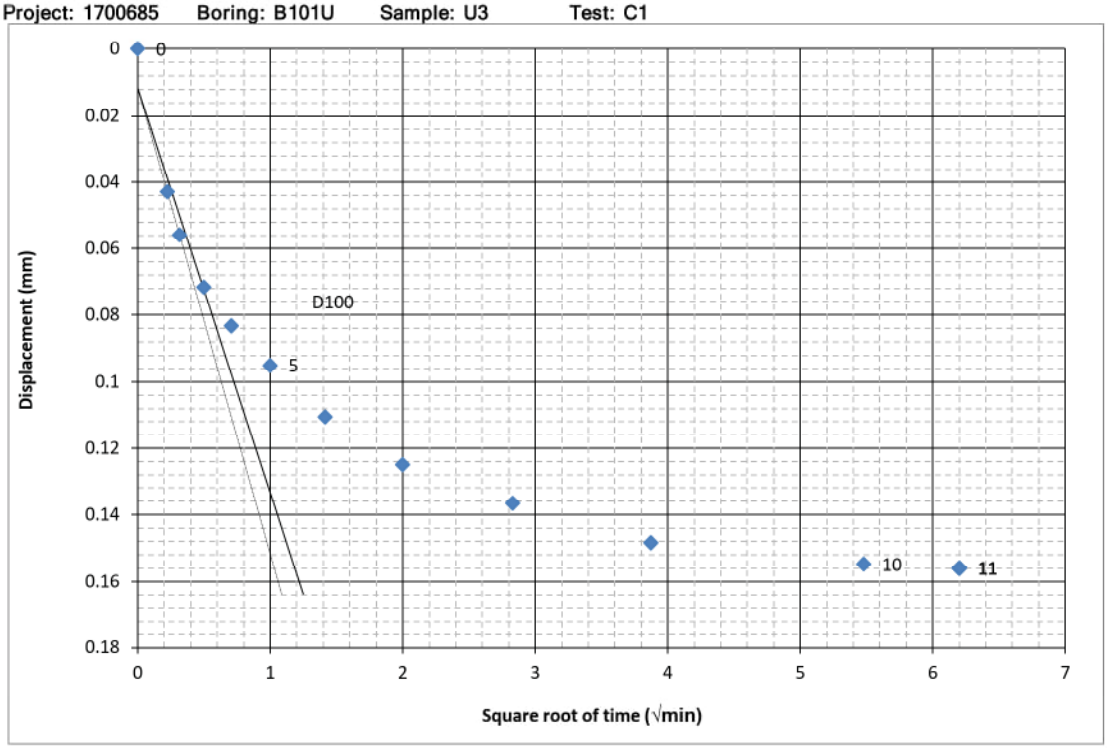


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.0937	0.0001	0.0224	0.0403	0.18	0.0447	0.05	0.0238	0.28	0.0475	0.0212
Absolute	-5.3099	-5.2161	-5.3097	-5.2874	-5.2696	0.18	-5.2651	0.05	-5.2861	0.28	-5.2624	0.0212

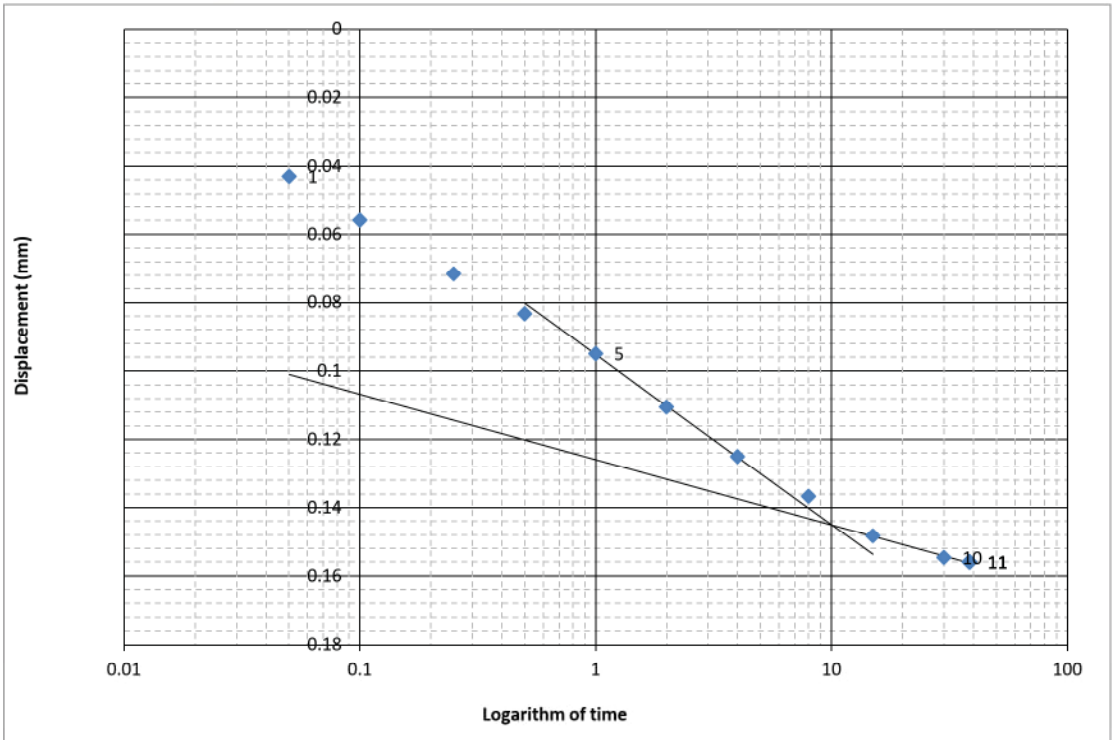
Load: 2
0.25 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.025
2	0.1	0.034
3	0.3	0.044
4	0.5	0.051
5	1.0	0.057
6	2.0	0.064
7	4.0	0.072
8	8.0	0.078
9	15.0	0.086
10	30.0	0.090
11	43.0	0.094
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	5	9
Second Point	2	3	7	11

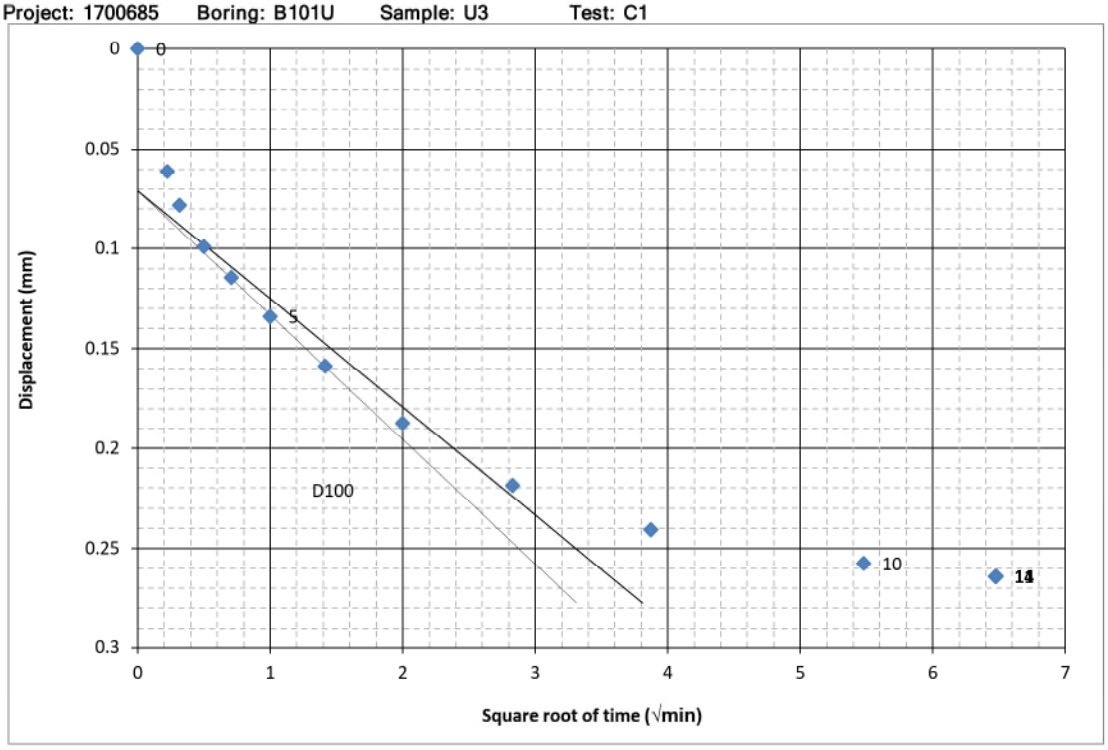


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.1560	0.0115	0.0438	0.0696	0.23	0.0761	0.23	0.0783	10.10	0.1452	0.0192
Absolute	-5.2161	-5.0602	-5.2046	-5.1723	-5.1465	0.23	-5.1400	0.23	-5.1378	10.10	-5.0710	0.0192

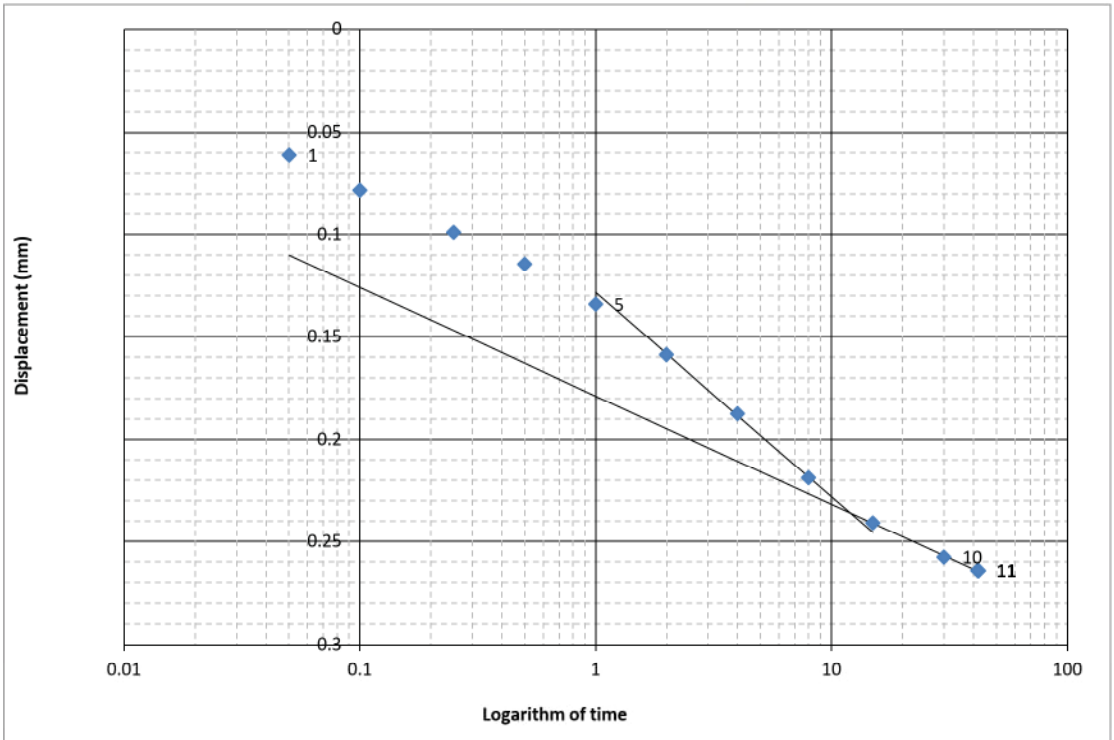
Load: 3
0.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.043
2	0.1	0.056
3	0.3	0.072
4	0.5	0.083
5	1.0	0.095
6	2.0	0.110
7	4.0	0.125
8	8.0	0.137
9	15.0	0.148
10	30.0	0.155
11	38.4	0.156
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	4	7	6	9
Second Point	6	8	8	11

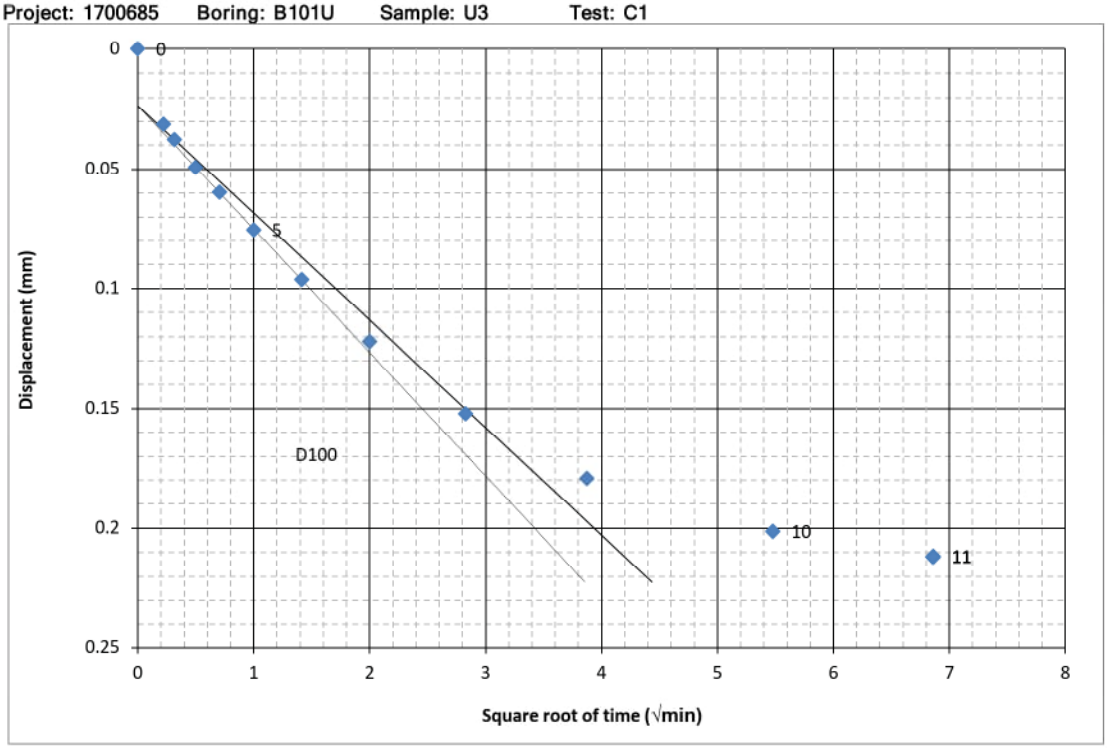


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2642	0.0710	0.1460	0.2060	6.21	0.2210	1.75	0.1535	12.05	0.2360	0.0529
Absolute	-5.0602	-4.7960	-4.9892	-4.9142	-4.8542	6.21	-4.8392	1.75	-4.9067	12.05	-4.8242	0.0529

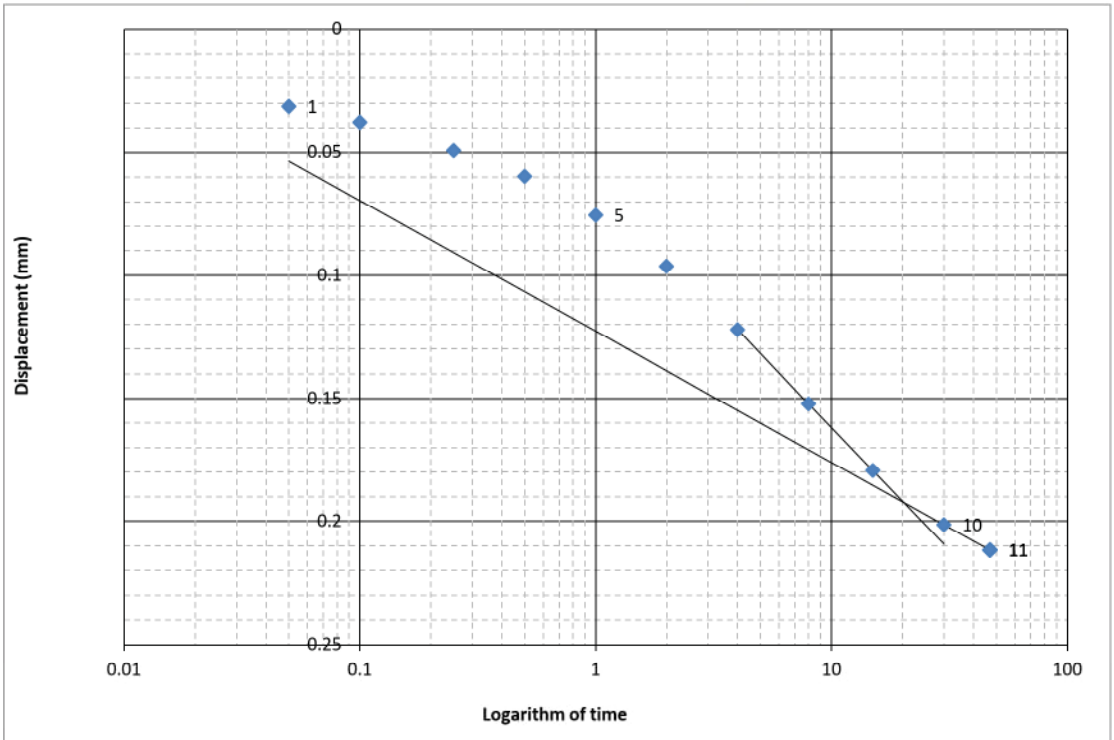
Load: 4
1.00 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.061
2	0.1	0.078
3	0.3	0.099
4	0.5	0.115
5	1.0	0.134
6	2.0	0.159
7	4.0	0.187
8	8.0	0.219
9	15.0	0.241
10	30.0	0.258
11	41.9	0.264
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	3	8	8	10
Second Point	6	9	9	11

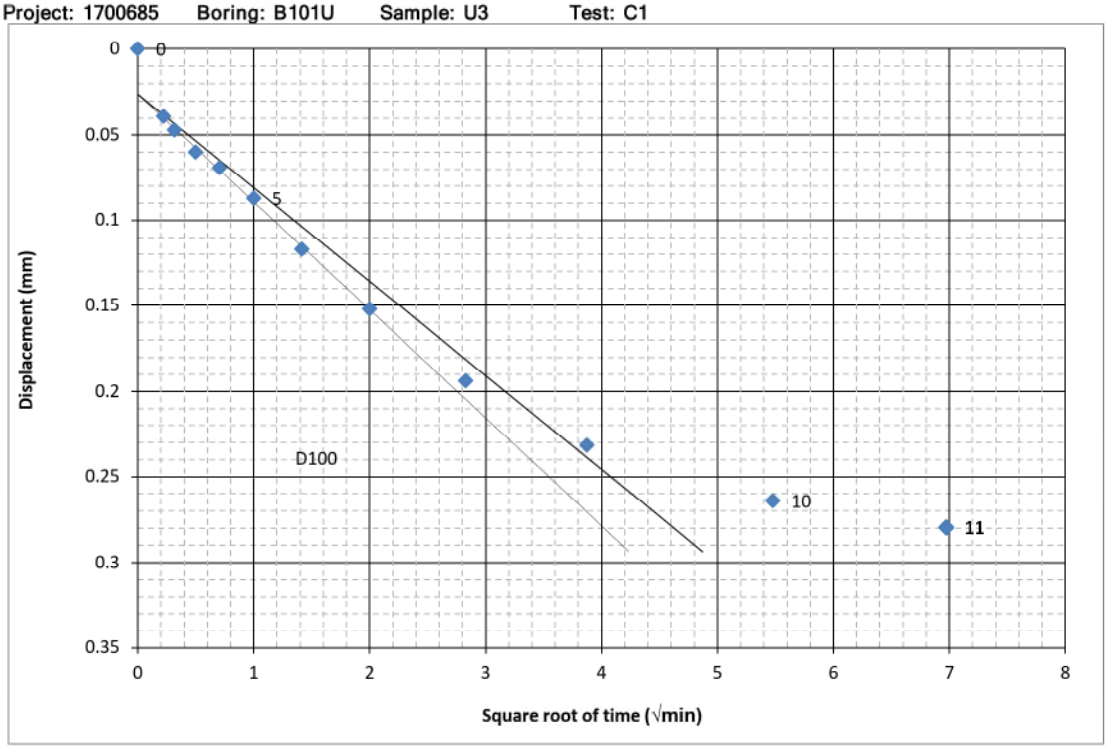


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2118	0.0235	0.0963	0.1546	8.55	0.1692	2.68	0.1079	20.29	0.1924	0.0533
Absolute	-4.7960	-4.5842	-4.7726	-4.6997	-4.6414	8.55	-4.6269	2.68	-4.6881	20.29	-4.6037	0.0533

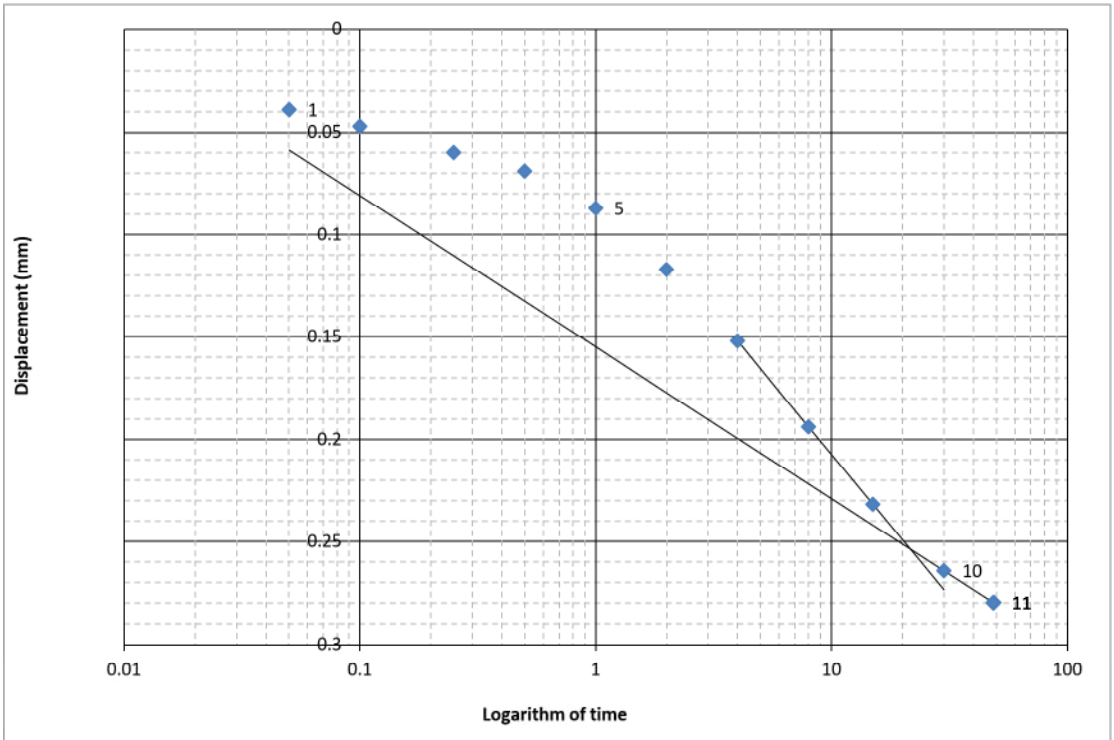
Load: 5
1.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.031
2	0.1	0.038
3	0.3	0.049
4	0.5	0.060
5	1.0	0.075
6	2.0	0.096
7	4.0	0.122
8	8.0	0.152
9	15.0	0.179
10	30.0	0.201
11	47.1	0.212
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	8	8	10
Second Point	7	9	9	11

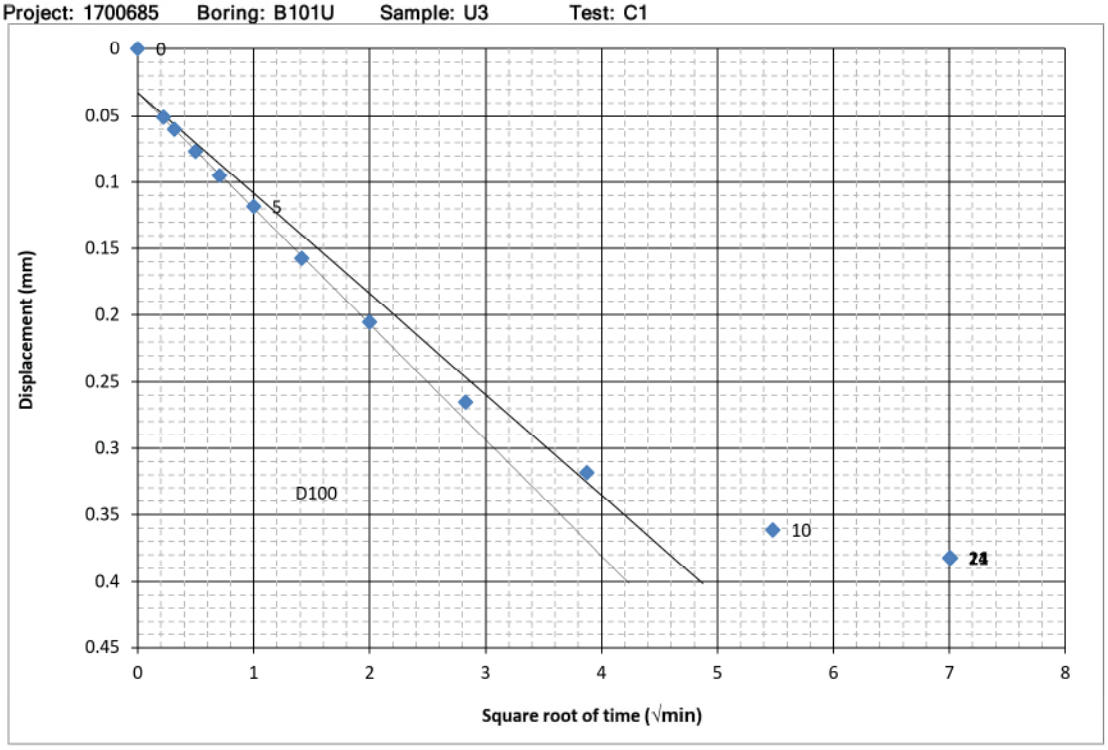


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2797	0.0260	0.1326	0.2179	12.20	0.2392	3.25	0.1398	21.60	0.2536	0.0739
Absolute	-4.5842	-4.3045	-4.5582	-4.4516	-4.3663	12.20	-4.3450	3.25	-4.4444	21.60	-4.3306	0.0739

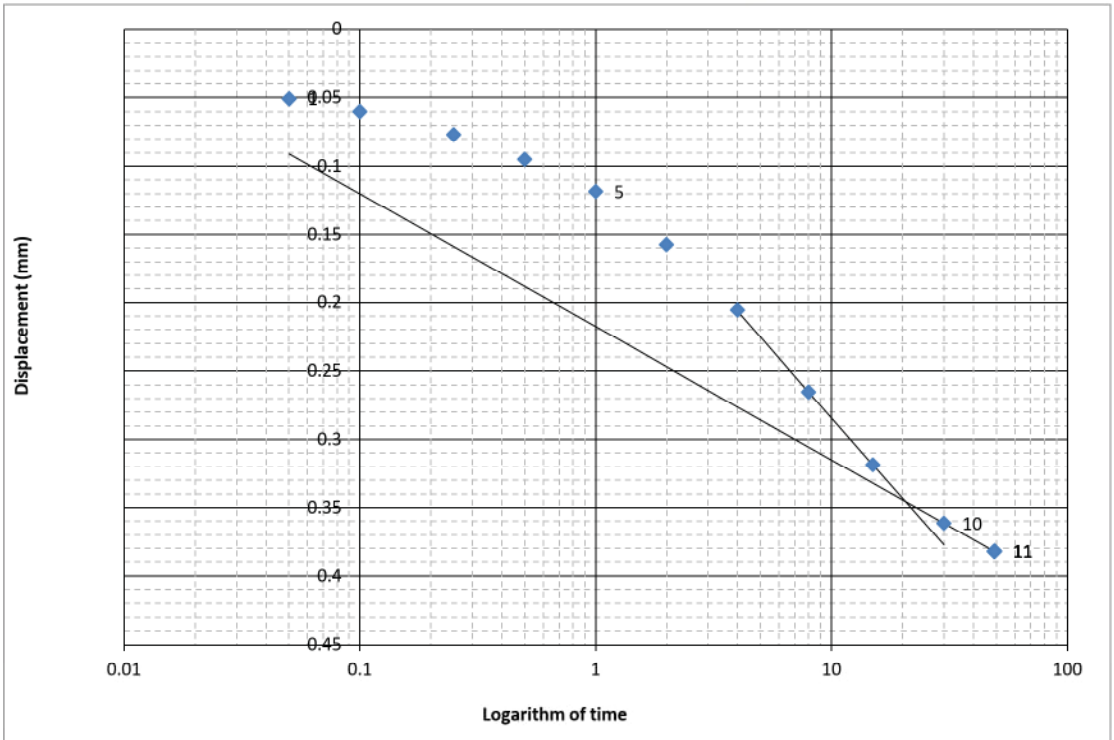
Load: 6
2.25 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.039
2	0.1	0.047
3	0.3	0.060
4	0.5	0.069
5	1.0	0.087
6	2.0	0.117
7	4.0	0.152
8	8.0	0.194
9	15.0	0.232
10	30.0	0.264
11	48.6	0.280
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	8	8	10
Second Point	7	9	9	11

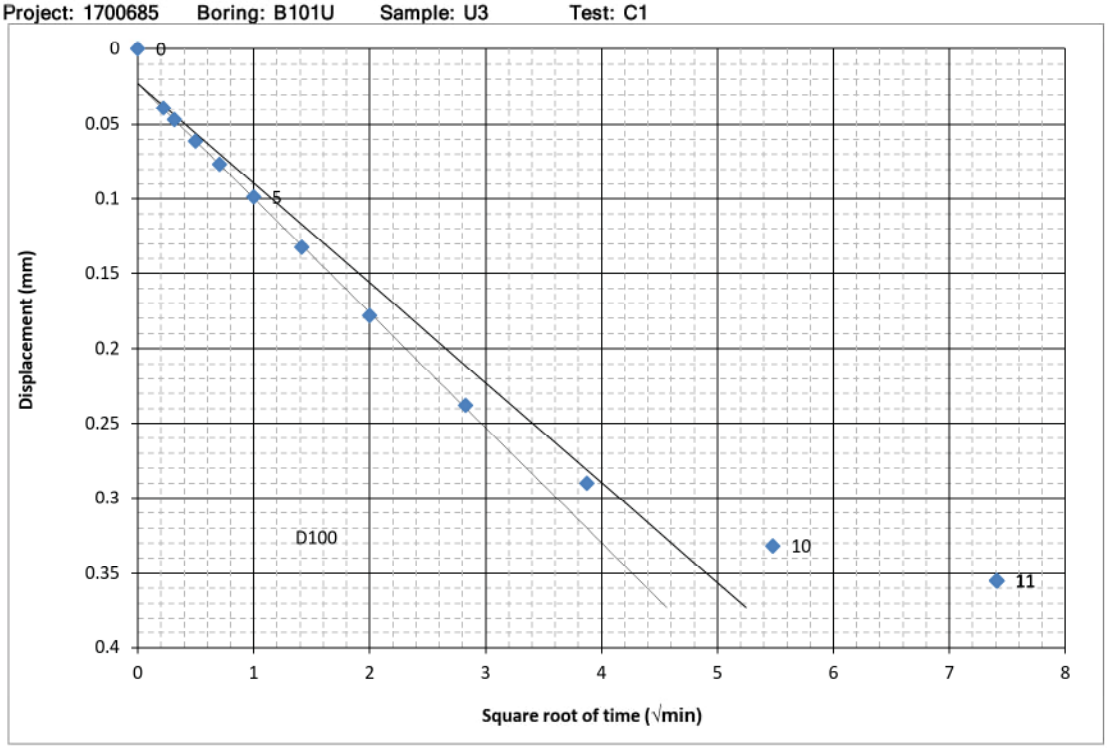


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.3823	0.0325	0.1831	0.3036	12.83	0.3337	3.23	0.1891	20.66	0.3457	0.0974
Absolute	-4.3058	-3.9235	-4.2734	-4.1227	-4.0022	12.83	-3.9721	3.23	-4.1168	20.66	-3.9601	0.0974

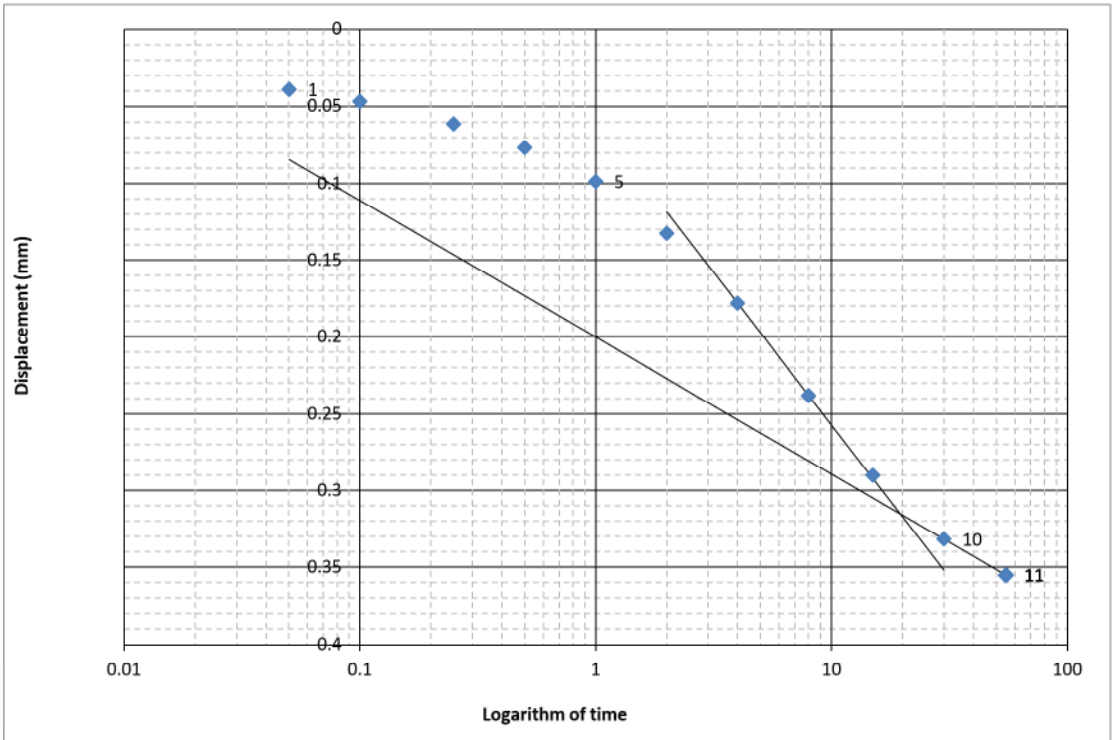
Load: 7
3.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.051
2	0.1	0.060
3	0.3	0.077
4	0.5	0.095
5	1.0	0.118
6	2.0	0.157
7	4.0	0.205
8	8.0	0.265
9	15.0	0.319
10	30.0	0.361
11	49.1	0.382
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	9	7	10
Second Point	8	10	8	11

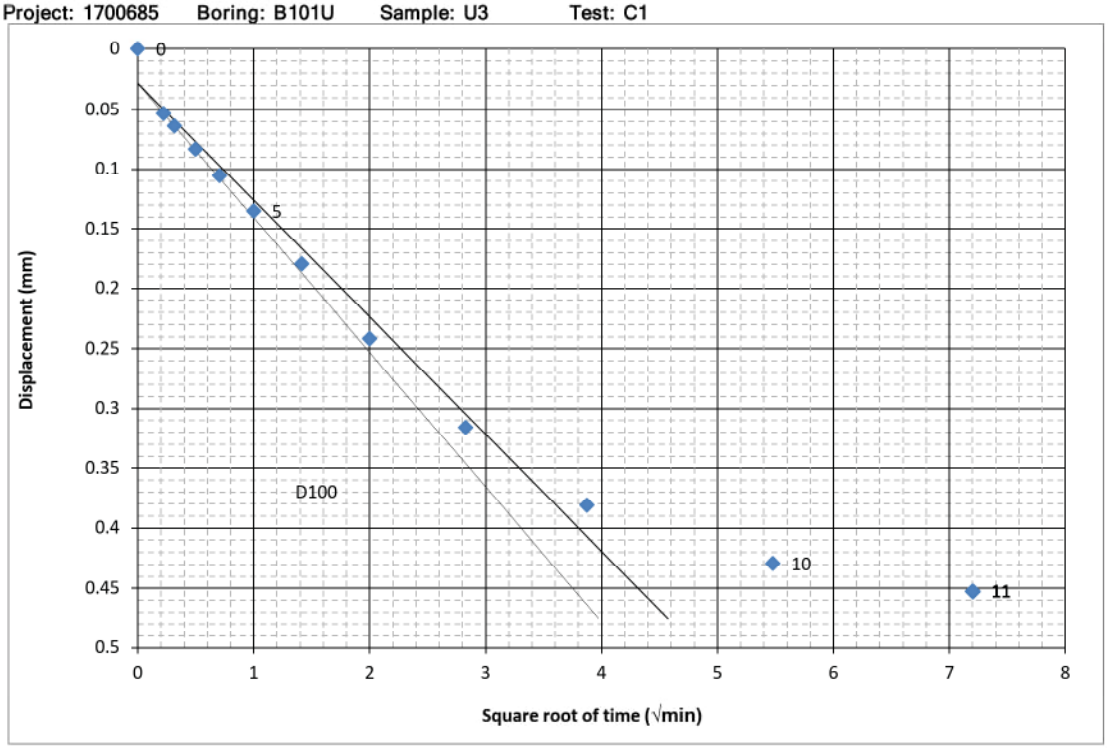


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.3551	0.0227	0.1744	0.2957	16.74	0.3261	3.63	0.1690	19.64	0.3153	0.0890
Absolute	-3.9235	-3.5684	-3.9008	-3.7492	-3.6278	16.74	-3.5975	3.63	-3.7545	19.64	-3.6082	0.0890

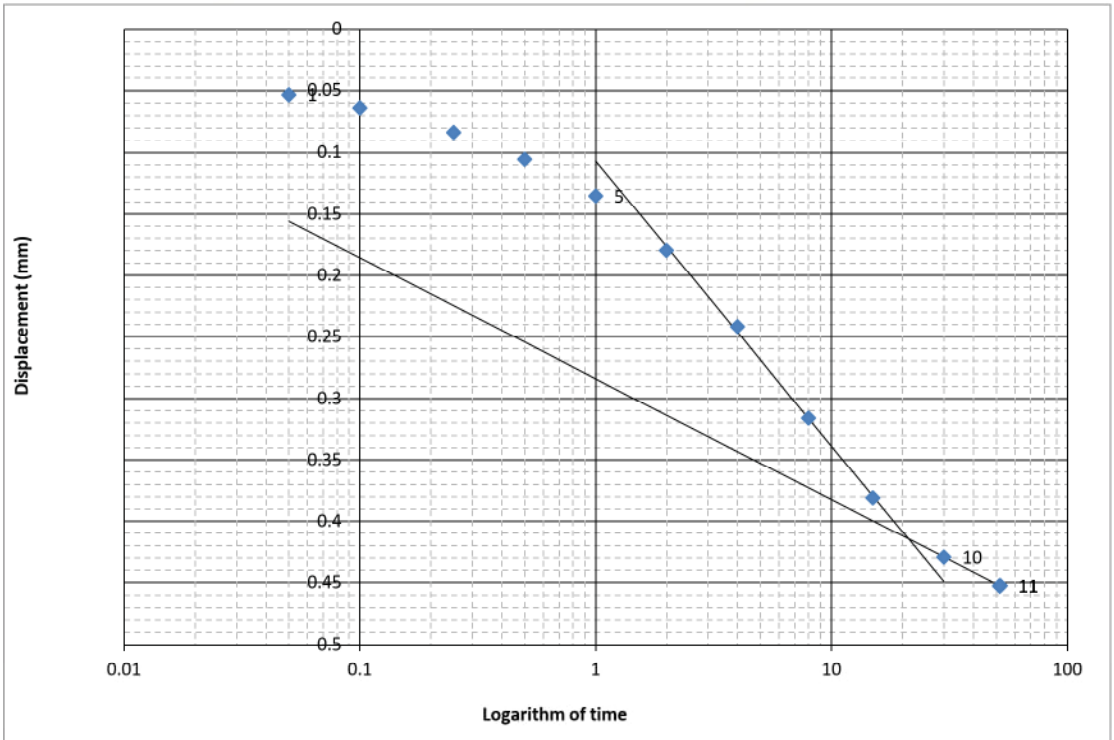
Load: 8
5.00 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.039
2	0.1	0.047
3	0.3	0.061
4	0.5	0.077
5	1.0	0.099
6	2.0	0.133
7	4.0	0.178
8	8.0	0.238
9	15.0	0.290
10	30.0	0.332
11	54.9	0.355
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	8	6	10
Second Point	2	9	9	11

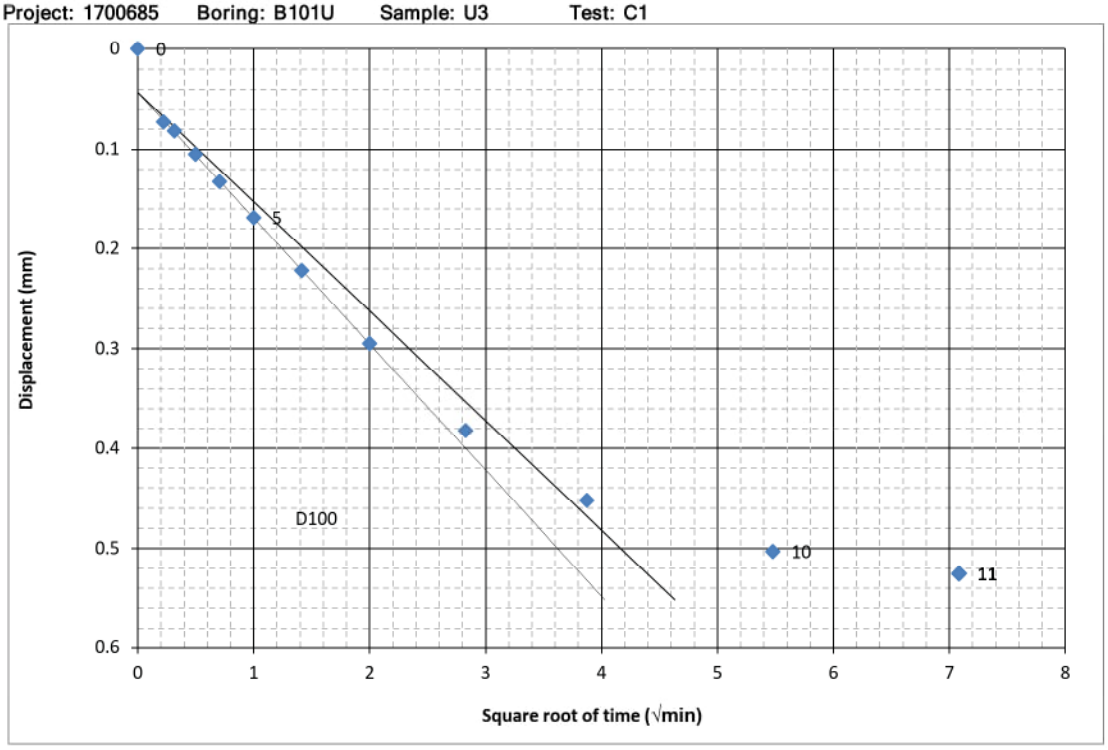


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.4526	0.0282	0.1990	0.3356	9.88	0.3697	2.95	0.2214	21.31	0.4146	0.0983
Absolute	-3.5684	-3.1158	-3.5402	-3.3695	-3.2329	9.88	-3.1987	2.95	-3.3470	21.31	-3.1538	0.0983

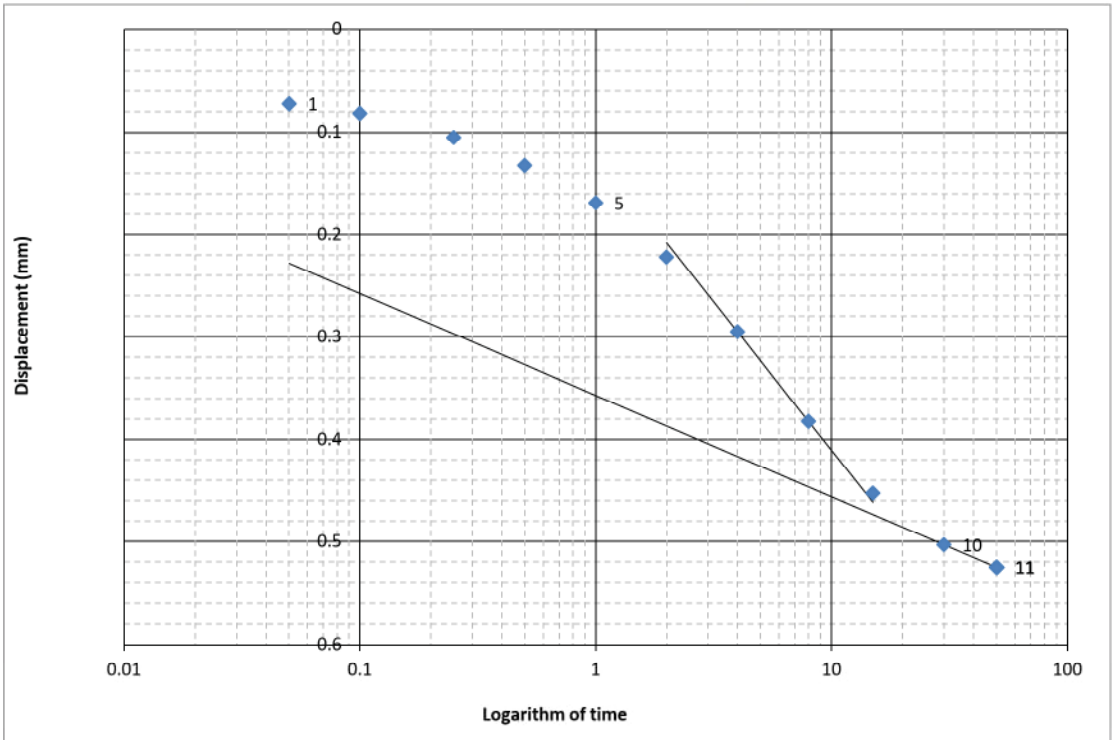
Load: 9
7.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.053
2	0.1	0.064
3	0.3	0.083
4	0.5	0.105
5	1.0	0.135
6	2.0	0.180
7	4.0	0.242
8	8.0	0.316
9	15.0	0.381
10	30.0	0.429
11	51.9	0.453
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 **Boring: B101U** **Sample: U3** **Test: C1**



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	8	7	10
Second Point	7	9	8	11

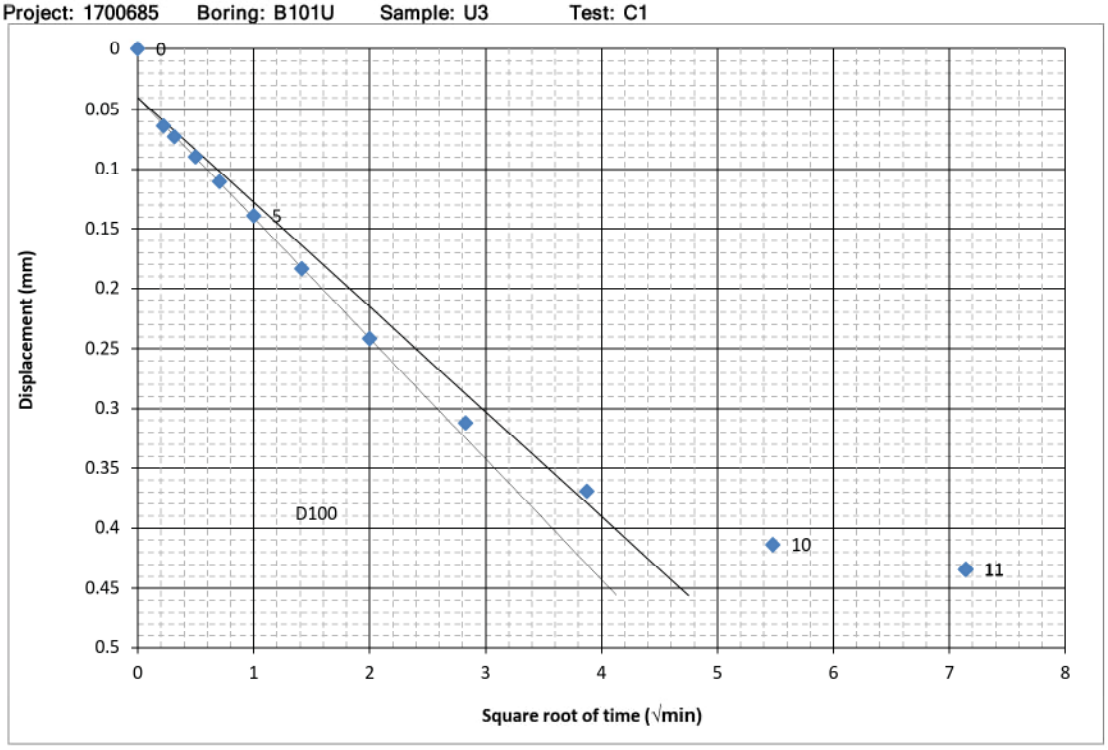


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.5253	0.0429	0.2566	0.4275	12.27	0.4702	2.99	0.2613	17.36	0.4796	0.0990
Absolute	-3.1158	-2.5905	-3.0729	-2.8592	-2.6883	12.27	-2.6456	2.99	-2.8545	17.36	-2.6362	0.0990

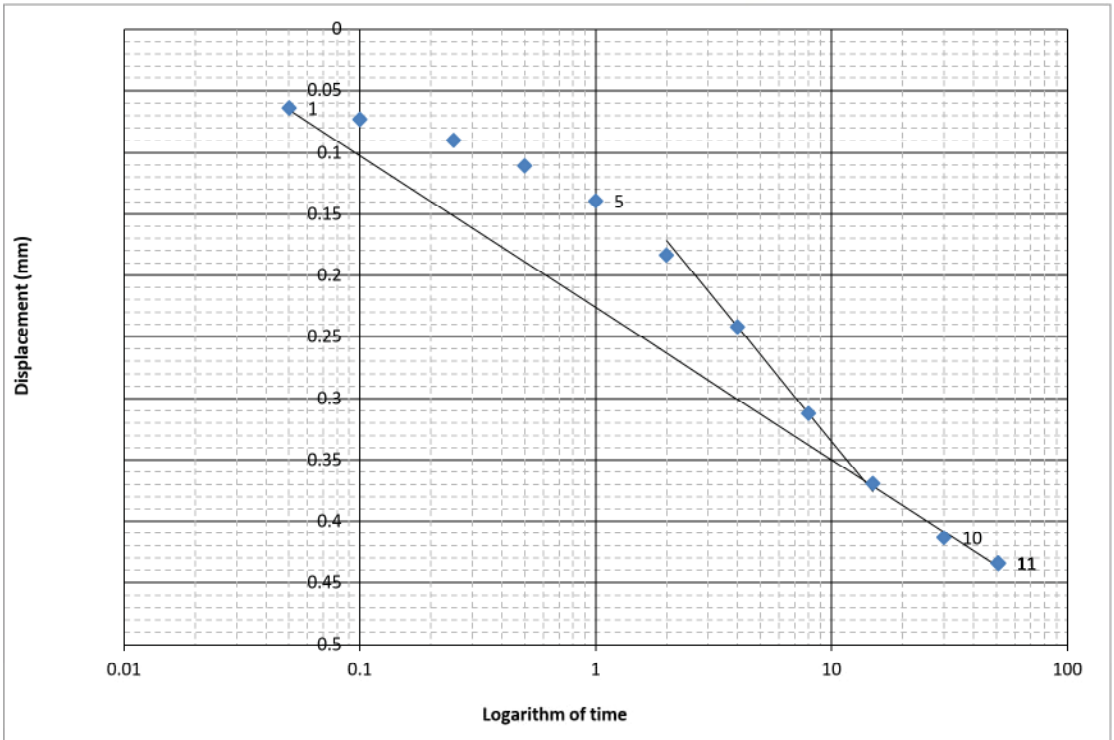
Load: 10
11.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.073
2	0.1	0.082
3	0.3	0.105
4	0.5	0.133
5	1.0	0.169
6	2.0	0.222
7	4.0	0.295
8	8.0	0.382
9	15.0	0.452
10	30.0	0.503
11	50.2	0.525
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	8	7	9
Second Point	7	9	8	11

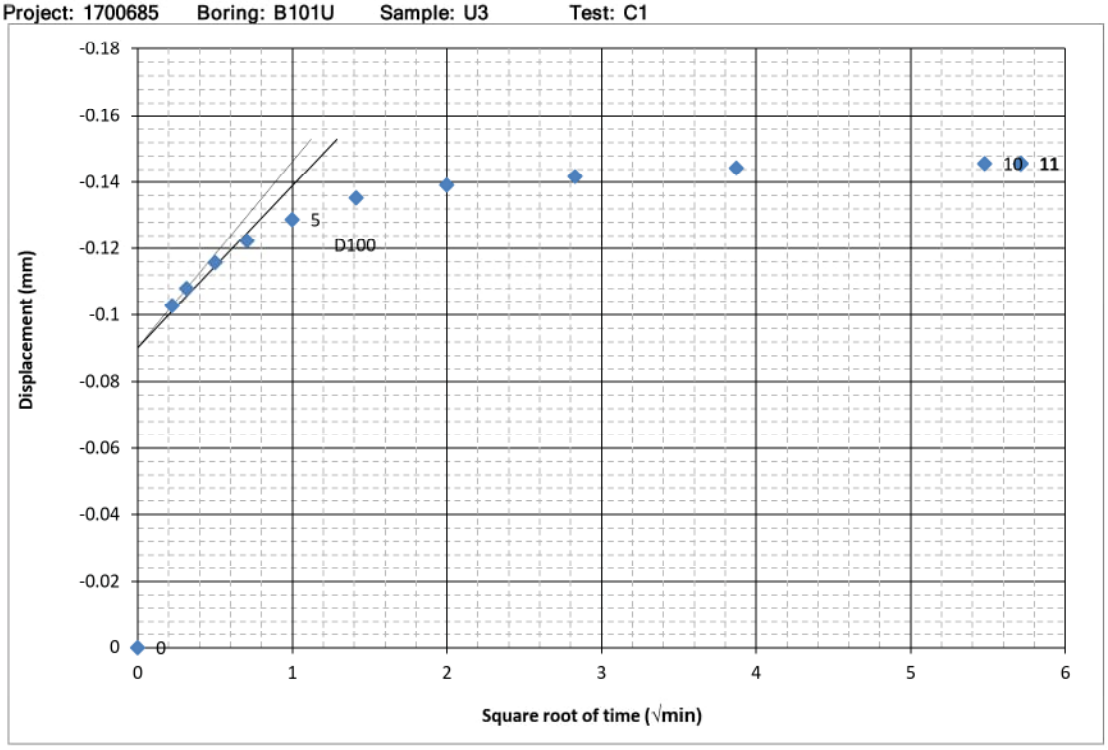


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.4344	0.0401	0.2139	0.3529	12.76	0.3876	2.63	0.2034	13.70	0.3666	0.1236
Absolute	-2.5905	-2.1562	-2.5504	-2.3767	-2.2377	12.76	-2.2029	2.63	-2.3872	13.70	-2.2239	0.1236

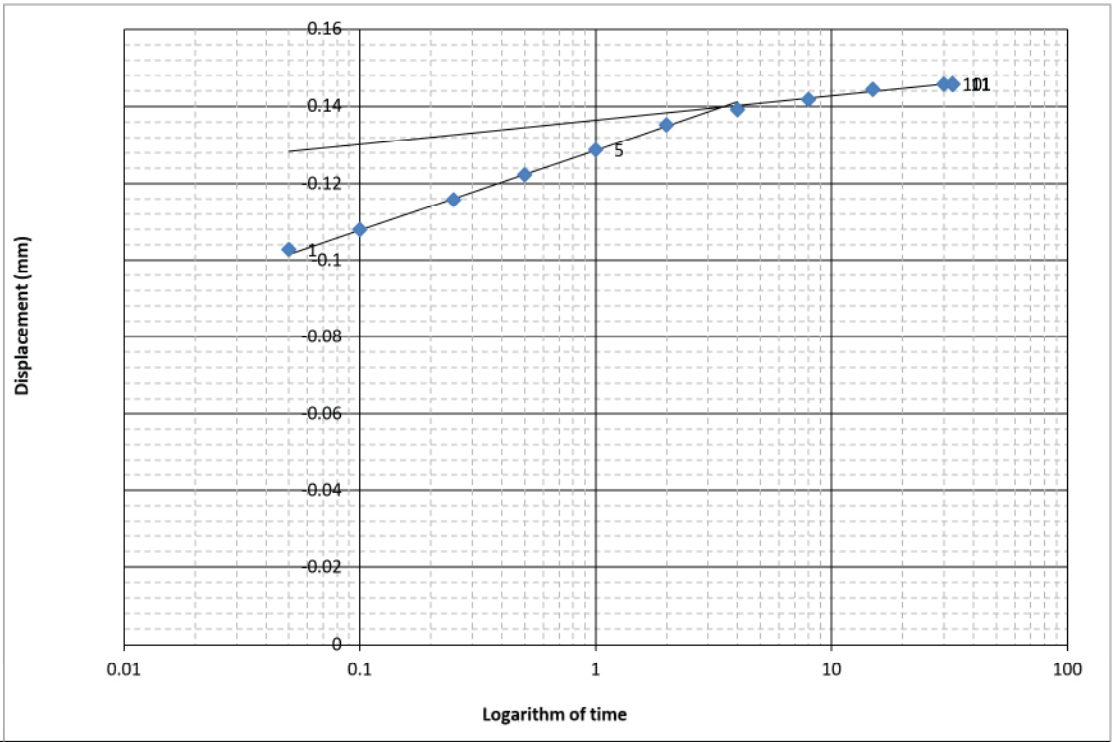
Load: 11
16.00 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.064
2	0.1	0.073
3	0.3	0.090
4	0.5	0.111
5	1.0	0.139
6	2.0	0.183
7	4.0	0.242
8	8.0	0.312
9	15.0	0.369
10	30.0	0.414
11	51.0	0.434
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	3	2	8
Second Point	2	4	5	11

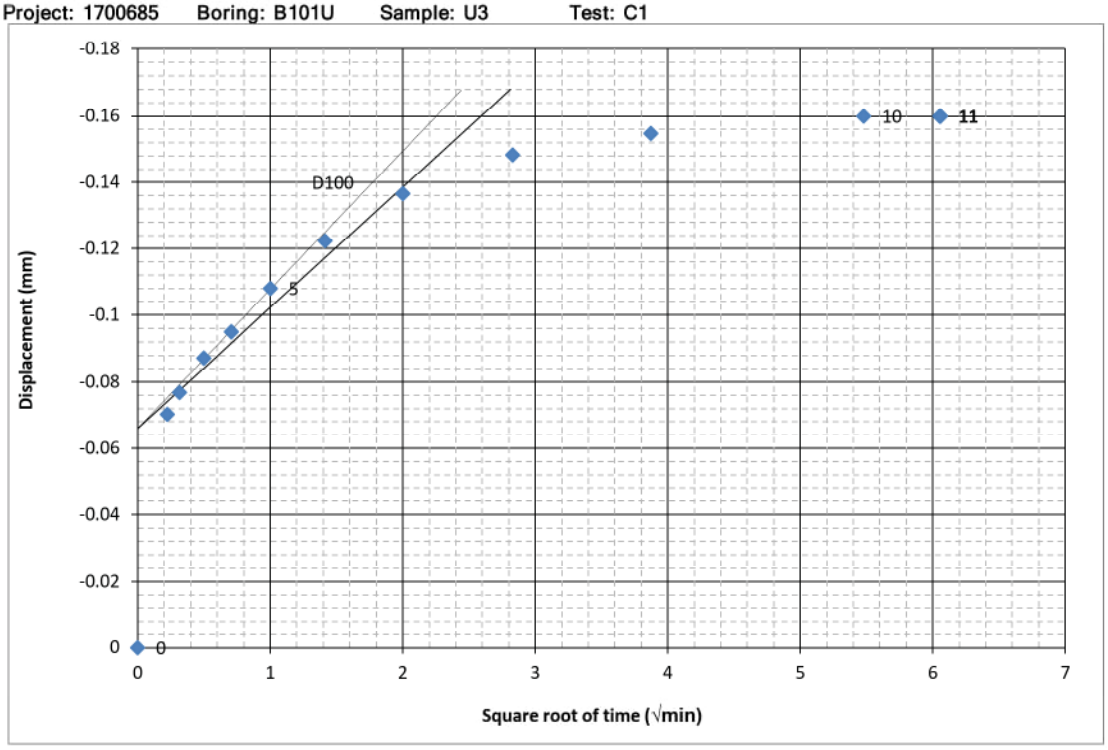


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.1456	-0.0902	-0.1056	-0.1179	0.32	-0.1210	0.20	-0.1150	3.44	-0.1398	-0.0062
Absolute	-2.1562	-2.3018	-2.2464	-2.2618	-2.2741	0.32	-2.2771	0.20	-2.2712	3.44	-2.2959	-0.0062

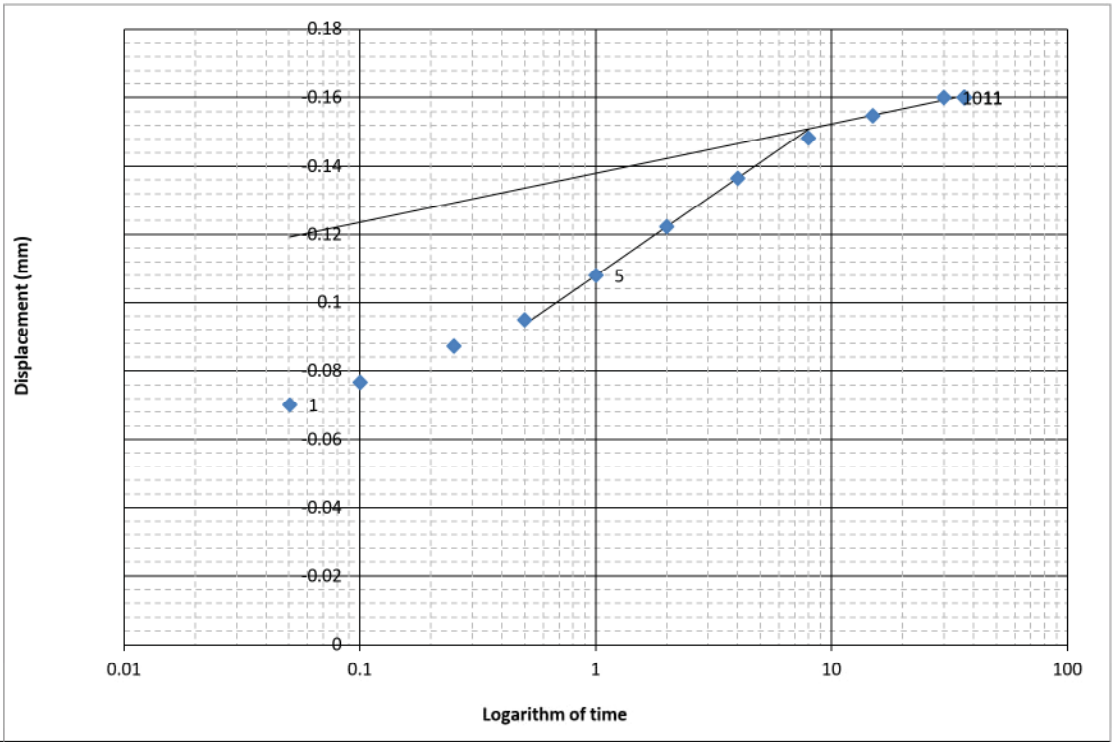
Load: 12
7.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.103
2	0.1	-0.108
3	0.3	-0.116
4	0.5	-0.122
5	1.0	-0.129
6	2.0	-0.135
7	4.0	-0.139
8	8.0	-0.142
9	15.0	-0.144
10	30.0	-0.146
11	32.6	-0.146
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	3	6	5	9
Second Point	5	7	6	11

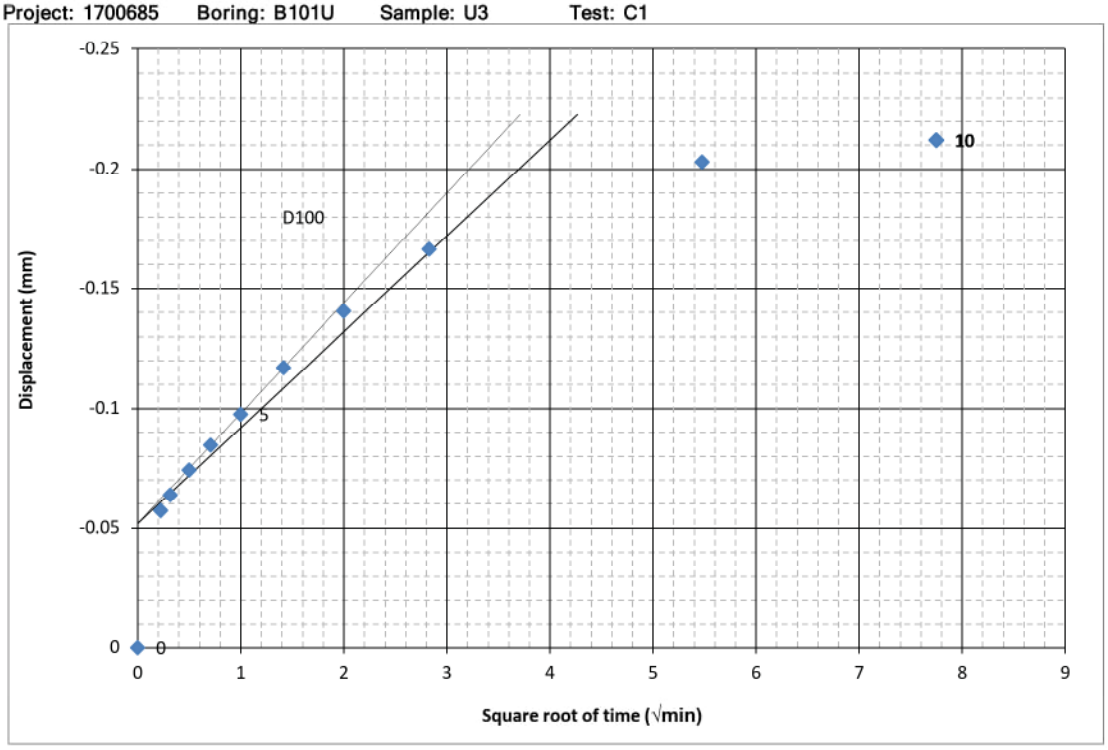


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.1600	-0.0660	-0.1029	-0.1325	3.36	-0.1399	1.04	-0.1085	8.06	-0.1510	-0.0144
Absolute	-2.3018	-2.4618	-2.3678	-2.4047	-2.4343	3.36	-2.4417	1.04	-2.4103	8.06	-2.4528	-0.0144

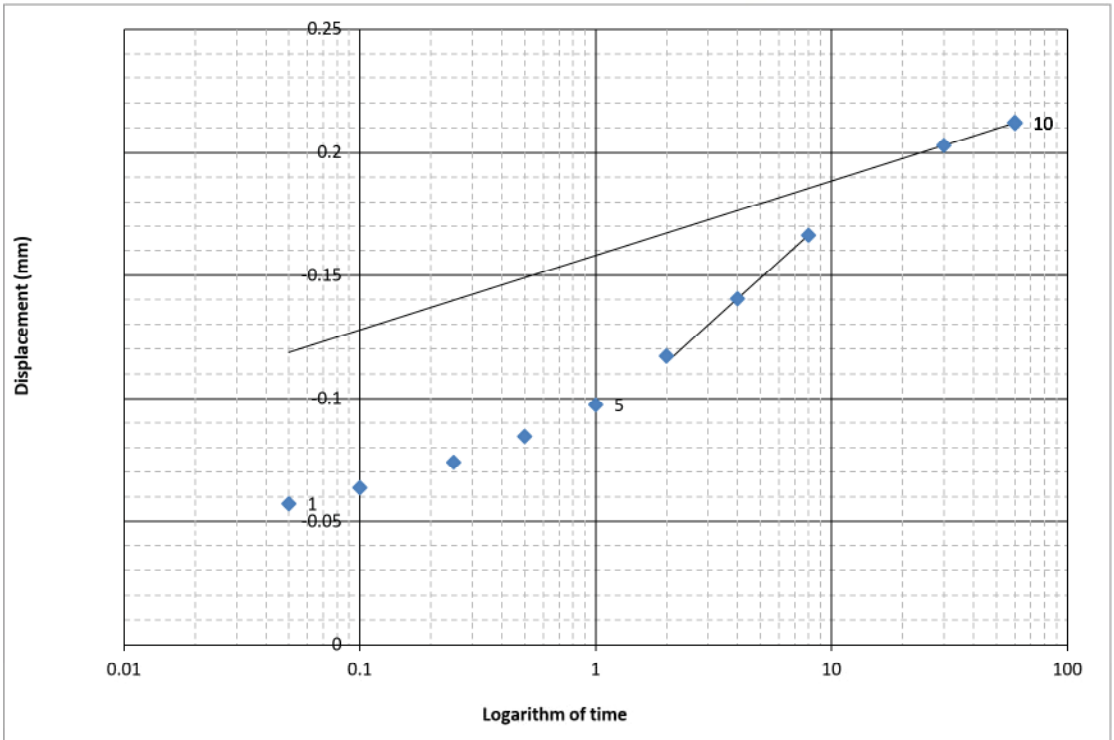
Load: 13
3.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.070
2	0.1	-0.077
3	0.3	-0.087
4	0.5	-0.095
5	1.0	-0.108
6	2.0	-0.122
7	4.0	-0.137
8	8.0	-0.148
9	15.0	-0.155
10	30.0	-0.160
11	36.7	-0.160
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	
First Point	4	8	7	9
Second Point	6	9	8	10



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.2121	-0.0518	-0.1158	-0.1670	8.28	-0.1798	2.45	-0.1239	17.66	-0.1960	-0.0304
Absolute	-2.4618	-2.6739	-2.5136	-2.5776	-2.6288	8.28	-2.6416	2.45	-2.5857	17.66	-2.6577	-0.0304

Load: 14
1.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.057
2	0.1	-0.064
3	0.3	-0.074
4	0.5	-0.085
5	1.0	-0.098
6	2.0	-0.117
7	4.0	-0.140
8	8.0	-0.166
9	30.0	-0.203
10	60.0	-0.212
11	-	-
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
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36	-	-
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38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
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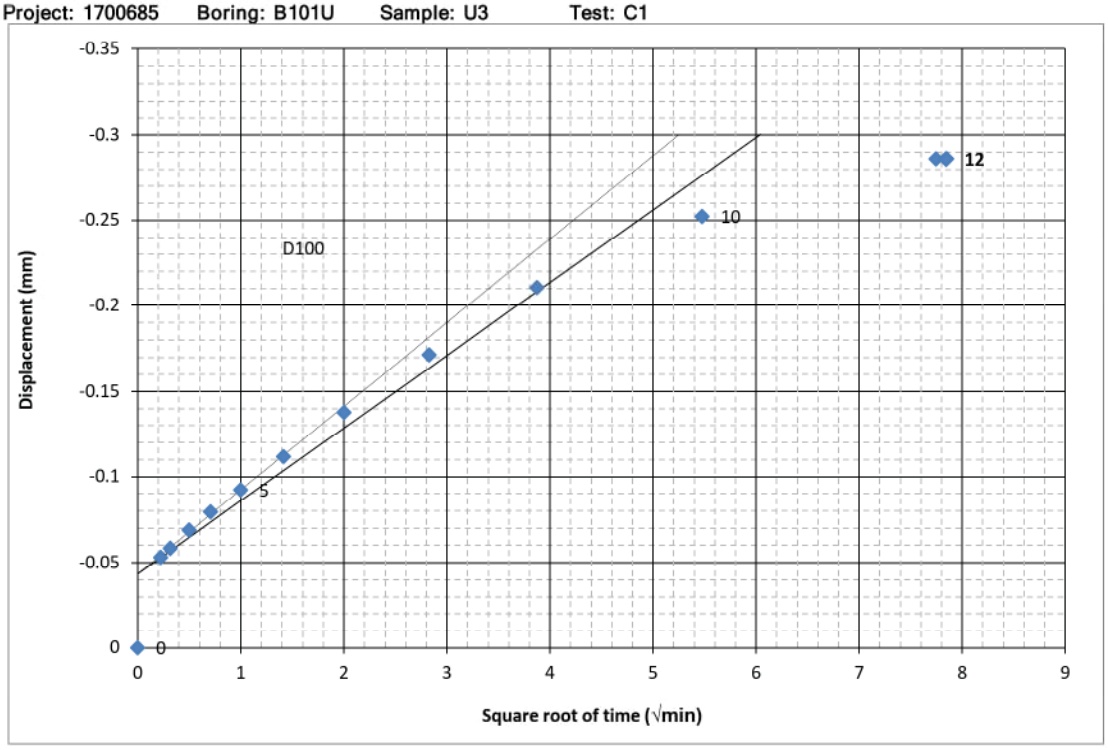
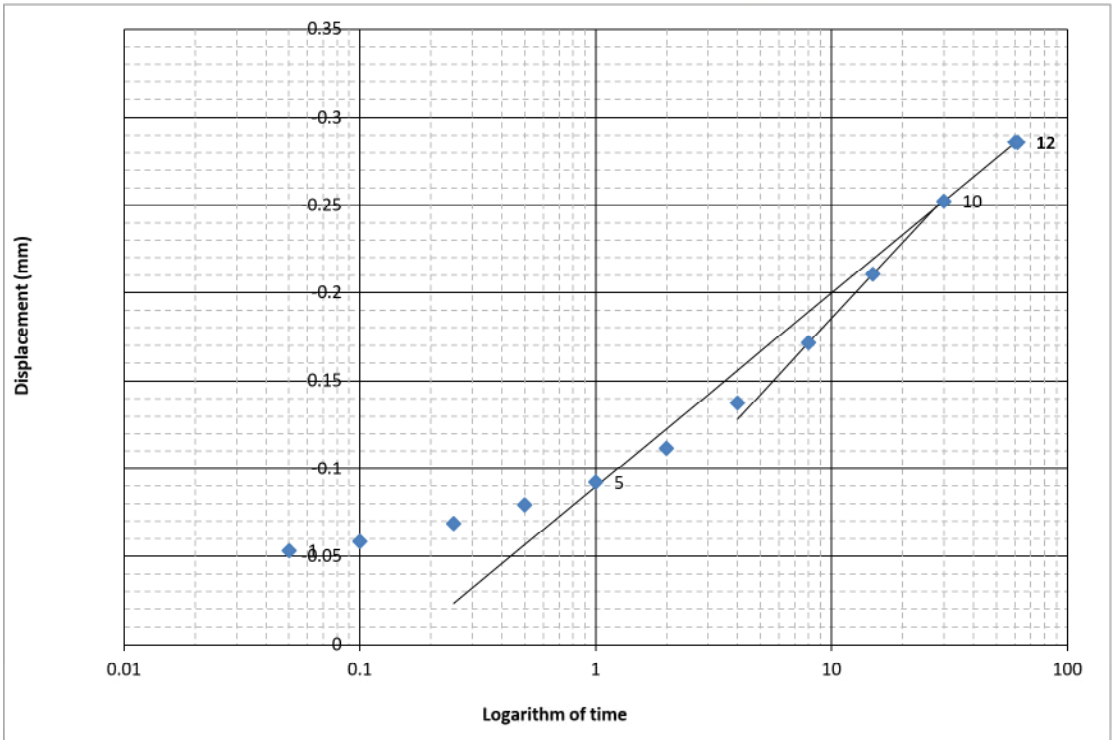
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	9	8	10
Second Point	6	10	9	12



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.2860	-0.0433	-0.1385	-0.2146	16.22	-0.2336	4.35	-0.1454	27.11	-0.2474	-0.1101
Absolute	-2.6739	-2.9599	-2.7172	-2.8123	-2.8884	16.22	-2.9074	4.35	-2.8192	27.11	-2.9213	-0.1101

Load: 15
0.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.053
2	0.1	-0.058
3	0.3	-0.069
4	0.5	-0.079
5	1.0	-0.092
6	2.0	-0.112
7	4.0	-0.138
8	8.0	-0.171
9	15.0	-0.211
10	30.0	-0.252
11	60.0	-0.286
12	61.5	-0.286
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
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36	-	-
37	-	-
38	-	-
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40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
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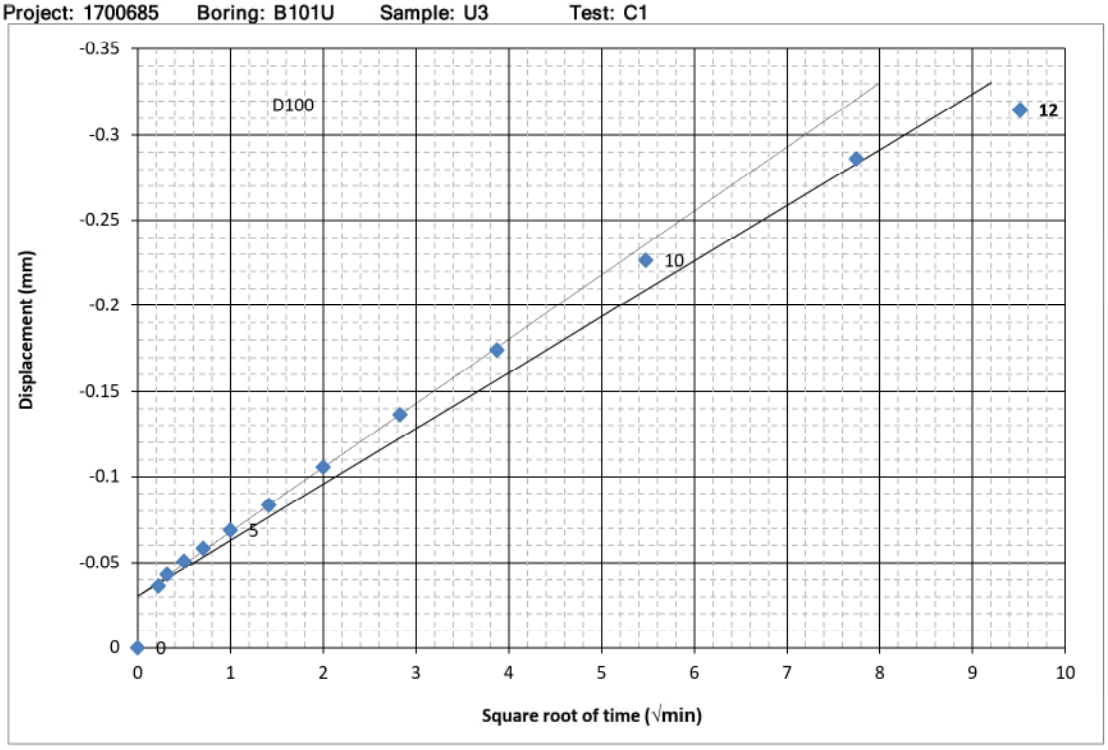
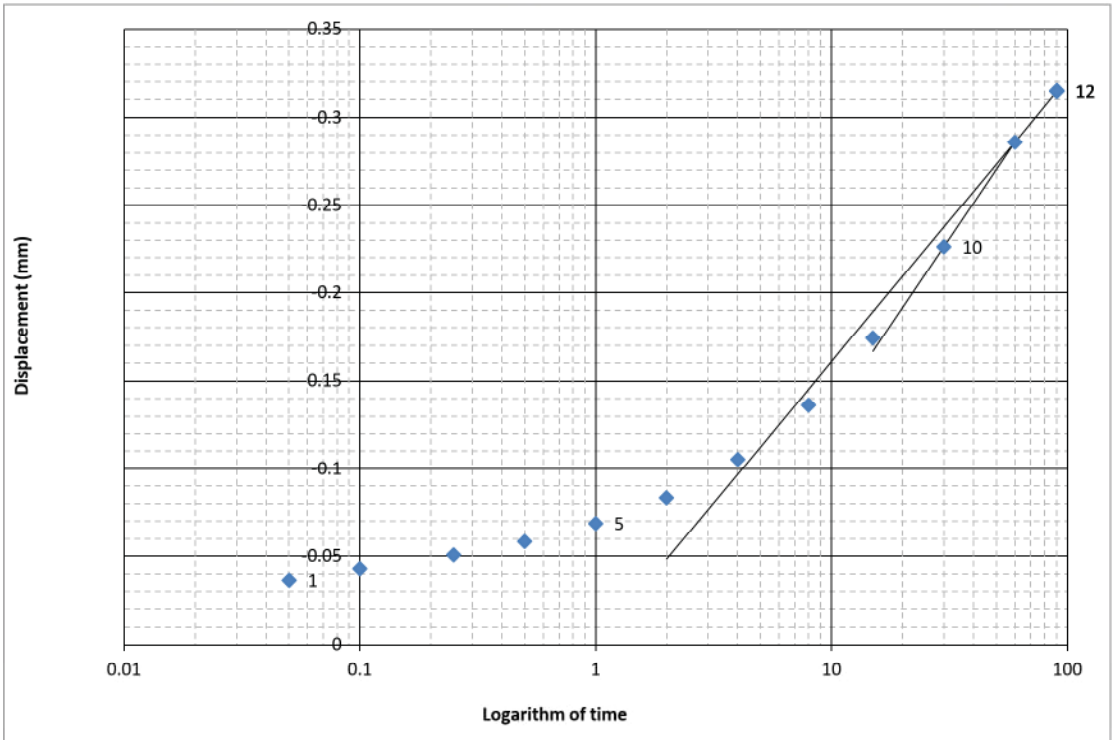
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B101U Sample: U3 Test: C1



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	6	11	10	11
Second Point	8	12	11	12



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.3147	-0.0303	-0.1740	-0.2890	62.89	-0.3177	11.62	-0.1581	60.00	-0.2860	-0.1609
Absolute	-2.9599	-3.2746	-2.9901	-3.1339	-3.2489	62.89	-3.2776	11.62	-3.1180	60.00	-3.2459	-0.1609

Load: 16
0.12 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.036
2	0.1	-0.043
3	0.3	-0.051
4	0.5	-0.058
5	1.0	-0.069
6	2.0	-0.083
7	4.0	-0.105
8	8.0	-0.136
9	15.0	-0.174
10	30.0	-0.226
11	60.0	-0.286
12	90.5	-0.3147
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
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36	-	-
37	-	-
38	-	-
39	-	-
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41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

PROJECT:	Glen Lyn Seismic Stability
PROJECT NO.:	1700685
BORING:	B101U
SAMPLE:	U3
TEST:	C1
DEPTH, ft:	55.2
BY:	W. Lukas
DATE:	12/11/17

Project Name	Line 1	Glen Lyn Seismic Stability
	Line 2	West Pond and Landfill
	Line 3	Glen Lyn, Virginia
Client	Line 1	American Electric Power
	Line 2	Columbus, Ohio

Figure No.
Report Date: March 2018
Surface Elevation: Sample Elevation:
Checked By: D. Aghjayan
SPECIMEN DESCRIPTION: LEAN CLAY with SAND (CL)
SAMPLE TYPE: 2.8-inch-diameter Shelby tube specimen
Liquid Limit
Plastic Limit — Water Table (ft):
Plasticity Index — Total Unit Weight (pcf):
EQUIPMENT: — Overburden Stress (tsf)
Load Frame No.: Geocomp

Initial DCDT reading:	-5.382514	mm	AREA:	31.67	sq. cm.
Final DCDT reading:	-3.274568	mm		4.909	sq. in.
Final Compliance	0.11313955	mm			
HEIGHT:	0.880	in.		22.35	mm
DIAMETER:	2.500	in.		63.50	mm

Log (l) or Sqrt(s) l

English(e) or Metric(m) e

WATER CONTENT AND WEIGHT OF SOLIDS INFORMATION	START		DURING	END		
	TRIMMINGS	SPECIMEN	LOST MATERIAL	LOST MATERIAL	SPECIMEN	EXCESS SOLIDS
W+TARE (gm)	88.810	304.060	-	-	164.900	-
D+TARE (gm)	76.280	274.710	0	0	140.800	229.890
TARE (gm)	31.540	165.120	0	0	31.300	229.800
Ws (gm)	44.74	109.590	0	0	109.500	0.090
w (%)	28.01	26.78	-	-	22.01	-
Specimen Solids (gm)		109.59	109.59	109.59	109.59	

PROJECT:	Glen Lyn Seismic Stability
PROJECT NO.:	1700685
BORING:	B101U
SAMPLE:	U3
TEST:	C1
DEPTH, ft:	55.2
BY:	W. Lukas
DATE:	12/11/17

		Computed Stress			delta Ws
Stage	Applied Load	psi	psf	tsf	g
1	8.3874	1.71	246.05	0.12	0
2	16.94975	3.45	497.23	0.25	0
3	34.004	6.93	997.52	0.50	0
4	68.078	13.87	1997.10	1.00	0
5	102.225	20.83	2998.82	1.50	0
6	153.35	31.24	4498.59	2.25	0
7	238.445	48.58	6994.89	3.50	0
8	340.81	69.43	9997.81	5.00	0
9	511.28	104.16	14998.62	7.50	0
10	783.94	159.70	22997.22	11.50	0
11	1090.725	222.20	31996.90	16.00	0
12	511.21	104.14	14996.57	7.50	0
13	238.445	48.58	6994.89	3.50	0
14	102.225	20.83	2998.82	1.50	0
15	34.004	6.93	997.52	0.50	0
16	8.42235	1.72	247.07	0.12	0
					final

COMPUTATIONS:

	Initial		Final Saturation	Final
WEIGHT OF SOLIDS (gm):	109.59		109.59	109.59
GRAVITY OF SOLIDS:	2.720	e	2.7159965	2.72
HEIGHT OF SOLIDS (mm):	12.722	"e" or "m"	12.741	12.741
CHANGE IN HEIGHT (mm):	1.99480645	(Est./meas.)		

TOTAL HEIGHT END:	20.357
HEIGHT WATER START:	9.268
HEIGHT WATER END:	7.616
SATURATION START:	0.962
SATURATION END:	0.998

One-Dimensional Consolidation Test

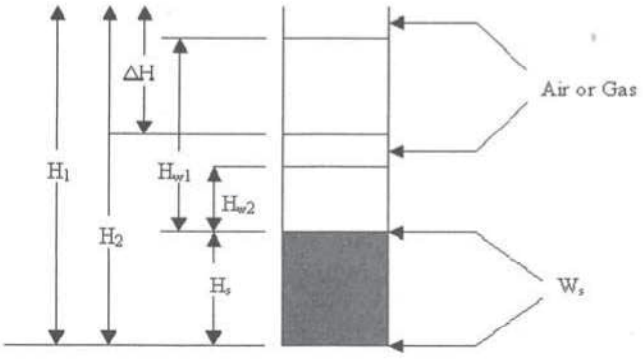
Project Name	GLEN LYN
Description of Sample	CLAYEY ALLUVIUM

Project No.	1700685
Test No.	C1
Boring	B101U
Sample	U3
Depth	55.2ft
By	
Date	
Checked	
Date	

	Soil at Start of Test		Soil at End of Test	
	Specimen	*Trimmings*	*Specimen*	*Excess Solids*
Container No.	Ring and Glass Plates	A-9	T-33	KD-09
Wet Wt. + Tare	304.06	88.81	164.90	--
Dry Wt. + Tare	274.71	76.28	140.80	229.89
Wt. Water	29.35	12.53	24.10	--
Tare Wt.	165.12	31.54	31.30	229.80
Dry Wt. Soil	w_s = 109.59	44.74	109.50	+ 0.09 = w_s
Water Content	w_1 = 26.8	28.0%	w_2 = 22.0	--

SPECIMEN DIMENSIONS

Test Ring Number		
Ht. Ring = Ht. Sample at Start of Test = H_1 =		cm
Inside Diameter of Ring		cm
Specific Gravity of Solids = S_s =		(Det. / Est.)
Reduced Ht. (Solid Matter) = Hs = (w_s / A * S_s		cm
Change in Ht. of Specimen from Beginning to End of Test = ΔH =		cm



Ht. of Specimen at End	$H_2 = H_1 - \Delta H$	cm
Ht. of Water at Start	$H_{W1} = w_1 * H_s * S_s$	cm
Ht. of Water at End	$H_{W2} = w_2 * H_s * S_s$	cm
Degree of Saturation at Start of Test	$G_1 = H_{W1} / (H_1 - H_s)$	cm
Degree of Saturation at End of Test	$G_2 = H_{W2} / (H_2 - H_s)$	cm

REMARKS Organic odor, manure-like

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γ_d, Dry Density - Undisturbed

	Project No.	1700685
	Test No.	C1
	Boring	B101U
	Sample	U3
	Depth	
	By	WBL
	Date	
	Checked	
	Date	

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	JJ-2	B-21		
Wet Wt. + Tare (g)	75.73	120.61		
Dry Wt. + Tare (g)	82.21	101.07		
Wt. Water (g)	13.52	19.54		
Tare (g)	31.46	31.94		
Dry Wt. Soil (g)	50.75	69.13		
Water Content (%)	26.6	28.3		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	14.0 cm
Top Empty Length					cm	Avg.	5.0 cm
Bottom Empty Length					cm	Avg.	1.7 cm

Trimmed Length in Tube, L: 7.3 cm

Tube Dimensions

Tube Inner Diameter	7.293	7.289	7.301		cm	Avg.	7.294 cm

Tube Weight (g):
Weight of other (specify:_____) (g):

Area, A: 41.79 cm^2
Volume in Tube = A x L: 305.059 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	g
Membrane	g
W_{moist}	g

Dry Wt. Of Excess Solids

Tare #	g
Dry + Tare	g
Tare	g
Dry Wt. Of Excess	g

Water Content

(Fraction Used:_____)

Tare #	
Wet + Tare	g
Dry + Tare	g
Wt. Water	g
Tare	g
Wt. Dry Soil	g
Water Content	%

$W_s = W_{moist} / (1 + wc) +$ Dry Wt of Excess = g

Estimate of γ_d using γ_m, in tube

Moist soil + tube + other (specify:—)	1038.20 g
Tube ~~+ other~~	416.86 g
Moist soil	621.34 g

γ_{moist} = Wt. Moist Soil / Volume in Tube = g/cm^3 / pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = g/cm^3 / pcf

Remarks:

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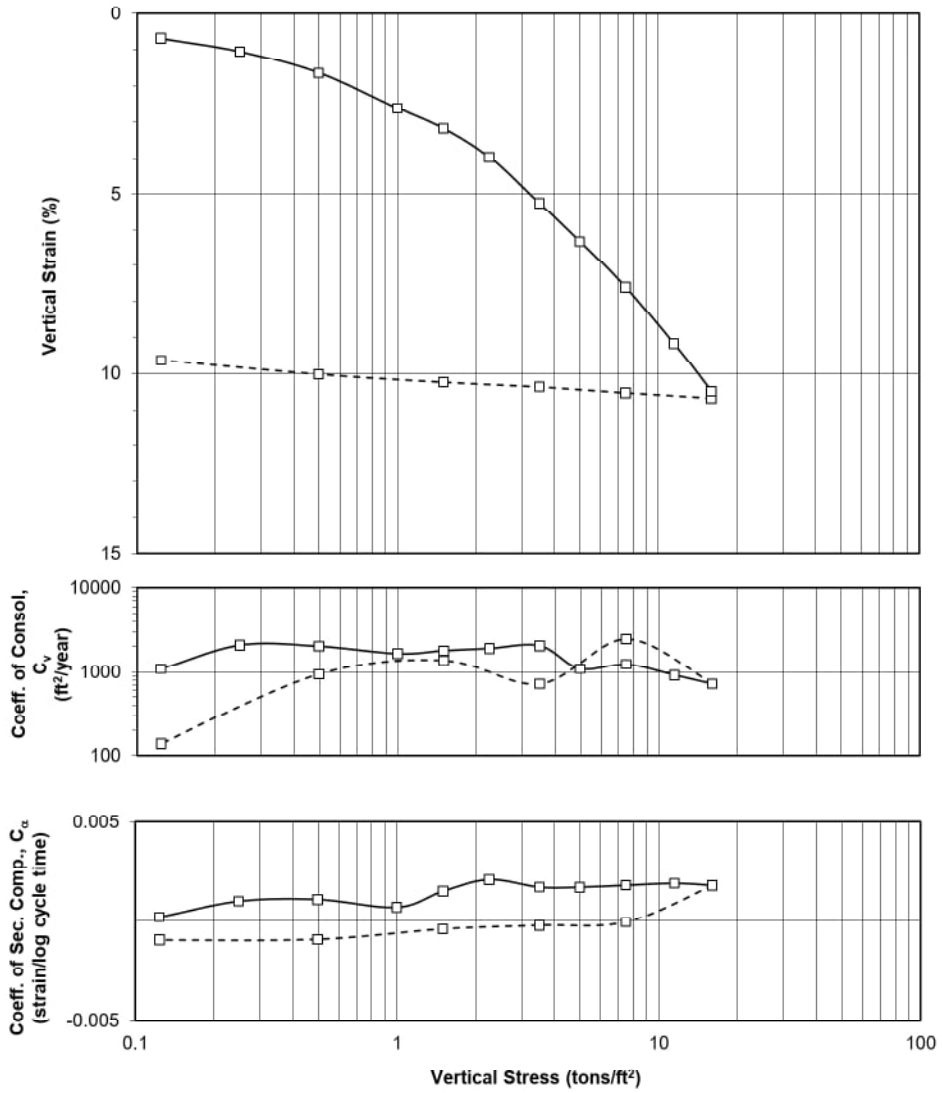


SAMPLE INFORMATION

Boring:	B110U
Sample:	U3
Depth:	53.9 ft
Test:	C2
Type:	2.8-inch-diameter Shelby tube specimen
Description:	SANDY LEAN CLAY (CL)

SPECIMEN INFORMATION

(Note: Initial and final states refer to specimen conditions at start and end of test)

Initial height:	0.88	inch
Diameter:	2.50	inch

Initial water content:	22.1	%
Initial total unit weight:	122.9	pcf
Initial dry unit weight:	100.7	pcf
Initial void ratio:	0.686	
Initial degree of saturation:	87	%
Final water content:	19.2	%
Final total unit weight:	132.7	pcf
Final dry unit weight:	111.4	pcf
Final void ratio:	0.525	
Final degree of saturation:	99	% (assumed specific gravity = 2.72)

TEST SUMMARY

Estimated preconsolidation stress (tsf):	2.9
Compression Ratio (strain per log cycle stress):	0.088
Compression Index (void ratio per log cycle stress):	0.148
Swell Ratio (strain per log cycle stress):	0.006
Swell Index (void ratio per log cycle stress):	0.010
Recompression Ratio (strain per log cycle stress):	0.033
Recompression Index (void ratio per log cycle stress):	0.056

REMARKS

Test Date:	12/12/17
Tested By:	W. Lukas
Checked By:	D. Aghjayan

LEGEND:
□ End of primary
○ End of stage
——— Loading
– – – – – Unloading

Seismic Stability of Ash Landfill and West Pond at Glen Lyn Plant Glen Lyn, Virginia	GEI Consultants	ONE DIMENSIONAL CONSOLIDATION TEST
American Electric Power Columbus, Ohio	Project 1700685	August 2018 Fig. K-2

3/15/2018

PROJECT:	Glen Lyn Seismic Stability						
PROJECT NO.:	1700685	SPECIMEN DESCRIPTION:	SANDY LEAN CLAY (CL)				
BORING:	B110U		2.8-inch-diameter Shelby tube specimen				
SAMPLE:	U3		G (est.)	LL	PL	PI	
TEST:	C2		2.72	0	0	0	
DEPTH, ft:	53.9						
BY:	W. Lukas	Initial height:	0.88 inch	Final height:	0.80 inch		
TEST DATE:	12/12/17	Initial water content:	22.07 %	Final water content:	19.17 %		
		Initial dry density:	100.71 pcf	Final dry density:	111.36 pcf		
EQUIPMENT:		Initial total density:	122.93 pcf	Final total density:	132.70 pcf		
Load Frame No.:	Geocomp	Initial saturation:	87 %	Final saturation:	99 %		
Ring Diameter:	2.50 inch	Initial void ratio:	0.686	Final void ratio:	0.525		
DCDT Calibration:	1 mm			Final strain:	9.565 %		
Initial DCDT reading:	-5.74548 mm						
Final DCDT reading:	-3.49 mm						

Load No.	Load (tsf)	d100 (inch)	t100 Strain (%)	t100 Void Ratio (-)	Final Strain (%)	Final Void Ratio (-)	cv (ft²/year)	Calpha (strain/logt)	Constrained Modulus (tsf)	Permeability (cm/sec)	Machine compliance (mm)	Extrusion compliance (mm)
setup	0.00	-	0	-	-	-	-	-	-	-	-	
1	0.12	0.0060	0.68	0.675	0.786	0.673	1093.9329	0.0002	18.12	1.82E-06	0.026009092	
2	0.25	0.0092	1.04	0.669	1.234	0.665	2094.7043	0.0010	34.68	1.82E-06	0.055919548	
3	0.50	0.0144	1.64	0.658	1.834	0.655	2027.7123	0.0011	41.89	1.46E-06	0.105275913	
4	1.00	0.0231	2.63	0.642	2.758	0.640	1660.4291	0.0007	50.54	9.91E-07	0.153453643	
5	1.50	0.0281	3.19	0.632	3.473	0.628	1805.2124	0.0015	88.62	6.15E-07	0.191166826	
6	2.25	0.0351	3.99	0.619	4.411	0.612	1915.8642	0.0021	94.72	6.10E-07	0.231480919	
7	3.50	0.0462	5.25	0.598	5.557	0.592	2056.6484	0.0017	98.73	6.28E-07	0.283499103	
8	5.00	0.0556	6.32	0.580	6.564	0.575	1094.5723	0.0017	139.99	2.36E-07	0.326414105	
9	7.50	0.0669	7.60	0.558	7.878	0.553	1237.1099	0.0018	196.07	1.90E-07	0.374530925	
10	11.50	0.0807	9.17	0.532	9.414	0.527	912.9519	0.0019	254.30	1.08E-07	0.434351836	
11	16.00	0.0923	10.49	0.509	10.677	0.506	717.4771	0.0018	341.81	6.33E-08	0.490271384	
12	7.50	0.0927	10.53	0.509	10.508	0.509	2466.6345	0.0000	18455.82	4.03E-09	0.409643199	
13	3.50	0.0913	10.37	0.511	10.351	0.512	716.3433	-0.0002	2504.75	8.63E-09	0.347221378	
14	1.50	0.0901	10.24	0.513	10.171	0.515	1378.1673	-0.0004	1540.74	2.70E-08	0.280898194	
15	0.50	0.0882	10.03	0.517	9.903	0.519	938.9972	-0.0009	462.72	6.12E-08	0.200270008	
16	0.12	0.0848	9.64	0.524	9.565	0.525	138.1521	-0.0009	95.57	4.36E-08	0.11313955	

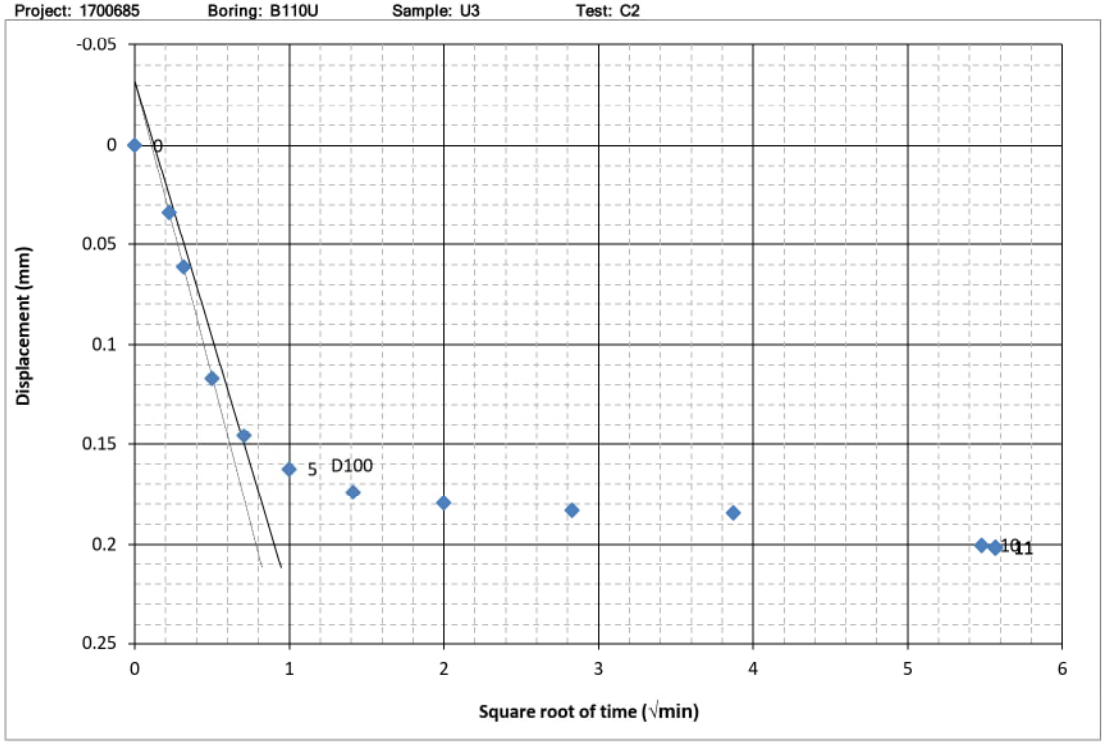
Cout	(UNIT)out				
0.3937	inch	1	cm	0.3937	inch
0.155	in²	1	cm²	0.155	in²
1.02408	tsf	1	ksc	1.0241	tsf
62.428	pcf	1	g/cm³	62.428	pcf
33944.7	ft²/year	1	cm²/sec	33945	ft²/year
2.1E+09	ft/year	1000	cm/sec	2E+09	ft/year

BORING: B110U SAMPLE: U3

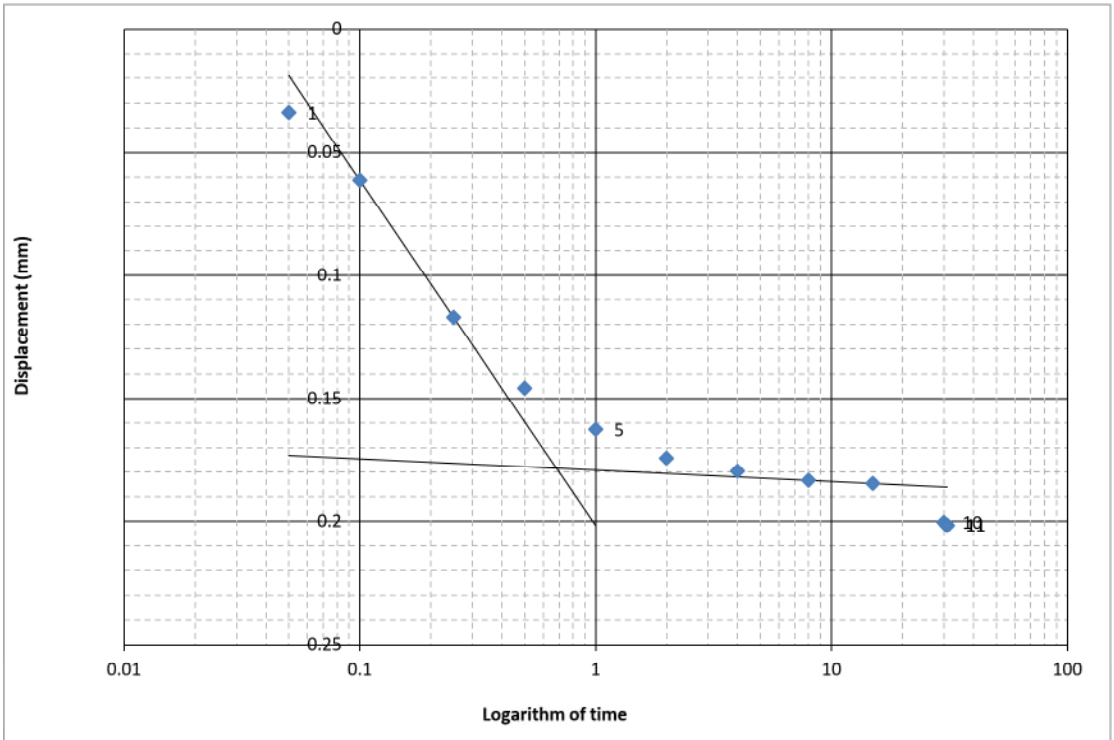
CHECK VERSION ONLY Ho(mm) 22.352

GENERAL			SQUARE ROOT ANALYSIS				LOG ANALYSIS					
Dinitial	Dfinal	D0	D50	D90	T90	D100	T50	D50	T100	D100	Secondary	Load
mm	mm	mm	mm	mm	min	mm	min	mm	min	mm	Slope	#
-5.7455	-5.5438	-5.7779	-5.6814	-5.604	0.45505	-5.5849	0.1267	-5.6725	0.68335	-5.5671	0.00465	1
-5.5438	-5.4138	-5.5563	-5.51	-5.473	0.24147	-5.4637	0.0654	-5.5064	0.42938	-5.4565	0.02271	2
-5.4138	-5.2304	-5.4201	-5.3538	-5.301	0.23518	-5.2875	0.0669	-5.3469	0.44828	-5.2737	0.02473	3
-5.2304	-4.9756	-5.2191	-5.1335	-5.065	0.21862	-5.0478	0.0803	-5.1117	0.64895	-5.0043	0.01587	4
-4.9756	-4.778	-4.9693	-4.9172	-4.876	0.20309	-4.8652	0.0727	-4.9048	0.52871	-4.8404	0.03408	5
-4.778	-4.5281	-4.7627	-4.7048	-4.659	0.19839	-4.647	0.0674	-4.6929	0.45712	-4.6231	0.04708	6
-4.5281	-4.22	-4.5263	-4.4353	-4.363	0.15385	-4.3444	0.0614	-4.4073	0.63533	-4.2884	0.03853	7
-4.22	-3.952	-4.1847	-4.118	-4.065	0.26826	-4.0513	0.1126	-4.0953	1.41498	-4.0059	0.03851	8
-3.952	-3.6101	-3.8919	-3.8133	-3.751	0.21374	-3.7348	0.0971	-3.7823	0.99018	-3.6727	0.04068	9
-3.6101	-3.207	-3.5025	-3.4204	-3.355	0.25282	-3.3383	0.1273	-3.3819	1.94462	-3.2613	0.04285	10
-3.207	-2.8687	-3.1329	-3.0689	-3.018	0.22447	-3.0049	0.1572	-3.022	3.54308	-2.9111	0.0406	11
-2.8687	-2.987	-2.9686	-2.9742	-2.979	0.14488	-2.9797	0.0451	-2.975	0.2256	-2.9814	-0.001	12
-2.987	-3.0846	-3.0616	-3.0695	-3.076	0.51333	-3.0773	0.156	-3.0706	1.36809	-3.0795	-0.0049	13
-3.0846	-3.1913	-3.1357	-3.1502	-3.162	0.19013	-3.1647	0.0812	-3.1553	0.66506	-3.1749	-0.0089	14
-3.1913	-3.3317	-3.226	-3.2506	-3.27	0.20447	-3.2752	0.1195	-3.2649	1.64917	-3.3038	-0.0203	15
-3.3317	-3.4943	-3.3655	-3.4057	-3.438	1.77122	-3.4458	0.8182	-3.422	10.7095	-3.4785	-0.0211	16

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	3	2	8
Second Point	2	4	3	9

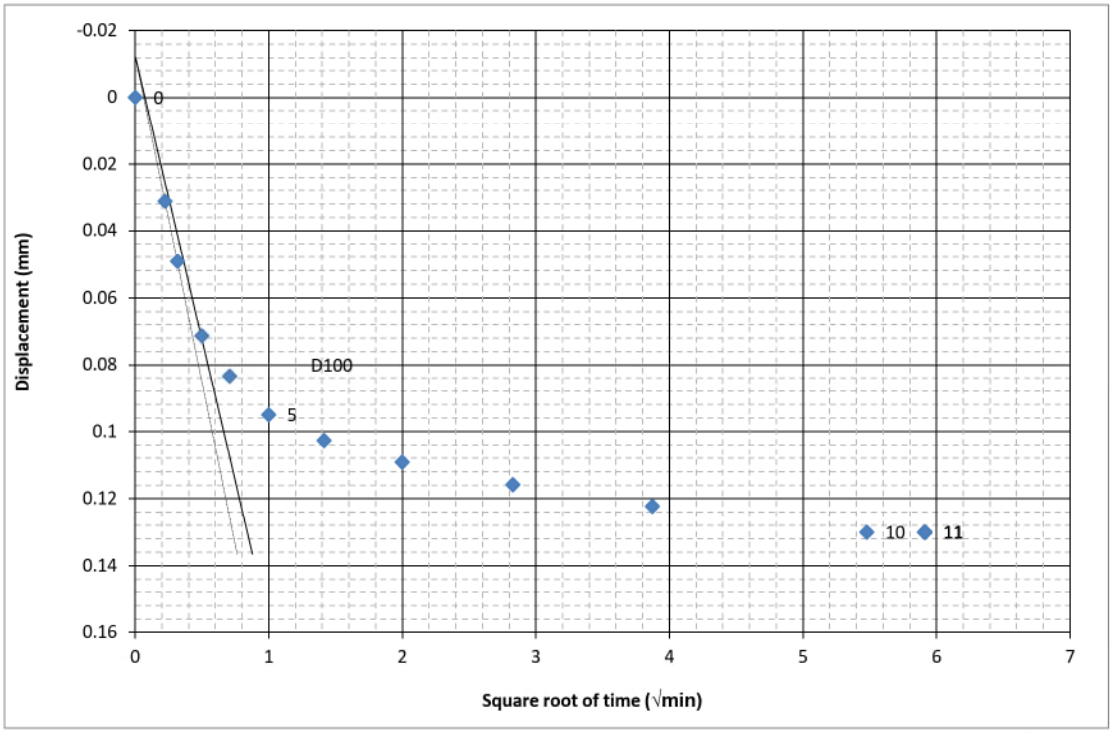


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2017	-0.0324	0.0641	0.1413	0.46	0.1606	0.13	0.0730	0.68	0.1784	0.0047
Absolute	-5.7455	-5.5438	-5.7779	-5.6814	-5.6042	0.46	-5.5849	0.13	-5.6725	0.68	-5.5671	0.0047

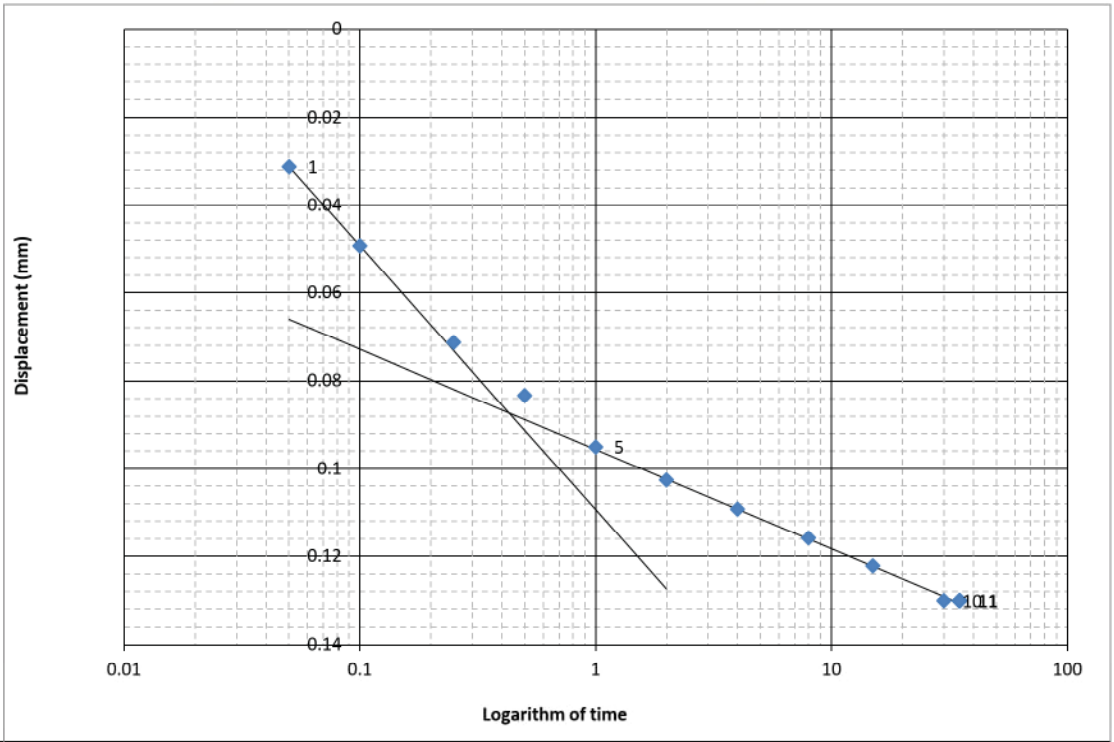
Load: 1
0.12 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.034
2	0.1	0.061
3	0.3	0.117
4	0.5	0.146
5	1.0	0.163
6	2.0	0.174
7	4.0	0.180
8	8.0	0.183
9	15.0	0.185
10	30.0	0.200
11	31.0	0.202
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	3	1	6
Second Point	2	4	2	11

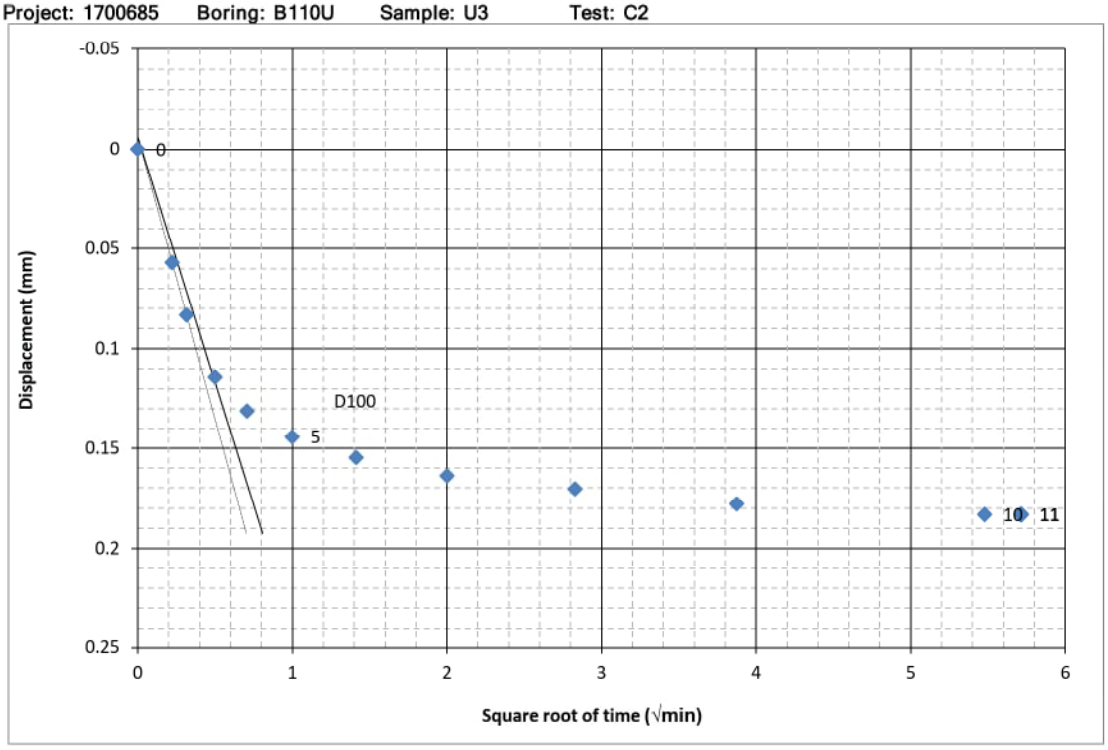


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.1300	-0.0125	0.0338	0.0709	0.24	0.0801	0.07	0.0374	0.43	0.0873	0.0227
Absolute	-5.5438	-5.4138	-5.5563	-5.5100	-5.4729	0.24	-5.4637	0.07	-5.5064	0.43	-5.4565	0.0227

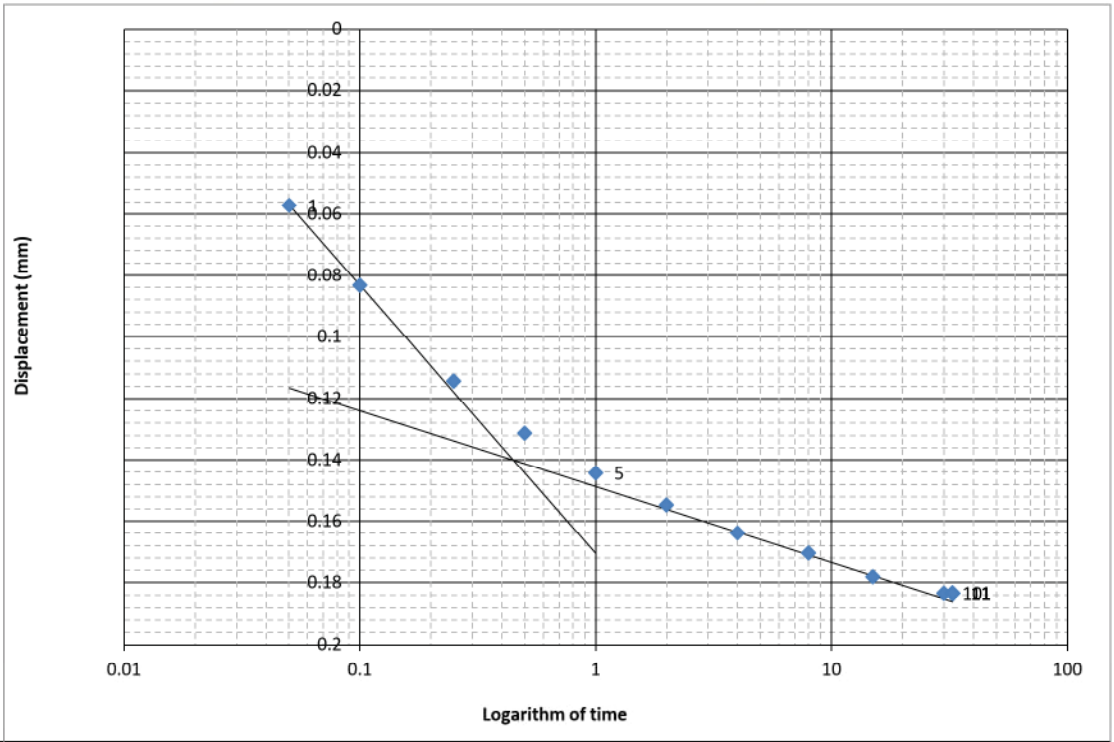
Load: 2
0.25 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.031
2	0.1	0.049
3	0.3	0.071
4	0.5	0.083
5	1.0	0.095
6	2.0	0.103
7	4.0	0.109
8	8.0	0.116
9	15.0	0.122
10	30.0	0.130
11	35.0	0.130
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	3	1	7
Second Point	2	4	2	9

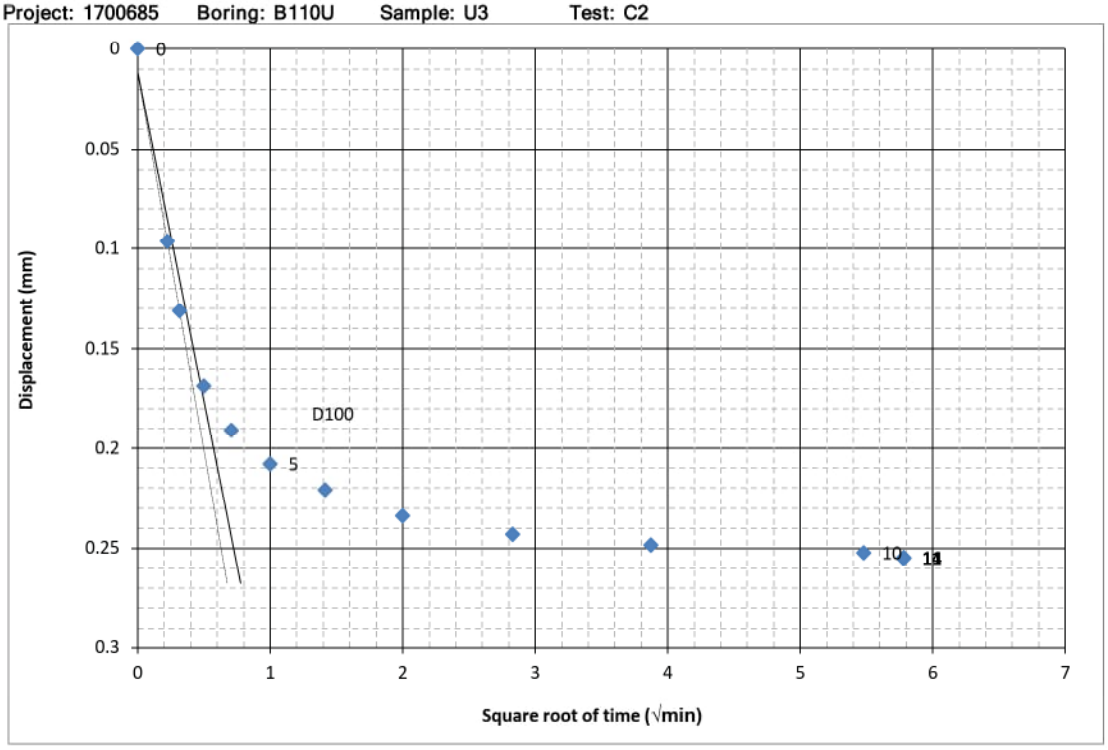


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.1834	-0.0063	0.0600	0.1130	0.24	0.1263	0.07	0.0669	0.45	0.1401	0.0247
Absolute	-5.4138	-5.2304	-5.4201	-5.3538	-5.3007	0.24	-5.2875	0.07	-5.3469	0.45	-5.2737	0.0247

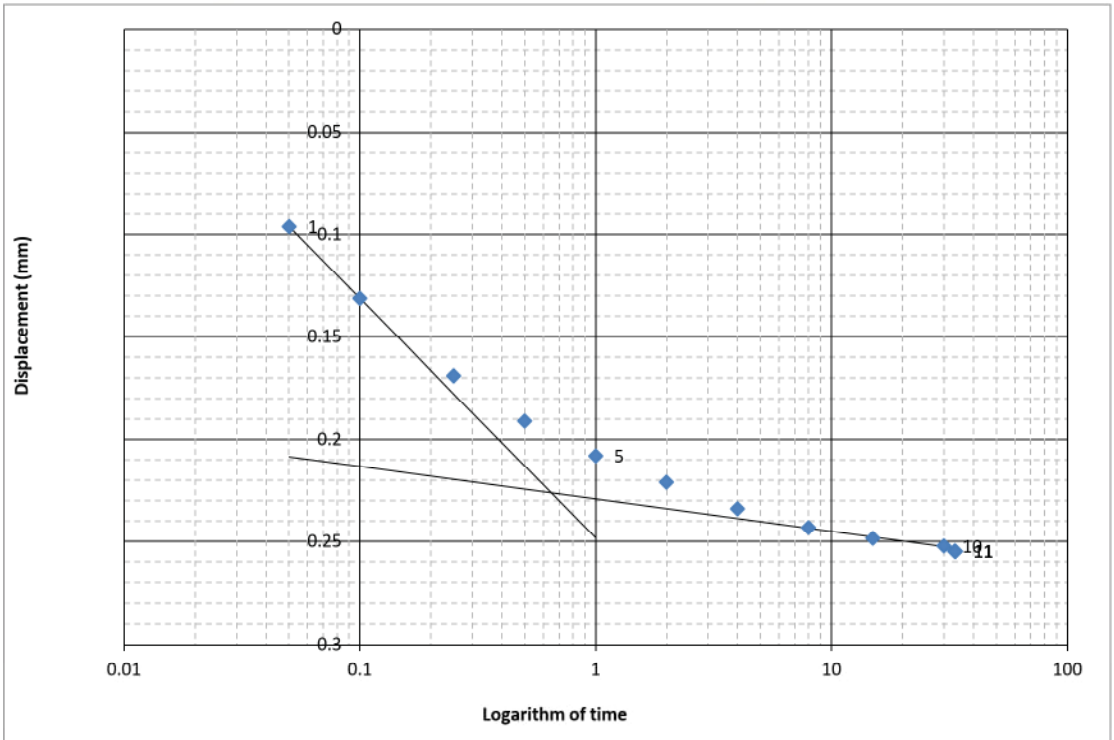
Load: 3
0.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.057
2	0.1	0.083
3	0.3	0.114
4	0.5	0.131
5	1.0	0.144
6	2.0	0.155
7	4.0	0.164
8	8.0	0.170
9	15.0	0.178
10	30.0	0.183
11	32.7	0.183
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	3	1	8
Second Point	2	4	2	10

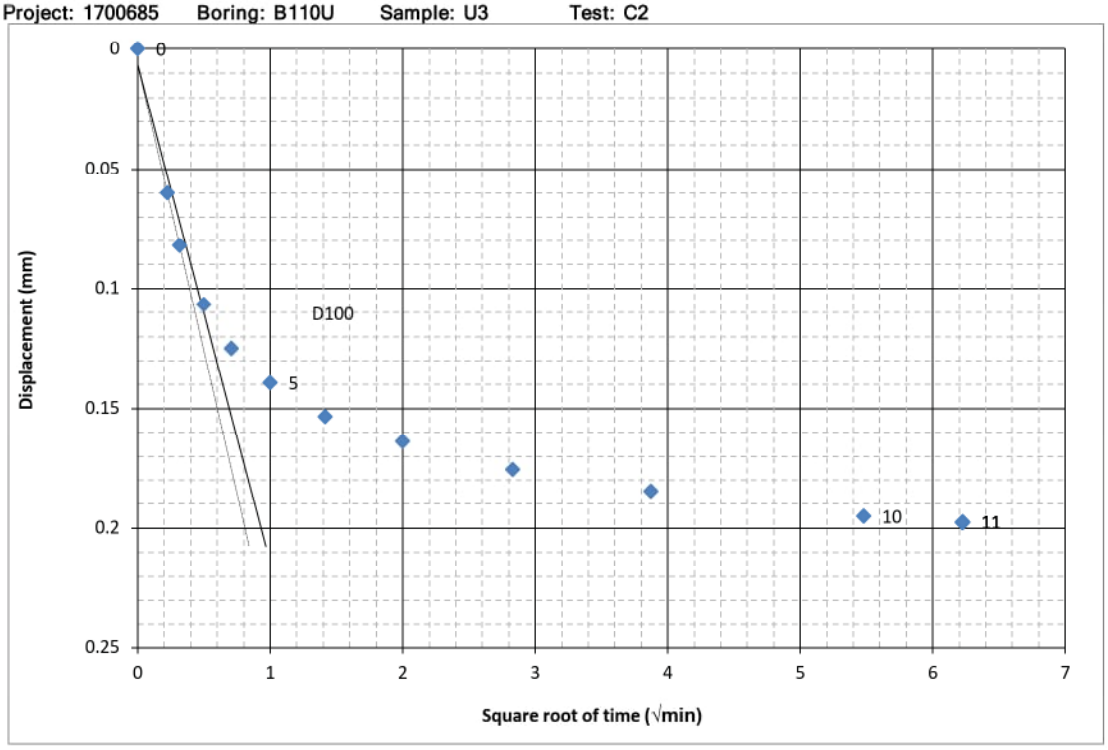


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2548	0.0113	0.0969	0.1654	0.22	0.1825	0.08	0.1187	0.65	0.2261	0.0159
Absolute	-5.2304	-4.9756	-5.2191	-5.1335	-5.0649	0.22	-5.0478	0.08	-5.1117	0.65	-5.0043	0.0159

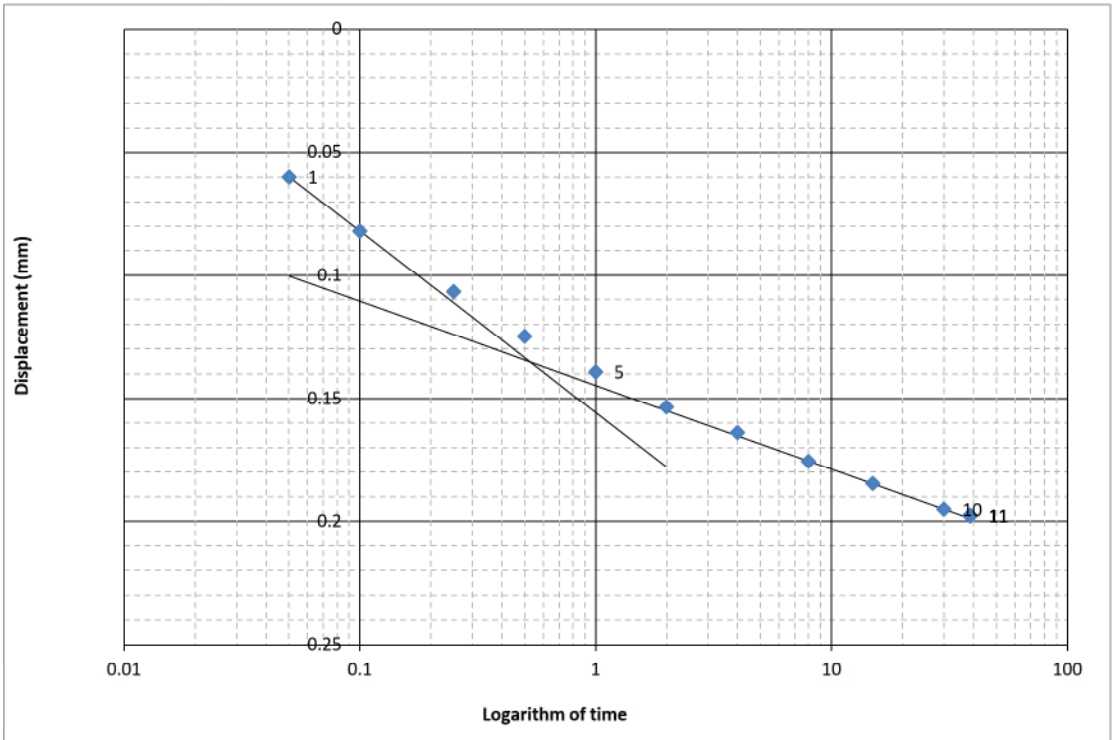
Load: 4
1.00 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.096
2	0.1	0.131
3	0.3	0.169
4	0.5	0.191
5	1.0	0.208
6	2.0	0.221
7	4.0	0.234
8	8.0	0.243
9	15.0	0.248
10	30.0	0.252
11	33.4	0.255
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	8
Second Point	2	3	2	10

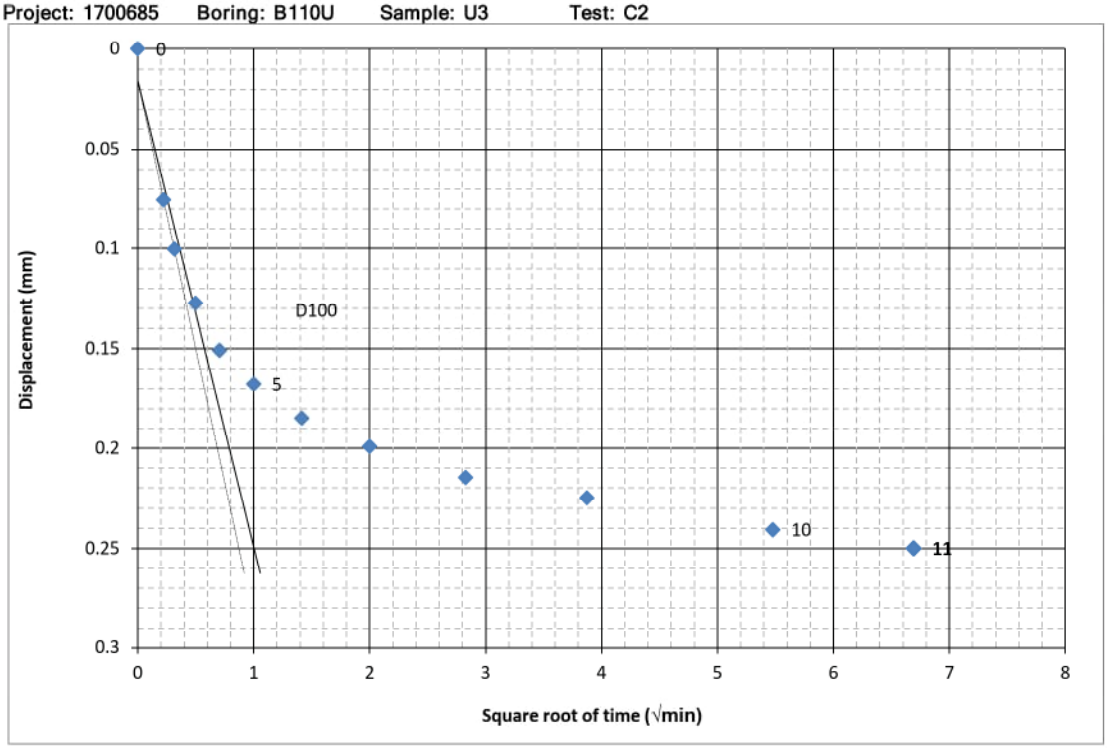


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.1976	0.0064	0.0584	0.1000	0.20	0.1104	0.07	0.0708	0.53	0.1353	0.0341
Absolute	-4.9756	-4.7780	-4.9693	-4.9172	-4.8756	0.20	-4.8652	0.07	-4.9048	0.53	-4.8404	0.0341

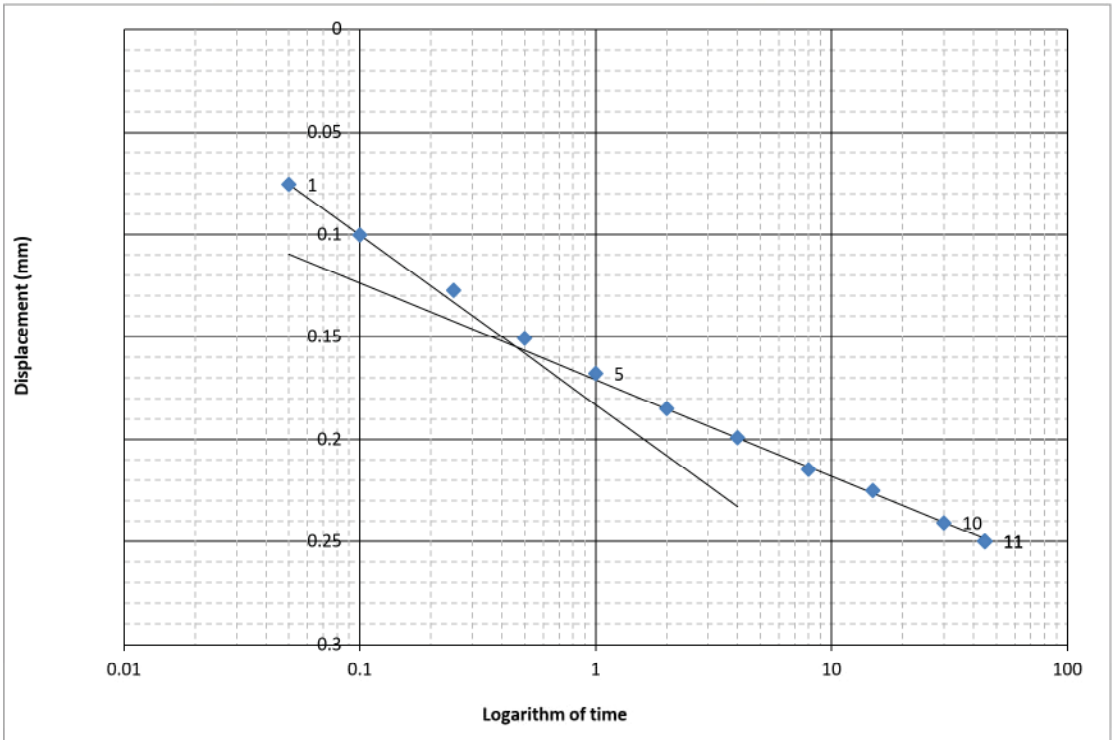
Load: 5
1.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.060
2	0.1	0.082
3	0.3	0.107
4	0.5	0.125
5	1.0	0.139
6	2.0	0.153
7	4.0	0.164
8	8.0	0.176
9	15.0	0.185
10	30.0	0.195
11	38.7	0.198
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	6
Second Point	2	3	2	10

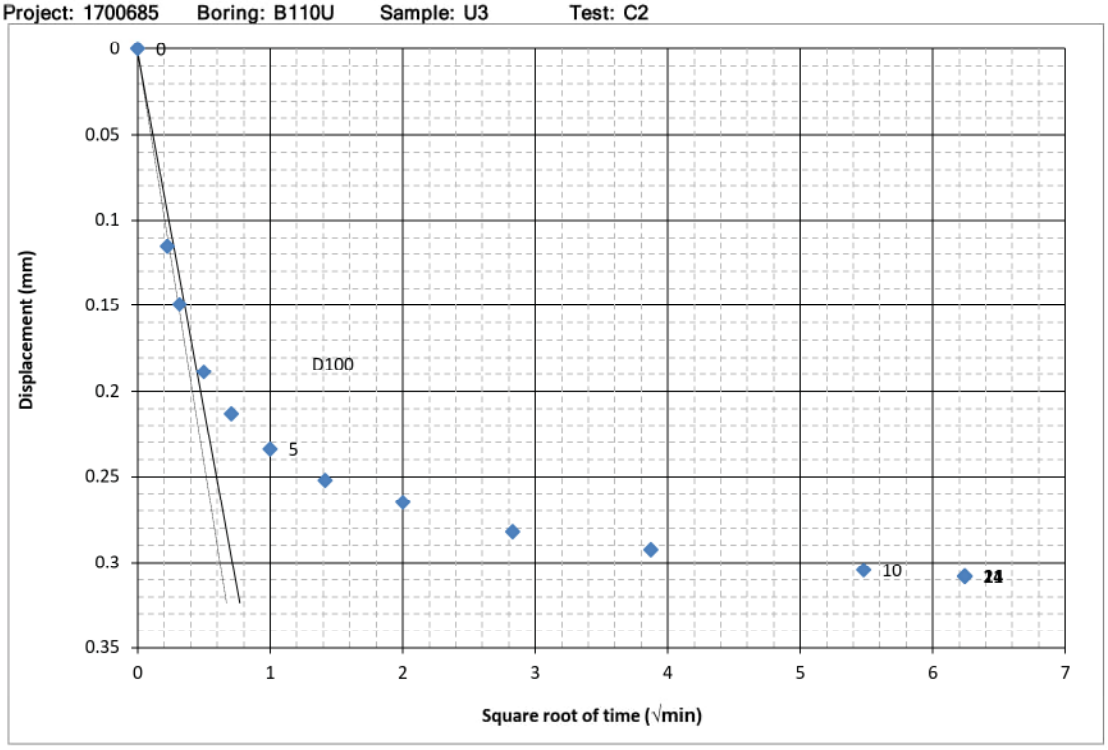


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2499	0.0153	0.0732	0.1194	0.20	0.1310	0.07	0.0851	0.46	0.1549	0.0471
Absolute	-4.7780	-4.5281	-4.7627	-4.7048	-4.6586	0.20	-4.6470	0.07	-4.6929	0.46	-4.6231	0.0471

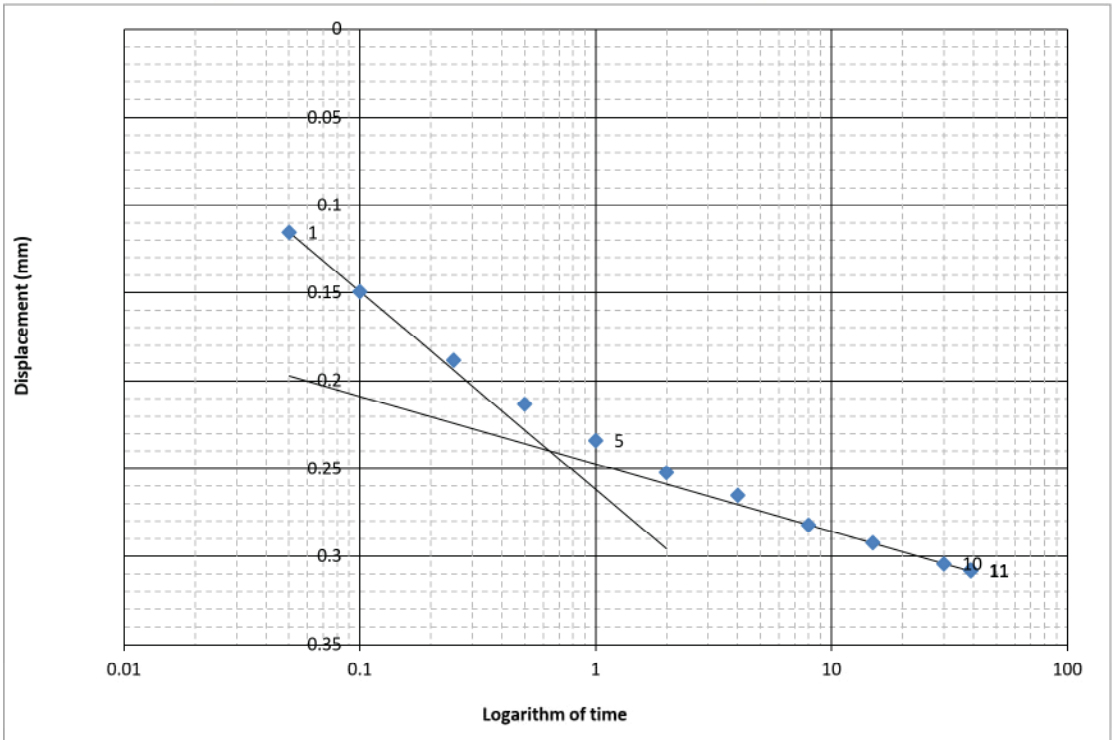
Load: 6
2.25 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.075
2	0.1	0.100
3	0.3	0.128
4	0.5	0.151
5	1.0	0.168
6	2.0	0.185
7	4.0	0.199
8	8.0	0.215
9	15.0	0.225
10	30.0	0.241
11	44.8	0.250
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	0	2	1	8
Second Point	2	3	2	10

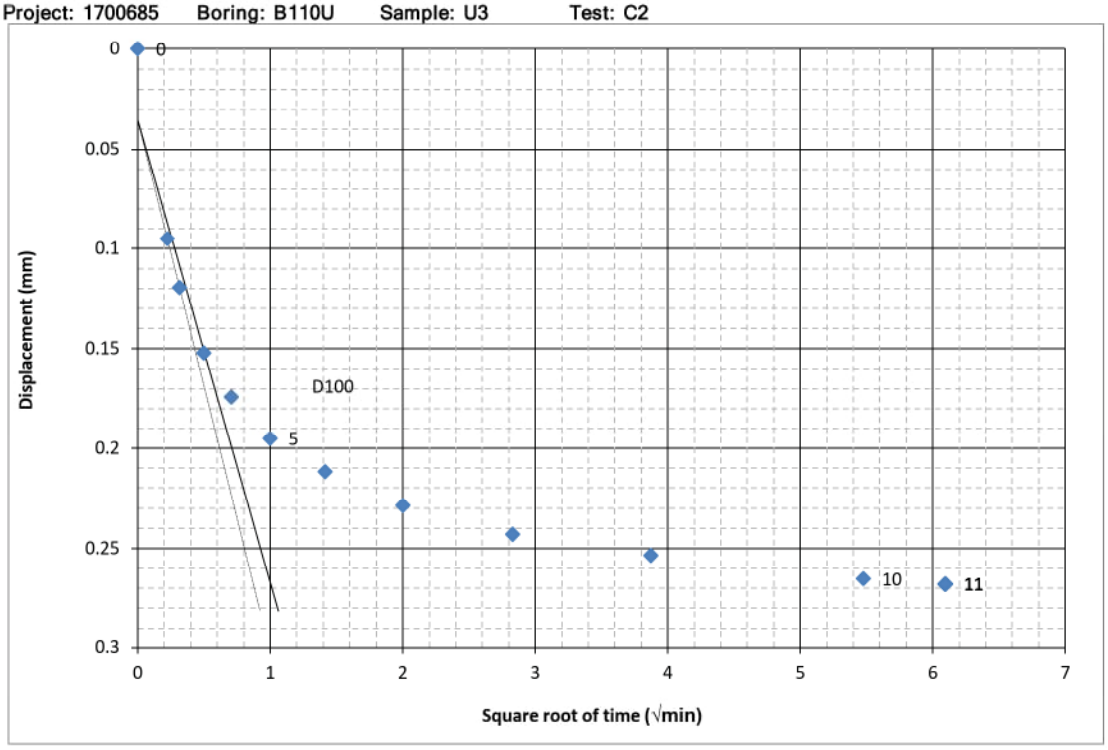


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.3081	0.0018	0.0927	0.1655	0.15	0.1836	0.06	0.1207	0.64	0.2397	0.0385
Absolute	-4.5281	-4.2200	-4.5263	-4.4353	-4.3626	0.15	-4.3444	0.06	-4.4073	0.64	-4.2884	0.0385

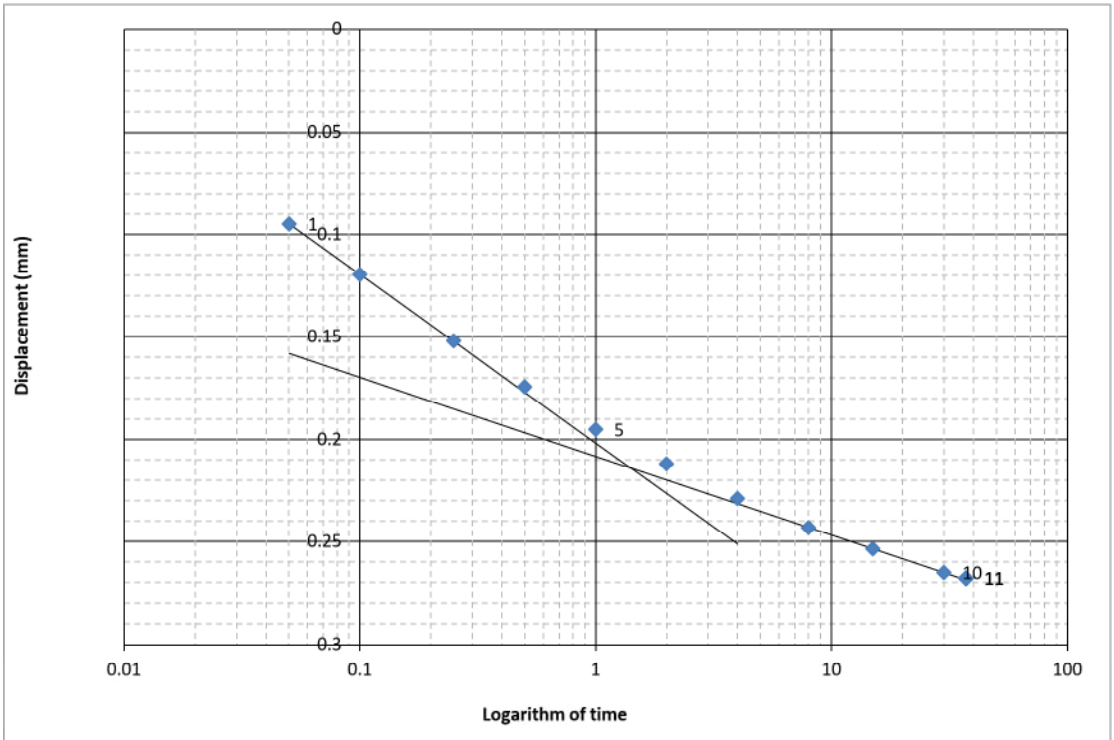
Load: 7
3.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.116
2	0.1	0.149
3	0.3	0.188
4	0.5	0.213
5	1.0	0.234
6	2.0	0.252
7	4.0	0.265
8	8.0	0.282
9	15.0	0.292
10	30.0	0.304
11	39.0	0.308
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	8
Second Point	2	3	2	10

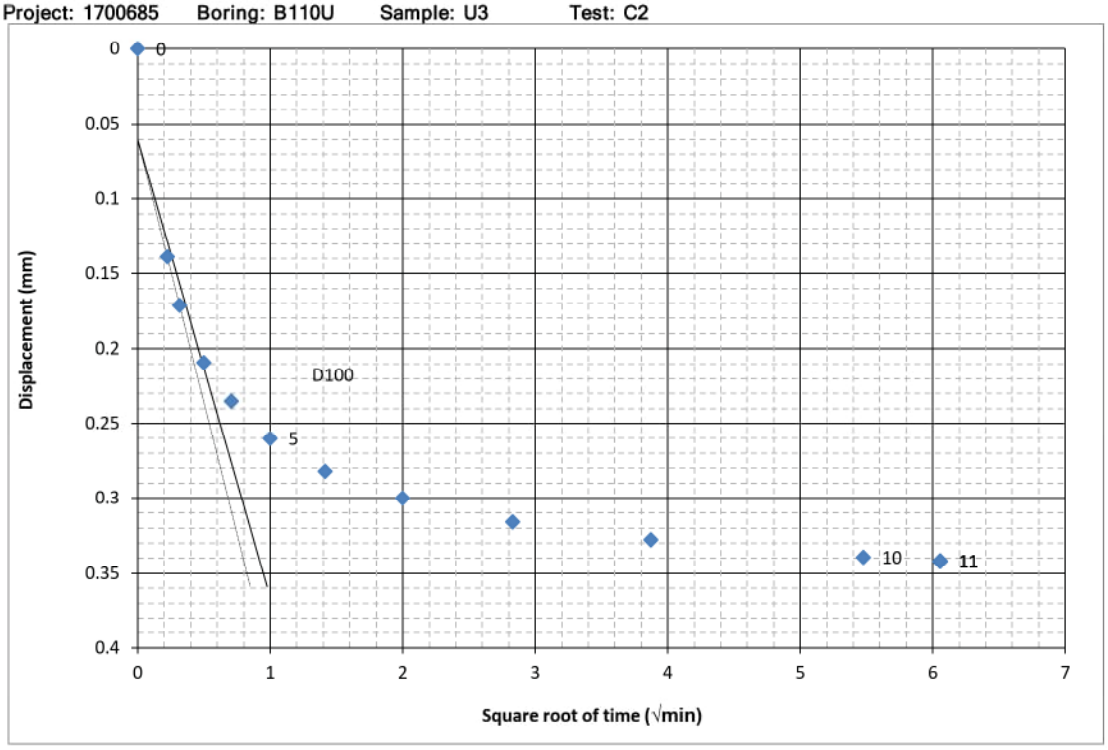


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.2680	0.0353	0.1019	0.1553	0.27	0.1686	0.11	0.1247	1.41	0.2141	0.0385
Absolute	-4.2200	-3.9520	-4.1847	-4.1180	-4.0647	0.27	-4.0513	0.11	-4.0953	1.41	-4.0059	0.0385

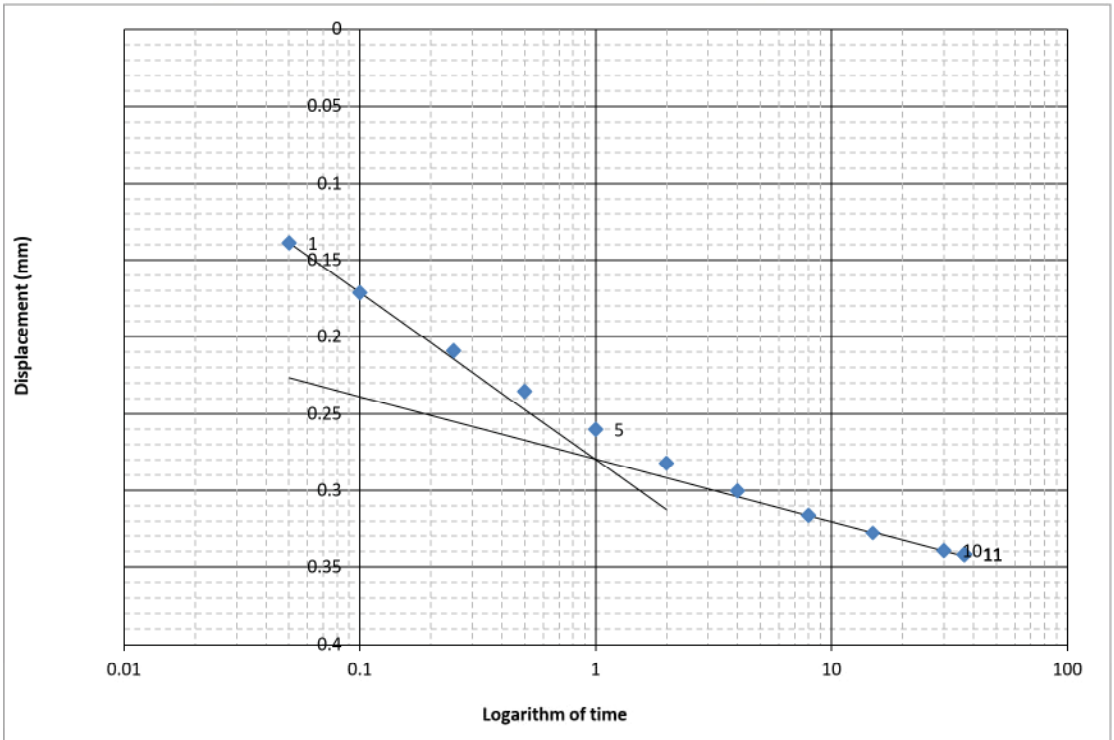
Load: 8
5.00 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.095
2	0.1	0.120
3	0.3	0.152
4	0.5	0.174
5	1.0	0.195
6	2.0	0.212
7	4.0	0.229
8	8.0	0.243
9	15.0	0.253
10	30.0	0.265
11	37.1	0.268
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	8
Second Point	2	3	2	10

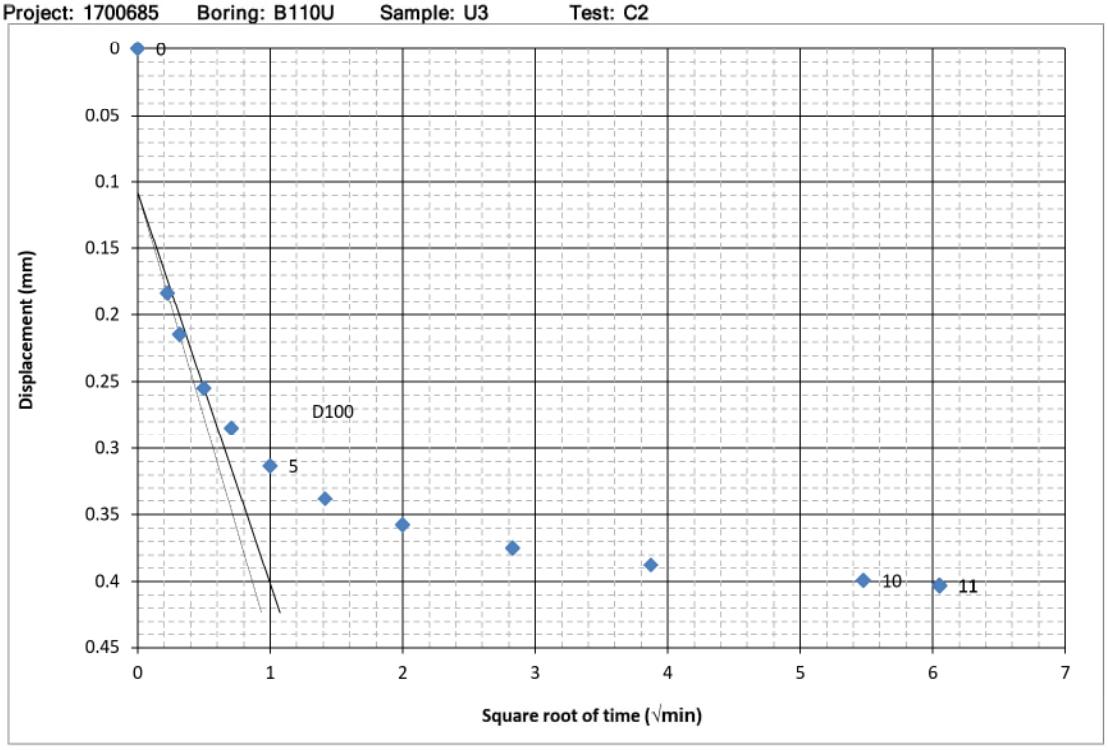


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.3419	0.0601	0.1386	0.2015	0.21	0.2172	0.10	0.1697	0.99	0.2793	0.0407
Absolute	-3.9520	-3.6101	-3.8919	-3.8133	-3.7505	0.21	-3.7348	0.10	-3.7823	0.99	-3.6727	0.0407

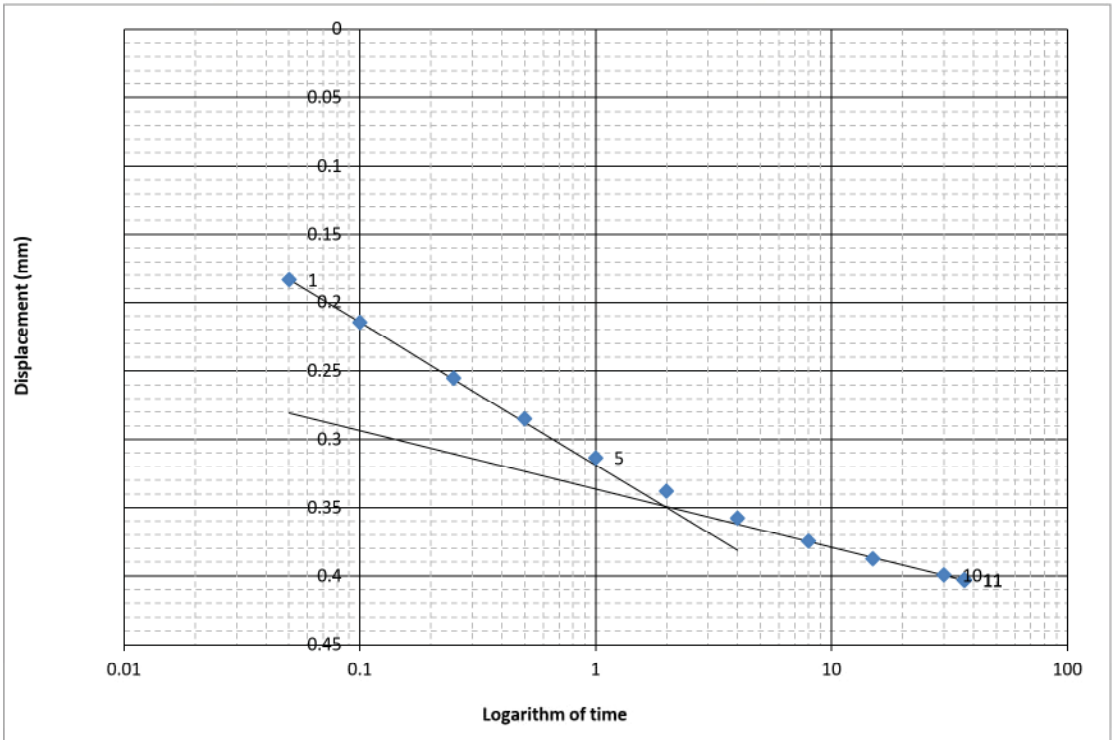
Load: 9
7.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.139
2	0.1	0.171
3	0.3	0.209
4	0.5	0.235
5	1.0	0.260
6	2.0	0.282
7	4.0	0.300
8	8.0	0.316
9	15.0	0.328
10	30.0	0.339
11	36.7	0.342
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	3	1	8
Second Point	2	4	2	10



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.4031	0.1076	0.1897	0.2554	0.25	0.2718	0.13	0.2282	1.94	0.3488	0.0429
Absolute	-3.6101	-3.2070	-3.5025	-3.4204	-3.3547	0.25	-3.3383	0.13	-3.3819	1.94	-3.2613	0.0429

Load: 10
11.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.183
2	0.1	0.215
3	0.3	0.255
4	0.5	0.285
5	1.0	0.313
6	2.0	0.338
7	4.0	0.358
8	8.0	0.375
9	15.0	0.388
10	30.0	0.399
11	36.6	0.403
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
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33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
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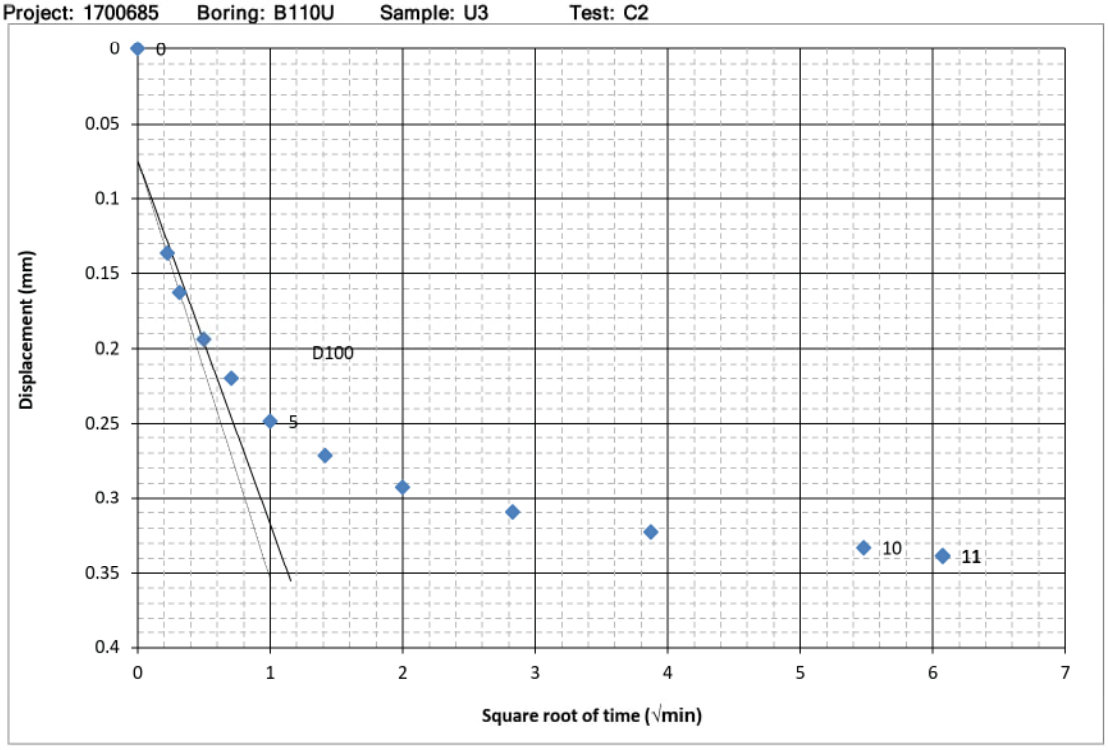
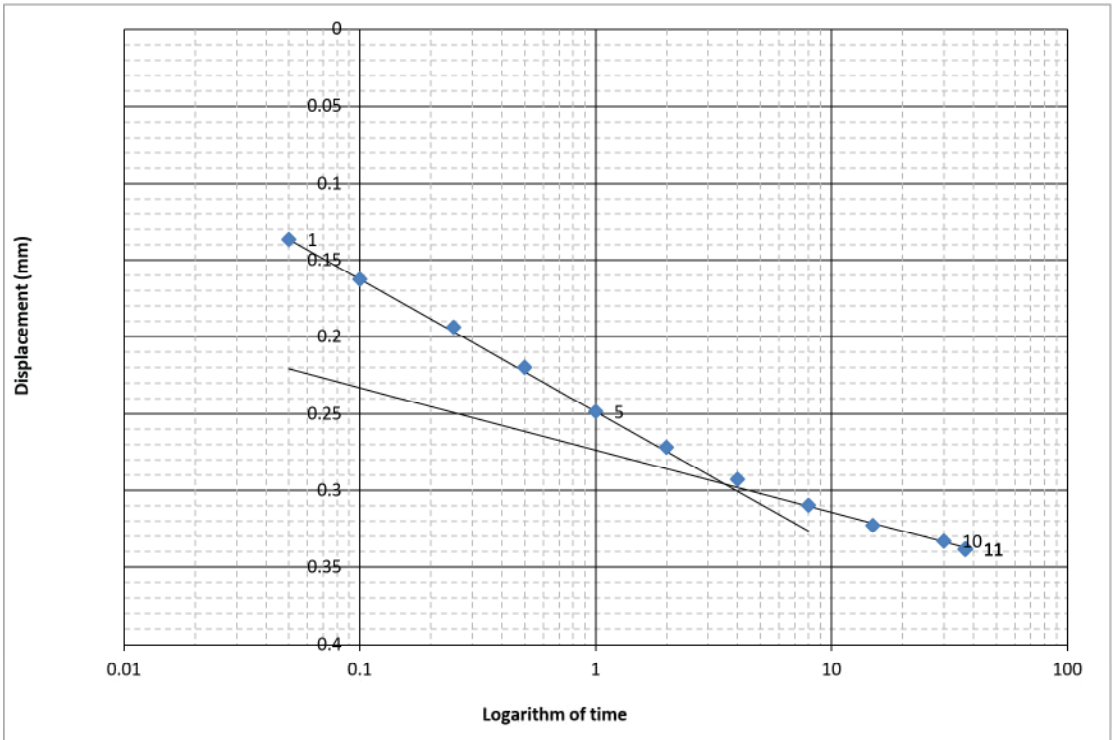
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	8
Second Point	2	3	2	10

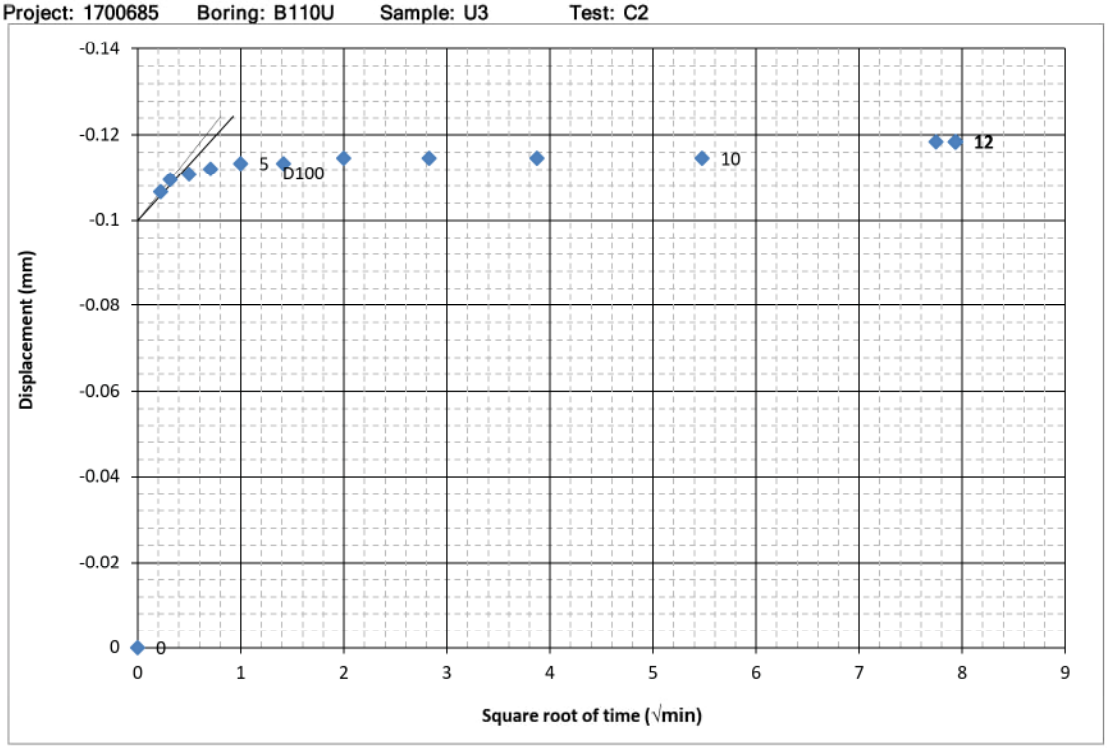


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	0.3383	0.0741	0.1381	0.1893	0.22	0.2021	0.16	0.1850	3.54	0.2959	0.0406
Absolute	-3.2070	-2.8687	-3.1329	-3.0689	-3.0177	0.22	-3.0049	0.16	-3.0220	3.54	-2.9111	0.0406

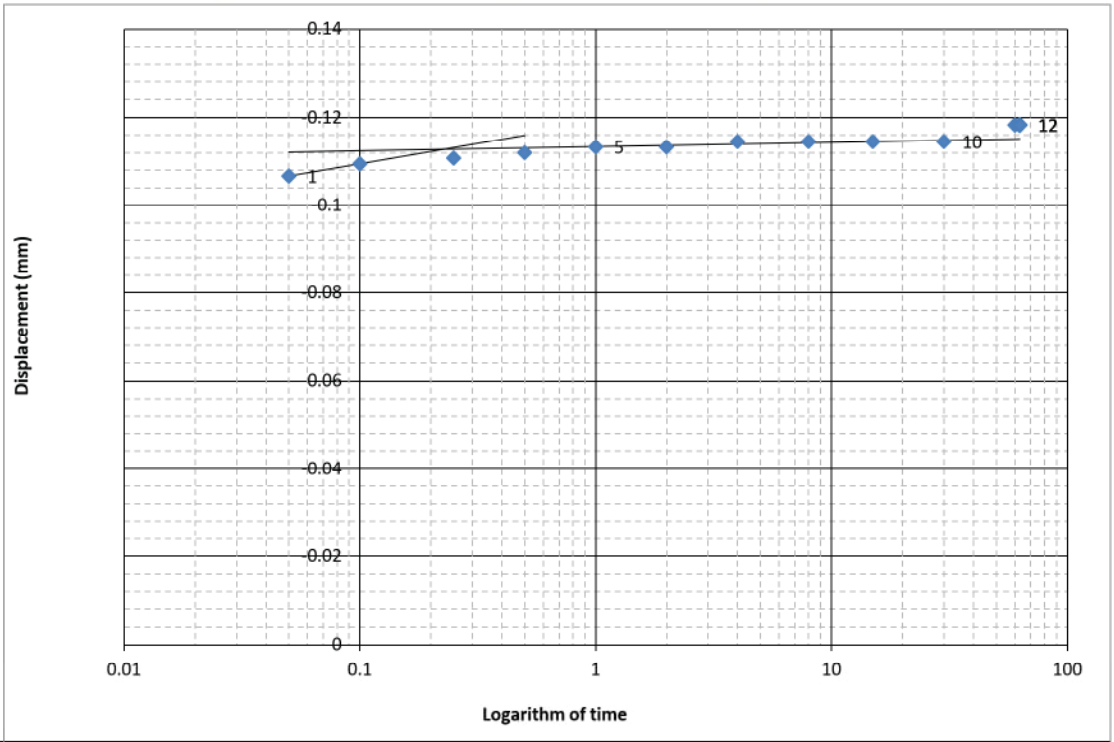
Load: 11
16.00 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	0.137
2	0.1	0.163
3	0.3	0.194
4	0.5	0.220
5	1.0	0.248
6	2.0	0.272
7	4.0	0.293
8	8.0	0.310
9	15.0	0.323
10	30.0	0.333
11	36.9	0.338
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	5
Second Point	2	3	2	10

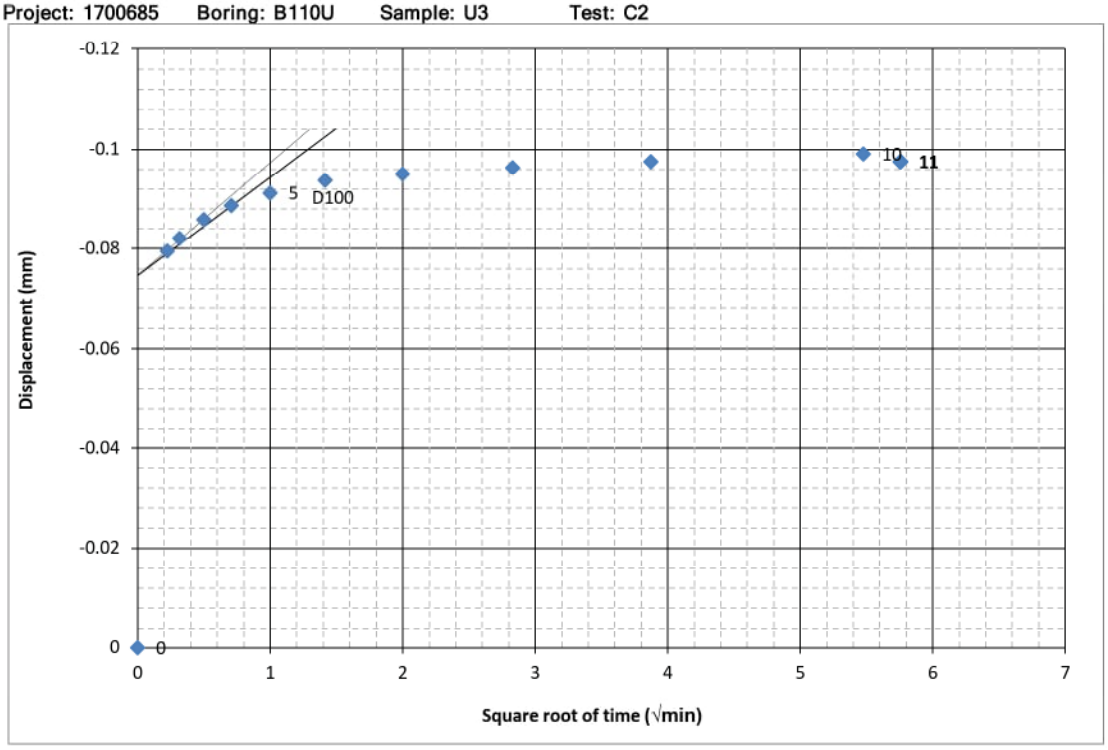


	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.1184	-0.0999	-0.1055	-0.1099	0.14	-0.1110	0.05	-0.1063	0.23	-0.1128	-0.0010
Absolute	-2.8687	-2.9870	-2.9686	-2.9742	-2.9786	0.14	-2.9797	0.05	-2.9750	0.23	-2.9814	-0.0010

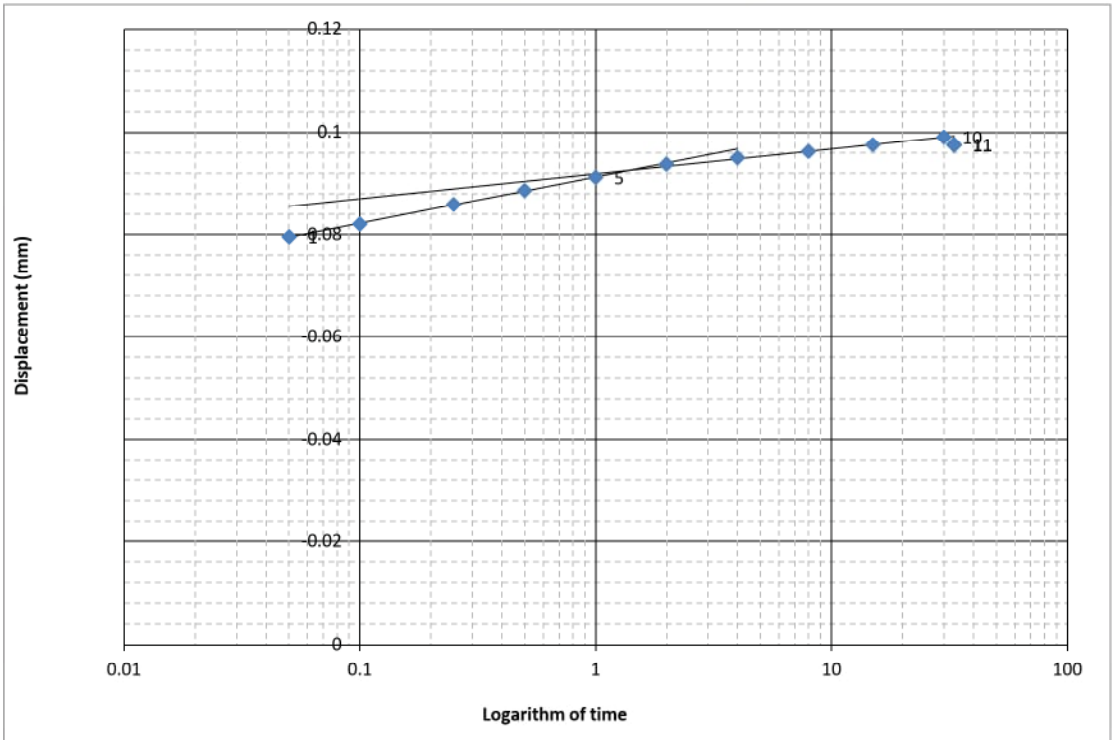
Load: 12
7.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.107
2	0.1	-0.109
3	0.3	-0.111
4	0.5	-0.112
5	1.0	-0.113
6	2.0	-0.113
7	4.0	-0.115
8	8.0	-0.115
9	15.0	-0.115
10	30.0	-0.115
11	60.0	-0.118
12	63.0	-0.1184
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	4	1	8
Second Point	3	5	5	10



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.0975	-0.0746	-0.0824	-0.0887	0.51	-0.0903	0.16	-0.0836	1.37	-0.0925	-0.0049
Absolute	-2.9870	-3.0846	-3.0616	-3.0695	-3.0758	0.51	-3.0773	0.16	-3.0706	1.37	-3.0795	-0.0049

Load: 13
3.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.080
2	0.1	-0.082
3	0.3	-0.086
4	0.5	-0.089
5	1.0	-0.091
6	2.0	-0.094
7	4.0	-0.095
8	8.0	-0.096
9	15.0	-0.098
10	30.0	-0.099
11	33.1	-0.098
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
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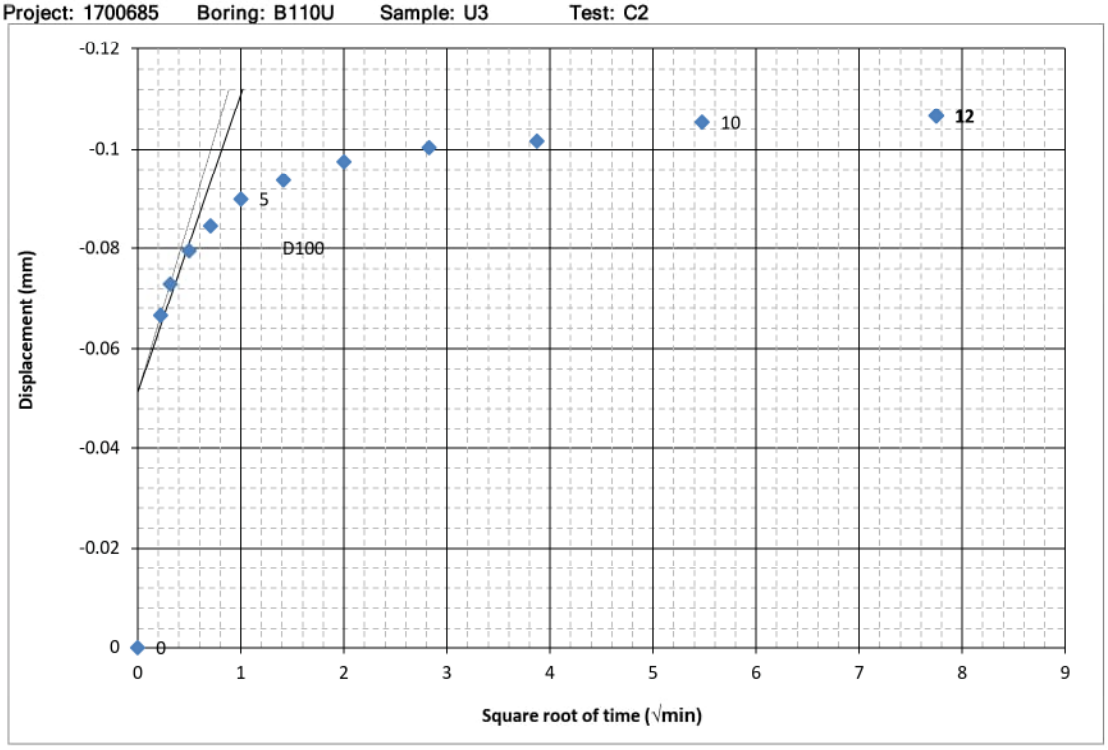
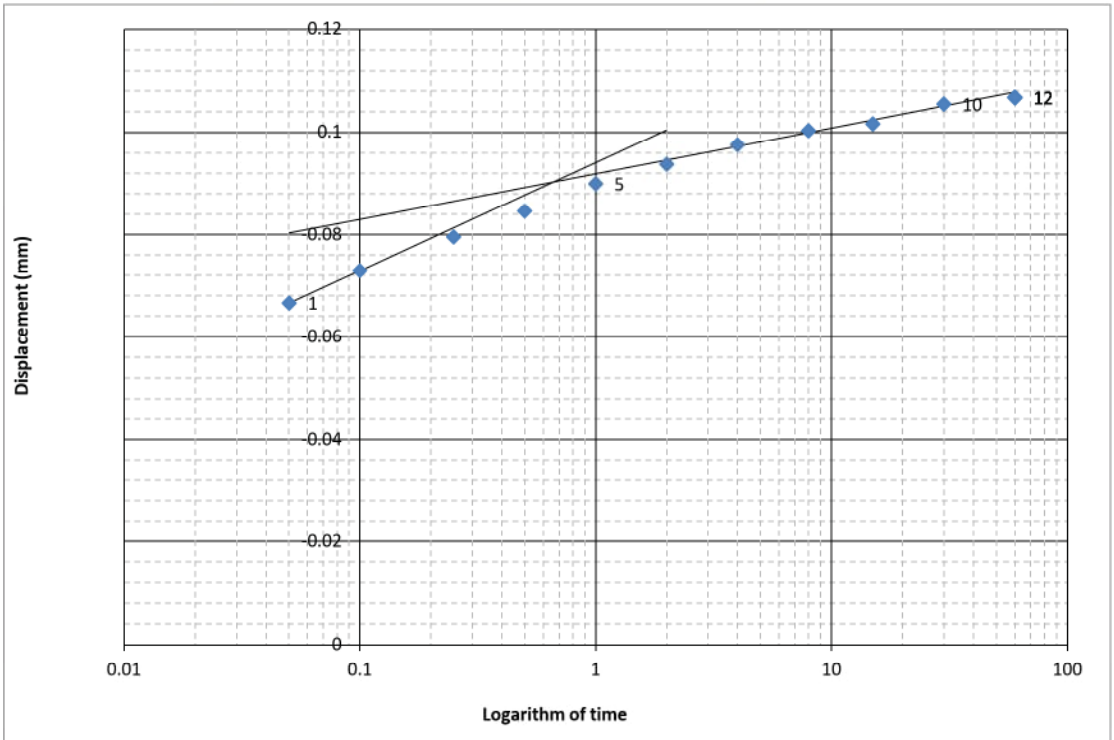
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	
First Point	1	2	1	8
Second Point	2	3	2	10



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.1067	-0.0511	-0.0656	-0.0772	0.19	-0.0801	0.08	-0.0707	0.67	-0.0903	-0.0089
Absolute	-3.0846	-3.1913	-3.1357	-3.1502	-3.1618	0.19	-3.1647	0.08	-3.1553	0.67	-3.1749	-0.0089

Load: 14
1.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.067
2	0.1	-0.073
3	0.3	-0.080
4	0.5	-0.085
5	1.0	-0.090
6	2.0	-0.094
7	4.0	-0.098
8	8.0	-0.100
9	15.0	-0.102
10	30.0	-0.105
11	60.0	-0.107
12	60.0	-0.1067
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
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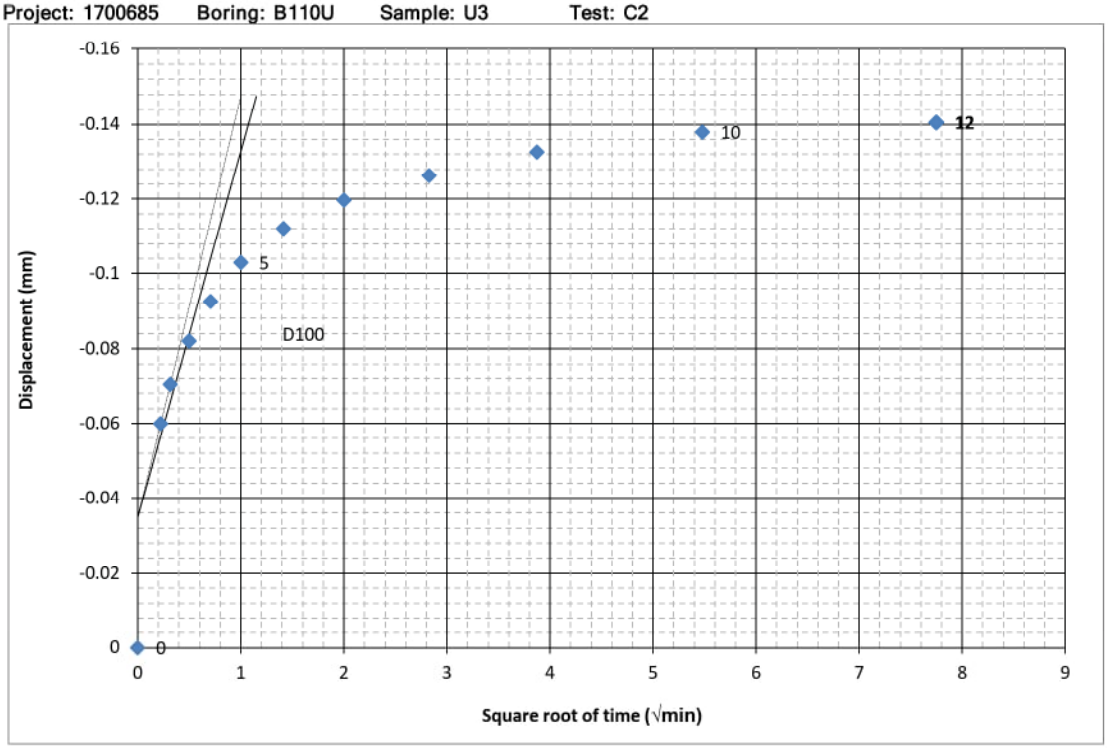
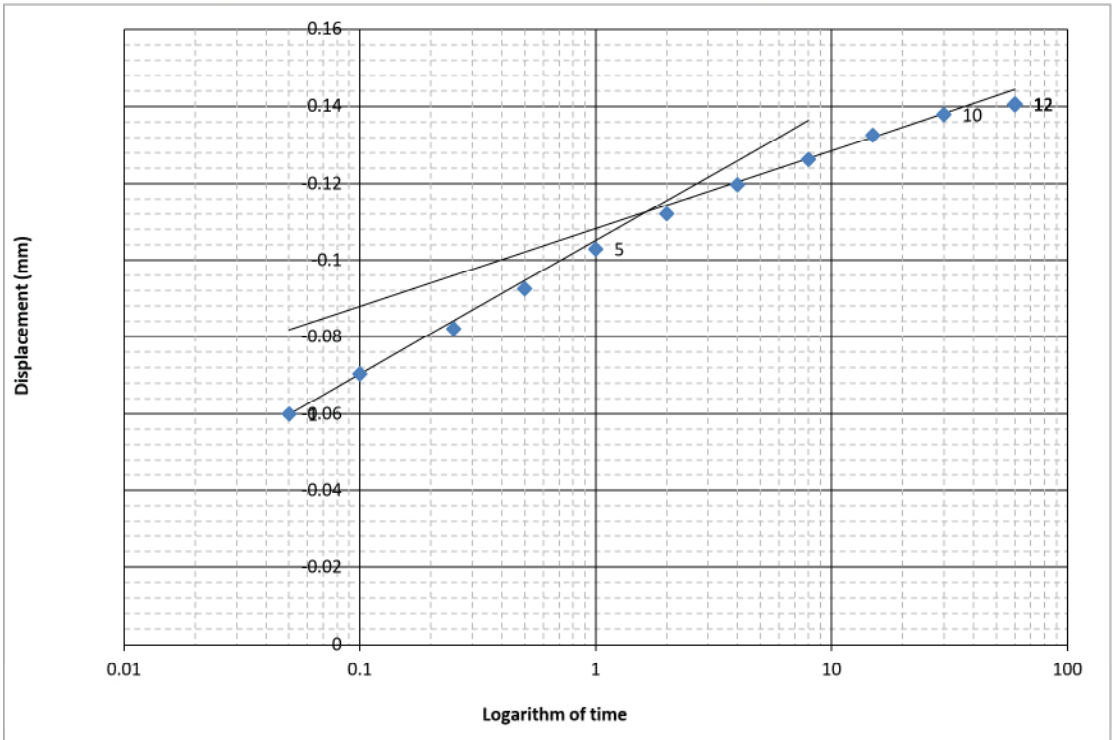
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	1	2	1	8
Second Point	2	3	2	10



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.1405	-0.0347	-0.0593	-0.0790	0.20	-0.0839	0.12	-0.0736	1.65	-0.1126	-0.0203
Absolute	-3.1913	-3.3317	-3.2260	-3.2506	-3.2702	0.20	-3.2752	0.12	-3.2649	1.65	-3.3038	-0.0203

Load: 15
0.50 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.060
2	0.1	-0.070
3	0.3	-0.082
4	0.5	-0.092
5	1.0	-0.103
6	2.0	-0.112
7	4.0	-0.120
8	8.0	-0.126
9	15.0	-0.133
10	30.0	-0.138
11	60.0	-0.140
12	60.0	-0.1405
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
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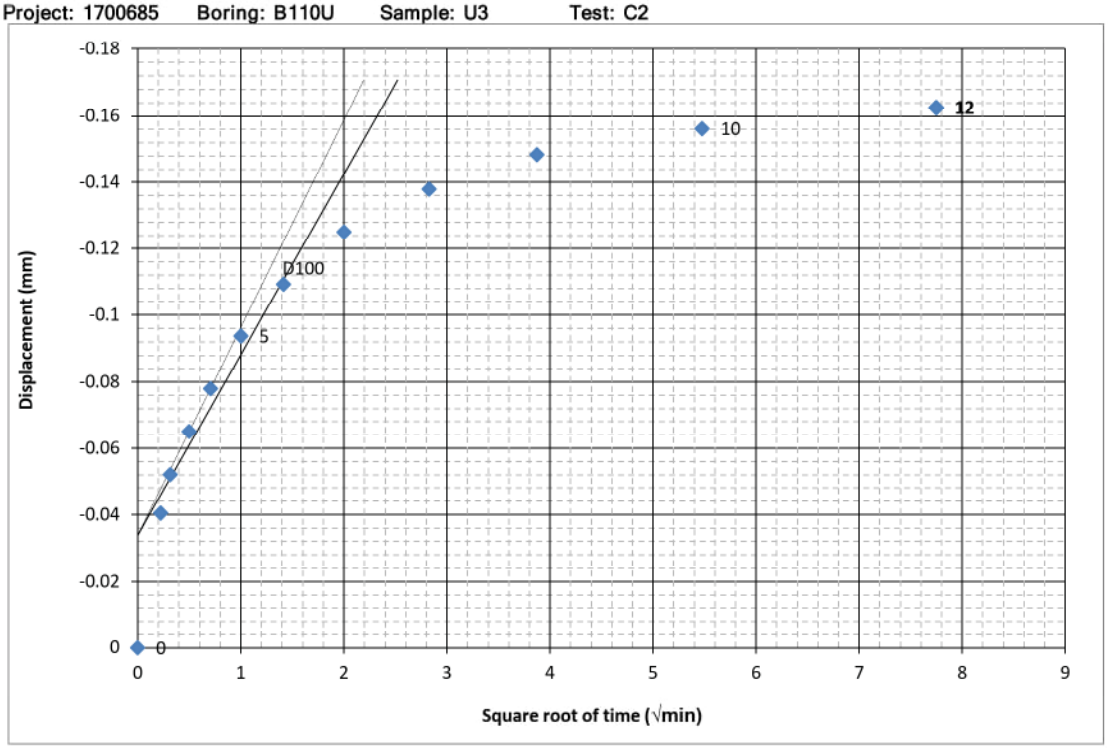
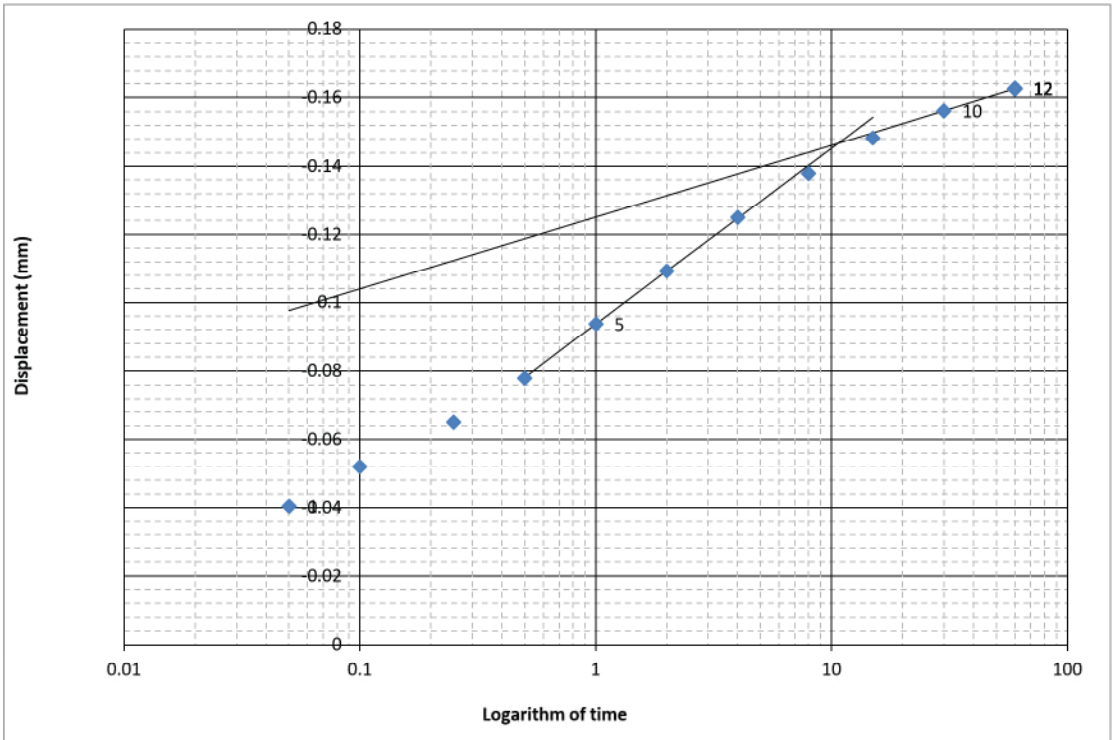
37	-	-
38	-	-
39	-	-
40	-	-
41	-	-
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

Project: 1700685 Boring: B110U Sample: U3 Test: C2



	Line 1	t90 Intercept	Straight Line on Log	Secondary Line
First Point	3	5	5	10
Second Point	4	6	6	12



	$d_{initial}$	d_{final}	From square root of time plot					From log of time plot				
			d_0	d_{50}	d_{90}	t_{90}	d_{100}	t_{50}	d_{50}	t_{100}	d_{100}	C_α
Relative	0	-0.1626	-0.0338	-0.0739	-0.1061	1.77	-0.1141	0.82	-0.0903	10.71	-0.1468	-0.0211
Absolute	-3.3317	-3.4943	-3.3655	-3.4057	-3.4378	1.77	-3.4458	0.82	-3.4220	10.71	-3.4785	-0.0211

Load: 16
0.12 tsf

	Time (min)	Def (mm)
0	0.0	0.000
1	0.1	-0.040
2	0.1	-0.052
3	0.3	-0.065
4	0.5	-0.078
5	1.0	-0.094
6	2.0	-0.109
7	4.0	-0.125
8	8.0	-0.138
9	15.0	-0.148
10	30.0	-0.156
11	60.0	-0.163
12	60.0	-0.1626
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	-	-
29	-	-
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43	-	-
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45	-	-
46	-	-
47	-	-
48	-	-
49	-	-

PROJECT:	Glen Lyn Seismic Stability
PROJECT NO.:	1700685
BORING:	B110U
SAMPLE:	U3
TEST:	C2
DEPTH, ft:	53.9
BY:	W. Lukas
DATE:	12/12/17

Project Name	Line 1	Glen Lyn Seismic Stability
	Line 2	West Pond and Landfill
	Line 3	Glen Lyn, Virginia
Client	Line 1	American Electric Power
	Line 2	Columbus, Ohio

Figure No.			
Report Date:	March 2018		
Surface Elevation:		Sample Elevation:	
Checked By:	D. Aghjayan		
SPECIMEN DESCRIPTION:	SANDY LEAN CLAY (CL)		
SAMPLE TYPE:	2.8-inch-diameter Shelby tube specimen		
Liquid Limit			
Plastic Limit		Water Table (ft):	
Plasticity Index		Total Unit Weight (pcf):	
EQUIPMENT:		Overburden Stress (tsf)	
Load Frame No.:	Geocomp		

Initial DCDT reading:	-5.74548	mm	AREA:	31.67	sq. cm.
Final DCDT reading:	-3.494278	mm		4.909	sq. in.
Final Compliance	0.11313955	mm			
HEIGHT:	0.880	in.		22.35	mm
DIAMETER:	2.500	in.		63.50	mm

Log (l) or Sqrt(s)	l
English(e) or Metric(m)	e

WATER CONTENT AND WEIGHT OF SOLIDS INFORMATION	START		DURING	END		
	TRIMMINGS	SPECIMEN	LOST MATERIAL	LOST MATERIAL	SPECIMEN	EXCESS SOLIDS
W+TARE (gm)	85.270	304.500	-	-	353.410	-
D+TARE (gm)	75.910	279.300	0	0	331.540	192.780
TARE (gm)	31.340	165.110	0	0	217.430	192.700
Ws (gm)	44.57	114.190	0	0	114.110	0.080
w (%)	21.00	22.07	-	-	19.17	-
Specimen Solids (gm)		114.19	114.19	114.19	114.19	

PROJECT:	Glen Lyn Seismic Stability
PROJECT NO.:	1700685
BORING:	B110U
SAMPLE:	U3
TEST:	C2
DEPTH, ft:	53.9
BY:	W. Lukas
DATE:	12/12/17

		Computed Stress			delta Ws
Stage	Applied Load	psi	psf	tsf	g
1	8.42235	1.72	247.07	0.12	0
2	16.94975	3.45	497.23	0.25	0
3	34.004	6.93	997.52	0.50	0
4	68.113	13.88	1998.12	1.00	0
5	102.225	20.83	2998.82	1.50	0
6	153.35	31.24	4498.59	2.25	0
7	238.48	48.58	6995.92	3.50	0
8	340.775	69.42	9996.78	5.00	0
9	511.245	104.15	14997.60	7.50	0
10	783.94	159.70	22997.22	11.50	0
11	1090.8	222.22	31999.10	16.00	0
12	511.21	104.14	14996.57	7.50	0
13	238.48	48.58	6995.92	3.50	0
14	102.19	20.82	2997.79	1.50	0
15	33.969	6.92	996.50	0.50	0
16	8.4573	1.72	248.10	0.12	0
					final

COMPUTATIONS:

	Initial		Final Saturation	Final
WEIGHT OF SOLIDS (gm):	114.19		114.19	114.19
GRAVITY OF SOLIDS:	2.720	e	2.7103799	2.72
HEIGHT OF SOLIDS (mm):	13.256	"e" or "m"	13.303	13.303
CHANGE IN HEIGHT (mm):	2.13806245	(Est./meas.)		
TOTAL HEIGHT END:	20.214			
HEIGHT WATER START:	7.957			
HEIGHT WATER END:	6.911			
SATURATION START:	0.875			
SATURATION END:	0.993			

One-Dimensional Consolidation Test

Project Name	GLEN LYN
Description of Sample	CLAYEY ALLUVIUM

Project No.	1700685
Test No.	C2
Boring	B110V
Sample	U3
Depth	53.91
By	WGL
Date	12/12/17
Checked	
Date	

	Soil at Start of Test		Soil at End of Test	
	Specimen	*Trimmings*	*Specimen*	*Excess Solids*
Container No.	Ring and Glass Plates	A-32	DA-31	EF-21
Wet Wt. + Tare	304.20	85.27	353.41	--
Dry Wt. + Tare	279.30	75.91	331.54	192.78
Wt. Water	24.90	9.36	21.87	--
Tare Wt.	165.11	31.34	217.43	192.70
Dry Wt. Soil	w_s = 114.19	44.57	114.11 +	0.08 = w_s
Water Content	w_1 = 21.8	21.0	w_2 = 19.2	--

SPECIMEN DIMENSIONS

Test Ring Number

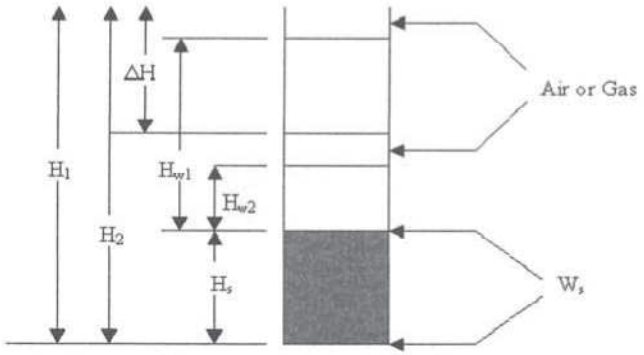
Ht. Ring = Ht. Sample at Start of Test = H_1 = 0.88 cm ~~in.~~

Inside Diameter of Ring 2.50 cm ~~in.~~

Specific Gravity of Solids = S_s = (Det. / Est.)

Reduced Ht. (Solid Matter) = Hs = (w_s / A * S_s) cm

Change in Ht. of Specimen from Beginning to End of Test = ΔH = cm



Ht. of Specimen at End	$H_2 = H_1 - \Delta H$	cm
Ht. of Water at Start	$H_{W1} = w_1 * H_s * S_s$	cm
Ht. of Water at End	$H_{W2} = w_2 * H_s * S_s$	cm
Degree of Saturation at Start of Test	$G_1 = H_{W1} / (H_1 - H_s)$	cm
Degree of Saturation at End of Test	$G_2 = H_{W2} / (H_2 - H_s)$	cm

REMARKS

GEI

Virginia Polytechnic Institute and State University
Geotechnical Engineering Laboratory
Constant Rate of Strain Consolidation Test (ASTM D4186)

Project:	GEI 001	Started:	1/12/18
Sample I.D./Loc.:	Boring:B119U-A-U2, Depth: 42.2 ft to 44.2 ft, Undisturbed	Finished:	1/16/18
Classification:	Brown, moist, hard and homogenous sandy lean clay (CL)		

Weight of Ring	217.55	(g)
Weight of Ring + Soil	364.88	(g)
Weight of soil	147.33	(g)

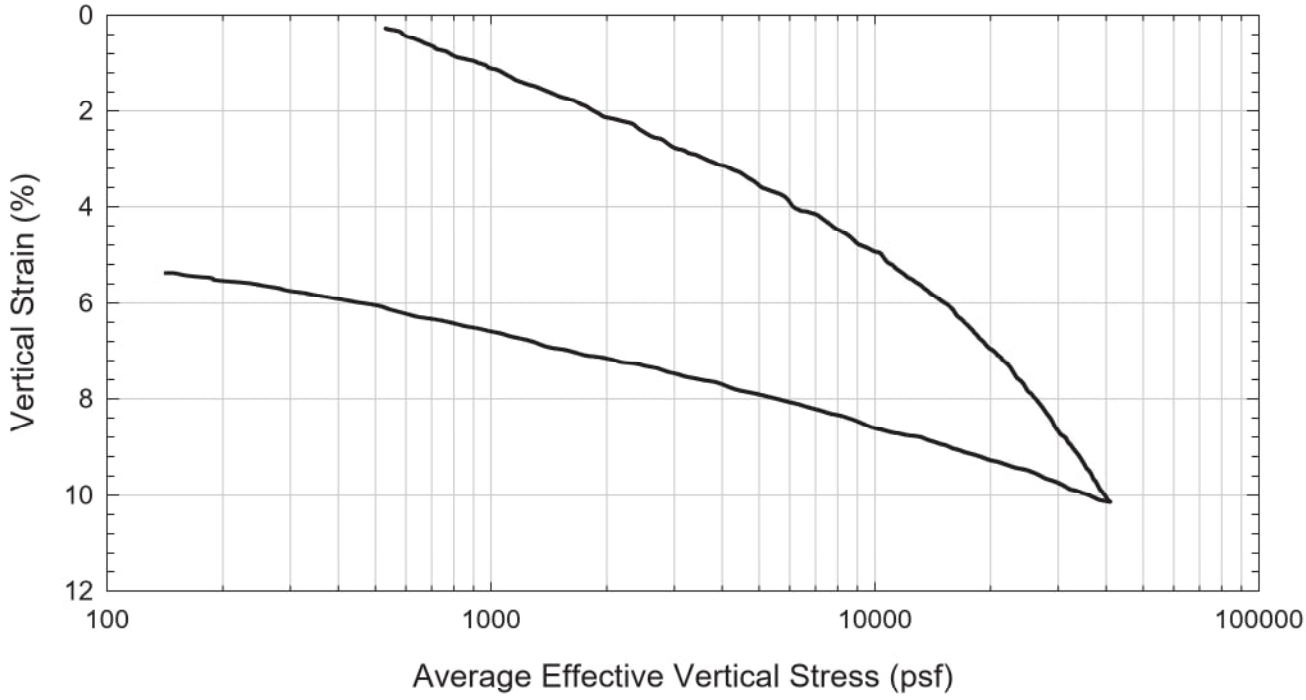
Specific Gravity	2.70	
Initial Thickness of Specimen	0.874	(in.)
Weight of Top Platen	295.33	(g)
Sample Diameter	2.50	(in.)

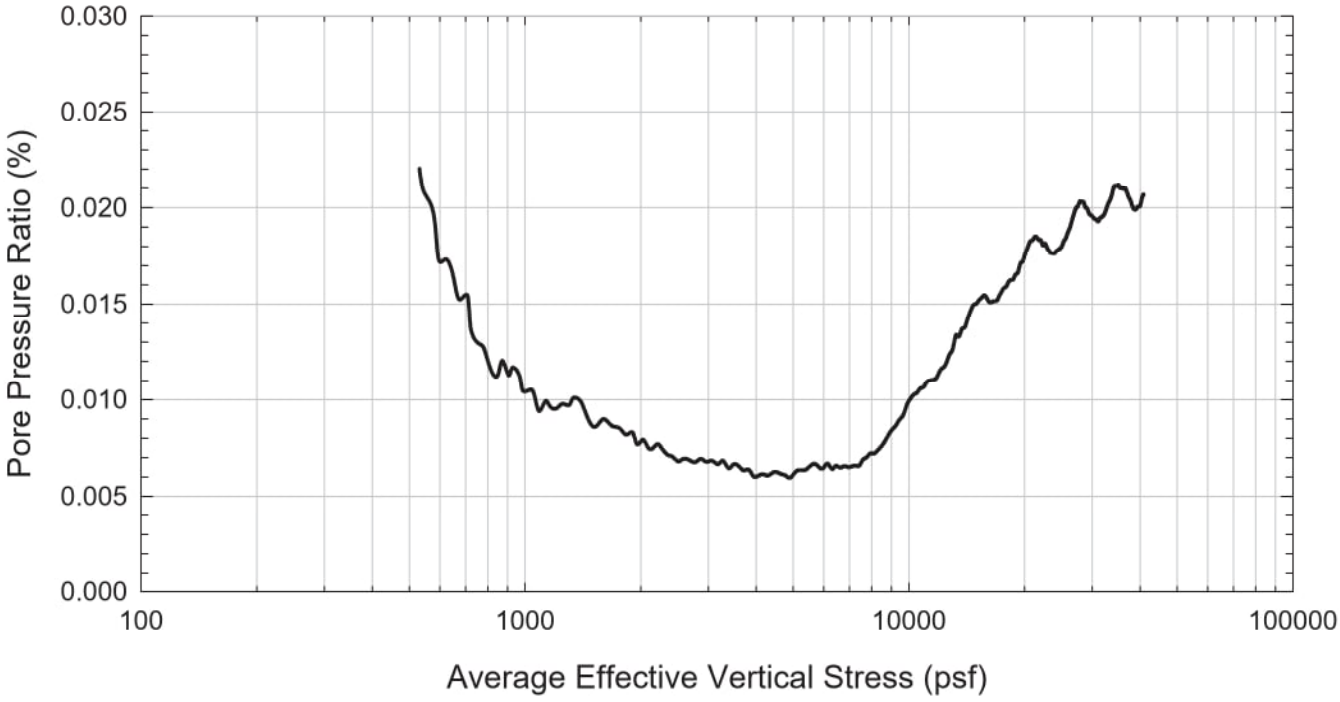
Initial Conditions		
Wt. of Moist Soil + Tare	107.74	(g)
Wt. of Dry Soil + Tare	94.18	(g)
Wt. of Tare	21.84	(g)
Wt. of Moist Soil	85.90	(g)
Wt. of Dry Soil	72.34	(g)
Water Content, w%	18.74	(%)
Dry Unit Weight	110.17	pcf
Wet Unit Weight	130.82	pcf
Void Ratio	0.53	
Saturation	95.6	(%)

Final Conditions		
Wt. of Moist Soil + Tare	169.27	(g)
Wt. of Dry Soil + Tare	146.34	(g)
Wt. of Tare	21.58	(g)
Wt. of Moist Soil	147.69	(g)
Wt. of Dry Soil	124.76	(g)
Water Content, w%	18.38	(%)
Dry Unit Weight	117.07	pcf
Wet Unit Weight	138.59	pcf
Void Ratio	0.50	
Saturation	100.0	(%)

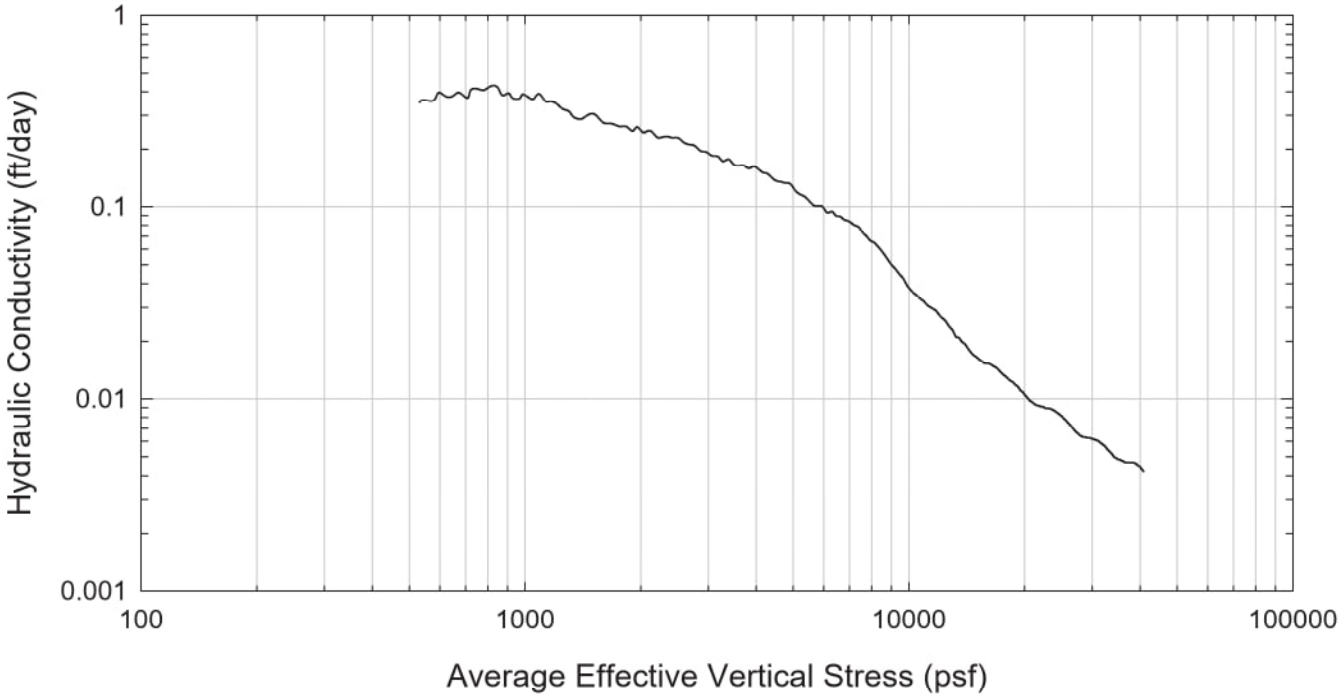
Test Conditions		
Total backpressure	100.00	(psi)
Seating Strain	0.2	(%)
Seating Pressure	150.00	(psf)
Loading Strain Rate	1.00	(%/hr)
Unloading Strain Rate	0.10	(%/hr)

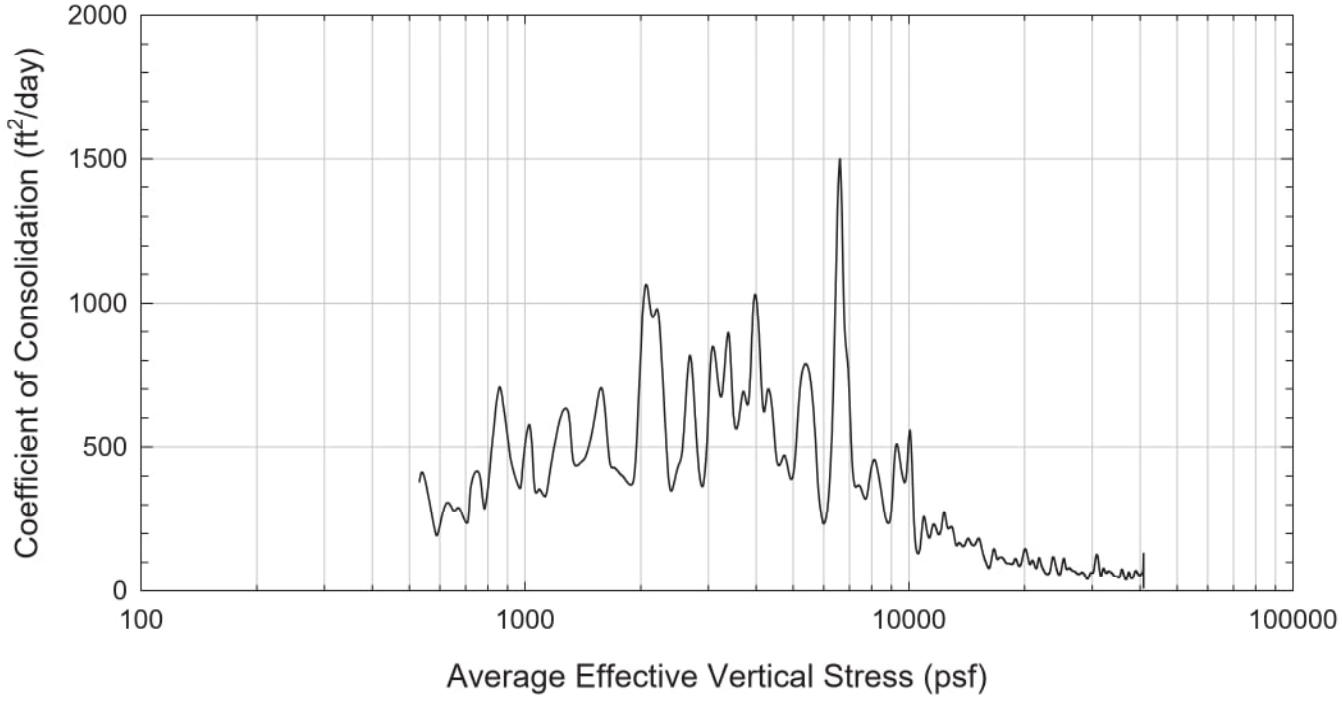
Comments:


Boring:B119U-A-U2, Depth: 42.2 ft to 44.2 ft, Undisturbed
Vertical Strain (%)
0
2
4
6
8
10
12
100
1000
10000
100000
Average Effective Vertical Stress (psf)

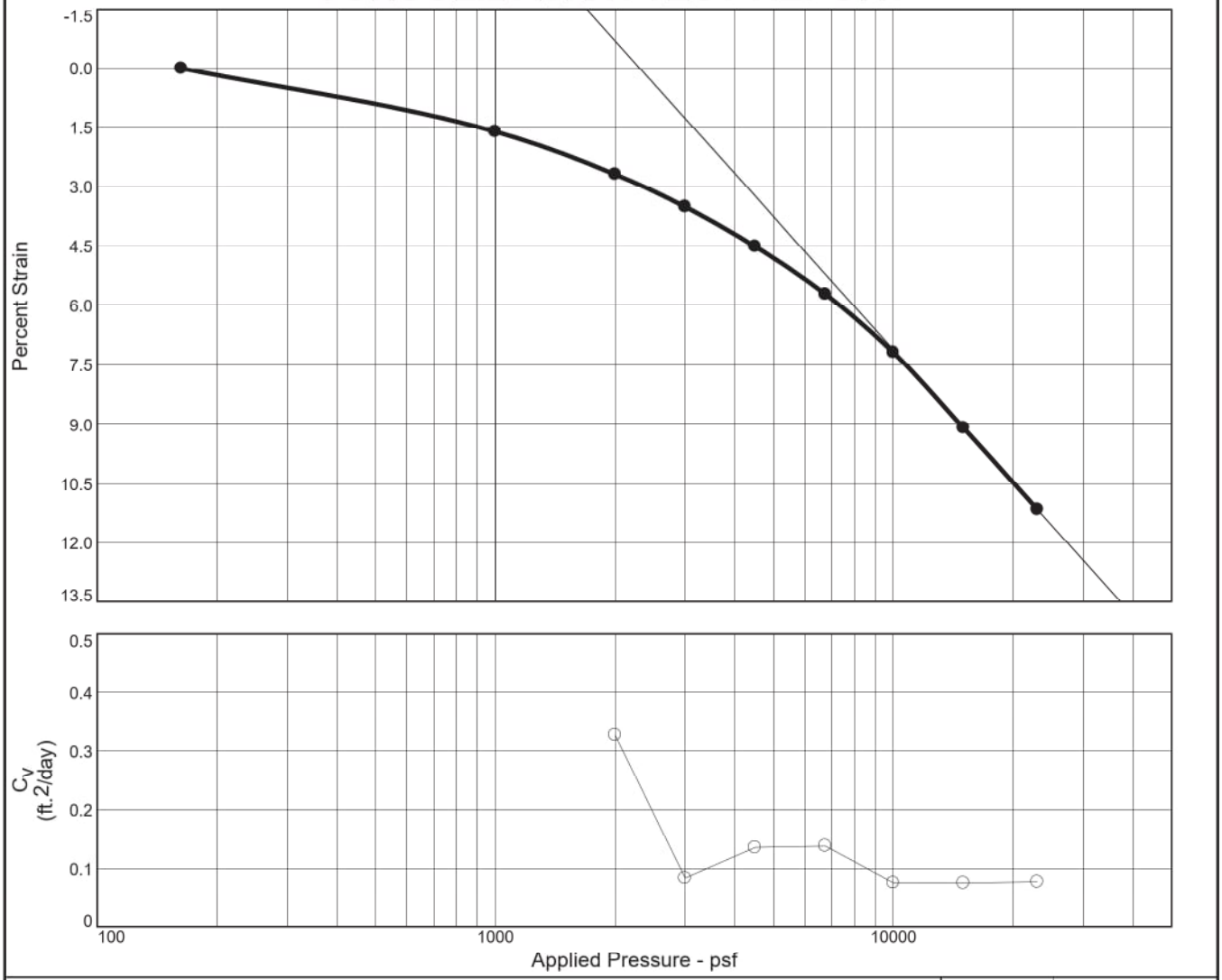

Pore Pressure Ratio (%)
0.030
0.025
0.020
0.015
0.010
0.005
0.000
100
1000
10000
100000
Average Effective Vertical Stress (psf)

Boring:B119U-A-U2, Depth: 42.2 ft to 44.2 ft, Undisturbed





CONSOLIDATION TEST REPORT



MATERIAL DESCRIPTION	USCS	AASHTO
Brown, moist, hard and homogenous sandy lean clay (CL)		

LL	PI	Sp. Gr.	Overburden (psf)	Dry Dens. (pcf)		Moisture		Saturation		Void Ratio		P_c (psf)	C_c
				Init.	Final	Init.	Final	Init.	Final	Init.	Final		
		2.7		94.6	105.2	24.6 %	21.4 %	82.8 %	96.1 %	0.804	0.602		0.20

	D2435 Method	C_r	Swell Press. (psf)	%
Preparation Process: Undisturbed				
Condition of Test: Undisturbed	Method A		162.0	

Project No. **Client:** GEI Consultants, Inc.

Project: GEI 001

Source: B119U-A-U2 **Depth:** 42.2' to 44.2' **Sample No.:** 1

VirginiaTech

English Geotechnical Lab

Remarks:

G_s was assumed to be 2.70. C_c, and c_v were calculated by the Geosystem software.

Checked By: Thomas L. Brandon, PhD

Title: Lab Director

Figure

Tested By: Bernardo Castellanos, PhD

CONSOLIDATION TEST DATA

1/20/2018

Client: GEI Consultants, Inc.
Project: GEI 001
Location: B119U-A-U2
Depth: 42.2' to 44.2' **Sample Number:** 1
Material Description: Brown, moist, hard and homogenous sandy lean clay (CL)
Preparation Process: Undisturbed
Condition of Test: Undisturbed
Test Method: Method A **Final Density:** 105.2
Testing Remarks: G_s was assumed to be 2.70. C_c, c_v were calculated by the Geosystem software.
Tested By: Bernardo Castellanos, PhD **Checked by:** Thomas L. Brandon, PhD **Title:** Lab Director

Test Specimen Data

NATURAL MOISTURE		VOID RATIO		AFTER TEST	
Wet w+t =	305.81 g.	Spec. Gr. =	2.7	Wet w+t =	168.06 g.
Dry w+t =	252.22 g.	Est. Ht. Solids =	0.554 in.	Dry w+t =	142.24 g.
Tare Wt. =	34.70 g.	Init. V.R. =	0.804	Tare Wt. =	21.83 g.
Moisture =	24.6 %	Init. Sat. =	82.8 %	Moisture =	21.4 %

UNIT WEIGHT		TEST START			
Height =	1.000 in.	Height =	1.000 in.	Dry Wt. =	120.41* g.
Diameter =	2.500 in.	Diameter =	2.500 in.		
Weight =	151.90 g.				
Dry Dens. =	94.6 pcf				

End-Of-Load Summary

Pressure (psf)	Final Dial (in.)	Deformation (in.)	C_v (ft.^{2}/day)	C_α	Void Ratio	% Strain
start	0.41159	0.00000			0.804	
162	0.41163	0.00004			0.804	0.0 Comprs.
1000	0.42770	0.01611		0.001	0.775	1.6 Comprs.
2000	0.43855	0.02696	0.327	0.002	0.755	2.7 Comprs.
3000	0.44673	0.03514	0.084	0.002	0.740	3.5 Comprs.
4500	0.45668	0.04509	0.136	0.002	0.722	4.5 Comprs.
6750	0.46874	0.05715	0.138	0.002	0.701	5.7 Comprs.
10000	0.48355	0.07196	0.076	0.003	0.674	7.2 Comprs.
15000	0.50245	0.09086	0.076	0.002	0.640	9.1 Comprs.
23000	0.52317	0.11158	0.078	0.002	0.602	11.2 Comprs.

Compression index (C_c), psf = 0.20 **Preconsolidation pressure (P_p), psf =** **Void ratio at P_p (e_m) =**

Pressure: 162 psf	TEST READINGS	Load No. 1

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.41159	16	2.5167	0.41160	31	79.5000	0.41157
2	0.0500	0.41158	17	3.1667	0.41159	32	100.0667	0.41157
3	0.0833	0.41158	18	4.0000	0.41159	33	125.9667	0.41159
4	0.1167	0.41159	19	5.0333	0.41159	34	158.5667	0.41166
5	0.1500	0.41160	20	6.3333	0.41157	35	199.6000	0.41169
6	0.2167	0.41159	21	7.9667	0.41161	36	251.2667	0.41166
7	0.2833	0.41159	22	10.0333	0.41159	37	316.3167	0.41169
8	0.3667	0.41159	23	12.6167	0.41156	38	398.2000	0.41165
9	0.4667	0.41159	24	15.8833	0.41154	39	501.2833	0.41157
10	0.6000	0.41158	25	20.0000	0.41157	40	631.0500	0.41155
11	0.7667	0.41159	26	25.1667	0.41158	41	794.4333	0.41163
12	0.9833	0.41158	27	31.6667	0.41158	42	1000.1000	0.41170
13	1.2500	0.41157	28	39.8667	0.41158	43	1259.0333	0.41171
14	1.5833	0.41158	29	50.1667	0.41160	44	1440.1167	0.41163
15	2.0000	0.41158	30	63.1500	0.41157			

Void Ratio = 0.804 **Compression =** 0.0%

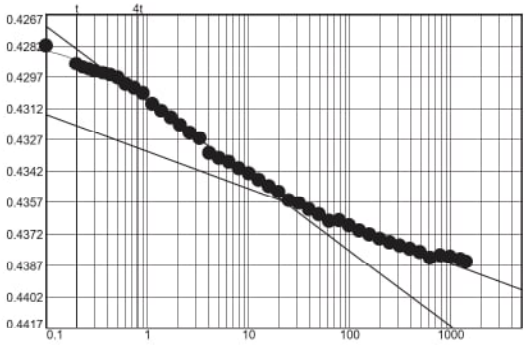
Pressure: 1000 psf	TEST READINGS	Load No. 2

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.40991	16	2.1333	0.42197	31	63.3000	0.42495
2	0.1000	0.41764	17	2.6500	0.42232	32	79.6333	0.42505
3	0.2000	0.41875	18	3.3167	0.42262	33	100.2167	0.42520
4	0.2333	0.41880	19	4.1333	0.42323	34	126.1167	0.42535
5	0.2667	0.41927	20	5.1667	0.42371	35	158.7167	0.42540
6	0.3000	0.41949	21	6.4667	0.42390	36	199.7500	0.42564
7	0.3667	0.41987	22	8.1167	0.42407	37	251.4167	0.42578
8	0.4333	0.42025	23	10.1667	0.42431	38	316.4667	0.42586
9	0.5167	0.42034	24	12.7667	0.42443	39	398.3500	0.42595
10	0.6167	0.42055	25	16.0333	0.42444	40	501.4333	0.42604
11	0.7500	0.42083	26	20.1333	0.42453	41	631.2000	0.42638
12	0.9167	0.42127	27	25.3000	0.42460	42	794.5833	0.42669
13	1.1333	0.42147	28	31.8167	0.42475	43	1000.2500	0.42701
14	1.3833	0.42159	29	40.0000	0.42477	44	1259.1833	0.42738
15	1.7167	0.42168	30	50.3167	0.42494	45	1440.1500	0.42770

Void Ratio = 0.775 **Compression =** 1.6%

Pressure: 2000 psf	TEST READINGS	Load No. 3

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.42563	24	12.7667	0.43466
2	0.1000	0.42822	25	16.0333	0.43496
3	0.2000	0.42909	26	20.1333	0.43523
4	0.2333	0.42925	27	25.3167	0.43564
5	0.2667	0.42933	28	31.8167	0.43578
6	0.3000	0.42942	29	40.0167	0.43608
7	0.3667	0.42954	30	50.3167	0.43631
8	0.4333	0.42963	31	63.3000	0.43662
9	0.5167	0.42977	32	79.6500	0.43660
10	0.6167	0.43007	33	100.2167	0.43683
11	0.7500	0.43025	34	126.1167	0.43707
12	0.9167	0.43051	35	158.7167	0.43726
13	1.1333	0.43103	36	199.7667	0.43746
14	1.3833	0.43134	37	251.4333	0.43764
15	1.7167	0.43166	38	316.4667	0.43780
16	2.1333	0.43202	39	398.3500	0.43794
17	2.6500	0.43239	40	501.4333	0.43809
18	3.3167	0.43267	41	631.2167	0.43836
19	4.1333	0.43338	42	794.5833	0.43825
20	5.1667	0.43362	43	1000.2667	0.43832
21	6.4667	0.43381	44	1259.1833	0.43844
22	8.1167	0.43411	45	1440.3833	0.43855
23	10.1667	0.43436			

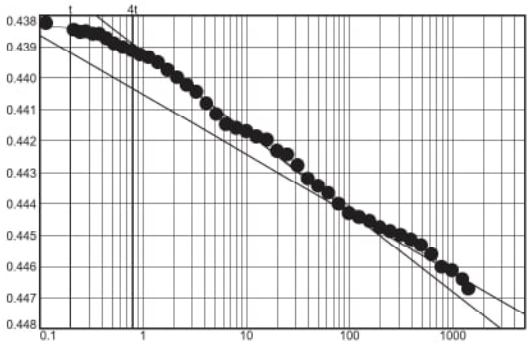


Void Ratio = 0.755 **Compression =** 2.7%

D_0 = 0.4272 **D_{50} =** 0.4314 **D_{100} =** 0.4357 **C_V at 1.45 min. =** 0.327 ft.^{2}/day **C_α =** 0.002

Pressure: 3000 psf	TEST READINGS	Load No. 4

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.43690	13	1.1500	0.43936
2	0.1167	0.43826	14	1.4167	0.43953
3	0.2167	0.43847	15	1.7500	0.43976
4	0.2500	0.43855	16	2.1667	0.44000
5	0.2833	0.43853	17	2.6833	0.44024
6	0.3333	0.43860	18	3.3333	0.44046
7	0.3833	0.43861	19	4.1667	0.44083
8	0.4500	0.43874	20	5.2000	0.44118
9	0.5333	0.43891	21	6.5000	0.44151
10	0.6500	0.43904	22	8.1333	0.44162
11	0.7833	0.43913	23	10.2000	0.44172
12	0.9500	0.43927	24	12.8000	0.44189



Pressure: 3000 psf	TEST READINGS (continued)	Load No. 4

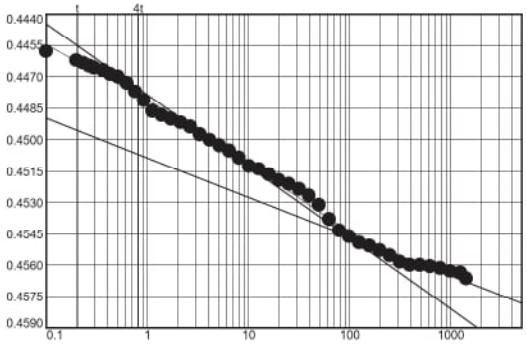
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
25	16.0667	0.44199	35	158.7500	0.44457	45	1440.2000	0.44673
26	20.1667	0.44234	36	199.7833	0.44477			
27	25.3333	0.44245	37	251.4500	0.44489			
28	31.8500	0.44279	38	316.5000	0.44501			
29	40.0333	0.44321	39	398.3833	0.44516			
30	50.3500	0.44344	40	501.4667	0.44534			
31	63.3333	0.44367	41	631.2333	0.44564			
32	79.6667	0.44402	42	794.6167	0.44604			
33	100.2500	0.44432	43	1000.2833	0.44615			
34	126.1500	0.44445	44	1259.2167	0.44643			

Void Ratio = 0.740 **Compression =** 3.5%

D_0 = 0.4377 D_{50} = 0.4411 D_{100} = 0.4445 C_v **at 5.52 min. =** 0.084 ft.^{2}/day C_α = 0.002

Pressure: 4500 psf	TEST READINGS	Load No. 5

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.44519	24	12.8000	0.45143
2	0.1000	0.44583	25	16.0667	0.45169
3	0.2000	0.44626	26	20.1667	0.45196
4	0.2333	0.44638	27	25.3333	0.45216
5	0.2667	0.44651	28	31.8500	0.45239
6	0.3000	0.44662	29	40.0333	0.45270
7	0.3667	0.44674	30	50.3500	0.45315
8	0.4333	0.44693	31	63.3333	0.45384
9	0.5167	0.44705	32	79.6667	0.45438
10	0.6333	0.44735	33	100.2333	0.45467
11	0.7667	0.44776	34	126.1333	0.45497
12	0.9333	0.44818	35	158.7333	0.45512
13	1.1333	0.44870	36	199.7833	0.45533
14	1.4000	0.44889	37	251.4500	0.45558
15	1.7333	0.44906	38	316.4833	0.45589
16	2.1500	0.44923	39	398.3667	0.45603
17	2.6833	0.44943	40	501.4500	0.45604
18	3.3333	0.44978	41	631.2333	0.45611
19	4.1667	0.45005	42	794.6000	0.45618
20	5.2000	0.45031	43	1000.2833	0.45632
21	6.5000	0.45056	44	1259.2000	0.45640
22	8.1333	0.45089	45	1440.2500	0.45668
23	10.2000	0.45129			

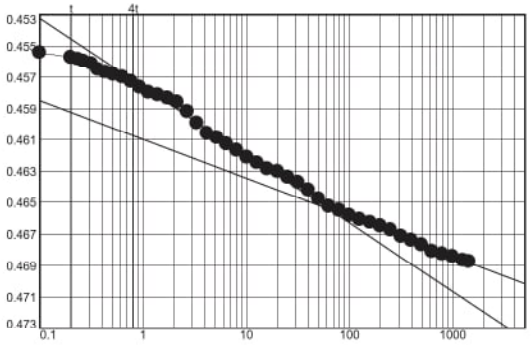


Void Ratio = 0.722 **Compression =** 4.5%

D_0 = 0.4447 D_{50} = 0.4496 D_{100} = 0.4546 C_v **at 3.35 min. =** 0.136 ft.^{2}/day C_α = 0.002

Pressure: 6750 psf	TEST READINGS	Load No. 6

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.45369	24	12.7833	0.46250
2	0.1000	0.45543	25	16.0500	0.46288
3	0.2000	0.45575	26	20.1667	0.46306
4	0.2333	0.45585	27	25.3333	0.46342
5	0.2667	0.45600	28	31.8333	0.46375
6	0.3167	0.45613	29	40.0333	0.46423
7	0.3667	0.45653	30	50.3333	0.46478
8	0.4333	0.45670	31	63.3167	0.46528
9	0.5167	0.45684	32	79.6667	0.46554
10	0.6333	0.45701	33	100.2333	0.46585
11	0.7667	0.45729	34	126.1333	0.46612
12	0.9333	0.45767	35	158.7333	0.46629
13	1.1333	0.45798	36	199.7833	0.46650
14	1.4000	0.45816	37	251.4500	0.46677
15	1.7333	0.45835	38	316.4833	0.46717
16	2.1500	0.45862	39	398.3667	0.46742
17	2.6833	0.45921	40	501.4500	0.46770
18	3.3333	0.45994	41	631.2333	0.46811
19	4.1667	0.46061	42	794.6000	0.46829
20	5.2000	0.46089	43	1000.2833	0.46844
21	6.5000	0.46130	44	1259.2000	0.46868
22	8.1333	0.46170	45	1440.1667	0.46874
23	10.2000	0.46213			

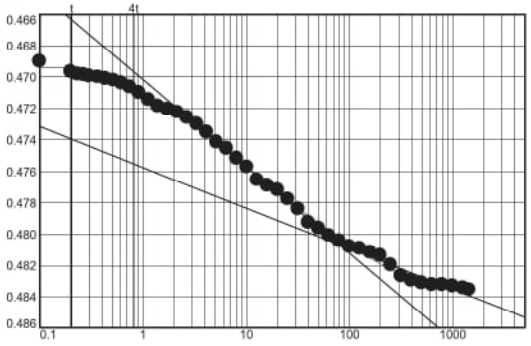


Void Ratio = 0.701 **Compression =** 5.7%

D_0 = 0.4541 **D_{50} =** 0.4598 **D_{100} =** 0.4655 **C_V at 3.22 min. =** 0.138 ft.^{2}/day **C_α =** 0.002

Pressure: 10000 psf	TEST READINGS	Load No. 7

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.46615	13	1.1333	0.47145
2	0.1000	0.46900	14	1.4000	0.47188
3	0.2000	0.46966	15	1.7333	0.47208
4	0.2333	0.46984	16	2.1500	0.47224
5	0.2667	0.46986	17	2.6667	0.47259
6	0.3000	0.46993	18	3.3333	0.47302
7	0.3667	0.47000	19	4.1500	0.47352
8	0.4333	0.47010	20	5.1833	0.47415
9	0.5167	0.47020	21	6.4833	0.47454
10	0.6167	0.47037	22	8.1333	0.47517
11	0.7500	0.47065	23	10.1833	0.47571
12	0.9167	0.47099	24	12.7833	0.47653



Pressure: 10000 psf	TEST READINGS (continued)	Load No. 7

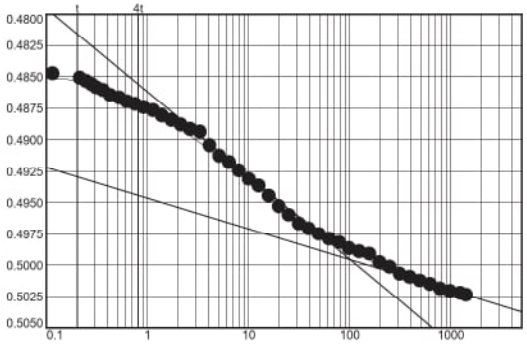
No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
25	16.0500	0.47689	35	158.7333	0.48118	45	1440.0333	0.48355
26	20.1500	0.47718	36	199.7667	0.48137			
27	25.3167	0.47775	37	251.4333	0.48197			
28	31.8333	0.47838	38	316.4833	0.48267			
29	40.0167	0.47925	39	398.3667	0.48295			
30	50.3333	0.47962	40	501.4500	0.48313			
31	63.3167	0.48009	41	631.2167	0.48322			
32	79.6500	0.48044	42	794.6000	0.48323			
33	100.2333	0.48079	43	1000.2667	0.48332			
34	126.1333	0.48092	44	1259.2000	0.48344			

Void Ratio = 0.674 **Compression =** 7.2%

D_0 = 0.4682 **D_{50} =** 0.4744 **D_{100} =** 0.4807 **C_V at 5.69 min. =** 0.076 ft.^{2}/day **C_α =** 0.003

Pressure: 15000 psf	TEST READINGS	Load No. 8

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.48084	24	12.8000	0.49372
2	0.1167	0.48481	25	16.0667	0.49453
3	0.2167	0.48516	26	20.1833	0.49536
4	0.2500	0.48542	27	25.3500	0.49606
5	0.2833	0.48566	28	31.8667	0.49676
6	0.3167	0.48592	29	40.0500	0.49716
7	0.3667	0.48616	30	50.3667	0.49759
8	0.4333	0.48654	31	63.3500	0.49797
9	0.5333	0.48674	32	79.6833	0.49825
10	0.6333	0.48704	33	100.2667	0.49874
11	0.7667	0.48726	34	126.1667	0.49897
12	0.9333	0.48752	35	158.7667	0.49917
13	1.1500	0.48775	36	199.8000	0.49984
14	1.4167	0.48819	37	251.4667	0.50023
15	1.7500	0.48852	38	316.5167	0.50078
16	2.1667	0.48889	39	398.4000	0.50100
17	2.6833	0.48924	40	501.4833	0.50130
18	3.3500	0.48946	41	631.2500	0.50159
19	4.1667	0.49052	42	794.6333	0.50196
20	5.2000	0.49135	43	1000.3000	0.50216
21	6.5000	0.49185	44	1259.2333	0.50231
22	8.1500	0.49251	45	1440.3500	0.50245
23	10.2167	0.49320			

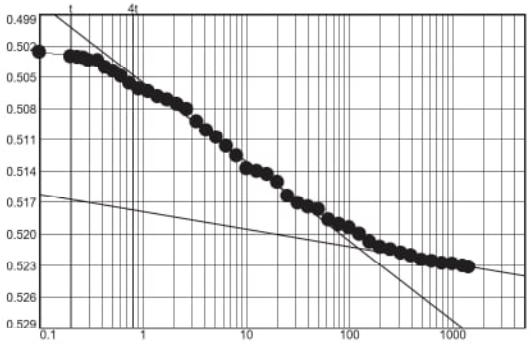


Void Ratio = 0.640 **Compression =** 9.1%

D_0 = 0.4836 **D_{50} =** 0.4916 **D_{100} =** 0.4996 **C_V at 5.51 min. =** 0.076 ft.^{2}/day **C_α =** 0.002

Pressure: 23000 psf	TEST READINGS	Load No. 9

No.	Elapsed Time	Dial Reading	No.	Elapsed Time	Dial Reading
1	0.0000	0.49778	24	12.7833	0.51408
2	0.1000	0.50263	25	16.0500	0.51435
3	0.2000	0.50304	26	20.1500	0.51513
4	0.2333	0.50311	27	25.3167	0.51646
5	0.2667	0.50318	28	31.8333	0.51714
6	0.3000	0.50342	29	40.0167	0.51750
7	0.3667	0.50345	30	50.3333	0.51775
8	0.4333	0.50410	31	63.3167	0.51871
9	0.5167	0.50445	32	79.6500	0.51915
10	0.6167	0.50496	33	100.2333	0.51947
11	0.7500	0.50565	34	126.1167	0.52004
12	0.9167	0.50616	35	158.7167	0.52082
13	1.1333	0.50642	36	199.7667	0.52128
14	1.4000	0.50690	37	251.4333	0.52151
15	1.7333	0.50721	38	316.4667	0.52184
16	2.1500	0.50762	39	398.3500	0.52211
17	2.6667	0.50811	40	501.4333	0.52249
18	3.3333	0.50932	41	631.2167	0.52263
19	4.1500	0.51015	42	794.5833	0.52282
20	5.1833	0.51081	43	1000.2667	0.52287
21	6.4833	0.51167	44	1259.2000	0.52308
22	8.1333	0.51261	45	1440.3000	0.52317
23	10.1833	0.51382			



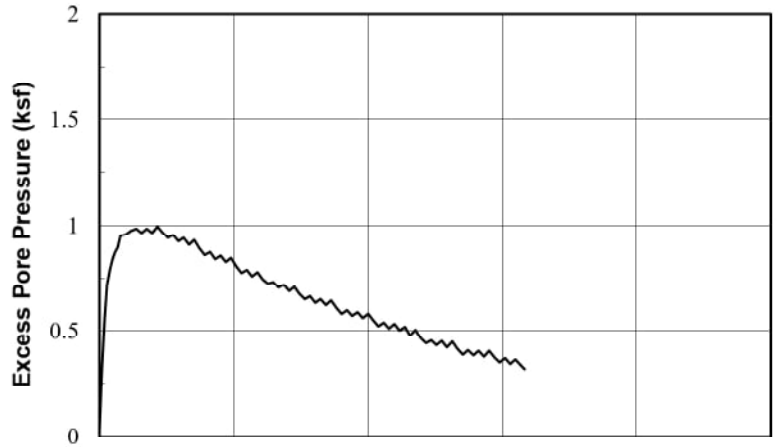
Void Ratio = 0.602 **Compression =** 11.2%

D_0 = 0.5005 **D_{50} =** 0.5109 **D_{100} =** 0.5213 **C_V at 5.16 min. =** 0.078 ft.^{2}/day C_α = 0.002

Appendix L

GEI Strength Test Data

- **Triaxial Tests, Clay Dike**
- **Triaxial Tests, Clay-like Alluvium**
- **Triaxial Tests, Fly Ash**
- **Laboratory Tube Records**



SAMPLE INFORMATION

Boring: B101U Sample: U1 Depth (ft): 21.8 Test: R'1
Type: 2.8-inch-diameter tube sample
Description: Orange-brown LEAN CLAY (CL) with sand and gravel

SPECIMEN INFORMATION (after saturation)

Height: 5.817 in Dia.: 2.867 in Area.: 6.461 sq. in
Water Content: 18.2% Dry Unit Weight: 113.9 pcf

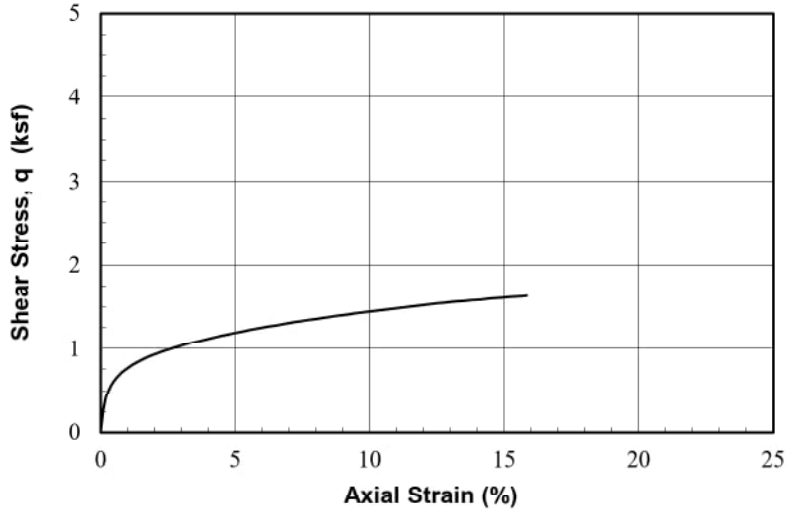
TEST SUMMARY (end of test)

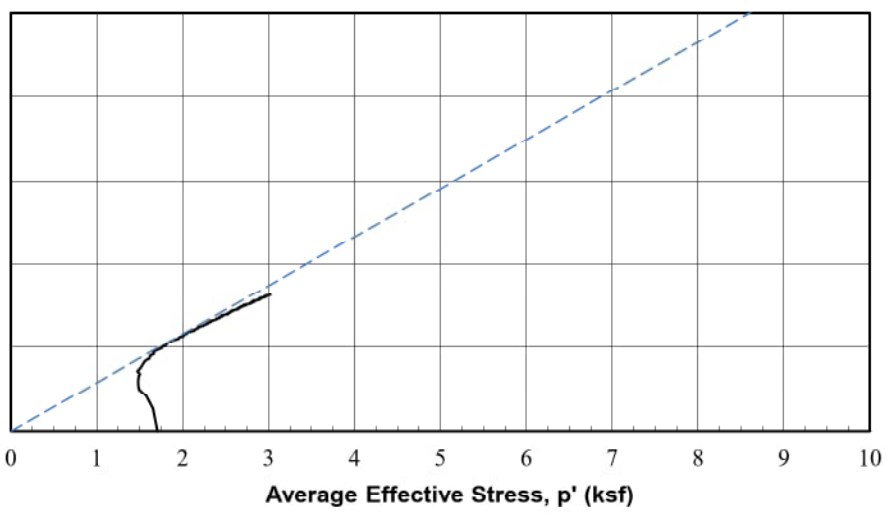
Effective Confining Stress: 1.71 ksf vertical, 1.71 ksf horiz.
Water Content: 17.9 % Dry Unit Weight: 114.5 pcf
B Coefficient: 0.97 Strain Rate: 0.014 %/min
Peak Shear Stress: 1.63 ksf @ 15.8 % Strain
Peak Friction Angle: 35.5 deg. @ 3.5 % Strain



Failure Sketch

REMARKS:





Operator: D. Aghjayan
Checked: N. Mazzella
Test Date: 17-Nov-2017

3/15/2018 16:00

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-1

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'1												
BORING:	B101U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U1			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	21.8			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	D. Aghjayan			In tube before extrusion	--	--	5.866	2.876	6.496	18.13	112.8	133.3	0.511
TEST DATE:	11/17/2017			Under vac.	1.01	1.01	5.843	2.870	6.468	--	113.8	--	0.498
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	1.02	1.02	5.843	2.868	6.461	18.19	113.9	134.6	0.496
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
Pressure Transducer		25218		Consol. Stage 2	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
				Consol. Stage 4	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
				Consol. Stage 6	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
B value start shear		0.97											
Test Stage End of#	1			This Stage Initial Values	1.71	1.71	5.817	2.867	6.457	17.91	114.5	135.0	0.489
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		9.99 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.025	10.678	69.372	0.00	6.46	0.00	1.71	1.71	1.71	1.71	0.00	1.00	0.0	0.00
0.031	34.820	71.615	0.10	6.46	0.32	1.39	2.25	1.92	1.66	0.27	1.39	9.4	0.60
0.037	48.400	73.196	0.20	6.47	0.55	1.16	2.55	2.00	1.58	0.42	1.72	15.4	0.66
0.043	56.060	74.376	0.30	6.48	0.72	0.99	2.72	2.00	1.49	0.50	2.02	19.7	0.71
0.048	61.689	74.872	0.39	6.48	0.79	0.92	2.84	2.05	1.48	0.57	2.24	22.4	0.70
0.054	65.984	75.202	0.49	6.49	0.84	0.87	2.94	2.10	1.48	0.61	2.41	24.4	0.68
0.060	69.640	75.438	0.59	6.50	0.87	0.84	3.02	2.14	1.49	0.65	2.56	26.0	0.67
0.066	72.599	75.580	0.69	6.50	0.89	0.82	3.08	2.19	1.50	0.69	2.68	27.2	0.65
0.071	75.385	75.981	0.79	6.51	0.95	0.76	3.14	2.19	1.47	0.72	2.89	29.1	0.66
0.077	77.706	76.005	0.89	6.51	0.96	0.75	3.19	2.24	1.49	0.74	2.96	29.7	0.64
0.083	79.853	76.028	0.99	6.52	0.96	0.75	3.24	2.28	1.51	0.76	3.03	30.3	0.63
0.094	83.742	76.147	1.18	6.53	0.98	0.73	3.32	2.34	1.54	0.81	3.19	31.5	0.61
0.106	86.991	76.217	1.38	6.55	0.99	0.72	3.39	2.40	1.56	0.84	3.32	32.5	0.59
0.117	89.951	76.076	1.57	6.56	0.97	0.74	3.45	2.48	1.61	0.87	3.34	32.6	0.55
0.128	92.737	76.217	1.77	6.57	0.99	0.72	3.51	2.52	1.62	0.90	3.48	33.6	0.55
0.140	95.232	76.076	1.97	6.59	0.97	0.74	3.56	2.59	1.67	0.92	3.49	33.6	0.52
0.151	97.495	76.288	2.16	6.60	1.00	0.71	3.60	2.61	1.66	0.95	3.66	34.8	0.53

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.163	99.585	76.099	2.36	6.61	0.97	0.74	3.65	2.68	1.71	0.97	3.61	34.5	0.50
0.174	101.620	75.910	2.56	6.63	0.94	0.77	3.69	2.74	1.76	0.99	3.57	34.2	0.48
0.185	103.650	76.005	2.75	6.64	0.96	0.75	3.73	2.77	1.76	1.01	3.67	34.9	0.47
0.197	105.500	75.792	2.95	6.65	0.92	0.78	3.76	2.84	1.81	1.03	3.62	34.5	0.45
0.208	107.480	75.910	3.14	6.67	0.94	0.77	3.80	2.86	1.81	1.05	3.72	35.2	0.45
0.220	109.280	75.674	3.34	6.68	0.91	0.80	3.83	2.93	1.86	1.06	3.65	34.7	0.43
0.231	111.020	75.840	3.54	6.69	0.93	0.78	3.87	2.94	1.86	1.08	3.78	35.5	0.43
0.243	112.580	75.556	3.73	6.71	0.89	0.82	3.90	3.01	1.91	1.09	3.67	34.9	0.41
0.254	114.150	75.344	3.93	6.72	0.86	0.85	3.93	3.07	1.96	1.11	3.61	34.5	0.39
0.265	115.830	75.438	4.12	6.73	0.87	0.84	3.96	3.08	1.96	1.12	3.69	35.0	0.39
0.277	117.400	75.202	4.32	6.75	0.84	0.87	3.99	3.15	2.01	1.14	3.62	34.5	0.37
0.288	119.080	75.320	4.52	6.76	0.86	0.85	4.02	3.16	2.01	1.15	3.71	35.1	0.37
0.300	120.590	75.108	4.71	6.78	0.83	0.88	4.05	3.22	2.05	1.17	3.64	34.7	0.35
0.311	122.100	75.250	4.91	6.79	0.85	0.86	4.07	3.23	2.04	1.18	3.74	35.3	0.36
0.322	123.490	74.966	5.10	6.80	0.81	0.90	4.10	3.29	2.10	1.19	3.64	34.7	0.34
0.334	124.830	74.754	5.30	6.82	0.78	0.93	4.12	3.35	2.14	1.21	3.58	34.3	0.32
0.345	126.340	74.848	5.50	6.83	0.79	0.92	4.15	3.36	2.14	1.22	3.65	34.7	0.32
0.357	127.730	74.636	5.69	6.85	0.76	0.95	4.17	3.41	2.18	1.23	3.59	34.3	0.31
0.368	129.180	74.777	5.89	6.86	0.78	0.93	4.20	3.42	2.17	1.24	3.67	34.9	0.31
0.379	130.460	74.541	6.09	6.88	0.74	0.96	4.22	3.47	2.22	1.25	3.60	34.4	0.30
0.391	131.790	74.400	6.28	6.89	0.72	0.99	4.24	3.52	2.25	1.27	3.57	34.2	0.29
0.402	133.010	74.447	6.48	6.90	0.73	0.98	4.26	3.53	2.25	1.28	3.61	34.5	0.29
0.414	134.290	74.258	6.67	6.92	0.70	1.01	4.28	3.58	2.29	1.29	3.56	34.1	0.27
0.425	135.620	74.353	6.87	6.93	0.72	0.99	4.30	3.59	2.29	1.30	3.62	34.5	0.28
0.436	136.960	74.140	7.07	6.95	0.69	1.02	4.33	3.64	2.33	1.31	3.56	34.1	0.26
0.448	138.230	74.282	7.26	6.96	0.71	1.00	4.35	3.64	2.32	1.32	3.63	34.6	0.27
0.459	139.450	74.046	7.46	6.98	0.67	1.04	4.37	3.69	2.37	1.33	3.56	34.2	0.25
0.471	140.610	73.881	7.66	6.99	0.65	1.06	4.39	3.74	2.40	1.34	3.52	33.9	0.24
0.482	141.830	73.975	7.85	7.01	0.66	1.05	4.40	3.74	2.39	1.35	3.58	34.3	0.25
0.494	142.940	73.763	8.05	7.02	0.63	1.08	4.42	3.79	2.43	1.36	3.52	33.9	0.23
0.505	144.210	73.881	8.24	7.04	0.65	1.06	4.44	3.79	2.43	1.37	3.58	34.3	0.24
0.516	145.370	73.692	8.44	7.05	0.62	1.09	4.46	3.84	2.46	1.38	3.53	34.0	0.23
0.528	146.590	73.833	8.64	7.07	0.64	1.07	4.48	3.84	2.45	1.38	3.60	34.4	0.23
0.539	147.690	73.597	8.83	7.08	0.61	1.10	4.50	3.89	2.49	1.39	3.53	34.0	0.22
0.551	148.800	73.408	9.03	7.10	0.58	1.13	4.51	3.93	2.53	1.40	3.48	33.6	0.21
0.562	149.900	73.526	9.22	7.11	0.60	1.11	4.53	3.93	2.52	1.41	3.54	34.0	0.21
0.573	151.060	73.338	9.42	7.13	0.57	1.14	4.55	3.97	2.56	1.42	3.49	33.7	0.20
0.585	152.220	73.456	9.62	7.14	0.59	1.12	4.56	3.97	2.55	1.43	3.54	34.1	0.21
0.596	153.380	73.267	9.81	7.16	0.56	1.15	4.58	4.02	2.58	1.44	3.50	33.7	0.20
0.608	154.540	73.408	10.01	7.17	0.58	1.13	4.60	4.02	2.57	1.44	3.56	34.1	0.20

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.619	155.530	73.196	10.20	7.19	0.55	1.16	4.61	4.06	2.61	1.45	3.50	33.8	0.19
0.630	156.630	73.007	10.40	7.21	0.52	1.19	4.63	4.10	2.64	1.46	3.46	33.5	0.18
0.642	157.730	73.125	10.60	7.22	0.54	1.17	4.64	4.10	2.63	1.47	3.51	33.8	0.18
0.653	158.780	72.936	10.79	7.24	0.51	1.20	4.66	4.14	2.67	1.47	3.46	33.5	0.17
0.665	159.940	73.078	10.99	7.25	0.53	1.18	4.67	4.14	2.66	1.48	3.52	33.9	0.18
0.676	160.980	72.866	11.18	7.27	0.50	1.21	4.69	4.18	2.69	1.49	3.47	33.5	0.17
0.687	162.140	72.984	11.38	7.29	0.52	1.19	4.70	4.18	2.69	1.50	3.52	33.9	0.17
0.699	163.190	72.700	11.58	7.30	0.48	1.23	4.72	4.24	2.73	1.50	3.45	33.4	0.16
0.710	164.350	72.889	11.77	7.32	0.51	1.20	4.73	4.23	2.71	1.51	3.51	33.8	0.17
0.722	165.390	72.606	11.97	7.33	0.47	1.24	4.75	4.28	2.76	1.52	3.44	33.4	0.15
0.733	166.610	72.441	12.17	7.35	0.44	1.27	4.76	4.32	2.79	1.53	3.41	33.1	0.14
0.745	167.720	72.535	12.36	7.37	0.46	1.25	4.78	4.32	2.79	1.53	3.45	33.4	0.15
0.756	168.590	72.370	12.56	7.38	0.43	1.28	4.79	4.36	2.82	1.54	3.41	33.1	0.14
0.767	169.510	72.511	12.75	7.40	0.45	1.26	4.80	4.35	2.80	1.55	3.46	33.5	0.15
0.779	170.500	72.299	12.95	7.42	0.42	1.29	4.81	4.39	2.84	1.55	3.41	33.1	0.14
0.790	171.780	72.488	13.15	7.43	0.45	1.26	4.83	4.38	2.82	1.56	3.48	33.6	0.14
0.802	172.530	72.252	13.34	7.45	0.41	1.29	4.84	4.42	2.86	1.56	3.42	33.2	0.13
0.813	173.520	72.063	13.54	7.47	0.39	1.32	4.85	4.46	2.89	1.57	3.38	32.9	0.12
0.824	174.560	72.205	13.73	7.48	0.41	1.30	4.86	4.45	2.88	1.58	3.42	33.2	0.13
0.836	175.430	72.039	13.93	7.50	0.38	1.33	4.87	4.49	2.91	1.58	3.39	33.0	0.12
0.847	176.190	72.181	14.13	7.52	0.40	1.30	4.88	4.47	2.89	1.58	3.43	33.3	0.13
0.859	177.120	71.992	14.32	7.54	0.38	1.33	4.89	4.51	2.92	1.59	3.39	33.0	0.12
0.870	178.220	72.181	14.52	7.55	0.40	1.30	4.90	4.50	2.90	1.60	3.45	33.4	0.13
0.881	179.030	71.969	14.71	7.57	0.37	1.34	4.91	4.54	2.94	1.60	3.40	33.0	0.12
0.893	180.080	71.803	14.91	7.59	0.35	1.36	4.92	4.57	2.97	1.61	3.37	32.8	0.11
0.904	181.120	71.945	15.11	7.61	0.37	1.34	4.94	4.57	2.95	1.61	3.41	33.1	0.11
0.916	181.990	71.756	15.30	7.62	0.34	1.37	4.95	4.60	2.98	1.62	3.37	32.8	0.11
0.927	182.860	71.898	15.50	7.64	0.36	1.35	4.95	4.59	2.97	1.62	3.41	33.1	0.11
0.938	183.670	71.709	15.70	7.66	0.34	1.37	4.96	4.63	3.00	1.63	3.37	32.8	0.10
0.947	184.490	71.591	15.84	7.67	0.32	1.39	4.97	4.65	3.02	1.63	3.35	32.7	0.10

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'1		Ground Surface Elevation
BORING:	B101U		Elevation Datum
SAMPLE:	U1		
DEPTH:	21.8	Elevation:	
TEST DATE:	17-Nov-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	D. Aghjayan		
Checked By:	N. Mazzella		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Orange-brown LEAN CLAY (CL) with sand and gravel		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:		VC:	#DIV/0!
Penetration, cm:			
Gross Recovery, cm:			
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	1.0000
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	23.1				23.1	cm
TOP EMPTY LENGTH	3.7				3.7	cm
BOT. EMPTY LENGTH	4.5				4.5	cm
TUBE INNER DIAMETER	7.302	7.308			7.305	cm

In tube length	14.90	cm
Tube Diameter	7.305	cm
Tube Area	41.91	(cm^2)
Tube Volume	624.48	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.384	7.386	7.385		7.385	cm
MEMBRANE 1 THICKNESS	0.098	0.094	0.096		0.096	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.39	13.492	13.467	13.471	13.455	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.776	8.774	8.751	8.799	8.775	cm

#filter strips	0		
Hi	14.840	cm	
Di	7.289	cm	2.03594457
Ai	41.728	cm^2	
Vi	619.241	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	211.250	165.630	*******	2013.670	*******	1670.830	948.260	*******
DRY+T	184.030	143.280		*******	0.000	*******	855.940	230.840
T	40.390	30.730		680.670	0.000	340.550	340.550	230.600
Wt. Solids	143.64	112.55	0	1333	0	1128.43	515.39	0.24
w %	18.95	19.86	*******	18.13	*******	17.91	17.91	*******

FINAL B VALUE 0.97

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00	
saturation	69.89	77.00	0.000	0.682	0.000	0.000	0.005	7.11	7.11	
Consolidation Stage 1	69.37	81.24	0.000	3.082	0.065	0.065	0.025	11.87	11.87	
2	69.37	81.24	0.000	0.000	0.000	0.000	0.000	11.87	11.87	
3	69.37	81.24	0.000	0.000	0.000	0.000	0.000	11.87	11.87	
4	69.37	81.24	0.000	0.000	0.000	0.000	0.000	11.87	11.87	
5	69.37	81.24	0.000	0.000	0.000	0.000	0.000	11.87	11.87	
6	69.37	81.24	0.000	0.000	0.000	0.000	0.000	11.87	11.87	
Start Shear	69.37	81.24	0.000	**********	**********			11.87	11.87	
End Shear				0.000	**********			**********	**********	

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							1.0000	1.81	112.8	0.511	
after sampling		0.00	0.00							1.0000	1.81	112.8	0.511	
after shipping		0.00	0.00							1.0000	1.81	112.8	0.511	
in tube before extrusion		0.00	0.00	14.90	7.305	41.911	624.48	1128.43	18.13	*****	1.81	112.8	0.511	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.840	7.289	41.728	619.241	1128.431	*****	*****	1.82	113.8	0.498	
saturation		7.11	7.11	14.840	7.285	41.682	618.559	1128.431	18.186		1.82	113.9	0.496	
	1	11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
	2	11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
	3	11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
	4	11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
	5	11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
	6	11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
Start Shear		11.87	11.87	14.775	7.283	41.656	615.477	1128.431	17.913	*****	1.83	114.5	0.489	
End Shear		**********	**********				615.477	1128.431	17.913	*****	1.83	114.5	0.489	0.489015309

Test comp (c) or ext (c) c

DEFORMATION RATE 1	0.021	mm/min	0.0142	%/min
DEFORMATION RATE 2		in/min	#VALUE!	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'1
Boring	B101J
Sample	U1
Depth	21.8'
By	DJA
Date	11-17-17
Checked	MM
Date	12/14/17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	D-35	6B		
Wet Wt. + Tare (g)	211.25	165.63		
Dry Wt. + Tare (g)	184.03	143.28		
Wt. Water (g)	27.22 ✓	22.35 ✓		
Tare (g)	40.39	30.73		
Dry Wt. Soil (g)	143.64 ✓	112.55 ✓		
Water Content (%)	19.0 ✓	~~27.3~~ 19.9		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	23.1 cm
Top Empty Length					cm	Avg.	3.7 cm
Bottom Empty Length					cm	Avg.	4.5 cm

Trimmed Length in Tube, L: 14.9 ✓ cm

Tube Dimensions

Tube Inner Diameter	7.302	7.308			cm	Avg.	7.305 ✓ cm

Tube Weight (g):

Weight of other (specify:_____) (g):

Area, A: 41.91 ✓ cm^2

Volume in Tube = A x L: 624.5 ✓ cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1670.83	g
Tare ~~Membrane~~	340.55	g
W_{moist}	1330.28	g ✓

Dry Wt. Of Excess Solids

Tare #	KD-10	g
Dry + Tare	230.84	g
Tare	230.60	g
Dry Wt. Of Excess	0.24	g ✓

Water Content

(Fraction Used: 1/2)

Tare #	K-14a	
Wet + Tare	948.26	g
Dry + Tare	855.94	g
Wt. Water	92.32	g ✓
Tare	340.56	g
Wt. Dry Soil	515.39	g ✓
Water Content	17.9	% ✓

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = 1128.5 ✓ g

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify:—)	2013.67	g
Tube + other	680.67	g
Moist soil	1333.00	g ✓

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.135 ✓ g/cm^3 = 133.3 ✓ pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.810 ✓ g/cm^3 = 113.1 ✓ pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'1
Boring	B101J
Sample	U1
Depth	21.8'
By	DJA
Date	11-17-17
Checked	NM
Date	12/14/17

Undisturbed Specimen ✓
Remolded or compacted Specimen

Filter Strips? Yes ✓ No
Lubricated End Platens? Yes No ✓

SPECIMEN DIMENSIONS

Diameter Tape #

Diameter over 1 membranes	7.384	7.386	7.385	—	Avg.	7.385 ✓ cm
Twice thickness 1 membranes	0.098	0.094	0.096	—	Avg.	- 0.096 ✓ cm
					Avg.	- cm

Diameter of Specimen	7.289 ✓	cm
Diameter of Specimen	2.870 ✓	inch
Area of Specimen	41.73	cm^2

Height Caliper #

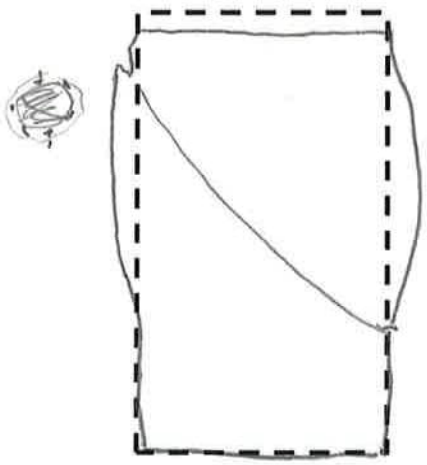
Height from top gauge block to top of top platen, with specimen	13.390	13.492	13.467	13.471	Avg.	13.455 ✓ cm

Height of Gauge Block	+10.160	cm

Height from top of top platen to cell base, without specimen	8.776	8.774	8.751	8.799	Avg.	- 8.775 ✓ cm

Height of Specimen in Cell	14.840 ✓	cm
Height of Specimen in Cell	5.842 ✓	inch
Volume in cell, initial	619.27	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

shear failure

Test Notes & Remarks:

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Saturation and Consolidation Data

Project No.	1700685
Test No.	R'1
Boring	B101U
Sample	U1
Depth	21.8'
By	DJA
Date	11-17-17
Page	1

Panel No. 1

Pressure Trans: SN 25218 Factor 2.3604e-2 Gain = 8
Load Trans: SN A8897 Factor 5.8033e-2 Gain = 8
Displ. Trans: SN 147 Factor 6.7108e-5 Gain = 64

Date	Time	Load	Axial Def.	Burrette				Pressure (psi)		
				Bottom (x)		Top (x 1.34)		Back	Pore	Cell
		( )	(inch)	(digit)	(cm^2)	(digit)	(cm^2)	( )	( )	( )
11/17	16:15	—	0			—		-7		0
						—		0		7
						—		1.35		7.58
						21.0		1.35		8.45
	16:20					19.6		10.86		17.80
11/18	11:00					18.0		10.88		
						17.5		20.28		27.19
11/20	8:00					16.6		19.90		
						16.4		30.07		37.01
	10:15					16.3		29.86		
						16.2		40.06		46.97
	12:50					16.1		40.08		
						16.0		50.16		57.10
	16:30					16.0		49.90		
						16.0		60.12		67.04
11/21	10:30					15.9		59.95		66.99
			B = 0.97			15.9		69.89	69.63	77.00
		Consol. to	$\bar{\sigma}_c$ = 11.8 psi							
	11:35					9.1		69.75		81.65
	0.1					9.3				
	0.25					9.3				
	0.5					9.4				
	11:36	1				9.5				
	11:37	2				9.6				
	11:39	4				9.8				
	11:43	8				10.0				
	11:56	16				10.3				
	12:07	32				10.75				
	12:35	60				10.8				
	15:00	205				11.3				
	17:15	340				11.4		69.37		81.24
	17:44		0.0255			11.4		~~69~~		

TEST REMARKS

$\bar{\sigma}_c$ = 1700 psf = 11.8 psi

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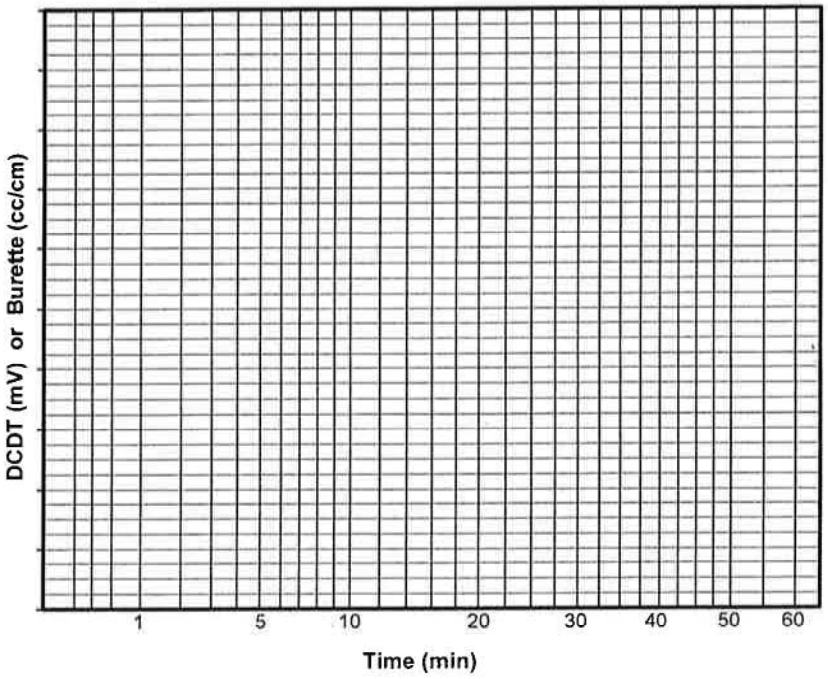
Consolidation Worksheet

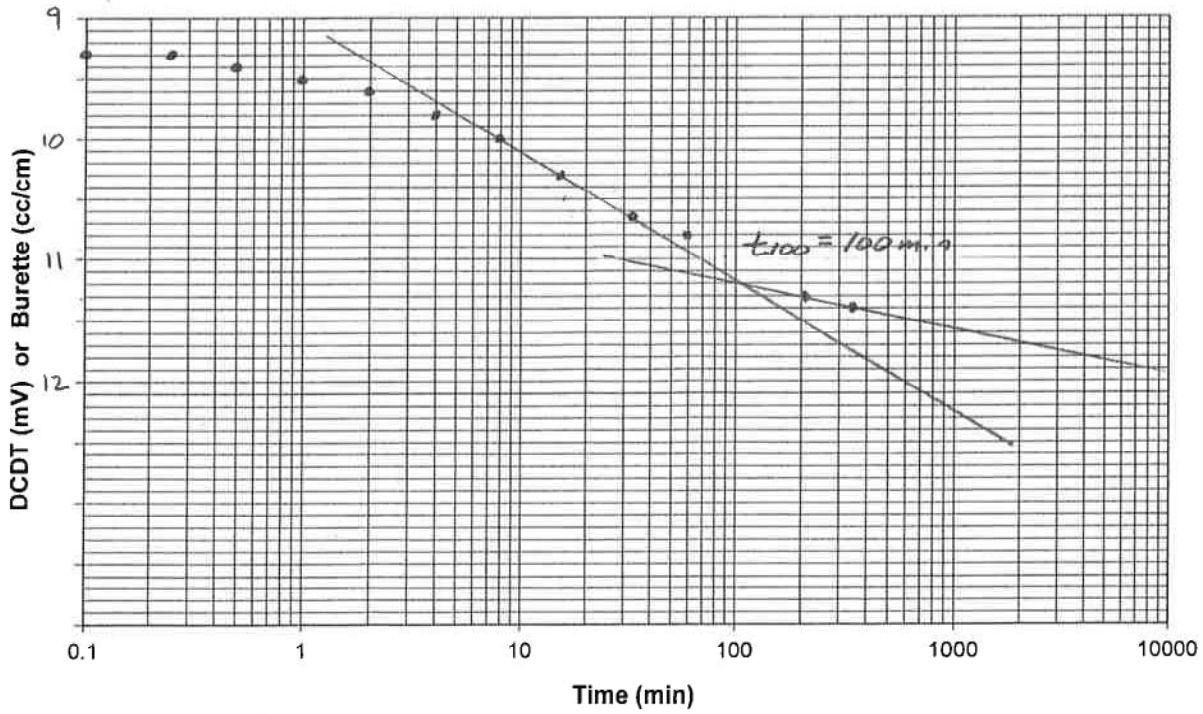
Project No.	1700685
Test	R'1
Boring	B101 U
Sample	U 1
By	21.8 ft
Date	DJA
Checked	11-21-17
Date	NM 11/14/17

Hanger Load _____ kg DCDT # _____

Loading Device _____ Channel _____

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
	0	
	0.1	
	0.25	
	0.5	
	1	
	2	
	4	
	8	
	15	
	30	
	60	





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R'1
Boring	B101U
Sample	U1
Depth	21.8 ft
By	DJA
Date	11-21-17
Checked	
Date	

Drained Tests

Stage #				
Initial Specimen Height in Cell		cm		
Height Change during Consolidation		cm		
Specimen Height, **A**		cm	=	inch
Estimated T_{100}, **B**		min		
Estimated Fail Strain, **C**		%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=	inch / min
Actual Deformation Rate, **E**		mm / min	=	inch / min
Strain Rate = (**E** / **A**) *10		% / min		

Undrained Tests

Stage #	–			
Initial Specimen Height in Cell	14.840	cm		
Height Change during Consolidation	0.065	cm	=	0.0255 ✓ inch
Specimen Height, **A**	14.775 ✓	cm	=	5.817 inch
Estimated T_{100}, **B**	100 ✓	min		
Estimated Fail Strain, **C**	4	%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.028 ✓	mm / min	=	~~0.00083~~ 0.0011 ✓ inch / min
Actual Deformation Rate, **E**	0.021 ✓	mm / min	=	inch / min
Strain Rate = (**E** / **A**) *10	0.014 ✓	% / min		

0.019% / min

$$\dot{\Delta} = \frac{(0.17)(147.75_{mm})}{20\,hrs \times 60\,min} =$$

TEST REMARKS

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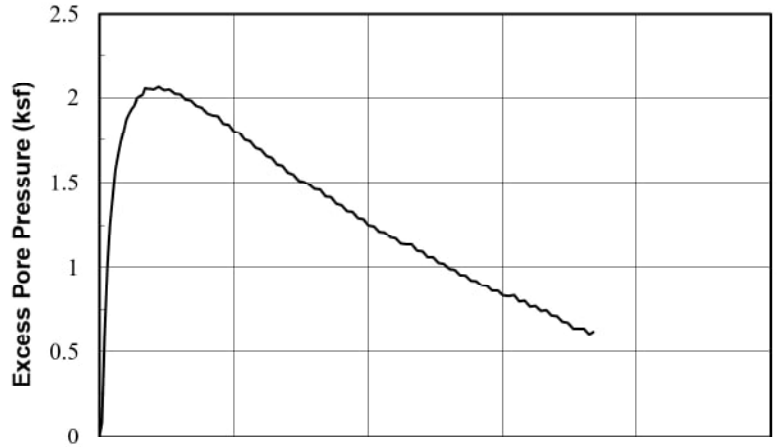


SAMPLE INFORMATION

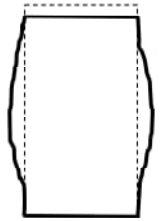
Boring: B101U Sample: U1 Depth (ft): 21.1 Test: R'2
Type: 2.8-inch-diameter tube sample
Description: Gray LEAN CLAY (CL) with fine sand

SPECIMEN INFORMATION (after saturation)

Height: 5.896 in Dia.: 2.835 in Area.: 6.333 sq. in
Water Content: 18.5% Dry Unit Weight: 113.3 pcf

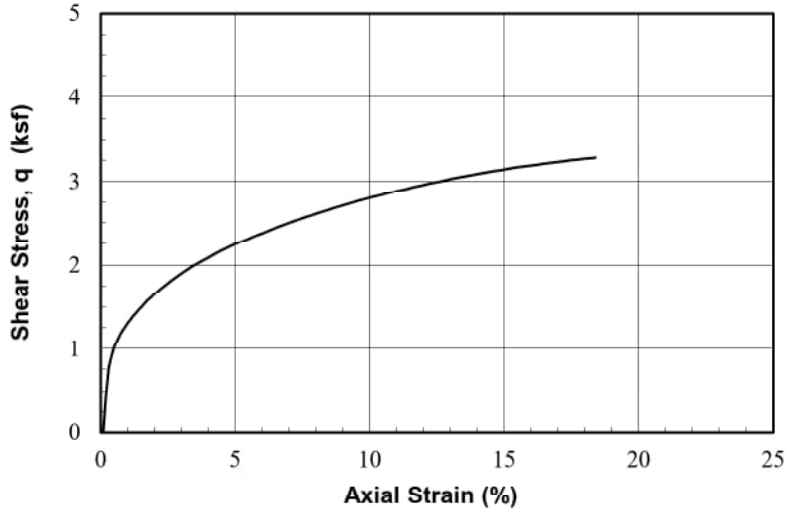
TEST SUMMARY (end of test)

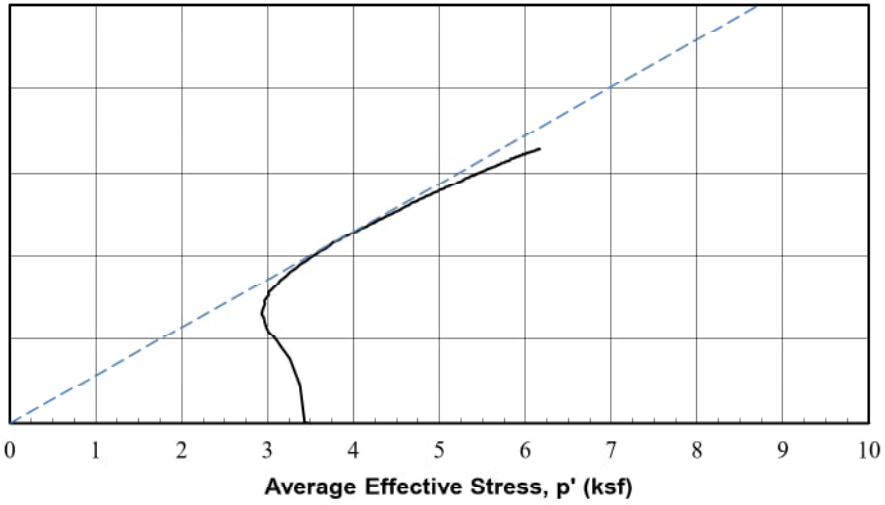
Effective Confining Stress: 3.50 ksf vertical, 3.50 ksf horiz.
Water Content: 17.9 % Dry Unit Weight: 114.5 pcf
B Coefficient: 0.99 Strain Rate: 0.014 %/min
Peak Shear Stress: 3.28 ksf @ 18.4 % Strain
Peak Friction Angle: 35.0 deg. @ 4.4 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: N. Mazzella
Test Date: 20-Nov-2017

3/15/2018 16:00

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-2

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'2												
BORING:	B101U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U1			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	21.1			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.945	2.876	6.496	17.88	110.3	130.1	0.545
TEST DATE:	11/20/2017			Under vac.	1.01	1.01	5.937	2.851	6.384	--	112.4	--	0.516
DCDT No.		146											
DCDT Calibration Factor		6.5277E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		1890-0004		Saturation	1.00	1.00	5.937	2.840	6.333	18.45	113.3	134.2	0.504
Load Cell Cal. Factor		0.027097	lb/cnt	Consol. Stage 1	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
Pressure Transducer		CP-GEI4		Consol. Stage 2	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
Pres. Trans. Cal. Factor		0.019127	psi/cnt	Consol. Stage 3	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
				Consol. Stage 4	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
				Consol. Stage 6	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
B value start shear		0.99											
Test Stage End of#	1			This Stage Initial Values	3.50	3.50	5.896	2.835	6.312	17.90	114.5	135.0	0.489
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		8.68 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.041	10.622	59.581	0.00	6.31	0.00	3.50	3.50	3.50	3.50	0.00	1.00	0.0	0.00
0.047	11.841	60.154	0.10	6.32	0.08	3.42	3.53	3.45	3.43	0.01	1.01	0.2	2.97
0.053	51.538	63.674	0.20	6.33	0.59	2.91	4.43	3.84	3.38	0.47	1.32	7.9	0.63
0.059	78.229	66.600	0.30	6.33	1.01	2.49	5.04	4.03	3.26	0.77	1.62	13.6	0.66
0.065	90.883	68.303	0.40	6.34	1.26	2.24	5.32	4.07	3.16	0.91	1.81	16.8	0.69
0.071	99.880	69.488	0.50	6.34	1.43	2.07	5.53	4.10	3.09	1.01	1.98	19.2	0.70
0.077	106.820	70.560	0.60	6.35	1.58	1.92	5.68	4.10	3.01	1.09	2.14	21.2	0.72
0.083	112.510	71.172	0.70	6.36	1.67	1.83	5.81	4.14	2.99	1.15	2.26	22.7	0.72
0.089	117.470	71.688	0.80	6.36	1.74	1.76	5.92	4.18	2.97	1.21	2.38	24.1	0.72
0.095	121.960	72.071	0.91	6.37	1.80	1.70	6.02	4.22	2.96	1.26	2.48	25.2	0.71
0.100	126.080	72.587	1.01	6.38	1.87	1.63	6.11	4.24	2.93	1.30	2.60	26.4	0.72
0.106	130.010	72.816	1.11	6.38	1.91	1.59	6.19	4.29	2.94	1.35	2.69	27.2	0.71
0.112	133.910	73.027	1.21	6.39	1.94	1.56	6.28	4.34	2.95	1.39	2.78	28.1	0.70
0.118	137.190	73.161	1.31	6.40	1.96	1.55	6.35	4.39	2.97	1.42	2.84	28.7	0.69
0.124	140.550	73.467	1.41	6.40	2.00	1.50	6.42	4.42	2.96	1.46	2.95	29.6	0.68
0.130	143.780	73.543	1.51	6.41	2.01	1.49	6.49	4.48	2.99	1.50	3.01	30.1	0.67
0.136	147.110	73.601	1.61	6.42	2.02	1.48	6.56	4.55	3.01	1.53	3.07	30.6	0.66

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.142	150.390	73.868	1.71	6.42	2.06	1.44	6.63	4.58	3.01	1.57	3.17	31.4	0.66
0.148	153.180	73.830	1.81	6.43	2.05	1.45	6.69	4.64	3.05	1.60	3.20	31.6	0.64
0.154	156.000	73.830	1.91	6.44	2.05	1.45	6.75	4.70	3.08	1.63	3.25	31.9	0.63
0.160	158.730	73.811	2.01	6.44	2.05	1.45	6.81	4.76	3.11	1.66	3.28	32.2	0.62
0.172	164.100	73.926	2.21	6.46	2.07	1.43	6.92	4.86	3.15	1.71	3.39	33.0	0.60
0.183	169.030	73.792	2.41	6.47	2.05	1.45	7.03	4.98	3.22	1.76	3.42	33.2	0.58
0.195	173.800	73.811	2.62	6.48	2.05	1.45	7.13	5.08	3.26	1.81	3.50	33.7	0.57
0.207	178.240	73.639	2.82	6.50	2.02	1.48	7.22	5.19	3.33	1.86	3.52	33.9	0.54
0.219	182.580	73.620	3.02	6.51	2.02	1.48	7.31	5.28	3.38	1.90	3.57	34.2	0.53
0.231	186.670	73.409	3.22	6.52	1.99	1.51	7.39	5.40	3.45	1.94	3.58	34.3	0.51
0.243	190.680	73.371	3.42	6.54	1.99	1.51	7.47	5.48	3.50	1.98	3.62	34.5	0.50
0.254	194.260	73.142	3.62	6.55	1.95	1.55	7.54	5.59	3.57	2.02	3.61	34.5	0.48
0.266	197.970	73.084	3.82	6.56	1.94	1.56	7.61	5.67	3.61	2.06	3.64	34.7	0.47
0.278	201.410	72.836	4.02	6.58	1.91	1.59	7.68	5.77	3.68	2.09	3.62	34.6	0.46
0.290	204.930	72.759	4.22	6.59	1.90	1.60	7.75	5.85	3.73	2.12	3.65	34.7	0.45
0.302	208.380	72.740	4.42	6.60	1.89	1.61	7.81	5.92	3.76	2.16	3.69	35.0	0.44
0.313	211.650	72.415	4.62	6.62	1.85	1.65	7.87	6.03	3.84	2.19	3.65	34.7	0.42
0.325	214.880	72.377	4.82	6.63	1.84	1.66	7.94	6.09	3.88	2.22	3.67	34.9	0.42
0.337	218.000	72.090	5.02	6.65	1.80	1.70	7.99	6.19	3.95	2.25	3.64	34.7	0.40
0.349	221.000	72.032	5.22	6.66	1.79	1.71	8.05	6.26	3.98	2.27	3.66	34.8	0.39
0.361	224.040	71.745	5.42	6.67	1.75	1.75	8.11	6.35	4.05	2.30	3.63	34.6	0.38
0.373	226.990	71.688	5.62	6.69	1.74	1.76	8.16	6.42	4.09	2.33	3.65	34.7	0.37
0.384	229.700	71.420	5.82	6.70	1.70	1.80	8.21	6.50	4.15	2.35	3.62	34.6	0.36
0.396	232.600	71.344	6.02	6.72	1.69	1.81	8.26	6.57	4.19	2.38	3.63	34.6	0.36
0.408	235.390	71.095	6.22	6.73	1.66	1.84	8.31	6.65	4.25	2.40	3.61	34.5	0.34
0.420	238.290	71.019	6.42	6.75	1.65	1.85	8.36	6.71	4.28	2.43	3.62	34.6	0.34
0.432	241.270	70.751	6.62	6.76	1.61	1.89	8.41	6.81	4.35	2.46	3.60	34.4	0.33
0.443	243.950	70.693	6.82	6.77	1.60	1.90	8.46	6.86	4.38	2.48	3.61	34.5	0.32
0.455	246.580	70.426	7.02	6.79	1.56	1.94	8.51	6.94	4.44	2.50	3.58	34.3	0.31
0.467	249.400	70.349	7.22	6.80	1.55	1.95	8.55	7.00	4.48	2.53	3.59	34.4	0.31
0.479	252.060	70.100	7.42	6.82	1.51	1.99	8.60	7.08	4.54	2.55	3.57	34.2	0.30
0.491	254.770	70.043	7.63	6.83	1.51	1.99	8.65	7.14	4.57	2.57	3.58	34.3	0.29
0.503	257.310	69.909	7.83	6.85	1.49	2.01	8.69	7.20	4.61	2.59	3.58	34.3	0.29
0.514	259.810	69.737	8.03	6.86	1.46	2.04	8.73	7.27	4.65	2.61	3.57	34.2	0.28
0.526	262.350	69.718	8.23	6.88	1.46	2.04	8.77	7.31	4.68	2.64	3.58	34.3	0.28
0.538	264.790	69.431	8.43	6.89	1.42	2.08	8.81	7.39	4.74	2.65	3.55	34.1	0.27
0.550	267.280	69.412	8.63	6.91	1.42	2.08	8.85	7.43	4.76	2.67	3.57	34.2	0.26
0.562	269.860	69.144	8.83	6.92	1.38	2.12	8.89	7.52	4.82	2.70	3.54	34.0	0.26
0.573	272.220	69.087	9.03	6.94	1.37	2.13	8.93	7.56	4.85	2.71	3.55	34.1	0.25
0.585	274.600	68.838	9.23	6.95	1.33	2.17	8.97	7.63	4.90	2.73	3.52	33.9	0.24

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.597	277.010	68.819	9.43	6.97	1.33	2.17	9.00	7.67	4.92	2.75	3.54	34.0	0.24
0.609	279.400	68.570	9.63	6.98	1.29	2.21	9.04	7.75	4.98	2.77	3.51	33.8	0.23
0.621	281.670	68.532	9.83	7.00	1.29	2.21	9.08	7.79	5.00	2.79	3.52	33.9	0.23
0.632	283.900	68.283	10.03	7.02	1.25	2.25	9.11	7.86	5.05	2.80	3.50	33.7	0.22
0.644	286.230	68.245	10.23	7.03	1.25	2.25	9.14	7.90	5.08	2.82	3.51	33.8	0.22
0.656	288.390	68.016	10.43	7.05	1.21	2.29	9.18	7.96	5.12	2.84	3.48	33.6	0.21
0.668	290.670	67.996	10.63	7.06	1.21	2.29	9.21	8.00	5.14	2.85	3.49	33.7	0.21
0.680	292.890	67.767	10.83	7.08	1.18	2.32	9.24	8.06	5.19	2.87	3.47	33.6	0.21
0.692	295.250	67.729	11.03	7.10	1.17	2.33	9.28	8.10	5.22	2.89	3.48	33.6	0.20
0.703	297.280	67.499	11.23	7.11	1.14	2.36	9.31	8.17	5.26	2.90	3.46	33.5	0.20
0.715	299.450	67.461	11.43	7.13	1.13	2.37	9.34	8.20	5.28	2.92	3.47	33.5	0.19
0.727	301.730	67.461	11.63	7.14	1.13	2.37	9.37	8.23	5.30	2.93	3.48	33.6	0.19
0.739	303.730	67.212	11.83	7.16	1.10	2.40	9.40	8.30	5.35	2.95	3.45	33.4	0.19
0.751	305.950	67.193	12.03	7.18	1.10	2.40	9.43	8.33	5.37	2.96	3.46	33.5	0.18
0.762	307.980	66.945	12.23	7.19	1.06	2.44	9.45	8.39	5.42	2.98	3.44	33.3	0.18
0.774	309.940	66.945	12.44	7.21	1.06	2.44	9.48	8.42	5.43	2.99	3.45	33.4	0.18
0.786	311.830	66.715	12.64	7.23	1.03	2.47	9.50	8.48	5.47	3.00	3.43	33.2	0.17
0.798	313.920	66.677	12.84	7.24	1.02	2.48	9.53	8.51	5.49	3.02	3.43	33.3	0.17
0.810	316.060	66.466	13.04	7.26	0.99	2.51	9.56	8.57	5.54	3.03	3.41	33.2	0.16
0.822	318.150	66.428	13.24	7.28	0.99	2.51	9.59	8.60	5.56	3.04	3.42	33.2	0.16
0.833	320.070	66.218	13.44	7.29	0.96	2.54	9.61	8.66	5.60	3.06	3.40	33.1	0.16
0.845	321.830	66.199	13.64	7.31	0.95	2.55	9.63	8.68	5.61	3.07	3.41	33.1	0.16
0.857	323.750	65.988	13.84	7.33	0.92	2.58	9.66	8.73	5.66	3.08	3.39	33.0	0.15
0.869	325.650	65.969	14.04	7.34	0.92	2.58	9.68	8.76	5.67	3.09	3.39	33.0	0.15
0.881	327.710	65.778	14.24	7.36	0.89	2.61	9.70	8.81	5.71	3.10	3.38	32.9	0.14
0.892	329.550	65.759	14.44	7.38	0.89	2.61	9.73	8.84	5.72	3.11	3.38	32.9	0.14
0.904	331.210	65.548	14.64	7.39	0.86	2.64	9.74	8.88	5.76	3.12	3.36	32.8	0.14
0.916	333.000	65.548	14.84	7.41	0.86	2.64	9.76	8.90	5.77	3.13	3.37	32.9	0.14
0.928	334.890	65.357	15.04	7.43	0.83	2.67	9.79	8.95	5.81	3.14	3.35	32.7	0.13
0.940	336.730	65.338	15.24	7.45	0.83	2.67	9.81	8.98	5.82	3.15	3.36	32.8	0.13
0.951	338.690	65.376	15.44	7.47	0.83	2.67	9.83	8.99	5.83	3.16	3.37	32.9	0.13
0.963	340.370	65.127	15.64	7.48	0.80	2.70	9.85	9.05	5.87	3.17	3.35	32.7	0.13
0.975	342.070	65.147	15.84	7.50	0.80	2.70	9.86	9.06	5.88	3.18	3.36	32.8	0.13
0.987	343.620	64.917	16.04	7.52	0.77	2.73	9.88	9.11	5.92	3.19	3.33	32.6	0.12
0.999	345.270	64.936	16.24	7.54	0.77	2.73	9.89	9.12	5.93	3.20	3.34	32.6	0.12
1.011	347.030	64.745	16.44	7.55	0.74	2.76	9.91	9.17	5.96	3.21	3.33	32.5	0.12
1.022	348.820	64.764	16.64	7.57	0.75	2.75	9.93	9.19	5.97	3.22	3.33	32.6	0.12
1.034	350.390	64.554	16.84	7.59	0.72	2.78	9.95	9.23	6.01	3.22	3.31	32.4	0.11
1.046	352.070	64.534	17.04	7.61	0.71	2.79	9.96	9.25	6.02	3.23	3.32	32.5	0.11
1.058	353.720	64.305	17.24	7.63	0.68	2.82	9.98	9.30	6.06	3.24	3.30	32.3	0.11

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.070	355.540	64.267	17.44	7.65	0.67	2.83	10.00	9.32	6.07	3.25	3.30	32.3	0.10
1.081	357.060	64.037	17.64	7.66	0.64	2.86	10.01	9.37	6.11	3.25	3.28	32.2	0.10
1.093	358.550	64.018	17.85	7.68	0.64	2.86	10.02	9.38	6.12	3.26	3.28	32.2	0.10
1.105	360.150	64.018	18.05	7.70	0.64	2.86	10.04	9.40	6.13	3.27	3.28	32.2	0.10
1.117	361.690	63.789	18.25	7.72	0.61	2.89	10.05	9.44	6.17	3.27	3.26	32.1	0.09
1.126	362.910	63.903	18.39	7.74	0.62	2.88	10.06	9.44	6.16	3.28	3.28	32.2	0.09

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'2		Ground Surface Elevation
BORING:	B101U		Elevation Datum
SAMPLE:	U1		
DEPTH:	21.1	Elevation:	
TEST DATE:	20-Nov-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	N. Mazzella		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Gray LEAN CLAY (CL) with fine sand		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	1890-0004	
Load Calibration Factor:	0.027097	lb/cnt
Pressure ID:	CP-GEI4	
Pressure Cal. Fator	0.019127	psi/cnt
Displacement ID:	146	
Displacement Cal. Factor:	0.000065277	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.96	VC:	2.5005
Penetration, cm:	60.66		
Gross Recovery, cm:	61.00		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	1.0250
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	22.4				22.4	cm
TOP EMPTY LENGTH	4.2				4.2	cm
BOT. EMPTY LENGTH	3.1				3.1	cm
TUBE INNER DIAMETER	7.306	7.299	7.309		7.304666667	cm

In tube length	15.10	cm
Tube Diameter	7.305	cm
Tube Area	41.91	(cm^2)
Tube Volume	632.80	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.356	7.346	7.321		7.341	cm
MEMBRANE 1 THICKNESS	0.099	0.099	0.1		0.099	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.577	13.48	13.396	13.564	13.504	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.623	8.54	8.571	8.606	8.585	cm

#filter strips	0		
Hi	15.079	cm	
Di	7.242	cm	2.08228999
Ai	41.188	cm^2	
Vi	621.079	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	144.620	150.770	*******	1988.840	*******	1684.840	1072.400	*******
DRY+T	128.770	133.280		*******	0.000	*******	965.280	183.860
T	34.650	40.470		670.440	0.000	366.680	366.680	183.490
Wt. Solids	94.12	92.81	0	1318.4	0	1118.45	598.6	0.37
w %	16.84	18.84	*******	17.88	*******	17.90	17.90	*******

FINAL B VALUE 0.99

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00	
saturation	60.31	67.23	0.000	4.992	0.000	0.000	0.040	6.92	6.92	
Consolidation Stage 1	60.31	84.62	0.000	6.251	0.104	0.104	0.051	24.31	24.31	
2	60.31	84.62	0.000	0.000	0.000	0.000	0.000	24.31	24.31	
3	60.31	84.62	0.000	0.000	0.000	0.000	0.000	24.31	24.31	
4	60.31	84.62	0.000	0.000	0.000	0.000	0.000	24.31	24.31	
5	60.31	84.62	0.000	0.000	0.000	0.000	0.000	24.31	24.31	
6	60.31	84.62	0.000	0.000	0.000	0.000	0.000	24.31	24.31	
Start Shear	60.31	84.62	0.000	**********	**********			24.31	24.31	
End Shear				0.000	**********			**********	**********	

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							1.0250	1.81	113.1	0.507	
after sampling		0.00	0.00							1.0000	1.77	110.3	0.545	
after shipping		0.00	0.00							1.0000	1.77	110.3	0.545	
in tube before extrusion		0.00	0.00	15.10	7.305	41.907	632.80	1118.45	17.88	*****	1.77	110.3	0.545	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.079	7.242	41.188	621.079	1118.449	*****	*****	1.80	112.4	0.516	
saturation		6.92	6.92	15.079	7.213	40.857	616.087	1118.449	18.454		1.82	113.3	0.504	
	1	24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
	2	24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
	3	24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
	4	24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
	5	24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
	6	24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
Start Shear		24.31	24.31	14.975	7.201	40.724	609.836	1118.449	17.895	*****	1.83	114.5	0.489	
End Shear		**********	**********				609.836	1118.449	17.895	*****	1.83	114.5	0.489	0.488535917

Test comp (c) or ext (c)	c			
DEFORMATION RATE 1	0.02118124	mm/min	0.0141	%/min
DEFORMATION RATE 2	0.00083391	in/min	0.000556872	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS	2.73	2.730	yields S=1
estimated or measured? (enter E or M)	e		
(assumed)			
Saturation	1.000		

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'2
Boring	B101U
Sample	U1
Depth	21.1'
By	WGL
Date	11/20/17
Checked	NM
Date	12/14/17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	F-12	T-10		
Wet Wt. + Tare (g)	144.62	150.77		
Dry Wt. + Tare (g)	128.77	133.28		
Wt. Water (g)	15.85 ✓	17.49 ✓		
Tare (g)	34.65	40.47		
Dry Wt. Soil (g)	94.12 ✓	92.81 ✓		
Water Content (%)	16.8 ✓	18.8 ✓		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	22.4 cm
Top Empty Length					cm	Avg.	4.2 cm
Bottom Empty Length					cm	Avg.	3.1 cm

Trimmed Length in Tube, L: 15.1 ✓ cm

Tube Dimensions

Tube Inner Diameter	7.306	7.299	7.309		cm	Avg.	7.305 ✓ cm

Tube Weight (g):

Weight of other (specify:_____) (g):

Area, A: 41.91 ✓ cm^2

Volume in Tube = A x L: 632.8 ✓ cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1684.84	g
Membrane	366.68	g
W_{moist}	1318.16 ✓	g

Dry Wt. Of Excess Solids

Tare #	EF-26	g
Dry + Tare	183.86	g
Tare	183.49	g
Dry Wt. Of Excess	0.37 ✓	g

183.49?

Water Content

(Fraction Used: 1/2)

Tare #	R-3	
Wet + Tare	1072.40	g
Dry + Tare	965.28	g
Wt. Water	107.21	g ✓
Tare	366.68	g
Wt. Dry Soil	598.60	g ✓
Water Content	17.9 ✓	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = 1118.40 g ✓

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify:_____)	1988.84	g
Tube + other	670.44	g
Moist soil	1318.40	g ✓

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.083 ✓ g/cm^3 = 130.0 ✓ pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.767 ✓ g/cm^3 = 110.3 ✓ pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700635
Test No.	R'2
Boring	B16U
Sample	U1
Depth	21.1'
By	WBL
Date	11/20/17
Checked	NM
Date	WBL 12/14/17

Undisturbed Specimen ✓
Remolded or compacted Specimen

Filter Strips? Yes ✓ No
Lubricated End Platens? Yes No ✓

SPECIMEN DIMENSIONS

Diameter Tape #

Diameter over 1 membranes	7.356	7.346	7.321	–	Avg.	7.341 ✓ cm
Twice thickness 1 membranes	0.099	0.099	0.100	–	Avg.	- 0.099 ✓ cm
					Avg.	- cm

Diameter of Specimen	7.242 ✓ cm
Diameter of Specimen	2.851 ✓ inch
Area of Specimen	41.19 ✓ cm^2

Height Caliper #

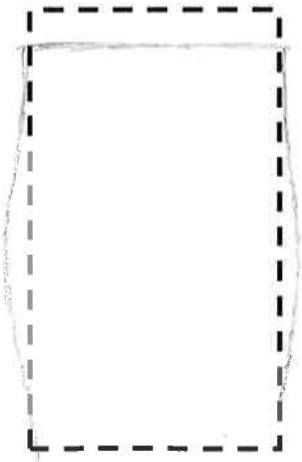
Height from top gauge block to top of top platen, with specimen	13.577	13.480	13.396	13.564	Avg.	13.504 ✓ cm

Height of Gauge Block + 10.160 cm

Height from top of top platen to cell base, without specimen	8.623	8.540	8.571	8.606	Avg.	- 8.585 ✓ cm

Height of Specimen in Cell	15.079 ✓ cm
Height of Specimen in Cell	5.937 ✓ inch
Volume in cell, initial	621.1 ✓ cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Bulging

Test Notes & Remarks:

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Saturation and Consolidation Data

Project No.	1700685
Test No.	B'2
Boring	B101U
Sample	U1
Depth	21.1 ft
By	WGL
Date	11/20/17
Page	1 of

Panel No. 2

Pressure Trans: SN CP-GEI 4 Factor 1.9127e-2 Gain = 8
Load Trans: SN 1890-0004 Factor 2.7097e-2 Gain = 8
Displ. Trans: SN 146 Factor 6.5277e-5 Gain = 64

Date	Time	Load ( )	Axial Def. (inch)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^3)	Burrette Top (x 1.33) (digit)	Burrette Top (x 1.33) (cm^3)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
11/20	16:30	-	0			-		-7		0
						-		0		7
						19.8		0.29		7.40
						18.5		10.08		17.06
11/21	8:00					13.8		10.19		16.97
						13.6		20.10		26.91
	11:00					12.5		20.03		
						12.2		30.20		36.90
	1400					11.5		30.22		
						11.5		40.01		46.86
	1655					11.1		39.94		46.88
						11.4		50.07		57.00
11/22	815					9.0		50.15		56.97
	1300					8.5		50.04		56.85
11/27	800					-				
	810					17.3		50.15		56.67
	1510					17.6		50.00		56.69
										56.90
							B=1.24	60.19	62.43	66.91
						18.4		60.08		66.81
					DRAIN	18.7	B=1.10	69.93	70.96	76.74
	16:36					18.3		69.95		76.95
11/28	845					16.7		70.04		76.95
	920					16.8		70.10		77.01
							B=1.13	80.37	81.6	87.18
11/28	11:20					17.0		80.22		87.01
										97.07
		REPLACED BLOCK DUE TO SUSPECTED LEAK								
		REFLUSHED LINES								
	1200					15.8		0.67		7.67
						15.7		10.18		17.12
	1310					15.7		10.35		17.33
						15.7		20.10		27.06
	1610					15.7		19.91		26.93
						15.6		30.34		37.36

TEST REMARKS

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Saturation and Consolidation Data

Panel No. 2

Pressure Trans: SN CP-GET4 Factor 1.9127e-2 Gain = 8
Load Trans: SN 1890-0004 Factor 2.7097e-2 Gain = 8
Displ. Trans: SN 146 Factor 6.5277e-5 Gain = 64

Project No.	1700685
Test No.	C'2
Boring	B101 U
Sample	U1
Depth	21.1 ft
By	WGL
Date	11/20/17
Page	2 of

Date	Time	Load ( )	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^3)	Burrette Top (x 1.33) (digit)	Burrette Top (x 1.33) (cm^3)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
11/29	810					15.5		30.41		37.37
						15.5		40.42		47.40
	950					15.5		40.43		47.40
						15.4		50.21		57.17
	1355					15.3		50.36		57.06
						15.3	B=0.99	60.42	60.29	67.14
11/30	8:15					15.2		60.31		67.23
		Consol. to	$\bar{\sigma}_c$ = 24.3 psi							
	8:20					7.0		60.31		84.62
	0.1					7.5				
	0.25					7.55				
	0.5					7.8				
	8:21	1				8.0				
	8:22	2				8.5				
	8:25	5				9.1				
	8:31	11				9.9				
	8:42	22				10.5				
	9:03	43				10.9				
	9:20	60				11.0				
	10:00	100				11.1				
	12:08	228				11.3				
	14:38					11.7		59.60		83.83
			SHEAR							

TEST REMARKS

$\bar{\sigma}_c$ = 3500 psf = 24.3 psi

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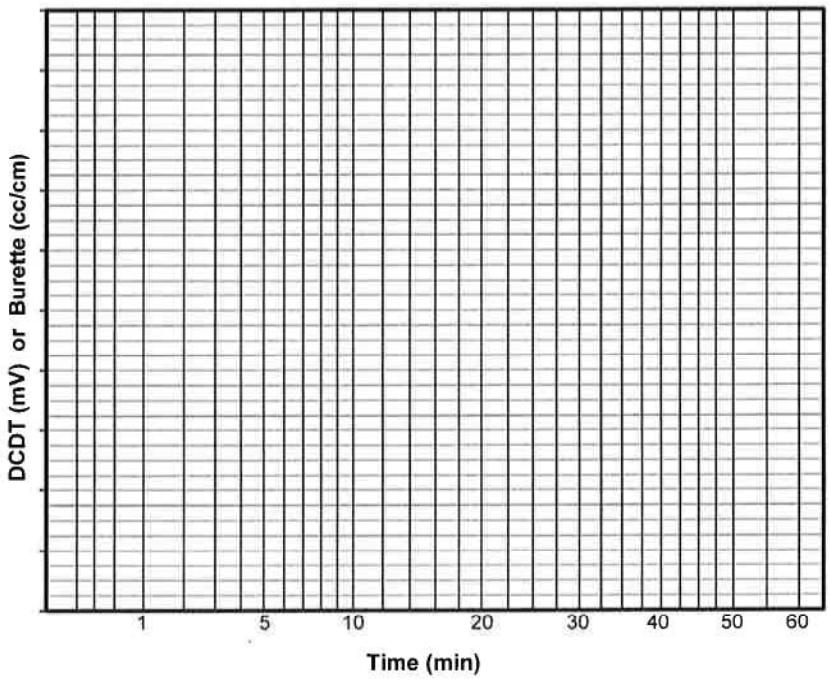
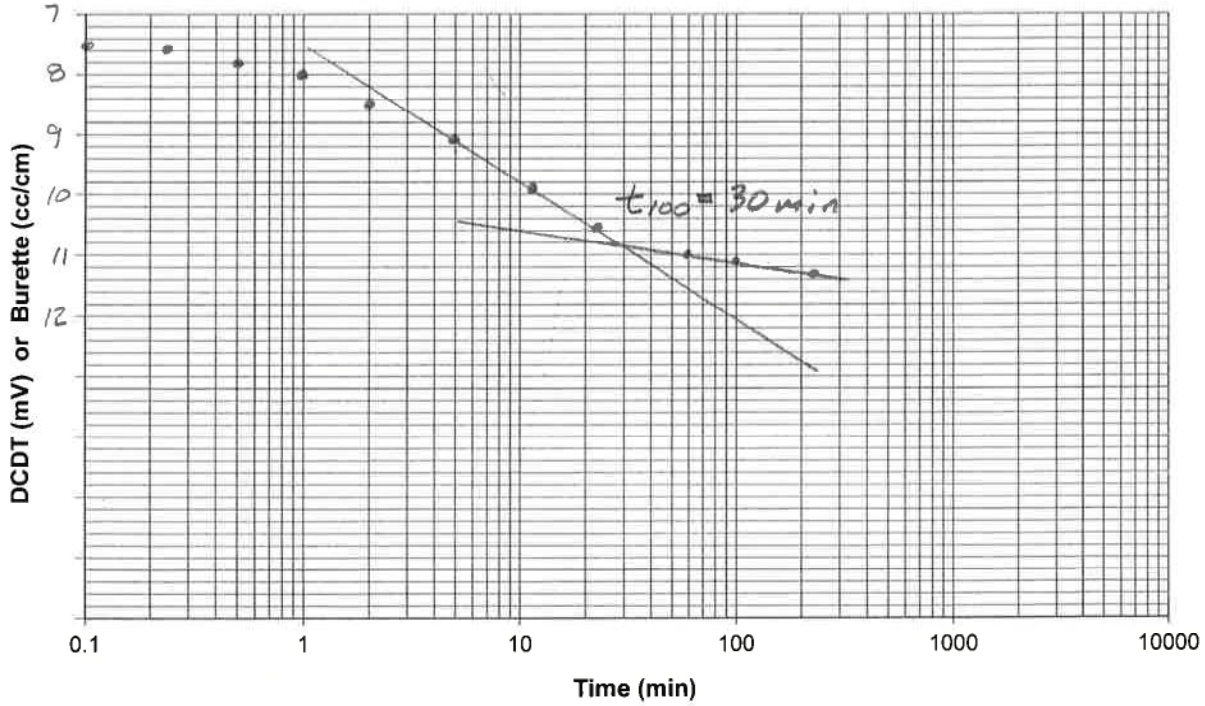
Consolidation Worksheet

Hanger Load		kg	
Loading Device			
DCDT #			
Channel			

Project No.	1700685
Test	R'2
Boring	B101U
Sample	U1
By	DJA
Date	11-30-17
Checked	
Date	

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
	0	
	0.1	
	0.25	
	0.5	
	1	
	2	
	4	
	8	
	15	
	30	
	60	





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R-2
Boring	B101U
Sample	U 1
Depth	21.1
By	WGL
Date	11/20/17
Checked	NM
Date	12/14/17

Drained Tests

Stage #				
Initial Specimen Height in Cell		cm		
Height Change during Consolidation		cm		
Specimen Height, **A**		cm	=	inch
Estimated T_{100}, **B**		min		
Estimated Fail Strain, **C**		%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=	inch / min
Actual Deformation Rate, **E**		mm / min	=	inch / min
Strain Rate = (**E** / **A**) *10		% / min		

Undrained Tests

Stage #				
Initial Specimen Height in Cell	15.079	cm		
Height Change during Consolidation	0.104	cm	=	0.041 inch
Specimen Height, **A**	14.975 ✓	cm	=	5.896 inch
Estimated T_{100}, **B**	30 ✓	min		
Estimated Fail Strain, **C**	3	%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.0713 ✓	mm / min	=	0.0028 ✓ inch / min
Actual Deformation Rate, **E**	0.021 ✓	mm / min	=	0.00084 ✓ inch / min
Strain Rate = (**E** / **A**) *10	0.014 ✓	% / min		

shear to 17% in 20hrs

$$\dot{\Delta} = \frac{0.17 \times 149.75}{20 \times 60} = 0.021 \text{ mm/min} < 0.071 \text{ ok}$$

TEST REMARKS

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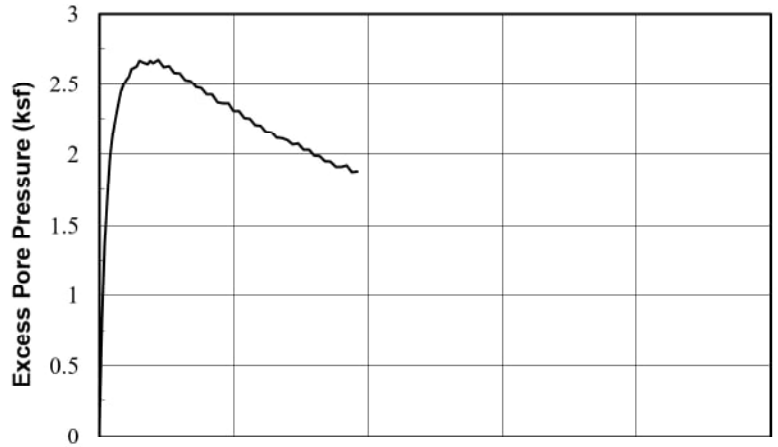


SAMPLE INFORMATION

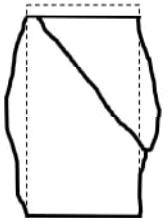
Boring: B110U Sample: U2-A Depth (ft): 36.8 Test: R'3
Type: 2.8-inch-diameter tube sample
Description: LEAN CLAY with SAND (CL), orange

SPECIMEN INFORMATION (after saturation)

Height: 5.865 in Dia.: 2.878 in Area.: 6.591 sq. in
Water Content: 19.9% Dry Unit Weight: 110.4 pcf

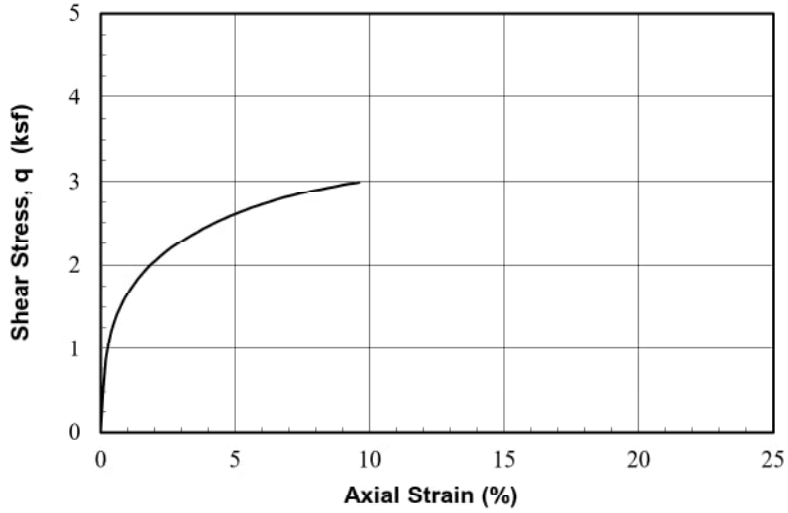
TEST SUMMARY (end of test)

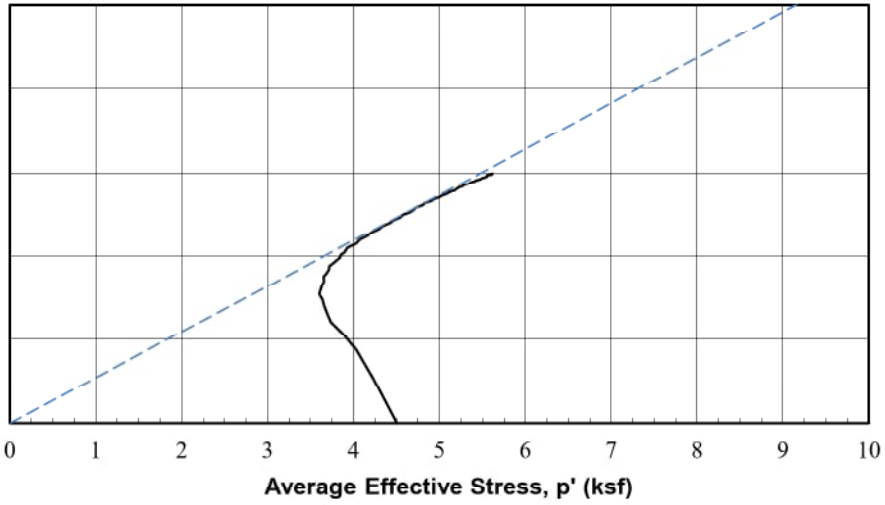
Effective Confining Stress: 4.51 ksf vertical, 4.51 ksf horiz.
Water Content: 18.8 % Dry Unit Weight: 112.5 pcf
B Coefficient: 0.91 Strain Rate: 0.014 %/min
Peak Shear Stress: 2.99 ksf @ 9.6 % Strain
Peak Friction Angle: 33.1 deg. @ 4.8 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: N. Mazzella
Test Date: 21-Nov-2017

3/15/2018 16:01

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-3

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'3												
BORING:	B110U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U2-A			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	36.8			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.866	2.870	6.468	19.41	113.2	135.2	0.506
TEST DATE:	11/21/2017			Under vac.	1.01	1.01	5.902	2.866	6.450	--	112.8	--	0.511
DCDT No.		10716											
DCDT Calibration Factor		9.3997E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		251674		Saturation	0.89	0.89	5.902	2.897	6.591	19.92	110.4	132.4	0.544
Load Cell Cal. Factor		0.13652	lb/cnt	Consol. Stage 1	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
Pressure Transducer		GE02		Consol. Stage 2	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
Pres. Trans. Cal. Factor		0.0065185	psi/cnt	Consol. Stage 3	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
				Consol. Stage 4	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
				Consol. Stage 6	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
B value start shear		0.91											
Test Stage End of#	1			This Stage Initial Values	4.51	4.51	5.865	2.878	6.506	18.84	112.5	133.7	0.514
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		10.20 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.037	18.976	70.361	0.00	6.51	0.00	4.51	4.51	4.51	4.51	0.00	1.00	0.0	0.00
0.043	67.987	76.064	0.10	6.51	0.82	3.69	5.59	4.77	4.23	0.54	1.29	7.4	0.76
0.048	98.294	79.747	0.20	6.52	1.35	3.16	6.26	4.91	4.03	0.88	1.56	12.5	0.77
0.054	116.040	82.198	0.30	6.53	1.70	2.80	6.65	4.94	3.87	1.07	1.76	16.0	0.80
0.060	128.740	84.102	0.40	6.53	1.98	2.53	6.93	4.95	3.74	1.21	1.96	18.9	0.82
0.066	138.570	85.164	0.50	6.54	2.13	2.38	7.14	5.01	3.69	1.32	2.11	20.9	0.81
0.072	146.620	86.005	0.60	6.55	2.25	2.25	7.32	5.06	3.66	1.40	2.25	22.6	0.80
0.078	153.450	86.650	0.70	6.55	2.35	2.16	7.46	5.12	3.64	1.48	2.37	24.0	0.79
0.084	159.460	87.354	0.80	6.56	2.45	2.06	7.59	5.14	3.60	1.54	2.50	25.3	0.79
0.089	165.050	87.674	0.90	6.57	2.49	2.01	7.71	5.22	3.62	1.60	2.59	26.3	0.78
0.095	170.240	87.928	1.00	6.57	2.53	1.98	7.82	5.29	3.63	1.66	2.68	27.1	0.76
0.101	175.020	88.104	1.10	6.58	2.55	1.95	7.92	5.37	3.66	1.71	2.75	27.8	0.75
0.107	179.520	88.482	1.20	6.58	2.61	1.90	8.02	5.41	3.65	1.76	2.85	28.7	0.74
0.113	183.620	88.547	1.30	6.59	2.62	1.89	8.10	5.49	3.69	1.80	2.90	29.2	0.73
0.119	187.580	88.632	1.40	6.60	2.63	1.88	8.19	5.56	3.72	1.84	2.96	29.7	0.72
0.125	191.260	88.880	1.50	6.61	2.67	1.84	8.26	5.60	3.72	1.88	3.04	30.3	0.71
0.131	194.680	88.815	1.60	6.61	2.66	1.85	8.33	5.68	3.76	1.91	3.07	30.6	0.69

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.136	198.090	88.769	1.70	6.62	2.65	1.86	8.40	5.75	3.80	1.95	3.10	30.8	0.68
0.142	201.230	88.723	1.80	6.63	2.64	1.86	8.47	5.82	3.84	1.98	3.13	31.0	0.67
0.148	204.230	88.880	1.90	6.63	2.67	1.84	8.53	5.86	3.85	2.01	3.19	31.5	0.66
0.154	206.960	88.775	2.00	6.64	2.65	1.86	8.58	5.93	3.89	2.04	3.20	31.6	0.65
0.166	212.700	88.919	2.20	6.65	2.67	1.83	8.70	6.03	3.93	2.10	3.29	32.2	0.64
0.177	217.610	88.573	2.40	6.67	2.62	1.88	8.80	6.18	4.03	2.15	3.28	32.2	0.61
0.189	222.530	88.619	2.60	6.68	2.63	1.88	8.90	6.27	4.07	2.19	3.34	32.6	0.60
0.201	227.030	88.287	2.80	6.69	2.58	1.93	8.98	6.40	4.16	2.24	3.32	32.5	0.58
0.213	231.400	88.280	3.00	6.71	2.58	1.93	9.07	6.49	4.21	2.28	3.37	32.8	0.57
0.224	235.630	87.954	3.20	6.72	2.53	1.97	9.15	6.62	4.29	2.32	3.35	32.7	0.55
0.236	239.730	87.902	3.40	6.74	2.53	1.98	9.23	6.70	4.34	2.36	3.38	32.9	0.54
0.248	243.420	87.589	3.60	6.75	2.48	2.03	9.30	6.82	4.42	2.39	3.36	32.8	0.52
0.260	247.240	87.517	3.80	6.76	2.47	2.04	9.37	6.90	4.47	2.43	3.39	33.0	0.51
0.271	250.790	87.204	4.00	6.78	2.43	2.08	9.43	7.01	4.54	2.46	3.37	32.8	0.49
0.283	254.340	87.211	4.20	6.79	2.43	2.08	9.50	7.07	4.58	2.50	3.40	33.0	0.49
0.295	257.750	86.826	4.40	6.81	2.37	2.14	9.56	7.19	4.66	2.53	3.36	32.8	0.47
0.307	261.030	86.761	4.60	6.82	2.36	2.15	9.62	7.26	4.70	2.56	3.38	32.9	0.46
0.318	264.170	86.761	4.80	6.83	2.36	2.15	9.67	7.31	4.73	2.58	3.41	33.1	0.46
0.330	267.170	86.403	5.00	6.85	2.31	2.20	9.73	7.42	4.81	2.61	3.38	32.9	0.44
0.342	270.170	86.403	5.20	6.86	2.31	2.20	9.78	7.47	4.83	2.64	3.40	33.0	0.44
0.354	272.900	86.051	5.40	6.88	2.26	2.25	9.82	7.56	4.91	2.66	3.37	32.8	0.42
0.365	275.770	86.018	5.60	6.89	2.25	2.25	9.87	7.62	4.94	2.68	3.38	32.9	0.42
0.377	278.360	85.712	5.80	6.91	2.21	2.30	9.91	7.70	5.00	2.70	3.35	32.7	0.41
0.389	280.960	85.673	6.00	6.92	2.20	2.30	9.96	7.75	5.03	2.73	3.37	32.8	0.40
0.401	283.550	85.379	6.21	6.94	2.16	2.34	10.00	7.84	5.09	2.75	3.34	32.6	0.39
0.412	286.010	85.347	6.41	6.95	2.16	2.35	10.04	7.88	5.12	2.77	3.35	32.7	0.39
0.424	288.600	85.060	6.61	6.97	2.12	2.39	10.08	7.96	5.18	2.79	3.33	32.6	0.38
0.436	290.920	85.027	6.81	6.98	2.11	2.40	10.12	8.00	5.20	2.80	3.34	32.6	0.38
0.448	293.240	84.936	7.01	7.00	2.10	2.41	10.15	8.05	5.23	2.82	3.34	32.7	0.37
0.459	295.290	84.727	7.21	7.01	2.07	2.44	10.18	8.11	5.28	2.84	3.33	32.5	0.36
0.471	297.480	84.780	7.41	7.03	2.08	2.43	10.21	8.14	5.28	2.85	3.35	32.7	0.36
0.483	299.520	84.454	7.61	7.04	2.03	2.48	10.24	8.21	5.35	2.87	3.32	32.4	0.35
0.495	301.710	84.467	7.81	7.06	2.03	2.48	10.28	8.25	5.36	2.88	3.33	32.6	0.35
0.506	303.620	84.193	8.01	7.07	1.99	2.52	10.30	8.31	5.41	2.90	3.30	32.4	0.34
0.518	305.530	84.173	8.21	7.09	1.99	2.52	10.33	8.34	5.43	2.91	3.31	32.4	0.34
0.530	307.310	83.919	8.41	7.10	1.95	2.55	10.35	8.40	5.48	2.92	3.29	32.2	0.33
0.542	309.220	83.913	8.61	7.12	1.95	2.56	10.38	8.43	5.49	2.94	3.30	32.3	0.33
0.553	311.130	83.658	8.81	7.13	1.91	2.59	10.40	8.49	5.54	2.95	3.27	32.1	0.32
0.565	313.040	83.652	9.01	7.15	1.91	2.59	10.43	8.52	5.55	2.96	3.28	32.2	0.32
0.577	314.820	83.724	9.21	7.17	1.92	2.58	10.45	8.53	5.56	2.97	3.30	32.3	0.32

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.589	316.320	83.398	9.41	7.18	1.88	2.63	10.47	8.59	5.61	2.98	3.27	32.1	0.31
0.600	318.090	83.430	9.61	7.20	1.88	2.63	10.49	8.61	5.62	2.99	3.28	32.2	0.31

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'3		Ground Surface Elevation
BORING:	B110U		Elevation Datum
SAMPLE:	U2-A		
DEPTH:	36.8	Elevation:	
TEST DATE:	21-Nov-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	N. Mazzella		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	LEAN CLAY with SAND (CL), orange		
Sample Description (2)			
Failure Type:	Bulging with Shear Plane		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	251674	
Load Calibration Factor:	0.13652	lb/cnt
Pressure ID:	GE02	
Pressure Cal. Fator	0.0065185	psi/cnt
Displacement ID:	10716	
Displacement Cal. Factor:	0.000093997	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.4	VC:	12.8667
Penetration, cm:	25.90		
Gross Recovery, cm:	29.00		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	1.1287
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	23.9				23.9	cm
TOP EMPTY LENGTH	4				4	cm
BOT. EMPTY LENGTH	5				5	cm
TUBE INNER DIAMETER	7.283	7.3	7.275	7.299	7.28925	cm

In tube length	14.90	cm
Tube Diameter	7.289	cm
Tube Area	41.73	(cm^2)
Tube Volume	621.79	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.385	7.374	7.372		7.377	cm
MEMBRANE 1 THICKNESS	0.096	0.099	0.1		0.098	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.742	13.758	13.752	13.743	13.749	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.906	8.898	8.943	8.923	8.918	cm

#filter strips	0		
Hi	14.991	cm	
Di	7.279	cm	2.05961486
Ai	41.610	cm^2	
Vi	623.780	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	205.040	138.650	*******	2051.180	*******	1542.030	1121.260	*******
DRY+T	172.630	125.500		*******	0.000	*******	1008.550	205.950
T	31.250	42.370		704.980	0.000	205.400	403.310	205.400
Wt. Solids	141.38	83.13	0	1346.2	0	1127.34	605.24	0.55
w %	22.92	15.82	*******	19.41	*******	18.62	18.62	*******

FINAL B VALUE 0.91

Fixed Piston? (y or n)	n		
Piston diameter	0.375	in	
Piston Area	0.110446617	(in^2)	

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00	
saturation	71.09	77.27	0.000	-13.685	0.000	0.000	-0.110	6.18	6.18	
Consolidation Stage 1	70.84	102.14	0.000	12.150	0.093	0.093	0.095	31.30	31.30	
2	70.84	102.14	0.000	0.000	0.000	0.000	0.000	31.30	31.30	
3	70.84	102.14	0.000	0.000	0.000	0.000	0.000	31.30	31.30	
4	70.84	102.14	0.000	0.000	0.000	0.000	0.000	31.30	31.30	
5	70.84	102.14	0.000	0.000	0.000	0.000	0.000	31.30	31.30	
6	70.84	102.14	0.000	0.000	0.000	0.000	0.000	31.30	31.30	
Start Shear	70.84	102.14	0.000	**********	**********			31.30	31.30	
End Shear				2.430	**********			**********	**********	

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							1.1287	2.05	127.8	0.334	
after sampling		0.00	0.00							1.0000	1.81	113.2	0.506	
after shipping		0.00	0.00							1.0000	1.81	113.2	0.506	
in tube before extrusion		0.00	0.00	14.90	7.289	41.731	621.79	1127.34	19.41	*****	1.81	113.2	0.506	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.991	7.279	41.610	623.780	1127.344	*****	*****	1.81	112.8	0.511	
saturation		6.18	6.18	14.991	7.358	42.522	637.465	1127.344	19.916		1.77	110.4	0.544	
	1	31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
	2	31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
	3	31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
	4	31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
	5	31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
	6	31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
Start Shear		31.30	31.30	14.898	7.310	41.974	625.315	1127.344	18.838	*****	1.80	112.6	0.514	
End Shear		**********	**********				622.885	1127.344	18.622	*****	1.81	113.0	0.508	0.508390556

Test comp (c) or ext (c) c

DEFORMATION RATE 1 0.02029886 mm/min 0.0136 %/min

DEFORMATION RATE 2 in/min 0 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R13
Boring	B1104
Sample	U2-A
Depth	36.8 ft
By	NGL
Date	11/21/17
Checked	NM
Date	12/4/17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	T-11	D-27		
Wet Wt. + Tare (g)	205.04	138.65		
Dry Wt. + Tare (g)	172.63	125.50		
Wt. Water (g)	32.41 ✓	13.15 ✓		
Tare (g)	31.25	42.37		
Dry Wt. Soil (g)	141.38 ✓	83.13 ✓		
Water Content (%)	22.9 ✓	15.8 ✓		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	23.9 cm
Top Empty Length					cm	Avg.	4.0 cm
Bottom Empty Length					cm	Avg.	5.0 cm

Trimmed Length in Tube, L: 14.9 ✓ cm

Tube Dimensions

Tube Inner Diameter	7.283	7.300	7.275	7.299	cm	Avg.	7.289 ✓ cm

Tube Weight (g): 704.98

Weight of other (specify: —) (g): —

Area, A: 41.73 ✓ cm^2

Volume in Tube = A x L: 621.8 ✓ cm^3

Measurements After Test

Weight in Membrane

Wet + ~~membrane~~	1542.03	g
Membrane	205.40	g
W_{moist}	1336.63	g ✓

Dry Wt. Of Excess Solids

Tare #	P-6	g ✓
Dry + Tare	205.95	g
Tare	205.40	g
Dry Wt. Of Excess	0.55	g ✓

Water Content

(Fraction Used: 1/2)

Tare #	S-4A	
Wet + Tare	1121.26	g
Dry + Tare	1008.55	g
Wt. Water	112.71 ✓	g
Tare	403.31	g
Wt. Dry Soil	605.24 ✓	g
Water Content	18.6 ✓	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = 1127.56 ✓ g

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify: —)	2051.18	g
Tube + other	704.98	g
Moist soil	1346.20	g ✓

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.165 ✓ g/cm^3 = 135.2 ✓ pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.825 ✓ g/cm^3 = 113.9 ✓ pcf

Remarks:

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Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'3
Boring	B1102
Sample	212-A
Depth	36.8 ft
By	WBL
Date	11/27/17
Checked	NM
Date	12/14/17

Undisturbed Specimen ✓
Remolded or compacted Specimen ____

Filter Strips? Yes ✓ No ____
Lubricated End Platens? Yes ____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes	7.385	7.374	7.372		Avg.	7.377 ✓ cm
Twice thickness 1 membranes	0.096	0.099	0.100		Avg.	-0.098 ✓ cm
					Avg.	- cm

Diameter of Specimen 7.279 ✓ cm
Diameter of Specimen 2.866 ✓ inch
Area of Specimen 41.61 ✓ cm^2

Height Caliper #____

Height from top gauge block to top of top platen, with specimen NEW	13.742, 13.758, 13.752, 13.743				Avg.	13.749 ✓ cm
OLD	14.408	14.376	14.391	14.499	Avg.	~~14.419~~ cm

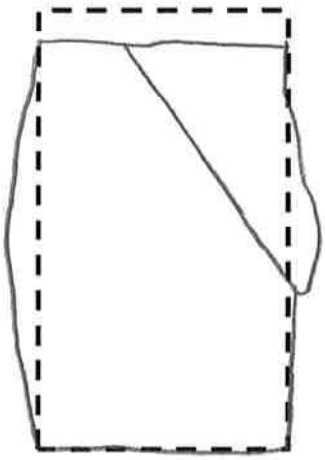
Height of Gauge Block +10.160 cm

Δh

Height from top of top platen to cell base, without specimen	9.523	9.515	9.560	9.540	-0.617 Avg.	-8.918 ✓ cm

Height of Specimen in Cell 14.991 ✓ cm
Height of Specimen in Cell 5.902 ✓ inch
Volume in cell, initial 623.8 ✓ cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:
Bulging with shear plane

Test Notes & Remarks:
REPLACED TOP PLATEN
OLD PLATEN: 25.35, 25.38, 25.34, 25.43 (mm) ⇒ 25.37 mm ✓
NEW PLATEN: 19.26, 19.18, 19.16, 19.20 (mm) ⇒ 19.20 mm ✓

Δh = 25.37 - 19.20 = 6.17 mm ✓

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Saturation and Consolidation Data

Project No.	1700685
Test No.	R13
Boring	BH04
Sample	U2-A
Depth	36.8 ft
By	WGL
Date	11/27/17
Page	1 of 2

Panel No. 3

Pressure Trans:	SN GE02	Factor 6.5185e-3	Gain = 80	
Load Trans:	SN 251674	Factor 1.3252e-1	Gain = 40	
Displ. Trans:	SN 10716	Factor 9.3992e-5	Gain = 40	

Date	Time	Load ( )	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.35) (digit)	Burrette Top (x 1.35) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
11/27	1430	-	0			-		-7		0
						-		0		7
						22.9		0.34		6.36
	1500					21.7		10.35		16.24
	1605					21.9		10.55		
						21.3		20.83		26.71
11/28	805					22.8		20.92		26.51
					DEAIR →	22.8		20.92		28.06
	09:18					18.9		20.87		28.03
	1200			DEAIR + →		21.1		20.87		27.99
	1320			REFILL		21.2		20.89		28.04
						20.8		30.77		37.86
11/29	810					21.9		30.72		37.77
	1400					22.2		30.87		37.92
		SWAPPED BLOCK VALVE TO CELL								
	1630					27.3		0.38		7.14
						26.0		11.43		17.92
12/4		LEAK CONTINUES								
		REPLACING TOP CAP								
	1505					18.3		0.27		7.20
						17.0		10.93		17.60
	1755					16.8		11.02		17.69
						16.4		20.54		27.14
12/5	850					16.5		20.55		27.10
						16.2		30.49		36.99
	1040					16.2		30.43		36.91
						16.1	B=0.85	41.05	39.33	47.40
	1610					16.0				
12/6	820					16.2		40.90		47.29
							B=0.87	50.84	49.53	57.21
12/7	820					16.0		50.96		57.29
							B=0.88	61.25	60.11	67.65
12/8	915					16.0		61.13		67.23
12/11	820					16.0		61.17		67.30
							B=0.91	70.82	70.07	77.07

TEST REMARKS

$\bar{\sigma}_c$ = 4500 psf = 31.3 psi

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Saturation and Consolidation Data

Panel No. _____

Pressure Trans: SN _____ Factor _____ Gain = _____
Load Trans: SN _____ Factor _____ Gain = _____
Displ. Trans: SN _____ Factor _____ Gain = _____

Project No.	1700685
Test No.	R'3
Boring	B110U
Sample	U2-A
Depth	36.8
By	WGL
Date	11/27/17
Page	2 of 2

Date	Time	Load ( )	Axial Def. ( )	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.35) (digit)	Burrette Top (x 1.35) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
			B=0.97 after one week, not							
			taking on water ⇒ consol.							
								71.09		77.27
			$\bar{\sigma}_c$ = 31.3 psi ⇒ cell to 102.4 psi							
								70.97		102.4
		Valve to block from cell pressure started								
		to leak during consolidation.								
		Valve replaced, block deaired.								
	1555					22.3		70.84		102.14
12/12	1530					23.8		70.52		101.64
12/13	810	All three GEOLOG-CU programs shut down at								
		3:33am, ~9.5% strain.								
		Reconsol								
	810					23.8				
	824					24.9				
	845					25.4				
	910					25.6				

TEST REMARKS

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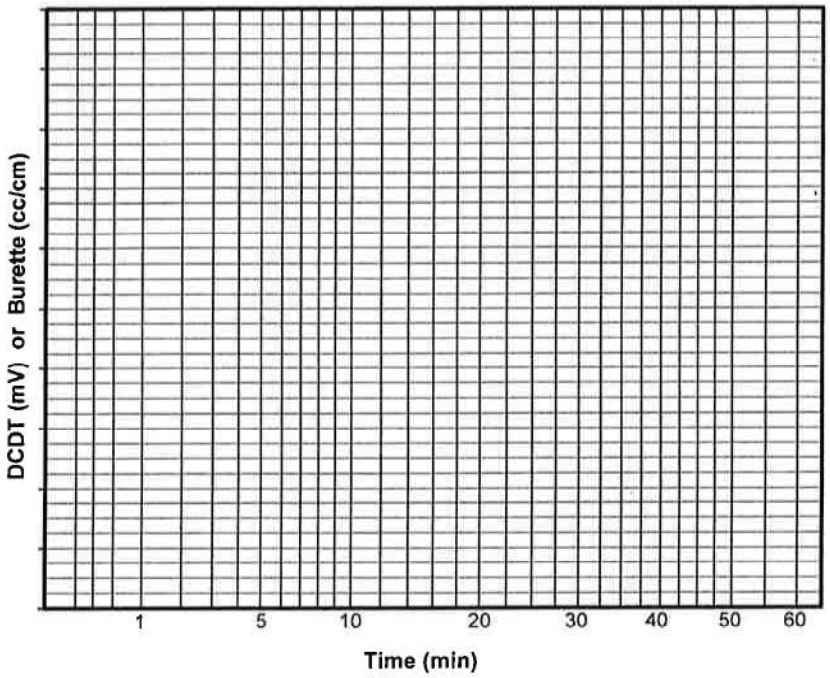
Consolidation Worksheet

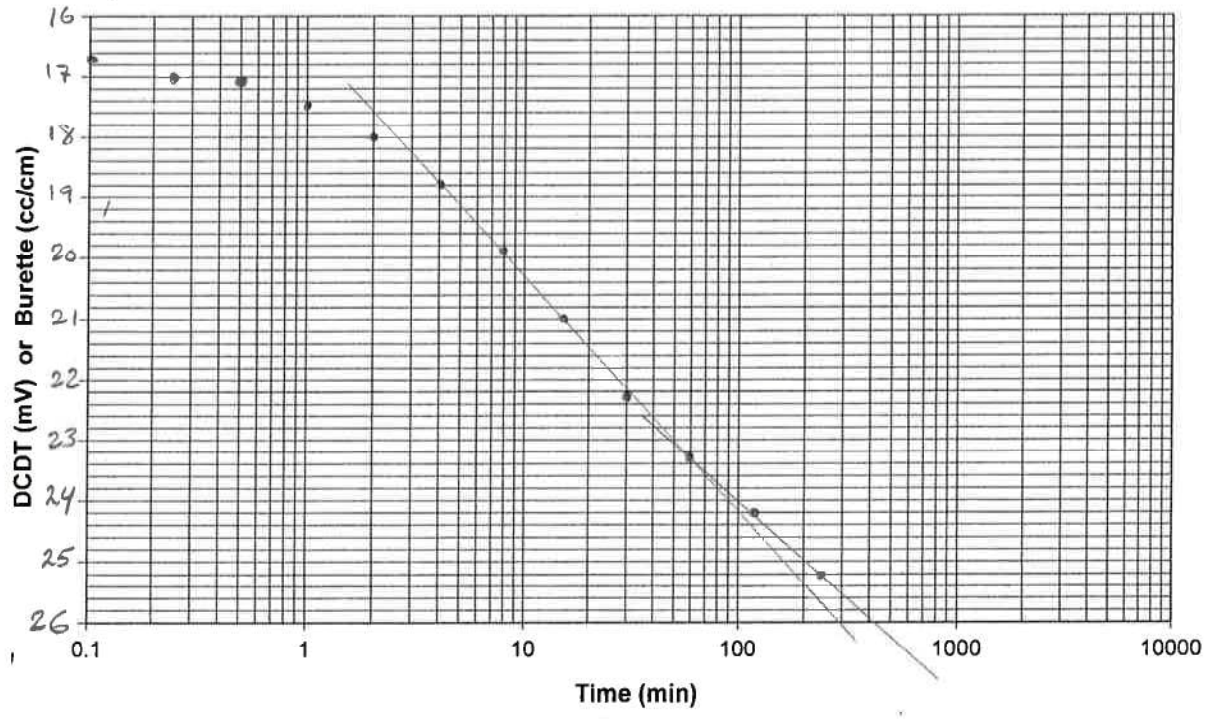
Project No.	1700685
Test	R'3
Boring	B110U
Sample	U2-A
By	WOL
Date	12/11/17
Checked	
Date	

Hanger Load _____ kg
Loading Device _____

DCDT # _____
Channel _____

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
829	0	16.0
	0.1	16.7
	0.25	17.0
	0.5	17.1
830	1	17.5
831	2	18.0
833	4	18.8
837	8	19.9
844	15	21.0
859	30	22.3
929	60	23.3
1029	120	24.2
1229	240+4	25.0





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R'3
Boring	B11U
Sample	U2-A
Depth	36.8 ft
By	WGL
Date	•
Checked	NM
Date	12/19/17

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

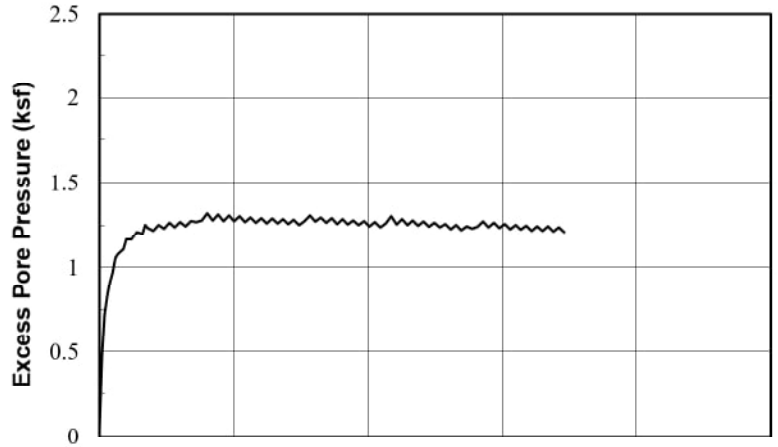
Stage #	3				
Initial Specimen Height in Cell	14.991✓	cm			
Height Change during Consolidation	0.093	cm	=	0.0368	inch
Specimen Height, **A**	14.898✓	cm	=		inch
Estimated T_{100}, **B**	100	min			
Estimated Fail Strain, **C**	4.0	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.0284✓	mm / min	=	0.00112	inch / min
Actual Deformation Rate, **E**	0.0207✓	mm / min	=	0.00081	inch / min
Strain Rate = (**E** / **A**) *10	0.0139✓	% / min			

$\frac{20\%}{1440 min} = 0.0139\ \%/min$

$\frac{148.95 \times 0.2}{1440} = 0.0207\ \frac{mm}{min} / 25.4 = 0.00081$

TEST REMARKS

GEI Consultants



SAMPLE INFORMATION

Boring: B113U Sample: U1 Depth (ft): 25.4 Test: R'4
Type: 2.8-inch-diameter tube sample
Description: Gray SANDY CLAY (CL)

SPECIMEN INFORMATION (after saturation)

Height: 5.065 in Dia.: 2.869 in Area.: 6.463 sq. in
Water Content: 23.3% Dry Unit Weight: 104.2 pcf

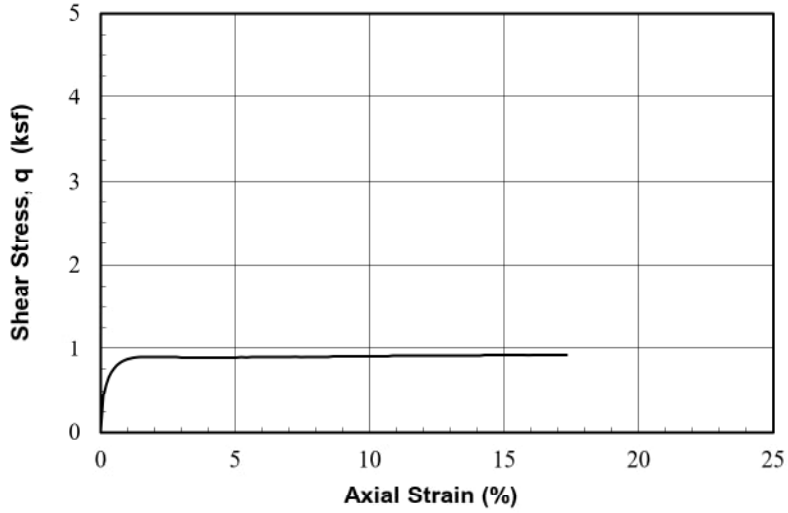
TEST SUMMARY (end of test)

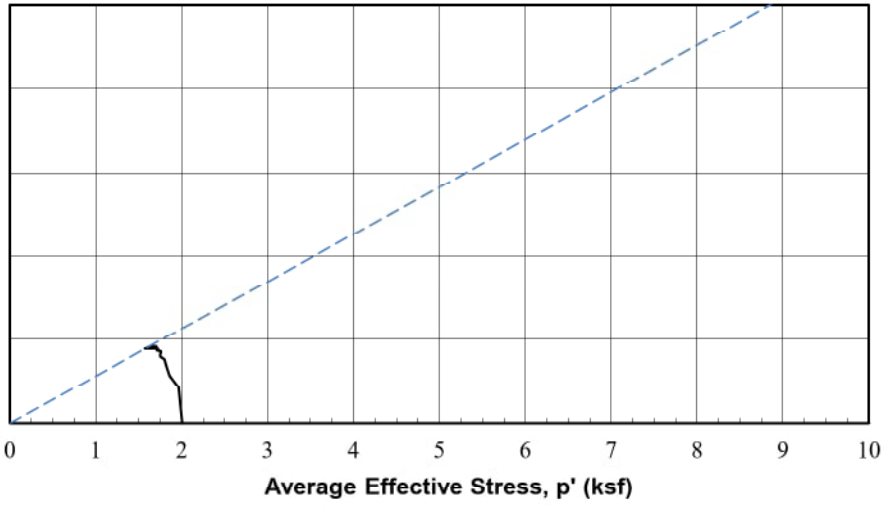
Effective Confining Stress: 2.01 ksf vertical, 2.01 ksf horiz.
Water Content: 23.1 % Dry Unit Weight: 104.5 pcf
B Coefficient: 0.97 Strain Rate: 0.014 %/min
Peak Shear Stress: 0.92 ksf @ 15.9 % Strain
Peak Friction Angle: 34.4 deg. @ 4.0 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: N. Mazzella
Test Date: 27-Nov-2017

3/15/2018 16:02

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-4

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'4												
BORING:	B113U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U1			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	25.4			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.827	2.872	6.480	19.41	90.6	108.2	0.881
TEST DATE:	11/27/2017			Under vac.	1.01	1.01	5.082	2.862	6.432	--	104.7	--	0.628
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	1.01	1.01	5.082	2.869	6.463	23.29	104.2	128.5	0.636
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
Pressure Transducer		25218		Consol. Stage 2	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
				Consol. Stage 4	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
				Consol. Stage 6	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
B value start shear		0.97											
Test Stage End of#	1			This Stage Initial Values	2.01	2.01	5.065	2.869	6.467	23.12	104.5	128.6	0.631
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		12.90 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.017	12.709	88.916	0.00	6.47	0.00	2.01	2.01	2.01	2.01	0.00	1.00	0.0	0.00
0.022	51.649	92.221	0.10	6.47	0.48	1.53	2.87	2.40	1.96	0.43	1.57	12.7	0.55
0.027	64.243	93.920	0.20	6.48	0.72	1.29	3.15	2.43	1.86	0.57	1.89	17.9	0.63
0.032	71.961	94.723	0.30	6.49	0.84	1.17	3.32	2.49	1.83	0.66	2.12	21.1	0.64
0.037	77.474	95.266	0.40	6.49	0.91	1.09	3.44	2.53	1.81	0.72	2.31	23.4	0.64
0.042	81.478	95.643	0.50	6.50	0.97	1.04	3.53	2.56	1.80	0.76	2.47	25.0	0.64
0.047	84.728	96.257	0.60	6.51	1.06	0.95	3.60	2.54	1.75	0.80	2.68	27.1	0.66
0.053	87.108	96.422	0.70	6.51	1.08	0.93	3.65	2.57	1.75	0.82	2.78	28.1	0.66
0.058	89.023	96.517	0.80	6.52	1.09	0.91	3.69	2.60	1.76	0.84	2.85	28.7	0.65
0.063	90.415	96.611	0.90	6.53	1.11	0.90	3.72	2.61	1.76	0.86	2.91	29.2	0.65
0.068	91.634	97.012	1.00	6.53	1.17	0.84	3.75	2.58	1.71	0.87	3.07	30.5	0.67
0.073	92.447	97.012	1.10	6.54	1.17	0.84	3.76	2.60	1.72	0.88	3.09	30.7	0.66
0.078	93.143	97.012	1.20	6.55	1.17	0.84	3.78	2.61	1.73	0.88	3.10	30.8	0.66
0.083	93.665	97.178	1.30	6.55	1.19	0.82	3.79	2.60	1.71	0.89	3.18	31.4	0.67
0.088	94.071	97.343	1.40	6.56	1.21	0.79	3.79	2.58	1.69	0.89	3.25	32.0	0.68
0.093	94.246	97.296	1.50	6.57	1.21	0.80	3.80	2.59	1.69	0.89	3.23	31.8	0.67
0.098	94.420	97.248	1.60	6.57	1.20	0.81	3.80	2.60	1.70	0.90	3.22	31.7	0.67

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.103	94.594	97.626	1.71	6.58	1.25	0.75	3.80	2.55	1.65	0.90	3.38	32.9	0.70
0.108	94.652	97.508	1.81	6.59	1.24	0.77	3.80	2.56	1.67	0.90	3.33	32.5	0.69
0.113	94.594	97.461	1.91	6.59	1.23	0.78	3.80	2.57	1.67	0.89	3.30	32.4	0.69
0.119	94.652	97.390	2.01	6.60	1.22	0.79	3.80	2.58	1.68	0.89	3.27	32.1	0.68
0.129	94.768	97.626	2.21	6.61	1.25	0.75	3.79	2.54	1.65	0.89	3.37	32.9	0.70
0.139	94.826	97.485	2.41	6.63	1.23	0.77	3.79	2.56	1.67	0.89	3.31	32.4	0.69
0.149	94.942	97.721	2.61	6.64	1.27	0.74	3.79	2.52	1.63	0.89	3.41	33.1	0.71
0.159	95.000	97.532	2.81	6.65	1.24	0.77	3.79	2.55	1.66	0.89	3.32	32.5	0.70
0.170	95.116	97.744	3.01	6.67	1.27	0.74	3.79	2.52	1.63	0.89	3.42	33.2	0.71
0.180	95.174	97.579	3.21	6.68	1.25	0.76	3.78	2.54	1.65	0.89	3.34	32.6	0.70
0.190	95.348	97.791	3.42	6.70	1.28	0.73	3.78	2.51	1.62	0.89	3.44	33.3	0.72
0.200	95.580	97.744	3.62	6.71	1.27	0.74	3.79	2.51	1.63	0.89	3.42	33.2	0.71
0.210	95.696	97.815	3.82	6.72	1.28	0.73	3.78	2.50	1.61	0.89	3.45	33.4	0.72
0.221	95.929	98.098	4.02	6.74	1.32	0.69	3.79	2.46	1.57	0.89	3.60	34.4	0.74
0.231	95.987	97.815	4.22	6.75	1.28	0.73	3.78	2.50	1.61	0.89	3.45	33.4	0.72
0.241	96.219	98.051	4.42	6.77	1.32	0.69	3.78	2.47	1.58	0.89	3.57	34.2	0.74
0.251	96.393	97.791	4.62	6.78	1.28	0.73	3.78	2.51	1.62	0.89	3.44	33.3	0.72
0.261	96.625	98.004	4.83	6.79	1.31	0.70	3.79	2.48	1.59	0.89	3.55	34.1	0.74
0.272	96.799	97.791	5.03	6.81	1.28	0.73	3.79	2.51	1.62	0.89	3.44	33.3	0.72
0.282	97.089	97.980	5.23	6.82	1.31	0.70	3.79	2.48	1.59	0.89	3.54	34.0	0.73
0.292	97.263	97.744	5.43	6.84	1.27	0.74	3.79	2.52	1.63	0.89	3.42	33.2	0.71
0.302	97.495	97.933	5.63	6.85	1.30	0.71	3.79	2.49	1.60	0.89	3.51	33.8	0.73
0.312	97.670	97.721	5.83	6.87	1.27	0.74	3.79	2.52	1.63	0.89	3.41	33.1	0.71
0.323	97.902	97.909	6.03	6.88	1.29	0.71	3.79	2.49	1.60	0.89	3.50	33.8	0.73
0.333	98.134	97.697	6.24	6.90	1.26	0.74	3.79	2.53	1.63	0.89	3.40	33.1	0.71
0.343	98.366	97.886	6.44	6.91	1.29	0.72	3.79	2.50	1.61	0.89	3.49	33.7	0.72
0.353	98.598	97.697	6.64	6.93	1.26	0.74	3.79	2.53	1.64	0.89	3.40	33.1	0.71
0.363	98.830	97.862	6.84	6.94	1.29	0.72	3.79	2.51	1.61	0.89	3.48	33.6	0.72
0.374	99.004	97.673	7.04	6.96	1.26	0.75	3.79	2.53	1.64	0.89	3.39	33.0	0.71
0.384	99.294	97.839	7.24	6.97	1.28	0.72	3.80	2.51	1.62	0.89	3.48	33.6	0.72
0.394	99.469	97.626	7.44	6.99	1.25	0.75	3.80	2.54	1.65	0.89	3.37	32.9	0.70
0.404	99.701	97.791	7.65	7.00	1.28	0.73	3.80	2.52	1.62	0.89	3.45	33.4	0.71
0.414	100.050	98.004	7.85	7.02	1.31	0.70	3.80	2.49	1.59	0.90	3.57	34.2	0.73
0.425	100.220	97.768	8.05	7.03	1.27	0.73	3.80	2.52	1.63	0.90	3.45	33.4	0.71
0.435	100.570	97.933	8.25	7.05	1.30	0.71	3.80	2.50	1.61	0.90	3.53	34.0	0.72
0.445	100.800	97.721	8.45	7.06	1.27	0.74	3.80	2.54	1.64	0.90	3.43	33.3	0.71
0.455	101.040	97.909	8.65	7.08	1.29	0.71	3.80	2.51	1.61	0.90	3.52	33.9	0.72
0.465	101.330	97.673	8.85	7.10	1.26	0.75	3.81	2.54	1.65	0.90	3.41	33.1	0.70
0.476	101.620	97.862	9.06	7.11	1.29	0.72	3.81	2.52	1.62	0.90	3.50	33.8	0.72
0.486	101.850	97.650	9.26	7.13	1.26	0.75	3.81	2.55	1.65	0.90	3.40	33.1	0.70

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.496	102.140	97.815	9.46	7.14	1.28	0.73	3.81	2.53	1.63	0.90	3.48	33.6	0.71
0.506	102.310	97.626	9.66	7.16	1.25	0.75	3.81	2.56	1.65	0.90	3.39	33.0	0.70
0.516	102.660	97.791	9.86	7.17	1.28	0.73	3.81	2.53	1.63	0.90	3.48	33.6	0.71
0.527	102.890	97.579	10.06	7.19	1.25	0.76	3.81	2.57	1.66	0.90	3.38	32.9	0.69
0.537	103.180	97.744	10.26	7.21	1.27	0.74	3.82	2.54	1.64	0.90	3.46	33.4	0.70
0.547	103.410	97.532	10.47	7.22	1.24	0.77	3.82	2.57	1.67	0.90	3.36	32.8	0.69
0.557	103.650	97.697	10.67	7.24	1.26	0.74	3.82	2.55	1.65	0.90	3.44	33.3	0.70
0.567	104.050	97.980	10.87	7.26	1.31	0.70	3.82	2.52	1.61	0.91	3.58	34.3	0.72
0.578	104.230	97.650	11.07	7.27	1.26	0.75	3.82	2.56	1.66	0.91	3.42	33.2	0.69
0.588	104.580	97.862	11.27	7.29	1.29	0.72	3.82	2.53	1.63	0.91	3.52	33.9	0.71
0.598	104.750	97.626	11.47	7.31	1.25	0.75	3.82	2.57	1.66	0.91	3.41	33.1	0.69
0.608	105.040	97.815	11.67	7.32	1.28	0.73	3.82	2.54	1.63	0.91	3.50	33.8	0.71
0.618	105.270	97.603	11.88	7.34	1.25	0.76	3.82	2.57	1.66	0.91	3.40	33.1	0.69
0.629	105.560	97.768	12.08	7.36	1.27	0.73	3.83	2.55	1.64	0.91	3.48	33.6	0.70
0.639	105.740	97.555	12.28	7.37	1.24	0.76	3.82	2.58	1.67	0.91	3.38	32.9	0.68
0.649	106.030	97.721	12.48	7.39	1.27	0.74	3.83	2.56	1.65	0.91	3.46	33.5	0.70
0.659	106.260	97.532	12.68	7.41	1.24	0.77	3.83	2.59	1.68	0.91	3.37	32.9	0.68
0.669	106.610	97.673	12.88	7.42	1.26	0.75	3.83	2.57	1.66	0.91	3.44	33.3	0.69
0.680	106.780	97.461	13.08	7.44	1.23	0.78	3.83	2.60	1.69	0.91	3.34	32.7	0.68
0.690	107.130	97.626	13.28	7.46	1.25	0.75	3.83	2.58	1.66	0.91	3.42	33.2	0.69
0.700	107.360	97.414	13.49	7.48	1.22	0.78	3.83	2.61	1.70	0.91	3.33	32.5	0.67
0.710	107.650	97.579	13.69	7.49	1.25	0.76	3.83	2.58	1.67	0.91	3.40	33.1	0.68
0.720	107.880	97.485	13.89	7.51	1.23	0.77	3.83	2.60	1.69	0.91	3.36	32.8	0.68
0.731	108.120	97.555	14.09	7.53	1.24	0.76	3.83	2.59	1.68	0.91	3.39	33.0	0.68
0.741	108.460	97.768	14.29	7.55	1.27	0.73	3.83	2.56	1.65	0.91	3.49	33.7	0.70
0.751	108.640	97.532	14.49	7.56	1.24	0.77	3.83	2.59	1.68	0.91	3.38	32.9	0.68
0.761	108.930	97.721	14.69	7.58	1.27	0.74	3.84	2.57	1.65	0.91	3.47	33.6	0.69
0.771	109.100	97.508	14.90	7.60	1.24	0.77	3.83	2.60	1.68	0.91	3.37	32.9	0.68
0.782	109.390	97.673	15.10	7.62	1.26	0.75	3.84	2.57	1.66	0.91	3.45	33.4	0.69
0.792	109.620	97.461	15.30	7.63	1.23	0.78	3.84	2.60	1.69	0.91	3.35	32.7	0.67
0.802	109.860	97.626	15.50	7.65	1.25	0.75	3.84	2.58	1.67	0.91	3.43	33.2	0.69
0.812	110.090	97.437	15.70	7.67	1.23	0.78	3.84	2.61	1.69	0.91	3.34	32.6	0.67
0.822	110.440	97.603	15.90	7.69	1.25	0.76	3.84	2.59	1.67	0.92	3.42	33.2	0.68
0.833	110.550	97.390	16.10	7.71	1.22	0.79	3.84	2.61	1.70	0.91	3.32	32.5	0.67
0.843	110.840	97.579	16.31	7.73	1.25	0.76	3.84	2.59	1.67	0.91	3.41	33.1	0.68
0.853	111.020	97.390	16.51	7.75	1.22	0.79	3.84	2.61	1.70	0.91	3.32	32.5	0.67
0.863	111.250	97.579	16.71	7.76	1.25	0.76	3.83	2.59	1.67	0.91	3.41	33.1	0.68
0.873	111.480	97.366	16.91	7.78	1.22	0.79	3.83	2.62	1.70	0.91	3.31	32.4	0.67
0.884	111.710	97.532	17.11	7.80	1.24	0.77	3.83	2.59	1.68	0.91	3.38	32.9	0.68
0.894	112.000	97.343	17.31	7.82	1.21	0.79	3.84	2.62	1.71	0.91	3.30	32.4	0.66

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'4		Ground Surface Elevation
BORING:	B113U		Elevation Datum
SAMPLE:	U1		
DEPTH:	25.4	Elevation:	
TEST DATE:	27-Nov-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	N. Mazzella		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Gray SANDY CLAY (CL)		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.97	VC:	-18.1025
Penetration, cm:	59.13		
Gross Recovery, cm:	47.50		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	0.8190
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	18.5				18.5	cm
TOP EMPTY LENGTH	1.6				1.6	cm
BOT. EMPTY LENGTH	2.1				2.1	cm
TUBE INNER DIAMETER	7.298	7.304	7.285		7.295666667	cm

In tube length	14.80	cm
Tube Diameter	7.296	cm
Tube Area	41.80	(cm^2)
Tube Volume	618.70	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.329	7.335	7.331	7.33	7.331	cm
MEMBRANE 1 THICKNESS	0.094	0.093	0.094	0.088	0.092	cm
MEMBRANE 2 THICKNESS	0.036	0.035	0.035	0.037	0.036	cm
HEIGHT WITH SPECIMEN	11.404	11.604	11.651	11.443	11.526	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.779	8.766	8.775	8.793	8.778	cm

#filter strips	6		
Hi	12.907	cm	
Di	7.269	cm	1.77571797
Ai	41.496	cm^2	
Vi	535.603	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	79.010	77.100	*******	1622.020	*******	1318.510	810.180	*******
DRY+T	71.800	69.940		*******	0.000	*******	703.080	189.700
T	31.660	31.380		549.530	0.000	221.590	221.590	188.830
Wt. Solids	40.14	38.56	0	1072.49	0	898.19	481.49	0.87
w %	17.96	18.57	*******	19.41	*******	22.24	22.24	*******

FINAL B VALUE 0.97

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00	
saturation	89.55	96.59	0.000	-2.575	0.000	0.000	-0.021	7.04	7.04	
Consolidation Stage 1	89.58	103.52	0.000	1.474	0.043	0.043	0.012	13.94	13.94	
2	89.58	103.52	0.000	0.000	0.000	0.000	0.000	13.94	13.94	
3	89.58	103.52	0.000	0.000	0.000	0.000	0.000	13.94	13.94	
4	89.58	103.52	0.000	0.000	0.000	0.000	0.000	13.94	13.94	
5	89.58	103.52	0.000	0.000	0.000	0.000	0.000	13.94	13.94	
6	89.58	103.52	0.000	0.000	0.000	0.000	0.000	13.94	13.94	
Start Shear	89.58	103.52	0.000	**********	**********			13.94	13.94	
End Shear				7.906	**********			**********	**********	

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							0.8190	1.19	74.2	1.296	
after sampling		0.00	0.00							1.0000	1.45	90.6	0.881	
after shipping		0.00	0.00							1.0000	1.45	90.6	0.881	
in tube before extrusion		0.00	0.00	14.80	7.296	41.804	618.70	898.19	19.41	*****	1.45	90.6	0.881	
End of:		0.00	0.00											
vacuum		7.00	7.00	12.907	7.269	41.496	535.603	898.194	*****	*****	1.68	104.7	0.628	
saturation		7.04	7.04	12.907	7.286	41.696	538.178	898.194	23.288		1.67	104.2	0.636	
	1	13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
	2	13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
	3	13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
	4	13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
	5	13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
	6	13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
Start Shear		13.94	13.94	12.864	7.288	41.721	536.704	898.194	23.124	*****	1.67	104.5	0.631	
End Shear		**********	**********				528.798	898.194	22.243	*****	1.70	106.0	0.607	0.607246256

Test comp (c) or ext (c) c

DEFORMATION RATE 1	0.01800778	mm/min	0.0140	%/min
DEFORMATION RATE 2	0.00070897	in/min	0.000551122	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'4
Boring	B113U
Sample	U1
Depth	25.4
By	MPC
Date	11/27/17
Checked	NM
Date	12/14/17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-3	A-11		
Wet Wt. + Tare (g)	77.10	79.01		
Dry Wt. + Tare (g)	69.94	71.80		
Wt. Water (g)	~~7.16~~	7.21 ✓		
Tare (g)	31.38 ✓	31.66		
Dry Wt. Soil (g)	38.56 ✓	40.14 ✓		
Water Content (%)	~~19.3~~	18.0 ✓		

18.6

Trimmed Length in Tube

Overall Tube Length	18.5	18.5	18.5		cm	Avg.	18.5 cm
Top Empty Length	~~1.556~~	~~1.566~~	~~1.555~~	~~1.566~~	cm	Avg.	1.6 cm
Bottom Empty Length	2.1	2.1	2.0	2.1	cm	Avg.	2.1 cm

Trimmed Length in Tube, L: 14.8 ✓ cm

Tube Dimensions

Tube Inner Diameter	7.298	7.304	7.285		cm	Avg.	7.296 ✓ cm

Tube Weight (g): 549.53

Weight of other (specify:_____) (g): 0

Area, A: 41.80 ✓ cm^2

Volume in Tube = A x L: 618.7 ✓ cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1318.51	g
Membrane	221.59	g
W_{moist}	1096.92	g ✓

Dry Wt. Of Excess Solids

Tare #	EF-22	g
Dry + Tare	189.70	g
Tare	188.83	g
Dry Wt. Of Excess	0.87	g ✓

Water Content

(Fraction Used: 1/2)

Tare #	MP-22	
Wet + Tare	810.18	g
Dry + Tare	703.08	g
Wt. Water	107.10	g ✓
Tare	221.59	g
Wt. Dry Soil	481.49	g ✓
Water Content	22.2	% ✓

$W_s = W_{moist} / (1 + wc) + $ Dry Wt of Excess = 898.51 ✓ g

Estimate of γ_d using γ_m in tube

Moist soil + tube + ~~other~~ (specify:_____)	1622.02	g
Tube + ~~other~~	549.53	g
Moist soil	1072.49	g ✓

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.733 ✓ g/cm^3 / 108.2 ✓ pcf

$\gamma_d = \gamma_{moist} / (1 + wc) =$ 1.419 ✓ g/cm^3 / 88.6 ✓ pcf

Remarks:

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Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'4
Boring	B113U
Sample	U1
Depth	25.4
By	MDC
Date	11/28/17
Checked	NM
Date	12/11/17

Undisturbed Specimen ✓
Remolded or compacted Specimen ____

Filter Strips? Yes ✓ No ____
Lubricated End Platens? Yes ____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes: 7.329 | 7.335 | 7.331 | 7.330 — Avg. 7.331 ✓ cm

Twice thickness 1 membranes: 0.094 | 0.093 | 0.094 | 0.088 — Avg. -0.092 ✓ cm
0.036 | 0.035 | 0.035 | 0.037 — Avg. +0.036 ✓ cm ✓

Diameter of Specimen 7.275 ✓ cm
Diameter of Specimen 2.864 ✓ inch
Area of Specimen 41.57 ✓ cm²

Height Caliper #____

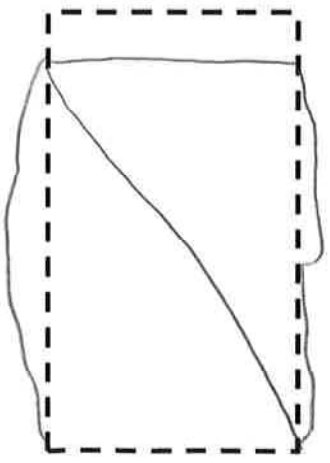
Height from top gauge block to top of top platen, with specimen: ~~11.464~~ | 11.604 | 11.651 | 11.443
11.501 | ~~10.854~~ | ~~11.518~~ — Avg. 11.526 ✓ cm

Height of Gauge Block +10.16 cm

Height from top of top platen to cell base, without specimen: 8.779 | 8.766 | 8.775 | 8.793 — Avg. -8.778 ✓ cm

Height of Specimen in Cell 12.908 ✓ cm
Height of Specimen in Cell 5.082 ✓ inch
Volume in cell, initial 536.6 ✓ cm³

Sketch of Specimen at End of Test



Specimen Description After Test:
Bulging with shear plane

Test Notes & Remarks:

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Saturation and Consolidation Data

Project No.	1700685
Test No.	R'4
Boring	B113V
Sample	U1
Depth	25.4
By	MPC
Date	11/27/17
Page	

Panel No. 1

Pressure Trans: SN 25218 Factor 2.3604E -2 Gain = 8
Load Trans: SN A8897 Factor 5.8033E -2 Gain = 8
Displ. Trans: SN 147 Factor 6.7108E -5 Gain = 64

Date	Time	Load ( )	Axial Def. (inch)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
11/28	15:30		0			–		-7		0
						–		0		7
						24.5		0.45		7.48
						17.0		10.15		17.16
	17:00					15.3		10.39		17.28
						12.1		20.35		27.12
11/29	830					10.7		20.39		27.24
						9.4		30.26		37.01
	11:30					8.9		29.65		36.52
						8.0		39.89		46.59
	13:45					7.5		39.68		46.5
						7.0		49.9		56.86
	1635					5.9		49.95		56.77
11/30	10:00					5.7		50.35		57.05
						5.4	B=0.74	60.21	57.83	67.11
	14:14					5.4		60.12		66.82
						5.1	B=0.80	70.01	68.19	76.88
12/1	13:00					4.5		69.442		76.45
						4.3	B=0.90	79.40	78.44	86.44
12/4	905					3.3		79.73		86.63
							B=0.97	89.55	89.44	96.59
			CONSOLIDATION			3.3		89.58		103.52
	1555		0.017			4.5		88.73		102.70
			SHEAR							
12/5			POST SHEAR							
	1048		RECONSOLIDATION			4.7				
	1135					10.2				
	1255					10.4				
	1610					10.6				
			After unload			11.9				
			After pressure			13.5				

TEST REMARKS

$\bar{\sigma}_c = 2000\,psf = 13.9\,psi$

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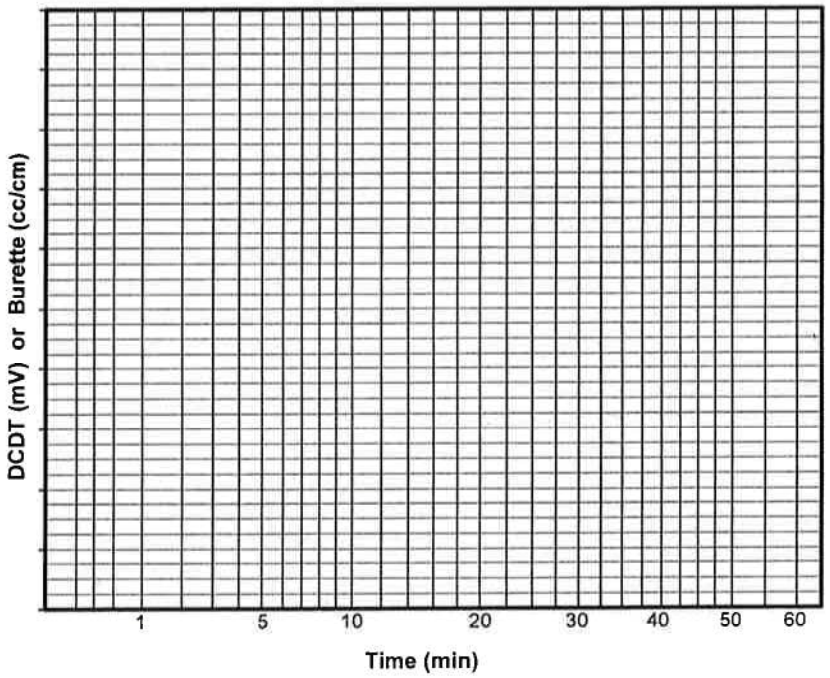
Consolidation Worksheet

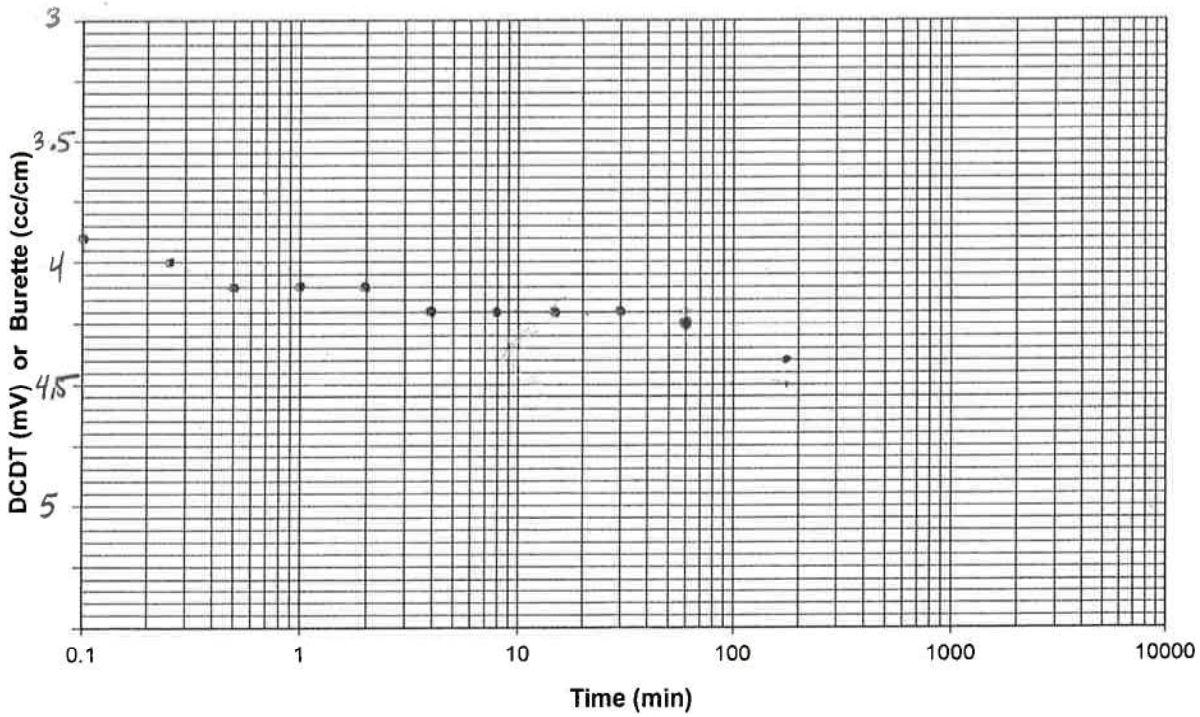
Project No.	1700685
Test	R'14
Boring	B113U
Sample	U1
By	WGL
Date	12/4/17
Checked	
Date	

Hanger Load ____ kg
Loading Device ____

DCDT # ____
Channel ____

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
9:29	0	3.3
	6s 0.1	3.9
	15s 0.25	4.0
	30s 0.5	4.1
9:30	1	4.1
9:31	2	4.1
9:33	4	4.2
9:37	8	4.2
9:44	15	4.2
9:59	30	4.2
10:29	60	4.25
12:29	180	4.4





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R14
Boring	B13 U
Sample	U1
Depth	25.4 ft
By	WGL
Date	12/4/17
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #					
Initial Specimen Height in Cell	12.908	cm			
Height Change during Consolidation	0.043	cm	=	0.017	inch
Specimen Height, **A**	12.865	cm	=	5.065	inch
Estimated T_{100}, **B**	<1	min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Shear to 17% strain in 20 hrs.

$$\dot{\Delta} = \frac{0.17 \times 5.065}{20 \times 60} = 0.00072 \text{ in/min}$$

$$\dot{\varepsilon} = \frac{17\%}{20 \times 60} = 0.014 \%/\text{min}$$

TEST REMARKS

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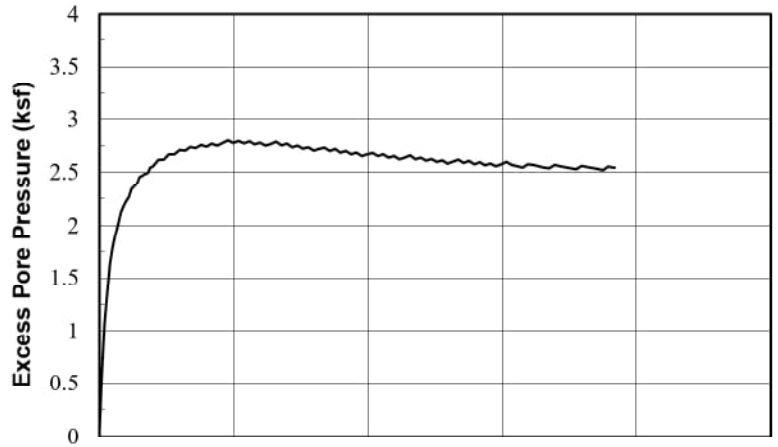


SAMPLE INFORMATION

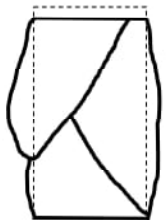
Boring: B113U Sample: U1 Depth (ft): 24.8 ft Test: R'5
Type: 2.8-inch-diameter tube sample
Description: SANDY LEAN CLAY (CL), light brown

SPECIMEN INFORMATION (after saturation)

Height: 5.760 in Dia.: 2.843 in Area.: 6.380 sq. in
Water Content: 21.2% Dry Unit Weight: 108.0 pcf

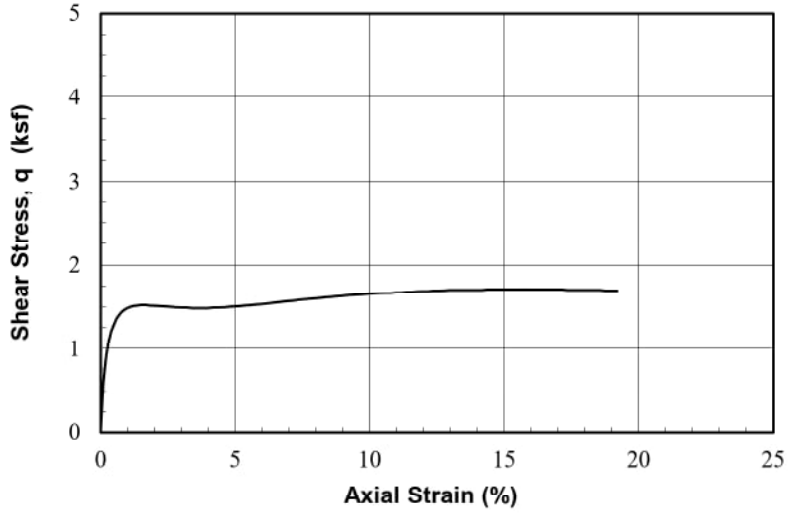
TEST SUMMARY (end of test)

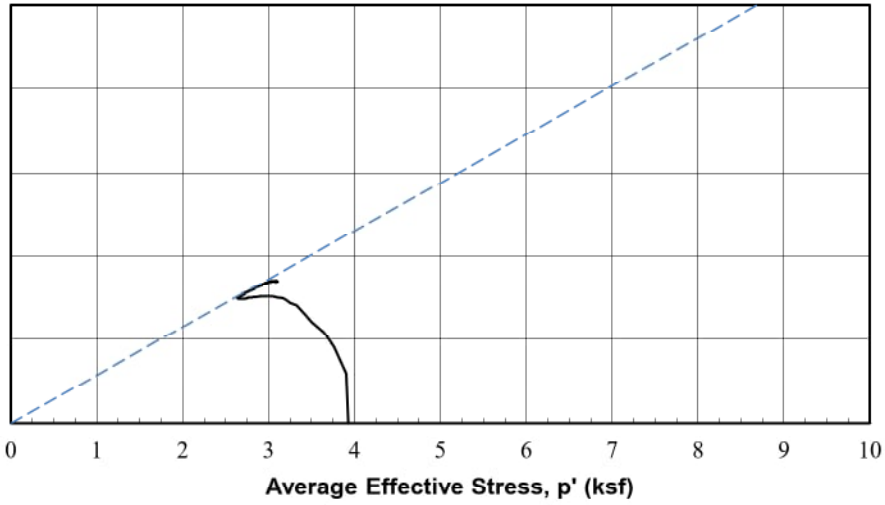
Effective Confining Stress: 3.93 ksf vertical, 3.93 ksf horiz.
Water Content: 20.7 % Dry Unit Weight: 109.0 pcf
B Coefficient: 0.94 Strain Rate: 0.014 %/min
Peak Shear Stress: 1.71 ksf @ 15.8 % Strain
Peak Friction Angle: 35.1 deg. @ 6.6 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: D. Aghjayan
Test Date: 1-Dec-2017

3/15/2018 16:02

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-5

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'5												
BORING:	B113U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U1			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	24.8 ft			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.787	2.874	6.488	15.17	106.1	122.2	0.606
TEST DATE:	12/1/2017			Under vac.	1.01	1.01	5.782	2.861	6.431	--	107.2	--	0.590
DCDT No.		146											
DCDT Calibration Factor		6.5277E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		1890-4		Saturation	0.72	0.72	5.782	2.850	6.380	21.16	108.0	130.9	0.578
Load Cell Cal. Factor		0.027097	lb/cnt	Consol. Stage 1	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
Pressure Transducer		CP-GEI-4		Consol. Stage 2	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
Pres. Trans. Cal. Factor		0.019127	psi/cnt	Consol. Stage 3	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
				Consol. Stage 4	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
				Consol. Stage 6	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
B value start shear		0.94											
Test Stage End of#	1			This Stage Initial Values	3.93	3.93	5.760	2.843	6.350	20.67	109.0	131.5	0.564
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		11.54 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.022	15.635	79.492	0.00	6.35	0.00	3.93	3.93	3.93	3.93	0.00	1.00	0.0	0.00
0.027	68.393	83.815	0.10	6.36	0.62	3.31	5.12	4.50	3.90	0.60	1.36	8.8	0.52
0.033	95.652	86.932	0.20	6.36	1.07	2.86	5.74	4.67	3.76	0.91	1.63	13.9	0.59
0.039	111.800	89.017	0.30	6.37	1.37	2.56	6.10	4.73	3.64	1.09	1.85	17.4	0.63
0.045	122.640	90.853	0.40	6.38	1.64	2.29	6.35	4.71	3.50	1.21	2.05	20.2	0.68
0.050	130.420	91.924	0.50	6.38	1.79	2.14	6.52	4.73	3.43	1.30	2.21	22.2	0.69
0.056	136.330	92.804	0.60	6.39	1.92	2.01	6.65	4.73	3.37	1.36	2.35	23.8	0.70
0.062	140.550	93.435	0.70	6.39	2.01	1.92	6.74	4.73	3.33	1.41	2.46	25.0	0.71
0.068	143.720	94.220	0.80	6.40	2.12	1.81	6.81	4.69	3.25	1.44	2.59	26.3	0.74
0.073	146.030	94.621	0.90	6.41	2.18	1.75	6.86	4.68	3.22	1.47	2.67	27.1	0.74
0.079	147.840	94.946	1.00	6.41	2.23	1.70	6.90	4.67	3.19	1.48	2.74	27.8	0.75
0.085	149.010	95.214	1.10	6.42	2.26	1.66	6.92	4.66	3.16	1.50	2.80	28.3	0.76
0.091	150.010	95.750	1.20	6.43	2.34	1.59	6.94	4.60	3.09	1.51	2.90	29.1	0.78
0.096	150.660	95.922	1.30	6.43	2.37	1.56	6.95	4.58	3.07	1.51	2.93	29.5	0.78
0.102	151.070	96.094	1.40	6.44	2.39	1.54	6.96	4.57	3.05	1.51	2.97	29.7	0.79
0.108	151.500	96.553	1.50	6.45	2.46	1.47	6.96	4.51	2.99	1.52	3.06	30.5	0.81
0.114	151.610	96.649	1.60	6.45	2.47	1.46	6.96	4.49	2.97	1.52	3.08	30.7	0.81

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.119	151.740	96.744	1.70	6.46	2.48	1.44	6.96	4.48	2.96	1.52	3.10	30.8	0.82
0.125	151.740	96.821	1.80	6.47	2.50	1.43	6.96	4.46	2.95	1.52	3.12	30.9	0.82
0.131	151.770	97.184	1.90	6.47	2.55	1.38	6.96	4.41	2.90	1.51	3.19	31.5	0.84
0.137	151.690	97.242	2.00	6.48	2.56	1.37	6.95	4.40	2.88	1.51	3.20	31.6	0.85
0.148	151.610	97.662	2.20	6.49	2.62	1.31	6.94	4.33	2.82	1.51	3.30	32.3	0.87
0.160	151.340	97.682	2.40	6.51	2.62	1.31	6.93	4.31	2.81	1.50	3.29	32.3	0.87
0.171	151.280	98.007	2.60	6.52	2.67	1.26	6.92	4.26	2.76	1.50	3.37	32.9	0.89
0.183	151.090	98.007	2.80	6.53	2.67	1.26	6.91	4.25	2.76	1.49	3.37	32.8	0.89
0.194	151.070	98.294	3.00	6.55	2.71	1.22	6.91	4.20	2.71	1.49	3.44	33.3	0.91
0.206	151.090	98.255	3.20	6.56	2.70	1.23	6.90	4.20	2.71	1.49	3.42	33.2	0.91
0.217	151.260	98.485	3.40	6.57	2.73	1.19	6.90	4.16	2.68	1.49	3.49	33.7	0.92
0.229	151.530	98.408	3.59	6.59	2.72	1.20	6.90	4.18	2.69	1.49	3.47	33.5	0.92
0.240	151.740	98.600	3.79	6.60	2.75	1.18	6.90	4.15	2.66	1.48	3.52	33.9	0.93
0.252	152.070	98.504	3.99	6.61	2.74	1.19	6.90	4.16	2.68	1.49	3.50	33.7	0.92
0.263	152.500	98.695	4.19	6.63	2.77	1.16	6.90	4.14	2.65	1.49	3.56	34.1	0.93
0.275	153.020	98.561	4.39	6.64	2.75	1.18	6.91	4.16	2.67	1.49	3.52	33.9	0.92
0.286	153.690	98.734	4.59	6.66	2.77	1.16	6.92	4.14	2.65	1.49	3.58	34.3	0.93
0.298	154.480	98.906	4.79	6.67	2.80	1.13	6.93	4.13	2.63	1.50	3.65	34.7	0.93
0.309	155.100	98.734	4.99	6.68	2.77	1.16	6.93	4.16	2.66	1.50	3.60	34.4	0.92
0.321	155.920	98.867	5.19	6.70	2.79	1.14	6.94	4.15	2.65	1.51	3.65	34.7	0.92
0.332	156.670	98.714	5.39	6.71	2.77	1.16	6.95	4.19	2.67	1.51	3.61	34.5	0.91
0.343	157.510	98.829	5.59	6.73	2.78	1.14	6.97	4.18	2.66	1.52	3.66	34.8	0.92
0.355	158.380	98.657	5.79	6.74	2.76	1.17	6.98	4.22	2.69	1.52	3.61	34.5	0.90
0.366	159.330	98.753	5.99	6.75	2.77	1.15	6.99	4.22	2.69	1.53	3.65	34.8	0.91
0.378	160.250	98.561	6.19	6.77	2.75	1.18	7.01	4.26	2.72	1.54	3.60	34.4	0.89
0.389	161.250	98.676	6.39	6.78	2.76	1.17	7.02	4.26	2.71	1.55	3.65	34.8	0.89
0.401	162.280	98.810	6.59	6.80	2.78	1.15	7.03	4.25	2.70	1.55	3.71	35.1	0.90
0.412	163.180	98.581	6.79	6.81	2.75	1.18	7.05	4.30	2.74	1.56	3.64	34.7	0.88
0.424	164.180	98.695	6.99	6.83	2.77	1.16	7.06	4.30	2.73	1.57	3.69	35.0	0.88
0.435	165.180	98.466	7.19	6.84	2.73	1.20	7.08	4.34	2.77	1.57	3.63	34.6	0.87
0.447	166.270	98.561	7.38	6.86	2.75	1.18	7.09	4.35	2.76	1.58	3.68	34.9	0.87
0.458	167.220	98.370	7.58	6.87	2.72	1.21	7.11	4.39	2.80	1.59	3.63	34.6	0.86
0.470	168.140	98.466	7.78	6.89	2.73	1.20	7.12	4.39	2.79	1.59	3.67	34.8	0.86
0.481	169.030	98.255	7.98	6.90	2.70	1.23	7.13	4.43	2.83	1.60	3.61	34.5	0.84
0.493	170.030	98.351	8.18	6.92	2.72	1.21	7.14	4.43	2.82	1.61	3.65	34.8	0.84
0.504	170.980	98.447	8.38	6.93	2.73	1.20	7.16	4.43	2.81	1.61	3.69	35.0	0.85
0.516	171.820	98.236	8.58	6.95	2.70	1.23	7.17	4.47	2.85	1.62	3.63	34.6	0.83
0.527	172.800	98.351	8.78	6.96	2.72	1.21	7.18	4.46	2.84	1.63	3.68	34.9	0.84
0.539	173.660	98.122	8.98	6.98	2.68	1.25	7.19	4.51	2.88	1.63	3.62	34.5	0.82
0.550	174.480	98.217	9.18	6.99	2.70	1.23	7.20	4.50	2.87	1.64	3.66	34.8	0.82

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.562	175.320	98.007	9.38	7.01	2.67	1.26	7.21	4.54	2.90	1.64	3.60	34.4	0.81
0.573	176.130	98.122	9.58	7.02	2.68	1.25	7.22	4.54	2.89	1.65	3.64	34.7	0.82
0.585	176.890	97.911	9.78	7.04	2.65	1.28	7.23	4.58	2.93	1.65	3.59	34.3	0.80
0.596	177.760	98.007	9.98	7.05	2.67	1.26	7.24	4.57	2.92	1.65	3.62	34.6	0.81
0.608	178.600	98.102	10.18	7.07	2.68	1.25	7.25	4.57	2.91	1.66	3.66	34.8	0.81
0.619	179.250	97.911	10.38	7.08	2.65	1.28	7.25	4.60	2.94	1.66	3.61	34.5	0.80
0.631	180.010	98.007	10.58	7.10	2.67	1.26	7.26	4.60	2.93	1.67	3.64	34.7	0.80
0.642	180.630	97.815	10.78	7.12	2.64	1.29	7.27	4.63	2.96	1.67	3.59	34.3	0.79
0.654	181.440	97.911	10.98	7.13	2.65	1.28	7.28	4.62	2.95	1.67	3.62	34.6	0.79
0.665	182.120	97.701	11.17	7.15	2.62	1.31	7.28	4.66	2.98	1.68	3.57	34.2	0.78
0.677	182.930	97.796	11.37	7.16	2.64	1.29	7.29	4.66	2.97	1.68	3.60	34.4	0.78
0.688	183.610	97.949	11.57	7.18	2.66	1.27	7.30	4.64	2.95	1.68	3.65	34.8	0.79
0.700	184.150	97.701	11.77	7.20	2.62	1.31	7.30	4.68	2.99	1.69	3.58	34.3	0.78
0.711	184.860	97.815	11.97	7.21	2.64	1.29	7.31	4.67	2.98	1.69	3.62	34.5	0.78
0.723	185.450	97.624	12.17	7.23	2.61	1.32	7.31	4.70	3.01	1.69	3.57	34.2	0.77
0.734	186.130	97.720	12.37	7.25	2.62	1.30	7.32	4.69	3.00	1.69	3.60	34.4	0.77
0.746	186.700	97.529	12.57	7.26	2.60	1.33	7.32	4.72	3.03	1.70	3.55	34.1	0.77
0.757	187.480	97.643	12.77	7.28	2.61	1.31	7.33	4.71	3.01	1.70	3.59	34.3	0.77
0.769	188.000	97.433	12.97	7.30	2.58	1.34	7.33	4.75	3.05	1.70	3.53	34.0	0.76
0.780	188.540	97.548	13.17	7.31	2.60	1.33	7.33	4.73	3.03	1.70	3.56	34.2	0.76
0.792	189.060	97.682	13.37	7.33	2.62	1.31	7.34	4.72	3.01	1.70	3.60	34.4	0.77
0.803	189.520	97.471	13.57	7.35	2.59	1.34	7.34	4.75	3.04	1.70	3.54	34.1	0.76
0.815	190.060	97.586	13.77	7.36	2.61	1.32	7.34	4.73	3.03	1.71	3.58	34.3	0.76
0.826	190.490	97.376	13.97	7.38	2.58	1.35	7.34	4.76	3.06	1.71	3.52	33.9	0.75
0.838	191.060	97.509	14.17	7.40	2.59	1.33	7.34	4.75	3.04	1.71	3.56	34.2	0.76
0.849	191.520	97.318	14.37	7.41	2.57	1.36	7.34	4.78	3.07	1.71	3.51	33.8	0.75
0.860	191.980	97.433	14.57	7.43	2.58	1.34	7.35	4.76	3.05	1.71	3.54	34.0	0.76
0.872	192.330	97.261	14.76	7.45	2.56	1.37	7.34	4.79	3.08	1.71	3.49	33.7	0.75
0.883	192.820	97.376	14.96	7.47	2.58	1.35	7.35	4.77	3.06	1.71	3.53	33.9	0.75
0.895	193.390	97.529	15.16	7.48	2.60	1.33	7.35	4.75	3.04	1.71	3.57	34.2	0.76
0.906	193.880	97.337	15.36	7.50	2.57	1.36	7.35	4.78	3.07	1.71	3.52	33.9	0.75
0.918	194.340	97.261	15.56	7.52	2.56	1.37	7.35	4.79	3.08	1.71	3.50	33.7	0.75
0.929	194.830	97.184	15.76	7.54	2.55	1.38	7.35	4.80	3.09	1.71	3.48	33.6	0.74
0.941	195.150	97.395	15.96	7.56	2.58	1.35	7.35	4.77	3.06	1.71	3.53	34.0	0.75
0.952	195.530	97.337	16.16	7.57	2.57	1.36	7.35	4.78	3.07	1.71	3.52	33.9	0.75
0.964	195.880	97.261	16.36	7.59	2.56	1.37	7.35	4.79	3.08	1.71	3.50	33.7	0.75
0.975	196.290	97.184	16.56	7.61	2.55	1.38	7.35	4.80	3.09	1.71	3.48	33.6	0.75
0.987	196.670	97.127	16.76	7.63	2.54	1.39	7.35	4.81	3.10	1.71	3.46	33.5	0.74
0.998	197.240	97.337	16.96	7.65	2.57	1.36	7.35	4.78	3.07	1.71	3.52	33.9	0.75
1.010	197.540	97.261	17.16	7.66	2.56	1.37	7.35	4.79	3.08	1.71	3.50	33.7	0.75

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.021	197.780	97.203	17.36	7.68	2.55	1.38	7.34	4.79	3.08	1.71	3.48	33.6	0.75
1.033	198.110	97.127	17.56	7.70	2.54	1.39	7.34	4.80	3.09	1.71	3.46	33.5	0.74
1.044	198.380	97.070	17.76	7.72	2.53	1.40	7.34	4.81	3.10	1.70	3.44	33.3	0.74
1.056	198.760	97.280	17.96	7.74	2.56	1.37	7.34	4.77	3.07	1.70	3.49	33.7	0.75
1.067	199.160	97.223	18.16	7.76	2.55	1.38	7.33	4.78	3.08	1.70	3.48	33.6	0.75
1.079	199.540	97.146	18.36	7.78	2.54	1.39	7.33	4.79	3.09	1.70	3.46	33.5	0.75
1.090	199.870	97.089	18.56	7.80	2.53	1.39	7.33	4.80	3.10	1.70	3.44	33.3	0.74
1.102	200.080	97.012	18.75	7.82	2.52	1.41	7.33	4.80	3.10	1.70	3.42	33.2	0.74
1.113	200.490	97.242	18.95	7.83	2.56	1.37	7.33	4.77	3.07	1.70	3.48	33.6	0.75
1.125	200.760	97.165	19.15	7.85	2.54	1.38	7.32	4.78	3.08	1.70	3.45	33.4	0.75
1.127	200.840	97.165	19.20	7.86	2.54	1.38	7.32	4.78	3.08	1.70	3.45	33.4	0.75

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'5		Ground Surface Elevation
BORING:	B113U		Elevation Datum
SAMPLE:	U1		
DEPTH:	24.8 ft	Elevation:	
TEST DATE:	01-Dec-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	SANDY LEAN CLAY (CL), light brown		
Sample Description (2)			
Failure Type:	Bulging w/ overlapping shear planes		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	1890-4	
Load Calibration Factor:	0.027097	lb/cnt
Pressure ID:	CP-GEI-4	
Pressure Cal. Fator	0.019127	psi/cnt
Displacement ID:	146	
Displacement Cal. Factor:	0.000065277	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.97	VC:	-18.1025
Penetration, cm:	59.13		
Gross Recovery, cm:	47.50		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	0.8190
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	17.7				17.7	cm
TOP EMPTY LENGTH	1.5				1.5	cm
BOT. EMPTY LENGTH	1.5				1.5	cm
TUBE INNER DIAMETER	7.296	7.305			7.3005	cm

In tube length	14.70	cm
Tube Diameter	7.301	cm
Tube Area	41.86	(cm^2)
Tube Volume	615.34	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.336	7.371	7.381	7.384	7.368	cm
MEMBRANE 1 THICKNESS	0.067	0.065	0.064	0.064	0.065	cm
MEMBRANE 2 THICKNESS	0.034	0.035	0.035	0.036	0.035	cm
HEIGHT WITH SPECIMEN	13.082	13.075	13.101	13.095	13.088	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.592	8.524	8.54	8.594	8.563	cm

#filter strips	0		
Hi	14.686	cm	
Di	7.268	cm	2.02060402
Ai	41.488	cm^2	
Vi	609.278	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	42.250	47.180	*******	1738.660	*******	1609.990	941.150	*******
DRY+T	39.630	43.240		*******	0.000	*******	848.990	197.150
T	21.540	21.260		534.050	0.000	367.800	367.800	193.690
Wt. Solids	18.09	21.98	0	1204.61	0	1045.98	481.19	3.46
w %	14.48	17.93	*******	15.17	*******	19.15	19.15	*******

FINAL B VALUE 0.94

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	80.08	85.06	0.000	4.790	0.000	0.000	0.038	4.98	4.98
Consolidation Stage 1	80.12	107.40	0.000	5.187	0.056	0.056	0.042	27.28	27.28
2	80.12	107.40	0.000	0.000	0.000	0.000	0.000	27.28	27.28
3	80.12	107.40	0.000	0.000	0.000	0.000	0.000	27.28	27.28
4	80.12	107.40	0.000	0.000	0.000	0.000	0.000	27.28	27.28
5	80.12	107.40	0.000	0.000	0.000	0.000	0.000	27.28	27.28
6	80.12	107.40	0.000	0.000	0.000	0.000	0.000	27.28	27.28
Start Shear	80.12	107.40	0.000	**********	**********			27.28	27.28
End Shear				15.827	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							0.8190	1.39	86.9	0.961	
after sampling		0.00	0.00							1.0000	1.70	106.1	0.606	
after shipping		0.00	0.00							1.0000	1.70	106.1	0.606	
in tube before extrusion		0.00	0.00	14.70	7.301	41.860	615.34	1045.98	15.17	*****	1.70	106.1	0.606	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.686	7.268	41.488	609.278	1045.981	*****	*****	1.72	107.2	0.590	
saturation		4.98	4.98	14.686	7.239	41.162	604.489	1045.981	21.162		1.73	108.0	0.578	
	1	27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
	2	27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
	3	27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
	4	27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
	5	27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
	6	27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
Start Shear		27.28	27.28	14.630	7.222	40.964	599.302	1045.981	20.666	*****	1.75	109.0	0.564	
End Shear		**********	**********				583.475	1045.981	19.153	*****	1.79	111.9	0.523	0.522863734

Test comp (c) or ext (c) c

DEFORMATION RATE 1 0.0203 mm/min 0.0139 %/min

DEFORMATION RATE 2 in/min 0 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'5
Boring	B113U
Sample	U1
Depth	24.8 ft
By	EF
Date	12/1/17
Checked	DJA
Date	12.29.17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	B-8	B-20		
Wet Wt. + Tare (g)	42.25	47.18		
Dry Wt. + Tare (g)	39.63	43.24		
Wt. Water (g)	2.62	3.94		
Tare (g)	21.54	21.26		
Dry Wt. Soil (g)	18.09	21.98		
Water Content (%)	14.5	~~12.3~~ 17.9		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	17.7 cm
Top Empty Length					cm	Avg.	1.5 cm
Bottom Empty Length					cm	Avg.	1.5 cm

Trimmed Length in Tube, L: 14.7 cm

Tube Dimensions

Tube Inner Diameter	7.296	7.305			cm	Avg.	7.301 cm

Tube Weight (g): 534.05

Weight of other (specify: —) (g): 0

Area, A: 41.87 cm^2

Volume in Tube = A x L: 615.4 cm^3

Measurements After Test

Weight in Membrane

Wet + ~~membrane~~	1609.99	g
~~Membrane~~	367.80	g
W_{moist}	1242.19	g

Dry Wt. Of Excess Solids

Tare #	EF-25	g
Dry + Tare	197.15	g
Tare	193.69	g
Dry Wt. Of Excess	3.46	g

Water Content

(Fraction Used: Yes)

Tare #	D-45	
Wet + Tare	941.15	g
Dry + Tare	848.99	g
Wt. Water	92.16	g
Tare	367.80	g
Wt. Dry Soil	481.19	g
Water Content	19.2	%

$W_s = W_{moist} / (1 + wc)$ + Dry Wt of Excess = 1045.57 g

Estimate of γ_d using γ_{moist} in tube

Moist soil + tube + other (specify:)	1738.66	g
Tube + other	534.05	g
Moist soil	1204.61	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.957 g/cm^3 / 122.14 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.726 g/cm^3 / 107.69 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'5
Boring	B113U
Sample	U1
Depth	24.8 ft
By	EF
Date	12/1/17
Checked	NM
Date	12/18/17

Undisturbed Specimen ✓
Remolded or compacted Specimen ____

Filter Strips? Yes ✓ No ____
Lubricated End Platens? Yes ____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes: 7.336 | 7.371 | 7.381 | 7.384 — Avg. 7.368 cm

Twice thickness 1 membranes: 0.067 | 0.065 | 0.064 | 0.064 — Avg. -0.065 cm
0.034 | 0.035 | 0.035 | 0.036 — Avg. -0.035 cm

Diameter of Specimen 7.268 cm
Diameter of Specimen 2.861 inch
Area of Specimen 41.49 cm²

Height Caliper #____

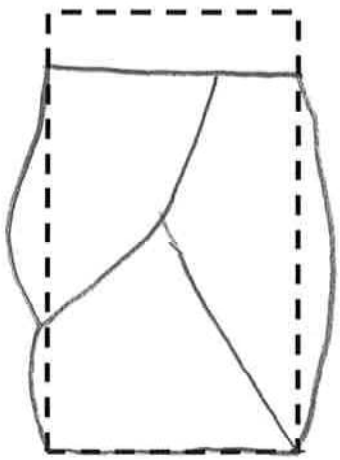
Height from top gauge block to top of top platen, with specimen: 13.082 | 13.075 | 13.101 | 13.095 — Avg. 13.088 cm

Height of Gauge Block +10.160 cm

Height from top of top platen to cell base, without specimen: 8.592 | 8.524 | 8.546 | 8.594 — Avg. -8.563 cm

Height of Specimen in Cell 14.685 cm
Height of Specimen in Cell 5.781 inch
Volume in cell, initial 609.28 cm³

Sketch of Specimen at End of Test



Specimen Description After Test:
Bulging with overlapping shear planes

Test Notes & Remarks:

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Saturation and Consolidation Data

Panel No. 2

Pressure Trans: SN CP-GEI-4 Factor 0.019127 psi/c Gain = 8
Load Trans: SN 1890-4 Factor 0.027097 lb/c Gain = 8
Displ. Trans: SN 146 Factor 6.5277e-5 in/c Gain = 64

Project No. 1700685
Test No. R15
Boring B113U
Sample U1
Depth 24.8 ft
By EF
Date 12/1/17
Page

Date	Time	Load ( )	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.33) (digit)	Burrette Top (x 1.33) (cm^2)	Pressure ( ) Back ( )	Pressure ( ) Pore ( )	Pressure ( ) Cell ( )
12/1/17	15:37							-5		0
						26.5		0.36		5.60
						15.0		10.14		15.11
12/4	835					10.7		10.27		15.40
						7.4		20.54		25.73
	1035					6.9		20.49		25.67
						5.1		30.18		35.40
	1215					4.8		30.22		35.50
					FILL	3.7	B=0.47	40.09	34.89	45.45
						29.0		40.47		45.41
	1510					28.9		40.38		45.39
						28.1	B=0.58	50.02	46.04	55.07
12/5	855					27.4		50.04		55.01
						27.0	B=0.68	60.56	57.48	65.59
	1610					26.8				
12/6	825					26.5		60.50		65.55
12/7	825					26.6		60.63		65.64
						25.9	B=0.82	70.16	68.47	75.21
12/8	915					25.6		70.06		75.07
12/12	920					24.9		70.10		75.07
12/13	815					24.8		70.04		74.98
							B=0.94	80.08	79.47	85.06
		$\bar{\sigma}_c$ =	27.8 psi	⇒ $\bar{\sigma}_{cell}$ =	107.88 psi					
								80.08		107.80
12/14	1410		0.022			28.7		80.12		107.40
12/15	1330	RECONSOL				19.7				
	1400					26.4				
			After unload			31.6				

TEST REMARKS

$\bar{\sigma}_c$ = 4000 psf = 27.8 psi

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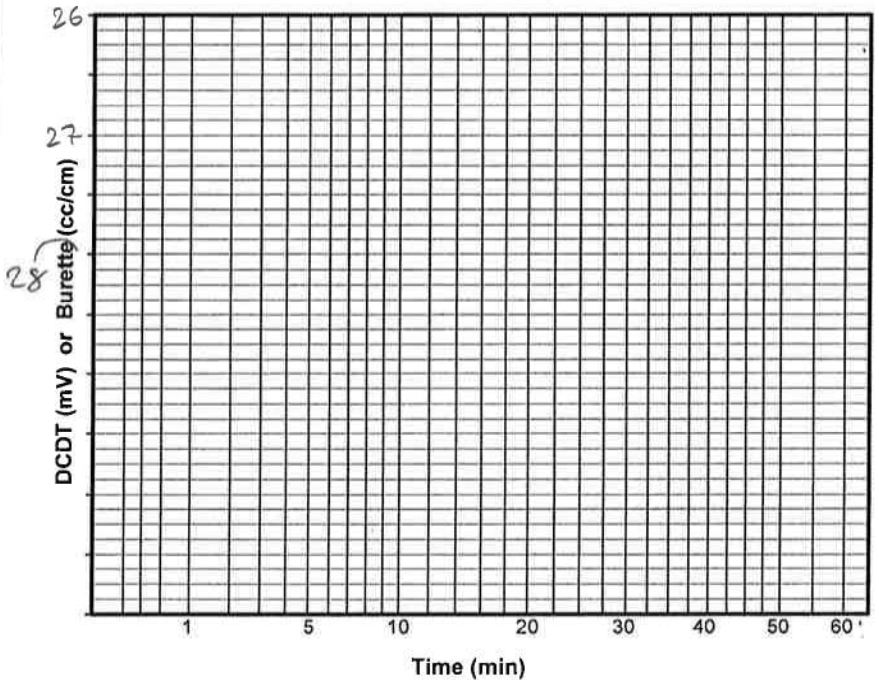
Consolidation Worksheet

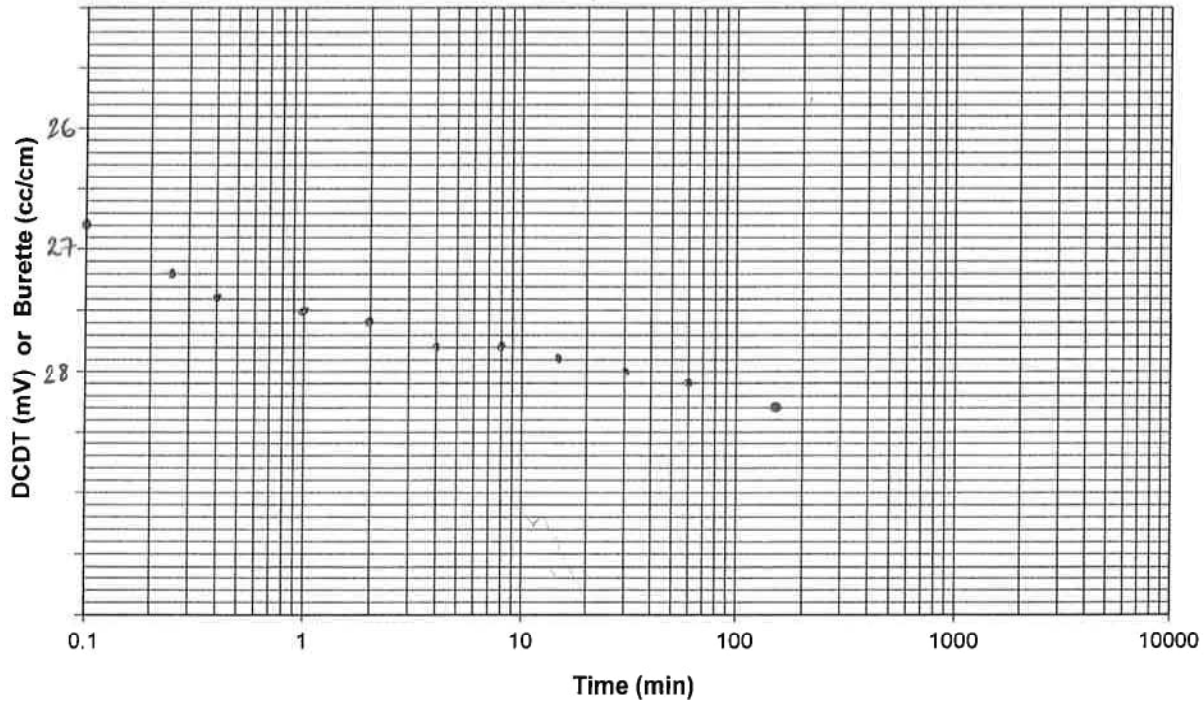
Project No.	1700685
Test	R'5
Boring	B113U
Sample	U1
By	WGL
Date	12/13/17
Checked	
Date	

Hanger Load ____ kg DCDT # ____

Loading Device ____ Channel ____

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
819	0	24.7
	0.1	26.8
	0.25	27.2
	0.5	27.4
820	1	27.5
821	2	27.6
823	4	27.8
827	8	27.8
834	15	27.9
849	30	28.0
919	60	28.1
1039	140	28.3
1439		28.6
843		28.7





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R'5
Boring	B113V
Sample	U1
Depth	24.8 ft
By	WGL
Date	12/14/17
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #	2				
Initial Specimen Height in Cell	14.685	cm			
Height Change during Consolidation	0.056	cm	=	0.022	inch
Specimen Height, **A**	14.629	cm	=	5.759	inch
Estimated T_{100}, **B**	SANDY	min			
Estimated Fail Strain, **C**	4	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**	0.0203	mm / min	=	0.00080	inch / min
Strain Rate = (**E** / **A**) *10	0.0139	% / min			

Specimen is sandy. Assume $20\%/1440\,min = 0.0139\%/min$

$$\frac{(14.629)(10\,\frac{mm}{cm})(0.20)}{1440\,min} = 0.0203\ mm/min$$

TEST REMARKS

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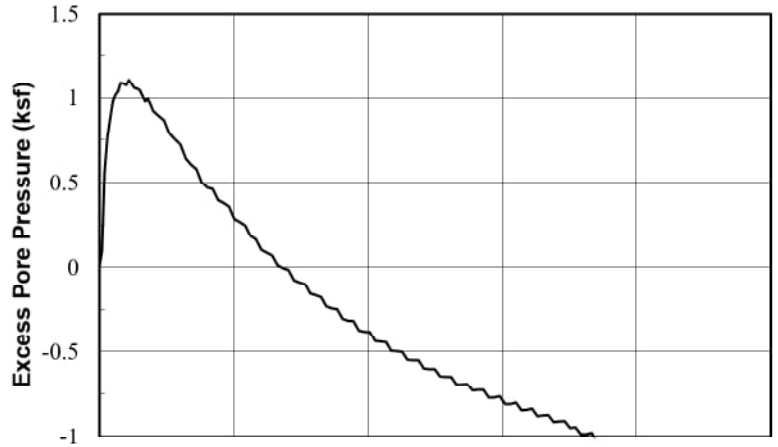


SAMPLE INFORMATION

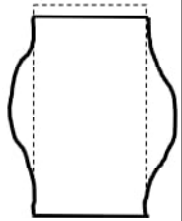
Boring: B119U-A Sample: U1 Depth (ft): 25.1 Test: R'6
Type: 2.8-inch-diameter tube sample
Description: LEAN CLAY with SAND (CL), orange

SPECIMEN INFORMATION (after saturation)

Height: 5.859 in Dia.: 2.883 in Area.: 6.563 sq. in
Water Content: 22.2% Dry Unit Weight: 106.1 pcf

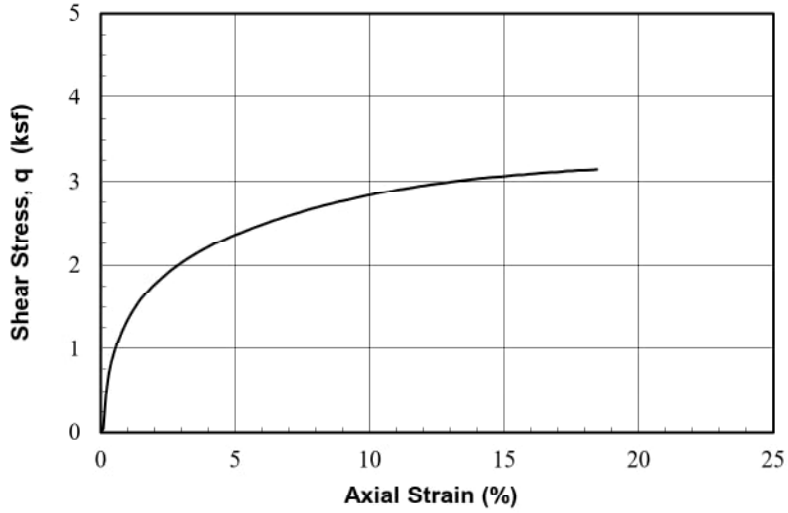
TEST SUMMARY (end of test)

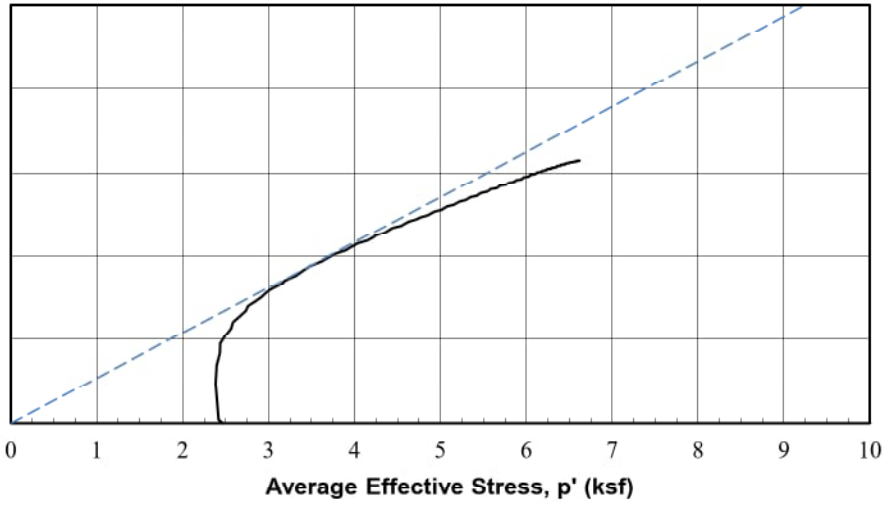
Effective Confining Stress: 2.47 ksf vertical, 2.47 ksf horiz.
Water Content: 21.7 % Dry Unit Weight: 106.9 pcf
B Coefficient: 0.98 Strain Rate: 0.012 %/min
Peak Shear Stress: 3.14 ksf @ 18.4 % Strain
Peak Friction Angle: 32.7 deg. @ 2.4 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: D. Aghjayan
Test Date: 1-Dec-2017

3/15/2018 16:02

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-6

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'6												
BORING:	B119U-A				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U1			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	25.1			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.827	2.874	6.487	21.23	108.2	131.2	0.575
TEST DATE:	12/1/2017			Under vac.	1.01	1.01	5.873	2.865	6.447	--	108.0	--	0.578
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	0.94	0.94	5.873	2.891	6.563	22.21	106.1	129.7	0.606
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
Pressure Transducer		25218		Consol. Stage 2	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
				Consol. Stage 4	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
				Consol. Stage 6	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
B value start shear		0.98											
Test Stage End of#	1			This Stage Initial Values	2.47	2.47	5.859	2.883	6.527	21.75	106.9	130.2	0.594
Stage Strain rate		0.012	%/min	Kc start stage	1.00		Back Pressure		8.54 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.014	9.924	58.916	0.00	6.53	0.00	2.47	2.47	2.47	2.47	0.00	1.00	0.0	0.00
0.020	13.928	59.576	0.10	6.53	0.10	2.38	2.56	2.46	2.42	0.04	1.04	1.0	1.08
0.026	52.926	62.810	0.20	6.54	0.56	1.91	3.42	2.86	2.38	0.47	1.50	11.5	0.59
0.032	72.831	64.250	0.30	6.55	0.77	1.70	3.85	3.09	2.39	0.69	1.81	16.8	0.56
0.037	85.947	64.982	0.40	6.55	0.87	1.60	4.14	3.27	2.43	0.84	2.05	20.1	0.52
0.043	96.277	65.737	0.50	6.56	0.98	1.49	4.37	3.38	2.44	0.95	2.27	22.9	0.52
0.049	105.330	65.997	0.60	6.57	1.02	1.45	4.56	3.54	2.50	1.05	2.44	24.8	0.49
0.055	113.280	66.138	0.70	6.57	1.04	1.43	4.74	3.70	2.56	1.13	2.58	26.2	0.46
0.061	120.480	66.516	0.80	6.58	1.09	1.38	4.89	3.80	2.59	1.21	2.76	27.9	0.45
0.067	127.030	66.469	0.90	6.59	1.09	1.38	5.03	3.94	2.66	1.28	2.85	28.7	0.42
0.073	132.900	66.398	1.00	6.59	1.08	1.39	5.16	4.08	2.74	1.34	2.93	29.4	0.40
0.079	138.470	66.634	1.10	6.60	1.11	1.36	5.28	4.16	2.76	1.40	3.06	30.5	0.40
0.085	143.460	66.445	1.20	6.61	1.08	1.39	5.38	4.30	2.84	1.46	3.10	30.8	0.37
0.090	148.270	66.280	1.31	6.61	1.06	1.41	5.48	4.42	2.92	1.51	3.14	31.1	0.35
0.096	152.680	66.256	1.41	6.62	1.06	1.41	5.58	4.52	2.97	1.55	3.20	31.6	0.34
0.102	156.690	66.186	1.51	6.63	1.05	1.42	5.66	4.61	3.02	1.59	3.24	31.9	0.33
0.108	160.520	65.973	1.61	6.63	1.02	1.45	5.74	4.72	3.09	1.63	3.25	31.9	0.31

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.114	164.000	65.737	1.71	6.64	0.98	1.49	5.81	4.83	3.16	1.67	3.24	31.9	0.29
0.120	167.480	65.832	1.81	6.65	1.00	1.48	5.88	4.89	3.18	1.71	3.31	32.4	0.29
0.126	170.680	65.596	1.91	6.65	0.96	1.51	5.95	4.99	3.25	1.74	3.31	32.4	0.28
0.132	173.630	65.336	2.01	6.66	0.92	1.55	6.01	5.09	3.32	1.77	3.29	32.2	0.26
0.143	179.500	65.147	2.21	6.67	0.90	1.57	6.13	5.23	3.40	1.83	3.32	32.5	0.25
0.155	184.890	64.958	2.41	6.69	0.87	1.60	6.24	5.37	3.48	1.88	3.35	32.7	0.23
0.167	190.000	64.392	2.61	6.70	0.79	1.68	6.34	5.55	3.62	1.93	3.30	32.3	0.20
0.179	194.760	64.156	2.81	6.72	0.75	1.72	6.43	5.68	3.70	1.98	3.31	32.4	0.19
0.191	199.230	63.943	3.02	6.73	0.72	1.75	6.52	5.80	3.77	2.03	3.32	32.5	0.18
0.202	203.580	63.377	3.22	6.74	0.64	1.83	6.61	5.96	3.90	2.07	3.26	32.0	0.16
0.214	207.640	63.141	3.42	6.76	0.61	1.86	6.68	6.08	3.97	2.11	3.26	32.1	0.14
0.226	211.760	62.952	3.62	6.77	0.58	1.89	6.76	6.18	4.04	2.15	3.27	32.1	0.14
0.238	215.480	62.409	3.82	6.79	0.50	1.97	6.83	6.33	4.15	2.18	3.22	31.7	0.12
0.250	219.130	62.197	4.02	6.80	0.47	2.00	6.90	6.43	4.21	2.21	3.22	31.7	0.11
0.262	222.610	62.126	4.23	6.82	0.46	2.01	6.96	6.50	4.26	2.25	3.24	31.9	0.10
0.273	225.810	61.677	4.43	6.83	0.40	2.07	7.02	6.63	4.35	2.28	3.20	31.6	0.09
0.285	229.230	61.559	4.63	6.84	0.38	2.09	7.09	6.70	4.40	2.31	3.21	31.6	0.08
0.297	232.420	61.418	4.83	6.86	0.36	2.11	7.14	6.78	4.45	2.34	3.21	31.7	0.08
0.309	235.320	60.922	5.03	6.87	0.29	2.18	7.19	6.90	4.54	2.36	3.16	31.3	0.06
0.321	238.280	60.804	5.23	6.89	0.27	2.20	7.25	6.97	4.59	2.39	3.17	31.4	0.06
0.332	241.360	60.662	5.43	6.90	0.25	2.22	7.30	7.05	4.63	2.41	3.18	31.4	0.05
0.344	244.380	60.214	5.64	6.92	0.19	2.28	7.35	7.16	4.72	2.44	3.14	31.1	0.04
0.356	247.100	60.072	5.84	6.93	0.17	2.30	7.40	7.23	4.77	2.46	3.14	31.1	0.03
0.368	249.770	59.647	6.04	6.95	0.11	2.37	7.44	7.34	4.85	2.49	3.10	30.8	0.02
0.380	252.440	59.529	6.24	6.96	0.09	2.38	7.49	7.40	4.89	2.51	3.11	30.9	0.02
0.391	255.170	59.411	6.44	6.98	0.07	2.40	7.53	7.46	4.93	2.53	3.11	30.9	0.01
0.403	257.720	59.010	6.64	6.99	0.01	2.46	7.57	7.56	5.01	2.55	3.08	30.6	0.00
0.415	260.390	58.892	6.85	7.01	0.00	2.47	7.62	7.62	5.05	2.57	3.08	30.7	0.00
0.427	262.890	58.821	7.05	7.02	-0.01	2.48	7.66	7.67	5.08	2.59	3.09	30.7	0.00
0.439	265.210	58.396	7.25	7.04	-0.07	2.55	7.69	7.77	5.16	2.61	3.05	30.4	-0.01
0.451	267.710	58.302	7.45	7.05	-0.09	2.56	7.73	7.82	5.19	2.63	3.06	30.5	-0.02
0.462	270.260	58.231	7.65	7.07	-0.10	2.57	7.77	7.87	5.22	2.65	3.06	30.5	-0.02
0.474	272.700	57.830	7.85	7.08	-0.16	2.63	7.81	7.97	5.30	2.67	3.03	30.3	-0.03
0.486	275.020	57.759	8.06	7.10	-0.17	2.64	7.85	8.01	5.33	2.69	3.04	30.3	-0.03
0.498	277.220	57.688	8.26	7.11	-0.18	2.65	7.88	8.06	5.35	2.70	3.04	30.4	-0.03
0.510	279.430	57.311	8.46	7.13	-0.23	2.70	7.91	8.14	5.42	2.72	3.01	30.1	-0.04
0.521	281.630	57.240	8.66	7.15	-0.24	2.71	7.95	8.19	5.45	2.74	3.02	30.2	-0.04
0.533	284.070	57.192	8.86	7.16	-0.25	2.72	7.98	8.23	5.48	2.76	3.03	30.2	-0.05
0.545	286.040	56.815	9.06	7.18	-0.30	2.77	8.01	8.31	5.54	2.77	3.00	30.0	-0.05
0.557	288.080	56.744	9.26	7.19	-0.31	2.78	8.04	8.35	5.57	2.78	3.00	30.0	-0.06

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.569	290.160	56.720	9.47	7.21	-0.32	2.79	8.07	8.38	5.59	2.80	3.01	30.1	-0.06
0.580	292.250	56.343	9.67	7.23	-0.37	2.84	8.10	8.47	5.65	2.81	2.98	29.8	-0.07
0.592	294.460	56.296	9.87	7.24	-0.38	2.85	8.13	8.51	5.68	2.83	2.99	29.9	-0.07
0.604	296.430	56.272	10.07	7.26	-0.38	2.85	8.15	8.54	5.69	2.84	2.99	29.9	-0.07
0.616	298.290	55.894	10.27	7.27	-0.44	2.91	8.18	8.61	5.76	2.85	2.96	29.7	-0.08
0.628	300.200	55.871	10.47	7.29	-0.44	2.91	8.20	8.64	5.78	2.87	2.97	29.8	-0.08
0.639	302.180	55.847	10.68	7.31	-0.44	2.91	8.23	8.67	5.79	2.88	2.98	29.8	-0.08
0.651	304.030	55.493	10.88	7.32	-0.49	2.96	8.25	8.75	5.86	2.89	2.95	29.6	-0.09
0.663	305.950	55.469	11.08	7.34	-0.50	2.97	8.28	8.77	5.87	2.90	2.96	29.6	-0.09
0.675	307.750	55.446	11.28	7.36	-0.50	2.97	8.30	8.80	5.89	2.91	2.96	29.7	-0.09
0.687	309.320	55.115	11.48	7.37	-0.55	3.02	8.32	8.86	5.94	2.92	2.94	29.5	-0.09
0.699	311.230	55.092	11.68	7.39	-0.55	3.02	8.34	8.89	5.96	2.94	2.94	29.5	-0.09
0.710	313.030	55.092	11.89	7.41	-0.55	3.02	8.36	8.91	5.97	2.95	2.95	29.6	-0.09
0.722	314.770	54.761	12.09	7.42	-0.60	3.07	8.38	8.98	6.03	2.96	2.93	29.4	-0.10
0.734	316.400	54.738	12.29	7.44	-0.60	3.07	8.40	9.00	6.04	2.97	2.93	29.4	-0.10
0.746	318.080	54.738	12.49	7.46	-0.60	3.07	8.42	9.02	6.05	2.97	2.94	29.5	-0.10
0.758	319.650	54.431	12.69	7.48	-0.65	3.12	8.44	9.08	6.10	2.98	2.91	29.3	-0.11
0.769	321.210	54.407	12.89	7.49	-0.65	3.12	8.45	9.10	6.11	2.99	2.92	29.3	-0.11
0.781	323.130	54.407	13.09	7.51	-0.65	3.12	8.48	9.13	6.12	3.00	2.92	29.4	-0.11
0.793	324.520	54.100	13.30	7.53	-0.69	3.16	8.49	9.18	6.17	3.01	2.90	29.2	-0.12
0.805	326.090	54.100	13.50	7.55	-0.69	3.16	8.50	9.20	6.18	3.02	2.91	29.2	-0.11
0.817	327.540	54.124	13.70	7.56	-0.69	3.16	8.52	9.21	6.18	3.02	2.91	29.3	-0.11
0.828	328.930	53.841	13.90	7.58	-0.73	3.20	8.53	9.26	6.23	3.03	2.89	29.1	-0.12
0.840	330.500	53.864	14.10	7.60	-0.73	3.20	8.55	9.27	6.24	3.04	2.90	29.1	-0.12
0.852	332.010	53.864	14.30	7.62	-0.73	3.20	8.56	9.29	6.24	3.04	2.90	29.2	-0.12
0.864	333.280	53.557	14.51	7.64	-0.77	3.24	8.57	9.34	6.29	3.05	2.88	29.0	-0.13
0.876	334.620	53.557	14.71	7.65	-0.77	3.24	8.58	9.35	6.30	3.05	2.88	29.0	-0.13
0.888	335.950	53.605	14.91	7.67	-0.76	3.24	8.59	9.36	6.30	3.06	2.89	29.1	-0.12
0.899	337.350	53.298	15.11	7.69	-0.81	3.28	8.60	9.41	6.35	3.07	2.87	28.9	-0.13
0.911	338.850	53.298	15.31	7.71	-0.81	3.28	8.62	9.43	6.35	3.07	2.87	28.9	-0.13
0.923	340.360	53.345	15.51	7.73	-0.80	3.27	8.63	9.43	6.35	3.08	2.88	29.0	-0.13
0.935	341.520	53.038	15.72	7.74	-0.85	3.32	8.64	9.48	6.40	3.08	2.86	28.8	-0.14
0.947	342.800	53.062	15.92	7.76	-0.84	3.31	8.65	9.49	6.40	3.09	2.86	28.8	-0.14
0.958	344.370	53.109	16.12	7.78	-0.84	3.31	8.66	9.50	6.40	3.09	2.87	28.9	-0.14
0.970	345.640	52.802	16.32	7.80	-0.88	3.35	8.67	9.55	6.45	3.10	2.85	28.7	-0.14
0.982	347.100	52.826	16.52	7.82	-0.88	3.35	8.68	9.56	6.45	3.10	2.85	28.8	-0.14
0.994	348.490	52.849	16.72	7.84	-0.87	3.34	8.69	9.56	6.45	3.11	2.86	28.8	-0.14
1.006	349.590	52.566	16.92	7.86	-0.91	3.39	8.70	9.61	6.50	3.11	2.84	28.6	-0.15
1.017	350.870	52.590	17.13	7.88	-0.91	3.38	8.70	9.62	6.50	3.12	2.84	28.7	-0.15
1.029	352.260	52.613	17.33	7.90	-0.91	3.38	8.71	9.62	6.50	3.12	2.85	28.7	-0.15

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.041	353.360	52.330	17.53	7.91	-0.95	3.42	8.72	9.67	6.54	3.12	2.83	28.5	-0.15
1.053	354.810	52.354	17.73	7.93	-0.94	3.42	8.73	9.68	6.55	3.13	2.83	28.6	-0.15
1.065	355.970	52.070	17.93	7.95	-0.99	3.46	8.74	9.72	6.59	3.13	2.81	28.4	-0.16
1.077	357.190	52.070	18.13	7.97	-0.99	3.46	8.74	9.73	6.59	3.14	2.81	28.4	-0.16
1.088	358.530	52.141	18.34	7.99	-0.98	3.45	8.75	9.73	6.59	3.14	2.82	28.5	-0.16
1.095	359.280	51.929	18.45	8.00	-1.01	3.48	8.76	9.76	6.62	3.14	2.81	28.3	-0.16

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'6		Ground Surface Elevation
BORING:	B119U-A		Elevation Datum
SAMPLE:	U1		
DEPTH:	25.1	Elevation:	
TEST DATE:	01-Dec-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	LEAN CLAY with SAND (CL), orange		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
LL=	41		
PL=	20		
PI=	21		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.7	VC:	-3.1073
Penetration, cm:	42.70		
Gross Recovery, cm:	40.80		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	0.9689
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	17.8				17.8	cm
TOP EMPTY LENGTH	1.5				1.5	cm
BOT. EMPTY LENGTH	1.5				1.5	cm
TUBE INNER DIAMETER	7.297	7.292	7.311		7.3	cm

In tube length	14.80	cm
Tube Diameter	7.300	cm
Tube Area	41.85	(cm^2)
Tube Volume	619.44	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.363	7.378	7.379		7.373	cm
MEMBRANE 1 THICKNESS	0.094	0.096	0.099		0.096	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.552	13.526	13.467	13.582	13.532	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.748	8.749	8.799	8.8	8.774	cm

#filter strips	0		
Hi	14.918	cm	
Di	7.277	cm	2.04998626
Ai	41.591	cm^2	
Vi	620.437	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	60.800	44.020	*******	1828.440	*******	1714.540	1104.590	*******
DRY+T	54.710	40.020		*******	0.000	*******	980.200	204.020
T	31.580	21.550		526.990	0.000	408.220	408.220	203.430
Wt. Solids	23.13	18.47	0	1301.45	0	1073.57	571.98	0.59
w %	26.33	21.66	*******	21.23	*******	21.75	21.75	*******

FINAL B VALUE 0.98

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum		-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation		59.65	66.16	0.000	-11.240	0.000	0.000	-0.090	6.51	6.51
Consolidation Stage	1	59.29	76.45	0.000	4.958	0.036	0.036	0.039	17.16	17.16
	2	59.29	76.45	0.000	0.000	0.000	0.000	0.000	17.16	17.16
	3	59.29	76.45	0.000	0.000	0.000	0.000	0.000	17.16	17.16
	4	59.29	76.45	0.000	0.000	0.000	0.000	0.000	17.16	17.16
	5	59.29	76.45	0.000	0.000	0.000	0.000	0.000	17.16	17.16
	6	59.29	76.45	0.000	0.000	0.000	0.000	0.000	17.16	17.16
Start Shear		59.29	76.45	0.000	**********	**********			17.16	17.16
End Shear					0.000	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							0.9689	1.68	104.8	0.626	
after sampling		0.00	0.00							1.0000	1.73	108.2	0.575	
after shipping		0.00	0.00							1.0000	1.73	108.2	0.575	
in tube before extrusion		0.00	0.00	14.80	7.300	41.854	619.44	1073.57	21.23	*****	1.73	108.2	0.575	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.918	7.277	41.591	620.437	1073.567	*****	*****	1.73	108.0	0.578	
saturation		6.51	6.51	14.918	7.343	42.344	631.677	1073.567	22.209		1.70	106.1	0.606	
	1	17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
	2	17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
	3	17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
	4	17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
	5	17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
	6	17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
Start Shear		17.16	17.16	14.882	7.322	42.112	626.719	1073.567	21.747	*****	1.71	106.9	0.594	
End Shear		**********	**********				626.719	1073.567	21.747	*****	1.71	106.9	0.594	0.593700304

Test comp (c) or ext (c) c

DEFORMATION RATE 1 0.01736615 mm/min 0.0117 %/min

DEFORMATION RATE 2 0.00068371 in/min 0.000116691 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'6
Boring	B119 UA
Sample	U1
Depth	25.1 ft
By	GE
Date	12/1/17
Checked	DOA
Date	12.29.17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	CW-18	B-33		
Wet Wt. + Tare (g)	60.80	44.02		
Dry Wt. + Tare (g)	54.71	40.02		
Wt. Water (g)	6.09	4.00		
Tare (g)	31.58	21.55		
Dry Wt. Soil (g)	23.13	18.47		
Water Content (%)	26.3	21.7		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	17.8 cm
Top Empty Length					cm	Avg.	1.6 cm
Bottom Empty Length					cm	Avg.	1.5 cm

Trimmed Length in Tube, L: 14.8 cm

Tube Dimensions

Tube Inner Diameter	7.297	7.292	7.311		cm	Avg.	7.300 cm

Tube Weight (g): 526.99

Weight of other (specify: —) (g): 0

Area, A: 41.85 cm^2

Volume in Tube = A x L: 619.4 cm^3

Measurements After Test

Weight in Membrane

Wet ~~+ membrane~~ tare	1714.54	g
tare ~~Membrane~~	408.22	g
W_{moist}	1306.32	g

Dry Wt. Of Excess Solids

Tare #	AC-8	g
Dry + Tare	204.02	g
Tare	203.43	g
Dry Wt. Of Excess	0.59	g

Water Content

(Fraction Used: 1/2)

Tare #	B5-4	
Wet + Tare	1104.59	g
Dry + Tare	980.20	g
Wt. Water	124.39	g
Tare	408.22	g
Wt. Dry Soil	571.98	g
Water Content	21.7	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = ~~1159.70~~ 1073.98 g

Estimate of γ_d using γ_m in tube

Moist soil + tube + ~~other (specify:_____)~~	1828.44	g
Tube + ~~other~~	526.99	g
Moist soil	1301.45	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.101 g/cm^3 = 131.10 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.694 g/cm^3 = 105.73 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R16
Boring	B19U-A
Sample	U1
Depth	25.1 ft
By	WGL
Date	12/6/17
Checked	
Date	

Undisturbed Specimen ✓
Remolded or compacted Specimen

Filter Strips? Yes ✓ No
Lubricated End Platens? Yes No ✓

SPECIMEN DIMENSIONS

Diameter Tape #

Diameter over ___ membranes	7.363	7.378	7.379		Avg.	7.373 cm
Twice thickness ___ membranes	0.094	0.096	0.099		Avg.	- 0.096 cm
					Avg.	- cm

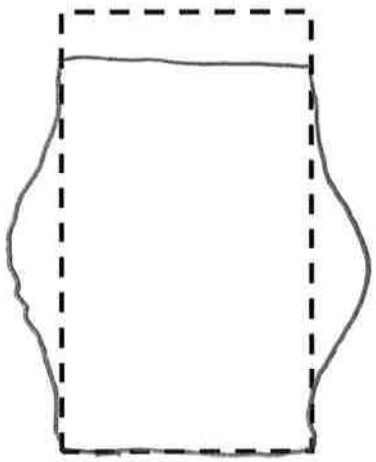
Diameter of Specimen	7.277	cm
Diameter of Specimen	2.865	inch
Area of Specimen	41.59	cm^2

Height Caliper #

Height from top gauge block to top of top platen, with specimen	13.552	13.526	13.467	13.582	Avg.	13.532 cm
Height of Gauge Block						+ 10.160 cm
Height from top of top platen to cell base, without specimen	8.748	8.749	8.797	8.800	Avg.	- 8.774 cm

Height of Specimen in Cell	14.918	cm
Height of Specimen in Cell	5.873	inch
Volume in cell, initial	620.4	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Bulging

Test Notes & Remarks:

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Saturation and Consolidation Data

Panel No. 1

Pressure Trans: SN 25218 Factor $2.3604e^{-2}$ Gain = 8
Load Trans: SN A8897 Factor $5.8033e^{-2}$ Gain = 8
Displ. Trans: SN 147 Factor $6.7108e^{-5}$ Gain = 64

Project No.	1700685
Test No.	R'6
Boring	B119U-A
Sample	U1
Depth	25.1 ft
By	WGL
Date	12/6/17
Page	

Date	Time	Load ( )	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
12/6	1230							-7		0
						20.9		0.09		7.32
			DEAIR PRESSURE LINE							
	1250					14.1		10.46		17.2
	1640					12.0		10.76		17.47
						11.7		20.11		26.65
12/7	815					10.8		19.73		26.46
						10.7		30.10		36.68
		ACCIDENTAL FLOW ACROSS BLOCK →				12.9				
	1110					12.8		30.26		36.54
						12.8	B=0.91	40.41	39.54	46.69
	1410					12.8		40.48		46.76
						12.8	B=0.92	49.76	49.24	56.25
12/8	910	REFILL BURRETTE				12.5				
		PRIOR TO WEEKEND				23.1		49.97		56.39
12/11	1605					22.8		49.88		56.34
						22.8	B=0.78	59.65	59.46	66.16
12/12	825	DRAINED PRIOR TO CONSOL				9.5		59.34		66.04
		CONSOLIDATION						59.29		76.74
		$\bar{\sigma}_c$ = 17.4 psi, $\bar{\sigma}_B$ = 59.34								
		⇒ 76.74 psi								
12/13	1020					13.2		59.29		76.45
			0.0140							

TEST REMARKS

$\bar{\sigma}_c$ = 2500 psf = 17.4 psi

GEI Consultants

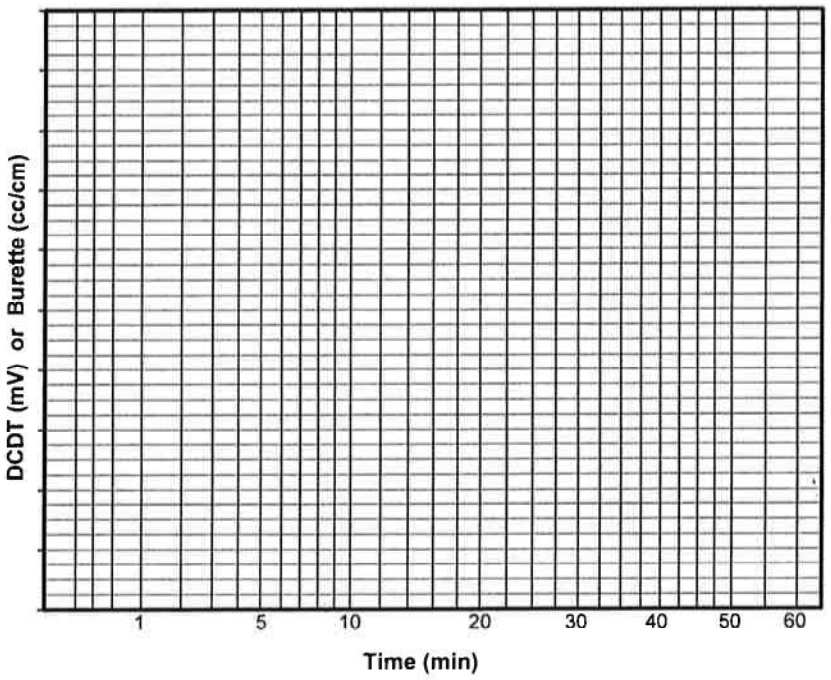
Consolidation Worksheet

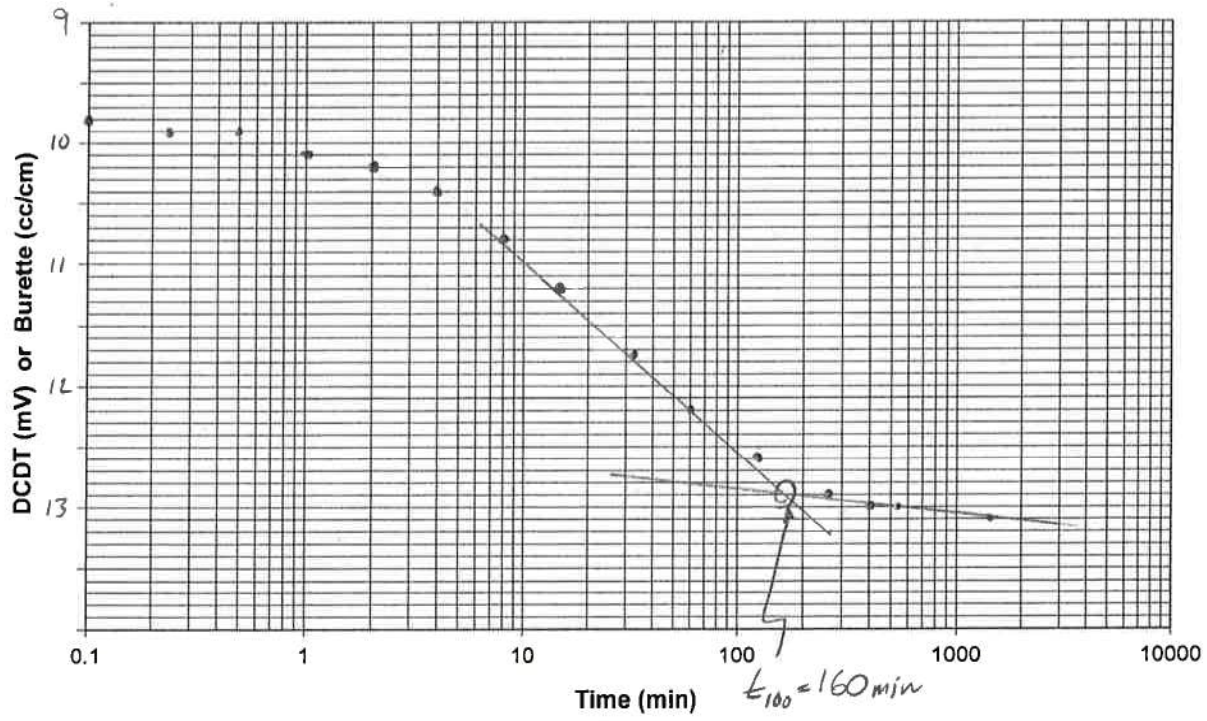
Project No.	1700685
Test	R16
Boring	B1HG-A
Sample	U1
By	WHZ
Date	12/12/17
Checked	
Date	

Hanger Load ____ kg
Loading Device ____

DCDT # ____
Channel ____

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
836	0	9.6
	0.1	9.8
	0.25	9.9
	0.5	9.9
837	1	10.1
838	2	10.2
840	4	10.4
844	8	10.8
851	15	11.2
908	30 +2	11.75
936	60	12.2
1036	120	12.6
1310	266	12.9
1520	404	13.0
1730	534	13.0
805	1419	13.1





GEI Consultants

Triaxial Rate Calculations

Project No.	1700685
Test No.	R'6
Boring	B119U-A
Sample	U1
Depth	25.1 ft
By	WBL
Date	12/15/17
Checked	
Date	

Drained Tests

Stage #				
Initial Specimen Height in Cell		cm		
Height Change during Consolidation		cm		
Specimen Height, **A**		cm	=	inch
Estimated T_{100}, **B**		min		
Estimated Fail Strain, **C**		%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=	inch / min
Actual Deformation Rate, **E**		mm / min	=	inch / min
Strain Rate = (**E** / **A**) *10		% / min		

Undrained Tests

Stage #	1			
Initial Specimen Height in Cell	14.983	cm		
Height Change during Consolidation	0.036	cm	=	0.0140 inch
Specimen Height, **A**	14.947	cm	=	5.885 inch
Estimated T_{100}, **B**	160	min		
Estimated Fail Strain, **C**	4	%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.0178	mm / min	=	0.00070 inch / min
Actual Deformation Rate, **E**	0.0176	mm / min	=	0.00069 inch / min
Strain Rate = (**E** / **A**) *10	0.0118	% / min		

$$\frac{(149.47\ \text{mm})(17\%)}{1440\ \text{min}} = 0.0176\ \text{mm/min} < 0.0178\ \text{mm/min} \checkmark$$

$$\frac{17\%}{1440\ \text{min}} = 0.0118\ \%/\text{min}$$

TEST REMARKS

GEI Consultants

Virginia Polytechnic Institute and State University
Geotechnical Engineering Laboratory
Triaxial Data Sheet

Project:	GEI 001	Started:	11/16/17
Sample I.D./Loc.:	Boring: B110UA1-U1, Depth: 16 ft, Undisturbed	Finished:	11/30/17
Classification:	Brown, moist, hard and homogenous lean clay (CL)		

Sample Preparation	Undisturbed	
Specimen Saturation Method	Wet	
Total backpressure	70.00	(psi)
Consolidation Pressure	10.00	(psi)
B value	0.97	

Initial Conditions Top		
Wt. of Moist Soil + Tare	66.95	(g)
Wt. of Dry Soil + Tare	58.12	(g)
Wt. of Tare	11.60	(g)
Wt. of Moist Soil	55.35	(g)
Wt. of Dry Soil	46.52	(g)
Water Content, w%	18.98	(%)

Initial Conditions Bottom		
Wt. of Moist Soil + Tare	35.65	(g)
Wt. of Dry Soil + Tare	32.14	(g)
Wt. of Tare	11.14	(g)
Wt. of Moist Soil	24.51	(g)
Wt. of Dry Soil	21.00	(g)
Water Content, w%	16.71	(%)

Initial Conditions Average		
Dry Unit Weight	114.14	(pcf)
Wet Unit Weight	134.51	(pcf)
Saturation	100.00	(%)
Void Ratio	0.47	

After Consolidation		
t_{50} Using Casagrande Method	190.05	(min)
t_{50} Using Taylor Method	131.58	(min)
Volumetric Strain	0.90	(%)
Height After Consolidation	5.71	(in)
Area After Consolidation	6.66	(in^2)
Method Used:	Method B	

Specific Gravity	2.65	Assumed
Initial Height	5.730	(in)
Initial Diameter	2.869	(in)
Initial Sample Weight	1308.20	(g)

In-tube Density		
Tube Height	6.295	(in)
Tube Diameter	2.875	(in)
Wt. of Tube + Soil	1910.06	(g)
Wt. of Tube	465.17	(g)
Wt. of Soil	1444.89	(g)
Wet Unit Weight	134.69	(pcf)

Final Conditions		
Wt. of Moist Soil + Tare	896.20	(g)
Wt. of Dry Soil + Tare	788.70	(g)
Wt. of Tare	204.92	(g)
Wt. of Moist Soil	691.28	(g)
Wt. of Dry Soil	583.78	(g)
Water Content, w%	18.41	(%)
Dry Unit Weight	111.13	(pcf)
Wet Unit Weight	131.59	(pcf)
Saturation	100.00	(%)
Void Ratio	0.49	

Failure		
Failure Criteria	Max PSR	
Deviator Stress at failure	18.54	(psi)
Principal Stress Ratio at failure	3.86	
Minor Principal Effective Stress at fail.	6.48	(psi)
Major Principal Effective Stress at fail.	25.02	(psi)
Corrections Applied	Membrane and Area	
Axial Strain at failure	1.74	(%)

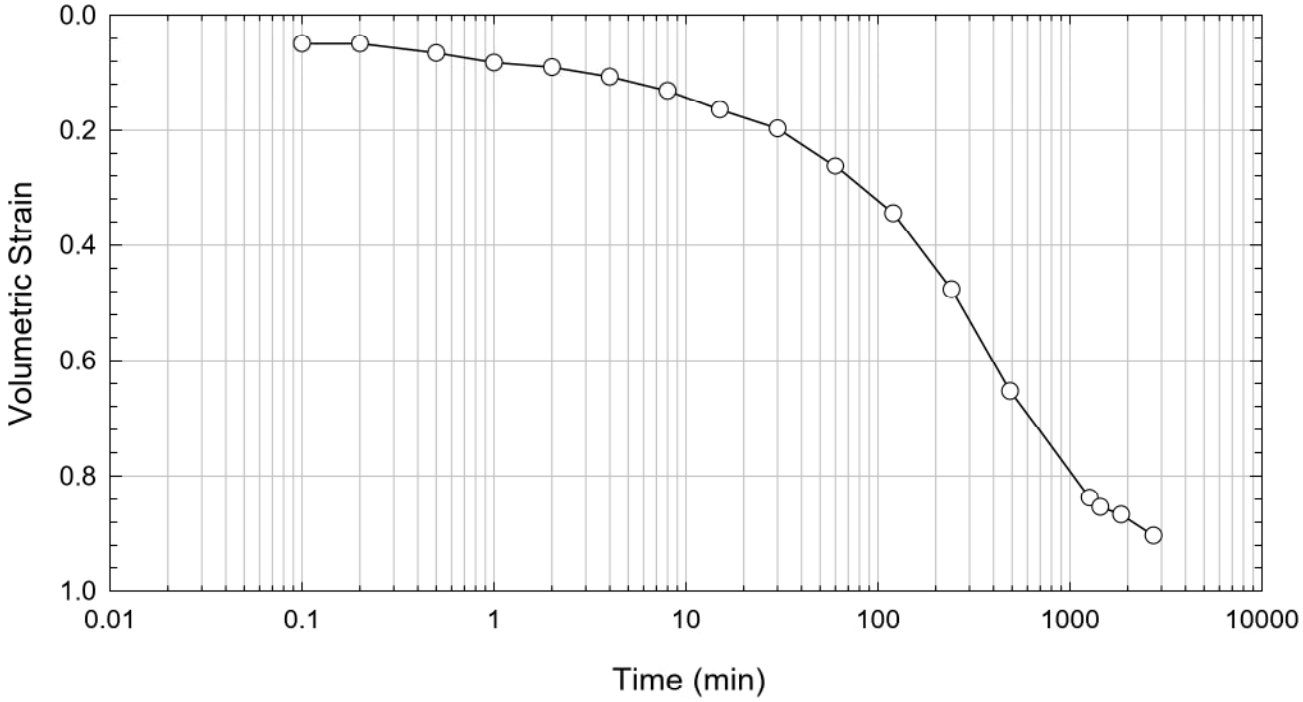
Test performed at strain rate =	0.10	%/hr.

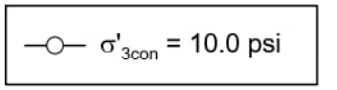
Comments: The final void ratio is higher than the initial void ratio. Owing to the difference in the water content from the top and the bottom, there is some uncertainty in the calculated initial water content as the average water content was used for calculations. Also, this being a hard clay, some swelling could have occured during backpressure saturation.

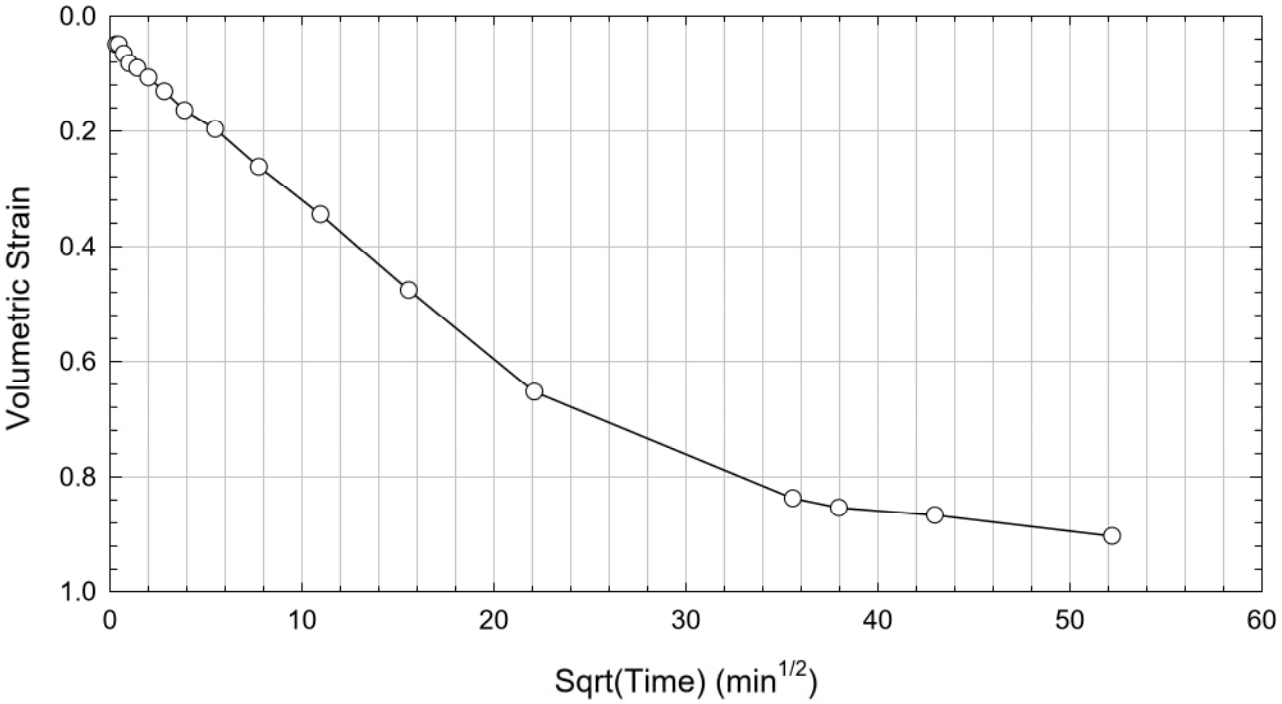
Boring: B110UA1-U1, Depth: 16 ft, Undisturbed, $\sigma'_{3\text{-con}}$ = 10.0 psi



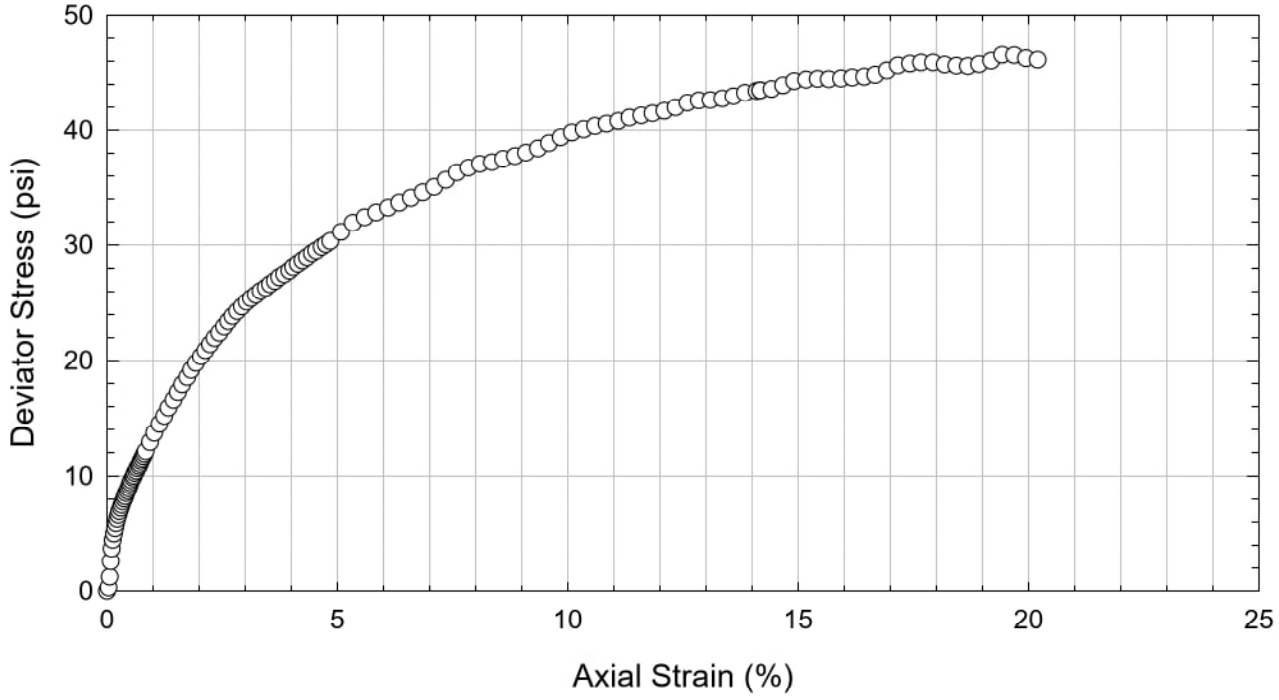
Boring: B110UA1-U1, Depth: 16 ft, Undisturbed

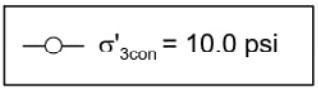


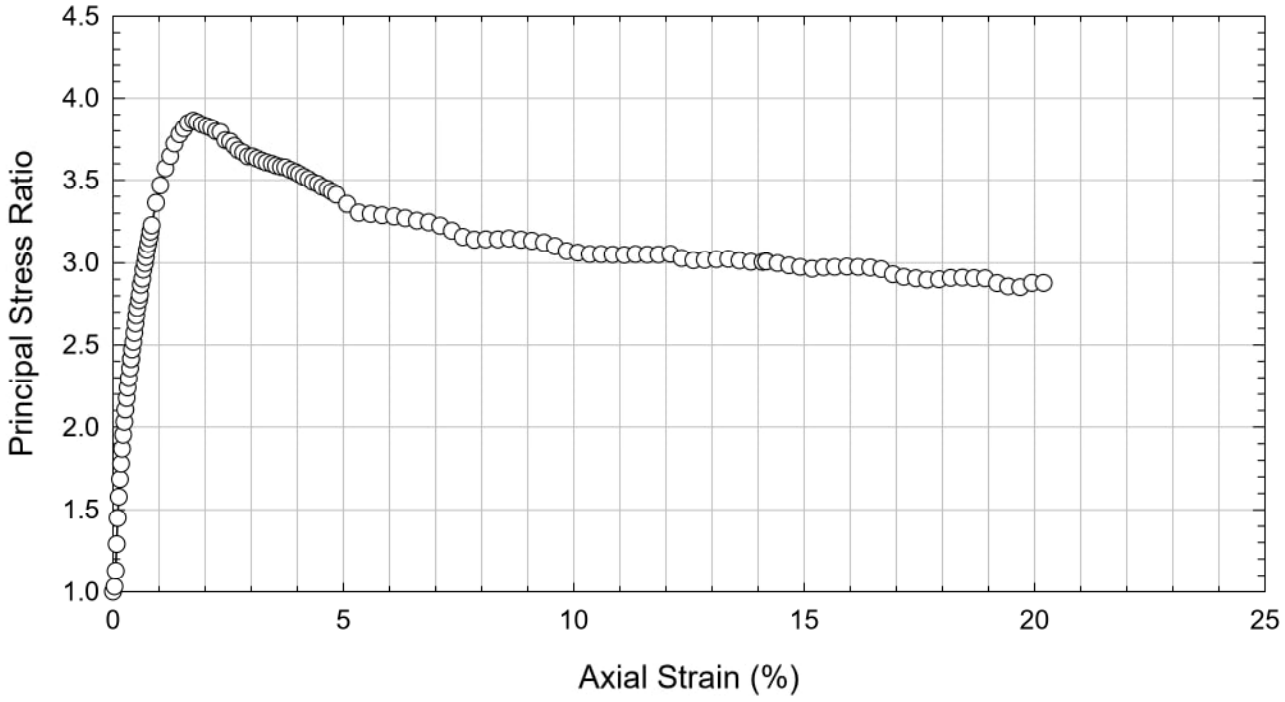




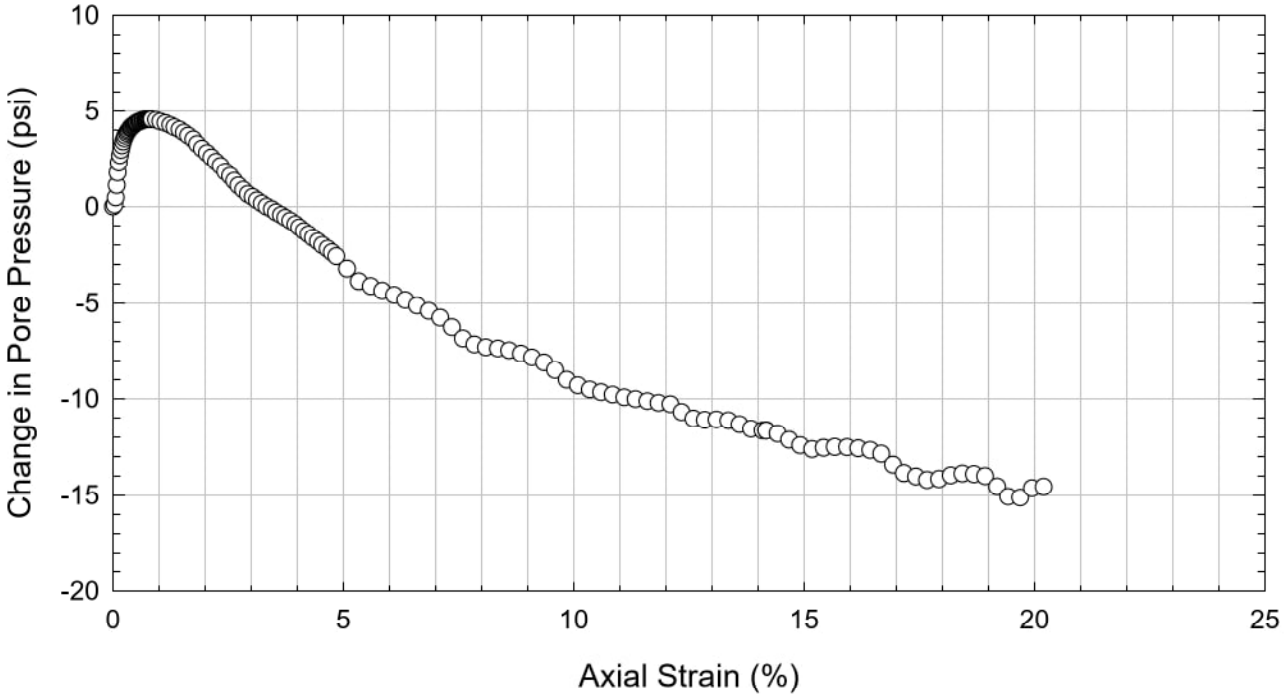
Boring: B110UA1-U1, Depth: 16 ft, Undisturbed

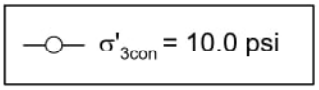


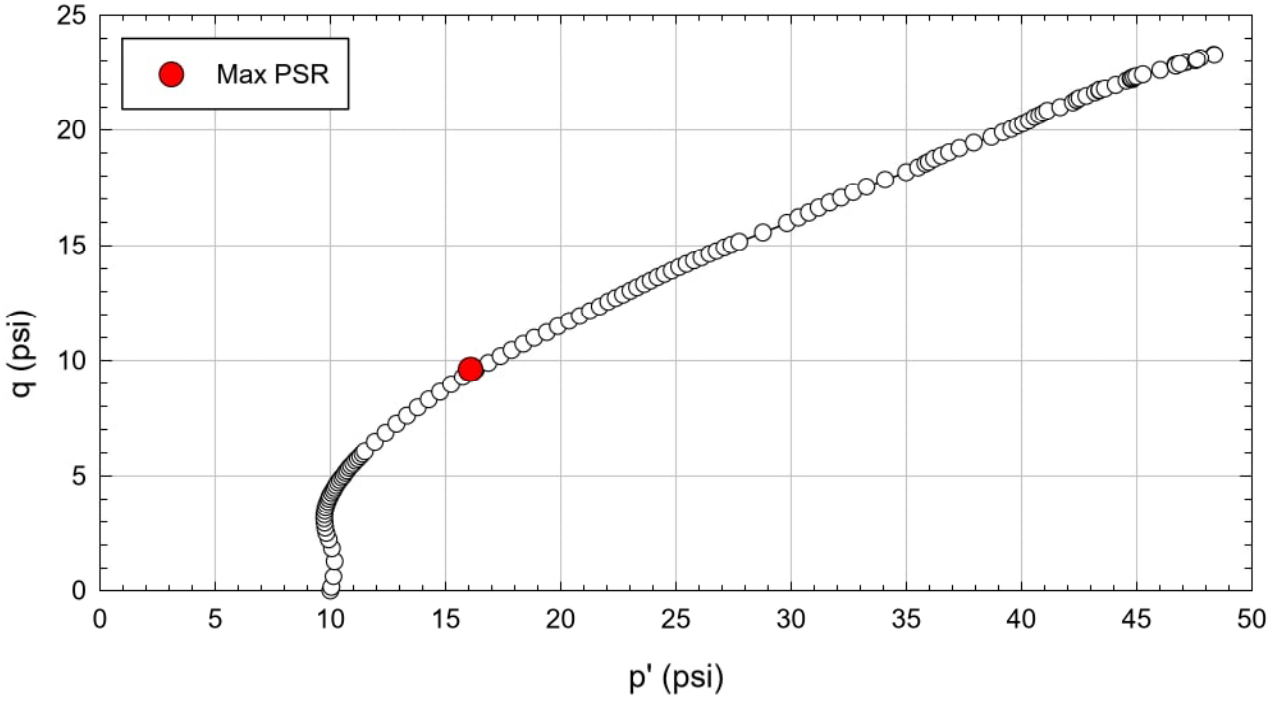


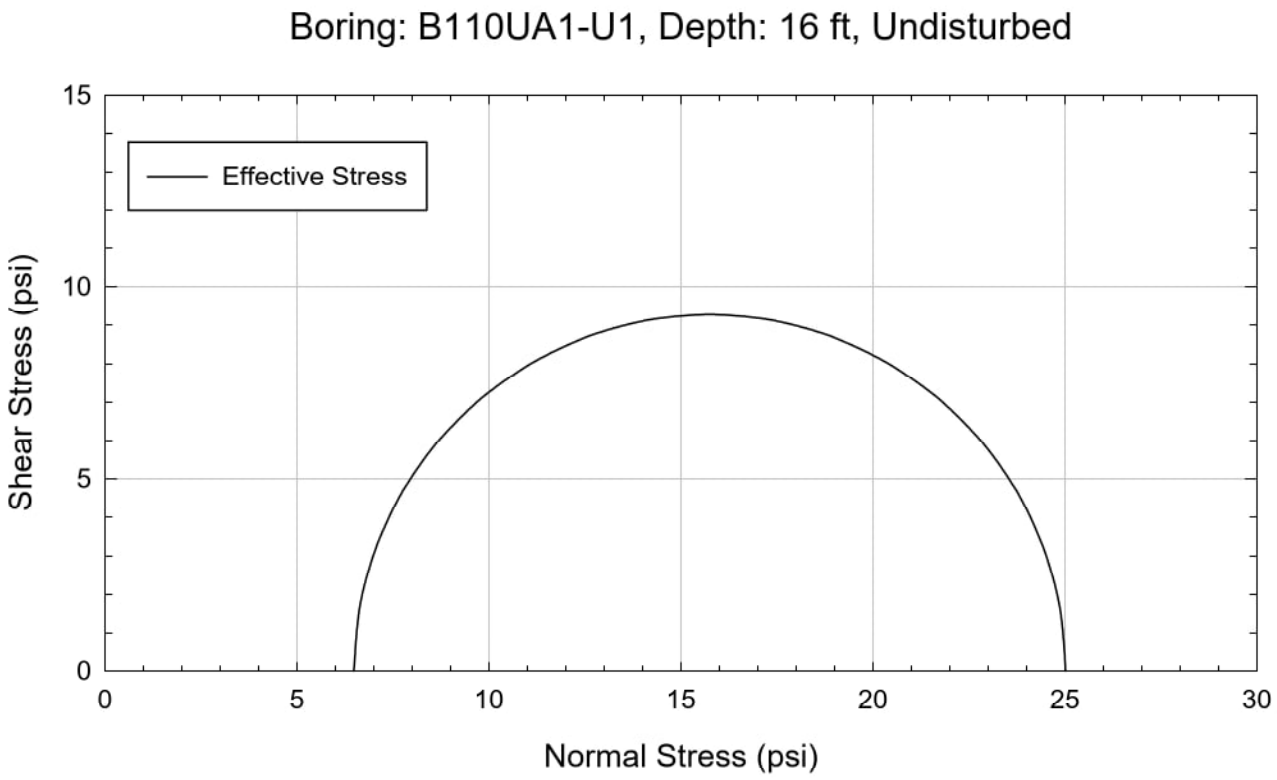


Boring: B110UA1-U1, Depth: 16 ft, Undisturbed









Note: The circle shown is based on the failure criterion of maximum principal stress ratio.

Virginia Polytechnic Institute and State University
Geotechnical Engineering Laboratory
Triaxial Data Sheet

Project:	GEI 001	Started:	12/2/17
Sample I.D./Loc.:	Boring: B113U-U2, Depth: 26.42 ft - 28.22 ft, Undisturbed	Finished:	12/5/17
Classification:	Brown greenish homogenous moist silty, clayey sand (SC-SM)		

Sample Preparation	Undisturbed	
Specimen Saturation Method	Wet	
Total backpressure	80.00	(psi)
Consolidation Pressure	35.00	(psi)
B value	0.97	

Initial Conditions Top		
Wt. of Moist Soil + Tare	148.65	(g)
Wt. of Dry Soil + Tare	131.79	(g)
Wt. of Tare	21.61	(g)
Wt. of Moist Soil	127.04	(g)
Wt. of Dry Soil	110.18	(g)
Water Content, w%	15.30	(%)

Initial Conditions Bottom		
Wt. of Moist Soil + Tare	167.39	(g)
Wt. of Dry Soil + Tare	146.35	(g)
Wt. of Tare	21.86	(g)
Wt. of Moist Soil	145.53	(g)
Wt. of Dry Soil	124.49	(g)
Water Content, w%	16.90	(%)

Initial Conditions Average		
Dry Unit Weight	111.81	(pcf)
Wet Unit Weight	129.82	(pcf)
Saturation	89.10	(%)
Void Ratio	0.48	

After Consolidation		
t_{50} Using Casagrande Method	8.00	(min)
t_{50} Using Taylor Method	4.29	(min)
Volumetric Strain	1.77	(%)
Height After Consolidation	5.69	(in)
Area After Consolidation	6.55	(in^2)
Method Used:	Method B	

Specific Gravity	2.65	Assumed
Initial Height	5.750	(in)
Initial Diameter	2.875	(in)
Initial Sample Weight	1272.00	(g)

In-tube Density		
Tube Height	7.020	(in)
Tube Diameter	2.875	(in)
Wt. of Tube + Soil	2091.20	(g)
Wt. of Tube	532.30	(g)
Wt. of Soil	1558.90	(g)
Wet Unit Weight	130.31	(pcf)

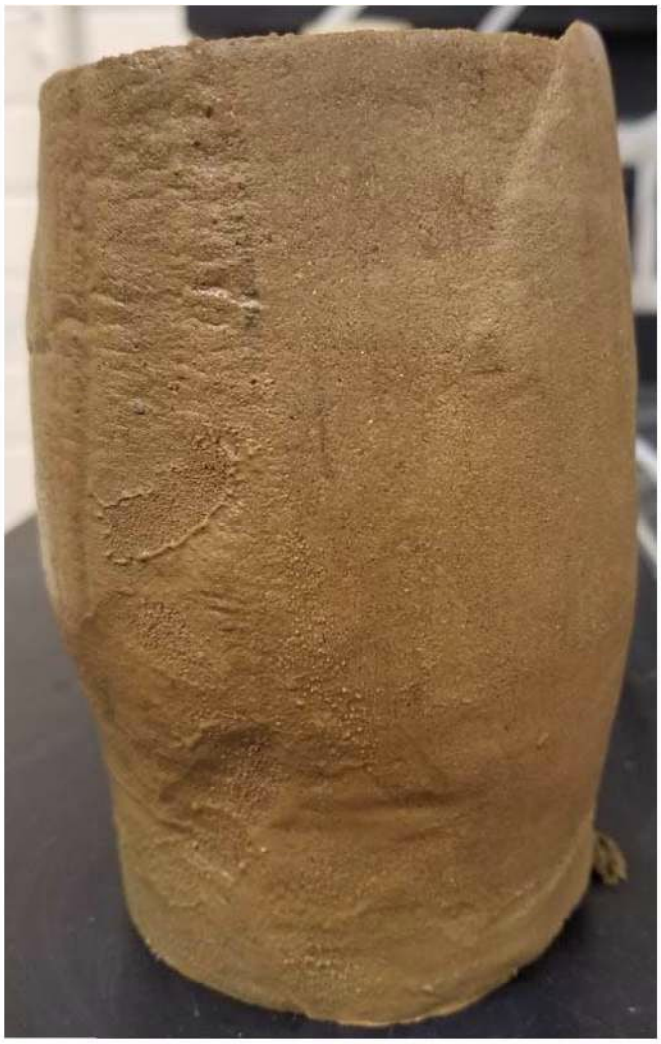
Final Conditions		
Wt. of Moist Soil + Tare	827.60	(g)
Wt. of Dry Soil + Tare	735.30	(g)
Wt. of Tare	223.20	(g)
Wt. of Moist Soil	604.40	(g)
Wt. of Dry Soil	512.10	(g)
Water Content, w%	18.02	(%)
Dry Unit Weight	111.91	(pcf)
Wet Unit Weight	132.08	(pcf)
Saturation	100.00	(%)
Void Ratio	0.48	

Failure		
Failure Criteria	Max PSR	
Deviator Stress at failure	60.02	(psi)
Principal Stress Ratio at failure	3.91	
Minor Principal Effective Stress at fail.	20.61	(psi)
Major Principal Effective Stress at fail.	80.63	(psi)
Corrections Applied	Membrane and Area	
Axial Strain at failure	4.57	(%)

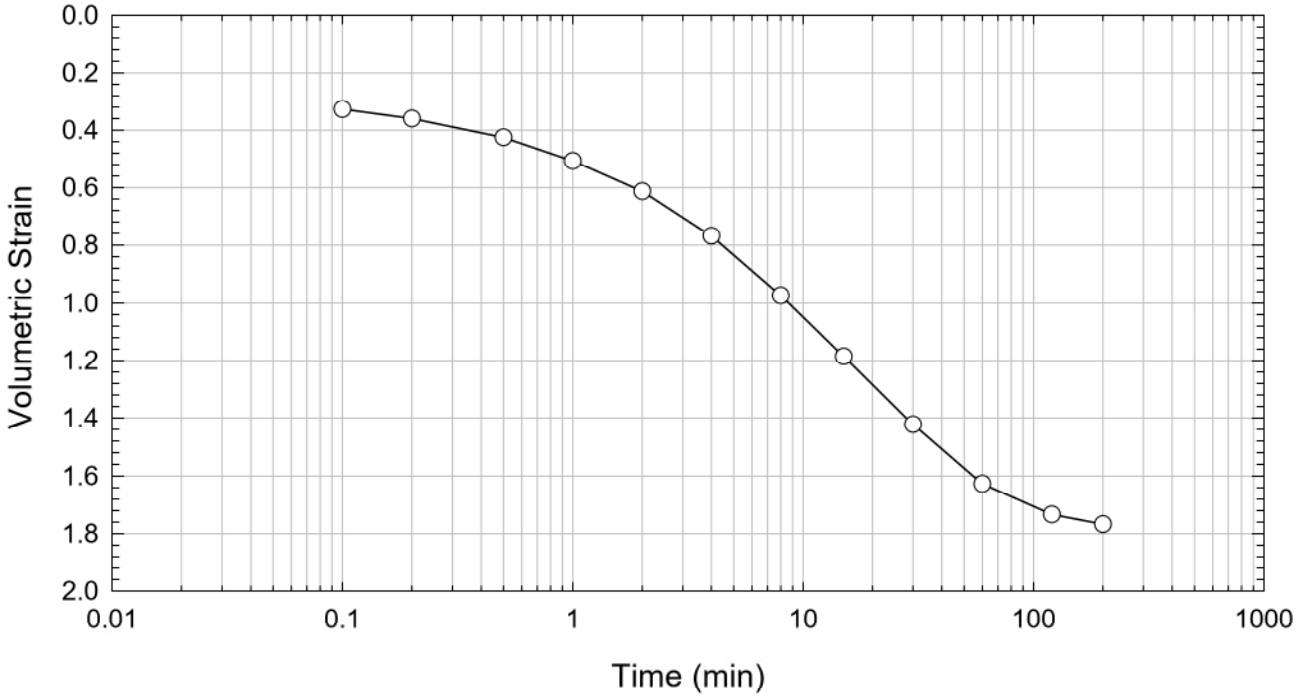
Test performed at strain rate =	1.00	%/hr.

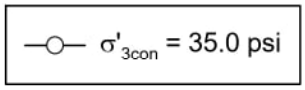
Comments: The final void ratio is equal than the initial void ratio. Owing to the difference in the water content from the top and the bottom, there is some uncertainty in the calculated initial water content as the average water content was used for calculations.

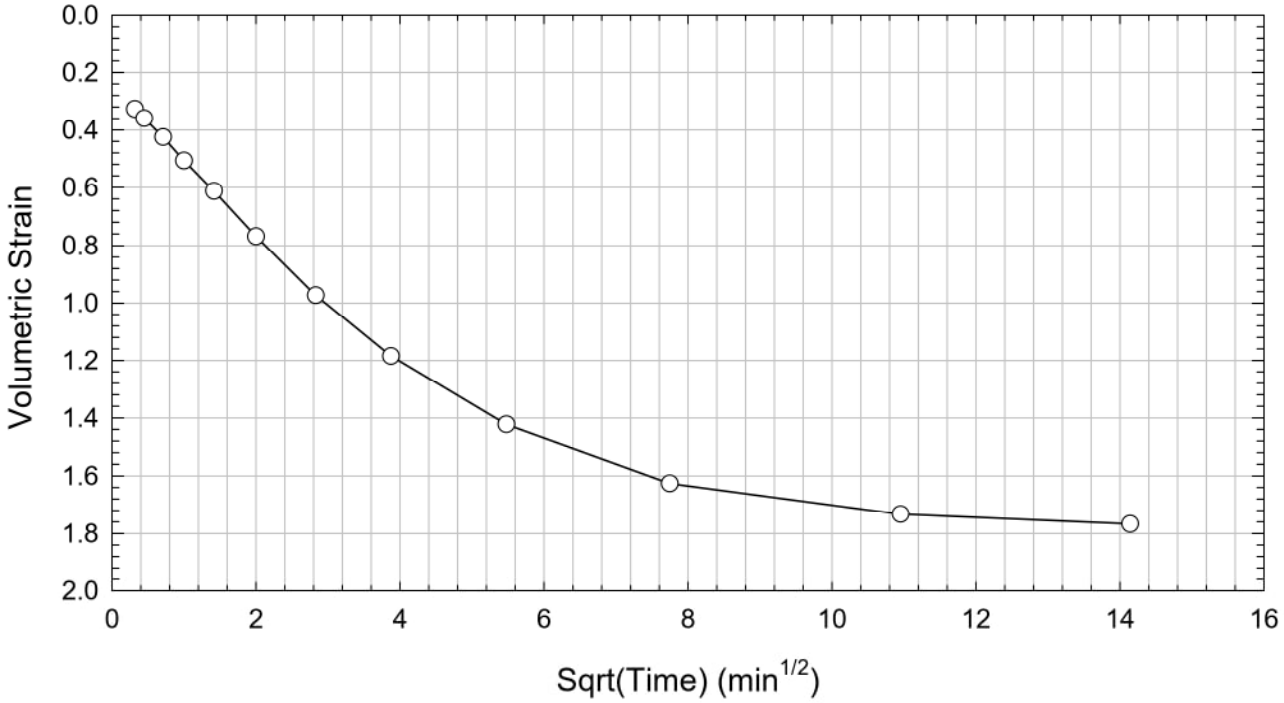
Boring: B113U-U2, Depth: 26.42 ft to 28.22 ft, Undisturbed, $\sigma'_{3\text{-con}}$ = 35.0 psi



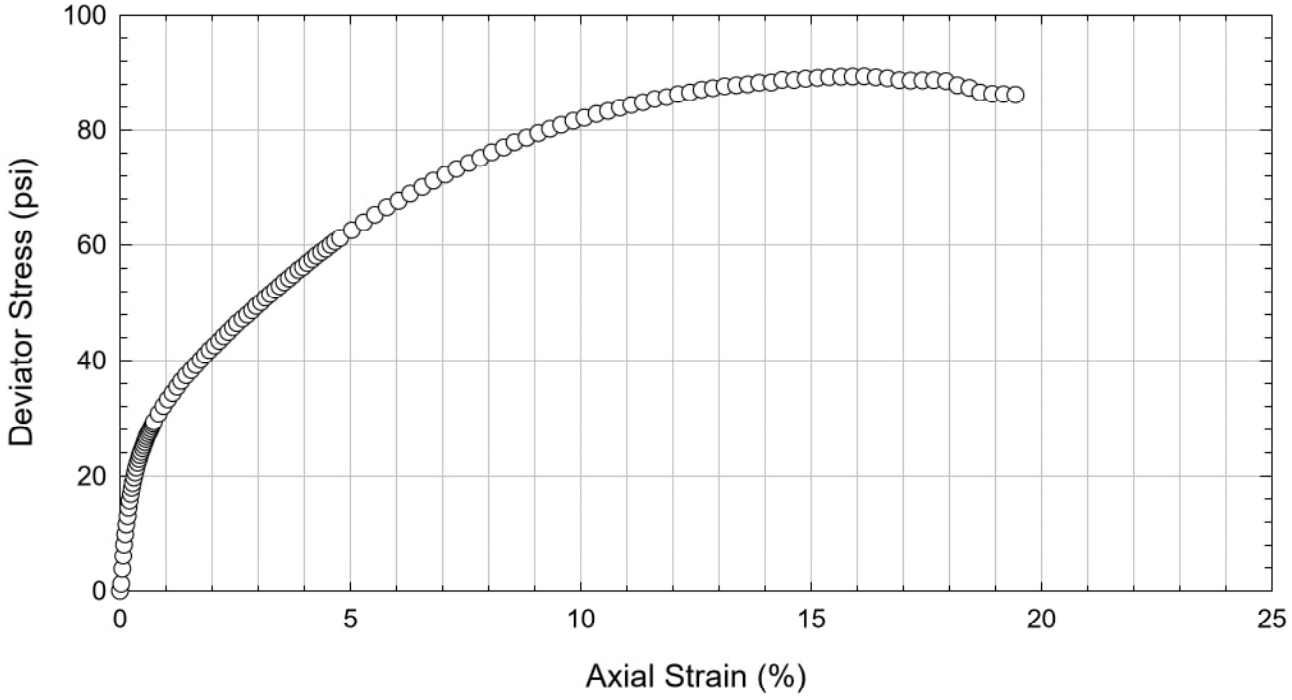
Boring: B113U-U2, Depth: 26.42 ft to 28.22 ft, Undisturbed

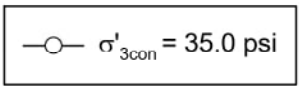


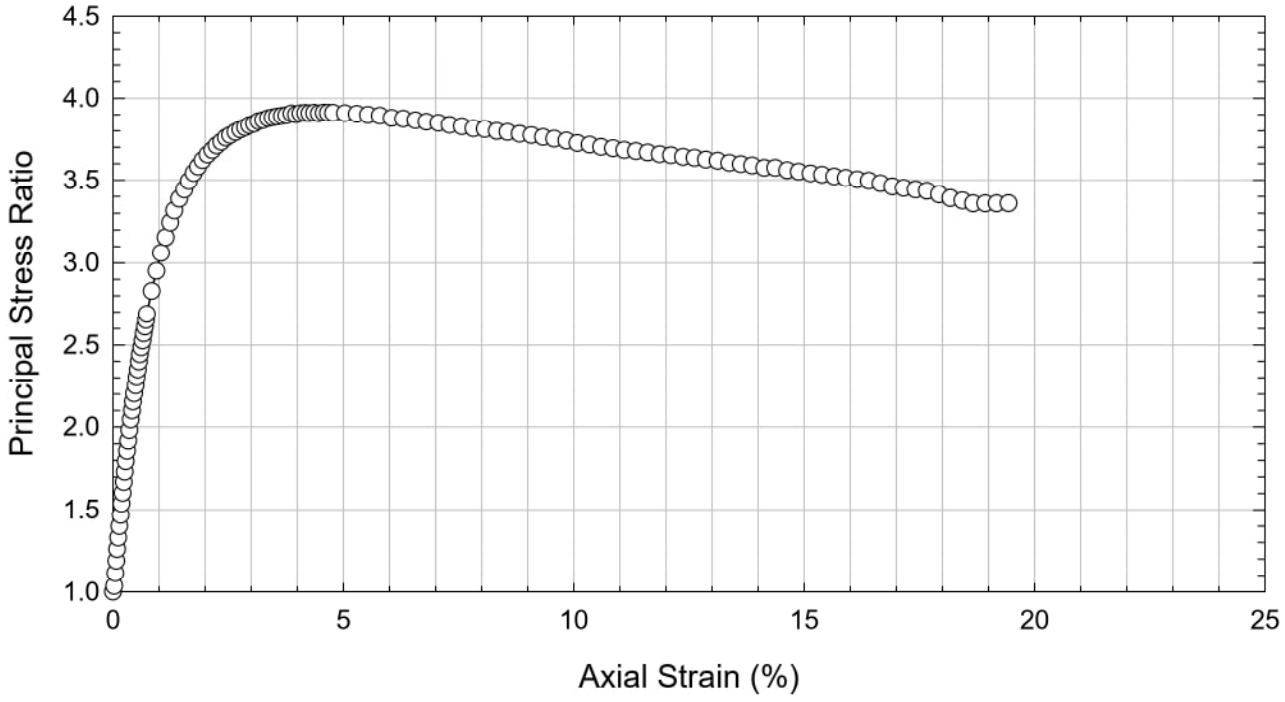




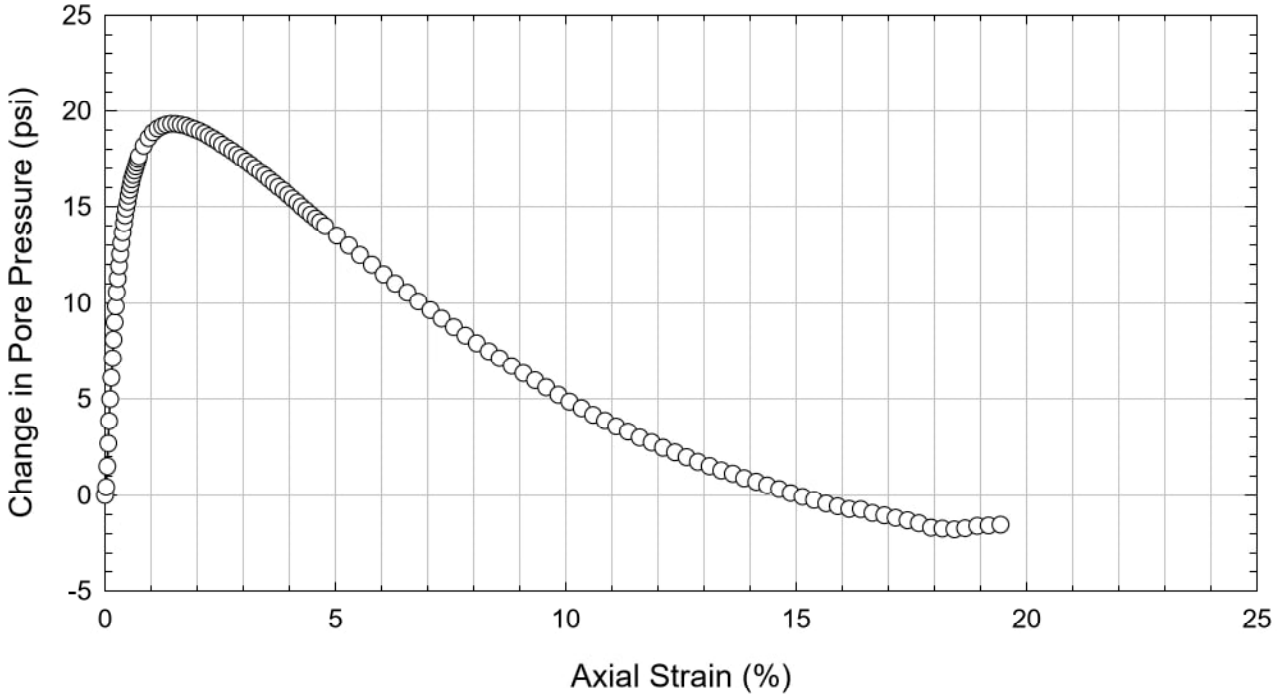
Boring: B113U-U2, Depth: 26.42 ft to 28.22 ft, Undisturbed

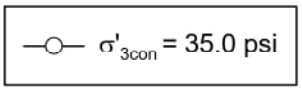


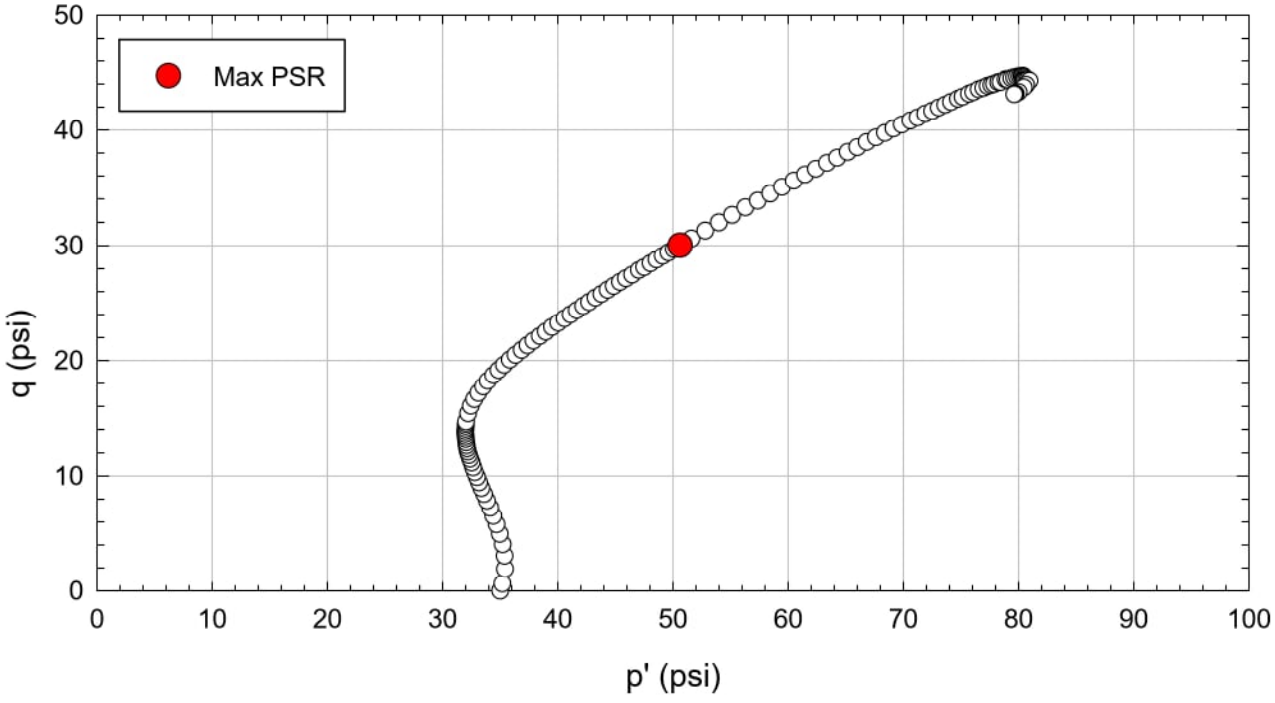




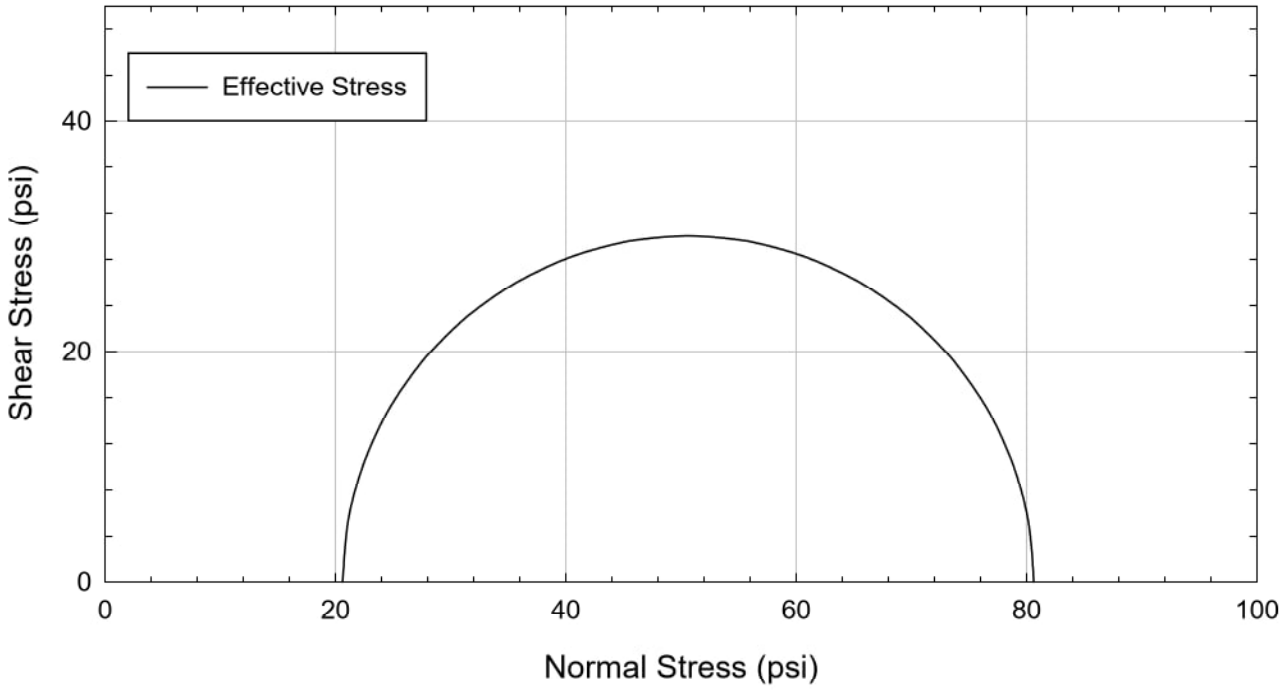
Boring: B113U-U2, Depth: 26.42 ft to 28.22 ft, Undisturbed



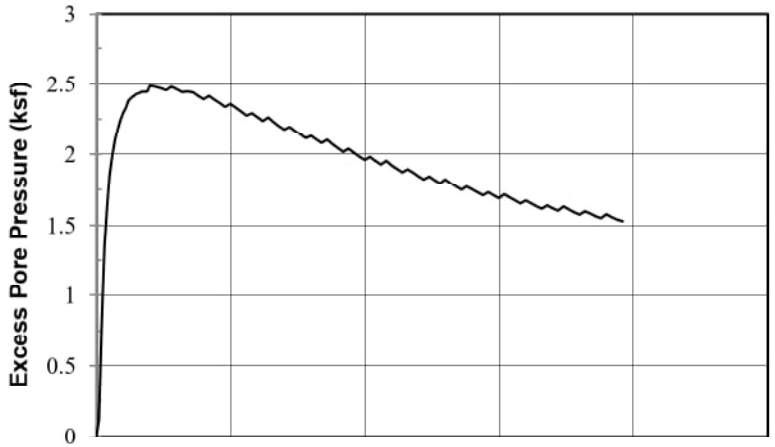




Boring: B113U-U2, Depth: 26.42 ft to 28.22 ft, Undisturbed



Note: The circle shown is based on the failure criterion of maximum principal stress ratio.



SAMPLE INFORMATION

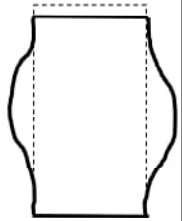
Boring: B110U Sample: U3 Depth (ft): 53.5 Test: R'7
Type: 2.8-inch-diameter tube sample
Description: SANDY LEAN CLAY (CL)

SPECIMEN INFORMATION (after saturation)

Height: 5.907 in Dia.: 2.861 in Area.: 6.485 sq. in
Water Content: 22.2% Dry Unit Weight: 106.2 pcf

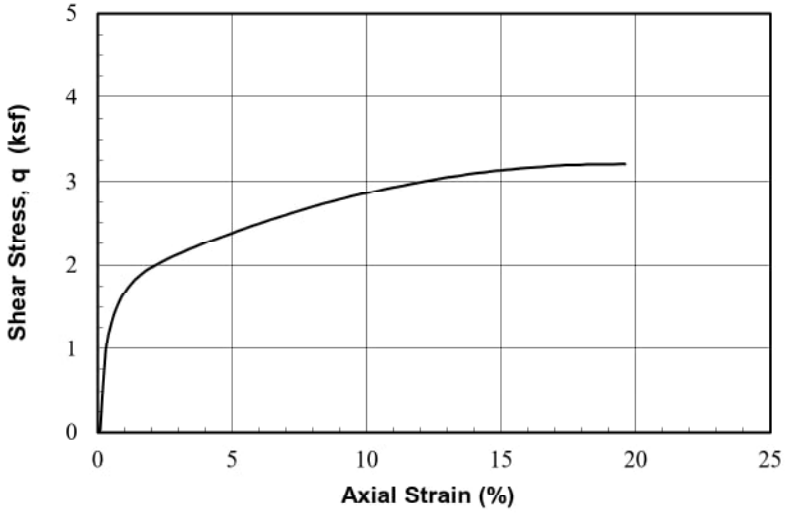
TEST SUMMARY (end of test)

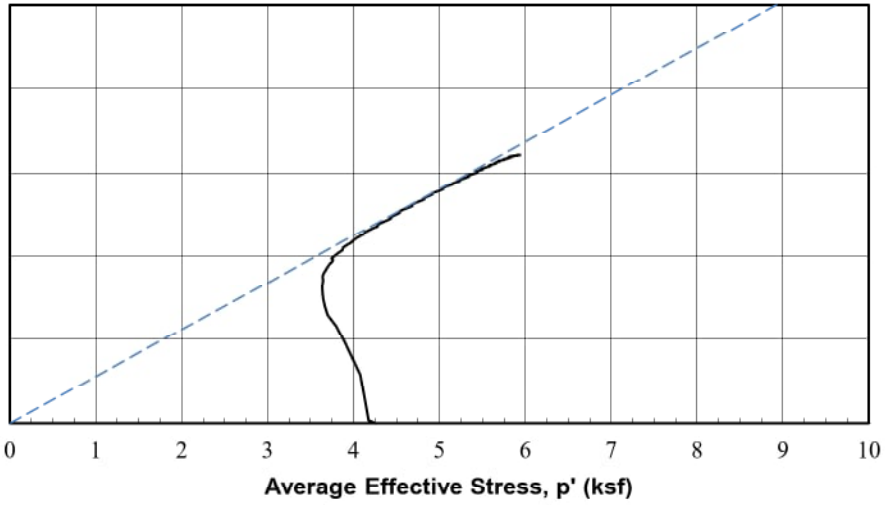
Effective Confining Stress: 4.26 ksf vertical, 4.26 ksf horiz.
Water Content: 21.5 % Dry Unit Weight: 107.4 pcf
B Coefficient: 0.95 Strain Rate: 0.014 %/min
Peak Shear Stress: 3.21 ksf @ 19.4 % Strain
Peak Friction Angle: 34.1 deg. @ 8.6 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked:
Test Date: 18-Dec-2017

3/15/2018 16:07

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-7

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'7												
BORING:	B110U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U3			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	53.5			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.906	2.876	6.498	22.15	106.3	129.8	0.603
TEST DATE:	12/18/2017			Under vac.	1.01	1.01	5.926	2.856	6.405	--	107.5	--	0.586
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	1.02	1.02	5.926	2.873	6.485	22.17	106.2	129.7	0.605
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
Pressure Transducer		25218		Consol. Stage 2	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
				Consol. Stage 4	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
				Consol. Stage 6	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
B value start shear		0.95											
Test Stage End of#	1			This Stage Initial Values	4.26	4.26	5.907	2.861	6.430	21.50	107.4	130.5	0.587
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		8.58 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.019	12.071	59.553	0.00	6.43	0.00	4.26	4.26	4.26	4.26	0.00	1.00	0.0	0.00
0.025	15.089	60.379	0.10	6.44	0.12	4.14	4.33	4.21	4.18	0.03	1.02	0.5	1.76
0.030	64.184	64.864	0.20	6.44	0.76	3.50	5.43	4.66	4.08	0.58	1.33	8.2	0.66
0.036	99.469	68.900	0.30	6.45	1.35	2.92	6.21	4.87	3.89	0.98	1.67	14.5	0.69
0.042	115.950	70.812	0.40	6.46	1.62	2.64	6.58	4.96	3.80	1.16	1.88	17.8	0.70
0.048	128.250	72.441	0.50	6.46	1.86	2.41	6.85	5.00	3.70	1.29	2.08	20.5	0.72
0.054	137.940	73.432	0.60	6.47	2.00	2.26	7.06	5.07	3.66	1.40	2.24	22.5	0.71
0.060	145.840	74.140	0.70	6.48	2.10	2.16	7.24	5.14	3.65	1.49	2.38	24.1	0.71
0.066	152.390	74.707	0.80	6.48	2.18	2.08	7.38	5.20	3.64	1.56	2.50	25.4	0.70
0.072	158.140	75.155	0.90	6.49	2.25	2.02	7.50	5.26	3.64	1.62	2.61	26.5	0.69
0.078	162.960	75.486	1.00	6.50	2.29	1.97	7.61	5.31	3.64	1.67	2.70	27.4	0.69
0.084	167.190	75.745	1.10	6.50	2.33	1.93	7.70	5.37	3.65	1.72	2.78	28.1	0.68
0.090	171.200	76.099	1.20	6.51	2.38	1.88	7.78	5.40	3.64	1.76	2.87	28.9	0.68
0.095	174.390	76.241	1.30	6.51	2.40	1.86	7.85	5.45	3.65	1.79	2.93	29.4	0.67
0.101	177.580	76.335	1.40	6.52	2.42	1.85	7.92	5.50	3.67	1.83	2.98	29.8	0.66
0.107	180.310	76.430	1.50	6.53	2.43	1.83	7.97	5.54	3.69	1.86	3.03	30.2	0.65
0.113	182.980	76.477	1.60	6.53	2.44	1.83	8.03	5.59	3.71	1.88	3.06	30.5	0.65

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.119	185.420	76.524	1.70	6.54	2.44	1.82	8.08	5.63	3.73	1.91	3.10	30.8	0.64
0.125	187.560	76.524	1.80	6.55	2.44	1.82	8.12	5.68	3.75	1.93	3.12	31.0	0.63
0.131	189.540	76.548	1.90	6.55	2.45	1.82	8.16	5.71	3.76	1.95	3.15	31.2	0.63
0.137	191.570	76.831	2.00	6.56	2.49	1.77	8.20	5.71	3.74	1.97	3.22	31.7	0.63
0.149	195.160	76.784	2.20	6.57	2.48	1.78	8.27	5.79	3.79	2.01	3.25	32.0	0.62
0.160	198.530	76.713	2.40	6.59	2.47	1.79	8.34	5.87	3.83	2.04	3.28	32.2	0.61
0.172	201.660	76.619	2.60	6.60	2.46	1.80	8.40	5.94	3.87	2.07	3.29	32.3	0.59
0.184	204.800	76.784	2.80	6.62	2.48	1.78	8.46	5.98	3.88	2.10	3.36	32.7	0.59
0.196	207.870	76.666	3.00	6.63	2.46	1.80	8.52	6.05	3.92	2.13	3.37	32.8	0.58
0.208	210.830	76.524	3.20	6.64	2.44	1.82	8.57	6.13	3.97	2.15	3.37	32.8	0.57
0.219	213.790	76.548	3.40	6.66	2.45	1.82	8.63	6.18	4.00	2.18	3.40	33.1	0.56
0.231	216.580	76.501	3.60	6.67	2.44	1.82	8.68	6.24	4.03	2.21	3.42	33.2	0.55
0.243	219.480	76.335	3.80	6.68	2.42	1.85	8.73	6.31	4.08	2.23	3.42	33.2	0.54
0.255	222.270	76.170	4.00	6.70	2.39	1.87	8.78	6.39	4.13	2.26	3.42	33.2	0.53
0.267	225.110	76.335	4.20	6.71	2.42	1.85	8.83	6.42	4.13	2.29	3.48	33.6	0.53
0.279	227.780	76.147	4.40	6.73	2.39	1.87	8.88	6.49	4.18	2.31	3.47	33.5	0.52
0.290	230.450	75.981	4.60	6.74	2.37	1.90	8.93	6.56	4.23	2.33	3.46	33.5	0.51
0.302	233.000	75.792	4.80	6.75	2.34	1.92	8.97	6.63	4.28	2.36	3.45	33.4	0.50
0.314	235.790	75.934	5.00	6.77	2.36	1.90	9.02	6.66	4.28	2.38	3.50	33.8	0.50
0.326	238.520	75.745	5.20	6.78	2.33	1.93	9.07	6.74	4.33	2.40	3.49	33.7	0.48
0.338	241.130	75.556	5.40	6.80	2.30	1.96	9.12	6.81	4.38	2.43	3.48	33.6	0.47
0.349	243.740	75.368	5.60	6.81	2.28	1.99	9.16	6.88	4.43	2.45	3.47	33.5	0.46
0.361	246.410	75.486	5.80	6.83	2.29	1.97	9.21	6.91	4.44	2.47	3.51	33.8	0.46
0.373	248.960	75.297	6.00	6.84	2.27	2.00	9.25	6.98	4.49	2.49	3.50	33.7	0.45
0.385	251.690	75.108	6.20	6.85	2.24	2.02	9.30	7.06	4.54	2.52	3.49	33.7	0.44
0.397	254.240	75.273	6.40	6.87	2.26	2.00	9.34	7.08	4.54	2.54	3.54	34.0	0.45
0.408	256.680	75.061	6.60	6.88	2.23	2.03	9.38	7.15	4.59	2.56	3.52	33.9	0.44
0.420	259.120	74.848	6.80	6.90	2.20	2.06	9.42	7.22	4.64	2.58	3.50	33.8	0.43
0.432	261.500	74.683	7.00	6.91	2.18	2.08	9.46	7.28	4.68	2.60	3.49	33.7	0.42
0.444	264.110	74.801	7.20	6.93	2.20	2.07	9.50	7.30	4.69	2.62	3.53	34.0	0.42
0.456	266.600	74.612	7.40	6.94	2.17	2.09	9.54	7.37	4.73	2.64	3.52	33.9	0.41
0.467	268.980	74.423	7.60	6.96	2.14	2.12	9.58	7.44	4.78	2.66	3.51	33.8	0.40
0.479	271.360	74.235	7.80	6.97	2.11	2.15	9.62	7.50	4.83	2.68	3.49	33.7	0.39
0.491	273.860	74.353	8.00	6.99	2.13	2.13	9.66	7.53	4.83	2.70	3.53	34.0	0.40
0.503	276.240	74.164	8.20	7.00	2.10	2.16	9.69	7.59	4.87	2.72	3.52	33.9	0.39
0.515	278.620	73.999	8.40	7.02	2.08	2.18	9.73	7.65	4.92	2.73	3.51	33.8	0.38
0.527	280.820	74.164	8.60	7.03	2.10	2.16	9.76	7.66	4.91	2.75	3.55	34.1	0.38
0.538	282.910	73.928	8.80	7.05	2.07	2.19	9.79	7.72	4.96	2.77	3.52	33.9	0.37
0.550	285.170	73.739	9.00	7.07	2.04	2.22	9.83	7.79	5.00	2.78	3.51	33.8	0.37
0.562	287.320	73.574	9.20	7.08	2.02	2.24	9.86	7.84	5.04	2.80	3.49	33.7	0.36

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.574	289.640	73.715	9.40	7.10	2.04	2.22	9.89	7.86	5.04	2.82	3.53	34.0	0.36
0.586	291.790	73.526	9.60	7.11	2.01	2.25	9.93	7.91	5.08	2.83	3.52	33.9	0.36
0.597	293.880	73.338	9.80	7.13	1.99	2.28	9.96	7.97	5.12	2.85	3.50	33.7	0.35
0.609	295.910	73.172	10.00	7.14	1.96	2.30	9.98	8.02	5.16	2.86	3.49	33.7	0.34
0.621	298.000	73.314	10.20	7.16	1.98	2.28	10.01	8.03	5.16	2.88	3.52	33.9	0.34
0.633	300.260	73.125	10.40	7.18	1.95	2.31	10.05	8.09	5.20	2.89	3.51	33.8	0.34
0.645	302.240	72.960	10.60	7.19	1.93	2.33	10.07	8.14	5.24	2.90	3.49	33.7	0.33
0.656	304.330	73.125	10.80	7.21	1.95	2.31	10.10	8.15	5.23	2.92	3.53	33.9	0.33
0.668	306.240	72.913	11.00	7.22	1.92	2.34	10.13	8.20	5.27	2.93	3.51	33.8	0.33
0.680	308.100	72.748	11.20	7.24	1.90	2.36	10.15	8.25	5.31	2.94	3.49	33.7	0.32
0.692	310.070	72.582	11.40	7.26	1.88	2.39	10.18	8.30	5.34	2.96	3.48	33.6	0.32
0.704	312.160	72.724	11.60	7.27	1.90	2.37	10.20	8.31	5.34	2.97	3.51	33.8	0.32
0.716	313.960	72.559	11.80	7.29	1.87	2.39	10.23	8.35	5.37	2.98	3.50	33.7	0.31
0.727	315.760	72.393	12.00	7.31	1.85	2.41	10.25	8.40	5.41	2.99	3.48	33.6	0.31
0.739	317.670	72.228	12.20	7.32	1.83	2.44	10.27	8.45	5.44	3.00	3.47	33.5	0.30
0.751	319.530	72.370	12.40	7.34	1.85	2.42	10.29	8.45	5.43	3.02	3.50	33.7	0.31
0.763	321.500	72.205	12.60	7.36	1.82	2.44	10.32	8.50	5.47	3.03	3.48	33.6	0.30
0.775	323.190	72.039	12.80	7.37	1.80	2.46	10.34	8.54	5.50	3.04	3.47	33.5	0.30
0.786	325.040	72.228	13.00	7.39	1.83	2.44	10.36	8.54	5.49	3.05	3.50	33.8	0.30
0.798	326.670	72.039	13.20	7.41	1.80	2.46	10.38	8.58	5.52	3.06	3.48	33.6	0.29
0.810	328.350	71.874	13.40	7.42	1.77	2.49	10.40	8.62	5.56	3.07	3.47	33.5	0.29
0.822	330.270	71.709	13.60	7.44	1.75	2.51	10.42	8.67	5.59	3.08	3.45	33.4	0.28
0.834	331.890	71.874	13.80	7.46	1.77	2.49	10.44	8.66	5.58	3.09	3.48	33.6	0.29
0.845	333.460	71.733	14.00	7.48	1.75	2.51	10.45	8.70	5.60	3.10	3.47	33.5	0.28
0.857	334.970	71.591	14.20	7.49	1.73	2.53	10.47	8.73	5.63	3.10	3.45	33.4	0.28
0.869	336.480	71.449	14.40	7.51	1.71	2.55	10.48	8.77	5.66	3.11	3.44	33.3	0.28
0.881	338.220	71.591	14.60	7.53	1.73	2.53	10.50	8.77	5.65	3.12	3.47	33.5	0.28
0.893	339.670	71.449	14.80	7.55	1.71	2.55	10.51	8.80	5.67	3.13	3.45	33.4	0.27
0.904	341.060	71.308	15.00	7.56	1.69	2.57	10.53	8.83	5.70	3.13	3.44	33.3	0.27
0.916	342.390	71.497	15.20	7.58	1.72	2.54	10.54	8.82	5.68	3.14	3.47	33.5	0.27
0.928	343.850	71.331	15.40	7.60	1.70	2.57	10.55	8.85	5.71	3.14	3.45	33.4	0.27
0.940	345.240	71.190	15.60	7.62	1.68	2.59	10.56	8.88	5.74	3.15	3.43	33.3	0.27
0.952	346.750	71.048	15.80	7.64	1.66	2.61	10.57	8.92	5.76	3.16	3.42	33.2	0.26
0.964	348.140	71.190	16.00	7.65	1.68	2.59	10.58	8.91	5.75	3.16	3.44	33.4	0.27
0.975	349.360	71.048	16.20	7.67	1.66	2.61	10.59	8.94	5.77	3.17	3.43	33.3	0.26
0.987	350.580	70.906	16.40	7.69	1.63	2.63	10.60	8.97	5.80	3.17	3.41	33.1	0.26
0.999	351.970	70.788	16.60	7.71	1.62	2.64	10.61	8.99	5.82	3.17	3.40	33.1	0.25
1.011	353.420	70.954	16.80	7.73	1.64	2.62	10.62	8.98	5.80	3.18	3.43	33.2	0.26
1.023	354.700	70.812	17.00	7.75	1.62	2.64	10.63	9.01	5.83	3.18	3.41	33.1	0.25
1.034	355.740	70.694	17.20	7.77	1.60	2.66	10.64	9.03	5.84	3.19	3.40	33.0	0.25

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.046	356.960	70.906	17.39	7.78	1.63	2.63	10.64	9.01	5.82	3.19	3.43	33.3	0.26
1.058	357.950	70.765	17.59	7.80	1.61	2.65	10.65	9.03	5.84	3.19	3.41	33.1	0.25
1.070	358.990	70.623	17.79	7.82	1.59	2.67	10.65	9.06	5.86	3.19	3.39	33.0	0.25
1.082	360.210	70.505	17.99	7.84	1.58	2.69	10.66	9.08	5.88	3.20	3.38	32.9	0.25
1.094	361.370	70.670	18.20	7.86	1.60	2.66	10.66	9.06	5.86	3.20	3.40	33.1	0.25
1.105	362.300	70.552	18.40	7.88	1.58	2.68	10.66	9.08	5.88	3.20	3.39	33.0	0.25
1.117	363.230	70.434	18.60	7.90	1.57	2.70	10.66	9.10	5.90	3.20	3.37	32.9	0.24
1.129	364.220	70.340	18.79	7.92	1.55	2.71	10.67	9.11	5.91	3.20	3.36	32.8	0.24
1.141	365.260	70.529	18.99	7.94	1.58	2.68	10.67	9.09	5.89	3.20	3.39	33.0	0.25
1.153	366.300	70.387	19.19	7.96	1.56	2.70	10.67	9.11	5.91	3.21	3.37	32.9	0.24
1.164	367.230	70.269	19.39	7.98	1.54	2.72	10.67	9.13	5.92	3.21	3.36	32.8	0.24
1.176	368.100	70.175	19.59	8.00	1.53	2.73	10.67	9.14	5.94	3.21	3.35	32.7	0.24
1.177	368.100	70.175	19.61	8.00	1.53	2.73	10.67	9.14	5.94	3.20	3.35	32.7	0.24

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'7		Ground Surface Elevation
BORING:	B110U		Elevation Datum
SAMPLE:	U3		
DEPTH:	53.5	Elevation:	
TEST DATE:	18-Dec-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	W. Lukas		
Checked By:			
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	SANDY LEAN CLAY (CL)		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	A8897		
Load Calibration Factor:	0.058033	lb/cnt	
Pressure ID:	25218		
Pressure Cal. Fator	0.023604	psi/cnt	
Displacement ID:	147		
Displacement Cal. Factor:	0.000067108	inch/cnt	

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.7	VC:	-3.1073
Penetration, cm:	42.70		
Gross Recovery, cm:	40.80		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	0.9689
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	18.2				18.2	cm
TOP EMPTY LENGTH	1.6				1.6	cm
BOT. EMPTY LENGTH	1.6				1.6	cm
TUBE INNER DIAMETER	7.306	7.315	7.297		7.306	cm

In tube length	15.00	cm
Tube Diameter	7.306	cm
Tube Area	41.92	(cm^2)
Tube Volume	628.84	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.356	7.358	7.367		7.360	cm
MEMBRANE 1 THICKNESS	0.072	0.07	0.075		0.072	cm
MEMBRANE 2 THICKNESS	0.034	0.035	0.034		0.034	cm
HEIGHT WITH SPECIMEN	13.624	13.742	13.637	13.716	13.680	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.805	8.749	8.803	8.797	8.789	cm

#filter strips	0		
Hi	15.051	cm	
Di	7.254	cm	2.07498507
Ai	41.324	cm^2	
Vi	621.982	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	304.200	100.460	*******	1856.000	*******	1666.220	988.690	*******
DRY+T	279.300	87.730		*******	0.000	*******	880.270	193.130
T	165.110	31.410		548.030	0.000	369.660	369.660	191.780
Wt. Solids	114.19	56.32	0	1307.97	0	1070.82	510.61	1.35
w %	21.81	22.60	*******	22.15	*******	21.23	21.23	*******

FINAL B VALUE 0.95

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	60.19	67.29	0.000	-7.684	0.000	0.000	-0.062	7.10	7.10
Consolidation Stage 1	59.55	89.15	0.000	7.236	0.047	0.047	0.058	29.60	29.60
2	59.55	89.15	0.000	0.000	0.000	0.000	0.000	29.60	29.60
3	59.55	89.15	0.000	0.000	0.000	0.000	0.000	29.60	29.60
4	59.55	89.15	0.000	0.000	0.000	0.000	0.000	29.60	29.60
5	59.55	89.15	0.000	0.000	0.000	0.000	0.000	29.60	29.60
6	59.55	89.15	0.000	0.000	0.000	0.000	0.000	29.60	29.60
Start Shear	59.55	89.15	0.000	**********	**********			29.60	29.60
End Shear				2.814	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							0.9689	1.65	103.0	0.655	
after sampling		0.00	0.00							1.0000	1.70	106.3	0.603	
after shipping		0.00	0.00							1.0000	1.70	106.3	0.603	
in tube before extrusion		0.00	0.00	15.00	7.306	41.923	628.84	1070.82	22.15	*****	1.70	106.3	0.603	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.051	7.254	41.324	621.982	1070.824	*****	*****	1.72	107.5	0.586	
saturation		7.10	7.10	15.051	7.298	41.835	629.666	1070.824	22.172		1.70	106.2	0.605	
	1	29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
	2	29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
	3	29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
	4	29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
	5	29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
	6	29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
Start Shear		29.60	29.60	15.004	7.268	41.484	622.430	1070.824	21.496	*****	1.72	107.4	0.587	
End Shear		**********	**********				619.616	1070.824	21.233	*****	1.73	107.9	0.580	0.579672549

Test comp (c) or ext (c) c

DEFORMATION RATE 1	0.02064797	mm/min	0.0138	%/min
DEFORMATION RATE 2	0.00081291	in/min	0.000137614	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R17
Boring	B110
Sample	U3
Depth	53.5 ft
By	WSL
Date	12/13/17
Checked	
Date	

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #		CW-3		
Wet Wt. + Tare (g)		100.46		
Dry Wt. + Tare (g)		87.73		
Wt. Water (g)		12.73		
Tare (g)		31.41		
Dry Wt. Soil (g)		56.32		
Water Content (%)		22.6		

Trimmed Length in Tube

Overall Tube Length					cm	Avg.	18.2 cm
Top Empty Length					cm	Avg.	1.6 cm
Bottom Empty Length					cm	Avg.	1.6 cm

Trimmed Length in Tube, L: 15.0 cm

Tube Dimensions

Tube Inner Diameter	7.306	7.315	7.297		cm	Avg.	7.306 cm

Tube Weight (g): 548.03

Weight of other (specify: —) (g): 0

Area, A: 41.92 cm^2

Volume in Tube = A x L: 628.84 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1666.22	g
~~Membrane~~	369.66	g
W_{moist}	1296.56	g

Dry Wt. Of Excess Solids

Tare #	EF-27	~~g~~
Dry + Tare	193.13	g
Tare	191.78	g
Dry Wt. Of Excess	1.35	g

Water Content

(Fraction Used: 1/2)

Tare #	GEI-3	
Wet + Tare	988.69	g
Dry + Tare	880.27	g
Wt. Water	108.42	g
Tare	369.66	g
Wt. Dry Soil	510.61	g
Water Content	21.2	%

$W_s = W_{moist} / (1 + wc) +$ Dry Wt of Excess = 1071.12 g

Estimate of γ_d using γ_m in tube

Moist soil + tube + ~~other~~ (specify:)	1856.00	g
Tube + ~~other~~	548.03	g
Moist soil	1307.97	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.080 g/cm^3 / 129.9 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.703 g/cm^3 / 106.3 pcf

Remarks:

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Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'7
Boring	B110
Sample	U3
Depth	53.5'
By	WGL
Date	12/15/17
Checked	
Date	

Undisturbed Specimen ✓
Remolded or compacted Specimen

Filter Strips? Yes ✓ No
Lubricated End Platens? Yes No ✓

SPECIMEN DIMENSIONS

Diameter Tape #

Diameter over ___ membranes	7.356	7.358	7.367		Avg.	7.360 cm
Twice thickness ___ membranes	0.072	0.070	0.075		Avg.	-0.072 cm
	0.034	0.035	0.034		Avg.	-0.034 cm

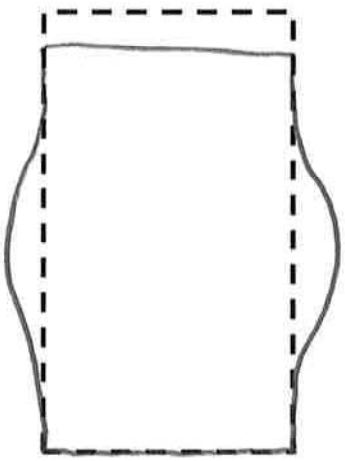
Diameter of Specimen	7.254 cm
Diameter of Specimen	2.856 inch
Area of Specimen	41.33 cm^2

Height Caliper #

Height from top gauge block to top of top platen, with specimen	13.624	13.742	13.637	13.716	Avg.	13.680 cm
Height of Gauge Block						+10.160 cm
Height from top of top platen to cell base, without specimen	8.805	8.749	8.803	8.797	Avg.	-8.789 cm

Height of Specimen in Cell	15.051 cm
Height of Specimen in Cell	5.926 inch
Volume in cell, initial	622.03 cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Bulging

Test Notes & Remarks:

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Saturation and Consolidation Data

Panel No. 1

Pressure Trans: SN 25218 Factor $2.3604e^{-2}$ Gain = 8
Load Trans: SN A8897 Factor $5.8033e^{-2}$ Gain = 8
Displ. Trans: SN 147 Factor $6.7108e^{-5}$ Gain = 64

Project No.	1700685
Test No.	R'7
Boring	B110U
Sample	U3
Depth	53,5'
By	WGL
Date	12/18/17
Page	

Date	Time	Load (lb)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )	
			0					-7		0	
								0		7	
12/18	1210	0				21.9		0.94		7.79	
						21.3		10.17		16.81	
	1455					21.4		10.76		17.30	
						21.1		20.23		26.63	
	1710					21.2		20.16		26.65	
						21.1		30.14		37.25	
12/19	810					21.0		30.12		37.03	
						21.0	B=0.88	40.20	39.06	47.21	
	1720					21.1		40.32		47.18	
						21.0	B=0.93	50.82	50.13	57.78	
12/20	800					20.9		50.72		57.74	
						20.9	B=0.95	60.19	59.77	67.29	
			DRAIN	PRIOR	TO CONS.	10.1		60.00		67.18	
									→	89.63	target
			CONSOL					59.98		89.55	
	1315		SHEAR			15.5		59,55		89.15	
			0.0185								
12/21	1300	POST TEST REBOUND				16.1		59.39		88.99	
	1307					17.5					
						18.2					

TEST REMARKS

$\bar{\sigma}_c$ = 4270 psf = 29.6 psi

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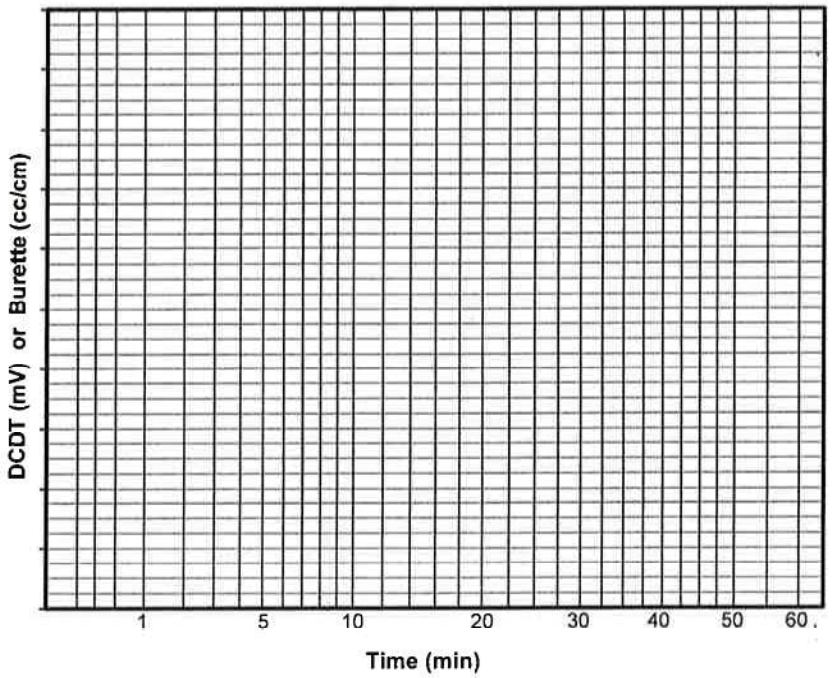
Consolidation Worksheet

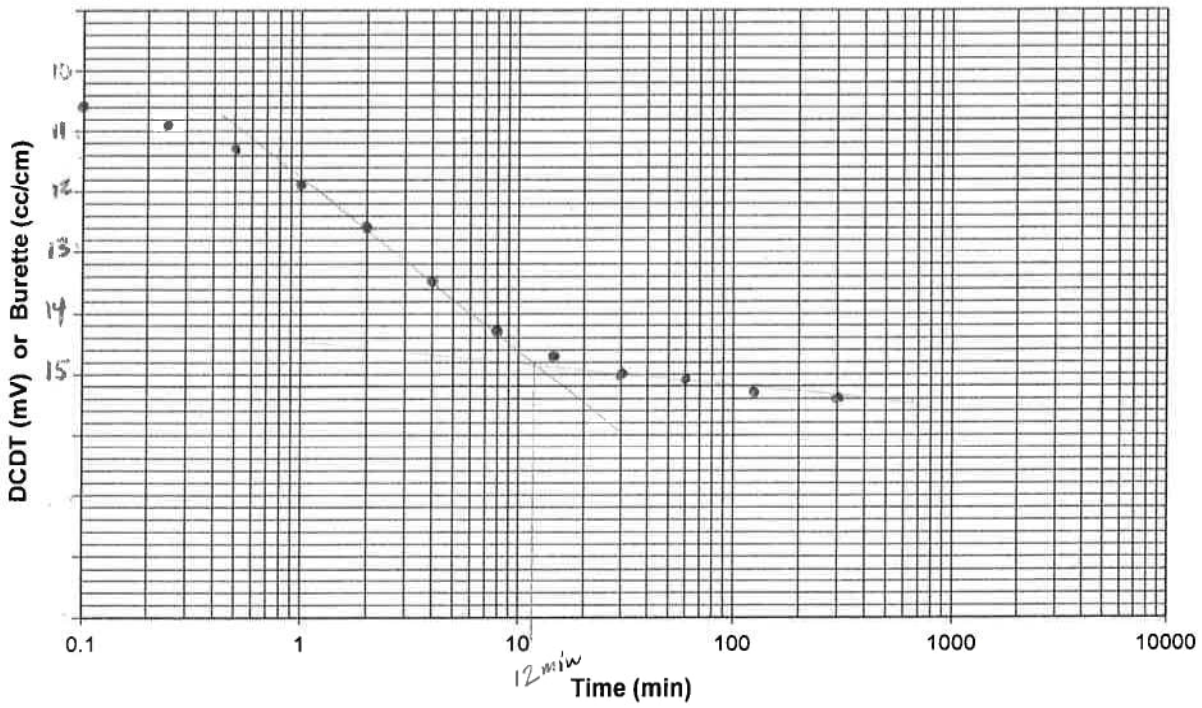
Project No.	1700685
Test	R'7
Boring	B11OU
Sample	U3
By	WBL
Date	12/26/17
Checked	
Date	

Hanger Load _____ kg DCDT # _____

Loading Device _____ Channel _____

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
804	0	10.1
	0.1	10.6
	0.25	10.9
	0.5	11.3
805	1	11.9
806	2	12.6
808	4	13.5
812	8	14.3
819	15	14.7
834	30	15.0
904	60	15.1
1004	120	15.3
1304	300	15.4





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R17
Boring	B110
Sample	U3
Depth	53.5'
By	WGL
Date	12/20/17
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #	1				
Initial Specimen Height in Cell	15.051	cm			
Height Change during Consolidation	0.047	cm	=	0.0185	inch
Specimen Height, **A**	15.004	cm	=	5.907	inch
Estimated T_{100}, **B**	12	min			
Estimated Fail Strain, **C**	4.0	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.238	mm / min	=	0.00938	inch / min
Actual Deformation Rate, **E**	0.0208	mm / min	=	0.00082	inch / min
Strain Rate = (**E** / **A**) *10	0.0139	% / min			

$$\frac{(15.004)(20\%)}{1440\,min}\left(\frac{10\,mm}{1\,cm}\right) = 0.0208\ mm/min$$ ✓

TEST REMARKS

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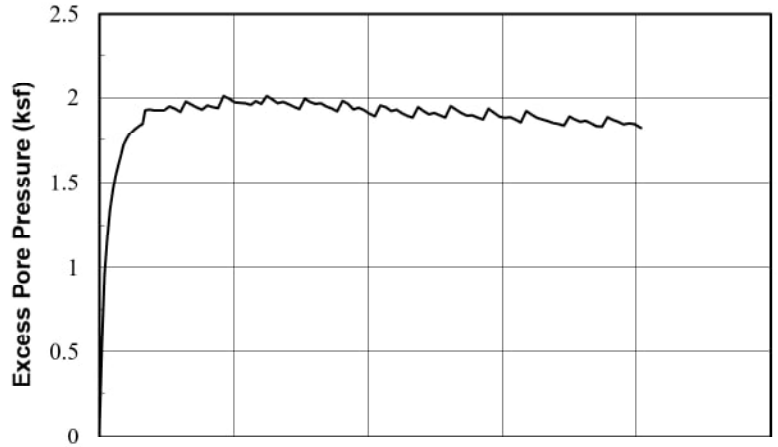


SAMPLE INFORMATION

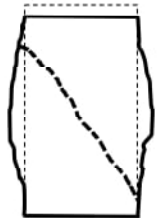
Boring: B101U Sample: U3 Depth (ft): 55.7 Test: R'14
Type: 2.8-inch-diameter tube sample
Description: Gray SANDY CLAY (CL)

SPECIMEN INFORMATION (after saturation)

Height: 5.791 in Dia.: 2.856 in Area.: 6.484 sq. in
Water Content: 29.9% Dry Unit Weight: 93.8 pcf

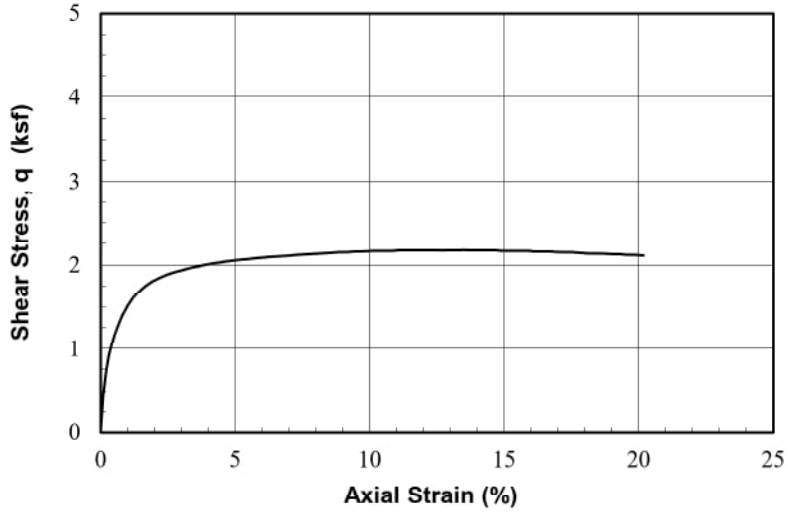
TEST SUMMARY (end of test)

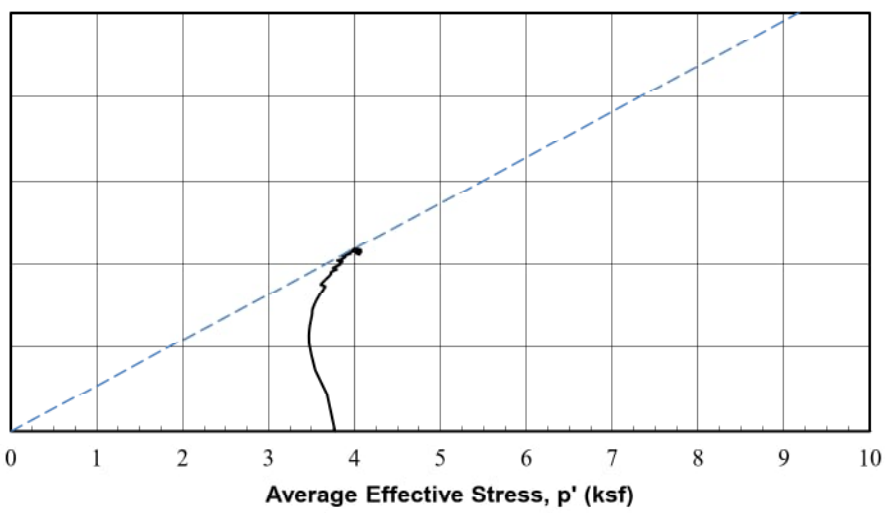
Effective Confining Stress: 3.77 ksf vertical, 3.77 ksf horiz.
Water Content: 28.7 % Dry Unit Weight: 95.6 pcf
B Coefficient: 0.92 Strain Rate: 0.012 %/min
Peak Shear Stress: 2.17 ksf @ 13.5 % Strain
Peak Friction Angle: 33.0 deg. @ 9.1 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: D. Aghjayan
Test Date: 25-Jan-2018

2/23/2018 14:06

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-8

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'14												
BORING:	B101U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U3			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	55.7			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.846	2.873	6.484	28.83	93.6	120.5	0.822
TEST DATE:	1/25/2018			Under vac.	1.01	1.01	5.833	2.867	6.456	--	94.2	--	0.810
DCDT No.		10716											
DCDT Calibration Factor		9.3997E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		251674		Saturation	0.91	0.91	5.833	2.873	6.484	29.95	93.8	121.9	0.818
Load Cell Cal. Factor		0.13652	lb/cnt	Consol. Stage 1	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
Pressure Transducer		GE02		Consol. Stage 2	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
Pres. Trans. Cal. Factor		6.5185E-05	psi/cnt	Consol. Stage 3	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
				Consol. Stage 4	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
				Consol. Stage 6	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
B value start shear		0.92											
Test Stage End of#	1			This Stage Initial Values	3.77	3.77	5.791	2.856	6.405	28.65	95.6	123.0	0.782
Stage Strain rate		0.012	%/min	Kc start stage	1.00		Back Pressure		14.47 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.042	15.563	100.930	0.00	6.40	0.00	3.77	3.77	3.77	3.77	0.00	1.00	0.0	0.00
0.047	56.246	104.780	0.10	6.41	0.55	3.22	4.69	4.13	3.68	0.46	1.28	7.1	0.61
0.053	80.683	107.600	0.20	6.42	0.96	2.81	5.24	4.27	3.54	0.73	1.52	11.9	0.66
0.059	96.520	109.150	0.30	6.42	1.18	2.59	5.59	4.41	3.50	0.91	1.70	15.0	0.65
0.065	108.530	110.240	0.40	6.43	1.34	2.43	5.86	4.52	3.47	1.04	1.86	17.4	0.64
0.071	118.230	111.020	0.50	6.44	1.45	2.32	6.07	4.62	3.47	1.15	1.99	19.3	0.63
0.077	126.690	111.620	0.60	6.44	1.54	2.23	6.26	4.72	3.48	1.24	2.11	20.9	0.62
0.082	133.930	112.080	0.70	6.45	1.61	2.17	6.42	4.81	3.49	1.32	2.22	22.2	0.61
0.088	140.340	112.450	0.81	6.46	1.66	2.12	6.56	4.90	3.51	1.39	2.32	23.4	0.60
0.094	146.210	112.880	0.91	6.46	1.72	2.05	6.69	4.96	3.51	1.46	2.42	24.5	0.59
0.100	151.400	113.110	1.01	6.47	1.75	2.02	6.80	5.04	3.53	1.51	2.50	25.3	0.58
0.106	156.040	113.290	1.11	6.48	1.78	1.99	6.90	5.12	3.56	1.56	2.57	26.1	0.57
0.111	160.270	113.430	1.21	6.48	1.80	1.97	6.99	5.19	3.58	1.61	2.63	26.7	0.56
0.117	163.820	113.540	1.31	6.49	1.82	1.96	7.06	5.25	3.60	1.64	2.68	27.2	0.55
0.123	167.100	113.630	1.41	6.50	1.83	1.95	7.13	5.30	3.63	1.68	2.73	27.6	0.54
0.129	169.970	113.710	1.51	6.50	1.84	1.93	7.19	5.35	3.64	1.71	2.77	28.0	0.54
0.135	172.560	113.770	1.61	6.51	1.85	1.93	7.25	5.40	3.66	1.74	2.80	28.3	0.53

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.141	175.020	114.320	1.71	6.52	1.93	1.85	7.30	5.37	3.61	1.76	2.91	29.2	0.55
0.146	177.070	114.330	1.81	6.52	1.93	1.84	7.34	5.41	3.63	1.78	2.93	29.4	0.54
0.152	179.250	114.330	1.91	6.53	1.93	1.84	7.38	5.45	3.65	1.80	2.96	29.6	0.53
0.158	180.890	114.320	2.01	6.54	1.93	1.85	7.42	5.49	3.67	1.82	2.97	29.8	0.53
0.170	184.030	114.310	2.22	6.55	1.93	1.85	7.48	5.55	3.70	1.85	3.00	30.0	0.52
0.182	186.760	114.310	2.42	6.56	1.93	1.85	7.53	5.60	3.73	1.88	3.03	30.3	0.51
0.193	189.220	114.480	2.62	6.58	1.95	1.82	7.58	5.63	3.72	1.90	3.09	30.7	0.51
0.205	191.260	114.390	2.82	6.59	1.94	1.84	7.61	5.67	3.76	1.92	3.09	30.7	0.50
0.216	193.180	114.260	3.02	6.60	1.92	1.85	7.65	5.73	3.79	1.94	3.09	30.7	0.50
0.228	195.090	114.680	3.22	6.62	1.98	1.79	7.68	5.70	3.75	1.95	3.18	31.4	0.51
0.240	196.860	114.560	3.42	6.63	1.96	1.81	7.71	5.75	3.78	1.97	3.17	31.4	0.50
0.251	198.500	114.440	3.62	6.65	1.95	1.83	7.74	5.79	3.81	1.98	3.17	31.3	0.49
0.263	200.140	114.350	3.83	6.66	1.93	1.84	7.77	5.83	3.84	2.00	3.17	31.3	0.48
0.275	201.640	114.520	4.03	6.67	1.96	1.82	7.79	5.83	3.82	2.01	3.21	31.7	0.49
0.286	203.010	114.460	4.23	6.69	1.95	1.83	7.81	5.86	3.84	2.02	3.21	31.7	0.48
0.298	204.230	114.410	4.43	6.70	1.94	1.83	7.83	5.89	3.86	2.03	3.21	31.7	0.48
0.310	205.600	114.900	4.63	6.72	2.01	1.76	7.85	5.84	3.80	2.04	3.31	32.4	0.49
0.321	206.690	114.800	4.83	6.73	2.00	1.78	7.86	5.87	3.82	2.04	3.30	32.3	0.49
0.333	207.920	114.650	5.03	6.74	1.98	1.80	7.88	5.91	3.85	2.05	3.28	32.2	0.48
0.345	209.010	114.630	5.23	6.76	1.97	1.80	7.90	5.92	3.86	2.06	3.29	32.2	0.48
0.356	209.970	114.610	5.44	6.77	1.97	1.80	7.91	5.94	3.87	2.07	3.29	32.3	0.48
0.368	210.920	114.540	5.64	6.79	1.96	1.81	7.92	5.96	3.89	2.07	3.28	32.2	0.47
0.380	212.020	114.690	5.84	6.80	1.98	1.79	7.93	5.95	3.87	2.08	3.32	32.5	0.48
0.391	212.970	114.580	6.04	6.82	1.97	1.81	7.94	5.98	3.89	2.09	3.31	32.4	0.47
0.403	214.060	114.900	6.24	6.83	2.01	1.76	7.96	5.95	3.85	2.09	3.37	32.9	0.48
0.415	214.880	114.770	6.44	6.85	1.99	1.78	7.97	5.97	3.88	2.10	3.35	32.7	0.48
0.426	215.700	114.610	6.64	6.86	1.97	1.80	7.98	6.01	3.90	2.10	3.33	32.5	0.47
0.438	216.520	114.670	6.84	6.88	1.98	1.80	7.98	6.00	3.90	2.10	3.34	32.7	0.47
0.450	217.340	114.570	7.05	6.89	1.96	1.81	7.99	6.03	3.92	2.11	3.33	32.6	0.47
0.461	218.430	114.470	7.25	6.91	1.95	1.82	8.00	6.06	3.94	2.12	3.32	32.5	0.46
0.473	219.250	114.370	7.45	6.92	1.94	1.84	8.01	6.08	3.96	2.12	3.30	32.4	0.46
0.485	220.070	114.800	7.65	6.94	2.00	1.78	8.02	6.02	3.90	2.12	3.39	33.0	0.47
0.496	220.890	114.670	7.85	6.95	1.98	1.80	8.03	6.05	3.92	2.13	3.37	32.8	0.47
0.508	221.710	114.580	8.05	6.97	1.97	1.81	8.04	6.07	3.94	2.13	3.36	32.7	0.46
0.520	222.530	114.610	8.25	6.98	1.97	1.80	8.04	6.07	3.94	2.13	3.37	32.8	0.46
0.531	223.350	114.480	8.45	7.00	1.95	1.82	8.05	6.10	3.96	2.14	3.35	32.7	0.46
0.543	224.170	114.400	8.66	7.01	1.94	1.83	8.06	6.12	3.98	2.14	3.34	32.6	0.45
0.554	224.850	114.280	8.86	7.03	1.92	1.85	8.06	6.14	4.00	2.14	3.32	32.5	0.45
0.566	225.530	114.710	9.06	7.04	1.98	1.79	8.07	6.08	3.94	2.15	3.40	33.0	0.46
0.578	226.210	114.580	9.26	7.06	1.97	1.81	8.07	6.11	3.96	2.15	3.38	32.9	0.46

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.589	227.030	114.360	9.46	7.07	1.93	1.84	8.08	6.15	3.99	2.15	3.34	32.6	0.45
0.601	227.720	114.430	9.66	7.09	1.94	1.83	8.08	6.14	3.98	2.15	3.35	32.7	0.45
0.613	228.400	114.330	9.86	7.11	1.93	1.84	8.09	6.16	4.00	2.16	3.34	32.6	0.45
0.624	229.080	114.190	10.06	7.12	1.91	1.86	8.09	6.18	4.02	2.16	3.32	32.4	0.44
0.636	229.630	114.090	10.27	7.14	1.90	1.88	8.09	6.20	4.04	2.16	3.30	32.3	0.44
0.648	230.310	114.520	10.47	7.15	1.96	1.82	8.10	6.14	3.98	2.16	3.38	32.9	0.45
0.659	230.990	114.450	10.67	7.17	1.95	1.83	8.10	6.15	3.99	2.16	3.37	32.8	0.45
0.671	231.670	114.300	10.87	7.19	1.93	1.85	8.10	6.18	4.01	2.17	3.34	32.6	0.44
0.683	232.360	114.350	11.07	7.20	1.93	1.84	8.11	6.18	4.01	2.17	3.35	32.7	0.45
0.694	232.770	114.200	11.27	7.22	1.91	1.86	8.11	6.20	4.03	2.17	3.33	32.5	0.44
0.706	233.310	114.100	11.47	7.23	1.90	1.88	8.11	6.21	4.04	2.17	3.31	32.4	0.44
0.718	233.860	114.030	11.67	7.25	1.89	1.89	8.11	6.22	4.06	2.17	3.30	32.3	0.44
0.729	234.400	114.460	11.88	7.27	1.95	1.83	8.11	6.16	3.99	2.17	3.37	32.9	0.45
0.741	234.950	114.300	12.08	7.28	1.93	1.85	8.11	6.19	4.02	2.17	3.35	32.7	0.44
0.753	235.630	114.170	12.28	7.30	1.91	1.87	8.11	6.21	4.04	2.17	3.32	32.5	0.44
0.764	236.180	114.220	12.48	7.32	1.91	1.86	8.12	6.20	4.03	2.17	3.33	32.6	0.44
0.776	236.590	114.130	12.68	7.33	1.90	1.87	8.11	6.21	4.04	2.17	3.32	32.5	0.44
0.788	237.140	114.030	12.88	7.35	1.89	1.89	8.11	6.23	4.06	2.17	3.30	32.3	0.43
0.799	237.820	114.490	13.08	7.37	1.95	1.82	8.12	6.16	3.99	2.17	3.38	32.9	0.45
0.811	238.360	114.350	13.28	7.39	1.93	1.84	8.12	6.19	4.01	2.17	3.36	32.8	0.44
0.823	238.910	114.220	13.49	7.40	1.91	1.86	8.12	6.20	4.03	2.17	3.34	32.6	0.44
0.834	239.320	114.110	13.69	7.42	1.90	1.88	8.12	6.22	4.05	2.17	3.31	32.4	0.44
0.846	239.730	114.130	13.89	7.44	1.90	1.87	8.11	6.21	4.04	2.17	3.32	32.5	0.44
0.858	240.140	114.030	14.09	7.46	1.89	1.89	8.11	6.23	4.06	2.17	3.30	32.3	0.43
0.869	240.550	113.960	14.29	7.47	1.88	1.90	8.11	6.23	4.07	2.17	3.28	32.2	0.43
0.881	240.960	114.390	14.49	7.49	1.94	1.84	8.11	6.17	4.00	2.17	3.36	32.8	0.45
0.893	241.500	114.230	14.69	7.51	1.92	1.86	8.11	6.19	4.03	2.17	3.33	32.6	0.44
0.904	241.910	114.070	14.90	7.53	1.89	1.88	8.11	6.21	4.05	2.17	3.30	32.3	0.44
0.916	242.320	114.020	15.10	7.54	1.88	1.89	8.10	6.22	4.05	2.16	3.29	32.3	0.44
0.927	242.600	114.040	15.30	7.56	1.89	1.89	8.10	6.21	4.05	2.16	3.29	32.3	0.44
0.939	243.010	113.960	15.50	7.58	1.88	1.90	8.10	6.22	4.06	2.16	3.28	32.2	0.43
0.951	243.420	113.840	15.70	7.60	1.86	1.92	8.09	6.23	4.07	2.16	3.25	32.0	0.43
0.962	244.100	114.290	15.90	7.62	1.92	1.85	8.10	6.17	4.01	2.16	3.34	32.6	0.45
0.974	244.370	114.150	16.10	7.63	1.90	1.87	8.09	6.19	4.03	2.16	3.31	32.4	0.44
0.986	244.640	114.020	16.30	7.65	1.88	1.89	8.09	6.20	4.04	2.16	3.28	32.2	0.44
0.997	244.920	113.960	16.51	7.67	1.88	1.90	8.08	6.20	4.05	2.15	3.27	32.1	0.44
1.009	245.330	113.890	16.71	7.69	1.87	1.91	8.08	6.21	4.06	2.15	3.26	32.0	0.43
1.021	245.600	113.810	16.91	7.71	1.85	1.92	8.07	6.22	4.07	2.15	3.24	31.9	0.43
1.032	245.870	113.770	17.11	7.73	1.85	1.93	8.07	6.22	4.07	2.15	3.23	31.8	0.43
1.044	246.280	113.700	17.31	7.75	1.84	1.94	8.06	6.22	4.08	2.14	3.22	31.7	0.43

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.056	246.690	114.070	17.51	7.76	1.89	1.88	8.06	6.17	4.03	2.14	3.28	32.2	0.44
1.067	246.960	113.960	17.71	7.78	1.88	1.90	8.06	6.18	4.04	2.14	3.26	32.0	0.44
1.079	247.240	113.860	17.91	7.80	1.86	1.91	8.05	6.19	4.05	2.14	3.24	31.9	0.44
1.091	247.510	113.900	18.11	7.82	1.87	1.91	8.04	6.18	4.04	2.14	3.24	31.9	0.44
1.102	247.920	113.790	18.32	7.84	1.85	1.92	8.04	6.19	4.06	2.13	3.22	31.7	0.43
1.114	248.330	113.680	18.52	7.86	1.84	1.94	8.04	6.20	4.07	2.13	3.20	31.6	0.43
1.126	248.600	113.670	18.72	7.88	1.83	1.94	8.03	6.20	4.07	2.13	3.20	31.6	0.43
1.137	249.010	114.050	18.92	7.90	1.89	1.88	8.03	6.14	4.01	2.13	3.26	32.0	0.44
1.149	249.150	113.940	19.12	7.92	1.87	1.90	8.02	6.15	4.02	2.12	3.23	31.9	0.44
1.161	249.420	113.860	19.32	7.94	1.86	1.91	8.02	6.15	4.03	2.12	3.22	31.7	0.44
1.172	249.700	113.760	19.52	7.96	1.85	1.93	8.01	6.16	4.04	2.12	3.20	31.6	0.44
1.184	250.240	113.800	19.73	7.98	1.85	1.92	8.01	6.16	4.04	2.12	3.20	31.6	0.44
1.196	250.380	113.770	19.93	8.00	1.85	1.93	8.00	6.15	4.04	2.11	3.20	31.6	0.44
1.207	250.650	113.640	20.13	8.02	1.83	1.94	8.00	6.17	4.05	2.11	3.17	31.4	0.43
1.210	250.650	113.610	20.18	8.02	1.83	1.95	7.99	6.17	4.06	2.11	3.17	31.3	0.43

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'14		Ground Surface Elevation
BORING:	B101U		Elevation Datum
SAMPLE:	U3		
DEPTH:	55.7	Elevation:	
TEST DATE:	25-Jan-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	February 2018		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Gray SANDY CLAY (CL)		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	251674	
Load Calibration Factor:	0.13652	lb/cnt
Pressure ID:	GE02	
Pressure Cal. Fator	0.000065185	psi/cnt
Displacement ID:	10716	
Displacement Cal. Factor:	0.000093997	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.97	VC:	-18.1025
Penetration, cm:	59.13		
Gross Recovery, cm:	47.50		
TUBE LENGTH			
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	0.8190
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	18.8				18.8	cm
TOP EMPTY LENGTH	2.5				2.5	cm
BOT. EMPTY LENGTH	1.45				1.45	cm
TUBE INNER DIAMETER	7.301	7.295	7.302	7.294	7.298	cm

In tube length	14.85	cm
Tube Diameter	7.298	cm
Tube Area	41.83	(cm^2)
Tube Volume	621.19	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.35	7.355	7.348		7.351	cm
MEMBRANE 1 THICKNESS	0.068	0.067	0.071		0.069	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	14.144	14.178	14.201	14.206	14.182	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	9.502	9.507	9.544	9.55	9.526	cm

#filter strips	0		
Hi	14.817	cm	
Di	7.282	cm	2.03458141
Ai	41.652	cm^2	
Vi	617.130	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	84.410	77.910	*******	1755.740	*******	1609.680	1031.870	*******
DRY+T	72.460	67.910		*******	0.000	*******	893.840	372.200
T	30.910	31.390		556.380	0.000	412.140	412.140	372.020
Wt. Solids	41.55	36.52	0	1199.36	0	931.00	481.7	0.18
w %	28.76	27.38	*******	28.83	*******	28.65	28.65	*******

FINAL B VALUE 0.92

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00	
saturation	101.50	107.80	0.000	-2.684	0.000	0.000	-0.021	6.30	6.30	
Consolidation Stage 1	100.49	126.70	0.000	12.015	0.107	0.107	0.096	26.21	26.21	
2	100.49	126.70	0.000	0.000	0.000	0.000	0.000	26.21	26.21	
3	100.49	126.70	0.000	0.000	0.000	0.000	0.000	26.21	26.21	
4	100.49	126.70	0.000	0.000	0.000	0.000	0.000	26.21	26.21	
5	100.49	126.70	0.000	0.000	0.000	0.000	0.000	26.21	26.21	
6	100.49	126.70	0.000	0.000	0.000	0.000	0.000	26.21	26.21	
Start Shear	100.49	126.70	0.000	**********	**********			26.21	26.21	
End Shear				0.000	**********			**********	**********	

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							0.8190	1.23	76.6	1.224	
after sampling		0.00	0.00							1.0000	1.50	93.6	0.822	
after shipping		0.00	0.00							1.0000	1.50	93.6	0.822	
in tube before extrusion		0.00	0.00	14.85	7.298	41.831	621.19	931.00	28.83	*****	1.50	93.6	0.822	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.817	7.282	41.652	617.130	930.997	*****	*****	1.51	94.2	0.810	
saturation		6.30	6.30	14.817	7.298	41.833	619.814	930.997	29.945		1.50	93.8	0.818	
	1	26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
	2	26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
	3	26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
	4	26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
	5	26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
	6	26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
Start Shear		26.21	26.21	14.710	7.253	41.319	607.799	930.997	28.655	*****	1.53	95.6	0.782	
End Shear		**********	**********				607.799	930.997	28.655	*****	1.53	95.6	0.782	0.782275067

Test comp (c) or ext (c) c

DEFORMATION RATE 1	0.01800778	mm/min	0.0122 %/min
DEFORMATION RATE 2	0.00070897	in/min	0.000481969 %/min
DEFORMATION RATE 3		in/min	

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	C'14
Boring	B101U
Sample	U3
Depth	55.71
By	W. LUKAS
Date	1/25/18
Checked	
Date	

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-30	A-31		
Wet Wt. + Tare (g)	84.41	77.91		
Dry Wt. + Tare (g)	72.46	67.91		
Wt. Water (g)	11.95	10.00		
Tare (g)	30.91	31.39		
Dry Wt. Soil (g)	41.55	36.52		
Water Content (%)	28.8	27.4		

28.1

Trimmed Length in Tube

Overall Tube Length	18.8	18.8	18.8	18.8	cm	Avg.	18.8	cm
Top Empty Length	2.5	2.5	2.5	2.5	cm	Avg.	2.5	cm
Bottom Empty Length	1.4	1.5	1.4	1.5	cm	Avg.	1.45	cm

Trimmed Length in Tube, L: 14.85 cm

Tube Dimensions

Tube Inner Diameter	7.301	7.295	7.302	7.294	cm	Avg.	7.298	cm

Tube Weight (g): 556.38

Weight of other (specify: —) (g): 0

Area, A: 41.83 cm^2

Volume in Tube = A x L: 621.2 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1609.68	g
Membrane	412.14	g
W_{moist}	1197.54	g

Dry Wt. Of Excess Solids

Tare #	D-12	~~g~~
Dry + Tare	372.20	g
Tare	372.02	g
Dry Wt. Of Excess	0.18	g

Water Content

(Fraction Used: 1/2)

Tare #	R-3AB	
Wet + Tare	1031.87	g
Dry + Tare	893.84	g
Wt. Water	138.03	g
Tare	412.14	g
Wt. Dry Soil	481.7	g
Water Content	28.7	%

$W_s = W_{moist} / (1 + wc) +$ Dry Wt of Excess = 930.67 g

Estimate of γ_d using γ_m in tube

Moist soil + tube + ~~other (specify:~~)	1755.74	g
Tube + ~~other~~	556.38	g
Moist soil	1199.36	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.931 g/cm^3 = 120.5 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.507 g/cm^3 = 94.1 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'14
Boring	B101J
Sample	U3
Depth	55.7'
By	W. Lukas
Date	11/25/18
Checked	
Date	

Undisturbed Specimen ✓
Remolded or compacted Specimen

Filter Strips? Yes ____ No ✓
Lubricated End Platens? Yes ____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes	7.350	7.355	7.348		Avg.	7.351 cm
Twice thickness 1 membranes	0.068	0.067	0.071		Avg.	-0.069 cm
					Avg.	- cm

Diameter of Specimen	7.282 cm
Diameter of Specimen	2.867 inch
Area of Specimen	41.65 cm^2

Height Caliper #____

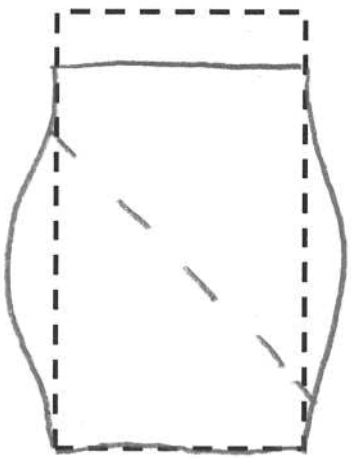
Height from top gauge block to top of top platen, with specimen	14.144	14.178	14.201	14.206	Avg.	14.182 cm

Height of Gauge Block	+10.160 cm

Height from top of top platen to cell base, without specimen	9.502	9.507	9.544	9.550	Avg.	-9.526 cm

Height of Specimen in Cell	14.816 cm
Height of Specimen in Cell	5.833 inch
Volume in cell, initial	617.1 cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

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Saturation and Consolidation Data

Project No.	1700685
Test No.	R'14
Boring	B101
Sample	U3
Depth	55.7'
By	VBZ
Date	1/25/18
Page	1 / 2

Panel No. 3

Pressure Trans:	SN GE02	Factor 6.5165e^{-5}	Gain =	80
Load Trans:	SN 251674	Factor 1.3652e^{-1}	Gain =	40
Displ. Trans:	SN 10716	Factor 9.3997e^{-5}	Gain =	40

Date	Time	Load (lb)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.35) (digit)	Burrette Top (x 1.35) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )	
1/25	1400	0	0					-7		0	
						22.5		0.00		12.16	
	1420					21.1		10.57		17.55	
	1620					18.2					
1/26	910					19.9		10.74		17.23	
		DEAIR TOP LINE →				16.6	B=0.23	21.04	13.15	27.83	
	1420					16.8					
		Deair top line, check connections →				19.8		21.02		27.85	
		"		" →		14.5		20.93		27.82	
1/29	830	"		" →		16.5					
			Refill	→		18.8		21.04		27.85	
						18.4	B=0.45	30.90	25.40	37.67	
	1400					17.5					
	1520	Flush block + deair top line				17.2					
1/30	835					17.1		30.79		37.72	
		Flush top line →				18.2	B=0.58	40.25	36.24	47.12	
1/31	840					17.6		40.30		47.01	)10.67
						12.2	B=0.63	50.94	47.07	57.68	
2/1	830					11.5		50.80		57.52	
		Flush top line →		→		16.5					
		"	"	" →		18.6					
2/2	835							50.84		57.53	10.30
						15.2	B=0.70	61.20	58.09	67.83	
	1640					15.0					
		Flush top + block				21.1					
2/5	800					21.3		61.18		67.38	9.77
						18.2	B=0.75	70.91	68.50	77.15	
2/6	855	Top line is fine				16.1					
2/7	800	Top line is fine				15.5		70.82		77.45	)9.97
							B=0.86	80.78	79.43	87.42	
2/8	1130	Cell pressure line leak →				16.5		80.31		86.57	)10.67
							B=0.92	91.03	90.16	97.24	
2/12	810					15.0		90.86		97.12	10.68
							B=0.90	101.50	100.4	107.80	
			CONSOL								

TEST REMARKS

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Saturation and Consolidation Data

Panel No. _____

Pressure Trans: SN _____ Factor _____ Gain = _____
Load Trans: SN _____ Factor _____ Gain = _____
Displ. Trans: SN _____ Factor _____ Gain = _____

Project No.	1700685
Test No.	E'14
Boring	B101J
Sample	U3
Depth	55.7 ft
By	WSL
Date	
Page	2 / 2

Date	Time	Load ( )	Axial Def. ( )	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x) (digit)	Burrette Top (x) (cm^2)	Pressure ( ) Back ( )	Pressure ( ) Pore ( )	Pressure ( ) Cell ( )
			σ'_K = 26.7 psi ⇒ 127.4 psi							
								101.62		127.40
			0.042					100.94		126.70

TEST REMARKS

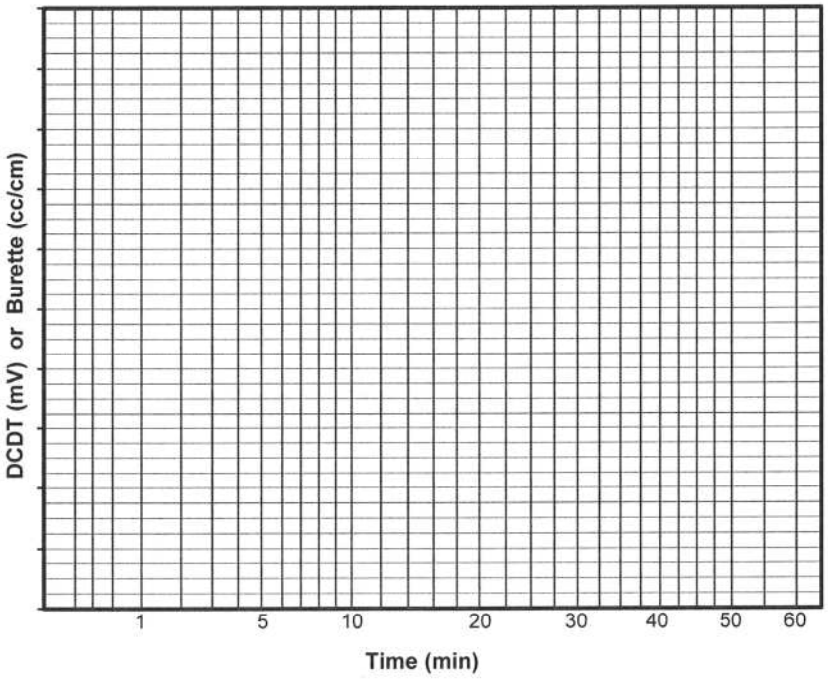
GEI Consultants

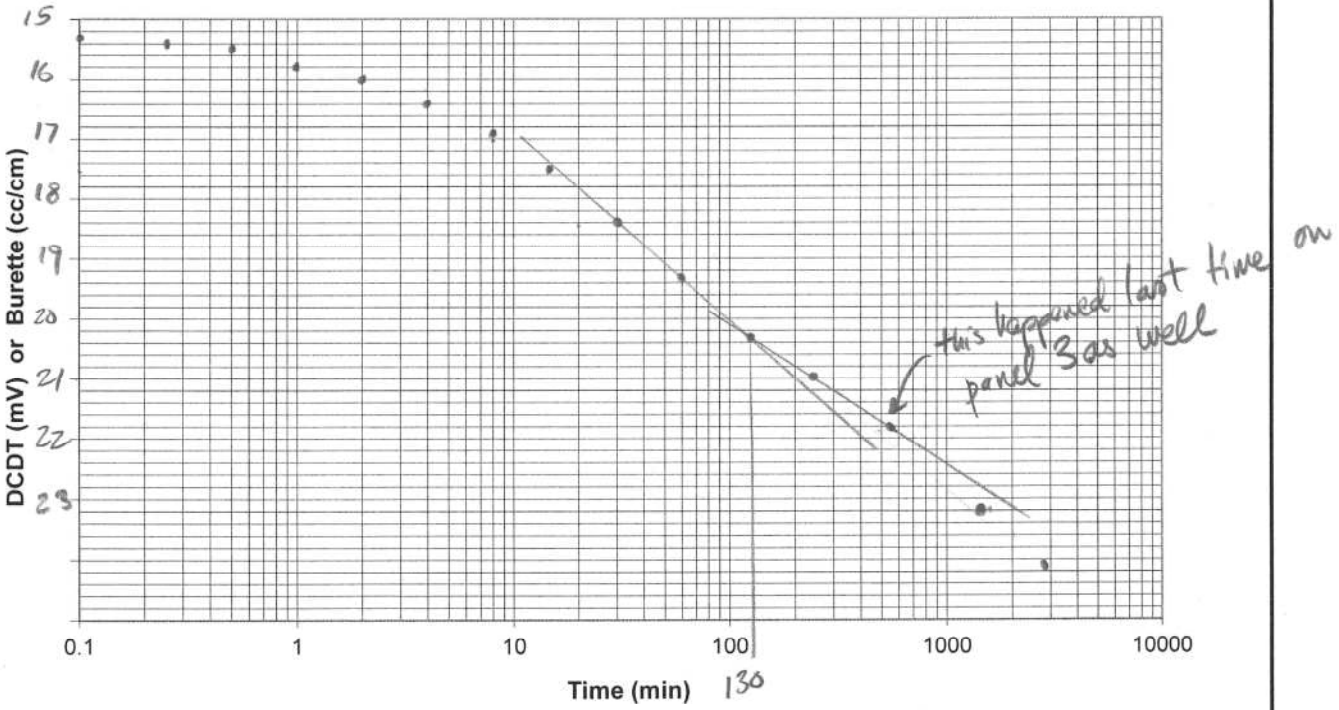
Consolidation Worksheet

Hanger Load		kg	DCDT #		
Loading Device			Channel		

Project No.	1700685
Test	R'14
Boring	B1010
Sample	U3
By	WGL
Date	2/12/18
Checked	
Date	

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
825	0	15.0
	0.1	15.3
	0.25	15.4
	0.5	15.5
826	1	15.8
827	2	16.0
829	4	16.4
833	8	16.9
840	15	17.5
855	30	18.4
925	60	19.3
1025	120	20.3
1225	240	21.0
1755	570	21.8
825	1440	23.2
825	2880	23.9





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R'14
Boring	B101U
Sample	U3
Depth	55.71
By	WBL
Date	2/13/18
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, A		cm	=		inch
Estimated T_{100}, B		min			
Estimated Fail Strain, C		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, E		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #	3				
Initial Specimen Height in Cell	14.816	cm			
Height Change during Consolidation	0.109	cm	=	0.0422	inch
Specimen Height, A	14.709	cm	=	5.791	inch
Estimated T_{100}, B	130	min			
Estimated Fail Strain, C	4	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.0216	mm / min	=	0.00085	inch / min
Actual Deformation Rate, E	0.0175	mm / min	=	0.00069	inch / min
Strain Rate = (**E** / **A**) *10	0.0119	% / min			

Say 20% in 28 hrs

$$\Rightarrow \frac{(147.09\,mm)(0.2)}{28(60)} = 0.0175\ mm/min = 0.00069\ in/min < 0.00085$$

50%

TEST REMARKS

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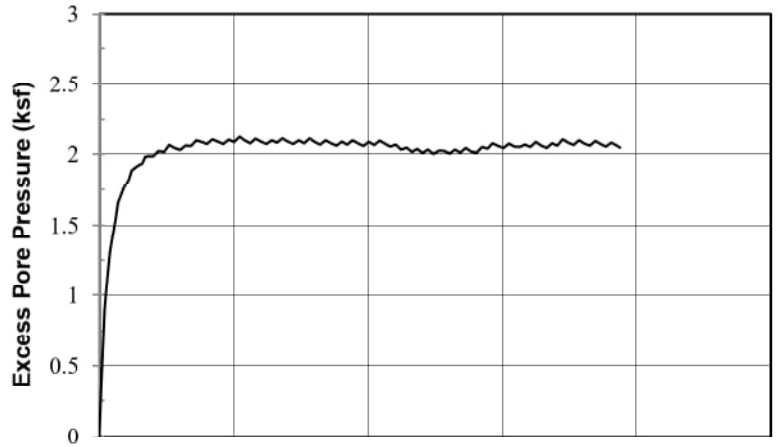


SAMPLE INFORMATION

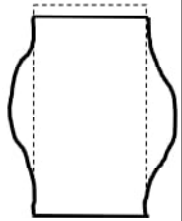
Boring: B101U Sample: U2 Depth (ft): 53.9 Test: R'15
Type: 2.8-inch-diameter tube sample
Description: SANDY LEAN CLAY (CL)

SPECIMEN INFORMATION (after saturation)

Height: 5.918 in Dia.: 2.848 in Area.: 6.454 sq. in
Water Content: 25.9% Dry Unit Weight: 99.8 pcf

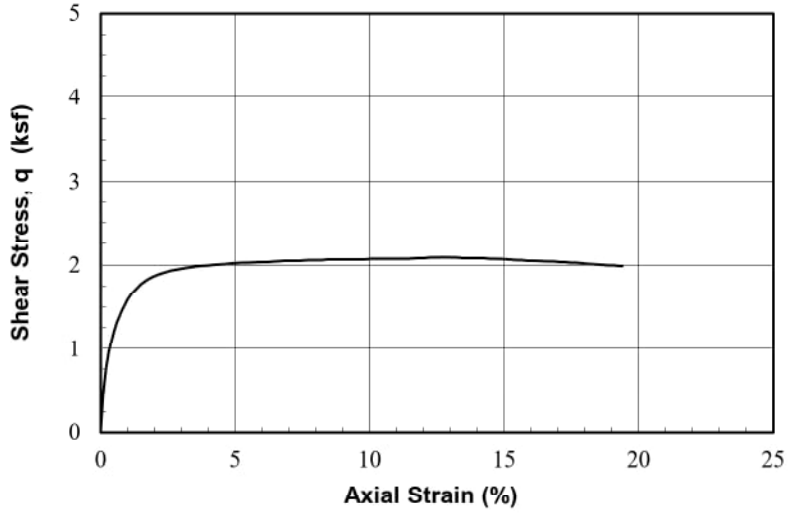
TEST SUMMARY (end of test)

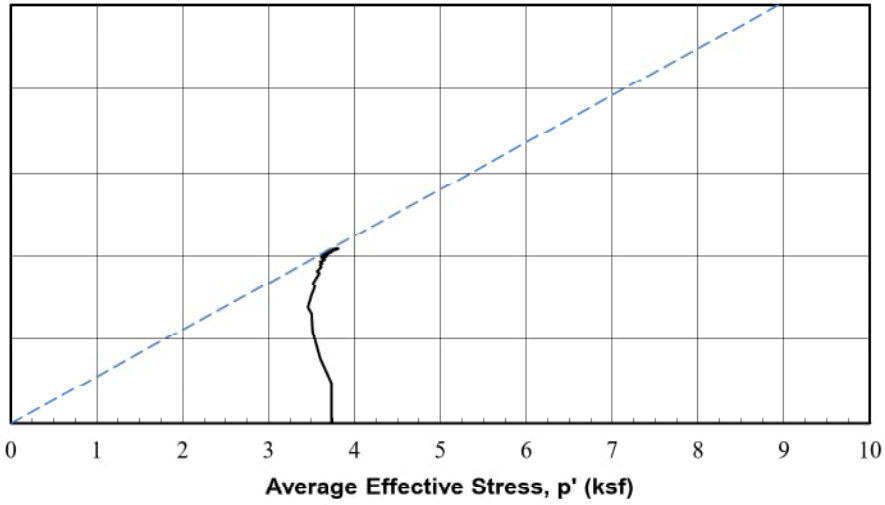
Effective Confining Stress: 3.73 ksf vertical, 3.73 ksf horiz.
Water Content: 24.9 % Dry Unit Weight: 101.5 pcf
B Coefficient: 0.95 Strain Rate: 0.014 %/min
Peak Shear Stress: 2.09 ksf @ 12.6 % Strain
Peak Friction Angle: 34.0 deg. @ 7.8 % Strain



Failure Sketch

REMARKS:





Operator: W. Lukas
Checked: D. Aghjayan
Test Date: 1-Feb-2018

2/14/2018 10:25

Seismic Stability Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-9

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'15												
BORING:	B101U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U2			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	53.9			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	W. Lukas			In tube before extrusion	--	--	5.925	2.878	6.504	26.11	99.3	125.2	0.717
TEST DATE:	2/1/2018			Under vac.	1.01	1.01	5.942	2.860	6.422	--	100.3	--	0.700
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	0.97	0.97	5.942	2.867	6.454	25.95	99.8	125.6	0.708
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
Pressure Transducer		25218		Consol. Stage 2	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
				Consol. Stage 4	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
Gravity of Solids		2.73	(assumed)	Consol. Stage 5	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
				Consol. Stage 6	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
B value start shear		0.95											
Test Stage End of#	1			This Stage Initial Values	3.73	3.73	5.918	2.848	6.371	24.89	101.5	126.7	0.680
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		4.38 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.024	5.397	29.788	0.00	6.37	0.00	3.73	3.73	3.73	3.73	0.00	1.00	0.0	0.00
0.030	48.341	33.164	0.10	6.38	0.49	3.24	4.70	4.21	3.73	0.48	1.30	7.5	0.50
0.036	73.644	36.020	0.20	6.38	0.90	2.83	5.27	4.37	3.60	0.77	1.54	12.3	0.58
0.042	89.893	37.648	0.30	6.39	1.13	2.60	5.63	4.50	3.55	0.95	1.73	15.6	0.59
0.048	102.780	38.899	0.40	6.40	1.31	2.42	5.92	4.61	3.51	1.10	1.91	18.2	0.60
0.054	112.930	39.749	0.50	6.40	1.43	2.30	6.15	4.71	3.50	1.21	2.05	20.2	0.59
0.060	121.870	40.457	0.60	6.41	1.54	2.19	6.35	4.81	3.50	1.31	2.19	21.9	0.59
0.066	129.010	41.307	0.70	6.42	1.66	2.07	6.50	4.85	3.46	1.39	2.34	23.6	0.60
0.072	135.800	41.661	0.80	6.42	1.71	2.02	6.65	4.94	3.48	1.46	2.45	24.8	0.58
0.078	141.770	41.992	0.90	6.43	1.76	1.97	6.78	5.03	3.50	1.53	2.55	25.9	0.58
0.084	147.170	42.251	1.00	6.44	1.79	1.93	6.90	5.11	3.52	1.59	2.64	26.8	0.57
0.090	151.760	42.464	1.10	6.44	1.83	1.90	7.00	5.18	3.54	1.64	2.72	27.5	0.56
0.096	155.640	42.912	1.20	6.45	1.89	1.84	7.08	5.19	3.52	1.68	2.82	28.5	0.56
0.102	159.130	43.006	1.31	6.46	1.90	1.83	7.16	5.26	3.54	1.71	2.88	29.0	0.56
0.107	162.090	43.101	1.41	6.46	1.92	1.81	7.22	5.30	3.56	1.75	2.93	29.4	0.55
0.113	164.700	43.172	1.51	6.47	1.93	1.80	7.28	5.35	3.58	1.77	2.97	29.7	0.54
0.119	167.140	43.243	1.61	6.48	1.94	1.79	7.33	5.39	3.59	1.80	3.01	30.1	0.54

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.125	169.170	43.549	1.71	6.48	1.98	1.75	7.37	5.39	3.57	1.82	3.08	30.7	0.54
0.131	171.020	43.573	1.81	6.49	1.99	1.74	7.41	5.42	3.58	1.84	3.11	30.9	0.54
0.137	172.710	43.573	1.91	6.50	1.99	1.74	7.44	5.45	3.60	1.85	3.13	31.0	0.54
0.143	174.100	43.573	2.01	6.50	1.99	1.74	7.47	5.48	3.61	1.87	3.14	31.1	0.53
0.155	176.710	43.833	2.21	6.52	2.02	1.71	7.52	5.49	3.60	1.89	3.22	31.7	0.53
0.167	178.860	43.785	2.41	6.53	2.02	1.71	7.56	5.54	3.63	1.91	3.23	31.8	0.53
0.179	180.890	44.116	2.61	6.54	2.06	1.67	7.59	5.53	3.60	1.93	3.32	32.5	0.53
0.191	182.340	43.974	2.81	6.56	2.04	1.69	7.62	5.57	3.63	1.94	3.30	32.4	0.53
0.202	183.670	43.880	3.01	6.57	2.03	1.70	7.64	5.61	3.65	1.95	3.30	32.3	0.52
0.214	185.070	44.092	3.21	6.58	2.06	1.67	7.66	5.60	3.64	1.97	3.35	32.7	0.52
0.226	186.230	44.069	3.41	6.60	2.06	1.67	7.68	5.62	3.65	1.97	3.36	32.8	0.52
0.238	187.500	44.352	3.61	6.61	2.10	1.63	7.70	5.60	3.62	1.98	3.43	33.3	0.53
0.250	188.380	44.258	3.81	6.62	2.08	1.65	7.71	5.62	3.63	1.99	3.42	33.2	0.52
0.262	189.190	44.163	4.01	6.64	2.07	1.66	7.72	5.65	3.65	1.99	3.40	33.1	0.52
0.274	190.170	44.399	4.22	6.65	2.10	1.63	7.73	5.63	3.63	2.00	3.46	33.5	0.53
0.286	190.870	44.281	4.42	6.67	2.09	1.64	7.74	5.65	3.65	2.00	3.44	33.3	0.52
0.297	191.740	44.163	4.62	6.68	2.07	1.66	7.75	5.68	3.67	2.01	3.42	33.2	0.52
0.309	192.610	44.376	4.82	6.69	2.10	1.63	7.76	5.66	3.64	2.01	3.47	33.6	0.52
0.321	193.370	44.258	5.02	6.71	2.08	1.65	7.76	5.68	3.66	2.02	3.45	33.4	0.52
0.333	194.120	44.517	5.22	6.72	2.12	1.61	7.77	5.65	3.63	2.02	3.51	33.8	0.52
0.345	194.700	44.352	5.42	6.74	2.10	1.63	7.78	5.68	3.66	2.02	3.48	33.6	0.52
0.357	195.400	44.210	5.62	6.75	2.08	1.65	7.78	5.71	3.68	2.03	3.45	33.4	0.51
0.369	196.150	44.423	5.82	6.76	2.11	1.62	7.79	5.68	3.65	2.03	3.50	33.8	0.52
0.381	196.910	44.281	6.02	6.78	2.09	1.64	7.80	5.71	3.68	2.03	3.48	33.6	0.51
0.393	197.490	44.163	6.22	6.79	2.07	1.66	7.80	5.73	3.70	2.04	3.45	33.4	0.51
0.404	198.180	44.352	6.42	6.81	2.10	1.63	7.81	5.71	3.67	2.04	3.50	33.7	0.51
0.416	198.820	44.234	6.62	6.82	2.08	1.65	7.81	5.73	3.69	2.04	3.47	33.6	0.51
0.428	199.580	44.446	6.82	6.84	2.11	1.62	7.82	5.71	3.66	2.04	3.53	33.9	0.52
0.440	200.210	44.281	7.03	6.85	2.09	1.64	7.82	5.74	3.69	2.05	3.49	33.7	0.51
0.452	200.790	44.163	7.23	6.87	2.07	1.66	7.83	5.76	3.71	2.05	3.47	33.5	0.51
0.464	201.370	44.352	7.43	6.88	2.10	1.63	7.83	5.73	3.68	2.05	3.51	33.8	0.51
0.476	201.950	44.210	7.63	6.90	2.08	1.65	7.83	5.76	3.70	2.05	3.48	33.6	0.51
0.488	202.770	44.446	7.83	6.91	2.11	1.62	7.84	5.73	3.67	2.06	3.54	34.0	0.51
0.499	203.350	44.258	8.03	6.93	2.08	1.65	7.84	5.76	3.70	2.06	3.50	33.7	0.51
0.511	203.810	44.139	8.23	6.94	2.07	1.66	7.85	5.78	3.72	2.06	3.47	33.6	0.50
0.523	204.450	44.352	8.43	6.96	2.10	1.63	7.85	5.75	3.69	2.06	3.52	33.9	0.51
0.535	204.910	44.210	8.63	6.97	2.08	1.65	7.85	5.77	3.71	2.06	3.49	33.7	0.50
0.547	205.490	44.092	8.83	6.99	2.06	1.67	7.85	5.79	3.73	2.06	3.47	33.5	0.50
0.559	206.310	44.281	9.03	7.00	2.09	1.64	7.86	5.77	3.71	2.07	3.51	33.8	0.51
0.571	206.660	44.139	9.23	7.02	2.07	1.66	7.86	5.79	3.73	2.06	3.48	33.6	0.50

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.583	207.240	44.352	9.43	7.03	2.10	1.63	7.86	5.76	3.70	2.07	3.53	34.0	0.51
0.594	207.700	44.210	9.63	7.05	2.08	1.65	7.86	5.78	3.72	2.07	3.50	33.7	0.50
0.606	208.160	44.069	9.84	7.07	2.06	1.67	7.86	5.81	3.74	2.07	3.47	33.5	0.50
0.618	208.920	44.258	10.04	7.08	2.08	1.65	7.87	5.78	3.72	2.07	3.51	33.8	0.50
0.630	209.380	44.116	10.24	7.10	2.06	1.67	7.87	5.80	3.74	2.07	3.48	33.6	0.50
0.642	209.910	44.328	10.44	7.11	2.09	1.64	7.87	5.78	3.71	2.07	3.53	34.0	0.51
0.654	210.310	44.187	10.64	7.13	2.07	1.66	7.87	5.79	3.73	2.07	3.50	33.7	0.50
0.666	210.830	44.045	10.84	7.15	2.05	1.68	7.87	5.82	3.75	2.07	3.47	33.5	0.50
0.678	211.410	44.139	11.04	7.16	2.07	1.66	7.87	5.81	3.73	2.07	3.49	33.7	0.50
0.689	211.940	43.903	11.24	7.18	2.03	1.70	7.87	5.84	3.77	2.07	3.44	33.3	0.49
0.701	212.630	43.998	11.44	7.19	2.05	1.68	7.88	5.83	3.76	2.07	3.46	33.5	0.49
0.713	213.390	43.785	11.64	7.21	2.02	1.71	7.88	5.87	3.79	2.08	3.42	33.2	0.49
0.725	214.200	43.927	11.84	7.23	2.04	1.69	7.89	5.85	3.77	2.08	3.46	33.5	0.49
0.737	214.840	43.738	12.04	7.24	2.01	1.72	7.89	5.88	3.80	2.08	3.42	33.2	0.48
0.749	215.530	43.903	12.24	7.26	2.03	1.70	7.90	5.86	3.78	2.08	3.46	33.4	0.49
0.761	216.060	43.691	12.44	7.28	2.00	1.73	7.90	5.90	3.81	2.08	3.41	33.1	0.48
0.773	216.870	43.856	12.65	7.29	2.03	1.70	7.90	5.88	3.79	2.09	3.45	33.4	0.49
0.784	217.220	43.833	12.85	7.31	2.02	1.71	7.90	5.88	3.79	2.09	3.44	33.4	0.48
0.796	217.390	43.715	13.05	7.33	2.01	1.72	7.90	5.89	3.81	2.08	3.42	33.2	0.48
0.808	217.800	43.903	13.25	7.34	2.03	1.70	7.89	5.86	3.78	2.08	3.45	33.4	0.49
0.820	218.090	43.762	13.45	7.36	2.01	1.72	7.89	5.88	3.80	2.08	3.42	33.2	0.48
0.832	218.670	43.974	13.65	7.38	2.04	1.69	7.89	5.85	3.77	2.08	3.47	33.5	0.49
0.844	218.960	43.809	13.85	7.40	2.02	1.71	7.89	5.87	3.79	2.08	3.43	33.3	0.49
0.856	219.250	43.762	14.05	7.41	2.01	1.72	7.88	5.87	3.79	2.08	3.42	33.2	0.48
0.868	219.650	44.021	14.25	7.43	2.05	1.68	7.88	5.83	3.76	2.08	3.47	33.6	0.49
0.880	219.830	43.951	14.45	7.45	2.04	1.69	7.88	5.84	3.76	2.07	3.45	33.4	0.49
0.891	220.180	44.210	14.65	7.46	2.08	1.65	7.87	5.80	3.72	2.07	3.51	33.8	0.50
0.903	220.290	44.069	14.85	7.48	2.06	1.67	7.87	5.81	3.74	2.07	3.47	33.6	0.50
0.915	220.410	43.974	15.05	7.50	2.04	1.69	7.86	5.81	3.75	2.06	3.45	33.4	0.49
0.927	220.760	44.187	15.25	7.52	2.07	1.66	7.85	5.78	3.72	2.06	3.49	33.7	0.50
0.939	220.870	44.045	15.46	7.54	2.05	1.68	7.85	5.79	3.74	2.06	3.46	33.4	0.50
0.951	221.050	44.021	15.66	7.55	2.05	1.68	7.84	5.79	3.74	2.06	3.45	33.4	0.50
0.963	221.110	44.139	15.86	7.57	2.07	1.66	7.83	5.77	3.71	2.05	3.47	33.5	0.50
0.975	221.340	44.021	16.06	7.59	2.05	1.68	7.83	5.78	3.73	2.05	3.44	33.3	0.50
0.986	221.630	44.258	16.26	7.61	2.08	1.65	7.82	5.74	3.69	2.05	3.49	33.7	0.51
0.998	221.860	44.092	16.46	7.63	2.06	1.67	7.82	5.76	3.71	2.04	3.45	33.4	0.50
1.010	221.920	43.974	16.66	7.64	2.04	1.69	7.81	5.77	3.73	2.04	3.42	33.2	0.50
1.022	222.150	44.210	16.86	7.66	2.08	1.65	7.80	5.73	3.69	2.04	3.46	33.5	0.51
1.034	222.210	44.092	17.06	7.68	2.06	1.67	7.79	5.73	3.70	2.03	3.43	33.3	0.51
1.046	222.500	44.399	17.26	7.70	2.10	1.63	7.79	5.69	3.66	2.03	3.50	33.7	0.52

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.058	222.440	44.234	17.46	7.72	2.08	1.65	7.78	5.70	3.67	2.02	3.45	33.4	0.51
1.070	222.670	44.116	17.66	7.74	2.06	1.67	7.77	5.71	3.69	2.02	3.43	33.2	0.51
1.081	222.790	44.352	17.86	7.76	2.10	1.63	7.77	5.67	3.65	2.02	3.47	33.6	0.52
1.093	222.730	44.187	18.06	7.78	2.07	1.66	7.75	5.68	3.67	2.01	3.43	33.3	0.52
1.105	222.730	44.092	18.27	7.79	2.06	1.67	7.74	5.68	3.68	2.01	3.40	33.1	0.51
1.117	222.960	44.305	18.47	7.81	2.09	1.64	7.74	5.65	3.64	2.00	3.45	33.4	0.52
1.129	223.080	44.163	18.67	7.83	2.07	1.66	7.73	5.66	3.66	2.00	3.41	33.1	0.52
1.141	223.310	44.045	18.87	7.85	2.05	1.68	7.73	5.67	3.67	2.00	3.38	32.9	0.51
1.153	223.490	44.234	19.07	7.87	2.08	1.65	7.72	5.64	3.64	1.99	3.42	33.2	0.52
1.165	223.490	44.092	19.27	7.89	2.06	1.67	7.71	5.65	3.66	1.99	3.38	32.9	0.52
1.172	223.660	43.998	19.39	7.90	2.05	1.68	7.71	5.66	3.67	1.99	3.36	32.8	0.51

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'15		Ground Surface Elevation
BORING:	B101U		Elevation Datum
SAMPLE:	U2		
DEPTH:	53.9	Elevation:	
TEST DATE:	01-Feb-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	February 2018		
Figure No.			
Test Operator:	W. Lukas		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	SANDY LEAN CLAY (CL)		
Sample Description (2)			
Failure Type:	Bulging		
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	A8897		
Load Calibration Factor:	0.058033	lb/cnt	
Pressure ID:	25218		
Pressure Cal. Fator	0.023604	psi/cnt	
Displacement ID:	147		
Displacement Cal. Factor:	0.000067108	inch/cnt	

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.3	VC:	0.9245
Penetration, cm:	62.18		
Gross Recovery, cm:	62.38		
TUBE LENGTH	91.44		
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	1.0092
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER			
LAB DIST BOT PACKER			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	21.2				21.2	cm
TOP EMPTY LENGTH	2.8	2.8	2.9	2.9	2.85	cm
BOT. EMPTY LENGTH	3.3	3.3	3.3	3.3	3.3	cm
TUBE INNER DIAMETER	7.307	7.313	7.311	7.306	7.30925	cm

In tube length	15.05	cm
Tube Diameter	7.309	cm
Tube Area	41.96	(cm^2)
Tube Volume	631.50	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.35	7.36	7.378		7.363	cm
MEMBRANE 1 THICKNESS	0.098	0.1	0.1		0.099	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.631	13.753	13.647	13.746	13.694	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.73	8.748	8.803	8.768	8.762	cm

#filter strips	0		
Hi	15.092	cm	
Di	7.263	cm	2.07783387
Ai	41.434	cm^2	
Vi	625.329	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	117.860	91.940	*******	1888.380	*******	1644.620	1131.930	*******
DRY+T	100.880	78.850		*******	0.000	*******	993.050	373.680
T	31.650	31.580		621.910	0.000	405.190	405.190	372.020
Wt. Solids	69.23	47.27	0	1266.47	0	1004.23	587.86	1.66
w %	24.53	27.69	*******	26.11	*******	23.62	23.62	*******

FINAL B VALUE 0.95

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum		-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation		30.54	37.29	0.000	-3.086	0.000	0.000	-0.025	6.75	6.75
Consolidation Stage	1	30.43	56.33	0.000	10.586	0.061	0.061	0.085	25.90	25.90
	2	30.43	56.33	0.000	0.000	0.000	0.000	0.000	25.90	25.90
	3	30.43	56.33	0.000	0.000	0.000	0.000	0.000	25.90	25.90
	4	30.43	56.33	0.000	0.000	0.000	0.000	0.000	25.90	25.90
	5	30.43	56.33	0.000	0.000	0.000	0.000	0.000	25.90	25.90
	6	30.43	56.33	0.000	0.000	0.000	0.000	0.000	25.90	25.90
Start Shear		30.43	56.33	0.000	**********	**********			25.90	25.90
End Shear					12.730	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							1.0092	1.60	100.2	0.701	
after sampling		0.00	0.00							1.0000	1.59	99.3	0.717	
after shipping		0.00	0.00							1.0000	1.59	99.3	0.717	
in tube before extrusion		0.00	0.00	15.05	7.309	41.960	631.50	1004.23	26.11	*****	1.59	99.3	0.717	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.092	7.263	41.434	625.329	1004.235	*****	*****	1.61	100.3	0.700	
saturation		6.75	6.75	15.092	7.281	41.639	628.415	1004.235	25.946		1.60	99.8	0.708	
	1	25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
	2	25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
	3	25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
	4	25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
	5	25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
	6	25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
Start Shear		25.90	25.90	15.031	7.234	41.104	617.829	1004.235	24.892	*****	1.63	101.5	0.680	
End Shear		**********	**********				605.099	1004.235	23.625	*****	1.66	103.6	0.645	0.64495356

Test comp (c) or ext (c) c

DEFORMATION RATE 1	0.02074061	mm/min	0.0138	%/min
DEFORMATION RATE 2	0.00081656	in/min	0.000137985	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) e

(assumed)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R15
Boring	B101U
Sample	U2
Depth	53.91
By	WGL
Date	2/1/18
Checked	DJA
Date	2·13·18

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-11	CW-18		
Wet Wt. + Tare (g)	117.86	91.94		
Dry Wt. + Tare (g)	100.88	78.85		
Wt. Water (g)	16.98	13.09		
Tare (g)	31.65	31.58		
Dry Wt. Soil (g)	69.23	47.27		
Water Content (%)	24.5	27.7		

26.1

Trimmed Length in Tube

Overall Tube Length	21.2				cm	Avg.	21.2 cm
Top Empty Length	2.8	2.8	2.9	2.9	cm	Avg.	2.85 cm
Bottom Empty Length	3.3	3.3	3.3	3.3	cm	Avg.	3.3 cm

Trimmed Length in Tube, L: 15.05 cm

Tube Dimensions

Tube Inner Diameter	7.304	7.313	7.311	7.306	cm	Avg.	7.309 cm

Tube Weight (g): 621.91

Weight of other (specify: —) (g): 0

Area, A: 41.96 cm^2

Volume in Tube = A x L: 681.50 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1644.62	g
Membrane	405.19	g
W_{moist}	1239.43	g

Dry Wt. Of Excess Solids

Tare #	D-12	g
Dry + Tare	373.68	g
Tare	372.02	g
Dry Wt. Of Excess	1.66	g

Water Content (Fraction Used: 1/2)

Tare #	MB-2	
Wet + Tare	1131.93	g
Dry + Tare	993.05	g
Wt. Water	138.88	g
Tare	405.19	g
Wt. Dry Soil	587.86	g
Water Content	23.6	%

$W_s = W_{moist} / (1 + wc)$ + Dry Wt of Excess = 1024.65 g

Estimate of γ_d using γ_m in tube

Moist soil + tube + ~~other~~ (specify: —)	1888.38	g
Tube + ~~other~~	621.91	g
Moist soil	1266.47	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.006 g/cm^3 = 125.2 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.590 g/cm^3 = 99.3 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700655
Test No.	K15
Boring	B1010
Sample	U2
Depth	53.9'
By	WGL
Date	2/2/18
Checked	DJA
Date	2.13.18

Undisturbed Specimen ✓
Remolded or compacted Specimen ____

Filter Strips? Yes ✓ No ____
Lubricated End Platens? Yes ____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over ____ membranes	7.350	7.360	~~7.378~~		Avg.	7.363 cm
Twice thickness ____ membranes	~~0.101~~	~~0.102~~	~~0.099~~		Avg.	- cm
	0.098	0.100	0.100		Avg.	- 0.099 cm

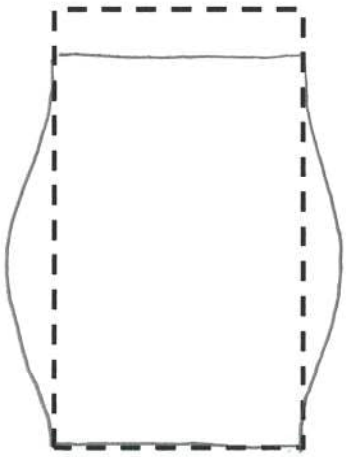
Diameter of Specimen	7.264	cm
Diameter of Specimen	2.860	inch
Area of Specimen	41.44	cm^2

Height Caliper #____

Height from top gauge block to top of top platen, with specimen	13.631	13.753	13.647	~~13.746~~	Avg.	13.694 cm
Height of Gauge Block						+ 10.160 cm
Height from top of top platen to cell base, without specimen	8.730	8.748	8.853	8.768	Avg.	- 8.762 cm

Height of Specimen in Cell	15.092	cm
Height of Specimen in Cell	5.942	inch
Volume in cell, initial	625.4	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Bulging

Test Notes & Remarks:

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Saturation and Consolidation Data

Project No.	1700685
Test No.	R15
Boring	B10U
Sample	U2
Depth	53.9'
By	WSL
Date	2/2/18
Page	

Panel No. 1

Pressure Trans:	SN 25218	Factor 2.3604e-2	Gain = 8		
Load Trans:	SN A8897	Factor 5.8033e-2	Gain = 8		
Displ. Trans:	SN 147	Factor 6.7108e-5	Gain = 64		

Date	Time	Load (lb)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
2/2		0	0					-7		0
	1020					24.6		0.21		8.33
						22.9		10.36		17.35
	1405					21.6				
	1600					21.6		11.12		17.82
						21.5		20.68		27.36
2/5	800					20.4		20.72		27.45
							B=0.95	30.54	30.07	37.29
		σ'_{vc} =	25.8 psi ⇒ σ_{cell} = 56.3 psi							
			CONSOL			11.9		30.43		56.41
						19.8		30.24		56.33
			SHEAR							
2/6	1430		Recons.			13.8				
	1445					21.2				
	1515					23.3				

TEST REMARKS

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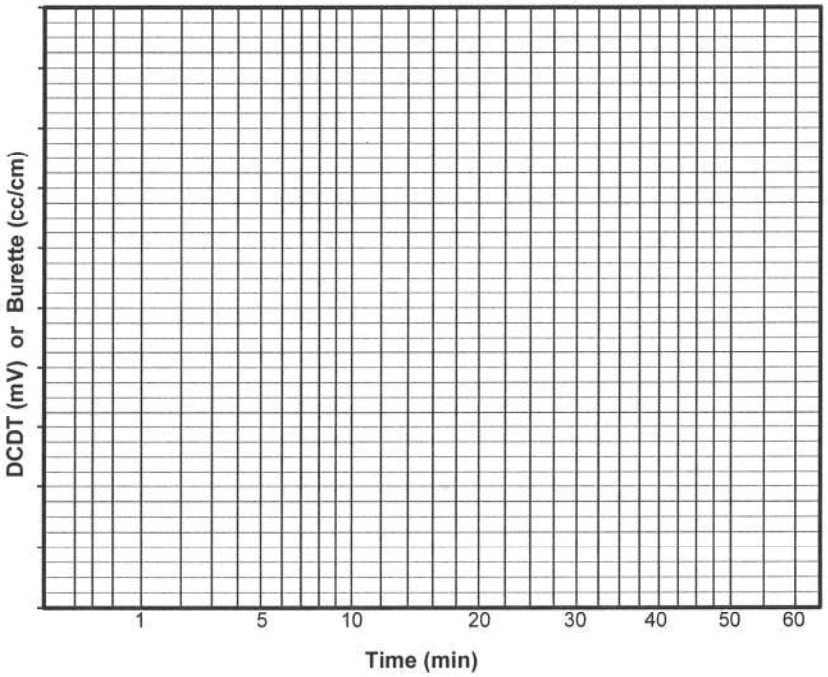
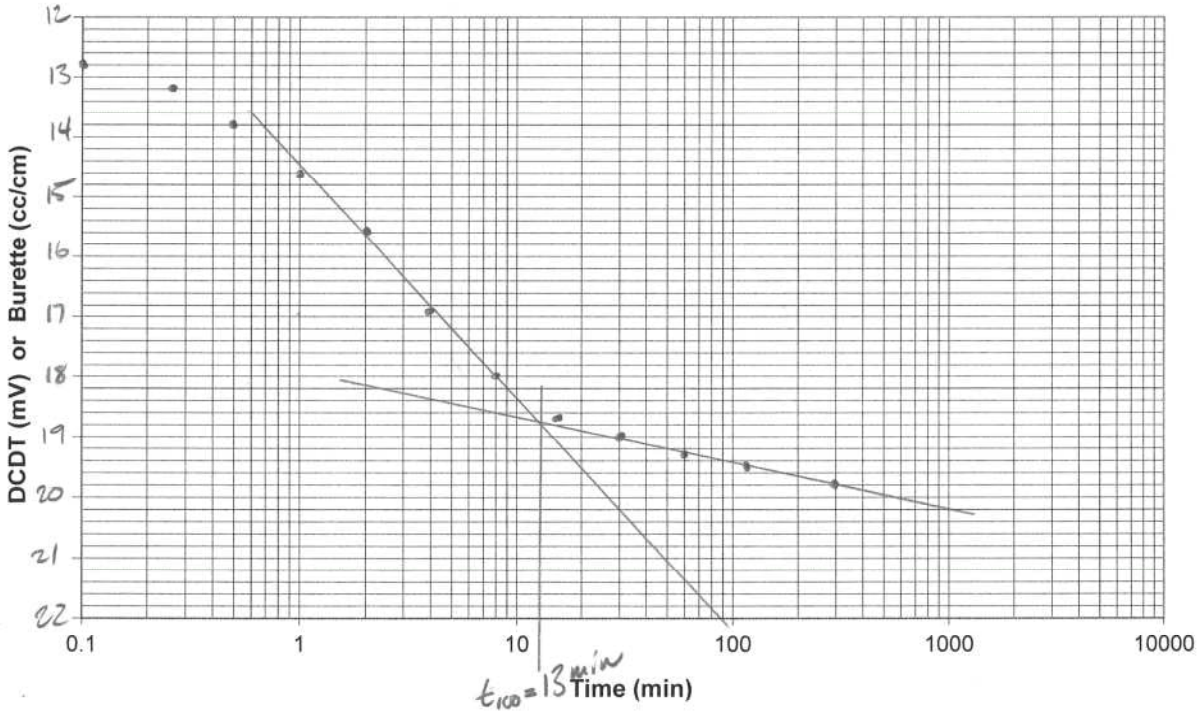
Consolidation Worksheet

Hanger Load		kg	
Loading Device			
DCDT #			
Channel			

Project No.	1700685
Test	R'15
Boring	B101U
Sample	U2
By	WSL
Date	2/5/18
Checked	DJA
Date	2.13.18

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
831	0	11.9
	0.1	12.8
	0.25	13.2
	0.5	13.8
832	1	14.6
833	2	15.6
835	4	16.9
839	8	18.0
846	15	18.7
901	30	19.0
931	60	19.3
1031	120	19.5
1331	300	19.8





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Triaxial Rate Calculations

Project No.	1700685
Test No.	R115
Boring	B101U
Sample	U2
Depth	53.91
By	WOL
Date	2/5/18
Checked	DJA
Date	2.13.18

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #	1				
Initial Specimen Height in Cell	15.092	cm			
Height Change during Consolidation	0.060	cm	=	0.0236	inch
Specimen Height, **A**	15.032	cm	=	5.918	inch
Estimated T_{100}, **B**	13	min			
Estimated Fail Strain, **C**	4	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	0.220	mm / min	=	0.00867	inch / min
Actual Deformation Rate, **E**	0.0209	mm / min	=	0.000822	inch / min
Strain Rate = (**E** / **A**) *10	0.0139	% / min			

20% in 24 hrs

$$\Rightarrow \frac{(15.032\,cm)(0.20)(10\,mm/cm)}{60(24)} = 0.0209\,mm/min = 0.000822\,in/min$$

< 0.0087 ✓

TEST REMARKS

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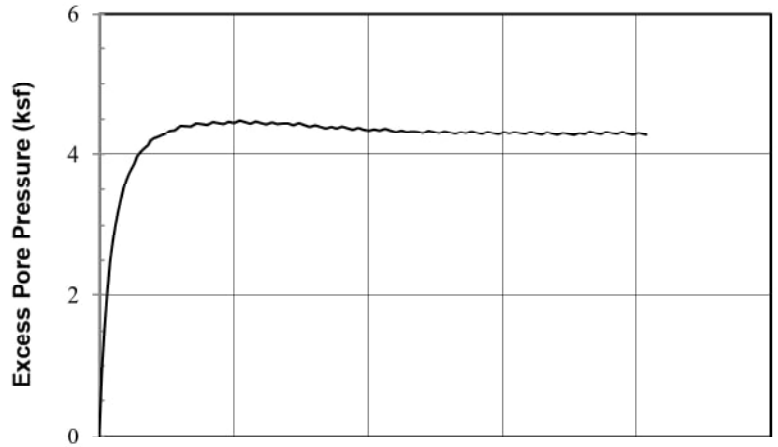


SAMPLE INFORMATION

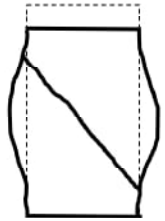
Boring: B101U Sample: U2 Depth (ft): 53.2 Test: R'16
Type: 2.8-inch-diameter tube sample
Description: Sandy CLAY (CL); clay-like alluvium

SPECIMEN INFORMATION (after saturation)

Height: 5.917 in Dia.: 2.843 in Area.: 6.498 sq. in
Water Content: 25.0% Dry Unit Weight: 101.3 pcf

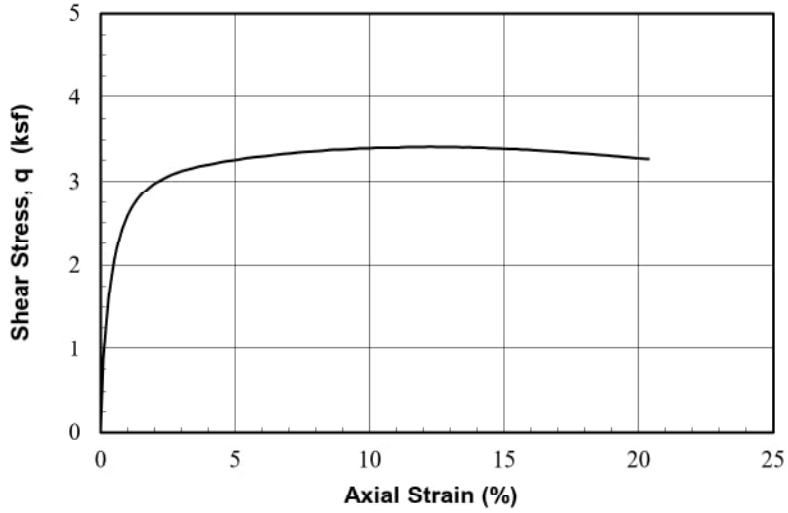
TEST SUMMARY (end of test)

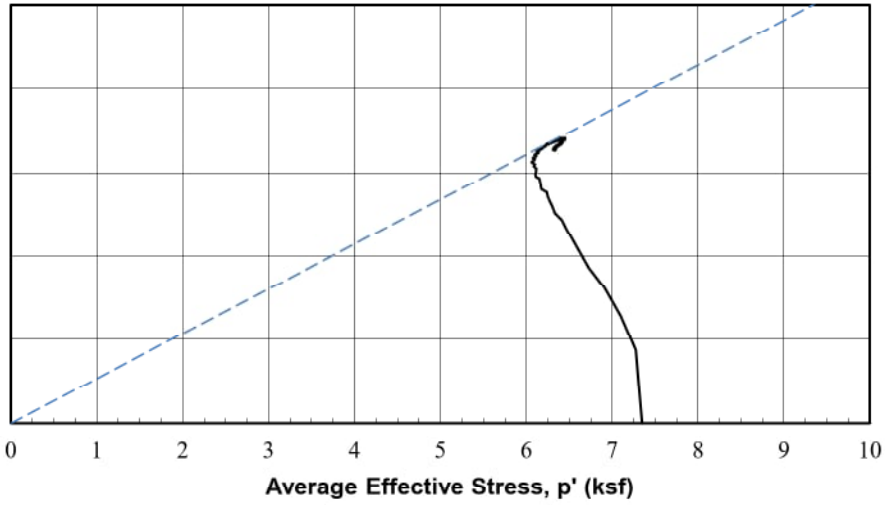
Effective Confining Stress: 7.35 ksf vertical, 7.35 ksf horiz.
Water Content: 23.1 % Dry Unit Weight: 104.4 pcf
B Coefficient: 0.97 Strain Rate: 0.014 %/min
Peak Shear Stress: 3.41 ksf @ 12.3 % Strain
Peak Friction Angle: 32.4 deg. @ 7.4 % Strain



Failure Sketch

REMARKS:





Operator: WGL
Checked: D. Aghjayan
Test Date: 7-Feb-2018

2/23/2018 14:05

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-10

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'16												
BORING:	B101U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U2			In situ	--	--	--	--	--	--	--	--	--
DEPTH (ft):	53.2			After Sampling	--	--	--	--	--	--	--	--	--
OPER.:	WGL			In tube before extrusion	--	--	5.945	2.875	6.491	25.00	101.6	127.1	0.677
TEST DATE:	2/7/2018			Under vac.	1.01	1.01	5.960	2.864	6.443	--	102.1	--	0.669
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	0.93	0.93	5.960	2.876	6.498	25.02	101.3	126.6	0.683
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
Pressure Transducer		25218		Consol. Stage 2	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
				Consol. Stage 4	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
Gravity of Solids		2.73	(measured)	Consol. Stage 5	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
				Consol. Stage 6	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
B value start shear		0.97											
Test Stage End of#	1			This Stage Initial Values	7.35	7.35	5.917	2.843	6.346	23.15	104.4	128.6	0.632
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		4.56 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.042	8.067	31.157	0.00	6.35	0.00	7.35	7.35	7.35	7.35	0.00	1.00	0.0	0.00
0.048	85.250	37.743	0.10	6.35	0.95	6.40	9.10	8.15	7.27	0.87	1.27	6.9	0.54
0.054	121.230	41.779	0.20	6.36	1.53	5.82	9.91	8.38	7.10	1.28	1.44	10.4	0.60
0.060	151.410	45.461	0.30	6.37	2.06	5.29	10.59	8.53	6.91	1.62	1.61	13.6	0.64
0.066	172.710	48.388	0.40	6.37	2.48	4.87	11.07	8.59	6.73	1.86	1.76	16.1	0.67
0.072	189.590	50.442	0.50	6.38	2.78	4.57	11.45	8.67	6.62	2.05	1.90	18.0	0.68
0.078	202.770	52.047	0.60	6.38	3.01	4.34	11.74	8.73	6.54	2.20	2.01	19.6	0.69
0.084	214.140	53.392	0.70	6.39	3.20	4.15	11.99	8.79	6.47	2.32	2.12	21.0	0.69
0.090	223.950	54.502	0.81	6.40	3.36	3.99	12.21	8.85	6.42	2.43	2.22	22.3	0.69
0.096	231.730	55.682	0.91	6.40	3.53	3.82	12.38	8.85	6.33	2.51	2.32	23.4	0.70
0.102	238.980	56.437	1.01	6.41	3.64	3.71	12.53	8.89	6.30	2.59	2.40	24.3	0.70
0.108	244.730	57.051	1.11	6.42	3.73	3.62	12.66	8.93	6.27	2.66	2.47	25.0	0.70
0.114	249.890	57.594	1.21	6.42	3.81	3.54	12.77	8.96	6.25	2.71	2.53	25.7	0.70
0.120	254.650	58.042	1.31	6.43	3.87	3.48	12.87	9.00	6.24	2.76	2.59	26.3	0.70
0.125	258.540	58.750	1.41	6.44	3.97	3.37	12.95	8.98	6.18	2.80	2.66	27.0	0.71
0.131	262.250	59.081	1.51	6.44	4.02	3.33	13.03	9.01	6.17	2.84	2.71	27.4	0.71
0.137	265.620	59.340	1.61	6.45	4.06	3.29	13.10	9.04	6.16	2.87	2.75	27.8	0.71

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.143	268.290	59.576	1.71	6.46	4.09	3.26	13.15	9.06	6.16	2.90	2.78	28.1	0.71
0.149	271.070	59.789	1.81	6.46	4.12	3.23	13.21	9.08	6.16	2.93	2.82	28.4	0.70
0.155	273.570	60.261	1.91	6.47	4.19	3.16	13.26	9.07	6.11	2.95	2.87	28.9	0.71
0.161	275.830	60.450	2.01	6.48	4.22	3.13	13.30	9.08	6.11	2.98	2.90	29.2	0.71
0.173	279.720	60.662	2.21	6.49	4.25	3.10	13.38	9.13	6.11	3.01	2.94	29.5	0.70
0.185	283.320	60.875	2.42	6.50	4.28	3.07	13.44	9.16	6.12	3.05	2.99	29.9	0.70
0.197	286.510	61.276	2.62	6.52	4.34	3.01	13.50	9.16	6.09	3.08	3.04	30.4	0.70
0.209	289.180	61.347	2.82	6.53	4.35	3.00	13.55	9.20	6.10	3.10	3.07	30.5	0.70
0.221	291.790	61.772	3.02	6.54	4.41	2.94	13.59	9.18	6.06	3.12	3.12	31.0	0.71
0.233	293.940	61.748	3.22	6.56	4.41	2.94	13.63	9.22	6.08	3.14	3.13	31.1	0.70
0.244	296.030	61.724	3.42	6.57	4.40	2.95	13.66	9.26	6.10	3.16	3.14	31.1	0.70
0.256	298.170	62.031	3.62	6.58	4.45	2.90	13.69	9.25	6.07	3.17	3.19	31.5	0.70
0.268	299.910	61.961	3.82	6.60	4.44	2.91	13.72	9.28	6.10	3.18	3.19	31.5	0.70
0.280	301.540	61.890	4.02	6.61	4.43	2.92	13.74	9.31	6.12	3.20	3.19	31.5	0.69
0.292	303.340	62.149	4.22	6.63	4.46	2.89	13.77	9.30	6.09	3.21	3.22	31.8	0.70
0.304	305.140	62.055	4.42	6.64	4.45	2.90	13.79	9.34	6.12	3.22	3.22	31.8	0.69
0.316	306.760	61.961	4.62	6.65	4.44	2.91	13.81	9.38	6.14	3.23	3.22	31.7	0.69
0.328	308.270	62.197	4.82	6.67	4.47	2.88	13.83	9.36	6.12	3.24	3.25	32.0	0.69
0.339	309.720	62.055	5.03	6.68	4.45	2.90	13.85	9.40	6.15	3.25	3.24	31.9	0.68
0.351	311.460	62.315	5.23	6.70	4.49	2.86	13.87	9.39	6.12	3.26	3.28	32.2	0.69
0.363	312.910	62.149	5.43	6.71	4.46	2.89	13.89	9.43	6.16	3.27	3.27	32.1	0.68
0.375	314.250	62.008	5.63	6.72	4.44	2.91	13.90	9.46	6.18	3.28	3.26	32.0	0.68
0.387	315.640	62.220	5.83	6.74	4.47	2.88	13.92	9.45	6.16	3.29	3.29	32.2	0.68
0.399	316.860	62.079	6.03	6.75	4.45	2.90	13.93	9.48	6.19	3.29	3.27	32.1	0.68
0.411	318.250	61.937	6.23	6.77	4.43	2.92	13.95	9.52	6.22	3.30	3.26	32.1	0.67
0.423	319.700	62.126	6.43	6.78	4.46	2.89	13.96	9.51	6.20	3.31	3.29	32.3	0.67
0.434	320.980	61.961	6.63	6.80	4.44	2.91	13.98	9.54	6.23	3.31	3.28	32.2	0.67
0.446	322.320	62.008	6.83	6.81	4.44	2.91	13.99	9.55	6.23	3.32	3.29	32.2	0.67
0.458	323.420	62.008	7.03	6.83	4.44	2.91	14.00	9.56	6.23	3.33	3.29	32.3	0.67
0.470	324.640	61.842	7.23	6.84	4.42	2.93	14.01	9.59	6.26	3.33	3.27	32.1	0.66
0.482	326.090	62.055	7.43	6.86	4.45	2.90	14.03	9.58	6.24	3.34	3.30	32.4	0.67
0.494	327.250	61.890	7.63	6.87	4.43	2.92	14.04	9.61	6.27	3.34	3.29	32.3	0.66
0.506	328.290	61.701	7.84	6.89	4.40	2.95	14.04	9.65	6.30	3.35	3.27	32.1	0.66
0.518	329.450	61.842	8.04	6.90	4.42	2.93	14.05	9.64	6.28	3.35	3.29	32.3	0.66
0.529	330.560	61.677	8.24	6.92	4.39	2.95	14.06	9.67	6.31	3.36	3.27	32.1	0.65
0.541	331.770	61.536	8.44	6.93	4.37	2.97	14.07	9.70	6.34	3.36	3.26	32.1	0.65
0.553	332.820	61.701	8.64	6.95	4.40	2.95	14.08	9.68	6.32	3.37	3.28	32.2	0.65
0.565	333.750	61.536	8.84	6.96	4.37	2.97	14.08	9.71	6.34	3.37	3.27	32.1	0.65
0.577	334.790	61.724	9.04	6.98	4.40	2.95	14.09	9.69	6.32	3.37	3.29	32.3	0.65
0.589	335.780	61.559	9.24	6.99	4.38	2.97	14.10	9.72	6.34	3.37	3.27	32.1	0.65

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.601	337.000	61.394	9.44	7.01	4.35	2.99	14.11	9.75	6.37	3.38	3.26	32.0	0.64
0.613	338.040	61.583	9.64	7.02	4.38	2.97	14.11	9.73	6.35	3.38	3.28	32.2	0.65
0.625	338.910	61.418	9.84	7.04	4.36	2.99	14.12	9.76	6.37	3.38	3.26	32.1	0.64
0.636	339.960	61.300	10.04	7.05	4.34	3.01	14.12	9.78	6.39	3.39	3.25	32.0	0.64
0.648	340.890	61.441	10.24	7.07	4.36	2.99	14.13	9.77	6.38	3.39	3.27	32.1	0.64
0.660	341.930	61.300	10.44	7.09	4.34	3.01	14.13	9.79	6.40	3.39	3.26	32.0	0.64
0.672	343.030	61.488	10.65	7.10	4.37	2.98	14.14	9.77	6.38	3.40	3.28	32.2	0.64
0.684	343.670	61.300	10.85	7.12	4.34	3.01	14.14	9.80	6.40	3.39	3.26	32.0	0.64
0.696	344.540	61.158	11.05	7.13	4.32	3.03	14.14	9.82	6.42	3.40	3.24	31.9	0.64
0.708	345.470	61.323	11.25	7.15	4.34	3.00	14.14	9.80	6.40	3.40	3.26	32.1	0.64
0.720	346.520	61.158	11.45	7.17	4.32	3.03	14.15	9.83	6.43	3.40	3.25	31.9	0.64
0.731	347.620	61.205	11.65	7.18	4.33	3.02	14.16	9.83	6.42	3.40	3.25	32.0	0.64
0.743	348.430	61.182	11.85	7.20	4.32	3.02	14.16	9.83	6.43	3.40	3.25	32.0	0.64
0.755	349.130	61.040	12.05	7.22	4.30	3.05	14.15	9.85	6.45	3.40	3.24	31.9	0.63
0.767	350.110	61.276	12.25	7.23	4.34	3.01	14.16	9.82	6.42	3.41	3.26	32.1	0.64
0.779	350.690	61.158	12.45	7.25	4.32	3.03	14.15	9.83	6.43	3.40	3.25	31.9	0.63
0.791	351.450	61.016	12.65	7.27	4.30	3.05	14.15	9.85	6.45	3.40	3.23	31.8	0.63
0.803	352.090	61.229	12.85	7.28	4.33	3.02	14.15	9.82	6.42	3.40	3.25	32.0	0.64
0.815	352.670	61.087	13.05	7.30	4.31	3.04	14.15	9.84	6.44	3.40	3.24	31.9	0.63
0.826	353.190	60.969	13.26	7.32	4.29	3.06	14.14	9.85	6.45	3.40	3.22	31.8	0.63
0.838	353.890	61.134	13.46	7.33	4.32	3.03	14.14	9.82	6.43	3.40	3.24	31.9	0.64
0.850	354.810	61.016	13.66	7.35	4.30	3.05	14.14	9.84	6.45	3.40	3.23	31.8	0.63
0.862	355.450	61.229	13.86	7.37	4.33	3.02	14.14	9.81	6.41	3.39	3.25	32.0	0.64
0.874	355.860	61.064	14.06	7.38	4.31	3.04	14.13	9.82	6.43	3.39	3.23	31.8	0.64
0.886	356.440	60.946	14.26	7.40	4.29	3.06	14.13	9.84	6.45	3.39	3.22	31.7	0.63
0.898	357.140	61.158	14.46	7.42	4.32	3.03	14.12	9.80	6.42	3.39	3.24	31.9	0.64
0.910	357.830	61.040	14.66	7.44	4.30	3.05	14.12	9.82	6.43	3.39	3.22	31.8	0.64
0.921	358.240	60.898	14.86	7.45	4.28	3.07	14.11	9.83	6.45	3.38	3.21	31.6	0.63
0.933	358.760	61.111	15.06	7.47	4.31	3.03	14.11	9.79	6.41	3.38	3.23	31.8	0.64
0.945	359.110	60.993	15.26	7.49	4.30	3.05	14.10	9.80	6.43	3.37	3.21	31.7	0.64
0.957	359.800	61.111	15.46	7.51	4.31	3.03	14.10	9.78	6.41	3.37	3.22	31.8	0.64
0.969	360.150	61.040	15.66	7.53	4.30	3.05	14.09	9.78	6.41	3.37	3.21	31.7	0.64
0.981	360.730	60.922	15.86	7.54	4.29	3.06	14.08	9.79	6.43	3.37	3.20	31.6	0.64
0.993	361.310	61.158	16.07	7.56	4.32	3.03	14.08	9.76	6.39	3.36	3.22	31.8	0.64
1.005	361.660	60.993	16.27	7.58	4.30	3.05	14.07	9.77	6.41	3.36	3.20	31.6	0.64
1.017	362.010	60.875	16.47	7.60	4.28	3.07	14.06	9.78	6.42	3.35	3.19	31.5	0.64
1.028	362.710	61.111	16.67	7.62	4.31	3.03	14.05	9.74	6.39	3.35	3.21	31.7	0.64
1.040	363.110	60.969	16.87	7.63	4.29	3.06	14.05	9.75	6.40	3.35	3.19	31.5	0.64
1.052	363.520	60.851	17.07	7.65	4.28	3.07	14.04	9.76	6.42	3.34	3.18	31.4	0.64
1.064	363.920	61.064	17.27	7.67	4.31	3.04	14.03	9.72	6.38	3.34	3.20	31.6	0.64

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.076	364.160	60.922	17.47	7.69	4.29	3.06	14.02	9.73	6.40	3.33	3.18	31.4	0.64
1.088	364.450	60.804	17.67	7.71	4.27	3.08	14.01	9.74	6.41	3.33	3.16	31.3	0.64
1.100	365.090	61.040	17.87	7.73	4.30	3.05	14.00	9.70	6.37	3.33	3.18	31.5	0.65
1.112	365.490	60.898	18.07	7.75	4.28	3.07	13.99	9.71	6.39	3.32	3.17	31.3	0.64
1.123	365.900	61.182	18.27	7.77	4.32	3.02	13.98	9.66	6.34	3.32	3.19	31.5	0.65
1.135	366.070	61.016	18.47	7.78	4.30	3.05	13.97	9.67	6.36	3.31	3.17	31.4	0.65
1.147	366.360	60.898	18.67	7.80	4.28	3.07	13.96	9.68	6.37	3.31	3.16	31.3	0.65
1.159	366.710	61.158	18.88	7.82	4.32	3.03	13.95	9.63	6.33	3.30	3.18	31.4	0.65
1.171	366.880	61.016	19.08	7.84	4.30	3.05	13.94	9.64	6.34	3.29	3.16	31.3	0.65
1.183	367.350	60.922	19.28	7.86	4.29	3.06	13.93	9.64	6.35	3.29	3.15	31.2	0.65
1.195	367.700	61.158	19.48	7.88	4.32	3.03	13.92	9.60	6.31	3.29	3.17	31.4	0.66
1.207	367.810	60.969	19.68	7.90	4.29	3.06	13.90	9.61	6.33	3.28	3.15	31.2	0.65
1.218	367.990	60.851	19.88	7.92	4.28	3.07	13.89	9.62	6.34	3.27	3.13	31.0	0.65
1.230	368.390	61.064	20.08	7.94	4.31	3.04	13.88	9.58	6.31	3.27	3.15	31.2	0.66
1.242	368.800	60.898	20.28	7.96	4.28	3.07	13.87	9.59	6.33	3.26	3.13	31.0	0.66
1.247	368.860	60.851	20.36	7.97	4.28	3.07	13.87	9.59	6.33	3.26	3.12	31.0	0.66

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'16	Ground Surface Elevation	
BORING:	B101U	Elevation Datum	
SAMPLE:	U2		
DEPTH:	53.2	Elevation:	
TEST DATE:	07-Feb-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	February 2018		
Figure No.			
Test Operator:	WGL		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Sandy CLAY (CL); clay-like alluvium		
Sample Description (2)			
Failure Type:			
Remarks (1):			
Remarks (2):			
	LL=		
	PL=		
	PI=		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.3	VC:	0.9245
Penetration, cm:	62.18		
Gross Recovery, cm:	62.38		
TUBE LENGTH, cm	91.44		
FIELD DIST. TO TOP SOIL, cm			
FIELD DIST. TO BOT SOIL, cm		IN SITU COR. FACTOR:	1.0092
FIELD DIST TOP PACKER, cm		TUBE TRANSPORT COR. FACTOR:	1.0000
FIELD DIST BOT PACKER, cm		TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm			
LAB DIST BOT PACKER, cm			

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	18.4				18.4	cm
TOP EMPTY LENGTH	1.3				1.3	cm
BOT. EMPTY LENGTH	2				2	cm
TUBE INNER DIAMETER	7.311	7.302	7.288	7.306	7.30175	cm

In tube length	15.10	cm
Tube Diameter	7.302	cm
Tube Area	41.87	(cm^2)
Tube Volume	632.30	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.38	7.376	7.371		7.376	cm
MEMBRANE 1 THICKNESS	0.068	0.066	0.064		0.066	cm
MEMBRANE 2 THICKNESS	0.034	0.036	0.034		0.035	cm
HEIGHT WITH SPECIMEN	13.703	13.747	13.733	13.802	13.746	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.737	8.733	8.784	8.814	8.767	cm

#filter strips	0		
Hi	15.139	cm	
Di	7.275	cm	2.08099656
Ai	41.568	cm^2	
Vi	629.304	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	98.210	101.560	*******	1830.810	*******	1670.510	1068.220	*******
DRY+T	84.570	88.440		*******	0.000	*******	943.240	401.280
T	31.900	31.470		543.890	0.000	403.260	403.260	400.850
Wt. Solids	52.67	56.97	0	1286.92	0	1029.50	539.98	0.43
w %	25.90	23.03	*******	25.00	*******	23.15	23.15	*******

FINAL B VALUE 0.97

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	31.32	37.81	0.000	-5.379	0.000	0.000	-0.043	6.49	6.49
Consolidation Stage 1	31.70	82.73	0.000	19.296	0.109	0.109	0.153	51.03	51.03
2	31.70	82.73	0.000	0.000	0.000	0.000	0.000	51.03	51.03
3	31.70	82.73	0.000	0.000	0.000	0.000	0.000	51.03	51.03
4	31.70	82.73	0.000	0.000	0.000	0.000	0.000	51.03	51.03
5	31.70	82.73	0.000	0.000	0.000	0.000	0.000	51.03	51.03
6	31.70	82.73	0.000	0.000	0.000	0.000	0.000	51.03	51.03
Start Shear	31.70	82.73	0.000	**********	**********			51.03	51.03
End Shear				0.000	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm³	pcf	void ratio	
in situ		0.00	0.00							1.0092	1.64	102.6	0.661	
after sampling		0.00	0.00							1.0000	1.63	101.6	0.677	
after shipping		0.00	0.00							1.0000	1.63	101.6	0.677	
in tube before extrusion		0.00	0.00	15.10	7.302	41.874	632.30	1029.50	25.00	*****	1.63	101.6	0.677	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.139	7.275	41.568	629.304	1029.499	*****	*****	1.64	102.1	0.669	
saturation		6.49	6.49	15.139	7.306	41.923	634.682	1029.499	25.020		1.62	101.3	0.683	
	1	51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
	2	51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
	3	51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
	4	51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
	5	51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
	6	51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
Start Shear		51.03	51.03	15.030	7.220	40.944	615.386	1029.499	23.145	*****	1.67	104.4	0.632	
End Shear		**********	**********				615.386	1029.499	23.145	*****	1.67	104.4	0.632	0.631866736

Test comp (c) or ext (e) c

DEFORMATION RATE 1 0.02061145 mm/min 0.0137 %/min

DEFORMATION RATE 2 0.00081147 in/min 0.000137135 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.73 2.730 yields S=1

estimated or measured? (enter E or M) m

(measured)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm²	0.1550031	in²	1	cm²
cm³	0.061023744	in³	1	cm³
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm³	62.427961	pcf	1	g/cm³
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'16
Boring	B101U
Sample	U2
Depth	53.2'
By	WBL
Date	2/7/18
Checked	
Date	

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-1	JJ-2		
Wet Wt. + Tare (g)	98.21	101.56		
Dry Wt. + Tare (g)	84.57	88.44		
Wt. Water (g)	13.64	13.12		
Tare (g)	31.90	31.47		
Dry Wt. Soil (g)	52.67	56.97		
Water Content (%)	25.9	23.0		

24.5%

Trimmed Length in Tube

Overall Tube Length	18.4				cm	Avg.	18.4 cm
Top Empty Length	1.3				cm	Avg.	1.3 cm
Bottom Empty Length	2.0				cm	Avg.	2.0 cm

Trimmed Length in Tube, L: 15.1 cm

Tube Dimensions

Tube Inner Diameter	7.311	7.302	7.288	7.306	cm	Avg.	7.302 cm

Tube Weight (g):
Weight of other (specify:_____) (g):

Area, A: 41.87 cm^2
Volume in Tube = A x L: 632.3 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1670.51 g
Membrane	403.26 g
W_{moist}	1267.25 g

Dry Wt. Of Excess Solids

Tare #	MB-77
Dry + Tare	401.28 g
Tare	400.85 g
Dry Wt. Of Excess	0.43 g

Water Content
(Fraction Used: 1/2)

Tare #	S-4A
Wet + Tare	1068.22 g
Dry + Tare	943.24 g
Wt. Water	124.98 g
Tare	403.26 g
Wt. Dry Soil	539.98 g
Water Content	23.1 %

W_s = W_{moist} / (1 + wc) + Dry Wt of Excess = 1029.9 g

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify:_____)	1830.81 g
Tube + other	543.89 g
Moist soil	1286.92 g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 2.035 g/cm^3 / 127.0 pcf

γ_d = γ_{moist} / (1 + wc) = 1.628 g/cm^3 / 101.6 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	E16
Boring	B101U
Sample	U2
Depth	
By	WOL
Date	2/8/18
Checked	
Date	

Undisturbed Specimen ✓

Remolded or compacted Specimen _____

Filter Strips? Yes ✓ No _____

Lubricated End Platens? Yes _____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #_____

Diameter over _____ membranes	7.380	7.376	7.371		Avg.	7.376 cm
Twice thickness _____ membranes	0.068	0.066	0.064		Avg.	-0.066 cm
	0.034	0.036	0.034		Avg.	-0.035 cm

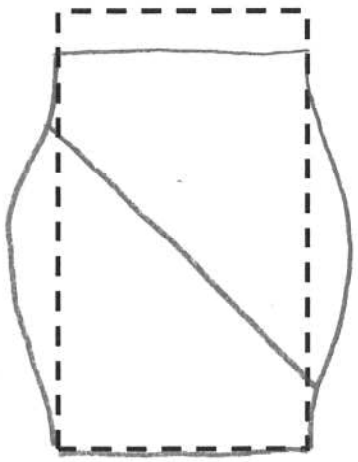
Diameter of Specimen	7.275 cm
Diameter of Specimen	2.864 inch
Area of Specimen	41.57 cm^2

Height Caliper #_____

Height from top gauge block to top of top platen, with specimen	13.703	13.747	13.783	13.802	Avg.	13.746 cm
Height of Gauge Block						+10.160 cm
Height from top of top platen to cell base, without specimen	8.737	8.733	8.784	8.814	Avg.	-8.767 cm

Height of Specimen in Cell	15.139 cm
Height of Specimen in Cell	5.960 inch
Volume in cell, initial	629.3 cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

GEI Consultants

Saturation and Consolidation Data

Panel No. 1

Pressure Trans: SN 25218 Factor 0.023604 Gain = 8
Load Trans: SN A8997 Factor 0.058033 Gain = 8
Displ. Trans: SN 147 Factor 6.7108e-5 Gain = 64

Project No.	1700685
Test No.	R'16
Boring	B104U
Sample	U2
Depth	53.2'
By	WOL
Date	2/7/18
Page	

Date	Time	Load (lb)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
2/8	1520	0	0					-7		0
						21.3		0.31		7.48
						20.5		10.39		17.11
2/9	905					18.8		11.35		17.99
	[illegible]							20.68		27.31
	1640					19.0		20.58		27.03
							B=0.97	31.32	31.06	37.81
2/12	1105					18.8		31.35		37.77
			$\bar{\sigma}_{vc}$ = 51.6 psi ⇒ 82.95							
			Consol			9.7		31.46		82.97
						24.1		31.70		82.73
			0.043	SHEAR						

TEST REMARKS

GEI Consultants

Triaxial Rate Calculations

Project No.	1700685
Test No.	K'16
Boring	B1010
Sample	U2
Depth	53.21
By	WOL
Date	2/12/18
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, A		cm	=		inch
Estimated T_{100}, B		min			
Estimated Fail Strain, C		%			
Maximum Deformation Rate, **D** = (**C** * A) / 10 / (8.1 * B)		mm / min	=		inch / min
Actual Deformation Rate, E		mm / min	=		inch / min
Strain Rate = (E / A) *10		% / min			

Undrained Tests

Stage #	1				
Initial Specimen Height in Cell	15.139	cm			
Height Change during Consolidation	0.110	cm	=	0.0432	inch
Specimen Height, A	15.029	cm	=		inch
Estimated T_{100}, B	28	min			
Estimated Fail Strain, C	4	%			
Maximum Deformation Rate, **D** = (**C** * A) / 10 / (2.1 * B)	0.716	mm / min	=	0.028	inch / min
Actual Deformation Rate, E	0.0209	mm / min	=	0.00082	inch / min
Strain Rate = (E / A) *10	0.0139	% / min			

20% in 24 hrs

$$\frac{(15.029)(0.2)}{24(60)} = 0.00209\ ^{cm}/_{min} = 0.0209\ ^{mm}/_{min} < 0.716 \checkmark$$

TEST REMARKS

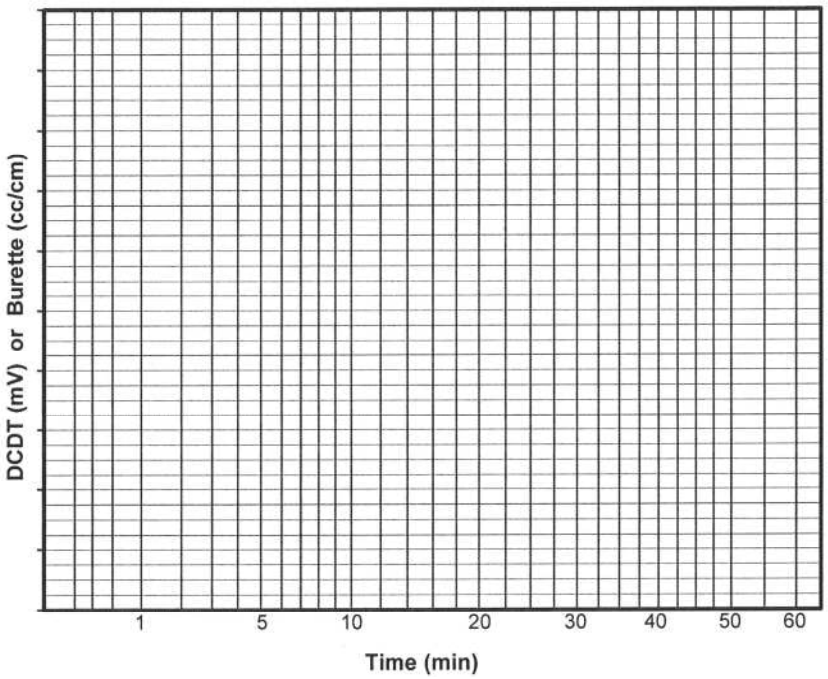
GEI Consultants

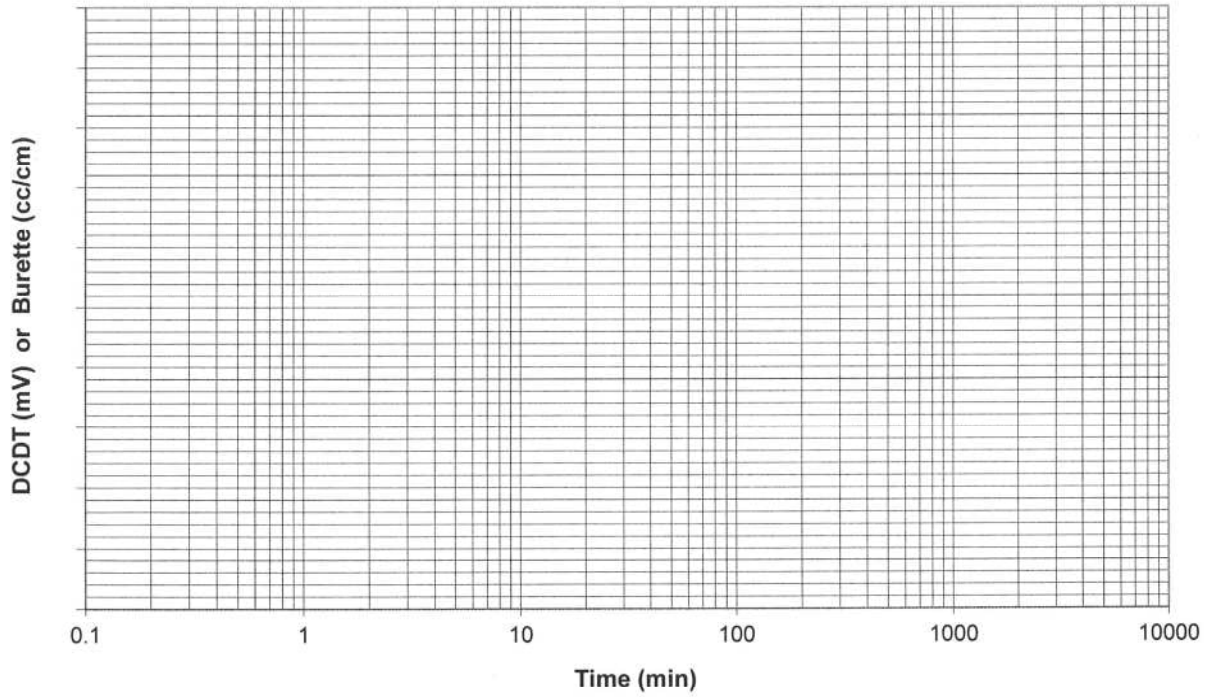
Consolidation Worksheet

Project No.	1700685		
Test	R'16		
Boring	B101U		
Sample	U2		
By	WOZ		
Date	2/12/18		
Checked			
Date			

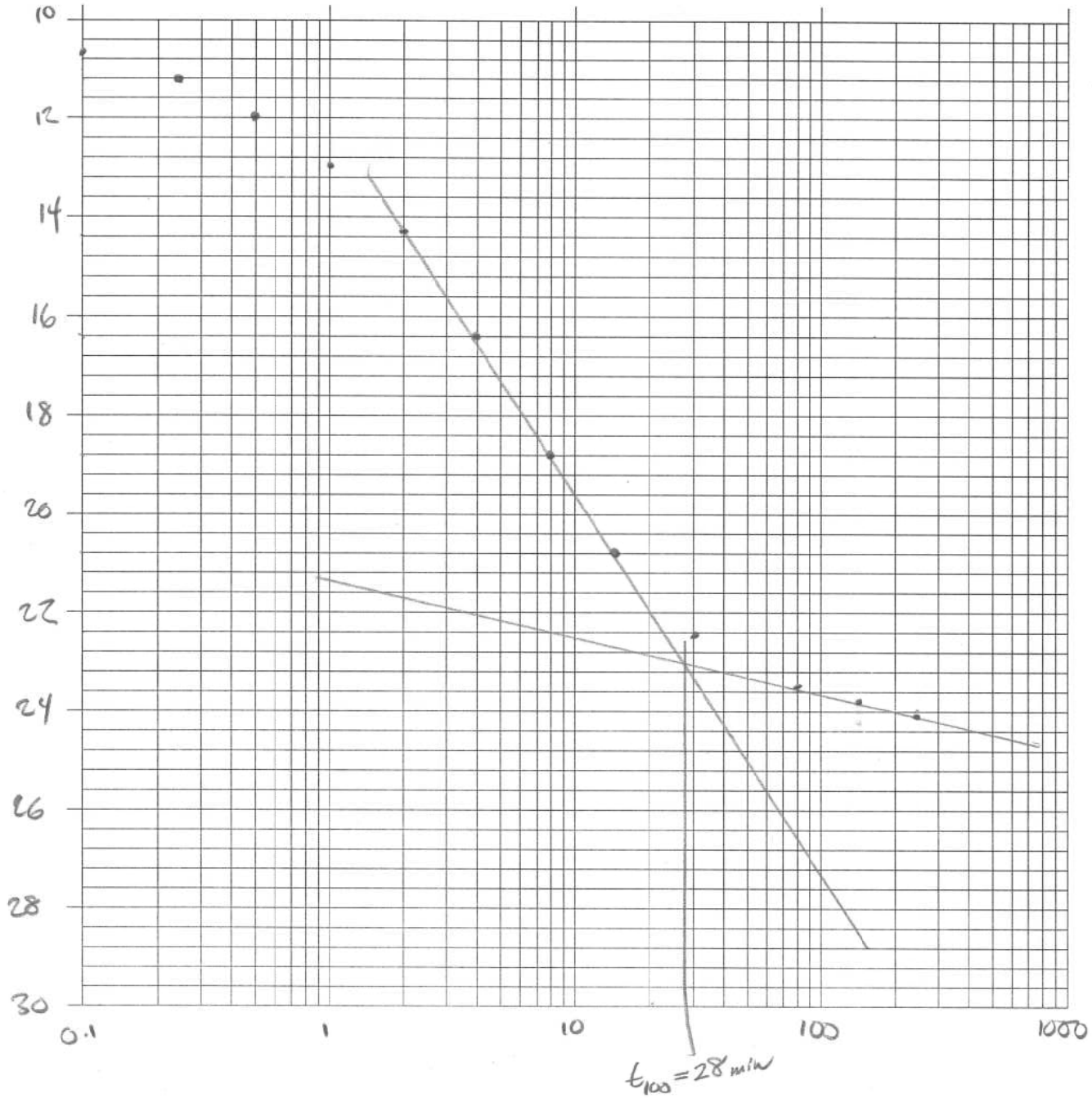
Hanger Load		kg	
Loading Device			
DCDT #			
Channel			

Time	Elapsed Time (min)	DCDT (mV) or Burette (cc/cm)
1106	0	9.4
	0.1	10.7
	0.25	11.2
	0.5	12.0
1107	1	12.9
1108	2	14.3
1110	4	16.4
1114	8	18.8
1121	15	20.8
1136	30	22.5
1226	80	23.5
1336	150	23.8
1506	240	24.1





GEI Consultants


10
12
14
16
18
20
22
24
26
28
30
0.1
1
10
100
1000
$t_{100} = 28$ min

Virginia Polytechnic Institute and State University
Geotechnical Engineering Laboratory
Triaxial Data Sheet

Project:	GEI 001	Started:	2/6/18
Sample I.D./Loc.:	Boring: B119-A-U2, Depth: 42.2 ft to 44.2 ft, Undisturbed	Finished:	2/12/18
Classification:	Brown, moist, medium and homogenous lean clay (CL)		

Sample Preparation	Undisturbed	
Specimen Saturation Method	Wet	
Total backpressure	90.00	(psi)
Consolidation Pressure	25.3	(psi)
B value	0.99	

Initial Conditions Top		
Wt. of Moist Soil + Tare	207.29	(g)
Wt. of Dry Soil + Tare	173.43	(g)
Wt. of Tare	21.85	(g)
Wt. of Moist Soil	185.44	(g)
Wt. of Dry Soil	151.58	(g)
Water Content, w%	22.34	(%)

Initial Conditions Bottom		
Wt. of Moist Soil + Tare	227.67	(g)
Wt. of Dry Soil + Tare	188.83	(g)
Wt. of Tare	21.58	(g)
Wt. of Moist Soil	206.09	(g)
Wt. of Dry Soil	167.25	(g)
Water Content, w%	23.22	(%)

Initial Conditions Average		
Dry Unit Weight	104.62	(pcf)
Wet Unit Weight	128.45	(pcf)
Saturation	100.00	(%)
Void Ratio	0.60	

After Consolidation		
t_{50} Using Casagrande Method	28.36	(min)
t_{50} Using Taylor Method	25.58	(min)
Volumetric Strain	3.19	(%)
Height After Consolidation	5.63	(in)
Area After Consolidation	6.55	(in^2)
Method Used:	Method B	

Specific Gravity	2.65	Assumed
Initial Height	5.70	(in)
Initial Diameter	2.870	(in)
Initial Sample Weight	1243.30	(g)

In-tube Density		
Tube Height	7.560	(in)
Tube Diameter	2.875	(in)
Wt. of Tube + Soil	2223.60	(g)
Wt. of Tube	579.80	(g)
Wt. of Soil	1643.80	(g)
Wet Unit Weight	127.60	(pcf)

Final Conditions		
Wt. of Moist Soil + Tare	878.98	(g)
Wt. of Dry Soil + Tare	761.28	(g)
Wt. of Tare	223.15	(g)
Wt. of Moist Soil	655.83	(g)
Wt. of Dry Soil	538.13	(g)
Water Content, w%	21.87	(%)
Dry Unit Weight	104.68	(pcf)
Wet Unit Weight	127.58	(pcf)
Saturation	100.00	(%)
Void Ratio	0.58	

Failure		
Failure Criteria	Max PSR	
Deviator Stress at failure	29.01	(psi)
Principal Stress Ratio at failure	3.52	
Minor Principal Effective Stress at fail.	11.52	(psi)
Major Principal Effective Stress at fail.	40.53	(psi)
Corrections Applied	Membrane and Area	
Axial Strain at failure	5.75	(%)

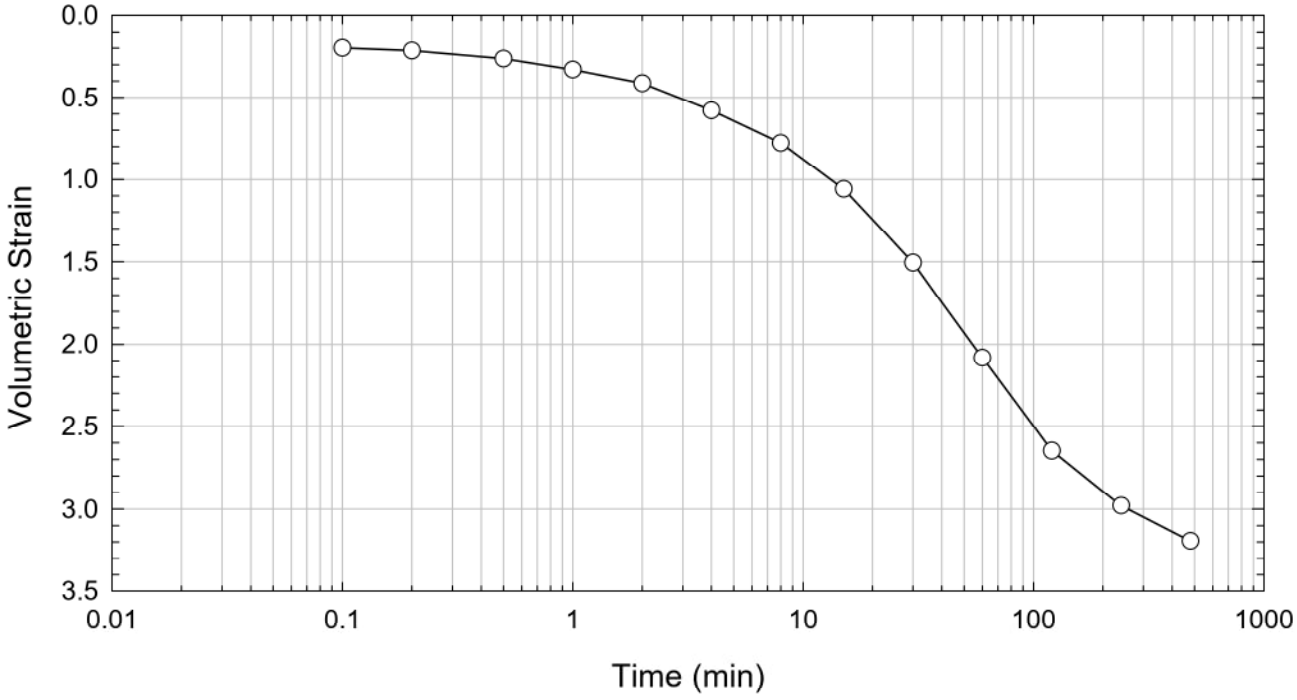
Test performed at strain rate =	0.50	%/hr.

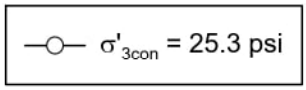
Comments:

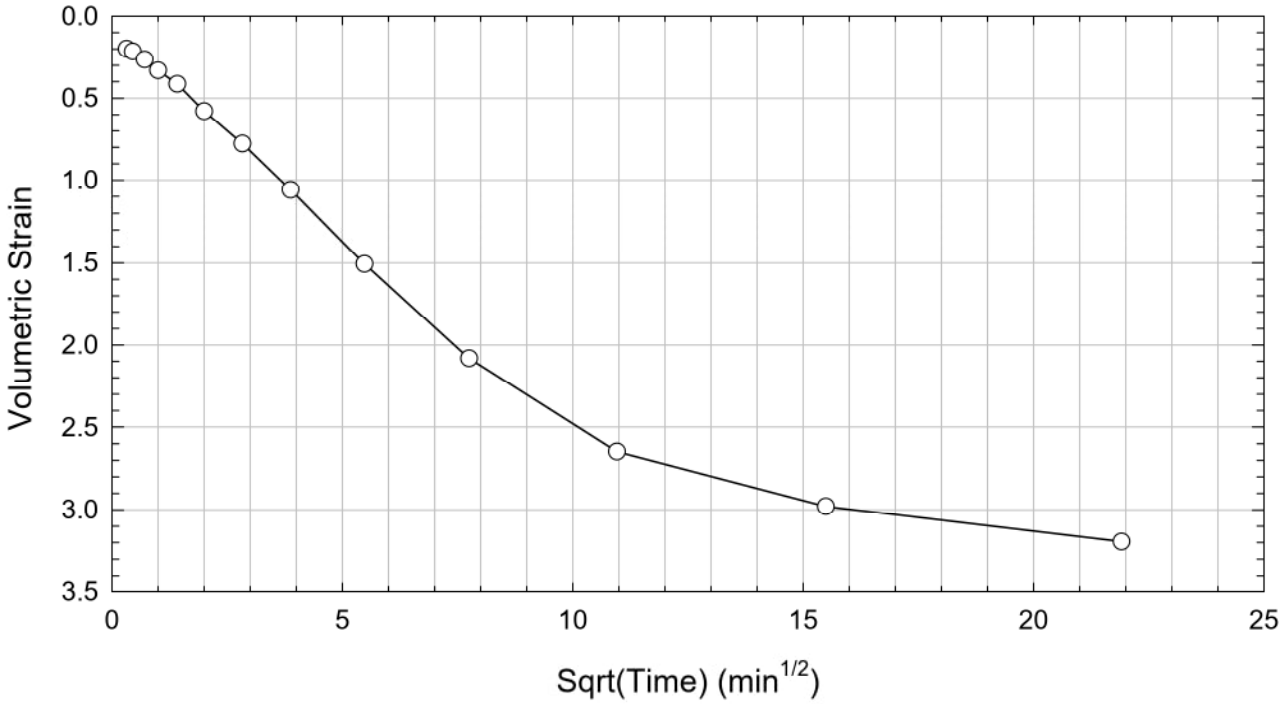
Boring: B119U-A-U2, Depths: 42.2 ft to 44.2 ft, Undisturbed, $\sigma'_{3\text{-con}}$ = 25.3 psi



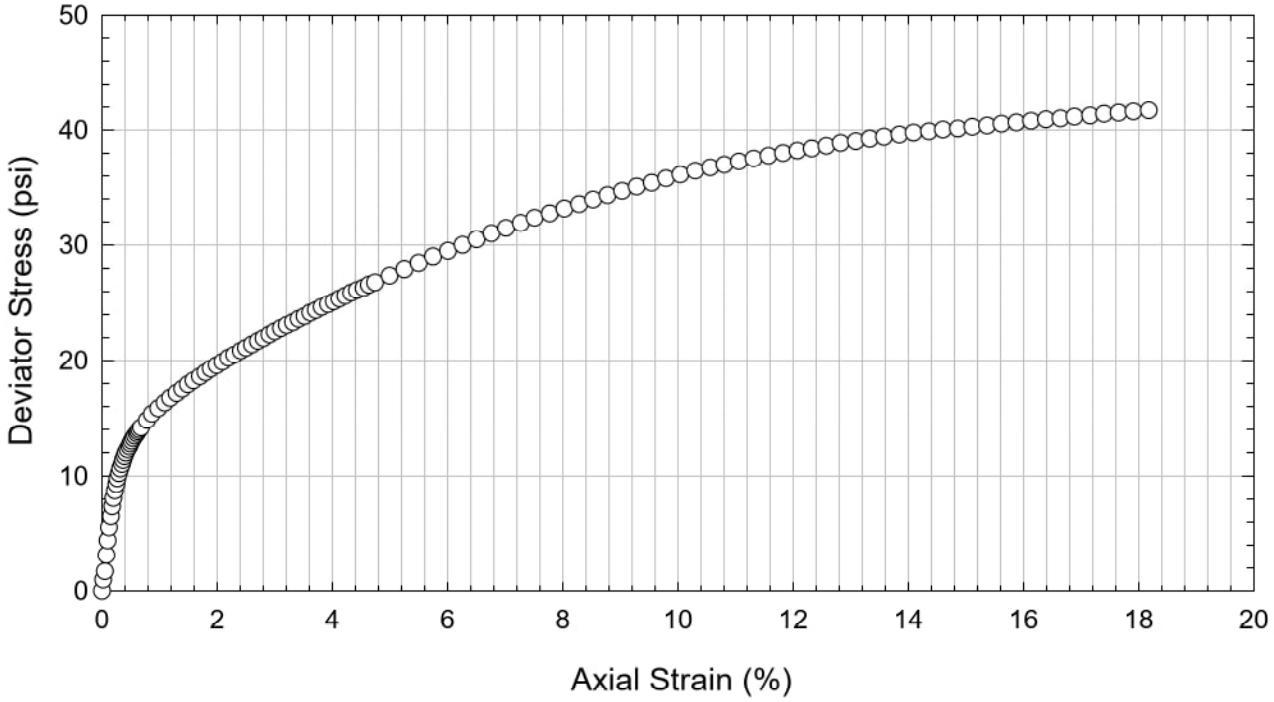
Boring: B119U-A-U2, Depths: 42.2 ft to 44.2 ft, Undisturbed

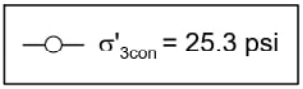


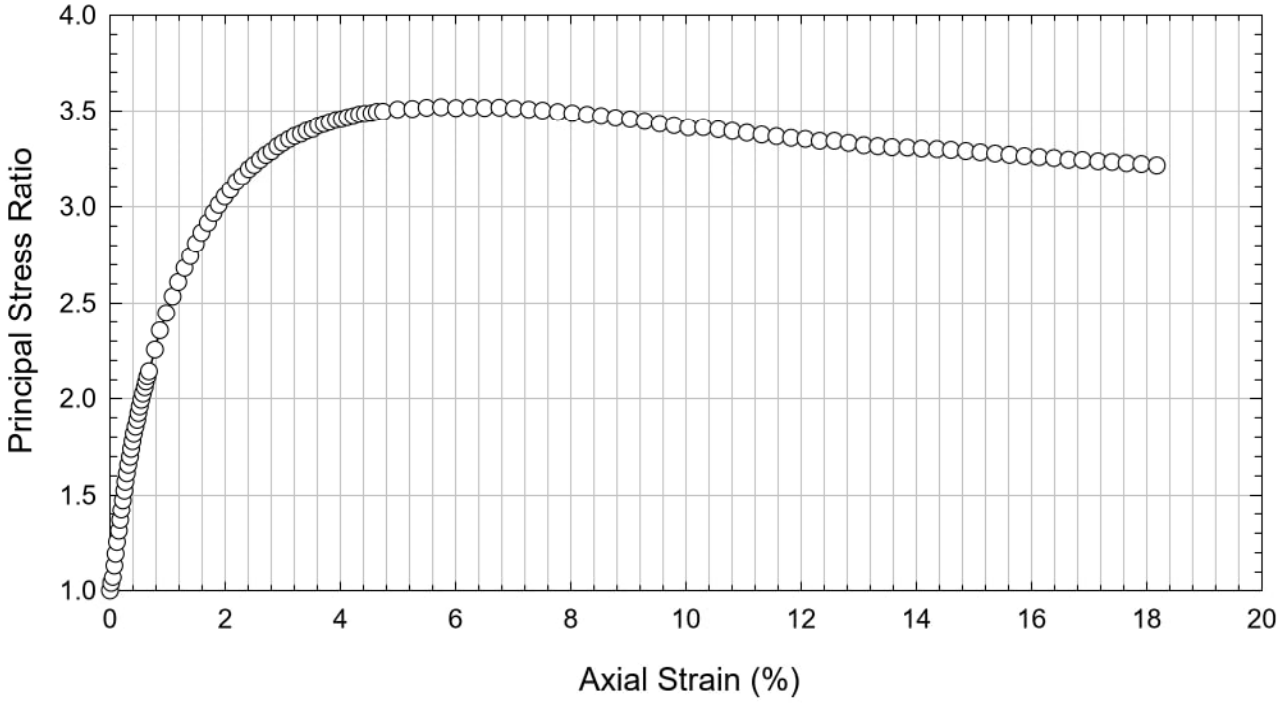




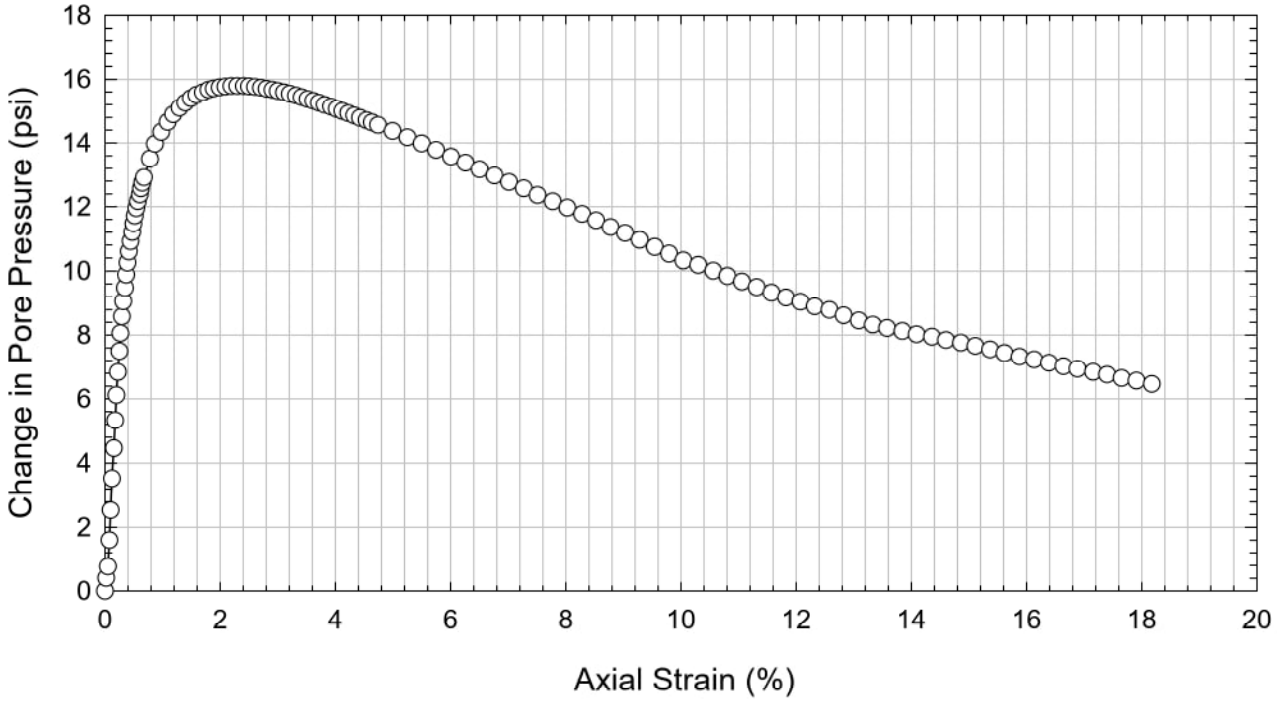
Boring: B119U-A-U2, Depths: 42.2 ft to 44.2 ft, Undisturbed

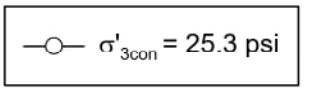


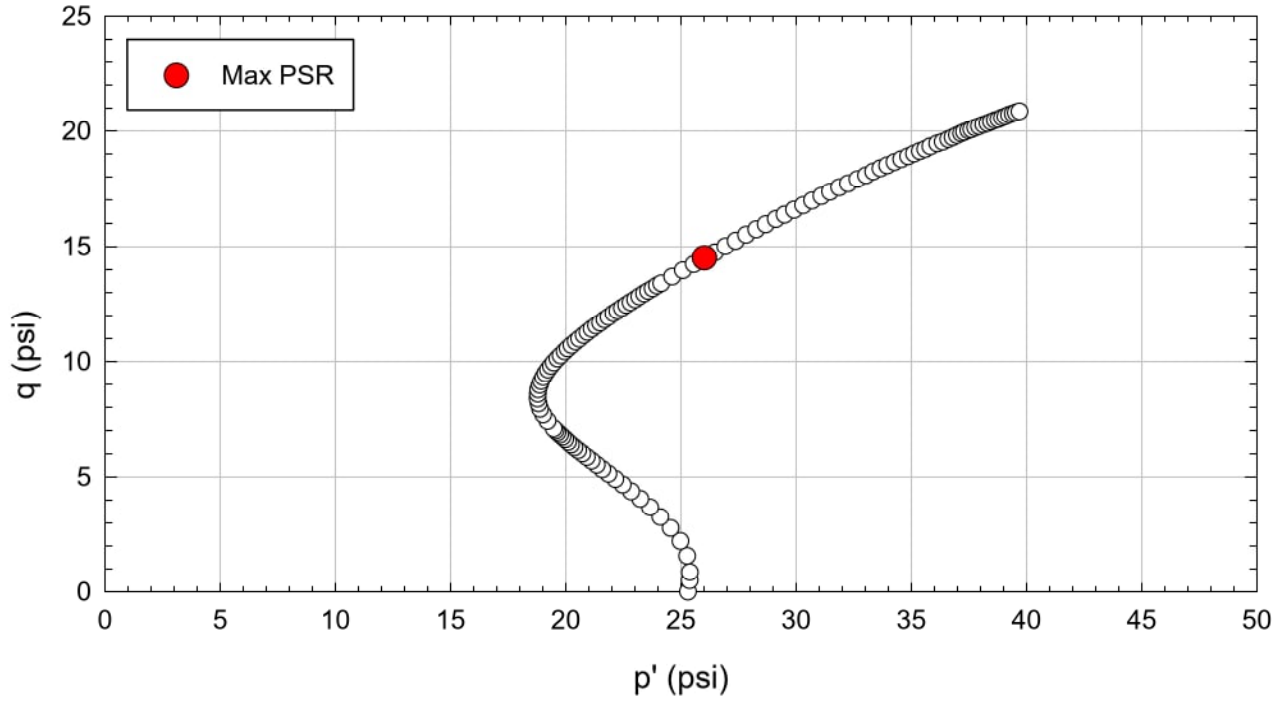




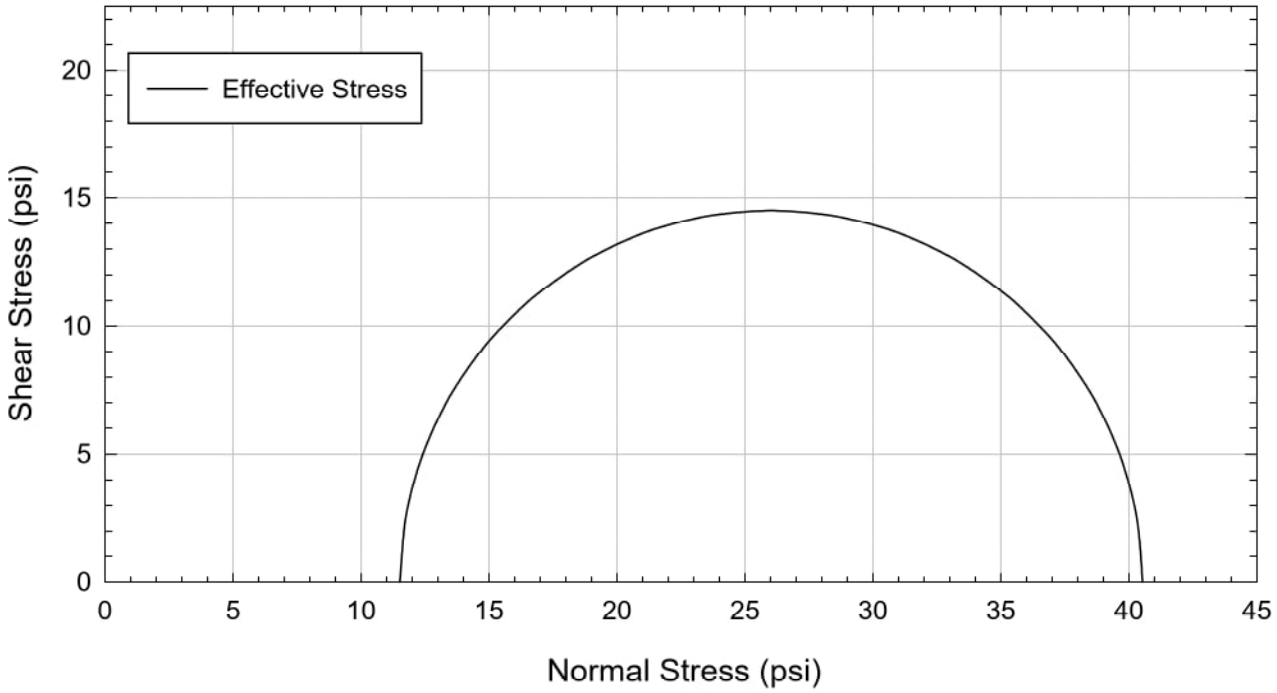
Boring: B119U-A-U2, Depths: 42.2 ft to 44.2 ft, Undisturbed



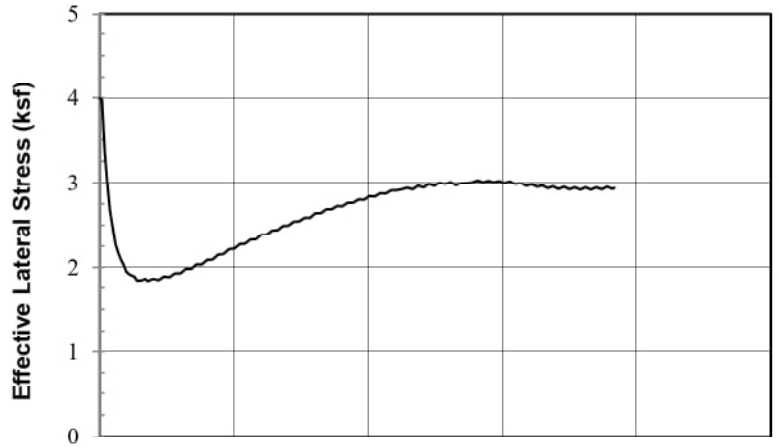




Boring: B119U-A-U2, Depths: 42.2 ft to 44.2 ft, Undisturbed



Note: The circle shown is based on the failure criterion of maximum principal stress ratio.



SAMPLE INFORMATION

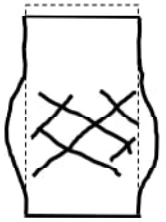
Boring: B109U Sample: U4 Depth (ft): 46.2 Test: R'8
Type: 2.8-inch-diameter tube sample
Description: Sluiced Flyash

SPECIMEN INFORMATION (after saturation)

Height: 5.875 in Dia.: 2.841 in Area.: 6.357 sq. in
Water Content: 64.8% Dry Unit Weight: 56.8 pcf

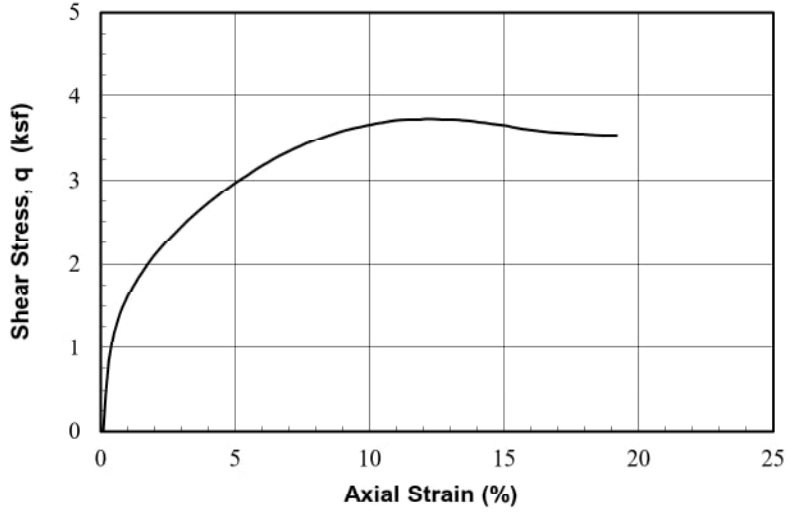
TEST SUMMARY (end of test)

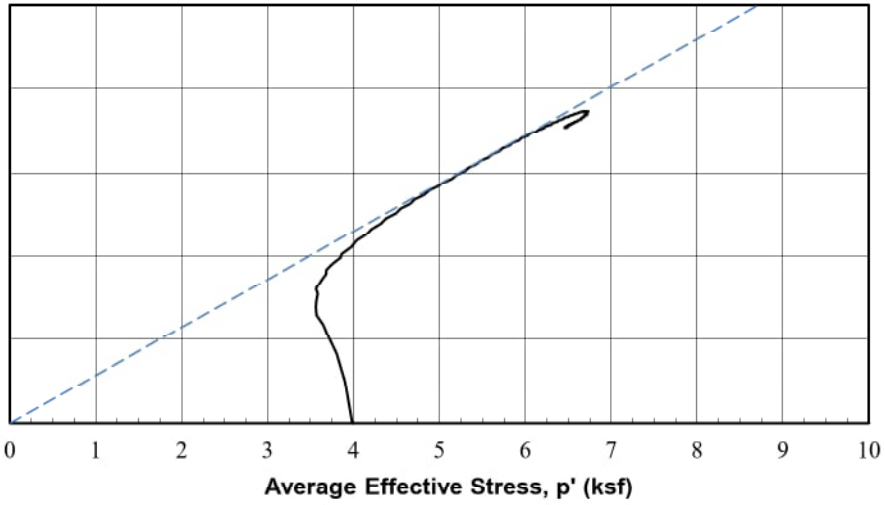
Effective Confining Stress: 4.00 ksf vertical, 4.00 ksf horiz.
Water Content: 63.8 % Dry Unit Weight: 57.3 pcf
B Coefficient: 0.95 Strain Rate: 0.014 %/min
Peak Shear Stress: 3.73 ksf @ 12.5 % Strain
Peak Friction Angle: 35.0 deg. @ 5.8 % Strain



Failure Sketch

REMARKS: Oven-dried at 110°C.





Operator: DJA/WL
Checked: D. Aghjayan
Test Date: 27-Dec-2017

1/18/2018 12:54

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-11

PROJECT #:	1700685													
PROJECT:	Glen Lyn			Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'8												
BORING:	B109U				(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U4			In situ	--	--	--	--	--	--	55.8	--	1.485
DEPTH (ft):	46.2			After Sampling	--	--	--	--	--	--	55.1	--	1.516
OPER.:	DJA/WL			In tube before extrusion	--	--	6.019	2.873	6.483	65.55	55.2	91.5	1.509
TEST DATE:	12/27/2017			Under vac.	1.01	1.01	5.875	2.853	6.393	--	56.5	--	1.454
DCDT No.		147											
DCDT Calibration Factor		6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.		A8897		Saturation	1.04	1.04	5.875	2.845	6.357	64.85	56.8	93.6	1.440
Load Cell Cal. Factor		0.058033	lb/cnt	Consol. Stage 1	2.04	2.04	5.875	2.841	6.340	64.56	57.0	93.7	1.433
Pressure Transducer		25218		Consol. Stage 2	4.00	4.00	5.836	2.841	6.339	63.84	57.3	93.9	1.417
Pres. Trans. Cal. Factor		0.023604	psi/cnt	Consol. Stage 3	4.00	4.00	5.836	2.841	6.339	63.84	57.3	93.9	1.417
				Consol. Stage 4	4.00	4.00	5.836	2.841	6.339	63.84	57.3	93.9	1.417
Gravity of Solids		2.22	(measured)	Consol. Stage 5	4.00	4.00	5.836	2.841	6.339	63.84	57.3	93.9	1.417
				Consol. Stage 6	4.00	4.00	5.836	2.841	6.339	63.84	57.3	93.9	1.417
B value start shear		0.95											
Test Stage End of#	2			This Stage Initial Values	4.00	4.00	5.836	2.841	6.339	63.84	57.3	93.9	1.417
Stage Strain rate		0.014	%/min	Kc start stage	1.00		Back Pressure		8.53 ksf				
Data Start Row	4												

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.038	12.419	59.175	0.00	6.34	0.00	4.00	4.00	4.00	4.00	0.00	1.00	0.0	0.00
0.044	12.593	59.270	0.10	6.35	0.01	3.98	4.00	3.99	3.99	0.00	1.00	0.0	3.46
0.050	56.988	63.353	0.20	6.35	0.60	3.40	5.01	4.41	3.90	0.51	1.30	7.4	0.60
0.056	85.715	66.280	0.30	6.36	1.02	2.97	5.66	4.63	3.80	0.83	1.56	12.6	0.62
0.062	103.880	68.381	0.40	6.37	1.33	2.67	6.07	4.74	3.71	1.03	1.77	16.2	0.64
0.068	116.700	69.797	0.50	6.37	1.53	2.47	6.35	4.82	3.65	1.18	1.96	18.9	0.65
0.073	126.980	71.119	0.60	6.38	1.72	2.28	6.58	4.86	3.57	1.29	2.14	21.2	0.66
0.079	135.800	71.851	0.70	6.38	1.83	2.17	6.78	4.95	3.56	1.39	2.28	23.0	0.66
0.085	143.050	72.370	0.80	6.39	1.90	2.10	6.94	5.04	3.57	1.47	2.40	24.4	0.65
0.091	149.780	72.771	0.90	6.40	1.96	2.04	7.09	5.13	3.59	1.55	2.52	25.5	0.63
0.097	155.820	73.385	1.01	6.40	2.05	1.95	7.22	5.18	3.56	1.61	2.65	26.9	0.63
0.103	161.620	73.550	1.11	6.41	2.07	1.93	7.35	5.28	3.60	1.68	2.74	27.7	0.62
0.109	166.790	73.692	1.21	6.42	2.09	1.91	7.46	5.37	3.64	1.73	2.82	28.4	0.60
0.114	171.720	73.763	1.31	6.42	2.10	1.90	7.57	5.47	3.68	1.79	2.88	29.0	0.59
0.120	176.540	74.117	1.41	6.43	2.15	1.85	7.67	5.52	3.68	1.84	2.99	29.9	0.59
0.126	180.950	74.093	1.51	6.44	2.15	1.85	7.77	5.62	3.73	1.89	3.04	30.3	0.57
0.132	185.130	74.069	1.61	6.44	2.14	1.85	7.86	5.71	3.78	1.93	3.08	30.7	0.56

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.138	189.710	73.951	1.71	6.45	2.13	1.87	7.96	5.83	3.85	1.98	3.12	30.9	0.54
0.144	193.770	74.140	1.81	6.46	2.15	1.84	8.04	5.89	3.86	2.02	3.20	31.6	0.53
0.150	197.950	74.046	1.91	6.46	2.14	1.86	8.13	5.99	3.92	2.07	3.23	31.8	0.52
0.156	201.610	73.951	2.01	6.47	2.13	1.87	8.21	6.08	3.98	2.11	3.25	32.0	0.51
0.167	208.800	74.069	2.21	6.48	2.14	1.85	8.36	6.21	4.03	2.18	3.35	32.7	0.49
0.179	215.530	73.786	2.41	6.50	2.10	1.89	8.50	6.40	4.14	2.25	3.38	32.9	0.47
0.191	222.380	73.833	2.62	6.51	2.11	1.89	8.64	6.53	4.21	2.32	3.46	33.5	0.45
0.203	228.650	73.526	2.82	6.52	2.07	1.93	8.77	6.70	4.32	2.39	3.47	33.6	0.43
0.214	234.920	73.526	3.02	6.54	2.07	1.93	8.90	6.83	4.38	2.45	3.54	34.0	0.42
0.226	240.780	73.172	3.22	6.55	2.02	1.98	9.02	7.00	4.49	2.51	3.53	34.0	0.40
0.238	246.520	73.172	3.42	6.56	2.02	1.98	9.13	7.12	4.55	2.57	3.59	34.4	0.39
0.250	252.210	72.795	3.62	6.58	1.96	2.04	9.25	7.29	4.66	2.62	3.58	34.3	0.37
0.261	257.610	72.795	3.82	6.59	1.96	2.04	9.35	7.39	4.71	2.68	3.63	34.6	0.37
0.273	263.060	72.417	4.02	6.61	1.91	2.09	9.46	7.55	4.82	2.73	3.61	34.5	0.35
0.285	268.400	72.370	4.23	6.62	1.90	2.10	9.57	7.67	4.88	2.78	3.66	34.8	0.34
0.297	273.510	71.992	4.43	6.63	1.85	2.15	9.67	7.82	4.99	2.83	3.63	34.6	0.33
0.308	278.850	71.921	4.63	6.65	1.84	2.16	9.77	7.93	5.05	2.89	3.67	34.9	0.32
0.320	283.550	71.544	4.83	6.66	1.78	2.22	9.86	8.08	5.15	2.93	3.64	34.7	0.30
0.332	288.370	71.497	5.03	6.68	1.77	2.22	9.95	8.18	5.20	2.98	3.68	34.9	0.30
0.344	292.890	71.119	5.23	6.69	1.72	2.28	10.04	8.32	5.30	3.02	3.65	34.7	0.28
0.355	297.250	71.095	5.43	6.70	1.72	2.28	10.12	8.40	5.34	3.06	3.68	35.0	0.28
0.367	301.710	70.741	5.63	6.72	1.67	2.33	10.20	8.53	5.43	3.10	3.66	34.8	0.27
0.379	306.120	70.718	5.84	6.73	1.66	2.34	10.28	8.62	5.48	3.14	3.69	35.0	0.26
0.391	310.360	70.340	6.04	6.75	1.61	2.39	10.36	8.75	5.57	3.18	3.66	34.8	0.25
0.402	314.420	70.293	6.24	6.76	1.60	2.40	10.43	8.83	5.61	3.22	3.68	35.0	0.25
0.414	318.370	69.962	6.44	6.78	1.55	2.44	10.50	8.95	5.70	3.25	3.66	34.8	0.24
0.426	322.370	69.939	6.64	6.79	1.55	2.45	10.57	9.02	5.73	3.29	3.69	35.0	0.24
0.437	326.090	69.585	6.84	6.80	1.50	2.50	10.64	9.14	5.82	3.32	3.66	34.8	0.23
0.449	329.690	69.561	7.04	6.82	1.50	2.50	10.70	9.20	5.85	3.35	3.68	34.9	0.22
0.461	333.170	69.254	7.24	6.83	1.45	2.55	10.76	9.30	5.93	3.38	3.65	34.8	0.21
0.473	336.530	69.231	7.45	6.85	1.45	2.55	10.81	9.36	5.96	3.41	3.67	34.9	0.21
0.484	339.960	68.924	7.65	6.86	1.40	2.59	10.87	9.46	6.03	3.44	3.65	34.7	0.20
0.496	343.090	68.924	7.85	6.88	1.40	2.59	10.92	9.52	6.05	3.46	3.67	34.9	0.20
0.508	346.050	68.593	8.05	6.89	1.36	2.64	10.97	9.61	6.13	3.48	3.64	34.7	0.19
0.520	349.070	68.593	8.25	6.91	1.36	2.64	11.01	9.66	6.15	3.51	3.66	34.8	0.19
0.531	351.910	68.286	8.45	6.92	1.31	2.69	11.06	9.75	6.22	3.53	3.63	34.6	0.19
0.543	354.760	68.286	8.65	6.94	1.31	2.69	11.10	9.79	6.24	3.55	3.65	34.7	0.18
0.555	357.600	67.980	8.85	6.96	1.27	2.73	11.14	9.88	6.30	3.57	3.62	34.5	0.18
0.567	360.090	68.003	9.05	6.97	1.27	2.73	11.18	9.91	6.32	3.59	3.63	34.6	0.18
0.578	362.530	67.720	9.26	6.99	1.23	2.77	11.21	9.98	6.38	3.61	3.61	34.5	0.17

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.590	364.740	67.720	9.46	7.00	1.23	2.77	11.24	10.01	6.39	3.62	3.62	34.5	0.17
0.602	366.830	67.460	9.66	7.02	1.19	2.80	11.27	10.08	6.44	3.64	3.59	34.4	0.16
0.614	369.150	67.484	9.86	7.03	1.20	2.80	11.30	10.11	6.45	3.65	3.61	34.5	0.16
0.625	371.060	67.201	10.06	7.05	1.16	2.84	11.32	10.17	6.51	3.66	3.58	34.3	0.16
0.637	373.040	67.224	10.26	7.06	1.16	2.84	11.35	10.19	6.51	3.68	3.59	34.4	0.16
0.649	374.890	66.965	10.46	7.08	1.12	2.88	11.37	10.25	6.56	3.69	3.56	34.2	0.15
0.661	376.750	66.988	10.66	7.10	1.13	2.87	11.39	10.27	6.57	3.70	3.57	34.2	0.15
0.672	378.550	66.729	10.87	7.11	1.09	2.91	11.41	10.32	6.62	3.71	3.55	34.1	0.15
0.684	380.170	66.729	11.07	7.13	1.09	2.91	11.43	10.34	6.62	3.71	3.55	34.1	0.15
0.696	381.390	66.658	11.27	7.14	1.08	2.92	11.43	10.36	6.64	3.72	3.55	34.1	0.14
0.708	382.500	66.516	11.47	7.16	1.06	2.94	11.44	10.38	6.66	3.72	3.53	34.0	0.14
0.719	383.420	66.634	11.67	7.18	1.07	2.92	11.44	10.37	6.65	3.72	3.55	34.1	0.14
0.731	384.180	66.351	11.87	7.19	1.03	2.96	11.44	10.41	6.69	3.72	3.51	33.8	0.14
0.743	385.460	66.492	12.07	7.21	1.05	2.94	11.45	10.39	6.67	3.73	3.53	34.0	0.14
0.755	386.270	66.209	12.27	7.23	1.01	2.98	11.45	10.43	6.71	3.72	3.50	33.7	0.14
0.766	387.250	66.351	12.48	7.24	1.03	2.96	11.45	10.42	6.69	3.73	3.51	33.8	0.14
0.778	387.950	66.068	12.68	7.26	0.99	3.00	11.45	10.45	6.73	3.72	3.48	33.6	0.13
0.790	388.760	66.186	12.88	7.28	1.01	2.99	11.45	10.44	6.71	3.72	3.49	33.7	0.14
0.802	389.400	66.020	13.08	7.29	0.99	3.01	11.44	10.45	6.73	3.72	3.47	33.6	0.13
0.813	390.100	66.304	13.28	7.31	1.03	2.97	11.44	10.41	6.69	3.72	3.50	33.8	0.14
0.825	390.160	66.091	13.48	7.33	1.00	3.00	11.42	10.43	6.71	3.71	3.47	33.6	0.13
0.837	390.560	66.091	13.68	7.34	1.00	3.00	11.41	10.42	6.71	3.71	3.47	33.5	0.13
0.849	390.740	66.044	13.88	7.36	0.99	3.01	11.40	10.41	6.71	3.70	3.46	33.5	0.13
0.860	390.560	65.879	14.09	7.38	0.97	3.03	11.38	10.41	6.72	3.69	3.43	33.3	0.13
0.872	390.790	66.044	14.29	7.40	0.99	3.01	11.36	10.38	6.69	3.68	3.45	33.4	0.13
0.884	390.740	65.902	14.49	7.41	0.97	3.03	11.35	10.38	6.70	3.67	3.43	33.2	0.13
0.895	390.910	66.044	14.69	7.43	0.99	3.01	11.33	10.34	6.68	3.67	3.44	33.3	0.13
0.907	390.970	65.926	14.89	7.45	0.97	3.03	11.32	10.34	6.68	3.66	3.42	33.2	0.13
0.919	390.790	66.091	15.09	7.47	1.00	3.00	11.30	10.30	6.65	3.65	3.43	33.3	0.14
0.931	390.270	65.973	15.29	7.48	0.98	3.02	11.27	10.29	6.65	3.64	3.41	33.1	0.13
0.942	389.870	66.209	15.49	7.50	1.01	2.98	11.24	10.23	6.61	3.62	3.43	33.2	0.14
0.954	389.520	66.115	15.69	7.52	1.00	3.00	11.22	10.22	6.61	3.61	3.41	33.1	0.14
0.966	389.630	66.351	15.90	7.54	1.03	2.96	11.20	10.17	6.57	3.60	3.43	33.3	0.14
0.978	389.690	66.233	16.10	7.56	1.02	2.98	11.19	10.17	6.58	3.60	3.41	33.1	0.14
0.989	389.870	66.445	16.30	7.57	1.05	2.95	11.17	10.13	6.54	3.59	3.43	33.3	0.15
1.001	390.040	66.327	16.50	7.59	1.03	2.97	11.16	10.13	6.55	3.58	3.41	33.2	0.14
1.013	390.330	66.540	16.70	7.61	1.06	2.94	11.15	10.09	6.51	3.58	3.43	33.3	0.15
1.025	390.740	66.422	16.90	7.63	1.04	2.95	11.14	10.09	6.52	3.57	3.42	33.2	0.15
1.036	391.140	66.610	17.10	7.65	1.07	2.93	11.13	10.06	6.49	3.57	3.44	33.3	0.15
1.048	391.660	66.445	17.31	7.67	1.05	2.95	11.12	10.07	6.51	3.56	3.41	33.2	0.15

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.060	392.070	66.634	17.51	7.68	1.07	2.92	11.11	10.04	6.48	3.56	3.43	33.3	0.15
1.072	392.540	66.492	17.71	7.70	1.05	2.94	11.10	10.05	6.50	3.55	3.41	33.2	0.15
1.083	393.230	66.681	17.91	7.72	1.08	2.92	11.10	10.02	6.47	3.55	3.43	33.3	0.15
1.095	393.640	66.492	18.11	7.74	1.05	2.94	11.09	10.04	6.49	3.55	3.41	33.1	0.15
1.107	394.160	66.681	18.31	7.76	1.08	2.92	11.08	10.00	6.46	3.54	3.43	33.3	0.15
1.119	394.740	66.492	18.51	7.78	1.05	2.94	11.07	10.02	6.48	3.54	3.40	33.1	0.15
1.130	395.490	66.634	18.71	7.80	1.07	2.92	11.07	10.00	6.46	3.54	3.42	33.2	0.15
1.142	396.310	66.445	18.91	7.82	1.05	2.95	11.07	10.02	6.49	3.54	3.40	33.0	0.15
1.154	397.120	66.610	19.12	7.84	1.07	2.93	11.07	9.99	6.46	3.53	3.41	33.2	0.15
1.158	397.410	66.540	19.18	7.84	1.06	2.94	11.07	10.00	6.47	3.53	3.41	33.1	0.15

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'8		Ground Surface Elevation
BORING:	B109U		Elevation Datum
SAMPLE:	U4		
DEPTH:	46.2	Elevation:	
TEST DATE:	27-Dec-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	January 2018		
Figure No.			
Test Operator:	DJA/WL		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Sluiced Flyash		
Sample Description (2)			
Failure Type:			
Remarks (1):			
Remarks (2):			
	LL= NV		
	PL= NP		
	PI= NP		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.37	VC:	1.2368
Penetration, cm:	61.00		
Gross Recovery, cm:	61.30		
TUBE LENGTH, cm	76.20		
FIELD DIST. TO TOP SOIL, cm	14.90		
FIELD DIST. TO BOT SOIL, cm	17.40	IN SITU COR. FACTOR:	1.0124
FIELD DIST TOP PACKER, cm	13.80	TUBE TRANSPORT COR. FACTOR:	0.9972
FIELD DIST BOT PACKER, cm	18.90	TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm	13.93		
LAB DIST BOT PACKER, cm	18.90		

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	26.7	26.7	26.7	26.7	26.7	cm
TOP EMPTY LENGTH	3.25	3.25	3.25	3.25	3.25	cm
BOT. EMPTY LENGTH	8.15	8.2	8.15	8.15	8.1625	cm
TUBE INNER DIAMETER	7.286	7.308	7.302	7.294	7.2975	cm

In tube length	15.29	cm
Tube Diameter	7.298	cm
Tube Area	41.83	(cm^2)
Tube Volume	639.40	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.339	7.32	7.285		7.315	cm
MEMBRANE 1 THICKNESS	0.067	0.067	0.07		0.068	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.521	13.56	13.573	13.564	13.555	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.799	8.767	8.75	8.856	8.793	cm

#filter strips	0		
Hi	14.922	cm	
Di	7.247	cm	2.05908464
Ai	41.245	cm^2	
Vi	615.430	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	189.090	134.290	*******	1734.220	*******	1293.190	1293.190	*******
DRY+T	123.290	96.540		*******	347.930	*******	946.260	213.410
T	29.830	31.520		803.400	338.970	389.780	389.780	213.040
Wt. Solids	93.46	65.02	0	930.82	8.96	556.85	556.48	0.37
w %	70.40	58.06	*******	65.55	*******	62.34	62.34	*******

FINAL B VALUE 0.95

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	59.86	67.06	0.000	3.500	0.000	0.000	0.028	7.20	7.20
Consolidation Stage 1	59.77	73.93	0.000	1.608	0.000	0.000	0.013	14.16	14.16
2	59.22	86.98	0.000	4.020	0.097	0.097	0.033	27.76	27.76
3	59.22	86.98	0.000	0.000	0.000	0.000	0.000	27.76	27.76
4	59.22	86.98	0.000	0.000	0.000	0.000	0.000	27.76	27.76
5	59.22	86.98	0.000	0.000	0.000	0.000	0.000	27.76	27.76
6	59.22	86.98	0.000	0.000	0.000	0.000	0.000	27.76	27.76
Start Shear	59.22	86.98	0.000	**********	**********			27.76	27.76
End Shear				8.308	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	dry density pcf	void ratio	
in situ		0.00	0.00							1.0124	0.89	55.8	1.485	
after sampling		0.00	0.00							0.9972	0.88	55.1	1.516	
after shipping		0.00	0.00							1.0000	0.88	55.2	1.509	
in tube before extrusion		0.00	0.00	15.29	7.298	41.825	639.40	565.81	65.55	*****	0.88	55.2	1.509	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.922	7.247	41.245	615.430	556.850	*****	*****	0.90	56.5	1.454	
saturation		7.20	7.20	14.922	7.226	41.010	611.930	556.850	64.846		0.91	56.8	1.440	
	1	14.16	14.16	14.922	7.217	40.902	610.322	556.850	64.558	*****	0.91	57.0	1.433	
	2	27.76	27.76	14.825	7.216	40.899	606.302	556.850	63.836	*****	0.92	57.3	1.417	
	3	27.76	27.76	14.825	7.216	40.899	606.302	556.850	63.836	*****	0.92	57.3	1.417	
	4	27.76	27.76	14.825	7.216	40.899	606.302	556.850	63.836	*****	0.92	57.3	1.417	
	5	27.76	27.76	14.825	7.216	40.899	606.302	556.850	63.836	*****	0.92	57.3	1.417	
	6	27.76	27.76	14.825	7.216	40.899	606.302	556.850	63.836	*****	0.92	57.3	1.417	
Start Shear		27.76	27.76	14.825	7.216	40.899	606.302	556.850	63.836	*****	0.92	57.3	1.417	
End Shear		**********	**********				597.994	556.850	62.344	*****	0.93	58.1	1.384	1.384029255

Test comp (c) or ext (c) c

DEFORMATION RATE 1 0.02041723 mm/min 0.0138 %/min

DEFORMATION RATE 2 0.00080383 in/min 0.000137726 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.22 2.220 yields S=1

estimated or measured? (enter E or M) m

(measured)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'8
Boring	B109
Sample	U4
Depth	46.2'
By	DJA / WL
Date	12-27-17
Checked	DJA
Date	1.15.17

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	D8	U19	JV-5	
Wet Wt. + Tare (g)	189.09	134.29		—
Dry Wt. + Tare (g)	123.29	96.54		347.93
Wt. Water (g)	65.80	37.75		—
Tare (g)	29.83	31.52		338.97
Dry Wt. Soil (g)	93.46	65.02		8.96
Water Content (%)	70.4	58.1		—

Trimmed Length in Tube

Overall Tube Length	26.7	26.7	26.7	26.7	cm	Avg.	26.7 cm
Top Empty Length	3.25	3.25	3.25	3.25	cm	Avg.	3.25 cm
Bottom Empty Length	8.15	8.2	8.15	8.15	cm	Avg.	8.16 cm

Trimmed Length in Tube, L: 15.29 cm

Tube Dimensions

Tube Inner Diameter	7.286	7.303	7.302	7.294	cm	Avg.	~~7.3146~~ 7.298 cm

Tube Weight (g): 803.40

Weight of other (specify: —) (g): —

Area, A: ~~41.83~~ 41.83 cm^2

Volume in Tube = A x L: ~~642.69~~ 639.40 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane		g
Membrane		g
W_{moist}		g

Dry Wt. Of Excess Solids

Tare #	P-34	g
Dry + Tare	213.41	g
Tare	213.04	g
Dry Wt. Of Excess	0.37	g

Water Content

(Fraction Used: 1)

Tare #	CW-1	
Wet + Tare	1293.19	g
Dry + Tare	946.26	g
Wt. Water	346.93	g
Tare	389.78	g
Wt. Dry Soil	556.48	g
Water Content	62.3	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = g

Estimate of γ_d using γ_m, in tube

Moist soil + tube + other (specify: —)	1734.22	g
Tube + other	803.40	g
Moist soil	930.82	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = ~~1.456~~ 1.448 g/cm^3, ~~90.9~~ 90.4 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 0.886 g/cm^3, 55.3 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R10
Boring	B1090
Sample	U4
Depth	46.2'
By	DJA
Date	12-27-17
Checked	
Date	

Undisturbed Specimen X
Remolded or compacted Specimen

Filter Strips? Yes ____ No X
Lubricated End Platens? Yes ____ No X

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes	7.339	7.320	7.285	–	Avg.	7.315	cm
Twice thickness 1 membranes	0.067	0.067	0.070	–	Avg.	-0.068	cm
					Avg.	-	cm

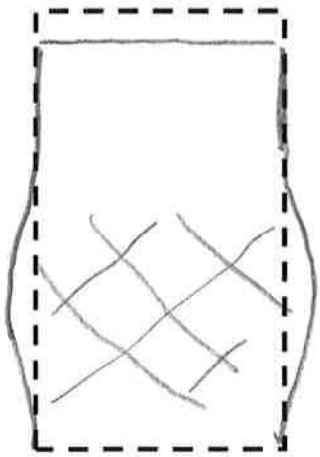
Diameter of Specimen	7.247	cm
Diameter of Specimen	2.853	inch
Area of Specimen	41.25	cm^2

Height Caliper #____

Height from top gauge block to top of top platen, with specimen	13.521	13.560	13.573	13.564	Avg.	13.554	cm
Height of Gauge Block						+10.160	cm
Height from top of top platen to cell base, without specimen	8.799	8.767	8.750	8.856	Avg.	-8.793	cm

Height of Specimen in Cell	14.921	cm
Height of Specimen in Cell	5.874	inch
Volume in cell, initial	615.47	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

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Saturation and Consolidation Data

Project No.	1700685
Test No.	R'8
Boring	B109
Sample	U4
Depth	46.2'
By	DJA
Date	12-27-17
Page	1

Panel No. 1

Pressure Trans:	SN 25218	Factor 2.3604e-2	Gain =	8
Load Trans:	SN A8897	Factor 5.8033e-2	Gain =	8
Displ. Trans:	SN 147	Factor 6.7108e-5	Gain =	64

Date	Time	Load (lbf)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
12/27	16:15		0.00			—		-7		0
						24.4		0.34		7.29
						22.3		10.08		17.07
12/28	7:17					20.6		10.10		
						20.1		20.16		26.98
	9:23					19.9				
						19.7		30.02		36.96
	11:01					19.7		29.93		
						19.5		40.06		47.04
	15:24					19.5		39.96		47.00
			B=0.94			19.4		49.90	49.38	57.00
	16:50					19.4		49.83		56.93
			B=0.95			19.3		59.86	59.46	67.06
		Consolidate to 14 psi								
	16:55					5.6		59.65		73.74
	17:02					6.8				
	17:30					6.8		59.77		73.93
		Consol to 28 psi								
	17:32					6.8		59.81		87.78
	17:36					9.3				
12/29	7:55					9.8				
1/2/18	14:15		0.038			9.8		59.22		86.98
			SHEAR							
			Reconsol.			3.2				
						9.4				
			Take Down							

TEST REMARKS

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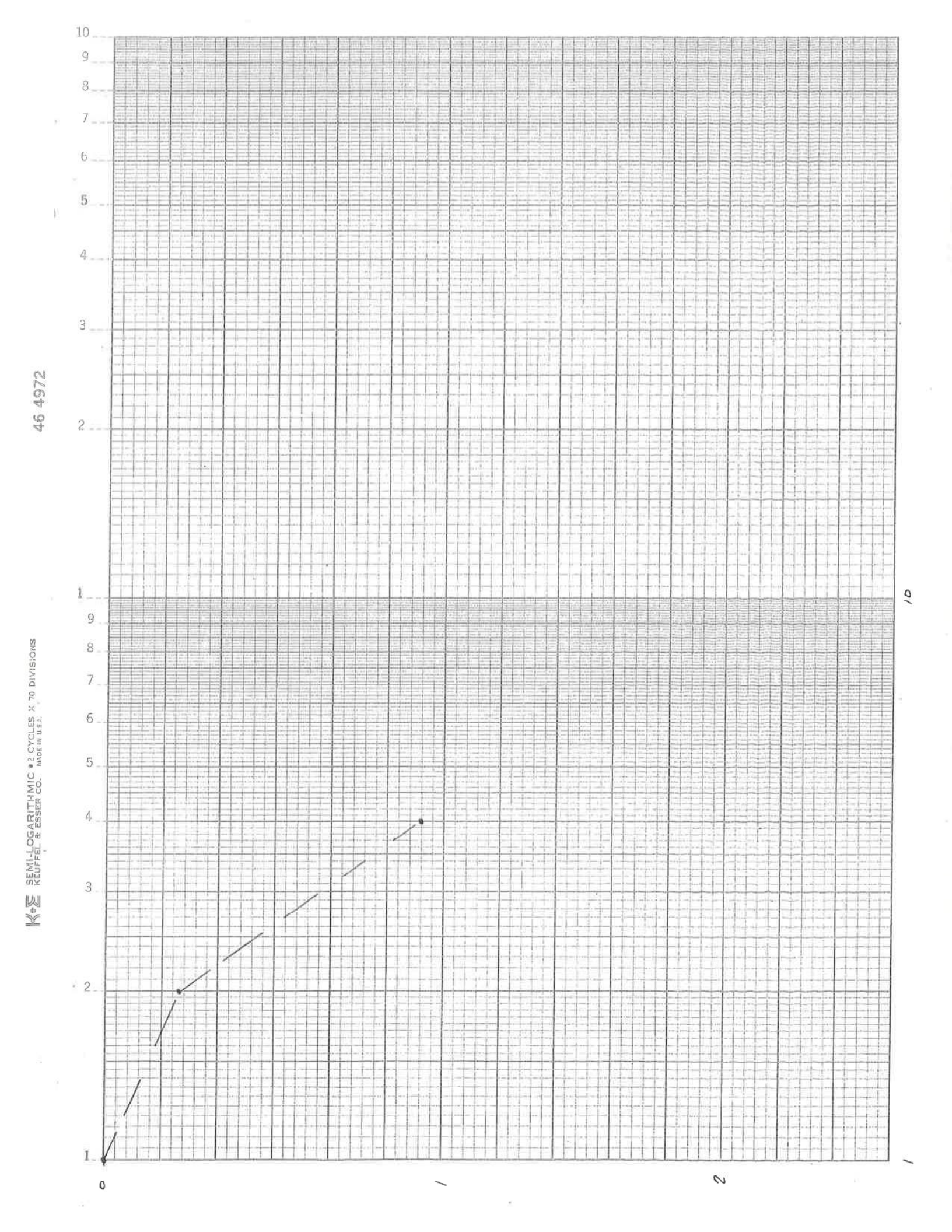
GEI Consultants	Client				Page	
	Project				Pg. Rev.	
	By		Chk.		App.	
	Date		Date		Date	
Project No.		Document No.				
Subject						

STAGE	$\bar{\sigma}_c$	VOL	Δ VOL	$\sum \Delta$ VOL	
VAC	1 ksf	615.47			0
			1.61	1.61	
1	2 ksf	613.86			0.26
			4.02	5.63	
2	4 ksf	609.84			0.92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K&E SEMI-LOGARITHMIC • 2 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

Triaxial Rate Calculations

Project No.	1700685
Test No.	R
Boring	B109J
Sample	U4
Depth	46.2'
By	DJA
Date	1-2-18
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #					
Initial Specimen Height in Cell	14.912	cm			
Height Change during Consolidation	0.097	cm	=	0.038	inch
Specimen Height, **A**	14.815	cm	=	5.833	inch
Estimated T_{100}, **B**	—	min			
Estimated Fail Strain, **C**	—	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**	0.021	mm / min	=	0.00081	inch / min
Strain Rate = (**E** / **A**) *10	0.014	% / min			

shear to 20% in 24 hrs

$$\dot{A} = \frac{0.2 \times 148.15}{1440} = 0.021 \ \frac{mm}{min}$$

TEST REMARKS

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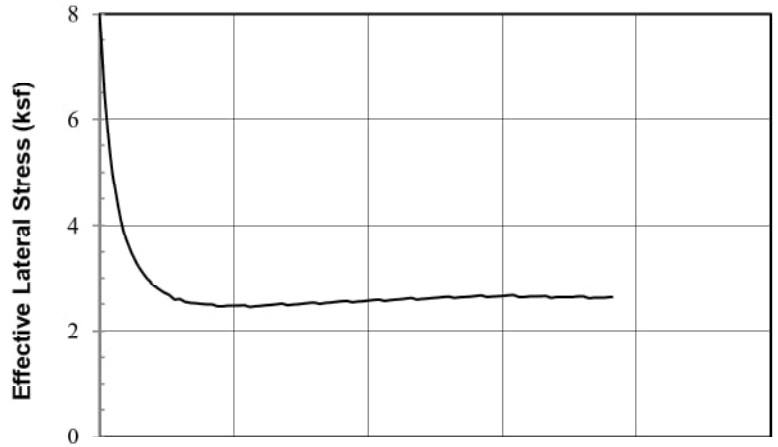


SAMPLE INFORMATION

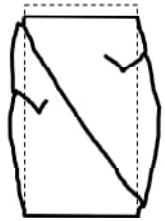
Boring: B103 Sample: U1 Depth (ft): 29.8 Test: R'9
Type: 2.8-inch-diameter tube sample
Description: Sluiced Flyash

SPECIMEN INFORMATION (after saturation)

Height: 6.025 in Dia.: 2.826 in Area.: 6.294 sq. in
Water Content: 58.8% Dry Unit Weight: 60.1 pcf

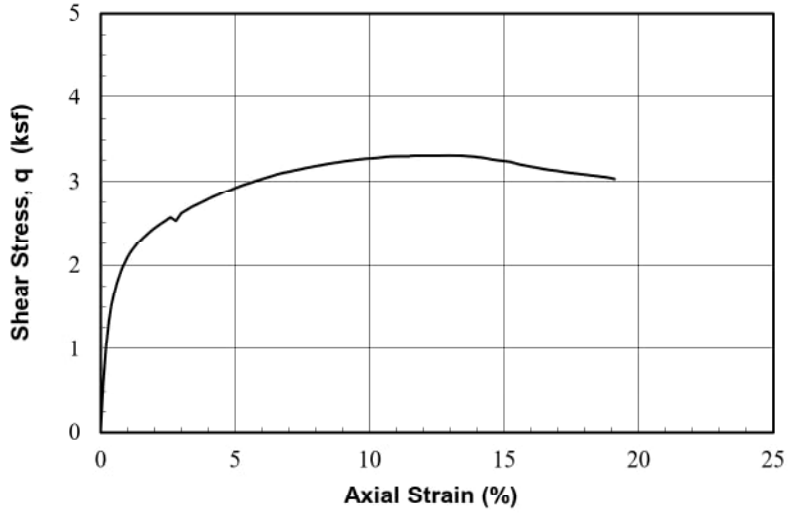
TEST SUMMARY (end of test)

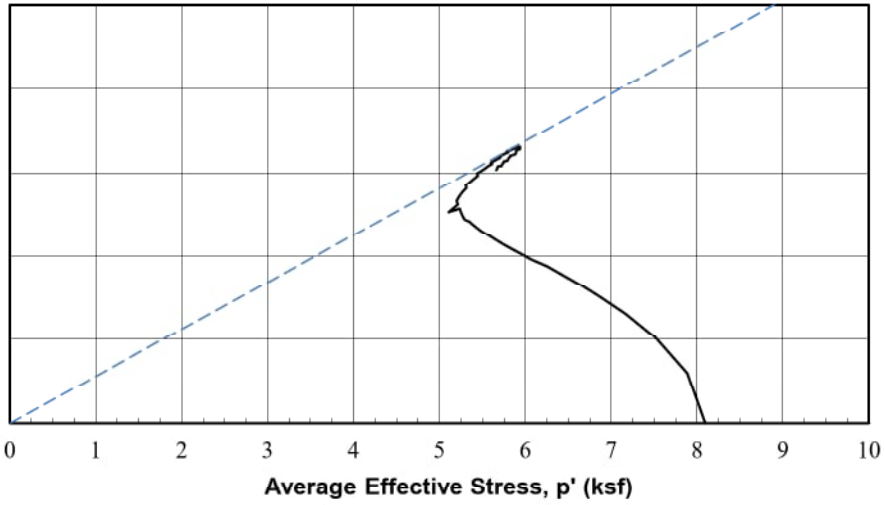
Effective Confining Stress: 8.10 ksf vertical, 8.10 ksf horiz.
Water Content: 55.2 % Dry Unit Weight: 62.3 pcf
B Coefficient: 0.99 Strain Rate: 0.022 %/min
Peak Shear Stress: 3.30 ksf @ 12.8 % Strain
Peak Friction Angle: 34.2 deg. @ 10.6 % Strain



Failure Sketch

REMARKS: Oven-dried at 110°C.





Operator: DJA/WL
Checked: D. Aghjayan
Test Date: 28-Dec-2017

1/18/2018 12:54

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-12

PROJECT #:	1700685												
PROJECT:	Glen Lyn		Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'9											
BORING:	B103			(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U1		In situ	--	--	--	--	--	--	56.6	--	1.447
DEPTH (ft):	29.8		After Sampling	--	--	--	--	--	--	56.1	--	1.472
OPER.:	DJA/WL		In tube before extrusion	--	--	6.132	2.874	6.488	60.11	58.0	92.9	1.388
TEST DATE:	12/28/2017		Under vac.	1.01	1.01	6.025	2.836	6.317	--	59.9	--	1.313
DCDT No.	146											
DCDT Calibration Factor	6.5277E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.	1890-4		Saturation	1.03	1.03	6.025	2.831	6.294	58.77	60.1	95.5	1.305
Load Cell Cal. Factor	0.027097	lb/cnt	Consol. Stage 1	2.00	2.00	6.025	2.826	6.272	58.41	60.3	95.6	1.297
Pressure Transducer	CP-GEI-4		Consol. Stage 2	3.98	3.98	6.025	2.808	6.193	57.10	61.1	96.0	1.268
Pres. Trans. Cal. Factor	0.019127	psi/cnt	Consol. Stage 3	8.10	8.10	5.928	2.804	6.176	55.19	62.3	96.7	1.225
			Consol. Stage 4	8.10	8.10	5.928	2.804	6.176	55.19	62.3	96.7	1.225
Gravity of Solids	2.22	(measured)	Consol. Stage 5	8.10	8.10	5.928	2.804	6.176	55.19	62.3	96.7	1.225
			Consol. Stage 6	8.10	8.10	5.928	2.804	6.176	55.19	62.3	96.7	1.225
B value start shear	0.99											
Test Stage End of#	3		This Stage Initial Values	8.10	8.10	5.928	2.804	6.176	55.19	62.3	96.7	1.225
Stage Strain rate	0.022	%/min	Kc start stage	1.00		Back Pressure		10.03 ksf				
Data Start Row	4											

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.097	13.061	69.565	0.00	6.18	0.00	8.10	8.10	8.10	8.10	0.00	1.00	0.0	0.00
0.103	64.843	75.207	0.10	6.18	0.81	7.28	9.30	8.49	7.89	0.60	1.17	4.4	0.67
0.109	101.720	80.812	0.20	6.19	1.62	6.48	10.16	8.54	7.51	1.03	1.32	7.9	0.79
0.115	125.650	85.115	0.30	6.19	2.24	5.86	10.71	8.47	7.17	1.31	1.45	10.5	0.86
0.121	143.340	88.577	0.40	6.20	2.74	5.36	11.12	8.38	6.87	1.51	1.56	12.7	0.90
0.127	156.460	91.293	0.50	6.21	3.13	4.97	11.42	8.29	6.63	1.66	1.67	14.5	0.94
0.133	166.670	93.493	0.60	6.21	3.45	4.65	11.66	8.21	6.43	1.78	1.77	16.1	0.97
0.139	175.320	95.386	0.70	6.22	3.72	4.38	11.85	8.13	6.26	1.88	1.86	17.5	0.99
0.145	182.610	97.261	0.80	6.23	3.99	4.11	12.02	8.03	6.07	1.96	1.95	18.9	1.02
0.151	188.970	98.657	0.90	6.23	4.19	3.91	12.16	7.97	5.94	2.03	2.04	20.0	1.03
0.156	194.180	99.805	1.00	6.24	4.35	3.74	12.28	7.92	5.83	2.09	2.12	21.0	1.04
0.162	198.700	100.780	1.10	6.25	4.49	3.60	12.38	7.88	5.74	2.14	2.19	21.9	1.05
0.168	202.850	101.620	1.20	6.25	4.62	3.48	12.47	7.85	5.67	2.19	2.26	22.7	1.06
0.174	206.510	102.370	1.30	6.26	4.72	3.37	12.55	7.82	5.60	2.23	2.32	23.4	1.06
0.180	210.000	103.040	1.40	6.26	4.82	3.28	12.62	7.80	5.54	2.26	2.38	24.1	1.06
0.186	213.120	103.610	1.50	6.27	4.90	3.19	12.69	7.79	5.49	2.30	2.44	24.7	1.07
0.192	216.150	104.150	1.60	6.28	4.98	3.12	12.75	7.77	5.45	2.33	2.50	25.3	1.07

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.198	219.000	104.610	1.70	6.28	5.05	3.05	12.82	7.77	5.41	2.36	2.55	25.9	1.07
0.204	221.460	105.010	1.80	6.29	5.10	2.99	12.87	7.76	5.38	2.39	2.59	26.3	1.07
0.210	223.980	105.350	1.90	6.30	5.15	2.94	12.92	7.77	5.35	2.41	2.64	26.8	1.07
0.216	226.450	105.940	2.00	6.30	5.24	2.86	12.97	7.73	5.30	2.44	2.71	27.4	1.07
0.228	231.110	106.460	2.20	6.32	5.31	2.78	13.07	7.75	5.27	2.49	2.79	28.2	1.07
0.239	235.310	106.900	2.40	6.33	5.38	2.72	13.15	7.78	5.25	2.53	2.86	28.8	1.06
0.251	239.270	107.250	2.60	6.34	5.43	2.67	13.23	7.81	5.24	2.57	2.92	29.4	1.06
0.263	236.010	107.860	2.80	6.35	5.51	2.58	13.15	7.63	5.11	2.53	2.96	29.6	1.09
0.275	244.630	107.760	3.00	6.37	5.50	2.60	13.33	7.83	5.21	2.62	3.02	30.1	1.05
0.287	248.590	108.120	3.20	6.38	5.55	2.54	13.41	7.86	5.20	2.66	3.09	30.7	1.04
0.299	252.250	108.240	3.40	6.39	5.57	2.53	13.48	7.91	5.22	2.69	3.13	31.1	1.03
0.311	255.710	108.320	3.60	6.41	5.58	2.51	13.55	7.97	5.24	2.73	3.17	31.3	1.02
0.323	258.970	108.370	3.80	6.42	5.59	2.51	13.61	8.02	5.27	2.76	3.20	31.6	1.01
0.334	262.110	108.410	4.00	6.43	5.59	2.50	13.67	8.08	5.29	2.79	3.23	31.8	1.00
0.346	265.250	108.430	4.20	6.45	5.60	2.50	13.73	8.13	5.32	2.82	3.25	32.0	0.99
0.358	268.400	108.700	4.40	6.46	5.64	2.46	13.79	8.15	5.31	2.85	3.31	32.4	0.99
0.370	271.400	108.680	4.60	6.47	5.63	2.46	13.84	8.21	5.34	2.87	3.33	32.6	0.98
0.382	274.280	108.640	4.81	6.49	5.63	2.47	13.89	8.27	5.37	2.90	3.35	32.7	0.97
0.394	276.990	108.620	5.01	6.50	5.62	2.47	13.94	8.32	5.39	2.92	3.36	32.8	0.96
0.406	279.670	108.580	5.21	6.52	5.62	2.48	13.99	8.37	5.42	2.95	3.38	32.9	0.95
0.418	282.270	108.550	5.41	6.53	5.61	2.48	14.03	8.42	5.45	2.97	3.39	33.0	0.95
0.430	284.820	108.780	5.61	6.54	5.65	2.45	14.08	8.43	5.44	2.99	3.44	33.4	0.94
0.441	287.280	108.680	5.81	6.56	5.63	2.46	14.12	8.49	5.47	3.01	3.44	33.4	0.94
0.453	289.640	108.620	6.01	6.57	5.62	2.47	14.16	8.53	5.50	3.03	3.45	33.4	0.93
0.465	292.020	108.560	6.21	6.59	5.62	2.48	14.20	8.58	5.53	3.05	3.46	33.5	0.92
0.477	294.300	108.510	6.41	6.60	5.61	2.49	14.23	8.62	5.56	3.07	3.47	33.5	0.91
0.489	296.600	108.430	6.61	6.61	5.60	2.50	14.27	8.67	5.59	3.09	3.47	33.5	0.91
0.501	298.610	108.350	6.81	6.63	5.59	2.51	14.30	8.71	5.61	3.10	3.47	33.6	0.90
0.513	300.530	108.550	7.01	6.64	5.61	2.48	14.33	8.71	5.60	3.12	3.51	33.8	0.90
0.525	302.460	108.490	7.21	6.66	5.61	2.49	14.36	8.75	5.62	3.13	3.51	33.8	0.90
0.536	304.350	108.410	7.41	6.67	5.59	2.50	14.38	8.79	5.65	3.14	3.51	33.8	0.89
0.548	306.140	108.340	7.61	6.69	5.58	2.51	14.41	8.83	5.67	3.16	3.51	33.8	0.88
0.560	307.850	108.280	7.81	6.70	5.57	2.52	14.43	8.86	5.69	3.17	3.51	33.8	0.88
0.572	309.580	108.200	8.01	6.71	5.56	2.53	14.46	8.89	5.71	3.18	3.51	33.8	0.87
0.584	311.340	108.370	8.21	6.73	5.59	2.51	14.48	8.89	5.70	3.19	3.55	34.1	0.88
0.596	313.020	108.280	8.41	6.74	5.57	2.52	14.50	8.93	5.72	3.20	3.54	34.0	0.87
0.608	314.790	108.220	8.61	6.76	5.57	2.53	14.52	8.96	5.74	3.21	3.54	34.0	0.87
0.620	316.360	108.140	8.81	6.77	5.55	2.54	14.54	8.99	5.76	3.22	3.54	34.0	0.86
0.631	317.930	108.070	9.01	6.79	5.54	2.55	14.56	9.02	5.78	3.23	3.54	34.0	0.86
0.643	319.370	107.990	9.21	6.80	5.53	2.56	14.58	9.05	5.80	3.24	3.53	34.0	0.85

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.655	320.800	108.180	9.41	6.82	5.56	2.54	14.60	9.03	5.78	3.25	3.56	34.2	0.86
0.667	322.210	108.090	9.61	6.83	5.55	2.55	14.61	9.06	5.81	3.26	3.56	34.1	0.85
0.679	323.460	108.030	9.82	6.85	5.54	2.56	14.62	9.08	5.82	3.26	3.55	34.1	0.85
0.691	324.650	107.950	10.02	6.86	5.53	2.57	14.63	9.11	5.84	3.27	3.55	34.1	0.85
0.703	325.840	107.900	10.22	6.88	5.52	2.58	14.64	9.12	5.85	3.27	3.54	34.0	0.84
0.715	327.090	107.820	10.42	6.89	5.51	2.59	14.65	9.15	5.87	3.28	3.54	34.0	0.84
0.727	328.440	108.010	10.62	6.91	5.54	2.56	14.67	9.13	5.85	3.29	3.57	34.2	0.84
0.738	329.580	107.910	10.82	6.93	5.52	2.57	14.68	9.16	5.86	3.29	3.56	34.1	0.84
0.750	330.580	107.840	11.02	6.94	5.51	2.58	14.68	9.17	5.88	3.29	3.55	34.1	0.84
0.762	331.450	107.780	11.22	6.96	5.50	2.59	14.69	9.18	5.89	3.30	3.54	34.0	0.83
0.774	332.260	107.700	11.42	6.97	5.49	2.60	14.69	9.20	5.90	3.30	3.53	34.0	0.83
0.786	333.210	107.650	11.62	6.99	5.48	2.61	14.69	9.21	5.91	3.30	3.53	33.9	0.83
0.798	334.110	107.860	11.82	7.00	5.51	2.58	14.70	9.18	5.88	3.30	3.56	34.1	0.84
0.810	334.890	107.760	12.02	7.02	5.50	2.60	14.70	9.20	5.90	3.30	3.54	34.0	0.83
0.822	335.650	107.700	12.22	7.04	5.49	2.60	14.70	9.21	5.91	3.30	3.54	34.0	0.83
0.833	336.440	107.650	12.42	7.05	5.48	2.61	14.70	9.21	5.91	3.30	3.53	33.9	0.83
0.845	337.220	107.570	12.62	7.07	5.47	2.62	14.70	9.23	5.92	3.30	3.52	33.9	0.83
0.857	337.980	107.490	12.82	7.08	5.46	2.63	14.70	9.24	5.94	3.30	3.51	33.8	0.83
0.869	338.630	107.440	13.02	7.10	5.45	2.64	14.70	9.24	5.94	3.30	3.50	33.7	0.83
0.881	339.250	107.610	13.22	7.12	5.48	2.62	14.70	9.22	5.92	3.30	3.52	33.9	0.83
0.893	339.880	107.550	13.42	7.13	5.47	2.63	14.69	9.22	5.92	3.30	3.51	33.8	0.83
0.905	340.340	107.490	13.62	7.15	5.46	2.63	14.69	9.23	5.93	3.30	3.50	33.8	0.83
0.917	340.770	107.440	13.82	7.17	5.45	2.64	14.68	9.23	5.93	3.29	3.49	33.7	0.83
0.929	340.800	107.380	14.02	7.18	5.45	2.65	14.67	9.22	5.94	3.28	3.48	33.6	0.83
0.940	340.690	107.300	14.22	7.20	5.43	2.66	14.65	9.21	5.94	3.28	3.46	33.5	0.83
0.952	340.230	107.510	14.42	7.22	5.46	2.63	14.62	9.16	5.90	3.26	3.48	33.6	0.84
0.964	340.040	107.460	14.62	7.23	5.46	2.64	14.60	9.15	5.89	3.25	3.47	33.5	0.84
0.976	339.960	107.400	14.83	7.25	5.45	2.65	14.59	9.14	5.89	3.25	3.45	33.4	0.84
0.988	339.930	107.360	15.03	7.27	5.44	2.65	14.57	9.13	5.89	3.24	3.44	33.3	0.84
1.000	339.740	107.300	15.23	7.29	5.43	2.66	14.55	9.12	5.89	3.23	3.43	33.2	0.84
1.012	338.880	107.260	15.43	7.30	5.43	2.67	14.52	9.09	5.88	3.21	3.41	33.1	0.84
1.024	338.010	107.510	15.63	7.32	5.46	2.63	14.49	9.02	5.83	3.20	3.43	33.3	0.85
1.035	337.490	107.490	15.83	7.34	5.46	2.63	14.46	9.00	5.82	3.18	3.42	33.2	0.86
1.047	337.110	107.470	16.03	7.36	5.46	2.64	14.44	8.98	5.81	3.17	3.41	33.1	0.86
1.059	336.820	107.440	16.23	7.37	5.45	2.64	14.42	8.97	5.80	3.16	3.39	33.0	0.86
1.071	336.460	107.400	16.43	7.39	5.45	2.65	14.40	8.95	5.80	3.15	3.38	32.9	0.86
1.083	336.080	107.360	16.63	7.41	5.44	2.65	14.37	8.93	5.79	3.14	3.37	32.8	0.87
1.095	336.060	107.610	16.83	7.43	5.48	2.62	14.36	8.88	5.75	3.13	3.39	33.0	0.87
1.107	335.920	107.550	17.03	7.44	5.47	2.63	14.34	8.87	5.75	3.12	3.38	32.9	0.88
1.119	335.680	107.530	17.23	7.46	5.47	2.63	14.32	8.85	5.74	3.11	3.37	32.8	0.88

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.131	335.620	107.510	17.43	7.48	5.46	2.63	14.31	8.84	5.74	3.10	3.36	32.8	0.88
1.142	335.540	107.490	17.63	7.50	5.46	2.63	14.29	8.83	5.73	3.10	3.35	32.7	0.88
1.154	335.430	107.470	17.83	7.52	5.46	2.64	14.27	8.81	5.73	3.09	3.34	32.6	0.88
1.166	335.460	107.440	18.03	7.54	5.45	2.64	14.26	8.80	5.72	3.08	3.33	32.6	0.89
1.178	335.680	107.670	18.23	7.55	5.49	2.61	14.25	8.76	5.68	3.08	3.36	32.8	0.89
1.190	335.600	107.650	18.43	7.57	5.48	2.61	14.23	8.75	5.68	3.07	3.35	32.7	0.89
1.202	335.570	107.610	18.63	7.59	5.48	2.62	14.21	8.74	5.68	3.06	3.34	32.6	0.90
1.214	335.600	107.570	18.83	7.61	5.47	2.62	14.20	8.73	5.67	3.05	3.33	32.5	0.90
1.226	335.110	107.530	19.03	7.63	5.47	2.63	14.17	8.71	5.67	3.04	3.31	32.4	0.90
1.230	334.620	107.530	19.10	7.64	5.47	2.63	14.16	8.69	5.66	3.03	3.31	32.4	0.90

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'9		Ground Surface Elevation
BORING:	B103		Elevation Datum
SAMPLE:	U1		
DEPTH:	29.8	Elevation:	
TEST DATE:	28-Dec-17		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	January 2018		
Figure No.			
Test Operator:	DJA/WL		
Checked By:	D. Aghjayan		
Last Edit By:			
Units to use (e or m)	e		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Sluiced Flyash		
Sample Description (2)			
Failure Type:			
Remarks (1):			
Remarks (2):			
	LL= NV		
	PL= NP		
	PI= NP		
HARDWARE			

Load ID:	1890-4	
Load Calibration Factor:	0.027097	lb/cnt
Pressure ID:	CP-GEI-4	
Pressure Cal. Fator	0.019127	psi/cnt
Displacement ID:	146	
Displacement Cal. Factor:	0.000065277	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.4	VC:	1.0331
Penetration, cm:	60.96		
Gross Recovery, cm:	61.10		
TUBE LENGTH, cm	76.20		
FIELD DIST. TO TOP SOIL, cm	15.10		
FIELD DIST. TO BOT SOIL, cm	0.00	IN SITU COR. FACTOR:	1.0103
FIELD DIST TOP PACKER, cm	14.40	TUBE TRANSPORT COR. FACTOR:	0.9658
FIELD DIST BOT PACKER, cm	0.00	TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm	16.49		
LAB DIST BOT PACKER, cm	0.00		

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	22.1	22.1	22.1	22.1	22.1	cm
TOP EMPTY LENGTH	3.25	3.25	3.25	3.25	3.25	cm
BOT. EMPTY LENGTH	3.25	3.3	3.25	3.3	3.275	cm
TUBE INNER DIAMETER	7.294	7.305	7.3	7.303	7.3005	cm

In tube length	15.58	cm
Tube Diameter	7.301	cm
Tube Area	41.86	(cm^2)
Tube Volume	651.96	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.281	7.26	7.284		7.275	cm
MEMBRANE 1 THICKNESS	0.073	0.069	0.072		0.071	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.645	13.704	13.664	13.761	13.694	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.539	8.588	8.561	8.508	8.549	cm

#filter strips	0		
Hi	15.305	cm	
Di	7.204	cm	2.12454306
Ai	40.757	cm^2	
Vi	623.758	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	177.190	204.360	*******	1622.320	*******	1281.770	1281.770	*******
DRY+T	125.440	149.560		*******	446.240	*******	967.900	363.490
T	31.780	40.380		656.430	438.710	369.850	369.850	362.960
Wt. Solids	93.66	109.18	0	965.89	7.53	598.58	598.05	0.53
w %	55.25	50.19	*******	60.11	*******	52.48	52.48	*******

FINAL B VALUE 0.99

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	69.87	77.04	0.000	2.340	0.000	0.000	0.019	7.17	7.17
Consolidation Stage 1	69.93	83.81	0.000	2.128	0.000	0.000	0.017	13.88	13.88
2	70.12	97.76	0.000	7.847	0.000	0.000	0.065	27.64	27.64
3	69.68	125.90	0.000	11.438	0.247	0.247	0.095	56.22	56.22
4	69.68	125.90	0.000	0.000	0.000	0.000	0.000	56.22	56.22
5	69.68	125.90	0.000	0.000	0.000	0.000	0.000	56.22	56.22
6	69.68	125.90	0.000	0.000	0.000	0.000	0.000	56.22	56.22
Start Shear	69.68	125.90	0.000	**********	**********			56.22	56.22
End Shear				16.226	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	pcf	void ratio	
in situ		0.00	0.00							1.0103	0.91	56.6	1.447	
after sampling		0.00	0.00							0.9658	0.90	56.1	1.472	
after shipping		0.00	0.00							1.0000	0.93	58.0	1.388	
in tube before extrusion		0.00	0.00	15.58	7.301	41.860	651.96	606.11	60.11	*****	0.93	58.0	1.388	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.305	7.204	40.757	623.758	598.580	*****	*****	0.96	59.9	1.313	
saturation		7.17	7.17	15.305	7.190	40.604	621.418	598.580	58.770		0.96	60.1	1.305	
	1	13.88	13.88	15.305	7.178	40.465	619.290	598.580	58.415	*****	0.97	60.3	1.297	
	2	27.64	27.64	15.305	7.132	39.952	611.443	598.580	57.104	*****	0.98	61.1	1.268	
	3	56.22	56.22	15.058	7.123	39.847	600.005	598.580	55.193	*****	1.00	62.3	1.225	
	4	56.22	56.22	15.058	7.123	39.847	600.005	598.580	55.193	*****	1.00	62.3	1.225	
	5	56.22	56.22	15.058	7.123	39.847	600.005	598.580	55.193	*****	1.00	62.3	1.225	
	6	56.22	56.22	15.058	7.123	39.847	600.005	598.580	55.193	*****	1.00	62.3	1.225	
Start Shear		56.22	56.22	15.058	7.123	39.847	600.005	598.580	55.193	*****	1.00	62.3	1.225	
End Shear		**********	**********				583.779	598.580	52.482	*****	1.03	64.0	1.165	1.165105593

Test comp (c) or ext (c) c

DEFORMATION RATE 1 0.03353658 mm/min 0.0223 %/min

DEFORMATION RATE 2 0.00132034 in/min 0.000222719 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.22 2.220 yields S=1

estimated or measured? (enter E or M) m
(measured)

Saturation 1.000

CALCULATE AREA FROM START OR
END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	0.03937008	inch
cm	0.39370079	inch	0.39370079	inch
cm^2	0.1550031	in^2	0.1550031	in^2
cm^3	0.061023744	in^3	0.06102374	in^3
kg	2.2046223	lb	2.2046223	lb
ksc	2.0481614	ksf	2.0481614	ksf
ksc	14.223	psi	14.223	psi
g/cm^3	62.427961	pcf	62.427961	pcf
Ht (mm)	1	inch	1	inch
psi	0.144	ksf	0.144	ksf
kg/Area	0.317465611	ksf	0.31746561	ksf
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'9
Boring	B103
Sample	U1
Depth	29.8'
By	DJA / WL
Date	12-28-17
Checked	DJA
Date	1·15·18

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	T-19	D 35		Z-4
Wet Wt. + Tare (g)	177.19	204.36		–
Dry Wt. + Tare (g)	125.44	149.56		446.24
Wt. Water (g)	51.75	54.80		–
Tare (g)	31.78	40.38		438.71
Dry Wt. Soil (g)	93.66	109.18		7.53
Water Content (%)	55.3	50.2		–

Trimmed Length in Tube

Overall Tube Length	22.1	22.1	22.1	22.1	cm	Avg.	22.1 cm
Top Empty Length	3.25	3.25	3.25	3.25	cm	Avg.	3.25 cm
Bottom Empty Length	3.25	3.3	3.25	3.3	cm	Avg.	3.3 cm

Trimmed Length in Tube, L: 15.6 cm

Tube Dimensions

Tube Inner Diameter	7.294	7.305	7.300	7.303	cm	Avg.	7.301 cm

Tube Weight (g):
Weight of other (specify:_____) (g):

Area, A: 41.86 cm^2
Volume in Tube = A x L: 651.96 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane		g
Membrane		g
W_{moist}		g

Dry Wt. Of Excess Solids

Tare #	D13	
Dry + Tare	363.49	g
Tare	362.96	g
Dry Wt. Of Excess	0.53	g

Water Content
(Fraction Used: 1)

Tare #	GEI-3	
Wet + Tare	1281.77	g
Dry + Tare	967.70	g
Wt. Water		g
Tare	369.85	g
Wt. Dry Soil	598.05	g
Water Content	52.5	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = _____ g

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify:_____)	1622.32	g
Tube + other	656.43	g
Moist soil	965.89	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.479 g/cm^3 / 92.33 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 0.924 g/cm^3 / 57.67 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'9
Boring	B103
Sample	U1
Depth	29.8'
By	DJA / WL
Date	12-28-17
Checked	DJA
Date	1.15.18

Undisturbed Specimen X
Remolded or compacted Specimen ____

Filter Strips? Yes____ No X
Lubricated End Platens? Yes____ No X

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes	7.281	7.260	7.284	—	Avg.	7.275 cm
Twice thickness 1 membranes	0.073	0.069	0.072	—	Avg.	- 0.071 cm
					Avg.	- — cm

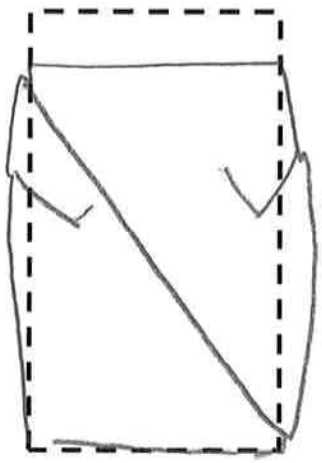
Diameter of Specimen	7.204	cm
Diameter of Specimen	2.836	inch
Area of Specimen	40.767	cm^2

Height Caliper #____

Height from top gauge block to top of top platen, with specimen	13.645	13.704	13.664	13.761	Avg.	13.694 cm
Height of Gauge Block						+ 10.160 cm
Height from top of top platen to cell base, without specimen	8.539	8.538	8.561	8.558	Avg.	- 8.549 cm

Height of Specimen in Cell	15.305	cm
Height of Specimen in Cell	6.026	inch
Volume in cell, initial	623.76	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

GEI Consultants

Saturation and Consolidation Data

Project No.	1700685
Test No.	R'9
Boring	B103
Sample	U1
Depth	29.8'
By	DJA
Date	12-28-17
Page	1

Panel No. 2

Pressure Trans:	SN CP-GEI-4	Factor 1.9127e-2	Gain =	8
Load Trans:	SN 1890-4	Factor 2.7097e-2	Gain =	8
Displ. Trans:	SN 146	Factor 6.5277e-5	Gain =	64

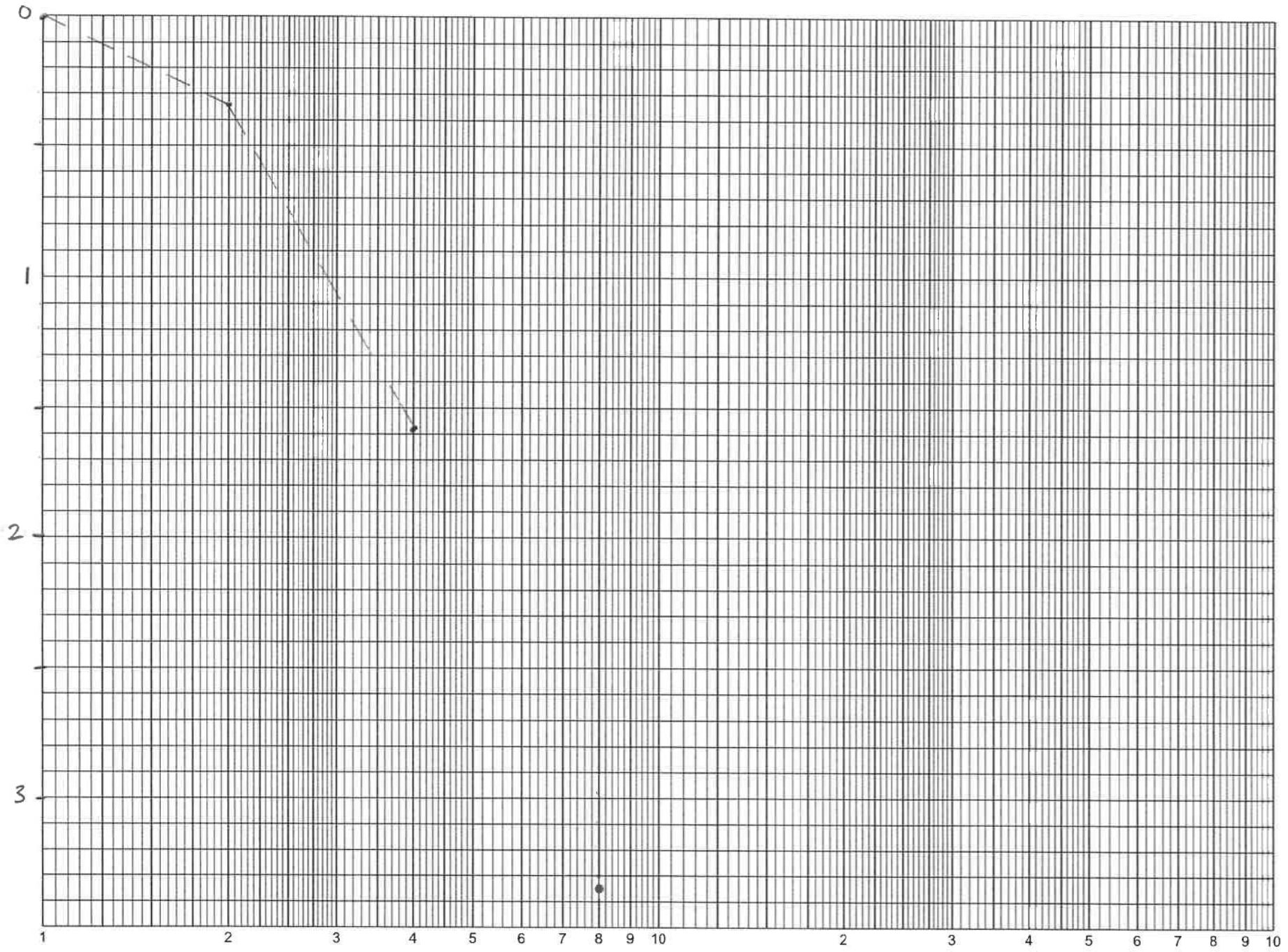
Date	Time	Load (lbf)	Axial Def. (inch)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x /.33) (digit)	Burrette Top (x /.33) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
12/28	11:20		0			–		-7		0
						22.9		0.34		7.23
						20.0		10.09		17.08
	13:17					19.4		10.16		
						18.3		20.14		27.16
	15:27					17.9		20.06		
						17.3		30.01		37.09
12/29	7:55					16.2		30.09		
						16.0		40.09		46.88
	9:30					15.9		40.17		47.00
			B=0.972			15.8		50.27	49.48	57.11
	11:00					15.7		50.21		57.02
			B=0.94			15.7		60.29	59.75	67.12
1/2/18	14:00					14.7		59.94		67.12
			B=0.99			14.7		69.87	69.76	77.04
	1425		CONSOLIDATE TO 14 PSI			14.7		67.87		77.04
						14.7		69.87		83.85
	1430					16.2				
	1448					16.3		69.93		83.81
			CONSOL TO 28 PSI							
	1457					16.3		69.91		98.03
	1457					21.9				
	1512					22.1				
	1523					22.1		69.99		97.85
1/3/18	810					22.2		70.12		97.76
		DRAIN	PRIOR TO CONSOL			11.2				
			CONSOL TO 56 PSI							
	815					11.2		69.95		126.44
	822					18.9				
	915					19.2				
	1055					19.5		69.99		126.33
	1545		0.098			19.8		69.68		125.90
			SHEAR							
1/4/18	630		RECONSOL			10.8				
						23.0				

TEST REMARKS

GEI Consultants

GEI Consultants	Client				Page	
	Project				Pg. Rev.	
	By		Chk.		App.	
	Date		Date		Date	
Project No.		Document No.				
Subject	R'9 CONSOLIDATION					

STAGE	$\bar{\sigma}_c$	VOL	ΔVOL	$\Sigma\Delta$VOL	ε_v(%)
BACK	1 ksf	623.84			0
			2.13	2.13	
1	2 ksf	621.71			0.34
			7.71	9.84	
2	4 ksf	614.00			1.58
			11.04	20.88	
3	8 ksf				3.35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Triaxial Rate Calculations

Project No.	
Test No.	
Boring	
Sample	
Depth	
By	
Date	
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #	2				
Initial Specimen Height in Cell	15.305	cm			
Height Change during Consolidation	0.246	cm	=	0.097	inch
Specimen Height, **A**	15.059	cm	=	5.929	inch
Estimated T_{100}, **B**	–	min			
Estimated Fail Strain, **C**	–	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	–	mm / min	=		inch / min
Actual Deformation Rate, **E**	0.0341	mm / min	=	0.00134	inch / min
Strain Rate = (**E** / **A**) *10	0.0226	% / min			

Shear 19% in 14 hrs

$$\frac{(150.59\text{ mm})(0.19)}{14\text{ hr}\left(60\frac{\text{min}}{\text{hr}}\right)} = 0.0341\text{ mm/min}$$

TEST REMARKS

GEI Consultants

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	UU
Boring	B103
Sample	U1
Depth	30.6'
By	DJA
Date	12-28-17
Checked	
Date	

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	U18	6B		D-12
Wet Wt. + Tare (g)	190.30	214.33		—
Dry Wt. + Tare (g)	136.94	152.20		395.10
Wt. Water (g)	53.36	62.13		—
Tare (g)	30.42	30.74		372.02
Dry Wt. Soil (g)	106.52	121.46		23.08
Water Content (%)	50.1	51.2		—

Trimmed Length in Tube

Overall Tube Length	23.3	23.3	23.3	23.3	cm	Avg.	23.3 cm
Top Empty Length	4.0	4.0	4.0	4.0	cm	Avg.	4.0 cm
Bottom Empty Length	4.2	4.2	4.2	4.2	cm	Avg.	4.2 cm

Trimmed Length in Tube, L: 15.1 cm

Tube Dimensions

Tube Inner Diameter	7.303	7.301	7.315	7.284	cm	Avg.	7.301 cm

Tube Weight (g):
Weight of other (specify:_____) (g):

Area, A: 41.86 cm^2
Volume in Tube = A x L: 632.12 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	g
Membrane	g
W_{moist}	g

Dry Wt. Of Excess Solids

Tare #	g
Dry + Tare	g
Tare	g
Dry Wt. Of Excess	g

Water Content

(Fraction Used: 1)

Tare #	MB-77
Wet + Tare	1326.07 g
Dry + Tare	1001.45 g
Wt. Water	324.62 g
Tare	400.90 g
Wt. Dry Soil	600.55 g
Water Content	54.1 %

$W_s = W_{moist} / (1 + wc)$ + Dry Wt of Excess = 623.63 g

(600.55 + 23.08)

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify:_____)	1648.12 g
Tube + other	684.68 g
Moist soil	963.44 g

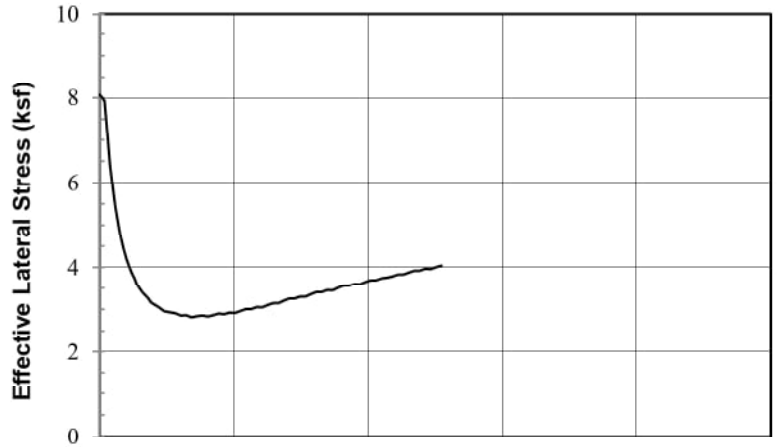
γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.524 g/cm^3 / 95.1 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 1.014 g/cm^3 / 63.2 pcf

Remarks:

UNIT WEIGHT ONLY

GEI Consultants



SAMPLE INFORMATION

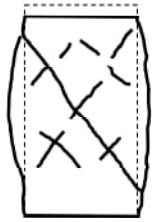
Boring: B105U Sample: U4 Depth (ft): 42.6 Test: R'10
Type: 2.8-inch-diameter tube sample
Description: Sluiced fly ash

SPECIMEN INFORMATION (after saturation)

Height: 5.969 in Dia.: 2.830 in Area.: 6.313 sq. in
Water Content: 67.2% Dry Unit Weight: 55.6 pcf

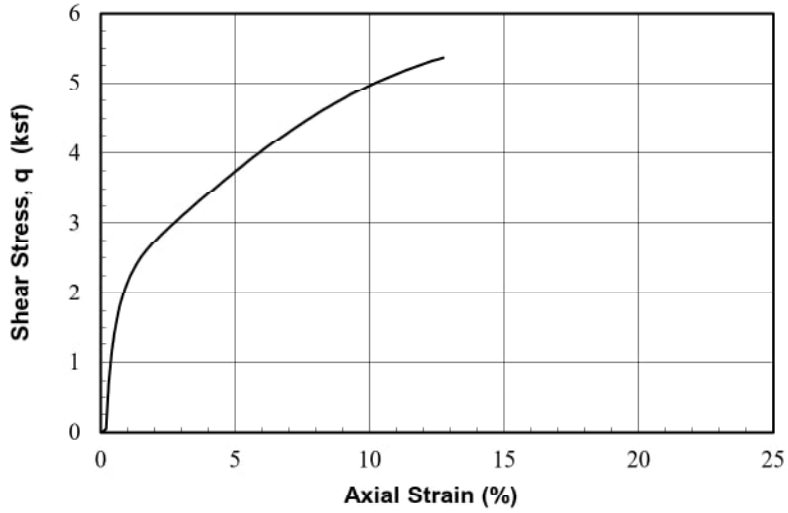
TEST SUMMARY (end of test)

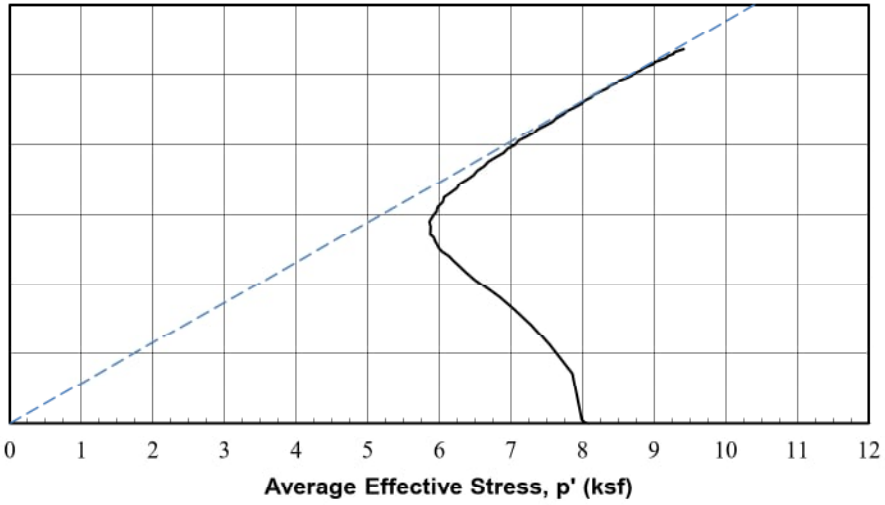
Effective Confining Stress: 8.09 ksf vertical, 8.09 ksf horiz.
Water Content: 63.6 % Dry Unit Weight: 57.5 pcf
B Coefficient: 0.96 Strain Rate: 0.018 %/min
Peak Shear Stress: 5.36 ksf @ 12.7 % Strain
Peak Friction Angle: 35.2 deg. @ 9.7 % Strain



Failure Sketch

REMARKS: Data acquisition computer shut down mid test. Oven-dried at 110°C.





Operator: DJA/WGL
Checked:
Test Date: 7-Jan-2018

1/18/2018 13:01

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-13

PROJECT #:	1700685												
PROJECT:	Glen Lyn		Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'10											
BORING:	B105U			(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U4		In situ	--	--	--	--	--	--	53.0	--	1.613
DEPTH (ft):	42.6		After Sampling	--	--	--	--	--	--	52.2	--	1.657
OPER.:	DJA/WGL		In tube before extrusion	--	--	6.063	2.874	6.487	69.91	53.9	91.6	1.571
TEST DATE:	1/7/2018		Under vac.	1.01	1.01	5.969	2.840	6.337	--	55.4	--	1.502
DCDT No.	147											
DCDT Calibration Factor	6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.	A8897		Saturation	1.02	1.02	5.969	2.835	6.313	67.23	55.6	93.0	1.493
Load Cell Cal. Factor	0.058033	lb/cnt	Consol. Stage 1	2.01	2.01	5.969	2.830	6.289	66.79	55.8	93.1	1.483
Pressure Transducer	25218		Consol. Stage 2	3.98	3.98	5.969	2.814	6.218	65.52	56.5	93.5	1.455
Pres. Trans. Cal. Factor	0.023604	psi/cnt	Consol. Stage 3	8.09	8.09	5.906	2.804	6.173	63.58	57.5	94.0	1.411
			Consol. Stage 4	8.09	8.09	5.906	2.804	6.173	63.58	57.5	94.0	1.411
Gravity of Solids	2.22	(measured)	Consol. Stage 5	8.09	8.09	5.906	2.804	6.173	63.58	57.5	94.0	1.411
			Consol. Stage 6	8.09	8.09	5.906	2.804	6.173	63.58	57.5	94.0	1.411
B value start shear	0.96											
Test Stage End of#	3		This Stage Initial Values	8.09	8.09	5.906	2.804	6.173	63.58	57.5	94.0	1.411
Stage Strain rate	0.018	%/min	Kc start stage	1.00		Back Pressure		5.68 ksf				
Data Start Row	4											

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.063	12.419	39.466	0.00	6.17	0.00	8.09	8.09	8.09	8.09	0.00	1.00	0.0	0.00
0.069	13.754	39.985	0.10	6.18	0.07	8.01	8.12	8.04	8.03	0.02	1.00	0.1	2.40
0.075	17.062	40.552	0.20	6.19	0.16	7.93	8.20	8.04	7.99	0.05	1.01	0.4	1.45
0.081	73.934	46.028	0.30	6.19	0.94	7.14	9.52	8.57	7.86	0.72	1.20	5.2	0.66
0.087	108.870	51.055	0.40	6.20	1.67	6.42	10.33	8.66	7.54	1.12	1.35	8.5	0.74
0.093	133.820	54.856	0.50	6.20	2.22	5.87	10.91	8.69	7.28	1.41	1.48	11.2	0.79
0.099	153.090	57.995	0.61	6.21	2.67	5.42	11.35	8.68	7.05	1.63	1.60	13.4	0.82
0.105	168.470	60.662	0.71	6.22	3.05	5.04	11.70	8.65	6.84	1.81	1.72	15.3	0.84
0.111	180.770	62.952	0.81	6.22	3.38	4.71	11.98	8.60	6.65	1.95	1.83	17.0	0.87
0.117	191.160	64.911	0.91	6.23	3.66	4.42	12.22	8.56	6.49	2.07	1.93	18.6	0.89
0.123	199.870	66.374	1.01	6.24	3.87	4.21	12.42	8.54	6.38	2.16	2.03	19.8	0.90
0.129	207.760	67.673	1.11	6.24	4.06	4.03	12.59	8.53	6.28	2.25	2.12	21.0	0.90
0.135	214.490	68.758	1.21	6.25	4.22	3.87	12.75	8.53	6.20	2.33	2.20	22.1	0.91
0.141	220.700	69.703	1.31	6.26	4.35	3.73	12.88	8.53	6.13	2.40	2.28	23.0	0.91
0.147	226.270	70.788	1.41	6.26	4.51	3.58	13.01	8.50	6.04	2.46	2.37	24.0	0.92
0.152	231.200	71.473	1.52	6.27	4.61	3.48	13.11	8.51	5.99	2.51	2.44	24.8	0.92
0.158	235.900	72.039	1.62	6.27	4.69	3.40	13.22	8.53	5.96	2.56	2.51	25.5	0.91

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.164	240.310	72.535	1.72	6.28	4.76	3.33	13.31	8.55	5.94	2.61	2.57	26.1	0.91
0.170	244.430	72.960	1.82	6.29	4.82	3.27	13.40	8.58	5.92	2.66	2.63	26.7	0.91
0.176	248.440	73.621	1.92	6.29	4.92	3.17	13.49	8.57	5.87	2.70	2.70	27.4	0.91
0.182	252.270	73.904	2.02	6.30	4.96	3.13	13.57	8.61	5.87	2.74	2.75	27.8	0.90
0.194	259.760	74.400	2.22	6.31	5.03	3.06	13.73	8.70	5.88	2.82	2.84	28.7	0.89
0.206	266.890	75.037	2.42	6.33	5.12	2.97	13.88	8.76	5.86	2.90	2.95	29.6	0.88
0.218	273.800	75.226	2.63	6.34	5.15	2.94	14.03	8.88	5.91	2.97	3.02	30.2	0.87
0.230	280.590	75.368	2.83	6.35	5.17	2.92	14.17	9.00	5.96	3.04	3.08	30.7	0.85
0.242	287.320	75.722	3.03	6.37	5.22	2.87	14.31	9.09	5.98	3.11	3.17	31.3	0.84
0.254	293.880	75.698	3.23	6.38	5.22	2.87	14.44	9.22	6.05	3.18	3.21	31.7	0.82
0.266	300.490	76.028	3.44	6.39	5.26	2.82	14.58	9.31	6.07	3.24	3.30	32.3	0.81
0.278	306.940	75.840	3.64	6.41	5.24	2.85	14.71	9.47	6.16	3.31	3.32	32.5	0.79
0.290	313.380	75.722	3.84	6.42	5.22	2.87	14.84	9.62	6.24	3.38	3.35	32.7	0.77
0.302	319.880	75.887	4.04	6.43	5.24	2.84	14.97	9.73	6.28	3.44	3.42	33.2	0.76
0.314	326.200	75.651	4.25	6.45	5.21	2.88	15.10	9.89	6.38	3.50	3.44	33.3	0.74
0.326	332.590	75.438	4.45	6.46	5.18	2.91	15.22	10.05	6.48	3.57	3.45	33.4	0.73
0.338	338.970	75.509	4.65	6.47	5.19	2.90	15.35	10.16	6.53	3.63	3.51	33.8	0.71
0.350	345.240	75.250	4.85	6.49	5.15	2.94	15.48	10.32	6.63	3.69	3.52	33.9	0.70
0.361	351.560	75.320	5.05	6.50	5.16	2.93	15.60	10.44	6.68	3.76	3.57	34.2	0.69
0.373	357.890	74.990	5.26	6.52	5.12	2.97	15.72	10.61	6.79	3.82	3.57	34.2	0.67
0.385	364.270	74.683	5.46	6.53	5.07	3.02	15.85	10.78	6.90	3.88	3.57	34.2	0.65
0.397	370.310	74.683	5.66	6.54	5.07	3.02	15.96	10.89	6.96	3.94	3.61	34.5	0.64
0.409	376.290	74.376	5.86	6.56	5.03	3.06	16.08	11.05	7.06	4.00	3.61	34.5	0.63
0.421	382.440	74.423	6.07	6.57	5.03	3.05	16.20	11.16	7.11	4.05	3.65	34.8	0.62
0.433	388.240	74.046	6.27	6.59	4.98	3.11	16.31	11.33	7.22	4.11	3.64	34.7	0.61
0.445	394.160	73.739	6.47	6.60	4.94	3.15	16.42	11.48	7.32	4.16	3.64	34.7	0.59
0.457	399.910	73.739	6.67	6.61	4.94	3.15	16.52	11.59	7.37	4.22	3.68	34.9	0.59
0.469	405.530	73.385	6.87	6.63	4.88	3.20	16.63	11.74	7.47	4.27	3.67	34.8	0.57
0.481	411.340	73.054	7.08	6.64	4.84	3.25	16.74	11.90	7.58	4.32	3.66	34.8	0.56
0.493	417.030	73.031	7.28	6.66	4.83	3.26	16.84	12.01	7.63	4.38	3.69	35.0	0.55
0.505	422.710	72.700	7.48	6.67	4.79	3.30	16.94	12.16	7.73	4.43	3.68	34.9	0.54
0.517	428.050	72.677	7.68	6.69	4.78	3.31	17.04	12.26	7.78	4.48	3.71	35.1	0.53
0.529	433.390	72.323	7.89	6.70	4.73	3.36	17.13	12.40	7.88	4.52	3.69	35.0	0.52
0.541	438.790	71.992	8.09	6.72	4.68	3.40	17.23	12.55	7.98	4.57	3.68	35.0	0.51
0.553	444.130	71.969	8.29	6.73	4.68	3.41	17.32	12.64	8.03	4.62	3.71	35.1	0.51
0.565	449.230	71.638	8.49	6.75	4.63	3.46	17.41	12.78	8.12	4.66	3.70	35.1	0.50
0.576	454.400	71.662	8.70	6.76	4.64	3.45	17.50	12.87	8.16	4.71	3.73	35.2	0.49
0.588	459.330	71.284	8.90	6.78	4.58	3.51	17.59	13.00	8.26	4.75	3.71	35.1	0.48
0.600	464.210	70.954	9.10	6.79	4.53	3.55	17.67	13.13	8.34	4.79	3.70	35.0	0.47
0.612	469.250	70.930	9.30	6.81	4.53	3.56	17.75	13.22	8.39	4.83	3.72	35.2	0.47

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.624	473.960	70.600	9.50	6.82	4.48	3.61	17.83	13.35	8.48	4.87	3.70	35.1	0.46
0.636	478.600	70.647	9.71	6.84	4.49	3.60	17.91	13.42	8.51	4.91	3.73	35.2	0.46
0.648	483.180	70.246	9.91	6.85	4.43	3.66	17.98	13.55	8.60	4.95	3.71	35.1	0.45
0.660	487.710	69.939	10.11	6.87	4.39	3.70	18.05	13.67	8.68	4.98	3.69	35.0	0.44
0.672	492.290	69.939	10.31	6.88	4.39	3.70	18.13	13.74	8.72	5.02	3.71	35.1	0.44
0.684	496.530	69.608	10.52	6.90	4.34	3.75	18.19	13.85	8.80	5.05	3.70	35.0	0.43
0.696	500.880	69.514	10.72	6.91	4.33	3.76	18.26	13.93	8.85	5.09	3.70	35.1	0.43
0.708	504.950	69.301	10.92	6.93	4.30	3.79	18.32	14.03	8.91	5.12	3.70	35.1	0.42
0.720	509.120	68.971	11.12	6.95	4.25	3.84	18.39	14.14	8.99	5.15	3.68	34.9	0.41
0.732	513.360	68.994	11.32	6.96	4.25	3.84	18.45	14.20	9.02	5.18	3.70	35.1	0.41
0.744	517.310	68.664	11.53	6.98	4.20	3.88	18.51	14.30	9.09	5.21	3.68	35.0	0.40
0.756	521.140	68.357	11.73	6.99	4.16	3.93	18.56	14.40	9.17	5.24	3.67	34.8	0.40
0.768	525.020	68.357	11.93	7.01	4.16	3.93	18.62	14.46	9.19	5.27	3.68	34.9	0.40
0.780	528.740	68.050	12.13	7.03	4.12	3.97	18.67	14.56	9.26	5.29	3.66	34.8	0.39
0.791	532.510	68.098	12.34	7.04	4.12	3.97	18.72	14.60	9.28	5.32	3.68	34.9	0.39
0.803	535.930	67.791	12.54	7.06	4.08	4.01	18.77	14.69	9.35	5.34	3.66	34.8	0.38
0.815	539.240	67.507	12.74	7.07	4.04	4.05	18.81	14.77	9.41	5.36	3.65	34.7	0.38

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'10		Ground Surface Elevation
BORING:	B105U		Elevation Datum
SAMPLE:	U4		
DEPTH:	42.6	Elevation: 1502.8	
TEST DATE:	07-Jan-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	DJA/WGL		
Checked By:			
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	SILT		
Sample Description (2)	Sluiced Ash		
Failure Type:			
Remarks (1):			
Remarks (2):			
LL=	NV		
PL=	NP		
PI=	NP		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.36	VC:	1.7169
Penetration, cm:	60.70		
Gross Recovery, cm:	61.30		
TUBE LENGTH, cm	76.20		
FIELD DIST. TO TOP SOIL, cm	14.90		
FIELD DIST. TO BOT SOIL, cm	0.00	IN SITU COR. FACTOR:	1.0172
FIELD DIST TOP PACKER, cm	14.00	TUBE TRANSPORT COR. FACTOR:	0.9674
FIELD DIST BOT PACKER, cm	0.00	TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm	16.00		
LAB DIST BOT PACKER, cm	0.00		

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	22.4	22.4	22.4	22.4	22.4	cm
TOP EMPTY LENGTH	3.7	3.7	3.8	3.7	3.725	cm
BOT. EMPTY LENGTH	3.3	3.2	3.3	3.3	3.275	cm
TUBE INNER DIAMETER	7.308	7.283	7.322	7.286	7.29975	cm

In tube length	15.40	cm
Tube Diameter	7.300	cm
Tube Area	41.85	(cm^2)
Tube Volume	644.51	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.242	7.29	7.328		7.287	cm
MEMBRANE 1 THICKNESS	0.075	0.07	0.071		0.072	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.694	13.857	13.795	13.719	13.766	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.765	8.772	8.735	8.79	8.766	cm

#filter strips	0		
Hi	15.161	cm	
Di	7.215	cm	2.10137914
Ai	40.881	cm^2	
Vi	619.788	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	137.780	101.040	*******	1601.230	*******	1295.670	1295.670	*******
DRY+T	95.550	73.650		*******	379.160	*******	952.980	204.470
T	31.360	31.580		660.160	372.580	403.420	403.420	204.030
Wt. Solids	64.19	42.07	0	941.07	6.58	550.00	549.56	0.44
w %	65.79	65.11	*******	69.91	*******	62.36	62.36	*******

FINAL B VALUE 0.96

Fixed Piston? (y or n)	n		
Piston diameter	0.375	in	
Piston Area	0.110446617	(in^2)	

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)	
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00	
saturation	40.01	47.07	0.000	2.276	0.000	0.000	0.019	7.06	7.06	
Consolidation Stage 1	39.84	53.77	0.000	2.412	0.000	0.000	0.020	13.93	13.93	
2	39.84	67.51	0.000	6.968	0.000	0.000	0.057	27.67	27.67	
3	39.47	95.64	0.000	10.720	0.160	0.160	0.089	56.17	56.17	
4	39.47	95.64	0.000	0.000	0.000	0.000	0.000	56.17	56.17	
5	39.47	95.64	0.000	0.000	0.000	0.000	0.000	56.17	56.17	
6	39.47	95.64	0.000	0.000	0.000	0.000	0.000	56.17	56.17	
Start Shear	39.47	95.64	0.000	**********	**********			56.17	56.17	
End Shear				6.700	**********			**********	**********	

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm^3	pcf	void ratio	
in situ		0.00	0.00							1.0172	0.85	53.0	1.613	
after sampling		0.00	0.00							0.9674	0.84	52.2	1.657	
after shipping		0.00	0.00							1.0000	0.86	53.9	1.571	
in tube before extrusion		0.00	0.00	15.40	7.300	41.851	644.51	556.58	69.91	*****	0.86	53.9	1.571	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.161	7.215	40.881	619.788	550.000	*****	*****	0.89	55.4	1.502	
saturation		7.06	7.06	15.161	7.201	40.731	617.512	550.000	67.230		0.89	55.6	1.493	
	1	13.93	13.93	15.161	7.187	40.572	615.100	550.000	66.791	*****	0.89	55.8	1.483	
	2	27.67	27.67	15.161	7.147	40.112	608.132	550.000	65.524	*****	0.90	56.5	1.455	
	3	56.17	56.17	15.001	7.121	39.825	597.412	550.000	63.575	*****	0.92	57.5	1.411	
	4	56.17	56.17	15.001	7.121	39.825	597.412	550.000	63.575	*****	0.92	57.5	1.411	
	5	56.17	56.17	15.001	7.121	39.825	597.412	550.000	63.575	*****	0.92	57.5	1.411	
	6	56.17	56.17	15.001	7.121	39.825	597.412	550.000	63.575	*****	0.92	57.5	1.411	
Start Shear		56.17	56.17	15.001	7.121	39.825	597.412	550.000	63.575	*****	0.92	57.5	1.411	
End Shear		**********	**********				590.712	550.000	62.357	*****	0.93	58.1	1.384	1.384328918

Test comp (c) or ext (c) c

DEFORMATION RATE 1 0.02750243 mm/min 0.0183 %/min

DEFORMATION RATE 2 0.00108277 in/min 0.00018334 %/min

DEFORMATION RATE 3 in/min

SPECIFIC GRAVITY OF SOLIDS 2.22 2.220 yields S=1

estimated or measured? (enter E or M) m

(measured)

Saturation 1.000

CALCULATE AREA FROM START OR END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm^3	62.427961	pcf	1	g/cm^3
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'10
Boring	B105U
Sample	U4
Depth	42.6'
By	WGL
Date	1/3/18
Checked	DJA
Date	1.19.18

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-3	CW-18		BS-1
Wet Wt. + Tare (g)	137.78	101.04		—
Dry Wt. + Tare (g)	95.55	73.65		379.16
Wt. Water (g)	42.23	27.39		—
Tare (g)	31.36	31.58		372.58
Dry Wt. Soil (g)	64.19	42.07		6.58
Water Content (%)	65.8	65.1		—

Trimmed Length in Tube

Overall Tube Length	22.4	22.4	22.4	22.4	cm	Avg.	22.4 cm
Top Empty Length	3.7	3.7	3.8	3.7	cm	Avg.	3.7 cm
Bottom Empty Length	3.3	3.2	3.3	3.3	cm	Avg.	3.3 cm

Trimmed Length in Tube, L: 15.4 cm

Tube Dimensions

Tube Inner Diameter	7.308	7.283	7.322	7.286	cm	Avg.	7.300 cm

Tube Weight (g): 660.16

Weight of other (specify: —) (g): —

Area, A: 41.85 cm^2

Volume in Tube = A x L: 644.5 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	1295.67	g
Membrane	403.42	g
W_{moist}	892.25	g

Dry Wt. Of Excess Solids

Tare #	L-1	g
Dry + Tare	204.47	g
Tare	204.03	g
Dry Wt. Of Excess	0.44	g

Water Content

(Fraction Used: 1)

Tare #	S-4A	
Wet + Tare	1295.67	g
Dry + Tare	952.98	g
Wt. Water	342.69	g
Tare	403.42	g
Wt. Dry Soil	549.56	g
Water Content	62.4	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = 550.00 g

Estimate of γ_d using γ_m, in tube

Moist soil + tube + other (specify: —)	1601.23	g
Tube + other	660.16	g
Moist soil	941.07	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.460 g/cm^3 / 91.1 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 0.883 g/cm^3 / 55.1 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'10
Boring	B105 U
Sample	U4
Depth	42.6 ft
By	DJA / WGL
Date	1-7-18
Checked	DJA
Date	1.19.18

Undisturbed Specimen X
Remolded or compacted Specimen ____

Filter Strips? Yes____ No X
Lubricated End Platens? Yes____ No X

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes	7.242	7.290	7.328	–	Avg.	7.287	cm
Twice thickness 1 membranes	0.075	0.070	0.071	–	Avg.	-0.072	cm
					Avg.	-	cm

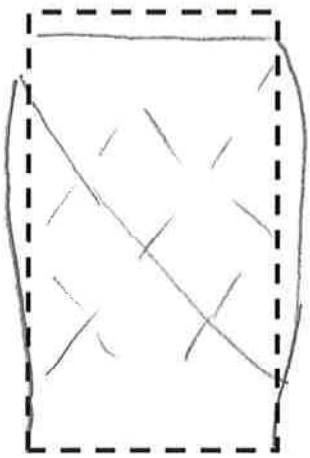
Diameter of Specimen	7.215	cm
Diameter of Specimen	2.841	inch
Area of Specimen	40.88	cm^2

Height Caliper #____

Height from top gauge block to top of top platen, with specimen	13.694	13.857	13.795	13.719	Avg.	13.766	cm
Height of Gauge Block						+10.160	cm
Height from top of top platen to cell base, without specimen	8.765	8.772	8.735	8.790	Avg.	-8.765	cm

Height of Specimen in Cell	15.161	cm
Height of Specimen in Cell	5.969	inch
Volume in cell, initial	619.788	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

GEI Consultants

Saturation and Consolidation Data

Project No.	1700685
Test No.	A'10
Boring	B105U
Sample	U4
Depth	42.6 ft
By	DTA
Date	1-7-18
Page	1

Panel No. 1

Pressure Trans: SN 25218 Factor 2.3604e-2 Gain = 8
Load Trans: SN A8897 Factor 5.8033e-2 Gain = 8
Displ. Trans: SN 147 Factor 6.7108e-5 Gain = 64

Date	Time	Load (lbf)	Axial Def. (/1ch)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x /.34) (digit)	Burrette Top (x /.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
1-7-18	13:00		0			—		-7		0
						25.6		1.10		8.10
						24.5		10.20		17.21
1-8-18	8:00					23.4		10.79		
						23.2		20.04		27.00
	9:30					23.2		19.99		
						23.0		30.05		37.06
	11:00					23.0		29.93		36.92
			B=0.96			23.0		40.01	39.70	47.07
		Consol to	14psi							
	11:09					5.4		39.75		53.75
	13:11					7.2		39.84		53.77
		Consol to $\bar{\sigma}_c$ =	28 psi							
	13:13					7.2		39.84		67.86
	14:20					12.4		39.80		67.51
		Consol to 56 psi								
	14:23					12.4		39.82		96.07
	15:26					20.3		39.82		
	15:40					20.4		39.47		95.64
		Shear								
		Reconsol				4.9				
						9.9				

TEST REMARKS

GEI Consultants

Triaxial Rate Calculations

Project No.	1700685
Test No.	R'10
Boring	B10 SU
Sample	U4
Depth	42.6 ft
By	DJA
Date	1-8-18
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

Stage #					
Initial Specimen Height in Cell	15.161	cm			
Height Change during Consolidation	0.160	cm	=	0.063	inch
Specimen Height, **A**	15.001	cm	=	5.906	inch
Estimated T_{100}, **B**	–	min			
Estimated Fail Strain, **C**	–	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	–	mm / min	=		inch / min
Actual Deformation Rate, **E**	0.028	mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10	0.019	% / min			

Shear to 20% in 18 hrs

$$\dot{\Delta} = \frac{0.2 \times 150.01 \text{ mm}}{18 \times 60} = 0.028 \text{ mm/min}$$

$$= 0.0011 \text{ in/min}$$

TEST REMARKS

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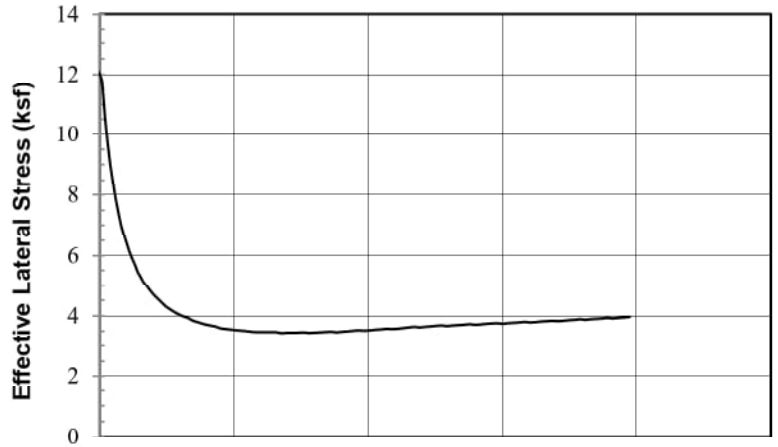


SAMPLE INFORMATION

Boring: B109U Sample: U5 Depth (ft): 61.8 Test: R'11
Type: 2.8-inch-diameter tube sample
Description: Sluiced fly ash

SPECIMEN INFORMATION (after saturation)

Height: 5.871 in Dia.: 2.798 in Area.: 6.180 sq. in
Water Content: 80.4% Dry Unit Weight: 49.8 pcf

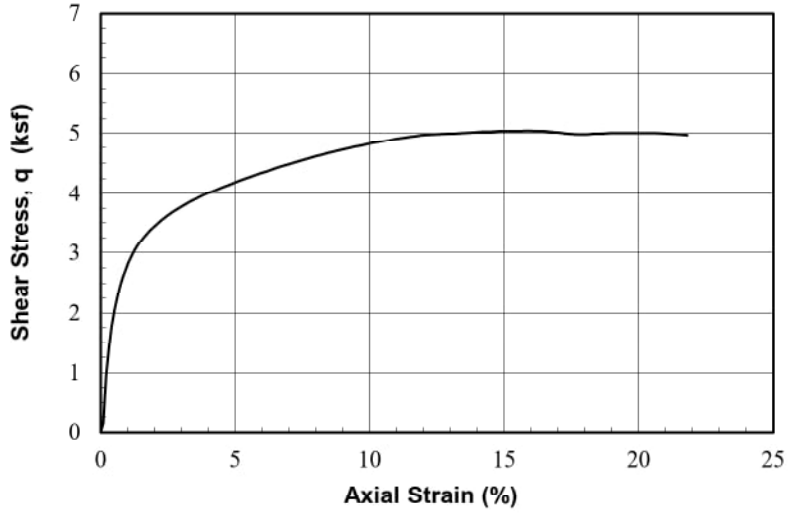
TEST SUMMARY (end of test)

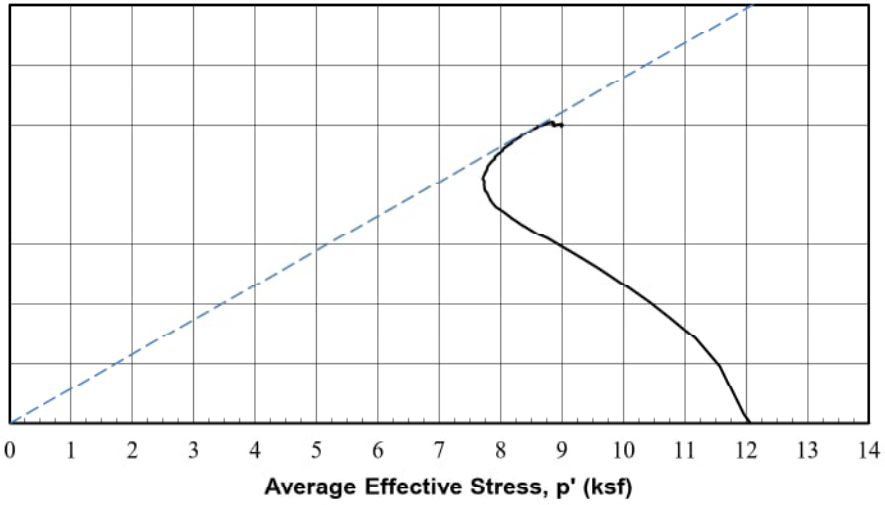
Effective Confining Stress: 12.07 ksf vertical, 12.07 ksf horiz.
Water Content: 72.2 % Dry Unit Weight: 53.3 pcf
B Coefficient: 0.98 Strain Rate: 0.019 %/min
Peak Shear Stress: 5.04 ksf @ 15.8 % Strain
Peak Friction Angle: 35.3 deg. @ 10.9 % Strain



Failure Sketch

REMARKS: Oven-dried at 110°C





Operator: DJA/WGL
Checked:
Test Date: 7-Jan-2018

1/18/2018 13:02

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-14

PROJECT #:	1700685												
PROJECT:	Glen Lyn		Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'11											
BORING:	B109U			(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U5		In situ	--	--	--	--	--	--	47.9	--	1.893
DEPTH (ft):	61.8		After Sampling	--	--	--	--	--	--	46.0	--	2.012
OPER.:	DJA/WGL		In tube before extrusion	--	--	6.063	2.872	6.480	86.05	46.7	86.9	1.967
TEST DATE:	1/7/2018		Under vac.	1.01	1.01	5.871	2.829	6.286	--	48.9	--	1.831
DCDT No.		146										
DCDT Calibration Factor		6.5277E-05 inch/cnt	End of:							calculated from end of test		
Load Cell No.		1890-4	Saturation	1.02	1.02	5.871	2.805	6.180	80.35	49.8	89.8	1.784
Load Cell Cal. Factor		0.027097 lb/cnt	Consol. Stage 1	2.01	2.01	5.871	2.798	6.148	79.71	50.0	89.9	1.770
Pressure Transducer		CP-GEI-4	Consol. Stage 2	4.00	4.00	5.871	2.776	6.053	77.77	50.8	90.4	1.727
Pres. Trans. Cal. Factor		0.019127 psi/cnt	Consol. Stage 3	8.04	8.04	5.871	2.737	5.886	74.38	52.3	91.2	1.651
			Consol. Stage 4	12.07	12.07	5.711	2.750	5.938	72.16	53.3	91.7	1.602
Gravity of Solids		2.22 (measured)	Consol. Stage 5	12.07	12.07	5.711	2.750	5.938	72.16	53.3	91.7	1.602
			Consol. Stage 6	12.07	12.07	5.711	2.750	5.938	72.16	53.3	91.7	1.602
B value start shear		0.98										
Test Stage End of#	4		This Stage Initial Values	12.07	12.07	5.711	2.750	5.938	72.16	53.3	91.7	1.602
Stage Strain rate		0.019 %/min	Kc start stage	1.00		Back Pressure		5.68 ksf				
Data Start Row	4											

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.159	17.478	39.478	0.00	5.94	0.00	12.07	12.07	12.07	12.07	0.00	1.00	0.0	0.00
0.165	30.132	41.295	0.10	5.94	0.26	11.81	12.38	12.12	11.96	0.15	1.03	0.7	0.85
0.171	96.492	49.596	0.20	5.95	1.46	10.62	13.99	12.53	11.57	0.96	1.18	4.7	0.76
0.177	134.700	55.545	0.31	5.96	2.31	9.76	14.91	12.59	11.18	1.42	1.29	7.3	0.82
0.183	163.990	60.919	0.41	5.96	3.09	8.99	15.61	12.52	10.75	1.77	1.39	9.5	0.87
0.189	186.450	65.147	0.51	5.97	3.70	8.38	16.15	12.45	10.41	2.04	1.49	11.3	0.91
0.194	204.800	68.800	0.62	5.97	4.22	7.85	16.59	12.37	10.11	2.26	1.58	12.9	0.94
0.200	220.460	72.013	0.72	5.98	4.69	7.39	16.96	12.27	9.83	2.44	1.66	14.4	0.96
0.206	233.440	74.729	0.82	5.99	5.08	7.00	17.27	12.19	9.59	2.60	1.74	15.7	0.98
0.212	243.820	76.986	0.92	5.99	5.40	6.67	17.51	12.11	9.39	2.72	1.82	16.8	0.99
0.218	253.440	79.052	1.03	6.00	5.70	6.37	17.74	12.04	9.21	2.83	1.89	17.9	1.01
0.224	261.730	80.888	1.13	6.01	5.96	6.11	17.93	11.97	9.04	2.93	1.96	18.9	1.02
0.230	269.100	82.495	1.23	6.01	6.19	5.88	18.10	11.91	8.89	3.01	2.03	19.8	1.03
0.236	276.060	83.987	1.34	6.02	6.41	5.66	18.26	11.85	8.76	3.09	2.09	20.7	1.04
0.241	282.050	85.517	1.44	6.02	6.63	5.44	18.40	11.77	8.61	3.16	2.16	21.6	1.05
0.247	287.470	86.626	1.54	6.03	6.79	5.28	18.52	11.73	8.51	3.22	2.22	22.3	1.05
0.253	292.570	87.697	1.64	6.04	6.94	5.13	18.63	11.69	8.41	3.28	2.28	23.0	1.06

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.259	297.250	88.635	1.75	6.04	7.08	4.99	18.74	11.66	8.33	3.33	2.33	23.6	1.06
0.265	301.730	89.495	1.85	6.05	7.20	4.87	18.84	11.64	8.25	3.38	2.39	24.2	1.06
0.271	305.680	90.241	1.95	6.06	7.31	4.76	18.93	11.62	8.19	3.43	2.44	24.7	1.07
0.277	309.640	90.930	2.06	6.06	7.41	4.66	19.01	11.60	8.13	3.47	2.49	25.3	1.07
0.288	316.790	92.154	2.26	6.08	7.59	4.49	19.17	11.58	8.03	3.55	2.58	26.2	1.07
0.300	323.240	93.378	2.47	6.09	7.76	4.31	19.30	11.54	7.93	3.62	2.68	27.1	1.07
0.312	329.340	94.220	2.67	6.10	7.88	4.19	19.43	11.55	7.87	3.68	2.76	27.9	1.07
0.324	335.080	94.927	2.88	6.11	7.98	4.09	19.55	11.57	7.83	3.74	2.83	28.5	1.07
0.335	340.530	95.501	3.08	6.13	8.07	4.01	19.67	11.60	7.80	3.80	2.90	29.1	1.06
0.347	345.600	95.998	3.29	6.14	8.14	3.93	19.77	11.63	7.78	3.85	2.96	29.6	1.06
0.359	350.580	96.649	3.50	6.15	8.23	3.84	19.87	11.64	7.74	3.90	3.03	30.2	1.06
0.371	355.320	96.993	3.70	6.17	8.28	3.79	19.96	11.68	7.74	3.94	3.08	30.7	1.05
0.382	359.790	97.337	3.91	6.18	8.33	3.74	20.05	11.72	7.73	3.99	3.13	31.1	1.04
0.394	364.100	97.624	4.11	6.19	8.37	3.70	20.13	11.76	7.73	4.03	3.18	31.4	1.04
0.406	368.170	97.854	4.32	6.21	8.41	3.67	20.21	11.80	7.74	4.07	3.22	31.7	1.03
0.418	372.070	98.313	4.52	6.22	8.47	3.60	20.28	11.81	7.71	4.10	3.28	32.2	1.03
0.429	375.810	98.466	4.73	6.23	8.49	3.58	20.35	11.86	7.72	4.14	3.31	32.4	1.03
0.441	379.600	98.600	4.94	6.25	8.51	3.56	20.42	11.91	7.73	4.17	3.35	32.7	1.02
0.453	383.450	98.734	5.14	6.26	8.53	3.54	20.49	11.96	7.75	4.21	3.38	32.9	1.01
0.465	387.130	98.810	5.35	6.27	8.54	3.53	20.56	12.01	7.77	4.24	3.40	33.1	1.01
0.476	390.930	98.982	5.55	6.29	8.57	3.50	20.63	12.06	7.78	4.28	3.44	33.3	1.00
0.488	394.420	99.154	5.76	6.30	8.59	3.48	20.69	12.09	7.79	4.31	3.48	33.6	1.00
0.500	397.970	99.193	5.96	6.31	8.60	3.47	20.75	12.15	7.81	4.34	3.50	33.7	0.99
0.512	401.520	99.212	6.17	6.33	8.60	3.47	20.81	12.21	7.84	4.37	3.52	33.9	0.98
0.523	405.070	99.212	6.38	6.34	8.60	3.47	20.87	12.27	7.87	4.40	3.54	34.0	0.98
0.535	408.570	99.193	6.58	6.36	8.60	3.47	20.93	12.33	7.90	4.43	3.55	34.1	0.97
0.547	411.850	99.403	6.79	6.37	8.63	3.44	20.99	12.36	7.90	4.46	3.59	34.3	0.97
0.559	415.040	99.365	6.99	6.38	8.62	3.45	21.04	12.42	7.93	4.48	3.60	34.4	0.96
0.570	418.400	99.327	7.20	6.40	8.62	3.45	21.10	12.48	7.97	4.51	3.61	34.5	0.96
0.582	421.710	99.269	7.40	6.41	8.61	3.46	21.15	12.54	8.00	4.54	3.62	34.6	0.95
0.594	425.040	99.212	7.61	6.43	8.60	3.47	21.20	12.60	8.04	4.57	3.63	34.6	0.94
0.606	428.380	99.365	7.82	6.44	8.62	3.45	21.26	12.63	8.04	4.59	3.66	34.8	0.94
0.617	431.440	99.288	8.02	6.46	8.61	3.46	21.31	12.69	8.08	4.62	3.67	34.9	0.93
0.629	434.580	99.212	8.23	6.47	8.60	3.47	21.36	12.75	8.11	4.64	3.67	34.9	0.93
0.641	437.700	99.135	8.43	6.49	8.59	3.48	21.40	12.81	8.15	4.67	3.68	34.9	0.92
0.653	440.650	99.040	8.64	6.50	8.58	3.50	21.45	12.87	8.18	4.69	3.68	34.9	0.91
0.664	443.630	99.173	8.84	6.51	8.60	3.48	21.49	12.90	8.19	4.71	3.71	35.1	0.91
0.676	446.480	99.078	9.05	6.53	8.58	3.49	21.53	12.95	8.22	4.73	3.71	35.1	0.91
0.688	449.380	98.963	9.26	6.54	8.57	3.51	21.58	13.01	8.26	4.75	3.71	35.1	0.90
0.700	452.090	98.867	9.46	6.56	8.55	3.52	21.62	13.06	8.29	4.77	3.71	35.1	0.90

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.711	454.930	98.753	9.67	6.57	8.54	3.54	21.66	13.12	8.33	4.79	3.71	35.1	0.89
0.723	457.860	98.867	9.87	6.59	8.55	3.52	21.70	13.15	8.33	4.81	3.73	35.3	0.89
0.735	460.620	98.753	10.08	6.60	8.54	3.54	21.74	13.20	8.37	4.83	3.73	35.3	0.88
0.747	463.200	98.638	10.28	6.62	8.52	3.55	21.77	13.25	8.40	4.85	3.73	35.2	0.88
0.758	465.800	98.523	10.49	6.63	8.50	3.57	21.80	13.30	8.44	4.87	3.73	35.2	0.87
0.770	468.400	98.389	10.70	6.65	8.48	3.59	21.84	13.35	8.47	4.88	3.72	35.2	0.87
0.782	471.050	98.504	10.90	6.66	8.50	3.57	21.87	13.37	8.47	4.90	3.74	35.3	0.87
0.794	473.630	98.370	11.11	6.68	8.48	3.59	21.91	13.43	8.51	4.92	3.74	35.3	0.86
0.805	475.990	98.236	11.31	6.70	8.46	3.61	21.93	13.47	8.54	4.93	3.73	35.3	0.86
0.817	478.290	98.122	11.52	6.71	8.44	3.63	21.96	13.52	8.57	4.94	3.73	35.2	0.85
0.829	480.620	97.988	11.73	6.73	8.43	3.65	21.99	13.56	8.60	4.96	3.72	35.2	0.85
0.841	482.870	98.102	11.93	6.74	8.44	3.63	22.01	13.57	8.60	4.97	3.74	35.3	0.85
0.852	484.820	97.968	12.14	6.76	8.42	3.65	22.03	13.61	8.63	4.98	3.73	35.2	0.85
0.864	486.420	97.854	12.34	6.77	8.41	3.67	22.04	13.64	8.65	4.98	3.72	35.2	0.84
0.876	487.960	97.758	12.55	6.79	8.39	3.68	22.05	13.66	8.67	4.99	3.71	35.1	0.84
0.888	489.430	97.643	12.75	6.81	8.38	3.70	22.06	13.68	8.69	4.99	3.70	35.1	0.84
0.899	490.810	97.777	12.96	6.82	8.40	3.68	22.06	13.67	8.67	5.00	3.72	35.2	0.84
0.911	492.300	97.682	13.17	6.84	8.38	3.69	22.07	13.69	8.69	5.00	3.71	35.1	0.84
0.923	493.980	97.586	13.37	6.85	8.37	3.71	22.08	13.72	8.71	5.01	3.70	35.1	0.84
0.935	495.550	97.490	13.58	6.87	8.35	3.72	22.09	13.74	8.73	5.01	3.69	35.0	0.83
0.946	497.040	97.395	13.78	6.89	8.34	3.73	22.10	13.76	8.75	5.01	3.69	35.0	0.83
0.958	498.610	97.529	13.99	6.90	8.36	3.71	22.11	13.75	8.73	5.02	3.70	35.1	0.83
0.970	500.290	97.414	14.19	6.92	8.34	3.73	22.12	13.78	8.75	5.02	3.69	35.0	0.83
0.982	501.700	97.318	14.40	6.94	8.33	3.74	22.12	13.80	8.77	5.03	3.68	35.0	0.83
0.993	503.190	97.242	14.61	6.95	8.32	3.75	22.13	13.81	8.78	5.03	3.68	34.9	0.83
1.005	504.760	97.146	14.81	6.97	8.30	3.77	22.14	13.84	8.80	5.03	3.67	34.9	0.82
1.017	506.230	97.280	15.02	6.99	8.32	3.75	22.15	13.82	8.79	5.04	3.69	35.0	0.83
1.029	507.720	97.165	15.22	7.00	8.31	3.77	22.15	13.84	8.81	5.04	3.68	34.9	0.82
1.040	509.100	97.050	15.43	7.02	8.29	3.78	22.16	13.87	8.82	5.04	3.67	34.8	0.82
1.052	510.480	96.974	15.63	7.04	8.28	3.79	22.16	13.88	8.84	5.04	3.66	34.8	0.82
1.064	511.780	96.859	15.84	7.06	8.26	3.81	22.16	13.90	8.85	5.04	3.65	34.7	0.82
1.076	512.810	97.012	16.05	7.07	8.28	3.79	22.16	13.87	8.83	5.04	3.66	34.8	0.82
1.087	513.600	96.917	16.25	7.09	8.27	3.80	22.15	13.88	8.84	5.04	3.65	34.7	0.82
1.099	514.650	96.802	16.46	7.11	8.25	3.82	22.15	13.89	8.85	5.04	3.64	34.7	0.82
1.111	515.280	96.687	16.66	7.13	8.24	3.83	22.13	13.90	8.86	5.03	3.62	34.6	0.82
1.123	515.680	96.591	16.87	7.14	8.22	3.85	22.12	13.89	8.87	5.02	3.61	34.5	0.82
1.134	516.090	96.725	17.07	7.16	8.24	3.83	22.10	13.86	8.84	5.01	3.62	34.5	0.82
1.146	516.060	96.591	17.28	7.18	8.22	3.85	22.07	13.85	8.85	5.00	3.60	34.4	0.82
1.158	516.250	96.477	17.49	7.20	8.21	3.87	22.05	13.85	8.86	4.99	3.58	34.3	0.82
1.170	517.310	96.381	17.69	7.21	8.19	3.88	22.05	13.86	8.87	4.99	3.57	34.2	0.82

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.181	518.500	96.266	17.90	7.23	8.18	3.90	22.05	13.87	8.88	4.99	3.56	34.2	0.82
1.193	519.910	96.419	18.10	7.25	8.20	3.87	22.05	13.85	8.86	4.99	3.58	34.3	0.82
1.205	521.400	96.285	18.31	7.27	8.18	3.89	22.06	13.88	8.88	4.99	3.56	34.2	0.82
1.217	522.780	96.171	18.52	7.29	8.16	3.91	22.06	13.89	8.90	4.99	3.55	34.1	0.82
1.228	524.410	96.075	18.72	7.31	8.15	3.92	22.06	13.91	8.92	5.00	3.55	34.1	0.82
1.240	526.200	95.960	18.93	7.32	8.13	3.94	22.07	13.94	8.94	5.00	3.54	34.0	0.81
1.252	527.770	96.113	19.13	7.34	8.16	3.92	22.08	13.92	8.92	5.00	3.55	34.1	0.81
1.264	529.290	95.979	19.34	7.36	8.14	3.94	22.08	13.95	8.94	5.01	3.54	34.0	0.81
1.275	530.880	95.865	19.54	7.38	8.12	3.95	22.09	13.97	8.96	5.01	3.53	34.0	0.81
1.287	532.400	95.750	19.75	7.40	8.10	3.97	22.09	13.99	8.98	5.01	3.52	33.9	0.81
1.299	533.700	95.635	19.95	7.42	8.09	3.99	22.09	14.01	9.00	5.01	3.51	33.8	0.81
1.311	535.000	95.692	20.16	7.44	8.09	3.98	22.09	14.00	8.99	5.01	3.52	33.9	0.81
1.322	536.250	95.692	20.37	7.46	8.09	3.98	22.09	14.00	8.99	5.01	3.52	33.9	0.81
1.334	537.410	95.616	20.57	7.48	8.08	3.99	22.09	14.00	9.00	5.01	3.51	33.8	0.81
1.346	538.230	95.539	20.78	7.50	8.07	4.00	22.08	14.00	9.00	5.00	3.50	33.8	0.81
1.358	539.230	95.463	20.98	7.52	8.06	4.01	22.07	14.01	9.01	5.00	3.49	33.7	0.81
1.369	540.100	95.405	21.19	7.53	8.05	4.02	22.06	14.01	9.01	4.99	3.48	33.6	0.81
1.381	540.880	95.578	21.40	7.55	8.08	3.99	22.05	13.97	8.98	4.99	3.50	33.7	0.81
1.393	541.510	95.520	21.60	7.57	8.07	4.00	22.04	13.97	8.98	4.98	3.49	33.7	0.81
1.405	542.020	95.463	21.81	7.59	8.06	4.01	22.02	13.96	8.98	4.97	3.48	33.6	0.81
1.416	542.180	95.425	22.01	7.61	8.06	4.02	22.00	13.94	8.98	4.96	3.47	33.5	0.81
1.428	542.320	95.367	22.22	7.63	8.05	4.02	21.97	13.92	8.97	4.95	3.46	33.5	0.81
1.440	542.450	95.558	22.42	7.65	8.08	4.00	21.95	13.87	8.94	4.94	3.47	33.5	0.82
1.445	542.540	95.539	22.51	7.66	8.07	4.00	21.94	13.87	8.93	4.93	3.47	33.5	0.82

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'11		Ground Surface Elevation
BORING:	B109U		Elevation Datum
SAMPLE:	U5		
DEPTH:	61.8	Elevation: 1510.3	
TEST DATE:	07-Jan-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	December 2017		
Figure No.			
Test Operator:	DJA/WGL		
Checked By:			
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	SILT		
Sample Description (2)	Sluiced Ash		
Failure Type:			
Remarks (1):			
Remarks (2):			
	LL= NV		
	PL= NP		
	PI= NP		
HARDWARE			

Load ID:	1890-4	
Load Calibration Factor:	0.027097	lb/cnt
Pressure ID:	CP-GEI-4	
Pressure Cal. Fator	0.019127	psi/cnt
Displacement ID:	146	
Displacement Cal. Factor:	0.000065277	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.4	VC:	4.1064
Penetration, cm:	75.95		
Gross Recovery, cm:	78.44		
TUBE LENGTH, cm	91.44		
FIELD DIST. TO TOP SOIL, cm	13.00		
FIELD DIST. TO BOT SOIL, cm	11.00	IN SITU COR. FACTOR:	1.0411
FIELD DIST TOP PACKER, cm	12.50	TUBE TRANSPORT COR. FACTOR:	0.9852
FIELD DIST BOT PACKER, cm	9.40	TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm	13.80		
LAB DIST BOT PACKER, cm	9.10		

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	22.5	22.5	22.5	22.5	22.5	cm
TOP EMPTY LENGTH	3.9	3.9	3.8	3.9	3.875	cm
BOT. EMPTY LENGTH	3.2	3.2	3.2	3.3	3.225	cm
TUBE INNER DIAMETER	7.297	7.29	7.292	7.304	7.29575	cm

In tube length	15.40	cm
Tube Diameter	7.296	cm
Tube Area	41.81	(cm^2)
Tube Volume	643.80	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.219	7.27	7.285		7.258	cm
MEMBRANE 1 THICKNESS	0.075	0.07	0.072		0.072	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.23	13.439	13.37	13.179	13.305	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.504	8.598	8.583	8.526	8.553	cm

#filter strips	0		
Hi	14.912	cm	
Di	7.186	cm	2.07520759
Ai	40.553	cm^2	
Vi	604.718	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	112.750	111.560	*******	1551.910	*******	1198.880	1198.880	*******
DRY+T	77.030	74.680		*******	232.660	*******	872.340	206.000
T	31.540	30.900		662.220	225.100	398.850	398.850	205.360
Wt. Solids	45.49	43.78	0	889.69	7.56	474.13	473.49	0.64
w %	78.52	84.24	*******	86.05	*******	68.96	68.96	*******

FINAL B VALUE 0.98

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	39.96	47.07	0.000	10.166	0.000	0.000	0.084	7.11	7.11
Consolidation Stage 1	39.82	53.77	0.000	3.059	0.000	0.000	0.026	13.95	13.95
2	39.84	67.63	0.000	9.177	0.000	0.000	0.077	27.79	27.79
3	40.03	95.83	0.000	16.093	0.000	0.000	0.137	55.80	55.80
4	39.46	123.30	0.000	10.507	0.406	0.406	0.092	83.84	83.84
5	39.46	123.30	0.000	0.000	0.000	0.000	0.000	83.84	83.84
6	39.46	123.30	0.000	0.000	0.000	0.000	0.000	83.84	83.84
Start Shear	39.46	123.30	0.000	**********	**********			83.84	83.84
End Shear				15.162	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm³	pcf	void ratio	
in situ		0.00	0.00							1.0411	0.77	47.9	1.893	
after sampling		0.00	0.00							0.9852	0.74	46.0	2.012	
after shipping		0.00	0.00							1.0000	0.75	46.7	1.967	
in tube before extrusion		0.00	0.00	15.40	7.296	41.805	643.80	481.69	86.05	*****	0.75	46.7	1.967	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.912	7.186	40.553	604.718	474.130	*****	*****	0.78	48.9	1.831	
saturation		7.11	7.11	14.912	7.125	39.871	594.551	474.130	80.353		0.80	49.8	1.784	
	1	13.95	13.95	14.912	7.107	39.666	591.492	474.130	79.708	*****	0.80	50.0	1.770	
	2	27.79	27.79	14.912	7.051	39.051	582.315	474.130	77.773	*****	0.81	50.8	1.727	
	3	55.80	55.80	14.912	6.953	37.972	566.222	474.130	74.378	*****	0.84	52.3	1.651	
	4	83.84	83.84	14.506	6.984	38.310	555.715	474.130	72.162	*****	0.85	53.3	1.602	
	5	83.84	83.84	14.506	6.984	38.310	555.715	474.130	72.162	*****	0.85	53.3	1.602	
	6	83.84	83.84	14.506	6.984	38.310	555.715	474.130	72.162	*****	0.85	53.3	1.602	
Start Shear		83.84	83.84	14.506	6.984	38.310	555.715	474.130	72.162	*****	0.85	53.3	1.602	
End Shear		**********	**********				540.553	474.130	68.964	*****	0.88	54.8	1.531	1.531011848

Test comp (c) or ext (e) c

DEFORMATION RATE 1	0.02756124	mm/min	0.0190	%/min
DEFORMATION RATE 2	0.00108509	in/min	0.000190002	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS 2.22 2.220 yields S=1

estimated or measured? (enter E or M) m
(measured)

Saturation 1.000

CALCULATE AREA FROM START OR
END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm²	0.1550031	in²	1	cm²
cm³	0.061023744	in³	1	cm³
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm³	62.427961	pcf	1	g/cm³
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R11
Boring	B109U
Sample	US
Depth	61.81
By	WSL
Date	1/3/18
Checked	DJA
Date	1.19.18

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-9	A-30		NM-2
Wet Wt. + Tare (g)	112.75	111.56		-
Dry Wt. + Tare (g)	77.03	74.68		232.66
Wt. Water (g)	35.72	36.88		—
Tare (g)	31.54	30.90		225.10
Dry Wt. Soil (g)	45.49	43.78		7.56
Water Content (%)	78.5	84.2		—

81.35

Trimmed Length in Tube

Overall Tube Length	22.5	22.5	22.5	22.5	cm	Avg.	22.5 cm
Top Empty Length	3.9	3.9	3.8	3.9	cm	Avg.	3.9 cm
Bottom Empty Length	3.2	3.2	3.2	3.3	cm	Avg.	3.2 cm

Trimmed Length in Tube, L: 15.4 cm

Tube Dimensions

Tube Inner Diameter	7.297	7.290	7.292	7.304	cm	Avg.	7.296 cm

Tube Weight (g): 662.22

Weight of other (specify:_____) (g): —

Area, A: 41.81 cm^2

Volume in Tube = A x L: 643.8 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane		g
Membrane		g
W_{moist}		g

Dry Wt. Of Excess Solids

Tare #	L-7	g
Dry + Tare	206.00	g
Tare	205.36	g
Dry Wt. Of Excess	0.64	g

Water Content

(Fraction Used: 1)

Tare #	MB-20	
Wet + Tare	1198.88	g
Dry + Tare	872.34	g
Wt. Water	326.54	g
Tare	398.85	g
Wt. Dry Soil	473.49	g
Water Content	69.0	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = 474.13 g

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify:_____)	1551.91	g
Tube + other	662.22	g
Moist soil	889.69	g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.382 g/cm^3 / 86.2 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 0.762 g/cm^3 / 47.6 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R'11
Boring	B109
Sample	U5
Depth	61.8
By	DJA
Date	1-7-18
Checked	DJA
Date	1.19.18

Undisturbed Specimen X
Remolded or compacted Specimen ____

Filter Strips? Yes____ No X
Lubricated End Platens? Yes____ No X

SPECIMEN DIMENSIONS

Diameter Tape #____

Diameter over 1 membranes	7.219	7.270	7.285	—	Avg.	7.258 cm
Twice thickness 1 membranes	0.075	0.070	0.072	—	Avg.	-0.072 cm
					Avg.	- cm

Diameter of Specimen 7.186 cm
Diameter of Specimen 2.829 inch
Area of Specimen ____ cm^2

Height Caliper #____

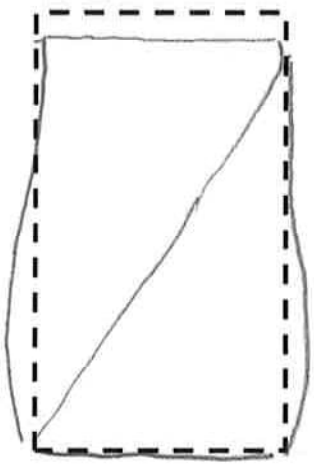
Height from top gauge block to top of top platen, with specimen	13.230	13.439	13.370	13.179	Avg.	13.304 cm

Height of Gauge Block + 10.160 cm

Height from top of top platen to cell base, without specimen	8.504	8.598	8.583	8.526	Avg.	-8.553 cm

Height of Specimen in Cell 14.911 cm
Height of Specimen in Cell 5.870 inch
Volume in cell, initial ____ cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

GEI Consultants

Saturation and Consolidation Data

Project No.	1700685
Test No.	R'11
Boring	B109U
Sample	U5
Depth	61.8
By	DJA
Date	1-7-18
Page	

Panel No. 2

Load Pressure Trans: SN 1890-4 Factor 2.7097e-2 Gain = 8

Press ~~Load~~ Trans: SN CP-GEI-4 Factor 1.9127e-2 Gain = 8

Displ. Trans: SN 146 Factor 6.5277e-5 Gain = 64

Date	Time	Load (lbf)	Axial Def. (inch)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x /.33) (digit)	Burrette Top (x /.33) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
1-7-18			0			–		-7		0
	14:30					22.0		0.73		7.78
						20.8		10.18		17.18
1-8-18	8:00					19.3		10.19		
						19.2		20.01		27.10
	9:30					19.2		20.03		
						19.1		30.07		37.16
	11:00					19.1		30.01		37.13
			B=0.98			19.1		39.96	39.73	47.07
		Consol. to $\bar{\sigma}_c$ = 14psi								
	11:11					3.7		39.73		53.80
	13:13					6.0		39.82		53.77
		Consol to $\bar{\sigma}_c$ = 28psi								
	13:15					6.0		39.82		67.90
	14:23					12.9		39.84		67.63
		Consol to 56 psi								
	14:25					12.9		39.84		96.09
	17:11					24.5				
1-9-18	11:00					25.0		40.03		95.82
		Consol to	84psi							
	11:10					9.2		40.03		124.00
	15:34		0.160			17.1		39.46		123.30
			SHEAR							
			RECONSOL			4.1				
			Remove			15.5				

TEST REMARKS

GEI Consultants

Triaxial Rate Calculations

Project No.	1700685
Test No.	R'11
Boring	B109
Sample	U5
Depth	61.8'
By	DJA
Date	1-9-17
Checked	
Date	

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

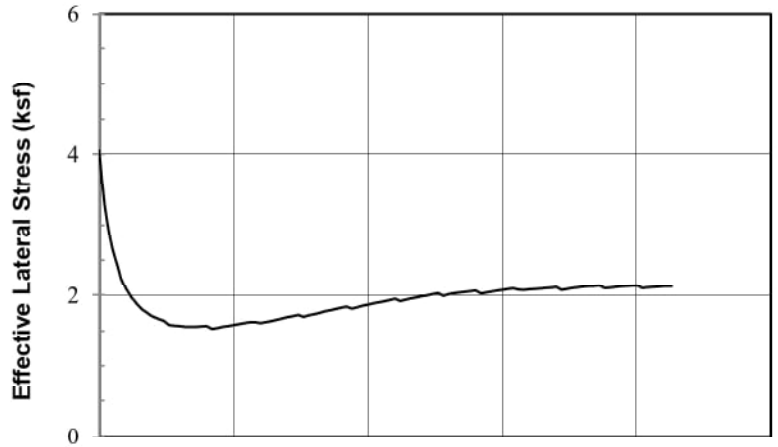
Stage #					
Initial Specimen Height in Cell	14.911	cm			
Height Change during Consolidation	0.406	cm	=	0.160	inch
Specimen Height, **A**	14.505	cm	=	5.711	inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**	0.0267	mm / min	=	0.0011	inch / min
Strain Rate = (**E** / **A**) *10	0.019	% / min			

Shear to 20% in 18 hrs

$$\dot{\Delta} = \frac{(0.2)(5.711\ \text{inch})}{18 \times 60} = 0.0011\ \frac{\text{inch}}{\text{min}}$$

TEST REMARKS

GEI Consultants



SAMPLE INFORMATION

Boring: B106U Sample: U3 Depth (ft): 48.6 Test: R'12
Type: 2.8-inch-diameter tube sample
Description: Sluiced Flyash

SPECIMEN INFORMATION (after saturation)

Height: 5.522 in Dia.: 2.750 in Area.: 5.970 sq. in
Water Content: 67.5% Dry Unit Weight: 55.5 pcf

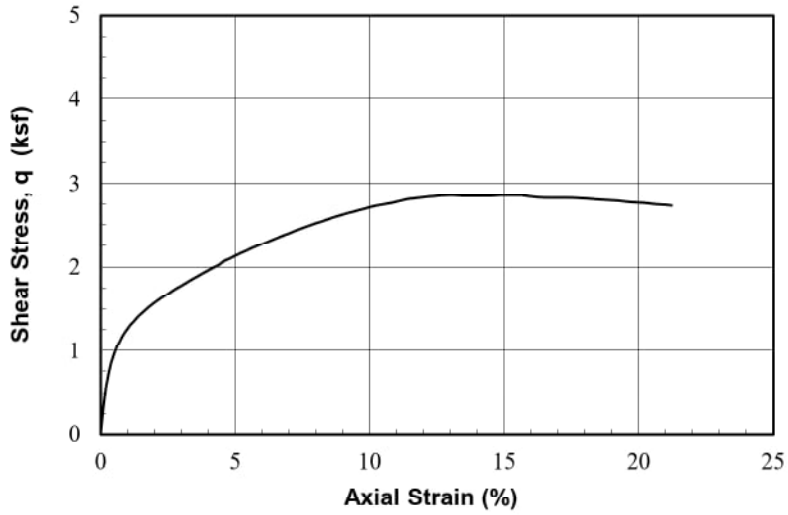
TEST SUMMARY (end of test)

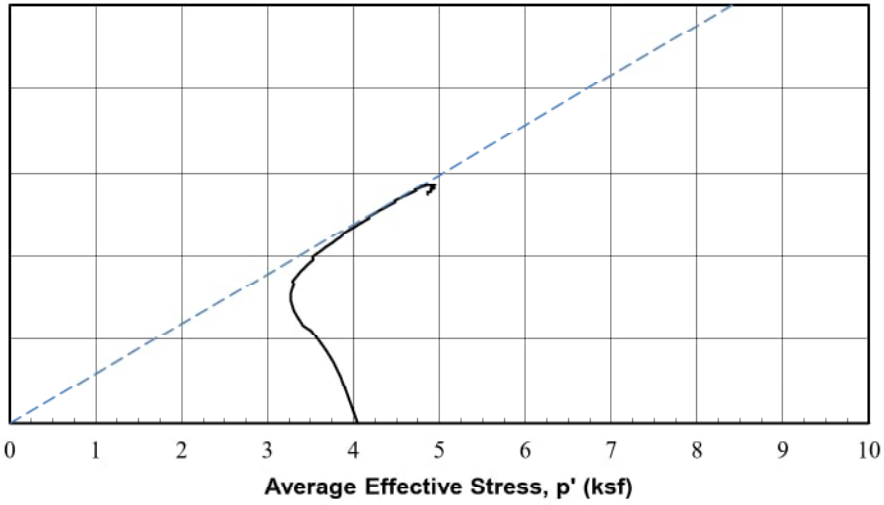
Effective Confining Stress: 4.05 ksf vertical, 4.05 ksf horiz.
Water Content: 65.9 % Dry Unit Weight: 56.3 pcf
B Coefficient: 0.95 Strain Rate: 0.057 %/min
Peak Shear Stress: 2.86 ksf @ 13.0 % Strain
Peak Friction Angle: 36.5 deg. @ 9.4 % Strain



Failure Sketch

REMARKS: Shear plane developed at approx. 12% axial strain. Sample had gouge in side, slumped slightly during extrusion and setup. Oven-dried at 60°C.





Operator: WGL
Checked: DJA
Test Date: 15-Jan-2018

1/31/2018 9:16

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-15

PROJECT #:	1700685												
PROJECT:	Glen Lyn		Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'12											
BORING:	B106U			(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U3		In situ	--	--	--	--	--	--	48.6	--	1.849
DEPTH (ft):	48.6		After Sampling	--	--	--	--	--	--	47.7	--	1.905
OPER.:	WGL		In tube before extrusion	--	--	5.994	2.874	6.489	71.41	47.9	82.1	1.893
TEST DATE:	1/15/2018		Under vac.	1.01	1.01	5.522	2.823	6.259	--	52.9	--	1.620
DCDT No.	147											
DCDT Calibration Factor	6.7108E-05	inch/cnt	End of:							calculated from end of test		
Load Cell No.	A8897		Saturation	0.89	0.89	5.522	2.757	5.970	67.51	55.5	92.9	1.499
Load Cell Cal. Factor	0.058033	lb/cnt	Consol. Stage 1	2.04	2.04	5.522	2.750	5.938	66.90	55.8	93.1	1.485
Pressure Transducer	25218		Consol. Stage 2	4.05	4.05	5.463	2.752	5.946	65.86	56.3	93.4	1.462
Pres. Trans. Cal. Factor	0.023604	psi/cnt	Consol. Stage 3	4.05	4.05	5.463	2.752	5.946	65.86	56.3	93.4	1.462
			Consol. Stage 4	4.05	4.05	5.463	2.752	5.946	65.86	56.3	93.4	1.462
Gravity of Solids	2.22	(measured)	Consol. Stage 5	4.05	4.05	5.463	2.752	5.946	65.86	56.3	93.4	1.462
			Consol. Stage 6	4.05	4.05	5.463	2.752	5.946	65.86	56.3	93.4	1.462
B value start shear	0.95											
Test Stage End of#	2		This Stage Initial Values	4.05	4.05	5.463	2.752	5.946	65.86	56.3	93.4	1.462
Stage Strain rate	0.057	%/min	Kc start stage	1.00		Back Pressure		5.85 ksf				
Data Start Row	4											

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.059	9.285	40.599	0.00	5.95	0.00	4.05	4.05	4.05	4.05	0.00	1.00	0.0	0.00
0.064	35.342	43.573	0.10	5.95	0.43	3.62	4.68	4.25	3.94	0.32	1.17	4.6	0.68
0.070	55.189	45.839	0.20	5.96	0.75	3.30	5.16	4.41	3.85	0.55	1.34	8.3	0.68
0.075	69.814	47.656	0.30	5.96	1.02	3.03	5.51	4.50	3.77	0.73	1.48	11.2	0.70
0.081	80.492	49.073	0.40	5.97	1.22	2.83	5.77	4.55	3.69	0.86	1.61	13.5	0.71
0.086	88.674	50.253	0.50	5.98	1.39	2.66	5.96	4.57	3.62	0.96	1.72	15.3	0.73
0.092	95.348	51.221	0.60	5.98	1.53	2.52	6.12	4.59	3.56	1.04	1.82	16.9	0.74
0.097	101.150	52.047	0.70	5.99	1.65	2.40	6.26	4.61	3.51	1.10	1.92	18.4	0.75
0.103	106.320	53.133	0.80	5.99	1.80	2.25	6.38	4.58	3.41	1.17	2.04	20.0	0.77
0.108	110.730	53.699	0.90	6.00	1.89	2.16	6.49	4.60	3.38	1.22	2.12	21.1	0.77
0.114	114.500	54.195	1.00	6.01	1.96	2.09	6.57	4.62	3.35	1.26	2.21	22.1	0.78
0.119	118.100	54.643	1.10	6.01	2.02	2.03	6.66	4.63	3.33	1.30	2.28	23.0	0.78
0.124	121.290	55.045	1.20	6.02	2.08	1.97	6.73	4.65	3.31	1.34	2.36	23.9	0.78
0.130	124.310	55.375	1.30	6.02	2.13	1.92	6.80	4.67	3.30	1.37	2.43	24.6	0.77
0.135	127.090	55.682	1.40	6.03	2.17	1.88	6.86	4.69	3.29	1.41	2.50	25.3	0.77
0.141	129.820	55.941	1.50	6.04	2.21	1.84	6.93	4.72	3.28	1.44	2.56	26.0	0.77
0.146	132.320	56.201	1.60	6.04	2.25	1.80	6.98	4.74	3.27	1.47	2.63	26.6	0.77

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.152	134.810	56.390	1.70	6.05	2.27	1.78	7.04	4.76	3.27	1.49	2.68	27.2	0.76
0.157	137.190	56.579	1.80	6.06	2.30	1.75	7.09	4.79	3.27	1.52	2.74	27.7	0.76
0.163	139.400	56.744	1.90	6.06	2.32	1.73	7.14	4.82	3.27	1.55	2.79	28.2	0.75
0.168	141.660	56.886	2.00	6.07	2.35	1.71	7.19	4.85	3.28	1.57	2.84	28.6	0.75
0.179	145.840	57.098	2.20	6.08	2.38	1.67	7.28	4.91	3.29	1.62	2.93	29.4	0.73
0.190	149.840	57.287	2.40	6.09	2.40	1.65	7.37	4.97	3.31	1.66	3.02	30.1	0.72
0.201	153.730	57.712	2.60	6.11	2.46	1.59	7.46	4.99	3.29	1.70	3.15	31.2	0.72
0.212	157.390	57.759	2.80	6.12	2.47	1.58	7.54	5.07	3.32	1.74	3.21	31.6	0.71
0.223	160.870	57.806	3.00	6.13	2.48	1.57	7.61	5.13	3.35	1.78	3.26	32.1	0.70
0.234	164.350	57.853	3.20	6.14	2.48	1.57	7.69	5.20	3.38	1.82	3.32	32.5	0.68
0.245	167.720	57.853	3.40	6.16	2.48	1.57	7.76	5.27	3.42	1.85	3.37	32.8	0.67
0.256	171.020	57.853	3.60	6.17	2.48	1.57	7.83	5.34	3.45	1.89	3.41	33.1	0.66
0.267	174.330	57.830	3.80	6.18	2.48	1.57	7.90	5.41	3.49	1.92	3.45	33.4	0.65
0.278	177.580	57.783	4.00	6.19	2.47	1.58	7.96	5.49	3.53	1.96	3.48	33.6	0.63
0.289	180.890	58.066	4.20	6.21	2.52	1.54	8.03	5.52	3.53	1.99	3.59	34.4	0.63
0.299	183.960	57.995	4.40	6.22	2.51	1.55	8.09	5.59	3.57	2.02	3.62	34.5	0.62
0.311	188.610	57.853	4.61	6.23	2.48	1.57	8.19	5.71	3.64	2.07	3.65	34.7	0.60
0.322	191.390	57.783	4.81	6.25	2.47	1.58	8.25	5.77	3.68	2.10	3.66	34.8	0.59
0.332	194.530	57.688	5.00	6.26	2.46	1.59	8.31	5.85	3.72	2.13	3.68	34.9	0.58
0.343	197.430	57.594	5.20	6.27	2.45	1.60	8.37	5.92	3.76	2.16	3.69	35.0	0.57
0.354	200.330	57.523	5.40	6.29	2.44	1.61	8.43	5.99	3.80	2.19	3.71	35.1	0.56
0.365	203.170	57.429	5.60	6.30	2.42	1.63	8.48	6.06	3.84	2.22	3.72	35.2	0.55
0.376	205.960	57.405	5.80	6.31	2.42	1.63	8.54	6.12	3.87	2.24	3.75	35.4	0.54
0.387	208.800	57.523	6.00	6.33	2.44	1.61	8.59	6.15	3.88	2.27	3.81	35.8	0.54
0.398	211.590	57.405	6.20	6.34	2.42	1.63	8.65	6.23	3.93	2.30	3.82	35.8	0.53
0.409	214.370	57.311	6.40	6.35	2.41	1.64	8.70	6.29	3.97	2.32	3.83	35.9	0.52
0.420	217.160	57.192	6.61	6.37	2.39	1.66	8.75	6.36	4.01	2.35	3.83	35.9	0.51
0.431	219.890	57.074	6.81	6.38	2.37	1.68	8.80	6.43	4.05	2.38	3.83	35.9	0.50
0.442	222.610	56.956	7.01	6.39	2.36	1.70	8.85	6.50	4.10	2.40	3.83	35.9	0.49
0.453	225.280	56.862	7.21	6.41	2.34	1.71	8.90	6.56	4.14	2.43	3.84	35.9	0.48
0.464	228.130	56.720	7.41	6.42	2.32	1.73	8.96	6.64	4.18	2.45	3.84	35.9	0.47
0.474	230.910	56.909	7.61	6.44	2.35	1.70	9.01	6.66	4.18	2.48	3.91	36.4	0.47
0.485	233.230	56.768	7.81	6.45	2.33	1.72	9.05	6.72	4.22	2.50	3.90	36.3	0.47
0.496	235.730	56.650	8.01	6.46	2.31	1.74	9.10	6.78	4.26	2.52	3.90	36.3	0.46
0.507	238.170	56.532	8.21	6.48	2.29	1.76	9.14	6.84	4.30	2.54	3.90	36.3	0.45
0.518	240.720	56.390	8.41	6.49	2.27	1.78	9.18	6.91	4.34	2.57	3.89	36.2	0.44
0.529	243.040	56.272	8.61	6.51	2.26	1.79	9.22	6.97	4.38	2.59	3.88	36.2	0.44
0.540	245.480	56.154	8.81	6.52	2.24	1.81	9.27	7.03	4.42	2.61	3.88	36.2	0.43
0.551	247.570	56.036	9.01	6.54	2.22	1.83	9.30	7.08	4.45	2.63	3.87	36.1	0.42
0.562	249.830	55.941	9.21	6.55	2.21	1.84	9.34	7.13	4.49	2.64	3.87	36.1	0.42

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.573	252.040	56.107	9.41	6.56	2.23	1.82	9.38	7.14	4.48	2.66	3.93	36.5	0.42
0.584	254.010	55.989	9.61	6.58	2.22	1.83	9.41	7.19	4.51	2.68	3.92	36.4	0.41
0.595	256.220	55.847	9.81	6.59	2.20	1.86	9.44	7.25	4.55	2.70	3.91	36.3	0.41
0.606	258.420	55.729	10.01	6.61	2.18	1.87	9.48	7.30	4.59	2.71	3.90	36.3	0.40
0.617	260.340	55.611	10.21	6.62	2.16	1.89	9.51	7.35	4.62	2.73	3.89	36.2	0.40
0.628	261.900	55.517	10.41	6.64	2.15	1.90	9.53	7.38	4.64	2.74	3.88	36.2	0.39
0.639	263.590	55.422	10.61	6.65	2.13	1.92	9.56	7.42	4.67	2.75	3.87	36.1	0.39
0.649	265.380	55.304	10.81	6.67	2.12	1.93	9.58	7.46	4.70	2.77	3.86	36.1	0.38
0.660	267.240	55.186	11.01	6.68	2.10	1.95	9.61	7.51	4.73	2.78	3.85	36.0	0.38
0.671	269.160	55.399	11.21	6.70	2.13	1.92	9.64	7.51	4.71	2.79	3.91	36.4	0.38
0.682	271.190	55.257	11.41	6.71	2.11	1.94	9.67	7.56	4.75	2.81	3.90	36.3	0.38
0.693	272.700	55.139	11.61	6.73	2.09	1.96	9.69	7.60	4.78	2.82	3.88	36.2	0.37
0.704	274.030	55.045	11.81	6.74	2.08	1.97	9.70	7.62	4.80	2.83	3.87	36.1	0.37
0.715	275.250	54.927	12.01	6.76	2.06	1.99	9.72	7.65	4.82	2.83	3.85	36.0	0.36
0.726	276.410	54.856	12.21	6.77	2.05	2.00	9.73	7.68	4.84	2.84	3.84	35.9	0.36
0.737	277.510	54.738	12.41	6.79	2.04	2.01	9.74	7.70	4.86	2.84	3.82	35.8	0.36
0.748	278.730	54.643	12.61	6.80	2.02	2.03	9.75	7.73	4.88	2.85	3.81	35.8	0.35
0.759	279.660	54.879	12.81	6.82	2.06	1.99	9.76	7.70	4.85	2.85	3.86	36.1	0.36
0.770	280.650	54.738	13.01	6.84	2.04	2.01	9.77	7.73	4.87	2.86	3.84	35.9	0.36
0.781	281.170	54.643	13.21	6.85	2.02	2.03	9.76	7.74	4.89	2.86	3.82	35.8	0.35
0.792	281.460	54.572	13.41	6.87	2.01	2.04	9.76	7.75	4.89	2.85	3.80	35.7	0.35
0.803	281.810	54.525	13.61	6.88	2.01	2.05	9.75	7.75	4.90	2.85	3.79	35.6	0.35
0.814	282.270	54.454	13.81	6.90	2.00	2.06	9.75	7.75	4.90	2.85	3.77	35.5	0.35
0.824	282.850	54.384	14.01	6.92	1.99	2.07	9.75	7.76	4.91	2.85	3.76	35.4	0.35
0.835	283.550	54.667	14.21	6.93	2.03	2.02	9.75	7.72	4.87	2.85	3.81	35.8	0.36
0.846	284.300	54.572	14.41	6.95	2.01	2.04	9.75	7.74	4.89	2.85	3.80	35.7	0.35
0.857	285.170	54.478	14.61	6.96	2.00	2.05	9.76	7.76	4.90	2.85	3.78	35.6	0.35
0.868	286.040	54.384	14.81	6.98	1.99	2.07	9.76	7.77	4.92	2.85	3.76	35.5	0.35
0.879	286.800	54.313	15.01	7.00	1.97	2.08	9.76	7.79	4.93	2.86	3.75	35.4	0.35
0.890	287.610	54.242	15.22	7.01	1.96	2.09	9.77	7.80	4.94	2.86	3.74	35.3	0.34
0.901	288.250	54.171	15.42	7.03	1.95	2.10	9.76	7.81	4.95	2.86	3.73	35.2	0.34
0.912	288.710	54.289	15.62	7.05	1.97	2.08	9.76	7.79	4.93	2.85	3.75	35.4	0.35
0.923	288.830	54.336	15.82	7.06	1.98	2.07	9.75	7.77	4.92	2.85	3.75	35.4	0.35
0.934	288.480	54.266	16.02	7.08	1.97	2.08	9.73	7.76	4.92	2.84	3.73	35.2	0.35
0.945	288.420	54.242	16.22	7.10	1.96	2.09	9.71	7.75	4.92	2.83	3.71	35.2	0.35
0.956	288.770	54.195	16.42	7.11	1.96	2.09	9.71	7.75	4.92	2.83	3.70	35.1	0.35
0.967	289.240	54.148	16.62	7.13	1.95	2.10	9.70	7.75	4.93	2.83	3.69	35.0	0.35
0.978	289.820	54.100	16.82	7.15	1.94	2.11	9.70	7.76	4.93	2.83	3.68	35.0	0.34
0.989	290.510	54.030	17.02	7.17	1.93	2.12	9.70	7.77	4.94	2.83	3.67	34.9	0.34
1.000	291.560	54.336	17.22	7.18	1.98	2.07	9.71	7.73	4.90	2.83	3.73	35.3	0.35

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.010	292.020	54.218	17.42	7.20	1.96	2.09	9.70	7.74	4.92	2.83	3.71	35.1	0.35
1.021	292.430	54.124	17.62	7.22	1.95	2.10	9.70	7.75	4.93	2.82	3.69	35.0	0.34
1.032	292.780	54.077	17.82	7.24	1.94	2.11	9.69	7.75	4.93	2.82	3.67	34.9	0.34
1.043	293.010	54.006	18.02	7.25	1.93	2.12	9.68	7.75	4.94	2.82	3.66	34.8	0.34
1.054	293.300	53.959	18.22	7.27	1.92	2.13	9.68	7.75	4.94	2.81	3.64	34.7	0.34
1.065	293.470	53.935	18.42	7.29	1.92	2.13	9.67	7.74	4.94	2.81	3.64	34.6	0.34
1.076	293.760	53.888	18.62	7.31	1.91	2.14	9.66	7.74	4.94	2.80	3.62	34.6	0.34
1.087	294.110	54.148	18.82	7.32	1.95	2.10	9.65	7.70	4.90	2.80	3.67	34.9	0.35
1.098	294.340	54.100	19.02	7.34	1.94	2.11	9.64	7.70	4.90	2.79	3.65	34.8	0.35
1.109	294.520	54.053	19.22	7.36	1.94	2.11	9.63	7.69	4.90	2.79	3.64	34.7	0.35
1.120	294.520	53.982	19.42	7.38	1.93	2.12	9.62	7.69	4.91	2.78	3.62	34.6	0.35
1.131	294.580	53.959	19.62	7.40	1.92	2.13	9.60	7.68	4.90	2.78	3.61	34.5	0.35
1.142	294.690	53.912	19.82	7.42	1.92	2.13	9.59	7.68	4.90	2.77	3.60	34.4	0.35
1.153	294.920	53.888	20.02	7.43	1.91	2.14	9.58	7.67	4.90	2.77	3.59	34.3	0.35
1.164	295.270	54.148	20.22	7.45	1.95	2.10	9.58	7.62	4.86	2.76	3.63	34.6	0.35
1.175	295.330	54.077	20.42	7.47	1.94	2.11	9.56	7.62	4.87	2.76	3.61	34.5	0.35
1.186	295.390	54.030	20.62	7.49	1.93	2.12	9.55	7.62	4.87	2.75	3.60	34.4	0.35
1.196	295.500	54.006	20.82	7.51	1.93	2.12	9.54	7.61	4.86	2.74	3.59	34.3	0.35
1.207	295.790	53.959	21.02	7.53	1.92	2.13	9.53	7.61	4.87	2.74	3.58	34.3	0.35
1.218	296.030	53.935	21.22	7.55	1.92	2.13	9.52	7.60	4.87	2.74	3.57	34.2	0.35
1.223	296.140	53.935	21.31	7.56	1.92	2.13	9.52	7.60	4.86	2.73	3.57	34.2	0.35

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'12		Ground Surface Elevation
BORING:	B106U		Elevation Datum
SAMPLE:	U3		
DEPTH:	48.6	Elevation:	
TEST DATE:	15-Jan-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	January 2018		
Figure No.			
Test Operator:	WGL		
Checked By:	DJA		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Sluiced Flyash		
Sample Description (2)	Silt		
Failure Type:			
Remarks (1):			
Remarks (2):			
LL=	NV		
PL=	NP		
PI=	NP		
HARDWARE			

Load ID:	A8897	
Load Calibration Factor:	0.058033	lb/cnt
Pressure ID:	25218	
Pressure Cal. Fator	0.023604	psi/cnt
Displacement ID:	147	
Displacement Cal. Factor:	0.000067108	inch/cnt

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.3	VC:	1.9871
Penetration, cm:	60.96		
Gross Recovery, cm:	61.80		
TUBE LENGTH, cm	76.20		
FIELD DIST. TO TOP SOIL, cm	14.40		
FIELD DIST. TO BOT SOIL, cm	0.97	IN SITU COR. FACTOR:	1.0199
FIELD DIST TOP PACKER, cm	13.55	TUBE TRANSPORT COR. FACTOR:	0.9959
FIELD DIST BOT PACKER, cm	0.00	TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm	13.80		
LAB DIST BOT PACKER, cm	0.00		

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	23.3	23.3	23.3	23.3	23.3	cm
TOP EMPTY LENGTH	4	4	4	4.1	4.025	cm
BOT. EMPTY LENGTH	4.1	4	4.1	4	4.05	cm
TUBE INNER DIAMETER	7.307	7.306	7.29	7.301	7.301	cm

In tube length	15.23	cm
Tube Diameter	7.301	cm
Tube Area	41.87	(cm^2)
Tube Volume	637.40	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.17	7.234	7.314		7.239	cm
MEMBRANE 1 THICKNESS	0.068	0.071	0.068		0.069	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	12.58	12.681	12.849	12.474	12.646	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.755	8.81	8.795	8.76	8.780	cm

#filter strips	0		
Hi	14.026	cm	
Di	7.170	cm	1.95611548
Ai	40.380	cm^2	
Vi	566.373	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	123.390	89.640	*******	1682.960	*******	1013.760	1013.760	*******
DRY+T	83.790	64.780		*******	211.060	*******	710.110	157.160
T	31.890	31.650		851.160	202.000	230.790	230.790	156.500
Wt. Solids	51.9	33.13	0	831.8	9.06	479.98	479.32	0.66
w %	76.30	75.04	*******	71.41	*******	63.35	63.35	*******

FINAL B VALUE 0.95

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE		Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ										
after sampling										0
after shipping										
in tube before extrusion										
End of:										
vacuum		-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation		41.21	47.42	0.000	26.132	0.000	0.000	0.216	6.21	6.21
Consolidation Stage	1	41.19	55.33	0.000	2.948	0.000	0.000	0.026	14.14	14.14
	2	40.60	68.73	0.000	4.958	0.150	0.150	0.043	28.13	28.13
	3	40.60	68.73	0.000	0.000	0.000	0.000	0.000	28.13	28.13
	4	40.60	68.73	0.000	0.000	0.000	0.000	0.000	28.13	28.13
	5	40.60	68.73	0.000	0.000	0.000	0.000	0.000	28.13	28.13
	6	40.60	68.73	0.000	0.000	0.000	0.000	0.000	28.13	28.13
Start Shear		40.60	68.73	0.000	**********	**********			28.13	28.13
End Shear					12.060	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm³	pcf	void ratio	
in situ		0.00	0.00							1.0199	0.78	48.6	1.849	
after sampling		0.00	0.00							0.9959	0.76	47.7	1.905	
after shipping		0.00	0.00							1.0000	0.77	47.9	1.893	
in tube before extrusion		0.00	0.00	15.23	7.301	41.865	637.40	489.04	71.41	*****	0.77	47.9	1.893	
End of:		0.00	0.00											
vacuum		7.00	7.00	14.026	7.170	40.380	566.373	479.980	*****	*****	0.85	52.9	1.620	
saturation		6.21	6.21	14.026	7.003	38.517	540.241	479.980	67.510		0.89	55.5	1.499	
	1	14.14	14.14	14.026	6.984	38.307	537.293	479.980	66.896	*****	0.89	55.8	1.485	
	2	28.13	28.13	13.876	6.989	38.364	532.335	479.980	65.863	*****	0.90	56.3	1.462	
	3	28.13	28.13	13.876	6.989	38.364	532.335	479.980	65.863	*****	0.90	56.3	1.462	
	4	28.13	28.13	13.876	6.989	38.364	532.335	479.980	65.863	*****	0.90	56.3	1.462	
	5	28.13	28.13	13.876	6.989	38.364	532.335	479.980	65.863	*****	0.90	56.3	1.462	
	6	28.13	28.13	13.876	6.989	38.364	532.335	479.980	65.863	*****	0.90	56.3	1.462	
Start Shear		28.13	28.13	13.876	6.989	38.364	532.335	479.980	65.863	*****	0.90	56.3	1.462	
End Shear		**********	**********				520.275	479.980	63.350	*****	0.92	57.6	1.406	1.406373613

Test comp (c) or ext (e)	c			
DEFORMATION RATE 1	0.07974363	mm/min	0.0575	%/min
DEFORMATION RATE 2	0.00313951	in/min	0.000574687	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS	2.22	2.220	yields S=1
estimated or measured? (enter E or M)	m		
(measured)			
Saturation	1.000		

CALCULATE AREA FROM START OR END? (start enter s, end enter e):	e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm²	0.1550031	in²	1	cm²
cm³	0.061023744	in³	1	cm³
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm³	62.427961	pcf	1	g/cm³
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R'12
Boring	B106U
Sample	U3
Depth	48.6 ft
By	WGL
Date	1/15/18
Checked	DJA
Date	1.30.18

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-1	A-11		F+10
Wet Wt. + Tare (g)	123.39	89.64		
Dry Wt. + Tare (g)	83.79	64.78		211.06
Wt. Water (g)	39.60	24.86		
Tare (g)	31.89	31.65		202.00
Dry Wt. Soil (g)	51.90	33.13		9.06
Water Content (%)	76.3	75.0		

75.7%

Trimmed Length in Tube

Overall Tube Length	23.3	23.3	23.3	23.3	cm	Avg.	23.3 cm
Top Empty Length	4.0	4.0	4.0	4.1	cm	Avg.	4.0 cm
Bottom Empty Length	4.1	4.0	4.1	4.0	cm	Avg.	4.05 cm

Trimmed Length in Tube, L = 15.25 cm

Tube Dimensions

Tube Inner Diameter	7.307	7.306	7.290	7.301	cm	Avg.	7.301 cm

Tube Weight (g) = 680.31

Weight of other (specify:_____) (g) = 170.85

Area, A = 41.87 cm^2

Volume in Tube = A x L = 638.45 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	/	g
Membrane	/	g
W_{moist}	/	g

Dry Wt. Of Excess Solids

Tare #	X-2	g
Dry + Tare	157.16	g
Tare	156.50	g
Dry Wt. Of Excess	0.66	g

Water Content

(Fraction Used: 1)

Tare #	KF10	
Wet + Tare	1013.76	g
Dry + Tare	710.11	g
Wt. Water	303.65	g
Tare	230.79	g
Wt. Dry Soil	479.32	g
Water Content	63.4	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = _____ g

Estimate of γ_d using γ_m in tube

Moist soil + tube + other (specify: 2 packer + F.P.)	1682.96	g
Tube + other	851.16	g
Moist soil	831.80	g

+9.06 = 840.86

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.317 g/cm^3 = 82.22 pcf

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 0.750 g/cm^3 = 46.80 pcf

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	1700685
Test No.	R112
Boring	B106U
Sample	U3
Depth	48.6'
By	WGL
Date	1/22/18
Checked	DJH
Date	1.30.18

Undisturbed Specimen ✓

Remolded or compacted Specimen _____

Filter Strips? Yes_____ No ✓

Lubricated End Platens? Yes_____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #_____

Diameter over 1 membranes	7.170	7.284	7.314		Avg.	7.239 cm
Twice thickness 1 membranes	0.068	0.071	0.068		Avg.	-0.069 cm
					Avg.	- cm

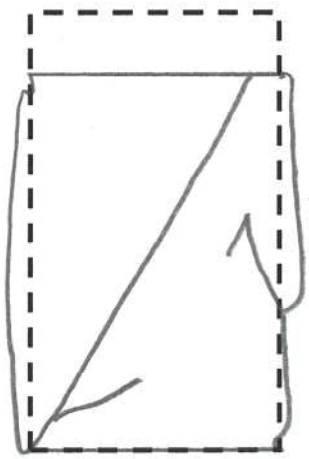
Diameter of Specimen	7.170	cm
Diameter of Specimen	2.823	inch
Area of Specimen	40.38	cm^2

Height Caliper #_____

Height from top gauge block to top of top platen, with specimen	12.580	12.681	12.849	12.474	Avg.	12.646 cm
Height of Gauge Block						+10.160 cm
Height from top of top platen to cell base, without specimen	8.755	8.810	8.775	8.760	Avg.	-8.778 cm

Height of Specimen in Cell	14.028	cm
Height of Specimen in Cell	5.523	inch
Volume in cell, initial	566.40	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

GEI Consultants

Saturation and Consolidation Data

Project No.	1700685
Test No.	R12
Boring	B106U
Sample	U3
Depth	48.6'
By	W. LUKAS
Date	1/23/18
Page	1

Panel No. 1

Pressure Trans:	SN 25218	Factor 2.3604 e^{-2}	Gain =	8
Load Trans:	SN A8897	Factor 5.8033 e^{-2}	Gain =	8
Displ. Trans:	SN 147	Factor 6.7108 e^{-5}	Gain =	64

Date	Time	Load (lbs)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.34) (digit)	Burrette Top (x 1.34) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
1/23	1510	0	0					-7		0
						24.0		0.33		7.41
	1512					20.1		10.62		16.92
	1650					19.2				
1/24	830					18.3		11.33		17.66
							B=0.87	21.29	20.04	27.62
	1340					17.6		21.29		27.52
							B=0.89	30.85	29.86	37.13
1/25	835					16.9		30.90		37.11
							B=0.95	41.21	40.67	47.42
	850	CONSOL TO 2 ksf ≈ 14 psi						41.09		47.21
Start@	850	Target σ_{cell} = 55 psi				8.5		40.95		55.21
	857					10.6				
	913					10.7				
	927	CONSOL TO 4 ksf ≈ 28 psi				10.7		41.19		55.33
	929	Target σ_{cell} = 69.2 psi				10.8		41.17		69.35
	935					14.3				
	942					14.4				
	952					14.5				
	1002					14.5				
		SHEAR						40.60		68.73
		RECONSOLIDATE				6.4				
						15.4				
		DOWN								

TEST REMARKS

GEI Consultants

Triaxial Rate Calculations

Project No.	1700685
Test No.	R'12
Boring	B106U
Sample	U3
Depth	48.6 Ft
By	WGL
Date	1.25.18
Checked	DOT
Date	1.30.17

Drained Tests

Stage #					
Initial Specimen Height in Cell		cm			
Height Change during Consolidation		cm			
Specimen Height, **A**		cm	=		inch
Estimated T_{100}, **B**		min			
Estimated Fail Strain, **C**		%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=		inch / min
Actual Deformation Rate, **E**		mm / min	=		inch / min
Strain Rate = (**E** / **A**) *10		% / min			

Undrained Tests

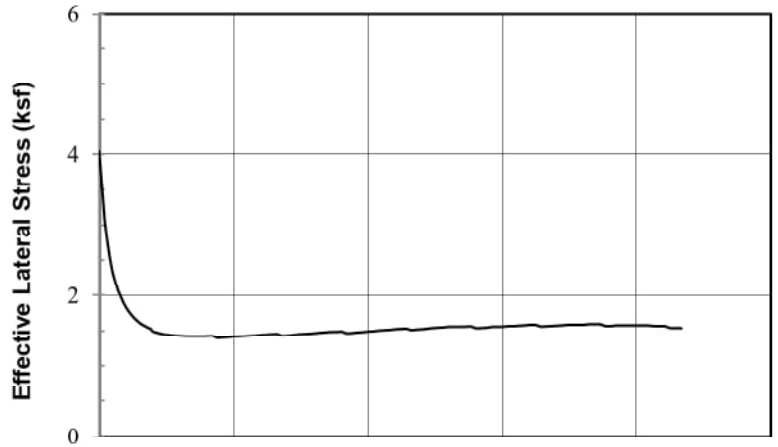
Stage #	1				
Initial Specimen Height in Cell	14.028	cm			
Height Change during Consolidation	0.149	cm	=	0.0587	inch
Specimen Height, **A**	13.879	cm	=	5.464	inch
Estimated T_{100}, **B**	1	min			
Estimated Fail Strain, **C**	4	%			
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	2.64	mm / min	=	0.104	inch / min
Actual Deformation Rate, **E**	0.0799	mm / min	=	0.00315	inch / min
Strain Rate = (**E** / **A**) *10	0.058	% / min			

Run 19% in 5.5 hrs

$$\Rightarrow \frac{(138.79\ \text{mm})(19\%)}{5.5\ (60)} = 0.0799\ \text{mm/min} = 0.00315\ \text{in/min}$$

TEST REMARKS

GEI Consultants



SAMPLE INFORMATION

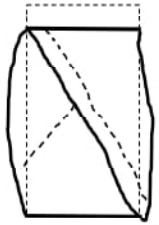
Boring: B112U Sample: U3 Depth (ft): 46.5 Test: R'13
Type: 2.8-inch-diameter tube sample
Description: Sluiced Ash

SPECIMEN INFORMATION (after saturation)

Height: 5.968 in Dia.: 2.830 in Area.: 6.307 sq. in
Water Content: 66.1% Dry Unit Weight: 56.2 pcf

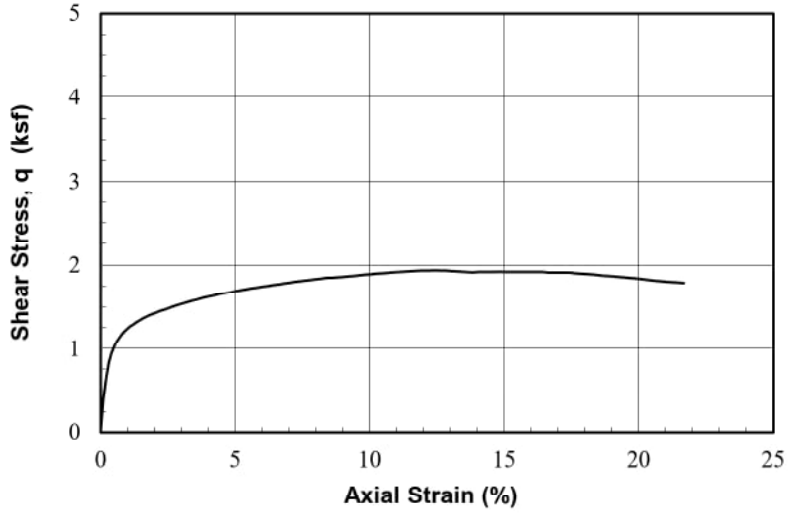
TEST SUMMARY (end of test)

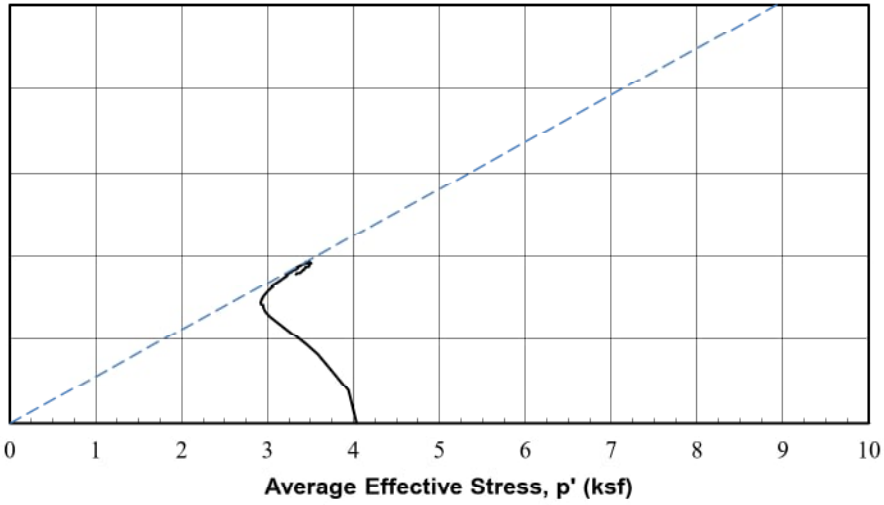
Effective Confining Stress: 4.04 ksf vertical, 4.04 ksf horiz.
Water Content: 65.1 % Dry Unit Weight: 56.7 pcf
B Coefficient: 0.97 Strain Rate: 0.055 %/min
Peak Shear Stress: 1.94 ksf @ 12.4 % Strain
Peak Friction Angle: 34.1 deg. @ 11.6 % Strain



Failure Sketch

REMARKS: Shear plane developed between 9 and 10% axial strain.
Oven-dried at 60°C





Operator: WGL
Checked: DJA
Test Date: 15-Jan-2018

2/1/2018 13:31

Seismic Stability of Ash Landfill
and West Pond at Glen Lyn Plant
Glen Lyn, Virginia

American Electric Power
Columbus, Ohio

GEI Consultants

Project 1700685

CONSOLIDATED ISOTROPIC
UNDRAINED TRIAXIAL COMPRESSION
with Pore Pressure Measurements

August 2018 Fig. L-16

PROJECT #:	1700685												
PROJECT:	Glen Lyn		Stage	SIGMAv'	SIGMAh'	Height	Diameter	Area	Water Content	Dry Density	Total Density	Void Ratio
TEST:	R'13											
BORING:	B112U			(ksf)	(ksf)	(in)	(in)	(in^2)	(%)	(pcf)	(pcf)	
SAMPLE:	U3		In situ	--	--	--	--	--	--	54.7	--	1.534
DEPTH (ft):	46.5		After Sampling	--	--	--	--	--	--	54.4	--	1.547
OPER.:	WGL		In tube before extrusion	--	--	5.974	2.873	6.484	67.29	54.7	91.4	1.536
TEST DATE:	1/15/2018		Under vac.	1.01	1.01	5.968	2.851	6.382	--	55.5	--	1.497
DCDT No.		146										
DCDT Calibration Factor		6.5277E-05 inch/cnt	End of:							calculated from end of test		
Load Cell No.		1890-0004	Saturation	0.92	0.92	5.968	2.834	6.307	66.10	56.2	93.3	1.467
Load Cell Cal. Factor		0.027097 lb/cnt	Consol. Stage 1	2.01	2.01	5.968	2.830	6.291	65.81	56.3	93.4	1.461
Pressure Transducer		CP-GEI-4	Consol. Stage 2	4.04	4.04	5.918	2.833	6.306	65.14	56.7	93.6	1.446
Pres. Trans. Cal. Factor		0.019127 psi/cnt	Consol. Stage 3	4.04	4.04	5.918	2.833	6.306	65.14	56.7	93.6	1.446
			Consol. Stage 4	4.04	4.04	5.918	2.833	6.306	65.14	56.7	93.6	1.446
Gravity of Solids		2.22 (measured)	Consol. Stage 5	4.04	4.04	5.918	2.833	6.306	65.14	56.7	93.6	1.446
			Consol. Stage 6	4.04	4.04	5.918	2.833	6.306	65.14	56.7	93.6	1.446
B value start shear		0.97										
Test Stage End of#	2		This Stage Initial Values	4.04	4.04	5.918	2.833	6.306	65.14	56.7	93.6	1.446
Stage Strain rate		0.055 %/min	Kc start stage	1.00		Back Pressure		4.44 ksf				
Data Start Row	4											

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.050	6.964	30.335	0.00	6.31	0.00	4.04	4.04	4.04	4.04	0.00	1.00	0.0	0.00
0.056	41.648	33.759	0.10	6.31	0.49	3.54	4.83	4.34	3.94	0.40	1.22	5.8	0.62
0.062	63.705	36.934	0.20	6.32	0.95	3.09	5.33	4.38	3.73	0.65	1.42	10.0	0.73
0.068	79.259	39.191	0.30	6.32	1.28	2.76	5.68	4.41	3.59	0.82	1.60	13.3	0.77
0.074	89.258	40.855	0.40	6.33	1.51	2.52	5.91	4.39	3.46	0.94	1.74	15.7	0.81
0.079	96.601	42.156	0.50	6.34	1.70	2.34	6.07	4.37	3.35	1.02	1.87	17.7	0.84
0.085	102.290	43.189	0.60	6.34	1.85	2.19	6.20	4.35	3.27	1.08	1.99	19.3	0.86
0.091	106.820	43.992	0.70	6.35	1.97	2.07	6.30	4.34	3.20	1.13	2.09	20.7	0.87
0.097	110.580	44.642	0.80	6.36	2.06	1.98	6.39	4.32	3.15	1.17	2.19	21.9	0.88
0.103	113.750	45.197	0.90	6.36	2.14	1.90	6.45	4.31	3.11	1.21	2.27	22.9	0.89
0.109	116.520	45.656	1.00	6.37	2.21	1.83	6.51	4.31	3.07	1.24	2.35	23.8	0.89
0.115	118.980	46.058	1.10	6.38	2.26	1.77	6.57	4.30	3.04	1.26	2.43	24.6	0.89
0.121	121.020	46.383	1.20	6.38	2.31	1.73	6.61	4.30	3.01	1.29	2.49	25.3	0.90
0.127	123.160	46.670	1.30	6.39	2.35	1.69	6.66	4.30	3.00	1.31	2.55	25.9	0.90
0.133	125.000	46.919	1.40	6.40	2.39	1.65	6.70	4.31	2.98	1.33	2.61	26.5	0.90
0.139	126.760	47.129	1.50	6.40	2.42	1.62	6.73	4.31	2.97	1.35	2.66	27.0	0.90
0.145	128.410	47.301	1.60	6.41	2.44	1.59	6.77	4.32	2.96	1.36	2.71	27.5	0.90

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.150	129.880	47.454	1.70	6.41	2.47	1.57	6.80	4.33	2.95	1.38	2.75	27.9	0.89
0.156	131.420	47.588	1.80	6.42	2.48	1.55	6.83	4.34	2.95	1.40	2.80	28.2	0.89
0.162	132.750	47.703	1.90	6.43	2.50	1.54	6.86	4.35	2.95	1.41	2.83	28.6	0.89
0.168	134.130	47.971	2.00	6.43	2.54	1.50	6.88	4.34	2.92	1.42	2.90	29.2	0.89
0.180	136.700	48.143	2.20	6.45	2.56	1.47	6.94	4.37	2.92	1.45	2.97	29.7	0.89
0.192	138.950	48.257	2.40	6.46	2.58	1.46	6.98	4.40	2.93	1.47	3.02	30.2	0.88
0.204	141.260	48.334	2.60	6.47	2.59	1.45	7.02	4.43	2.94	1.49	3.07	30.5	0.87
0.216	143.510	48.391	2.80	6.49	2.60	1.44	7.07	4.47	2.95	1.52	3.11	30.9	0.86
0.228	145.590	48.430	3.00	6.50	2.61	1.43	7.11	4.50	2.97	1.54	3.14	31.2	0.85
0.239	147.570	48.449	3.20	6.51	2.61	1.43	7.15	4.54	2.98	1.55	3.17	31.4	0.84
0.251	149.470	48.468	3.40	6.53	2.61	1.43	7.18	4.57	3.00	1.57	3.20	31.6	0.83
0.263	151.340	48.468	3.61	6.54	2.61	1.43	7.22	4.60	3.02	1.59	3.23	31.8	0.82
0.275	153.230	48.468	3.80	6.56	2.61	1.43	7.25	4.64	3.03	1.61	3.25	32.0	0.81
0.287	154.910	48.449	4.01	6.57	2.61	1.43	7.28	4.67	3.05	1.62	3.27	32.1	0.80
0.299	156.460	48.430	4.21	6.58	2.61	1.43	7.31	4.70	3.07	1.64	3.28	32.2	0.80
0.311	158.190	48.659	4.41	6.60	2.64	1.40	7.34	4.70	3.05	1.65	3.36	32.8	0.80
0.323	159.760	48.602	4.61	6.61	2.63	1.41	7.37	4.74	3.07	1.66	3.37	32.8	0.79
0.334	161.230	48.563	4.81	6.62	2.62	1.41	7.39	4.77	3.09	1.68	3.37	32.9	0.78
0.346	162.720	48.525	5.01	6.64	2.62	1.42	7.42	4.80	3.11	1.69	3.38	32.9	0.78
0.358	164.100	48.487	5.21	6.65	2.61	1.42	7.44	4.83	3.12	1.70	3.39	33.0	0.77
0.370	165.480	48.449	5.41	6.67	2.61	1.43	7.46	4.85	3.14	1.71	3.40	33.0	0.76
0.382	166.860	48.410	5.61	6.68	2.60	1.43	7.48	4.88	3.16	1.72	3.40	33.1	0.76
0.394	168.220	48.372	5.81	6.69	2.60	1.44	7.51	4.91	3.17	1.73	3.41	33.1	0.75
0.406	169.550	48.334	6.01	6.71	2.59	1.45	7.53	4.94	3.19	1.74	3.41	33.2	0.74
0.418	170.710	48.296	6.21	6.72	2.59	1.45	7.54	4.96	3.20	1.75	3.42	33.2	0.74
0.429	171.930	48.257	6.41	6.74	2.58	1.46	7.56	4.98	3.22	1.76	3.42	33.2	0.73
0.441	173.180	48.238	6.61	6.75	2.58	1.46	7.58	5.00	3.23	1.77	3.43	33.3	0.73
0.453	174.420	48.430	6.81	6.77	2.61	1.43	7.60	5.00	3.21	1.78	3.49	33.7	0.73
0.465	175.700	48.372	7.01	6.78	2.60	1.44	7.62	5.02	3.23	1.79	3.49	33.7	0.72
0.477	176.860	48.315	7.22	6.80	2.59	1.45	7.64	5.05	3.25	1.80	3.48	33.6	0.72
0.489	178.030	48.277	7.42	6.81	2.58	1.45	7.65	5.07	3.26	1.81	3.49	33.7	0.71
0.501	179.080	48.219	7.62	6.83	2.58	1.46	7.67	5.09	3.28	1.82	3.48	33.6	0.71
0.512	180.250	48.200	7.82	6.84	2.57	1.47	7.69	5.11	3.29	1.82	3.49	33.7	0.71
0.524	181.390	48.162	8.02	6.86	2.57	1.47	7.70	5.13	3.30	1.83	3.49	33.7	0.70
0.536	182.470	48.104	8.22	6.87	2.56	1.48	7.72	5.16	3.32	1.84	3.49	33.7	0.70
0.548	183.470	48.066	8.42	6.89	2.55	1.48	7.73	5.18	3.33	1.85	3.49	33.7	0.69
0.560	184.020	48.047	8.62	6.90	2.55	1.49	7.73	5.18	3.33	1.85	3.48	33.6	0.69
0.572	184.960	48.028	8.82	6.92	2.55	1.49	7.74	5.20	3.34	1.85	3.49	33.7	0.69
0.584	185.890	47.990	9.02	6.93	2.54	1.50	7.76	5.21	3.35	1.86	3.49	33.7	0.68
0.596	186.970	48.181	9.22	6.95	2.57	1.47	7.77	5.20	3.33	1.87	3.54	34.0	0.69

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
0.607	187.970	48.124	9.42	6.96	2.56	1.48	7.78	5.22	3.35	1.87	3.54	34.0	0.68
0.619	188.950	48.066	9.62	6.98	2.55	1.48	7.79	5.24	3.36	1.88	3.53	34.0	0.68
0.631	189.950	48.028	9.82	6.99	2.55	1.49	7.81	5.26	3.37	1.88	3.53	33.9	0.68
0.643	190.980	47.990	10.02	7.01	2.54	1.50	7.82	5.28	3.39	1.89	3.53	33.9	0.67
0.655	191.900	47.932	10.22	7.02	2.53	1.50	7.83	5.30	3.40	1.90	3.52	33.9	0.67
0.667	192.820	47.894	10.42	7.04	2.53	1.51	7.84	5.31	3.41	1.90	3.52	33.9	0.67
0.679	193.740	47.856	10.63	7.06	2.52	1.51	7.85	5.33	3.42	1.91	3.52	33.9	0.66
0.691	194.660	47.818	10.83	7.07	2.52	1.52	7.86	5.34	3.43	1.91	3.51	33.8	0.66
0.702	195.420	47.760	11.03	7.09	2.51	1.53	7.87	5.36	3.44	1.91	3.51	33.8	0.66
0.714	196.290	47.722	11.23	7.10	2.50	1.53	7.88	5.37	3.45	1.92	3.50	33.8	0.65
0.726	197.160	47.684	11.43	7.12	2.50	1.54	7.88	5.39	3.46	1.92	3.50	33.7	0.65
0.738	198.050	47.856	11.63	7.14	2.52	1.51	7.89	5.37	3.44	1.93	3.55	34.1	0.65
0.750	198.730	47.798	11.83	7.15	2.51	1.52	7.90	5.38	3.45	1.93	3.54	34.0	0.65
0.762	199.430	47.741	12.03	7.17	2.51	1.53	7.90	5.40	3.46	1.93	3.52	33.9	0.65
0.774	200.060	47.703	12.23	7.18	2.50	1.54	7.91	5.41	3.47	1.94	3.52	33.9	0.65
0.786	200.570	47.645	12.43	7.20	2.49	1.55	7.91	5.42	3.48	1.94	3.51	33.8	0.64
0.797	200.920	47.607	12.63	7.22	2.49	1.55	7.91	5.42	3.49	1.93	3.50	33.7	0.64
0.809	201.250	47.569	12.83	7.23	2.48	1.56	7.91	5.42	3.49	1.93	3.49	33.6	0.64
0.821	201.250	47.550	13.03	7.25	2.48	1.56	7.90	5.42	3.49	1.93	3.48	33.6	0.64
0.833	201.090	47.531	13.23	7.27	2.48	1.56	7.88	5.41	3.48	1.92	3.46	33.5	0.64
0.845	201.090	47.531	13.43	7.28	2.48	1.56	7.88	5.40	3.48	1.92	3.46	33.5	0.65
0.857	201.250	47.511	13.63	7.30	2.47	1.56	7.87	5.40	3.48	1.92	3.45	33.4	0.65
0.869	201.490	47.473	13.84	7.32	2.47	1.57	7.87	5.40	3.48	1.91	3.44	33.3	0.64
0.881	202.090	47.664	14.04	7.34	2.50	1.54	7.87	5.37	3.46	1.92	3.48	33.6	0.65
0.892	202.630	47.626	14.24	7.35	2.49	1.55	7.87	5.38	3.46	1.92	3.48	33.6	0.65
0.904	203.150	47.588	14.44	7.37	2.48	1.55	7.87	5.39	3.47	1.92	3.47	33.5	0.65
0.916	203.690	47.550	14.64	7.39	2.48	1.56	7.87	5.39	3.48	1.92	3.46	33.5	0.65
0.928	204.230	47.531	14.84	7.40	2.48	1.56	7.87	5.40	3.48	1.92	3.46	33.5	0.65
0.940	204.660	47.492	15.04	7.42	2.47	1.57	7.87	5.40	3.48	1.92	3.45	33.4	0.64
0.952	205.100	47.454	15.24	7.44	2.47	1.57	7.87	5.41	3.49	1.92	3.44	33.3	0.64
0.964	205.530	47.435	15.44	7.46	2.46	1.58	7.87	5.41	3.49	1.92	3.43	33.3	0.64
0.975	206.020	47.416	15.64	7.47	2.46	1.58	7.87	5.41	3.50	1.92	3.43	33.3	0.64
0.987	206.480	47.378	15.84	7.49	2.45	1.58	7.87	5.42	3.50	1.92	3.42	33.2	0.64
0.999	206.890	47.358	16.04	7.51	2.45	1.59	7.87	5.42	3.50	1.92	3.42	33.2	0.64
1.011	207.320	47.339	16.24	7.53	2.45	1.59	7.87	5.42	3.51	1.92	3.41	33.1	0.64
1.023	207.750	47.511	16.44	7.55	2.47	1.56	7.87	5.40	3.48	1.92	3.45	33.4	0.65
1.035	207.940	47.473	16.64	7.56	2.47	1.57	7.86	5.40	3.48	1.91	3.44	33.3	0.65
1.047	208.160	47.454	16.84	7.58	2.47	1.57	7.86	5.39	3.48	1.91	3.43	33.3	0.65
1.059	208.510	47.416	17.05	7.60	2.46	1.58	7.86	5.40	3.49	1.91	3.42	33.2	0.64
1.070	208.890	47.378	17.24	7.62	2.45	1.58	7.85	5.40	3.49	1.91	3.41	33.1	0.64

Axial DCDT (inch)	Load Cell (lb)	Pore Pressure (lb/in^2)	Axial Strain (%)	Area (in^2)	Excess Pore Pressure (ksf)	Sigma3 effective (ksf)	Total SigmaV (ksf)	SigmaV Effective (ksf)	P' (ksf)	q (ksf)	s1'/s3'	Friction Angle (deg)	Pressure Parameter A (-)
1.082	209.220	47.339	17.45	7.64	2.45	1.59	7.85	5.40	3.50	1.91	3.40	33.1	0.64
1.094	209.270	47.339	17.65	7.66	2.45	1.59	7.84	5.39	3.49	1.90	3.39	33.0	0.64
1.106	209.190	47.320	17.85	7.68	2.45	1.59	7.83	5.39	3.49	1.90	3.38	32.9	0.64
1.118	209.160	47.301	18.05	7.69	2.44	1.59	7.82	5.38	3.49	1.89	3.37	32.9	0.65
1.130	209.240	47.263	18.25	7.71	2.44	1.60	7.81	5.38	3.49	1.89	3.36	32.8	0.65
1.142	209.160	47.263	18.45	7.73	2.44	1.60	7.80	5.37	3.48	1.88	3.35	32.7	0.65
1.154	208.860	47.263	18.65	7.75	2.44	1.60	7.79	5.35	3.48	1.88	3.34	32.7	0.65
1.165	208.890	47.454	18.85	7.77	2.47	1.57	7.78	5.31	3.44	1.87	3.38	32.9	0.66
1.177	208.920	47.435	19.05	7.79	2.46	1.58	7.77	5.31	3.44	1.87	3.37	32.8	0.66
1.189	208.730	47.416	19.25	7.81	2.46	1.58	7.76	5.30	3.44	1.86	3.36	32.8	0.66
1.201	208.650	47.416	19.45	7.83	2.46	1.58	7.75	5.29	3.43	1.85	3.35	32.7	0.66
1.213	208.460	47.397	19.65	7.85	2.46	1.58	7.73	5.28	3.43	1.85	3.34	32.6	0.66
1.225	208.210	47.397	19.85	7.87	2.46	1.58	7.72	5.26	3.42	1.84	3.33	32.6	0.67
1.237	208.020	47.416	20.05	7.89	2.46	1.58	7.71	5.25	3.41	1.84	3.33	32.5	0.67
1.249	207.810	47.416	20.25	7.91	2.46	1.58	7.70	5.24	3.41	1.83	3.32	32.5	0.67
1.260	207.430	47.416	20.46	7.93	2.46	1.58	7.68	5.22	3.40	1.82	3.31	32.4	0.68
1.272	207.210	47.435	20.66	7.95	2.46	1.58	7.67	5.20	3.39	1.81	3.30	32.4	0.68
1.284	206.990	47.435	20.86	7.97	2.46	1.58	7.65	5.19	3.38	1.81	3.29	32.3	0.68
1.296	206.800	47.454	21.06	7.99	2.47	1.57	7.64	5.18	3.37	1.80	3.29	32.3	0.68
1.308	206.830	47.664	21.26	8.01	2.50	1.54	7.63	5.14	3.34	1.80	3.33	32.6	0.69
1.320	206.830	47.664	21.46	8.03	2.50	1.54	7.62	5.13	3.33	1.79	3.32	32.5	0.70
1.332	206.830	47.645	21.66	8.05	2.49	1.55	7.61	5.12	3.33	1.79	3.31	32.4	0.70
1.333	206.800	47.664	21.67	8.05	2.50	1.54	7.61	5.12	3.33	1.79	3.32	32.5	0.70

PROJECT #:	1700685		
PROJECT:	Glen Lyn		
TEST:	R'13	Ground Surface Elevation	
BORING:	B112U	Elevation Datum	
SAMPLE:	U3		
DEPTH:	46.5	Elevation:	
TEST DATE:	15-Jan-18		
FILE NAME			
Project Title (1)	Seismic Stability Evaluation		
Project Title (2)	Ash Landfill and West Pond at Glen Lyn Plant		
Project Title (3)	Glen Lyn, Virginia		
CLIENT	American Electric Power		
	Columbus, Ohio		
Report Date	January 2018		
Figure No.			
Test Operator:	WGL		
Checked By:	DJA		
Last Edit By:			
Units to use (e or m)	m		
Structure:	2.8-inch-diameter tube sample		
Sample Description (1)	Sluiced Ash		
Sample Description (2)	silt		
Failure Type:			
Remarks (1):			
Remarks (2):			
	LL= NV		
	PL= NP		
	PI= NP		
HARDWARE			

Load ID:	1890-0004		
Load Calibration Factor:	0.027097	lb/cnt	
Pressure ID:	CP-GEI-4		
Pressure Cal. Fator	0.019127	psi/cnt	
Displacement ID:	146		
Displacement Cal. Factor:	0.000065277	inch/cnt	

TUBE SAMPLING RECORD INFORMATION

Clearance Ratio:	0.43	VC:	0.5295
Penetration, cm:	60.70		
Gross Recovery, cm:	60.50		
TUBE LENGTH, cm	76.20		
FIELD DIST. TO TOP SOIL, cm	15.70		
FIELD DIST. TO BOT SOIL, cm	0.00	IN SITU COR. FACTOR:	1.0053
FIELD DIST TOP PACKER, cm	14.10	TUBE TRANSPORT COR. FACTOR:	0.9955
FIELD DIST BOT PACKER, cm	0.00	TUBE CUTTING COR. FACTOR:	1
LAB DIST TOP PACKER, cm	14.38		
LAB DIST BOT PACKER, cm	0.00		

TUBE SECTION DIMENSIONS	Reading 1	Reading 2	Reading 3	Reading 4	Average	
TOTAL SECTION LENGTH	23.2	23.1	23.1	23.2	23.15	cm
TOP EMPTY LENGTH	4	4	3.9	3.9	3.95	cm
BOT. EMPTY LENGTH	4.1	4	4	4	4.025	cm
TUBE INNER DIAMETER	7.284	7.304	7.302	7.302	7.298	cm

In tube length	15.18	cm
Tube Diameter	7.298	cm
Tube Area	41.83	(cm^2)
Tube Volume	634.78	(cm^3)

INITIAL SPECIMEN DIMENSIONS	reading 1	reading 2	reading 3	reading 4	Average	
AV. DIAM + MEMBRANE	7.31	7.304	7.31		7.308	cm
MEMBRANE 1 THICKNESS	0.067	0.068	0.068		0.068	cm
MEMBRANE 2 THICKNESS	0				0.000	cm
HEIGHT WITH SPECIMEN	13.544	13.524	13.527	13.54	13.534	cm
GAGE BLOCK	10.160				10.160	cm
HEIGHT W/O SPECIMEN	8.561	8.544	8.495	8.542	8.536	cm

#filter strips	0		
Hi	15.158	cm	
Di	7.240	cm	2.09358455
Ai	41.172	cm^2	
Vi	624.103	cm^3	

	TOP TRIM (g)	BOT. TRIM (g)	EXT. TRIM (g)	Initial WET Wt. (g)	STUCK ON TUBE (g)	FINAL WET Wt. (g)	FINAL water cont. (g)	FINAL EXCESS SOLIDS (g)
WET+T	91.630	103.010	*******	1615.240	*******	1298.470	1298.470	*******
DRY+T	65.120	74.490		*******	204.210	*******	953.690	335.190
T	31.400	31.940		686.090	203.430	399.340	399.340	334.580
Wt. Solids	33.72	42.55	0	929.15	0.78	554.96	554.35	0.61
w %	78.62	67.03	*******	67.29	*******	62.20	62.20	*******

FINAL B VALUE 0.97

Fixed Piston? (y or n)	n	
Piston diameter	0.375	in
Piston Area	0.110446617	(in^2)

CONSOLIDATION STAGES

STAGE	Back Pressure (psi)	Cell Pressure (psi)	Vertical Load (lb)	DELTA V (cm^3)	Measured Delta H (cm)	Delta H Used (cm)	Theoretical Delta H (cm)	SIGMA'v (psi)	SIGMA'h (psi)
in situ									
after sampling									0
after shipping									
in tube before extrusion									
End of:									
vacuum	-7.00	0.00	0.000	**********	**********			7.00	7.00
saturation	30.72	37.14	0.000	7.282	0.000	0.000	0.059	6.42	6.42
Consolidation Stage 1	30.83	44.78	0.000	1.596	0.000	0.000	0.013	13.95	13.95
2	30.82	58.86	0.000	3.724	0.127	0.127	0.031	28.04	28.04
3	30.82	58.86	0.000	0.000	0.000	0.000	0.000	28.04	28.04
4	30.82	58.86	0.000	0.000	0.000	0.000	0.000	28.04	28.04
5	30.82	58.86	0.000	0.000	0.000	0.000	0.000	28.04	28.04
6	30.82	58.86	0.000	0.000	0.000	0.000	0.000	28.04	28.04
Start Shear	30.82	58.86	0.000	**********	**********			28.04	28.04
End Shear				16.359	**********			**********	**********

STAGE		SIGMA'v (psi)	SIGMA'h (psi)	H (cm)	Diameter (cm)	Area (cm^2)	Volume (cm^3)	Wt. Solids g	wc %	Correction Factor	dry density g/cm³	pcf	void ratio	
in situ		0.00	0.00							1.0053	0.88	54.7	1.534	
after sampling		0.00	0.00							0.9955	0.87	54.4	1.547	
after shipping		0.00	0.00							1.0000	0.88	54.7	1.536	
in tube before extrusion		0.00	0.00	15.18	7.298	41.831	634.78	555.74	67.29	*****	0.88	54.7	1.536	
End of:		0.00	0.00											
vacuum		7.00	7.00	15.158	7.240	41.172	624.103	554.960	*****	*****	0.89	55.5	1.497	
saturation		6.42	6.42	15.158	7.198	40.692	616.820	554.960	66.102		0.90	56.2	1.467	
	1	13.95	13.95	15.158	7.189	40.587	615.224	554.960	65.814	*****	0.90	56.3	1.461	
	2	28.04	28.04	15.031	7.197	40.682	611.500	554.960	65.143	*****	0.91	56.7	1.446	
	3	28.04	28.04	15.031	7.197	40.682	611.500	554.960	65.143	*****	0.91	56.7	1.446	
	4	28.04	28.04	15.031	7.197	40.682	611.500	554.960	65.143	*****	0.91	56.7	1.446	
	5	28.04	28.04	15.031	7.197	40.682	611.500	554.960	65.143	*****	0.91	56.7	1.446	
	6	28.04	28.04	15.031	7.197	40.682	611.500	554.960	65.143	*****	0.91	56.7	1.446	
Start Shear		28.04	28.04	15.031	7.197	40.682	611.500	554.960	65.143	*****	0.91	56.7	1.446	
End Shear		**********	**********				595.141	554.960	62.195	*****	0.93	58.2	1.381	1.380737079

Test comp (c) or ext (e) c

DEFORMATION RATE 1	0.08306146	mm/min	0.0553	%/min
DEFORMATION RATE 2	0.00327014	in/min	0.000552592	%/min
DEFORMATION RATE 3		in/min		

SPECIFIC GRAVITY OF SOLIDS 2.22 2.220 yields S=1

estimated or measured? (enter E or M) m
(measured)

Saturation 1.000

CALCULATE AREA FROM START OR
END? (start enter s, end enter e): e

Conversion Table

input unit	Conversion	out unit	C and units used	
mm	0.039370079	inch	1	mm
cm	0.39370079	inch	1	cm
cm^2	0.1550031	in^2	1	cm^2
cm^3	0.061023744	in^3	1	cm^3
kg	2.2046223	lb	1	kg
ksc	2.0481614	ksf	1	ksc
ksc	14.223	psi	1	ksc
g/cm³	62.427961	pcf	1	g/cm³
Ht (mm)	1	inch	0.1	cm
psi	0.144	ksf	1	ksc
kg/Area	0.317465611	ksf	1	ksc
KPa	0.020885547	ksf		
N	0.000225	kips		

γ_d, Dry Density - Undisturbed

Project No.	1700685
Test No.	R113
Boring	B122U
Sample	U3
Depth	46.5'
By	WBL
Date	1/15/18
Checked	
Date	

	Top Trim	Bot Trim	Ext. Trim	On Tube
Tare #	A-31	B-21		AC-8
Wet Wt. + Tare (g)	91.63	103.01		
Dry Wt. + Tare (g)	65.12	74.49		204.21
Wt. Water (g)	26.51	28.52		
Tare (g)	31.40	31.94		203.43
Dry Wt. Soil (g)	33.72	42.55		0.78
Water Content (%)	78.6	67.0		

72.8 %

Trimmed Length in Tube

Overall Tube Length	23.2	23.1	23.1	23.2	cm	Avg.	23.15 cm
Top Empty Length	4.0	4.0	3.9	3.9	cm	Avg.	3.95 cm
Bottom Empty Length	4.1	4.0	4.0	4.0	cm	Avg.	4.0 cm

Trimmed Length in Tube, L: 15.2 cm

Tube Dimensions

Tube Inner Diameter	7.284	7.304	7.302	7.302	cm	Avg.	7.298 cm

Tube Weight (g): 686.09

Weight of other (specify: —) (g): 0

Area, A: 41.83 cm^2

Volume in Tube = A x L: 635.83 cm^3

Measurements After Test

Weight in Membrane

Wet + membrane	—	g
Membrane	—	g
W_{moist}	—	g

Dry Wt. Of Excess Solids

Tare #	MB-87	g
Dry + Tare	335.19	g
Tare	334.58	g
Dry Wt. Of Excess	0.61	g

Water Content (Fraction Used: 1)

Tare #	BK-1	
Wet + Tare	1298.47	g
Dry + Tare	953.69	g
Wt. Water	344.78	g
Tare	399.34	g
Wt. Dry Soil	554.35	g
Water Content	62.2	%

$W_s = W_{moist} / (1 + wc) + Dry\ Wt\ of\ Excess$ = _____ g

Estimate of γ_d using γ_m, in tube

Moist soil + tube + ~~other (specify:_____)~~	1615.24	g
Tube + ~~other~~	686.09	g
Moist soil	929.15	g +0.78 = 929.93 g

γ_{moist} = Wt. Moist Soil / Volume in Tube = 1.463 g/cm^3 (91.33 pcf)

$\gamma_d = \gamma_{moist} / (1 + wc)$ = 0.846 g/cm^3 (52.84 pcf)

Remarks:

GEI Consultants

Specimen Dimensions, Description, & Sketch

Project No.	170685
Test No.	C113
Boring	B12U
Sample	U3
Depth	46.5'
By	WSL
Date	1/22/18
Checked	
Date	

Undisturbed Specimen ✓

Remolded or compacted Specimen

Filter Strips? Yes_____ No ✓

Lubricated End Platens? Yes_____ No ✓

SPECIMEN DIMENSIONS

Diameter Tape #_____

Diameter over _____ membranes	7.310	7.304	7.310		Avg.	7.308 cm
Twice thickness _____ membranes	0.067	0.068	0.068		Avg.	-0.068 cm
					Avg.	- cm

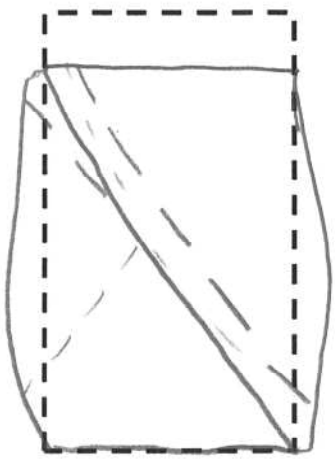
Diameter of Specimen	7.240	cm
Diameter of Specimen	2.850	inch
Area of Specimen	41.17	cm^2

Height Caliper #_____

Height from top gauge block to top of top platen, with specimen	13.544	13.524	13.527	13.540	Avg.	13.534 cm
Height of Gauge Block						+10.160 cm
Height from top of top platen to cell base, without specimen	8.561	8.544	8.495	8.542	Avg.	-8.536 cm

Height of Specimen in Cell	15.168	cm
Height of Specimen in Cell	5.968	inch
Volume in cell, initial	624.4	cm^3

Sketch of Specimen at End of Test



Specimen Description After Test:

Test Notes & Remarks:

Under 0.5 tsf vacuum

Shear plane @ 9-10% strain

GEI Consultants

Saturation and Consolidation Data

Project No.	1700685
Test No.	R113
Boring	B122U
Sample	U3
Depth	46.5'
By	WGL
Date	1/24/18
Page	

Panel No. 2

Pressure Trans:	SN CP-GEI-4	Factor 1.9127e^{-2}	Gain =	8
Load Trans:	SN 1890-0004	Factor 2.7097e^{-2}	Gain =	8
Displ. Trans:	SN 146	Factor 6.5277e^{-5}	Gain =	64

Date	Time	Load (lb)	Axial Def. (in)	Burrette Bottom (x) (digit)	Burrette Bottom (x) (cm^2)	Burrette Top (x 1.33) (digit)	Burrette Top (x 1.33) (cm^2)	Pressure (psi) Back ( )	Pressure (psi) Pore ( )	Pressure (psi) Cell ( )
1/24		0	0					-7		0
	1005					20.4		0.29		7.23
						19.6		10.31		16.77
1/25	835					18.1		10.35		16.79
							B=0.93	20.81	20.12	27.24
1/26	905					17.8		20.70		27.12
							B=0.97	30.72	30.39	37.14
	906	CONSOL TO 2 KSF ≈ 14 psi				17.8		30.72		44.74
	910	→ TARGET σ_{cell} = 44.7 psi				19.0				
	916					19.0		30.83		44.78
	919	→ CONSOL to 4 KSF ≈ 28 psi				12.5		30.74		58.80
	922	→ σ_{cell} = 58.8 psi				15.1				
	934					15.2				
	940					15.3				
	947		0.050			15.3		30.82		58.86
		SHEAR								
		RECONSOLIDATE				8.5				
						20.8				

DRAIN B

TEST REMARKS

GEI Consultants

Triaxial Rate Calculations

Project No.	1700685
Test No.	R113
Boring	B122U
Sample	U3
Depth	40.5'
By	WDZ
Date	1/26/18
Checked	
Date	

Drained Tests

Stage #				
Initial Specimen Height in Cell		cm		
Height Change during Consolidation		cm		
Specimen Height, **A**		cm	=	inch
Estimated T_{100}, **B**		min		
Estimated Fail Strain, **C**		%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (8.1 * **B**)		mm / min	=	inch / min
Actual Deformation Rate, **E**		mm / min	=	inch / min
Strain Rate = (**E** / **A**) *10		% / min		

Undrained Tests

Stage #	2			
Initial Specimen Height in Cell	15.158	cm		
Height Change during Consolidation	0.127	cm	=	0.050 inch
Specimen Height, **A**	15.031	cm	=	5.918 inch
Estimated T_{100}, **B**	1	min		
Estimated Fail Strain, **C**	4	%		
Maximum Deformation Rate, **D** = (**C** * **A**) / 10 / (2.1 * **B**)	2.863	mm / min	=	0.113 inch / min
Actual Deformation Rate, **E**	0.0835	mm / min	=	0.00329 inch / min
Strain Rate = (**E** / **A**) *10	0.0556	% / min		

20% in 6 hrs $\rightarrow \frac{20\%}{6(60)} = 0.0556\ \%/\text{min}$

$\frac{(15.031\text{cm})(10\ \text{mm/cm})(20\%)}{360\ \text{min}} = 0.0835\ \text{mm/min} = 0.00329\ \text{in/min}$

TEST REMARKS

GEI Consultants

Record of Laboratory Use of Tube Sample

Project Name	Glen Lyn
Project No.	1700685
Boring	B101J
Sample	U1
Depth	20.2 – 22.2 ft
Performed by	DTH
Date	11-17-17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	in.
					Top of Packer ↓		
			CUT		Brown lean clay w/ sand and gravel		
			21.1'		R'2		
			CUT		Brown sandy lean clay w/ gravel		
					Brn sandy lean CLAY w/ gravel		
			21.8'		R' 1		
					Brn. lean Clay w/ sand		
			22.2		Bottom of Tube ↑		

Record of Laboratory Use of Tube Sample

Project Name	1700685
Project No.	GLEN LYN
Boring	B101U
Sample	U2
Depth	52.2'-54.2'
Performed by	WGL
Date	12/13/17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
		5				5	
		10			CUT	10	
5		15			DISTURBED ~2" balls of mpf in matrix of CLAYEY SAND, ~60% fine sand, ~40% lpf.	15	5
		20				20	
10		25				25	10
		30				30	
		35	CUT		CLAY w/ SAND ~85% lpf, ~15% fine sand	35	
15		40				40	15
		45	53.2'		R'16	45	
20		50				50	20
		55	CUT		Similar to below SANDY CLAY, ~60% lpf, ~40% fine sand	55	
		60				60	
25		65	53.9'		R'15	65	25
		70				70	
		75	54.2'		SAME AS BELOW SANDY CLAY, ~60% lpf, ~40% fine sand	75	30
30		80				80	
		85				85	
35		90				90	35
		95				95	
40		100				100	40
		105			POSSIBLE R'	105	

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B101U
Sample	U3
Depth	55-57'
Performed by	WGL
Date	12 / 11 / 17

Scale: 1cm = 2mm

GEI Consultants

Inches | Section | Centimeters | Section Sketch | Length of Section | Visual Description | cm | In.

CUT
TOP OF PACKER
LEAN CLAY, ~90% lpf, ~10% fine sand
55.2' C1
CUT — LEAN CLAY w/ SAND, ~85% lpf, ~15% fine sand
SIMILAR TO ABOVE
55.7' R'14
CUT — SANDY LEAN CLAY, ~65% lpf, ~35% fine sand
Similar to below.
CUT — SILTY SAND, ~80% f.s., ~20% v.lpf
57' SILTY SAND, ~80% fine sand, ~20% very low plasticity fines.

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B103
Sample	U1
Depth	29-31 ft
Performed by	DJA
Date	12-28-17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
					Top of Bolt = 13.9 cm		
					Top Packer = [16.5 + 16.5 + 16.45 + 16.5] 1/4 =		
			CUT		SLUICED ASH		
			29.3'		UNIT WEIGHT		
			CUT		SLUICED ASH		
			29.8'		R̄9		
			CUT		similar to bottom, wetter		
			30.6'		UNIT WEIGHT ONLY No test. ~~R̄9~~ Specimen had large void down sidewall upon extrusion		
					Laminated black & gray flyash		

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B1030
Sample	U2
Depth	31.5'-32.7'
Performed by	WBL
Date	1/26/18

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
					DISTANCE TO PACKER (38.6, 38.5, 38.9, 38.5) = 38.6cm		
					TOP OF SOIL: (39.8, 39.8, 39.9, 39.7) = 39.8cm		
					EMPTY		
			CUT		TOP OF SLUICED ASH		
			CUT		SLUICED ASH		
			32.3'		R'15 Unit Weight Only		
			32.7'		SLUICED ASH, SILT		
					BOTTOM OF TUBE		

Record of Laboratory Use of Tube Sample

Project Name	Glen Cyn
Project No.	1700685
Boring	B105U
Sample	U4
Depth	41 - 43 ft
Performed by	MDL
Date	1/3/18

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
		5				5	
		10				10	
5		15			TOP OF SOIL	15	5
		20				20	
		25				25	
10		30				30	10
			CUT				
		35			SLUICED ASH	35	
15		40	41.9'		UNIT WEIGHT ONLY	40	15
		45				45	
20		50				50	20
			CUT		SLUICED ASH		
		55			SLUICED ASH	55	
		60				60	
25		65	42.6'		R'10	65	25
		70				70	
			42.99ft		SLUICED ASH		
30		75			BOTTOM OF TUBE	75	30
		80				80	
		85				85	
35		90				90	35
		95				95	
40		100				100	40
		105				105	

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B106U
Sample	U3
Depth	46.93' - 48.73'
Performed by	WGL
Date	1/15/18

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
					Top of parker bolt: 10.8cm Top of packer (13.5 + 13.5 + 13.6 + 13.6) Top of soil (14.5 + 14.4 + 14.3 + 14.3)		
					Top of soil		
			CUT		SLUICED ASH		
			47.9'		UNIT WEIGHT		
			CUT		SLUICED ASH		
					SLUICED ASH,		
			48.6'		R'12		
			BOTTOM		SLUICED ASH		
					Soil partially flush with bottom.		
				Soil			
				1.5cm			

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B109U
Sample	U4
Depth	45.3 – 47.3 ft
Performed by	DJA
Date	12-27-17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
					11.2 cm to top of packer bolt		
					(14.0 + 13.9 + 13.7 + 14.1)/4 =		
					Top of sample		
			CUT		similar to bottom		
			46.2'		$\bar{R}$ Specimen R'8		
					Laminated gray & black Flyash		
			CUT	16.1 cm	Empty		
					(18.45 + 19.45 + 18.7 + 19.0)/4 =		

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B109U
Sample	U5
Depth	60.15 - 62.64'
Performed by	WGR
Date	1 / 3 / 18

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	in.
					11.1 cm to top of packer bolt (13.7+13.8+13.8+13.7)/4 = 13.8 cm to top of packer (14.4+14.3+14.3+14.4)/4 = 14.4 cm to top of sample		
			CUT		SIMILAR TO BOTTOM		
			61.8'		R'11		
			CUT		SLUICED ASH		
					BOTTOM OF SAMPLE		
					PACKER MOIST RAGS		
					(9.4+8.9+8.9+9.3)/4 = 9.1 cm to packer (11.1, 11.8, 12.5, 11.5)/4 = 11.8 cm to unknown soil		

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B1104
Sample	U2-A
Depth	
Performed by	WGL
Date	11/21/17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
		5				5	
		10				10	
5		15				15	5
		20				20	
		25				25	
10		30				30	10
		35				35	
		40				40	
15		45			TOP OF PACKER	45	15
		50	CUT			50	
20		55			LEAN CLAY WITH SAND, ORANGE	55	20
		60				60	
		65	36.8'		R'3	65	
25		70				70	25
		75	37.2'		REDDISH BROWN SANDY LEAN CLAY W/GRAVEL	75	
		80				80	
		85				85	
30		90				90	30
		95				95	
		100				100	
35		105				105	35
40							40

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700885
Boring	B110 U
Sample	U3
Depth	52.1-54.2'
Performed by	WGL
Date	12/12/17

Scale: 1cm = 2mm

GEI Consultants

Inches | Section | Centimeters | Section Sketch | Length of Section | Visual Description | cm | In.

CUT

Mix of balls of reddish medium plasticity fines and clayey sand, ~60% f-m sand, ~40% low PI fines.

CUT

SANDY CLAY: ~60% hpf, ~40% f-c sand

53.5'

R'7

CUT

53.9'

C2

SANDY CLAY: ~55% hpf, ~45% f-c sand

54.2'

Record of Laboratory Use of Tube Sample

Project Name	Glen Lyn Seismic
Project No.	170685
Boring	B113U
Sample	U1
Depth	23.78
Performed by	MPC
Date	11/27/17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
		5				5	
		10				10	
5		15				15	5
		20				20	
10		25			Top of Packer	25	10
		30				30	
		35				35	
15		40	CUT			40	15
		45	24.8'		R'5	45	
20		50				50	20
		55			cut sandy lean clay brown	55	
		60				60	
25		65	25.4'		R'4	65	25
		70				70	
30		75	25.72'		sandy lean clay brown Bottom of Tube	75	30
		80				80	
		85				85	
35		90				90	35
		95				95	
40		100				100	40
		105				105	

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B114
Sample	V1
Depth	23-25'
Performed by	WCA
Date	2/19/18

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
					Top of packer: (14.8, 14.6, 14.5, 14.7 cm) 15.8cm to top of soil		
					Top of soil		
			CUT				
			VOID		STACKED ASH, ~85% Fines, ~15% F. sand		
			24.7'		UNIT WEIGHT		
			25.0'		STACKED ASH, Similar to above		
					BOTTOM		
					Bottom of soil interval		
			0cm		2.5cm		

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700685
Boring	B115U
Sample	U1
Depth	20–21.91
Performed by	WDL
Date	2/16/18

Scale: 1cm = 2mm

GEI Consultants

Inches | Section | Centimeters | Section Sketch | Length of Section | Visual Description | cm | In.

EMPTY

Cut at 49.4cm
Packer flowed over top ash

CUT

8.4, 8.6, 7.8, 8.8 to soil

CUT

DRY SLUICED ASH

21.7'

UNIT WEIGHT

21.9'

DRY SLUICED ASH
SOIL FLUSH

Record of Laboratory Use of Tube Sample

Project Name	GLEN LYN
Project No.	1700665
Boring	B116J
Sample	U1A
Depth	
Performed by	
Date	

Scale: 1cm = 2mm

GEI Consultants

Inches | Section | Centimeters | Section Sketch | Length of Section | Visual Description | cm | In.

CUT

TOP OF SOIL

~60% fine sand, ~35% f-c gravel up to 1.5", 5% low plasticity fines

PROBABLY TOO SANDY FOR TE

SILTY SAND, ~80% fine sand, ~20% n-p fines

BOTTOM OF PACKER — CUT

Record of Laboratory Use of Tube Sample

Project Name	1700685
Project No.	Glen Lyn
Boring	B119 UA
Sample	U1
Depth	23.9-25.4 ft
Performed by	EF
Date	12/1/17

Scale: 1cm = 2mm

GEI Consultants

Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
		5				5	
		10				10	
5		15				15	5
		20				20	
		25				25	
10		30				30	10
		35			TOP OF PACKER	35	
		40				40	
15		45				45	15
		50				50	
		55				55	
20		60				60	20
		65	25.1 ft		R16	65	
		70				70	
25		75				75	25
		80			Lean Clay; Reddish brown, trace fine gravel.	80	
		85				85	
30		90				90	30
		95				95	
		100				100	
35		105				105	35
40							40

Record of Laboratory Use of Tube Sample

Project Name	Glen Lyn
Project No.	170085
Boring	B1220
Sample	U2
Depth	9-11'
Performed by	WR
Date	2/16/18

Scale: 1cm = 2mm

GEI Consultants

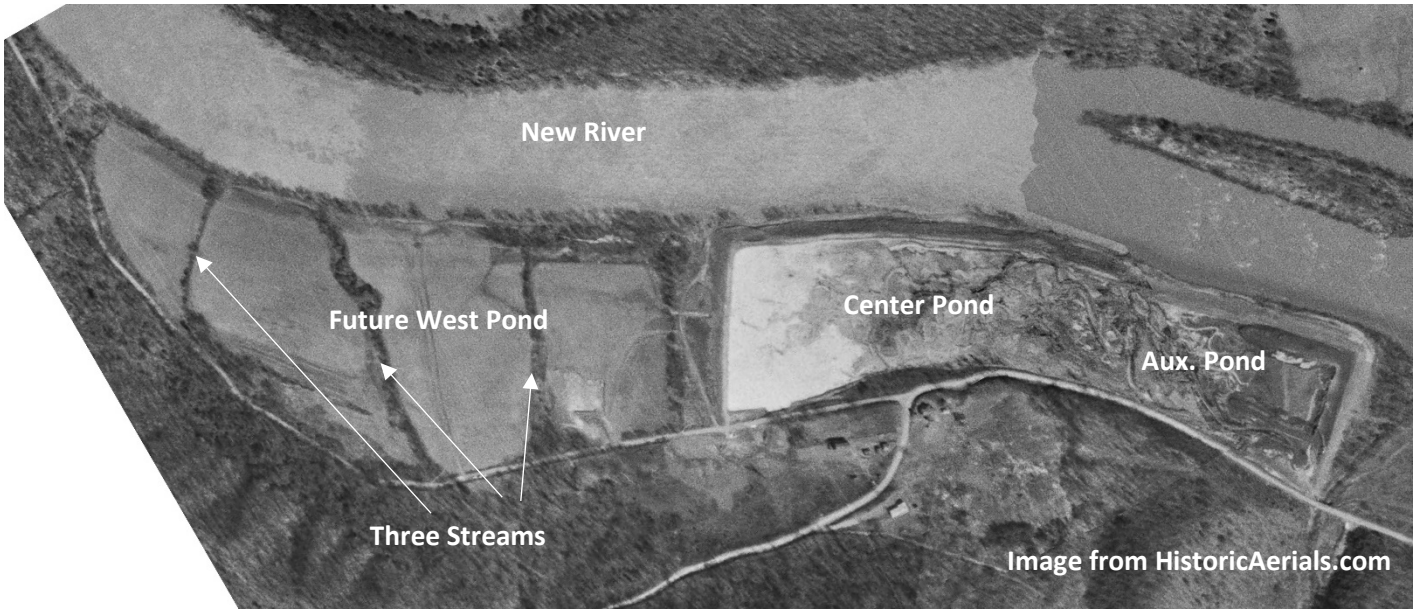
Inches	Section	Centimeters	Section Sketch	Length of Section	Visual Description	cm	In.
					Top of soil: 7.6, 7.9, 7.9, 7.9 cm		
			CUT		SIMILAR TO BOTTOM		
			10.7'		UNIT WEIGHT		
			11'		STACKED BOTTOM AND FLY ASH SOIL FLUSH		

ATTACHMENT C

Chronology of Ash Placement

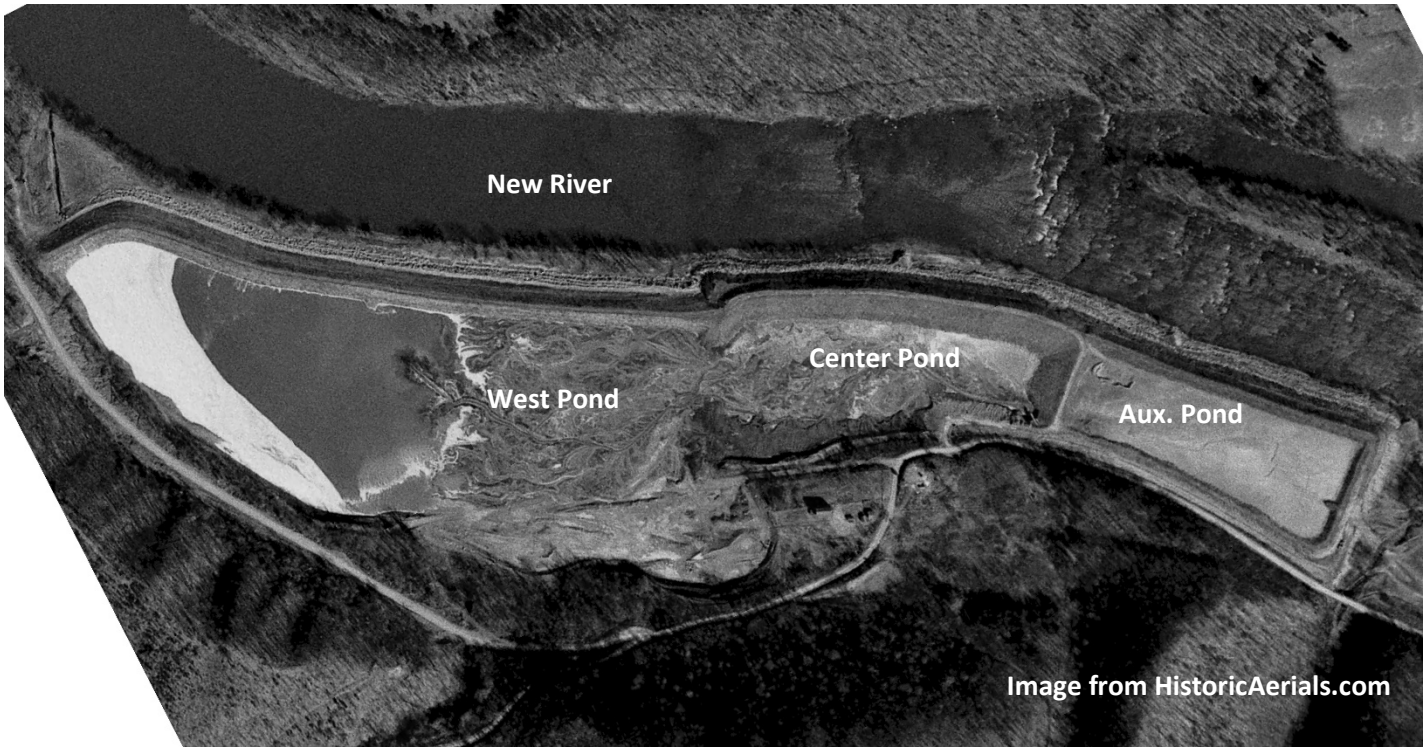
Glen Lyn Plant Ash Storage Area Chronology

Year	Description	Reference
1958	Auxiliary Pond and Center Pond dikes were built and the disposal area went into service. The original dike was constructed to El. 1525.	TWAbolinCorrespondence1959.pdf
1960	A section of the fly ash area dike (combined pond that in the future is divided into the Aux. Pond and Center Pond) failed towards the river. The section was located near the north (northwest) corner of the dike (future Center Pond). A letter from Casagrande Consultants from 1972 suggests that the failure occurred due to weak foundation soils in the area.	April 1960-DikeFailure.pdf
1963	Future Auxiliary Pond and Center Pond (not yet divided) in use, with ash being sluiced in. There is no dike separating the two ponds. The West Pond has not been constructed, but it appears to have been cleared. The Aux. Pond and Center Pond dike was raised to El. 1535 using dry fly ash.	1963-Aerial.jpg Glen Lyn Aux Pond Geotechnical Cross Sections.pdf

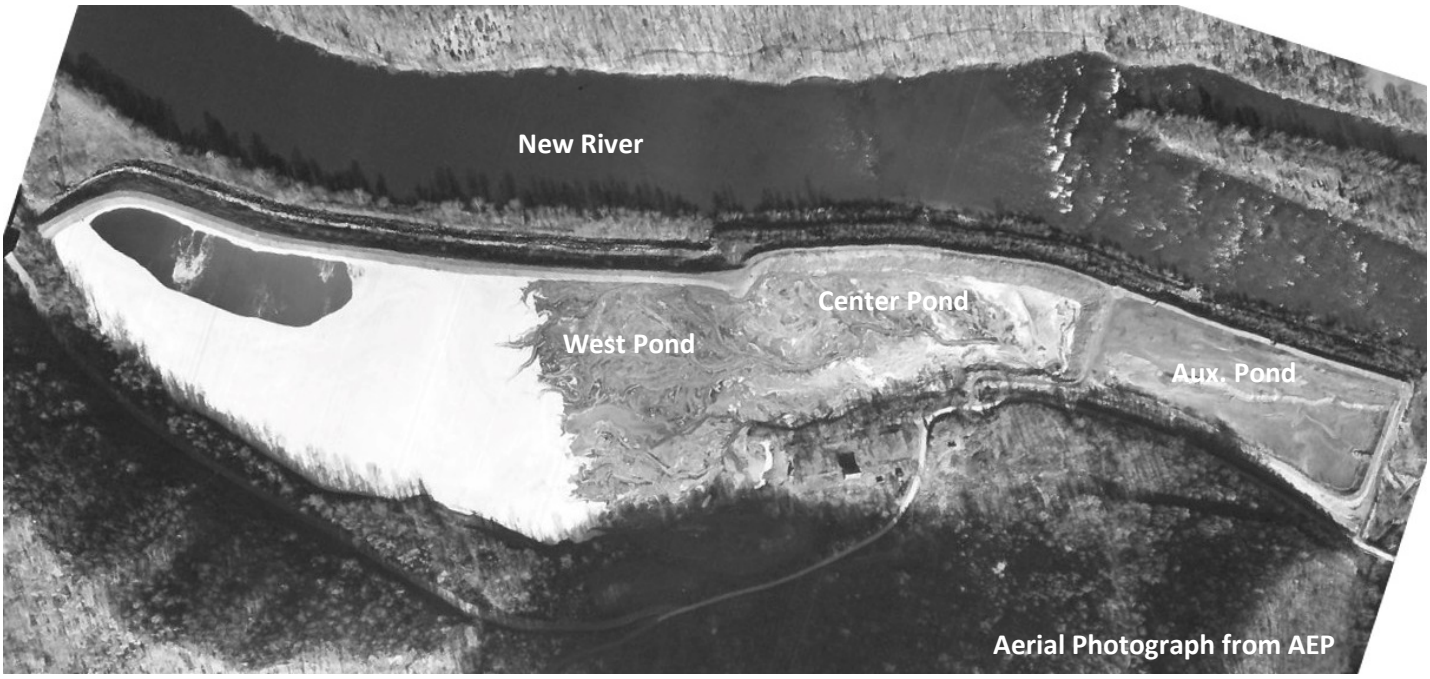


1964-1965	Drawing showing the existing topo and the proposed West Pond dikes. The existing Auxiliary Pond and Center Pond are shown, with an existing dike separating them. The drawing shows an existing dike between the Center Pond and the future West Pond. The middle of that dike is 12 ft lower than the rest of the dike surrounding the Center Pond (El. 1523 vs, El. 1535), implying that if the Center Pond filled up, it would spill into the future West Pond. The drawing also shows a future dike in the middle of the Center Pond (which we think was never built).	S-AP-2670-3621c-rev4 1964-1965.tif

1965	The West Pond perimeter dike was built between 1964 and 1965 as shown on construction photographs. A 1957 thru 1973 drawing also states that the West Pond was constructed in 1965 up to El. 1536. The dike through the middle of the Center Pond is still shown as a "future" dike (which we think was never built). A 2013 geotechnical cross section through the Aux. Pond (drawn by AEP?) states that the Aux. Pond (and Center Pond?) dike was raised to El. 1540 using dry fly ash in 1965.	WestPondDikeConstructionPhotos.pdf 6-3621B-rev6_1957-1973.tif
1967	Aerial image shows West Pond in use for sluicing ash. It appears that ash in the Center Pond has been excavated. The center of the dike between the Center Pond and West Pond is covered with what appears to be sluiced ash. The Auxiliary Pond looks like it is full of ash with no water on top.	1967-Aerial.jpg



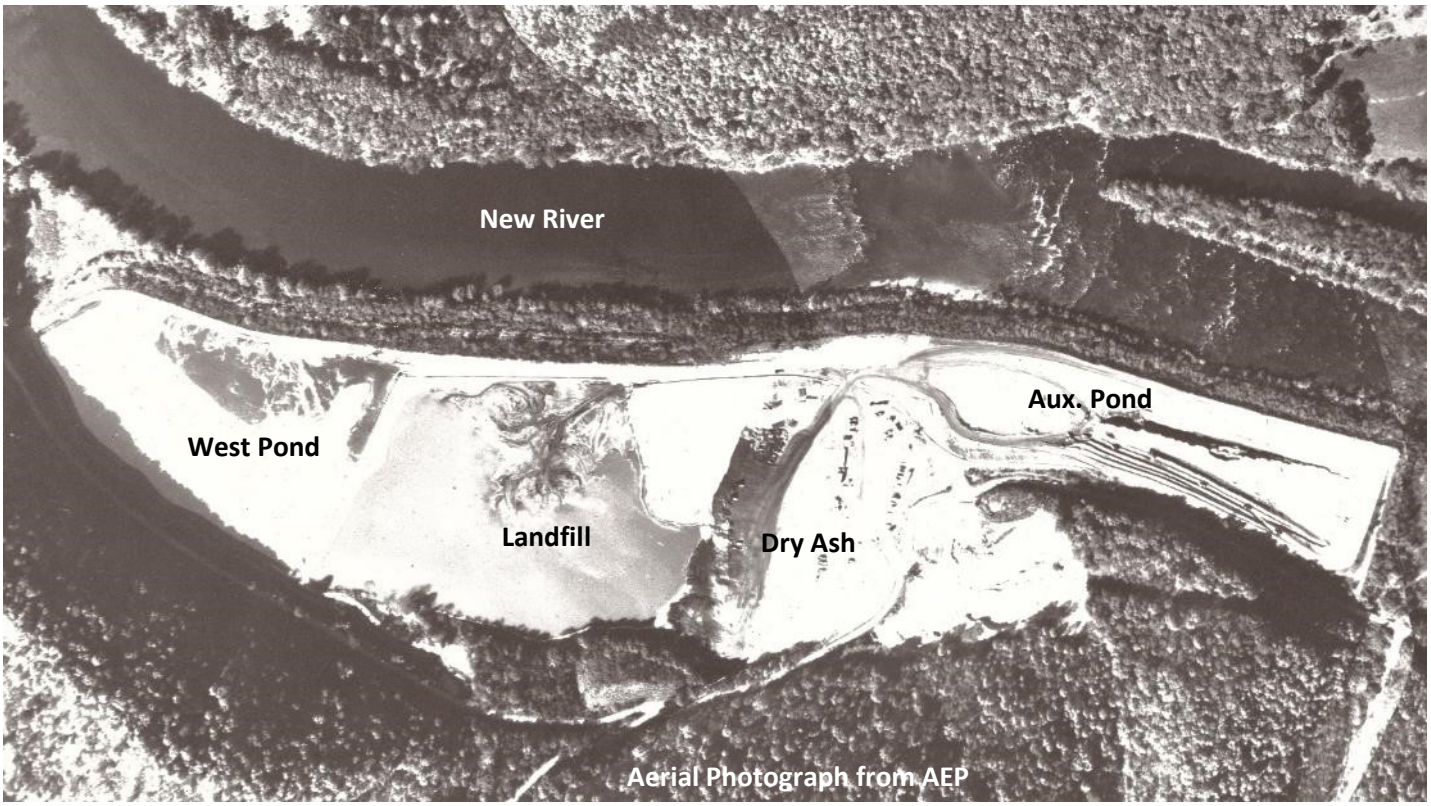
1971	Aerial photograph shows the West Pond/Center Pond in use for sluicing ash. The dike between these two ponds is not visible. At this time, along the river, the Center Pond/Auxiliary Pond Dike is 4 ft higher than the West Pond dike.	Aerial 1.pdf



1972	Borings were performed along the West Pond, Center Pond, and Auxiliary Pond Dikes. Ash is present in some of the boring logs which were performed on the raised ash dikes, and in pond areas where dry ash had been placed to provide a working surface for the drill rigs.	1972 Dike Borings - AEP.pdf
	There is a 1972 letter from Casagrande Consultants discussing analyses performed on three proposed sections for new dike extensions. It is unclear where these sections were proposed. (This is the letter that referred to weak foundation soils causing the 1960 dike failure.)	Casagrande Correspondence 1972.11.23.pdf

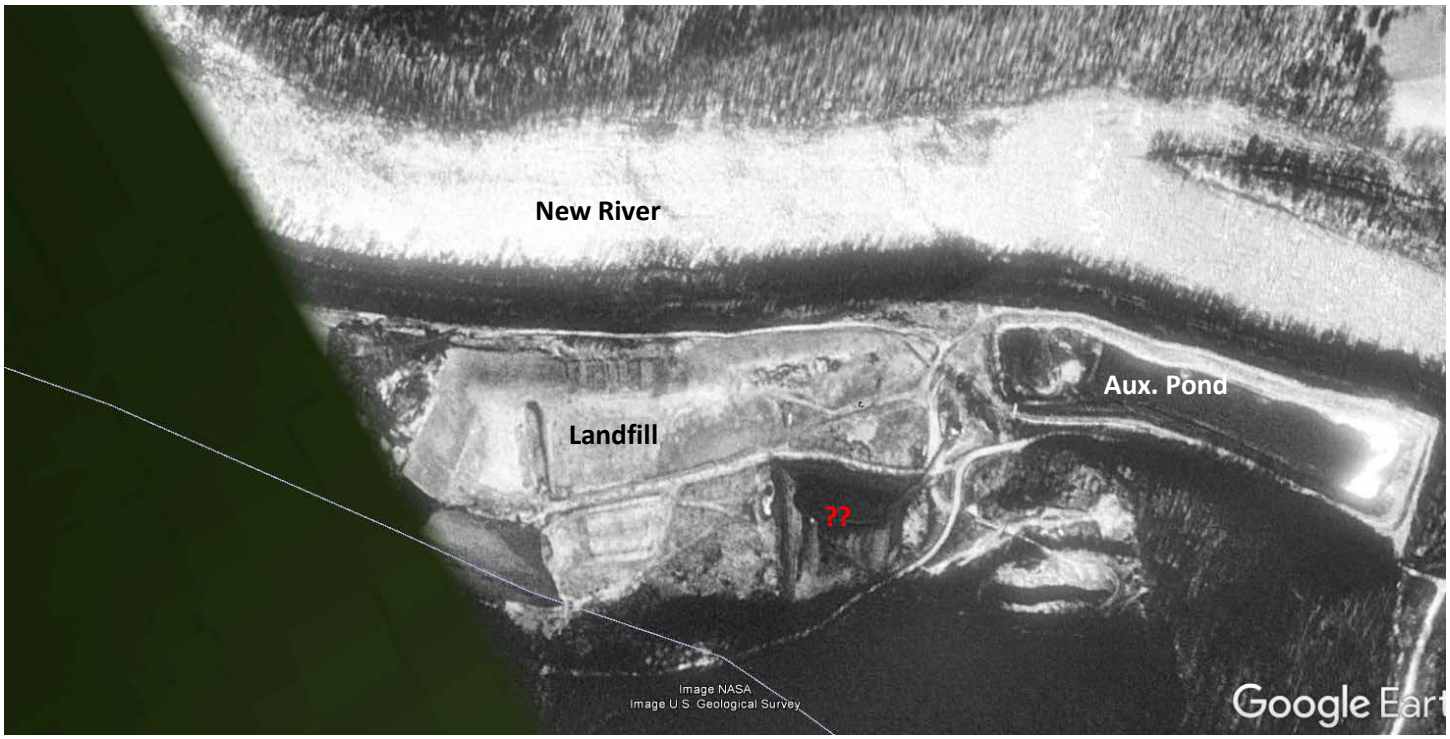
1973	Drawing showing: • Proposed dike (located at the east edge of the current leachate collection pond). To the east of this dike, the West Pond becomes the Landfill. However, for a few years after the dike was built, ash was both dry-stacked and sluiced in the Landfill area. To the west of this dike, the West Pond continues in use for sluicing. • Existing topo (ash surface) in West Pond/future Landfill is 1527 to 1528. • The West Pond (future Landfill area) and Center Pond are combined. The dike between the Center Pond and West Pond is no longer shown in the drawing. Some of that dike may be covered, but some must have been excavated. • The dike between the Center Pond and the Auxiliary Pond is still shown on the drawing. • Proposed excavation of existing ash in part of the Center Pond and in the Aux. Pond, to create new storage space. This excavation will remove part of the dike mentioned in the previous bullet. This excavation will merge the Aux. Pond and the east portion of the Center Pond into what we now call the Aux. Pond. Construction photos from October 1973 show the Aux. Pond excavation and a clay liner being placed on the excavated slopes of the Aux. Pond. An internal AEP letter from November 1973 on compaction testing on the fly ash at Glen Lyn states: "The flyash storage area at Glen Lyn will consist of two ponds into which the material will be sluiced and a central area where fly ash will be dry stored. As one of these ponds is being filled, the other draining one will be excavated and the material hauled and placed into this dry storage area. When one pond has become full, which should happen in the space of about a year, the other will have been completely excavated, and the sluicing operation will be shifted." We interpret this to mean that ash will be dry stacked in the east portion of the Landfill area, while sluicing and excavation of ash alternates between the Auxiliary Pond and west portion of the Landfill area (per 1976 aerial photo below).	16-3540 rev3_1973-1979.tif ClayLinerInAuxPond.pdf DPCavaliereCorrespondence1973.11.15.pdf
1974	According to "Flood Level and Floodway Study, AEP 2014, revised 2016," ash disposal operations switched from wet disposal to dry landfill disposal. This might refer to the start of the dry storing material excavated from the sluicing ponds.	

1976	Aerial photograph shows the excavation in the Auxiliary Pond that was shown in the 1973 drawing. The dike between the West Pond and the Landfill area has been constructed. It appears that dry ash is being placed in the east half of Landfill (specifically, the area that was the west portion of the original Center Pond and the east portion of the original West Pond). It appears that ash is still being sluiced into the west portion of the Landfill. This photograph shows what was described in the 1973 letter mentioned above.



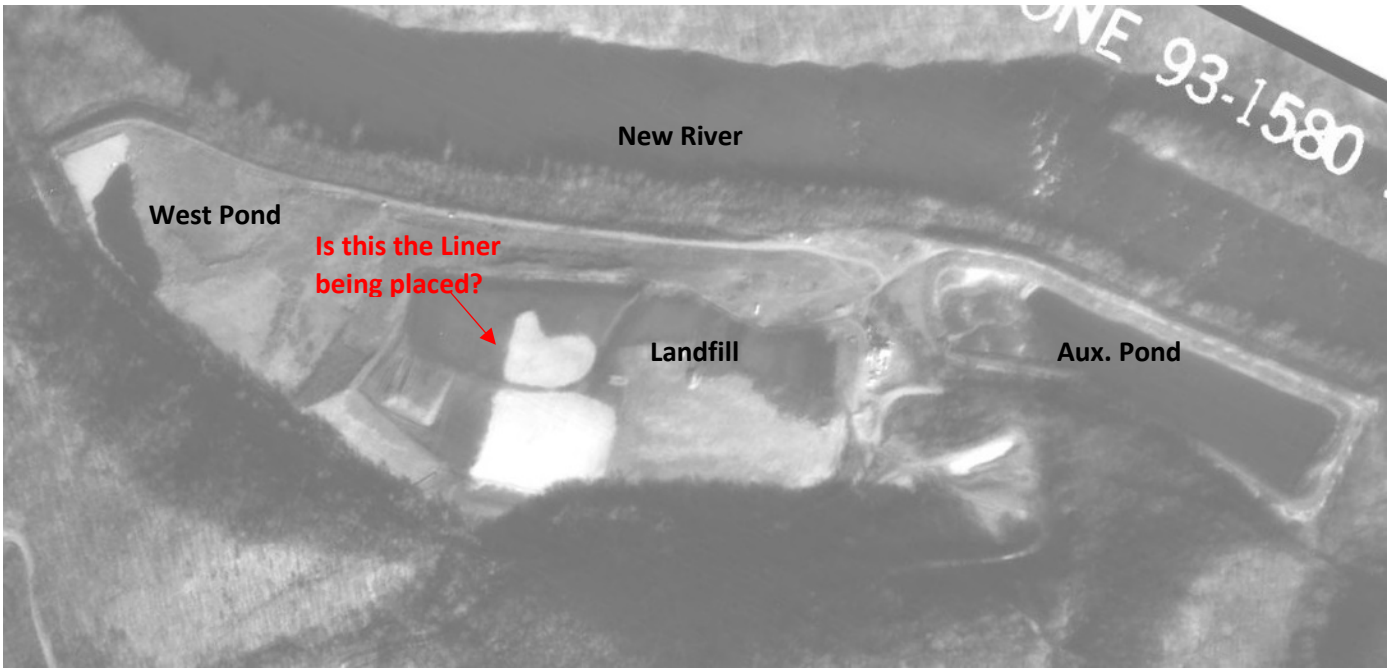
1977 to 1989	We have no specific information for this period. At some point, the dike along the West Pond and Landfill was raised. According to the 1973-1979 drawing, the dike elevation was 1536. Based on the borings performed by GAI in 1990, the dike elevation was 1537 at the West Pond and 1542 at the Landfill. The 1992 topo plan confirms this, showing that the dike elevation was 1537 at the West Pond and increasing gradually to 1544 at the east end of the Landfill.

1990	B-series borings performed by GAI and wells installed. Aerial photo from 1990 is not very good quality, but the Auxiliary Pond looks like it has water and the Landfill looks dry stacked. There is a dark area (possible excavation?) in the south east corner of the Landfill.	1990-Aerial.jpg



1991	Drawings by GAI showing proposed ash landfill closure, including the leachate collection pond, intermediate capping and leachate collection system, and the proposed final grading and capping.

1993	Aerial photograph does not show the leachate collection pond. It appears that closure activities are ongoing at the Landfill. (Do very dark and very light areas correspond to membrane and drainage layers?) The Auxiliary Pond looks like it is filled with water.	1993 Aerial.jpg



1996	Aerial photograph shows filling of landfill, leachate pond already constructed (Maybe Phase 2 of 5 from 1991 drawings).	56-30105.tif



2001	Aerial photograph shows filling of landfill (Phase 4 of 5 from 1991 drawings).	56-30107.tif

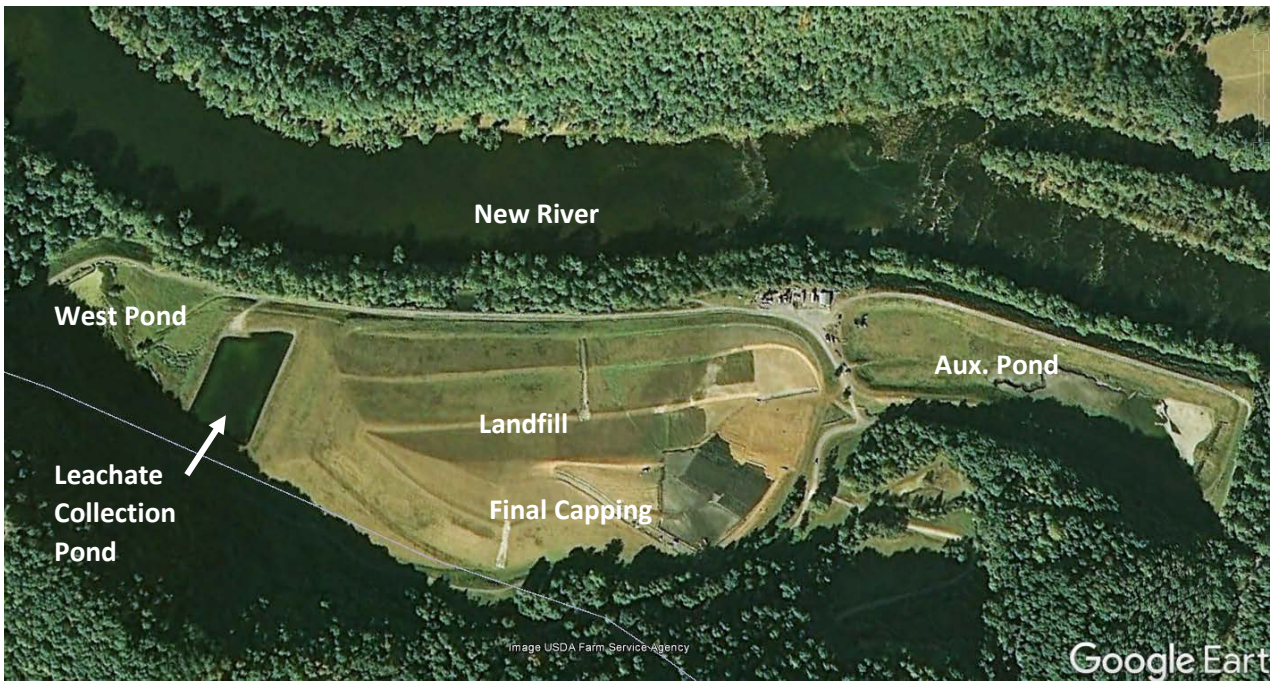


2003	Aerial photograph shows grading of the top of the landfill and filling of the south side (Phase 5 of 5 from 1991 drawings).	56-30108.tif

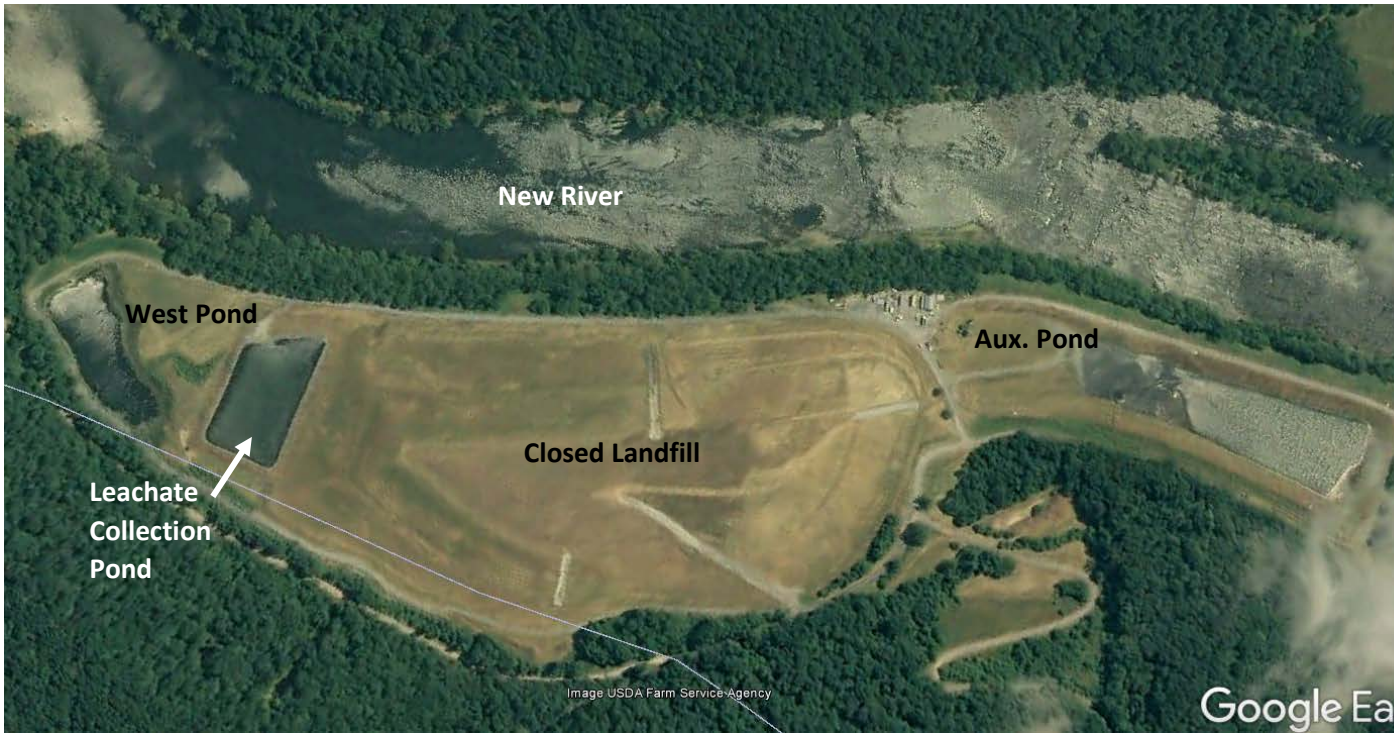


2004	AEP construction photo log (from some time after 2004) refers to a section of liner placed in 2004.	Construction Photo Log.pdf
2007	Aerial photograph shows capping of southern corner of landfill (Drawing 56-30109 from 1991 drawings). Construction photo log (presumably from 2006 or 2007) shows compaction of ash and placement of liner for cap.	56-30109.tif





2008 Aerial photograph shows landfill with final capping complete.



2009 Borings performed by MACTEC.

2011 Aerial Image shows the Auxiliary Pond (full and?) dry.



2015 Aerial Image shows the Auxiliary Pond capped and the dikes cut down. Topography shows the elevation of the Aux Pond goes from to El. 1540 on the West side sloping down to El. 1525 on the East.



ATTACHMENT D

Design Drawings

DR. No. 6-3621-A-5

FOR ADDITIONAL EXTENSIONS SEE DWG No. 16-3540

THESE AREAS REVISED SEE DWG. No. 16-3540

RIVER

Edge New River

TOP OF DIKE

Toe of Slope at Bottom of Excavation El 1495.5

New 1963 dike extension up to el. 1535' shown in cross-section only (for 1964 analysis of this storage see dwg E-AP-2670-3621-C)

Existing Storage Area Dike 5-36-A & 5-36-B

Existing Storage Area Dike 6-36-A

Existing Storage Area Dike 6-36-B

Existing Storage Area Dike 7-36-A

Existing Storage Area Dike 7-36-B

Future ash disposal area See Dwg. 5-36-C-3 & E-AP-2670-3621-C

Note "A"

Filter grave analysis:	
Screen	Passing %
1"	100
3/4"	80
1/2"	35
No. 16	20
No. 100	6

Detail "J"

Section E-E (Typical)

Scale: 1"=20'

Dike extension to be built from ash with cover of soil on outside slope

Existing top of ash

Top of dike el. 1550

New top of dike el. 1535'

Existing top of dike elev. 1533'

20 feet perforated horizontal pipe

Rock-fill on river side of dike only

6" dia. perforated pipes as shown to be installed @ 150' c. c. & perforated pipe to be installed along the dike extension as shown on dwg. "J"

Section E-E (Typical)

Scale: 1"=20'

Top of dike el 1535'

Existing contours

Existing top of ash

Section G9-G9

Scale: 1"=10'

NOTES:

For Drain Shaft Plans & Sections See Dwg. G-3963-A AP-2534-3993

Dike Fill (Includes 15% Cover) 1,238,000 Cu. Yds.
Cut (Fly Ash Area To El. 1490 & Th. 1995 Out Slope) 1,042,000 Cu. Yds.
Fill for Dike Extension from 1528' to 1535' 46000 cu yds
Fill for New Fut Dike (West from Existing) from El. 1500' to 1535' 196,000 Cu. yds.

ORIGINAL CONSTRUCTION

REVISIONS

FLY ASH DISPOSAL AREA

APPALACHIAN ELECTRIC POWER CO.
GLEN LYN PLANT
GLEN LYN, VIRGINIA

DR. No. 6-3621-A-5

ARCH. | ELEC. | MECH. | STR.

SCALE 1"=60'
DR. [illegible]
CK.
DATE 5-29-64

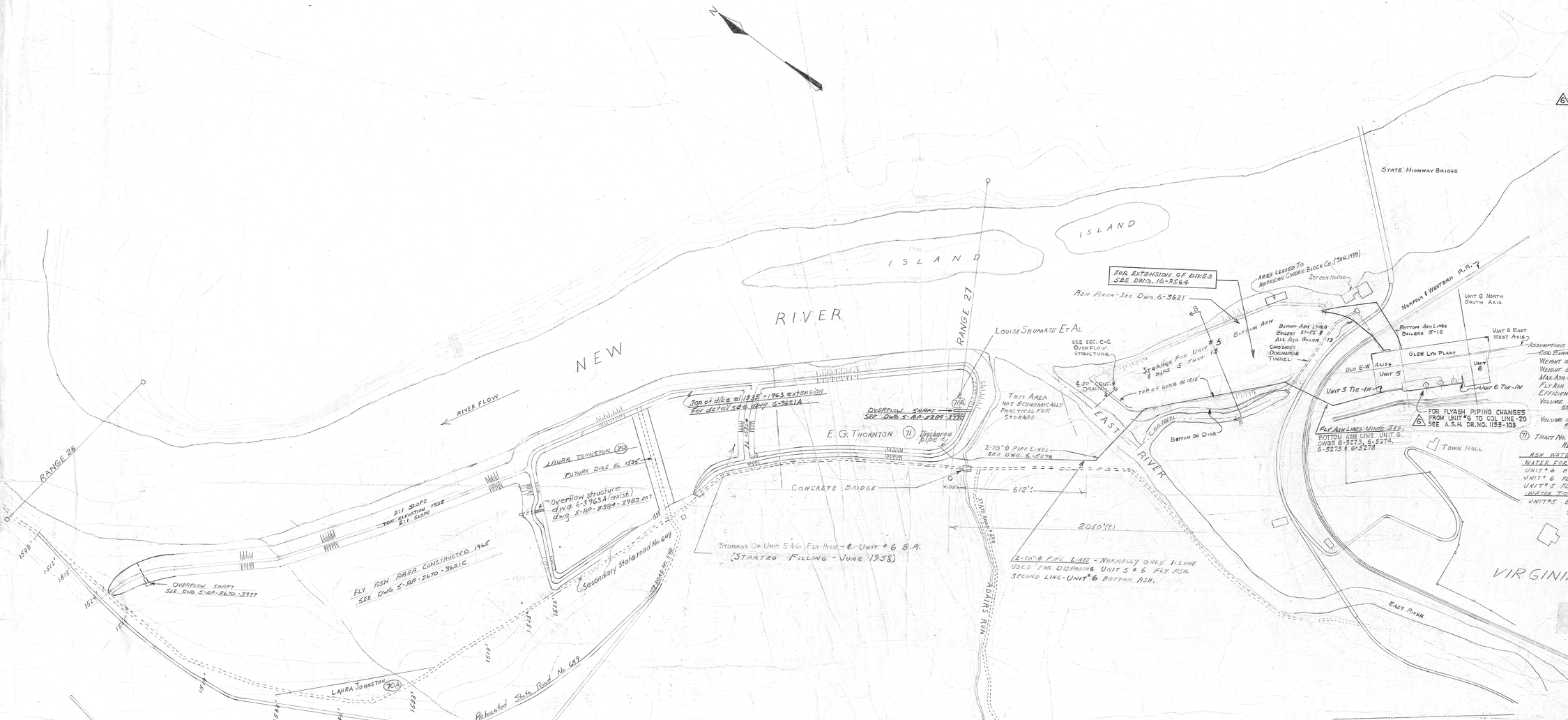
APPROVED

AMERICAN GAS & ELECTRIC SERVICE CORP.
30 CHURCH STREET NEW YORK

19-1 10 6-3621-A

AEP Confidential - Moderate Risk - Approved - 3621A - 05/08/1968 - plt_6_awp_3621a_5.tif

DR. NO. 6-3621B-6



REFERENCE DRAWINGS

4761-1061A - General Location Plan
6-5924 - Unit No. 6 Plot Plan
6-3621 - Bottom Ash Disposal Area
6-5274 - Fly Ash & Bottom Ash Pipe Line
6-3623 - Fly Ash Drainage Diagram
6-3979 - Ash Pipe Trench & Drainage Details
6-5279 - Arrgt. of Unit 6 Fly Ash Lines
Other Roads
6-5273 - Arrgt. of Unit 6 Bottom Ash Lines
6-5278 - Arrgt. of Unit 6 Ash Storage Area
4761-3295 - General Arrgt. of Ash Disposal Area
Ash Storage Area Plan Sheet 1 of 2
Ash Storage Area Plan Sheet 2 of 2

FOREIGN DRAWINGS

W. Va. Pioneer & Bluestone Projects
Corps of Engineers U.S. Army Map
Real Estate - Bluestone Reservoir
Sta. No. 1+00

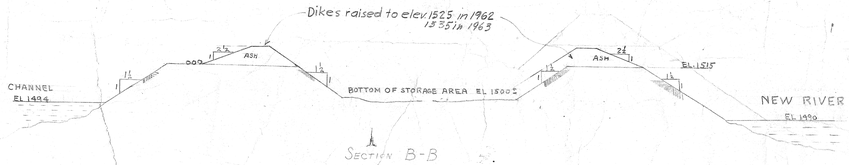
NOTES

1. Assumptions:
   - Coal Burn Required for Units 5&6: 850,000 Tons/Year
   - Weight of Fly Ash 65 #/Ft.³
   - Weight of Cinders 50 #/Ft.³
   - Max. Ash Content 15%
   - Fly Ash 80%
   - Efficiency of Collectors 90%
   - Volume of Fly Ash $\frac{850000 \times 2000 \times 15\% \times 80\% \times 90\%}{65 \#/Ft^3}$ = 104,630 Cu Yds./Yr.
   - Volume of Cinders $\frac{850000 \times 15\% \times 20\%}{50 \#/Ft^3}$ = 37,780 Cu Yds./Yr.
2. (71) Tract No. Corps of Engineers Bluestone Reservoir Project Reference
3. Ash Water Consumption Data:
   - Water for New Ash Area
     - Unit #6 Bottom Ash - 2450 GPM Approx Running Capacity
     - Unit #6 Fly Ash - 1,000 GPM - 24 Hrs/Day "
     - Unit #5 Fly Ash - (1,000 GPM) - 24 Hrs/Day "
   - Water to Old Ash Area
     - Units #5 Bottom Ash - 2,000 GPM, 5 Hrs/Day Operation
     - Total Water Consumption
       - New Area - 1,264,000 Gals/Day
       - Old Area - 400,000 Gals/Day
4. School

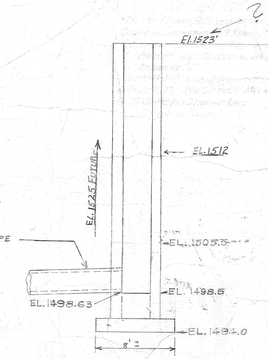
Information from H. Beal 7/20/62:

Ash Production:

Fly Ash of Unit 5&6	168,000 yd³/year
Bottom Ash of Unit 6	35,000 yd³/year
Bottom Ash of Unit 5	13,000 yd³/year



SECTION B-B
SECTION THRU DIKE
SCALE 1"=30'



SECTION C-C
30" CONDUCT PIPE & OVERFLOW STRUCTURE
SCALE 1"=6'-0"

STRUCTURE DESIGN PER CABIN CREEK DWG 5-68-3581

THIS DRAWING WAS FORMERLY 3-SK-11854

DATE	No.	DESCRIPTION	APPD.
10/16/73	6	ADDED REFERENCE DRAWINGS (0.2) 1,000 GPM WAS 420 GPM (0.3) ADDED NOTE (M.4) PROJECT NO. P2337	R.L.
5/13/63	5	Added new 1962 & fly ash storage: raised dike extension	V.E.P.
1/61/62	3	ADD WATER C.	V.E.P.
7-8-61	2	SHOWED OVERFLOW & IN ASH AREA N.E. OF EAST RIVER	D.T.W.
5-27-61	1	SHOWED UNDERPASS & ELEVATION AREA N.E. OF EAST RIVER	H.M.H.

REVISIONS

ASH STORAGE AREA PLAN

APPALACHIAN ELECTRIC POWER CO.
GLEN LYN
VIRGINIA

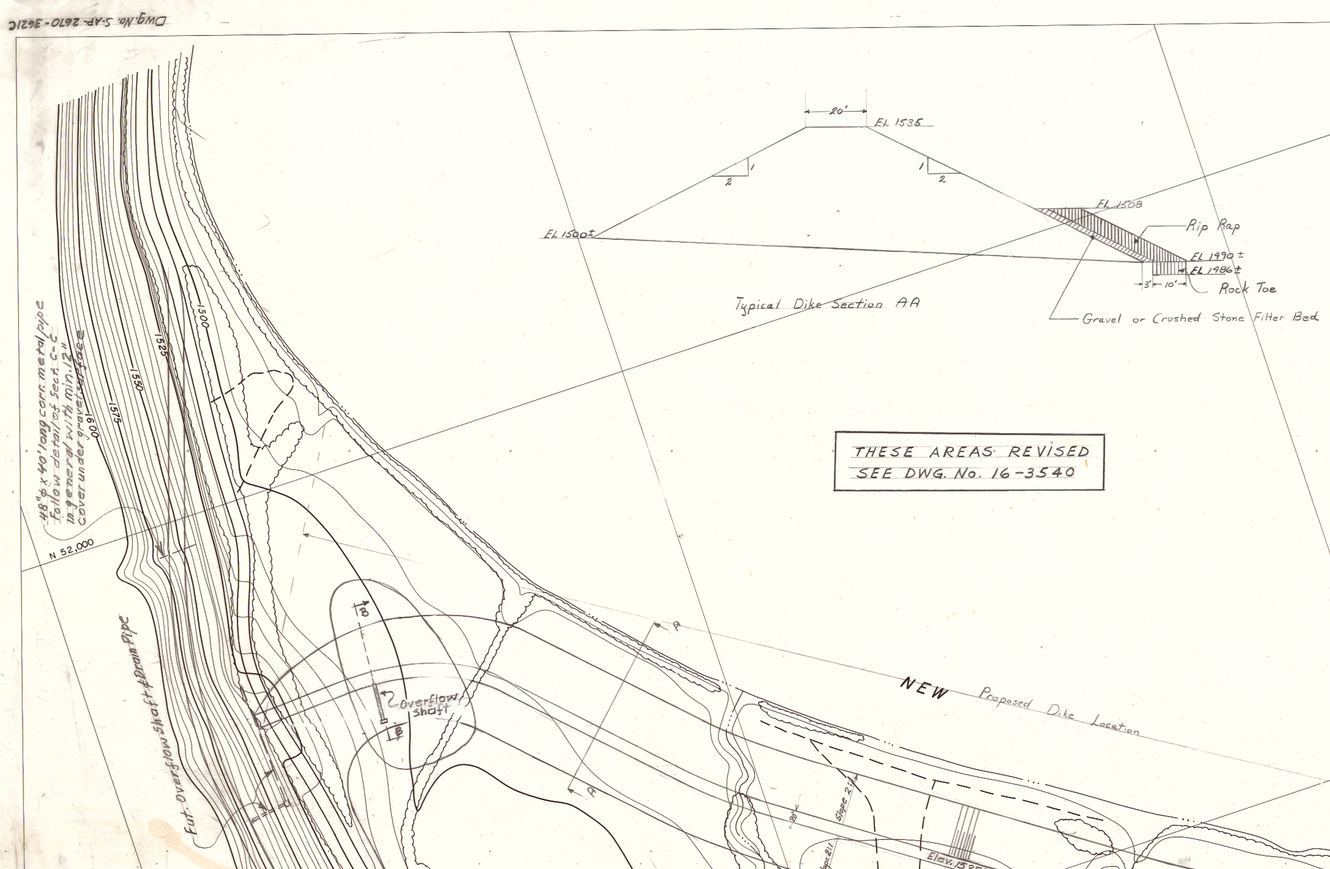
DR. No. 6-3621B-6

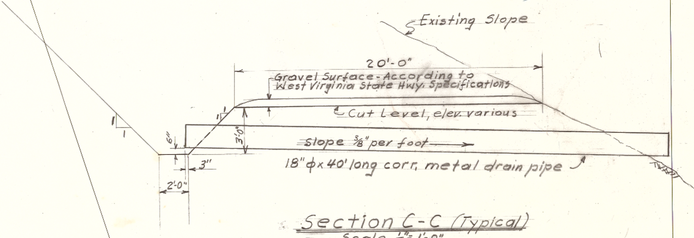
ARCH.	ELEC.	MECH.	STR.

SCALE 1"=200' APPROVED
DR. R.P.N.
CH. H.A.F.
DATE 3-27-62

AMERICAN GAS &
30 STREET

Dwg. No. S-AP-2670-3621C





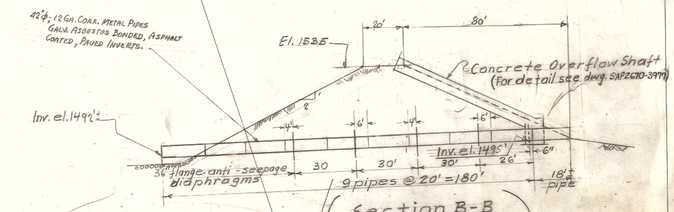
THESE AREAS REVISED
SEE DWG. No. 16-3540

NOTE:

When placing borrow materials within the dike, one of the following two schemes may be used if there is a clear distinction between clayey & sandy soils:

a) Place the sandy soils within the outside half section, and the clayey soils within the inside half section;

b) Place the clayey soils in a central core zone, and the sandy soils in the outer zones.



Revisions:

Date	No.	Description	Appd
9/22/64	1	Added Section B-B, C.C. culverts & revised road 649	WAF
9/29/64	2	Revised Section B-B	WAF
1-20-65	3	General Revision	WAF
5-19-65	4	REVISED SECTION B-B	S.S.

TOPOGRAPHIC MAP
OF
GLEN LYN POWER PLANT
(ASH DISPOSAL PLANT)
GILES CO. VA. and MERCER CO. W. VA.
SCALE 1" = 100' CONTOUR INTERVAL 5'

FLY ASH DISPOSAL AREA

DWG. No. S-AP-2670-3621C-4

DATE: 1-20-65

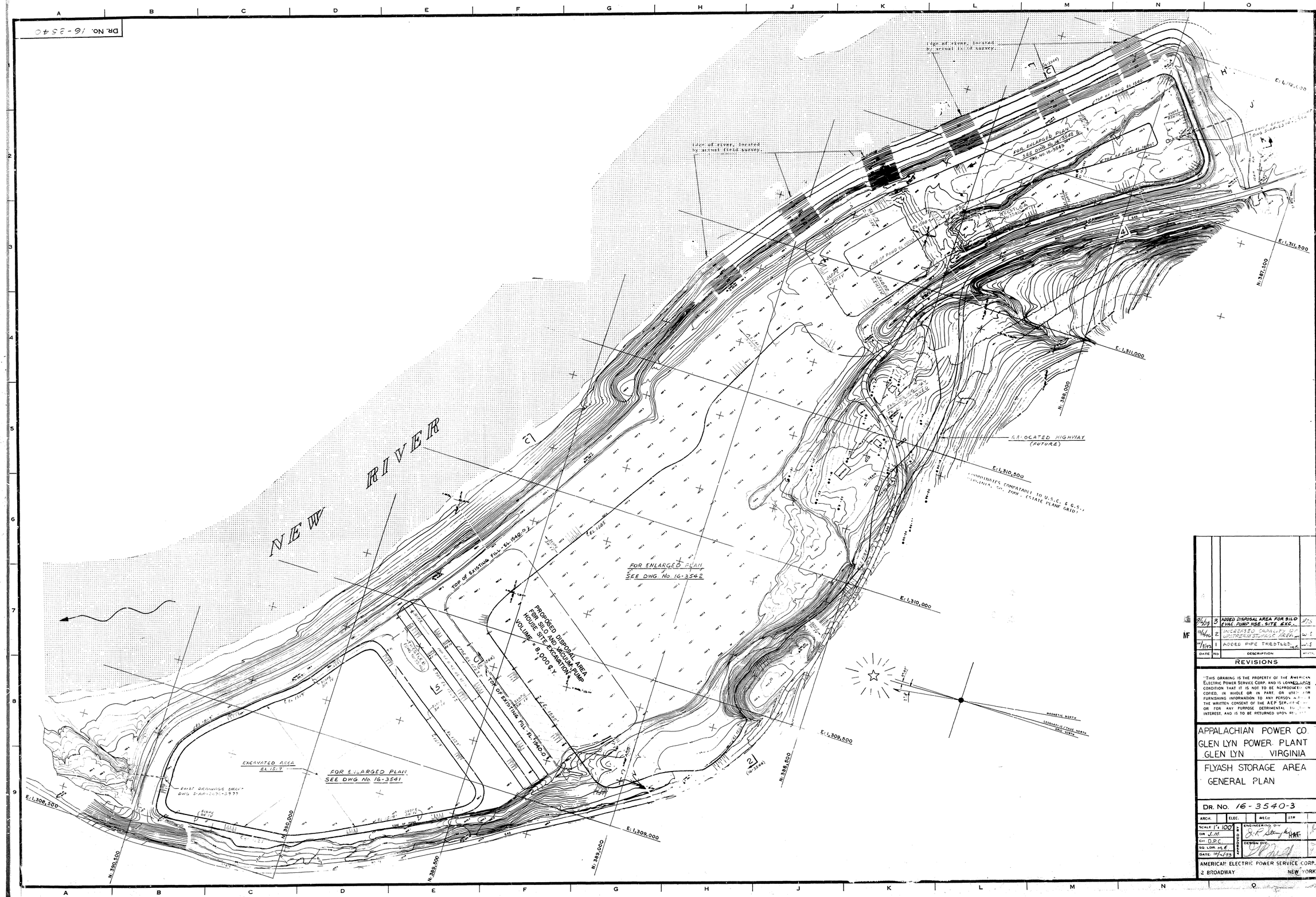
PREPARED BY
Aerial Map Service Co.
Pittsburgh, Pa.

GLEN LYN PLANT
DWG. No. S-AP-2670-3621C-4

9-1 1

3047

DR. No. 16-3540



DATE	NO.	DESCRIPTION	APPD.
2/4/74	3	ADDED DISPOSAL AREA FOR SILO & VAC. PUMP HSE. SITE EXC.	J.T.
12/4/73	2	INCREASED CAPACITY OF WASTEWATER TREATMENT AREA	W.S.
11/9/73	1	ADDED PIPE TRESTLES	W.S.

REVISIONS

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APPALACHIAN POWER CO.
GLEN LYN POWER PLANT
GLEN LYN VIRGINIA

FLYASH STORAGE AREA
GENERAL PLAN

DR. No. 16-3540-3

ARCH.	ELEC.	MECH	STR
SCALE 1"= 100'			
DR J.M.	ENGINEERING DIV. J.K. Stanley		
CH D.P.C.	DESIGN DIV.		
SQ. LOR. M.E.			
DATE 10/1/73			

APPROVED BY

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

DR. NO. 16-3542

NEW RIVER

MATCH LINE - FOR CONTINUATION SEE DWG 16-3541

MATCH LINE - FOR CONTINUATION SEE DWG NO. 16-3543

PANEL #13 EL. 1535.97

PANEL #16 EL. 1541.98

PANEL #4-A EL. 1537.90

PANEL #3 EL. 1523.75

PANEL #5-A EL. 1562.21

PANEL #5 EL. 1560.56

PANEL #6 EL. 1617.53

PANEL #7 EL. 1562.13

EL. 1585'

SLOPE 2.5H:1V

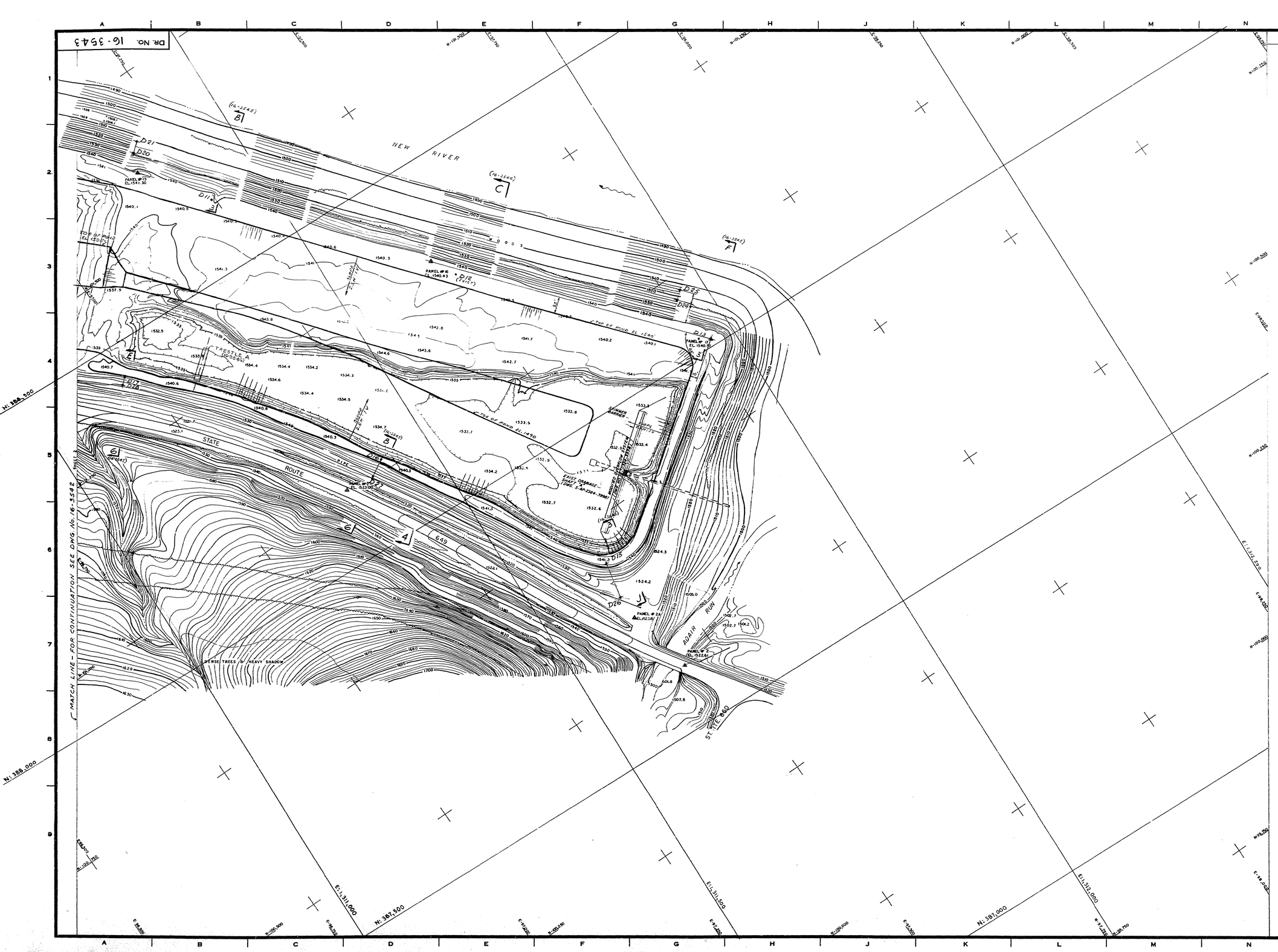
SLOPE 3H:1V

SLOPE 2H:1V

SLOPE 2.5H:1V

SLOPE 2.5H:1V

SLOPE 2.5



AERIAL SURVEYS, INC.
CLEVELAND, OHIO
AS1 613

PREPARED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY TAKEN 12-22-71 & 3-6-72.

VERTICAL AND HORIZONTAL CONTROL FURNISHED BY APPALACHIAN POWER CO.

DATE	No.	DESCRIPTION	APPD.
12/4/72	1	INCREASED CAPACITY OF STORAGE AREA.	

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APPALACHIAN POWER CO
GLEN LYN POWER PLANT
GLEN LYN · VIRGINIA

FLYASH STORAGE AREA
DIKES

SHEET 3 OF 3

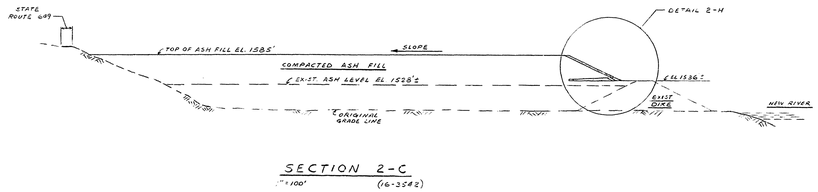
DR. NO. 16-3543-1

ARCH.	ELEC.	MECH.	STR.

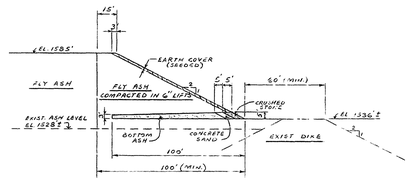
SCALE: 1" = 50'
DR. J. M.
CH. D.P.C.
SQ. LDR. M. A.
DATE: 10/2/77

APPROVED BY
ENGINEERING DIV. J. R. Stump
DESIGN DIV. G. P. Wilk

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK



SECTION 2-C
1"=100' (16-3542)



DETAIL 2-H
1"=40' (16-3 44)

SECTION 4-C
1"=50' (16-3543)

SECTION E-C
1"=20' (16-3541)

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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APPALACHIAN POWER CO.
GLEN LYN POWER PLANT
GLEN LYN VIRGINIA

FLYASH STORAGE AREA
DIKE SECTIONS
SH. 1 OF 2

DR. NO. 16-3544

ARCH.	ELEC.	MECH.	STR.
SCALE AS NOTED		ENGINEERING DIV.	
DR. J.M.	APPROVED BY		
CH. D.P.C.		DESIGN DIV.	
SO. LDR. M.E.			
DATE 10/2/73			

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

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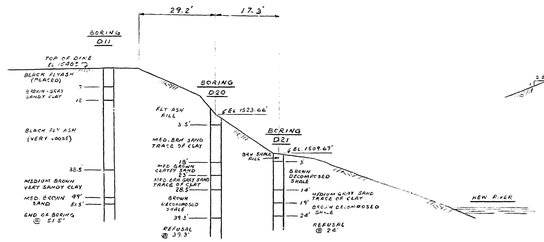
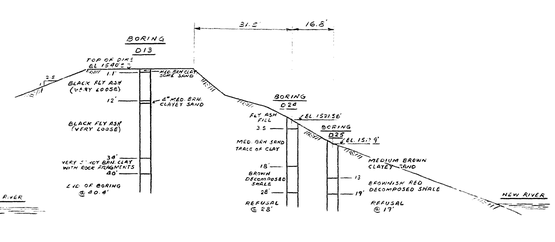
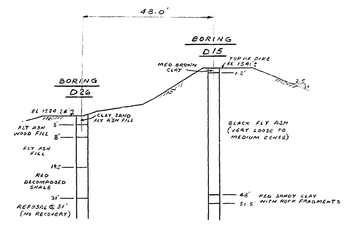


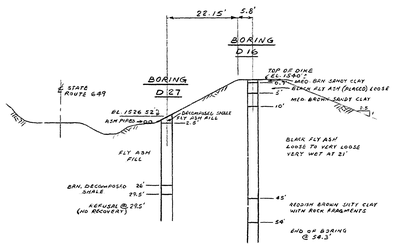
SECTION 3-B
BORINGS D11, D20 & D21
1"=20' DWG. 16-3543



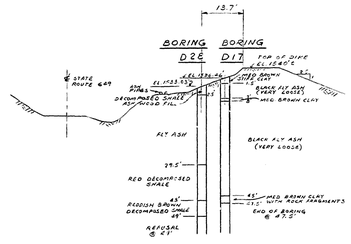
SECTION 3-F
BORINGS D13, D24 & D25
1"=20' DWG. 16-3543



SECTION 3-J
BORINGS D15 & D26
1"=20' DWG 16-3543



SECTION 6-B
BORINGS D16 & D27
1"=20' DWG. 16-3543



SECTION 6-E
BORINGS D17 & D28
1"=20' DWG. 16-3543

GENERAL NOTES

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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APPALACHIAN POWER CO.
GLEN LYN POWER PLANT
GLEN LYN VIRGINIA

FLYASH STORAGE AREA
DIKE SECTIONS
SH. 2 OF 2

DR. NO. 16-3545

ARCH.	ELEC.	MECH.	STR.

SCALE: AS NOTED
DR. J.M.
CH. D.P.C.
SQ. LDR. M.E.
DATE: 10/2/73
APPROVED BY
ENGINEERING DIV. J. R. Stengh
DESIGN DIV. [signature]

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

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DR. No. S-AP-2670-3977

General Notes

ALL CONCRETE MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE A.E.P.S. CORP. SPECIFICATIONS 1-1004.

DIMENSIONS GIVEN FOR REINFORCING STEEL ARE TO CENTER-LINE OF BAR. CONSTRUCTION JOINTS ARE NOT TO BE MODIFIED, EXCEPT BY PRIOR EXECUTION OF CHANGE ORDER OR APPROVAL OF ENGINEER. IT IS INTENDED THAT THE CONTRACTOR SHALL SET AND PLACE REINFORCING TO THESE DIMENSIONS AND JOINTS WILL RESULT IN THE CONCRETE EXPANSION JOINTS NOT BE LOCATED AS SHOWN.

ALL EXPOSED EDGES SHALL HAVE 3/4" CHAMFER FILLET.

ALL CONCRETE SHALL HAVE SLUMP TEST TO BE A.E.P.S. CORP'S SPEC. AND, TYPE OF MIX WILL BE DECIDED UPON BY CONCRETE LABORATORY.

ALL EXPOSED VERTICAL EXTERNAL CONCRETE SURFACES TO HAVE RUBBED FINISH.

ALL STRUCTURAL STEEL AND WORKMANSHIP SHALL CONFORM TO THE A.I.S.C. SPECIFICATIONS.

ALL SHOP CONNECTIONS SHALL BE RIVETED UNLESS NOTED. ALL F.U.S. BOLTED.

ALL FIELD CONNECTIONS SHALL BE BOLTED ~~UNLESS NOTED WELDED~~

~~ALL WELDED SHOP CONNECTIONS WHERE WELDMENTS CALLED FOR, ARE TO BE CHIPPED WITH A CHISEL~~

ALL RIVETS AND BOLTS SHALL BE ~~3/4" DIAMETER UNLESS OTHERWISE NOTED~~ HIGH STRENGTH BOLTS AND WASHERS, CONFORMING WITH ASTM SPEC. A325, UNLESS OTHERWISE NOTED. ~~CONFORM TO SPECIFICATIONS APPROVED BY THE AMERICAN WELDING SOCIETY.~~

CONFORM TO SPECIFICATIONS APPROVED BY THE AMERICAN WELDING SOCIETY.

THE FABRICATOR SHALL PREPARE BOLT LISTS AND ERECTION PLAN COPIES TO THE PURCHASER.

WHERE WELDED CONNECTIONS ARE CALLED FOR THE WORK IS TO BE DONE IN ACCORDANCE WITH THE AMERICAN WELDING SOCIETY'S SPECIFICATIONS "CODE FOR FUSION WELDING AND GAS CUTTING IN BUILDING CONSTRUCTION".

ALL WELDS SHALL BE 5/16" FILLET WELDS UNLESS NOTED

ALL BOLTS SHALL BE TIGHTENED TO A MINIMUM TENSION EQUIVALENT OF 90% OF YIELD OF BOLT IN PSI FOR THE F'ULL EFFECTIVE AREA. SAME NUMBER OF ERECTION BOLTS.

ALL STEEL TO BE A36

PAINT: AS NOTED

GAL. SHOP PAINT

Material

CONCRETE 3000 P.S.I. @ 28 DAYS UNREINFORCED

METAL GRATING: ALUMINUM ALLOY 6061-T6 WELDED, DOUBLE ALUMINUM COATED AND PAINTED JOINTS, WATERTIGHT BANDS, GALV. STEEL BOLTS, DOUBLE ALUMINUM COATED WITH 18 SYNTHETIC BONDS WITH ASSET AND SILO FOAM GASKET ANTI-LEAKAGE DIAPHRAGMS BY ARMCO STEEL CORP. ORDER G-37 AX-L.

3/8" INSERTS: WINGE (WITH LOCKING FEATURE) PLANT

MISC. STEEL SHAPES: MONTGOMERY PEERS ORDER NO. 2172 AX-S

1 - SHIP WORM SAFETY WINCH MODEL WS

HOT EYE BOLTS, PORT SIDES & THIMBLE

6" STAINLESS STEEL WIRE ROPE

BY: HANSEN & YEARY ORDER NO. 2172 AX-S

REINFORCING (REBAR) BY: MONTGOMERY-PEERS ORDER 2367 AX-S

Reference Drawings

S-AP-2670-3977A FLY ASH DRAINAGE SHAFT - REINF.

PS 2 - SHEET 1 OF 2 REINF. SHEET SAP-2670-3621C - LOCATION PLAN OF DRAINAGE SHAFT

Use This Dwg. With Dwg. S-AP-2670-3977A (Reinf.)

MATERIAL	RELEASE DATE
MISC. STRUCT. STEEL	2-15-65
REINF. STEEL	3-1-65
DECKING	
GRATING	
STAIR TREADS	
HANDRAILING	
RE-BAR STEEL SUB.	10-8-64
MISC. Hardware	2-15-65

NOTE: CHECKER IS RESPONSIBLE TO SEE THAT THE ABOVE APPLICABLE MATERIALS TO BE ORDERED ARE BROUGHT TO HIS SQUAD LEADERS ATTENTION.

DATE	DESCRIPTION	APPD.
5-19-65	1	Added Vent. Slots For Cool. St. - Revised Over All Length of Shaft, Slope Inv. At Shaft & Added 8'0"	GD	SS

Revisions

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FLY ASH
DRAINAGE SHAFT
MASONRY

APPALACHIAN POWER CO.
GLEN LYN PLANT
GLEN LYN, VIRGINIA

DR. No. S-AP-2670-3977-1

ARCH.	ELEC.	MECH.	STR.
SCALE: 3/4" = 1'-0"			
DR. DEPOLO			
CH. YEE			
SQ.LDR. DK			
DATE: 3-15-64			

AS CONSTRUCTED

Wm J. E. Holzer 5-19-65

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY 10-4 NEW YORK

SECTION H-H (TYPICAL)

3'-3"x3'-3"x1'-2"ø - BY OPERATIONS JAM ACROSS VENT SLOTS REVEL LOGS ARE PLACED

SECTION C-C

SECTION E-E

SECTION G-G

SECTION F-F

PLAN a-a
SCALE: 3/8" = 1'-0"

VIEW b-b

NOTE! DO NOT PAINT THESE SURFACES OF THE RUNNER

SKIMMER NK 5-1 (1) REQD. - SIDE VIEW
PAINT: (1) SHOPCOAT BITUMINOUS PAINT
SCALE 3/8" = 1'-0"

DETAIL OF OVERFLOW STRUCTURE SKIMMER

ANGLES FOR MOUNTING WINCH (In Position)
PAINT (1) SHOP COAT OF BITUMINOUS PAINT

ARRANGEMENT FOR MOVING SKIMMER PLAN
SCALE: 3/8" = 1'-0"

"SHIP WORM" (SAFETY WINCH - MODEL WS)

PLAN

NOTE! - FOR LOCATION OF SHAFT, SEE DWG. S-AP-2670-3621C

SECTION A-A

DETAIL "A"
CONCRETE LOGS (37) REQD
FOR REINF. SEE DET'A ON DWG. S-AP-2670-3977A

SECTION B-B

SECTION D-D

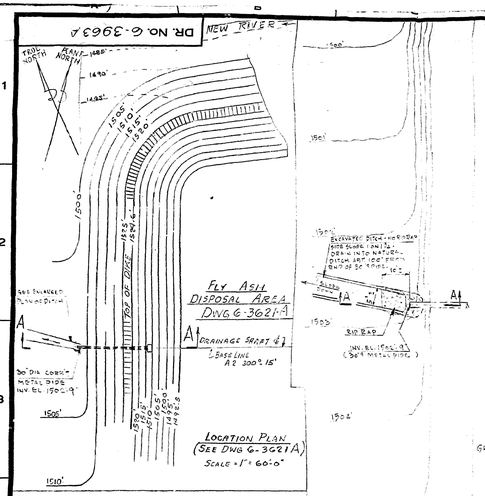
NOTE
TOP OF DRAINAGE SHAFT WALLS TO BE TROWELLED TO A SMOOTH FINISH.

NOTE!
BACKFILL AND TAMP THIS SIDE FROM BOTTOM OF FOOTING TO BOTTOM OF TEMPORARY PIPE BEFORE PLACING THE SLOPING SECTIONS OF THE SHAFT.

NOTE
THIS PORTION OF 42"ø CORR. STEEL PIPE TO BE REMOVED AT COMPLETION OF STRUCTURE

N.T.S.
65'-3"
60'-0"
N.T.S.

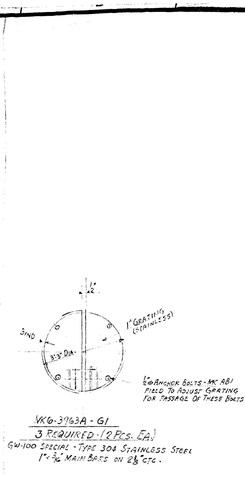
DR. NO. G-3963 A



Fly Ash Disposal Area
Dwg G-3621-A

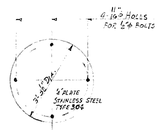
Drainage Shaft ℄

Location Plan
(See Dwg G-3621A)
Scale 1" = 60'-0"

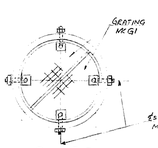


Enlarged Plan of Ditch
Scale 1" = 20'-0"

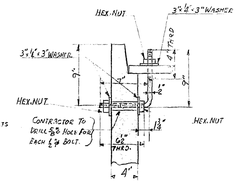
VK6-37163A-G1
3 Required - (2 Pcs. Ea.)
GW-100 Special - Type 304 Stainless Steel 1"x3/16" Main Bars on 2 1/8" C.to C.



Detail "A" (Type 304 St. Steel)
To Be Furnished By The Operating Department When The Fly Ash Fill Approaches Each Shaft Opening.



Plan E-E

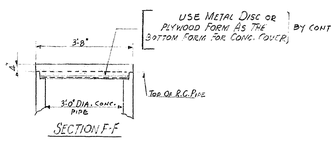


Anchor Bolt MK AB1
Type 304 Stainless Steel 1/2 Reqd



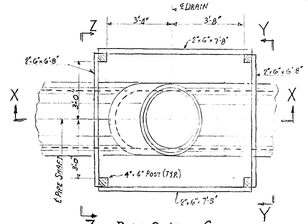
Plan Of Concrete Lid (Cast In Place Before Placing Pipe)
One (1) Required At Top End Of Shaft (By Contractor)

Detail "B"
Scale 1/2" = 1'-0"

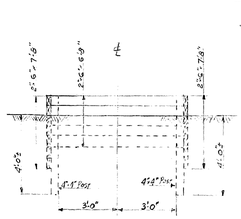


Section F-F

NOTE!
FOR EXTENSION OF DRAINAGE SHAFT SEE DWG. S-AP-2384-3983
DISREGARD ALL REFERENCES TO EXTENSION OF SHAFT ON THIS DWG.

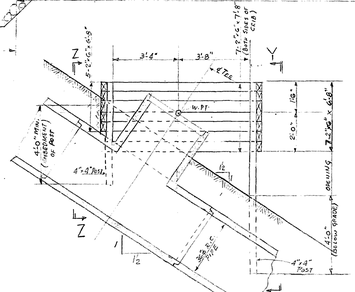


Plan Of Wood Crib
Typical - See Note "A"
Scale = 3/8" = 1'-0"

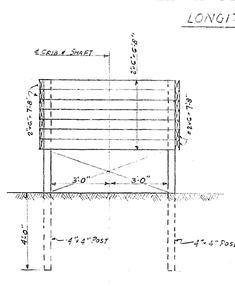


Elevation Z-Z

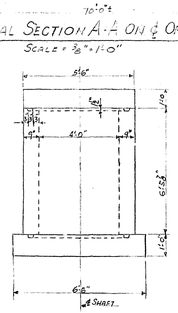
Longitudinal Section A-A on ℄ Of Shaft (See Location Plan)
Scale = 3/8" = 1'-0"



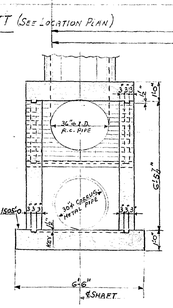
Section X-X
(See Plan Above)



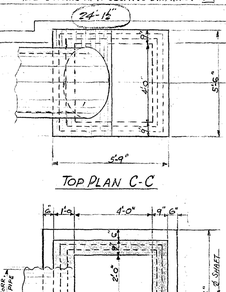
Elevation Y-Y



Elevation G-G



Section B-B



Top Plan C-C

Section D-D

Note "A"
Wood Crib Shown Is Typical For Each Opening. Erect Only One At This Time. Operating Department To Build Future Crib As The Fly Ash Basin Fills.

Material	Release Date
Struct. Steel	—
Reinf. Steel	By Contractor
Decking	—
Grating	7-7-60
Stair Rotaes	—
Handrailing	—
Shafts	7-7-60
Gages (Conc. Cast-in-Place)	7-7-60

NOTE: Checker Is Responsible To See That The Above Applicable Materials To Be Ordered Are Brought To Ng Squad Leaders' Attention.

Use This Drawing With G-3926A (Reina)
This Drawing Supersedes Dwg. G-3963

General Notes

[illegible] Concrete Shall Be Placed To A Depth Of Not Less Than 6" Nor Closer To Be Spaced At Less Than 3 Times The Largest Size Of Coarse Aggregate. Neither The Greatest Thickness Shall Be Less Than 1½ Times The Length Of Any Material In Cement. Some Kind Of Trimming Is Used To Provide A Uniform Smooth Well Integrated Finish Of Concrete.

Paint All Timber To Receive 2 Coats Of Creosote Paint (By Contractor)

Materials:
Concrete By Contractor

Timber By Contractor

36"ø Extra Strength Reinf. Concrete Tongue And Groove Pipe, Tees And Rubber Gaskets By Lock Joint Pipe Co. Order # AGL-366410

Grating GW-100 Special 1" x 3/16" Bar On 2 1/8" C.to C. Type 304 St. St. Or Rock-Well Standard Cube Grate #GW-1000

Anchor Bolts - Stainless Steel By Esco Iron Wks. Order # AGL 36630

Reinforcing Steel By Contractor.

Rip Rap By Contractor

3 Pcs - 20'-0" Lg. & 1 Pc. 10'-0" Lg. Of 30"ø 10 Ga. Corrugated Metal Pipe, Zinc Clad Asbestos Bonded And Paved Invert, Water Tight Bands And Two (2) Metal Anti-Seepage Diaphragms. By Republic Steel Corp Order No. AGL-2610-0

Reference Drawings
G-3621-A Fly Ash Disposal Area

G-3963-A Fly Ash Drainage Shaft Reinforcing

RSC - Reinf. Schedule Sheet 1 & 2.

Date	No.	Description	Appd.
7/11/63	1	Added Dimensions, Noted Encl. Structure To Be Removed	CS

Revisions

Fly Ash Drainage Shaft Masonry

Appalachian Power Co.
Glen Lyn Plant
Glen Lyn, Virginia

DR. No. G-3963 A-1

ARCH.	ELEC.	MECH.	STR.

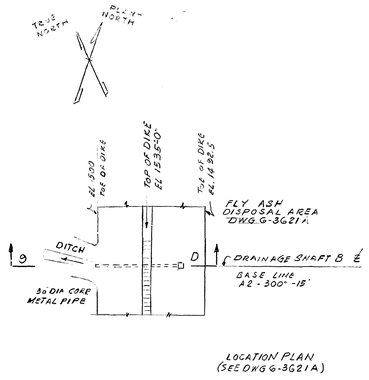
Scale 3/8" = 1'-0" Approved C.S.
Dr. G.M.D.
Ch. W.H.K.
Date 7-7-60

American Electric Power Service Corp.
2 Broadway 10-4 / New York

Change 60-AP-1895

AEP Confidential - Moderate Risk - Approved - 3963A - 09/19/1963 - gfx_6_aep_3963a_1.tif

DR. NO. S-AP 2384-3983

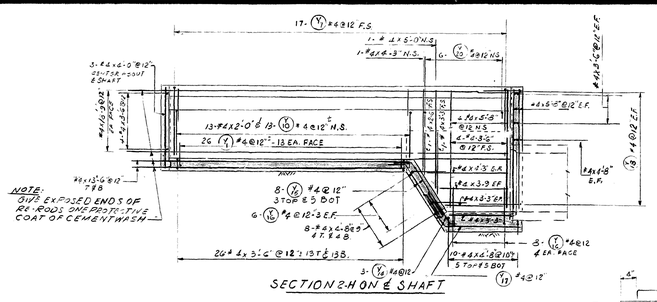


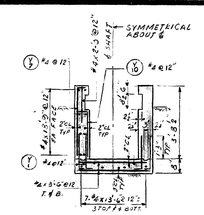
LOCATION PLAN
(SEE DWG G-3621A)

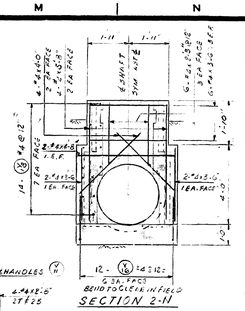
June 2 1964 GD

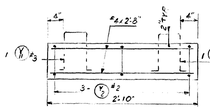
NOTE:

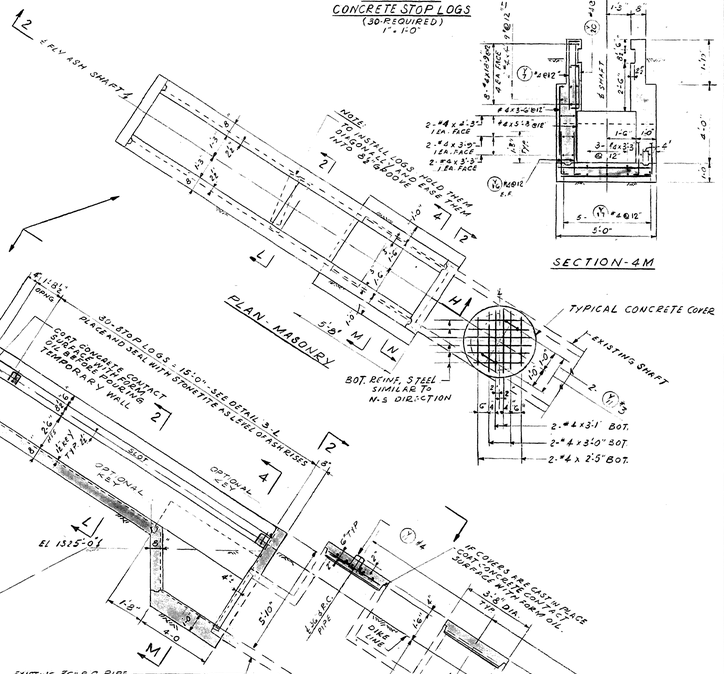
SHAFT WAS EXTENDED BY FIELD BUT NOT IN ACCORDANCE WITH THIS DWG.

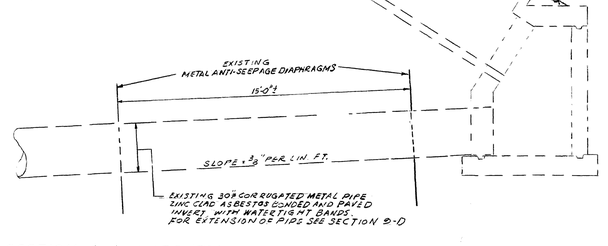




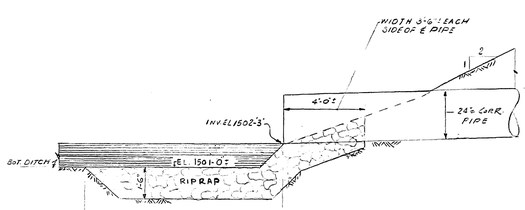




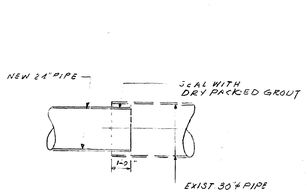




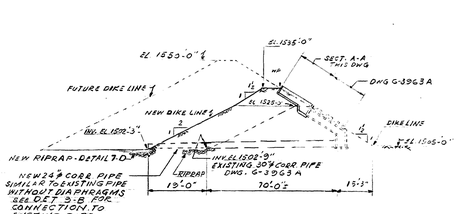
SECTION A-A - MASONRY



DETAIL 7-D



DETAIL 9-B



SECTION D-D ON ℄ SHAFT AND PIPE
LOOKING NORTH
SCALE 1"=30'0"

GENERAL NOTES

ALL CONCRETE MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE A.E.P.C.O.M. SPECIFICATIONS 1958
SURFACES TO BE FORMED WITH FORMS OF PLANKS OR PLYWOOD
CONSTRUCTION JOINTS ARE NOT TO BE LOCATED AT SLOPES OR CURVES
EXPANSION JOINTS NOT TO BE LOCATED AT CURVES
PROVIDED THAT THE CONTRACTOR MAKING AND PLACING ESTIMATES OF ENVELOPED AREAS SHALL BE SOLELY RESPONSIBLE FOR THE CONCRETE
EXPANSION JOINTS NOT TO BE LOCATED AT CURVES
ALL EXPOSED CORNERS SHALL HAVE 3/4" CHAMFER STRIPS
ALL EXPOSED VERTICAL EXTERIOR CONCRETE SURFACES TO HAVE RUBBED FINISH

RIPRAP (STONES 50 TO 150 LBS.) SHALL BE PLACED TO A DEPTH OF 18" OR AS THE STONES TO BE GRADED IN SIZE AS THEY ARE LOADED & HOISTED. THE BREADTH NOR THICKNESS SHALL BE LESS THAN 1/3 THE LENGTH. MIXTURE MATERIAL IS DUMPED, SAME HAVE TO TRIMMED TO REGULAR TO PROVIDE A REASONABLY SMOOTH WELL INTEGRATED FINISHED SURFACE

MATERIALS

CONCRETE 9 C.Y. BY CONTRACTOR

24" "ILGA CORRUGATED METAL PIPE ZINC CLAD ASBESTOS BONDED AND PAVED INVERT

1PC. 30-0 LG.
BY ARMCO STEEL CORP
ORDER NO. G3H93A3

RIPRAP 9 C.Y. BY CONTRACTOR

REINF. SEE DRS 2

REFERENCE DRAWINGS

G-3963A-FLY ASH DRAINAGE SHAFT
G-3621A-FLY ASH DISPOSAL AREA
DRS 2-SHEETS 1 & 3-REINF SCHED

DATE	DESCRIPTION	APPD.

REVISIONS

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FLY ASH DRAINAGE SHAFT "B" MASONRY & REINFORCING

APPALACHIAN POWER CO.
GLEN LYN PLANT
GLEN LYN, VIRGINIA

DR. No. S-AP 2384-3983

ARCH.	ELEC.	MECH.	STR.

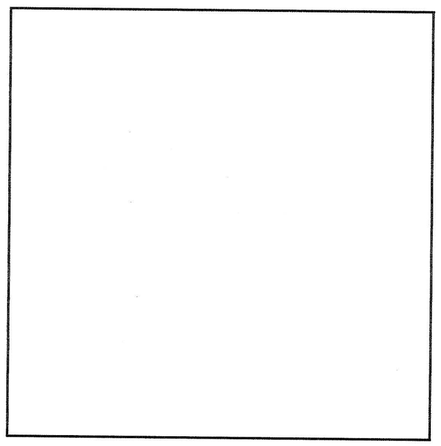
SCALE: 3/8"=1'-0"
DR. L.M.
CK. [illegible]
SOLOM. M. E.
DATE: 12/6/63

APPROVED BY: ENGINEERING DIV. [signature] DATE 12/6/63
DESIGN DIV. [signature] DATE 12/6/63

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY, N.Y. NEW YORK

AEP Confidential - Moderate Risk - Approved - S-AP-2384-3983 - 12/09/1963 - gfp_6_dwg_s-ap-2384-3983_0.tif

DESIGN PLANS
PART B APPLICATION
SOLID WASTE MANAGEMENT FACILITY
AMENDMENT TO PERMIT No. 222
GLEN LYN PLANT LANDFILL EXPANSION
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY
GLEN LYN, VIRGINIA



SITE LOCATION MAP

SCALE: 1" =2000'

2000' 0 2000' 4000'

MAP REFERENCE: U. S. G. S. 7.5 MINUTE QUADRANGLES
NARROWS, VA. - W. VA. PHOTOREVISED 1985
OAKVALE, W. VA. - VA. PHOTOREVISED 1977
LERONA, W. VA. - VA. PHOTOREVISED 1976
PETERSTOWN, W. VA. - VA. PHOTOREVISED 1984

GAI DWG FILE: 03640F006.DGN 12/8/93

INDEX OF DRAWINGS

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56-30102	90-364-F8	3 OF 21	BASE GRADE PLAN
56-30103	90-364-F9	4 OF 21	ENGINEERING MODIFICATION PLAN
56-30104	90-364-F10	5 OF 21	PHASING PLAN, 1 OF 5
56-30105	90-364-F11	6 OF 21	PHASING PLAN, 2 OF 5
56-30106	90-364-F34	6A OF 21	PHASING PLAN, 3 OF 5
56-30107	90-364-F35	6B OF 21	PHASING PLAN, 4 OF 5
56-30108	90-364-F12	7 OF 21	PHASING PLAN, 5 OF 5
56-30109	90-364-F13	8 OF 21	FINAL TOPOGRAPHY PLAN
56-30123	90-364-F36	8A OF 21	SITE MONITORING SHEET
56-30110	90-364-F31	9 OF 21	INTERMEDIATE CLOSURE PLAN
56-30111	90-364-F14	10 OF 21	CROSS-SECTIONS, 1 OF 2
56-30112	90-364-F15	11 OF 21	CROSS-SECTIONS, 2 OF 2
56-30113	90-364-F16	12 OF 21	DETAILS, 1 OF 6
56-30114	90-364-F17	13 OF 21	DETAILS, 2 OF 6
56-30115	90-364-F18	14 OF 21	DETAILS, 3 OF 6
56-30116	90-364-F19	15 OF 21	DETAILS, 4 OF 6
56-30117	90-364-F20	16 OF 21	DETAILS, 5 OF 6
56-30118	90-364-F32	17 OF 21	DETAILS, 6 OF 6
56-30119	90-364-F21	18 OF 21	AREA DEVELOPMENT PLAN, 1 OF 3
56-30120	90-364-F22	19 OF 21	AREA DEVELOPMENT PLAN, 2 OF 3
56-30121	90-364-F23	20 OF 21	AREA DEVELOPMENT PLAN, 3 OF 3
56-30122	90-364-F24	21 OF 21	AREA DEVELOPMENT DETAILS

DATE	NO.	DESCRIPTION	APPD.
12-8-93	C	DRAWING MODIFICATIONS	
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

TITLE AND INDEX SHEET
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30100

ARCH. | ELEC. | MECH. | STR.

SCALE: NOTED
DR: JPS
CH: MRL
SO.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

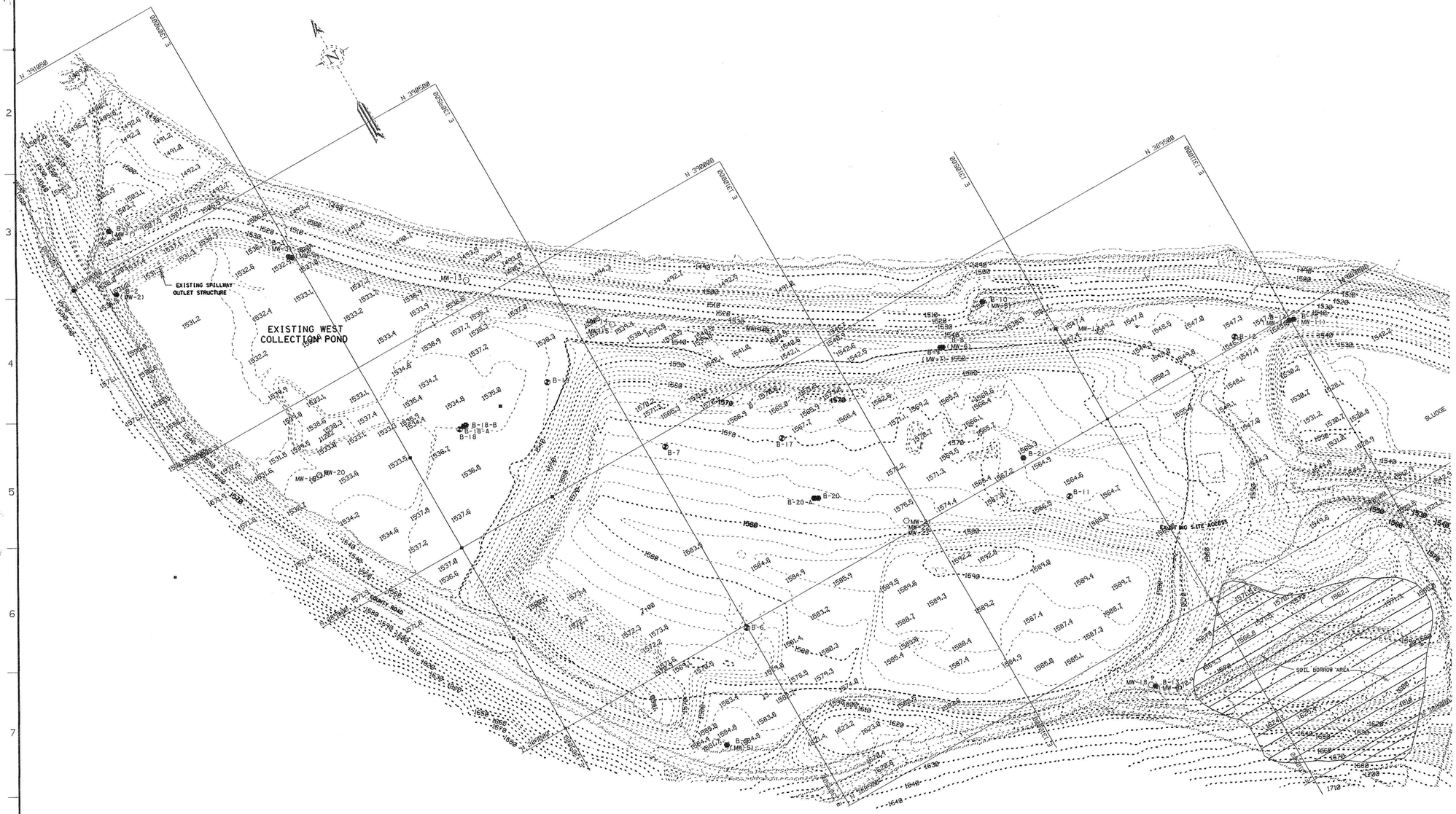
SHEET 1 OF 21

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, Pa
412-856-8400

GAI Dwg. File No. 90-364-F6

DRAFTING		ENGINEERING	
DATE	CHKD.	ENG.	MGR.
JPS	GRL	MRL	DWD
DATE: 8-16-94	29-92	4-29-92	4-29-92

AMERICAN ELECTRIC POWER SERVICE CORP.



LEGEND

B-4 (MW-4)	MONITORING WELL/BORING LOCATION
B-17	BORING LOCATION
MW-20	PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
———	EXISTING SITE TOPOGRAPHY
- - - - - - -	APPROXIMATE LIMITS OF EXISTING ASH FILL

SCALE: 1" = 100'

200' 100' 0 100' 200'

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

EXISTING SITE CONDITIONS COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30101

ARCH.		ELEC.		MECH.		STR.	
SCALE: 1"=100'						ENGINEERING DIVISION	
DR: JPS							APPROVED BY
CH: MRL						DESIGN DIVISION	
SO.LER: GRL							
DATE: 4-29-92							

AMERICAN ELECTRIC POWER SERVICE CORP.

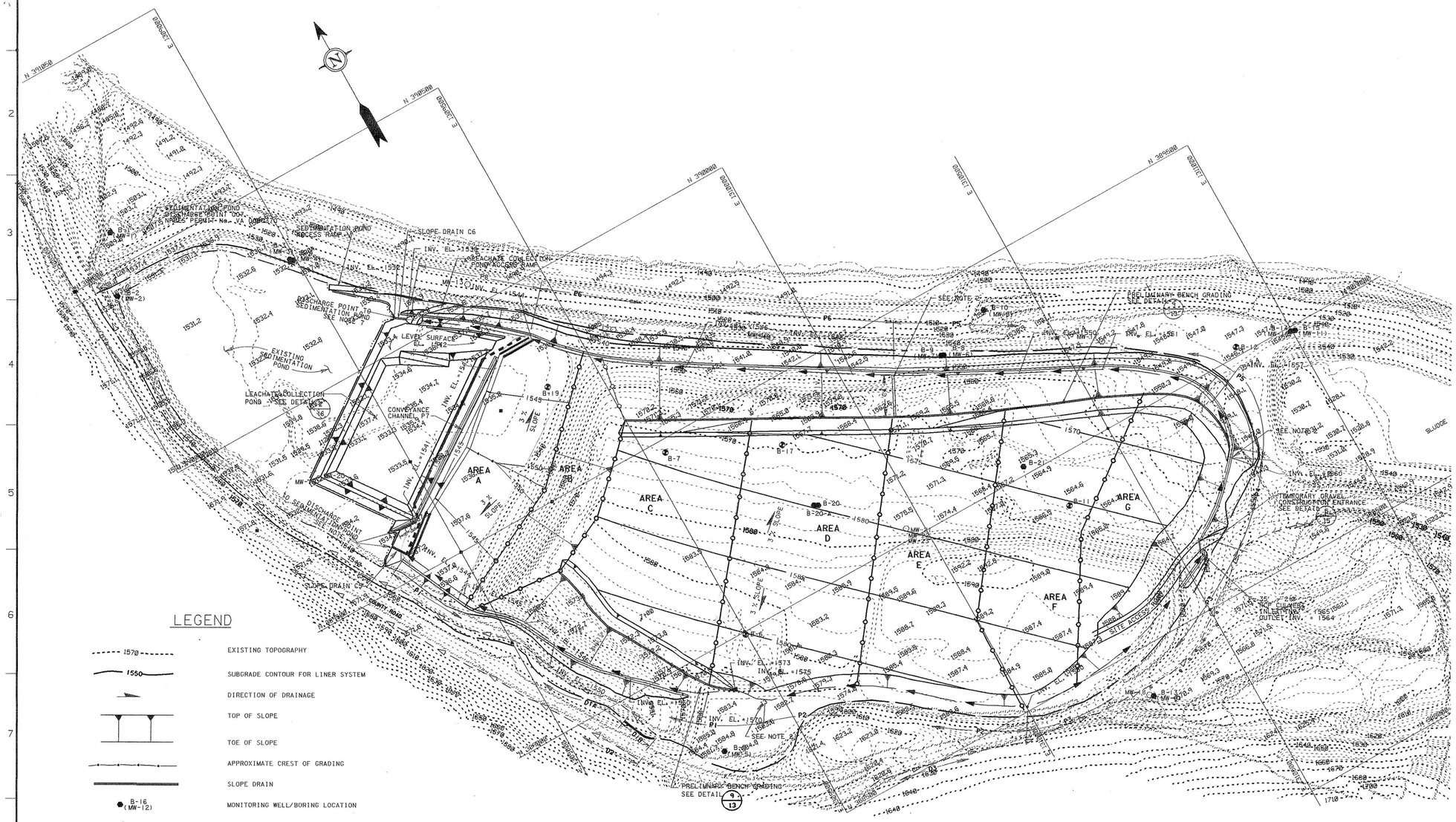
SHEET 2 OF 21

GAI Dwg. File No. 90-364-F7

DRAFTING		ENGINEERING	
INIT.	CHKD.	INIT.	CHKD.
JPS	GRL	MRL	DWO
DATE	7-25-9	4-29-92	4-29-92

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, PA
412-856-6400

GAI DWG FILE: 0364F007.DGW 12/8/93



NOTES:

1. SEE DETAIL SHEETS 12 AND 13 TO DETERMINE EXACT LOCATION OF ON-SITE CONVEYANCE CHANNELS.
2. PLACE A MINIMUM 20' x 20' LAYER OF RIPRAP 1.5' THICK WITHIN THE CONVEYANCE CHANNEL AT THE END OF THE SLOPE DRAIN CHANNEL. USE NSA R-6 RIPRAP. EXTEND THE RIPRAP TO THE FAR BANK OF THE CONVEYANCE CHANNEL. SURFACE OF RIPRAP SHALL BE LEVEL WITH CHANNEL BOTTOM.
3. FOR ON-SITE CONVEYANCE CHANNEL DIMENSIONS - SEE DETAIL 4/14
4. FOR ON-SITE SLOPE DRAIN DIMENSIONS - SEE DETAILS 1/14 3/14
5. OFF-SITE DIVERSION CHANNEL D1 IS EXISTING AND IS TO BE MODIFIED AS SHOWN ON DETAIL 1/15 2/15. OFF-SITE DIVERSION CHANNELS D2 AND D3 ARE ALSO EXISTING BUT DO NOT REQUIRE ANY ADDITIONAL MODIFICATIONS.
6. ALL ON-SITE CONVEYANCE CHANNELS, PRELIMINARY BENCH GRADING, AND OFF-SITE DIVERSION CHANNELS, AS SHOWN ON THIS DRAWING, SHALL BE CONSTRUCTED AND PERFORMED DURING THE INITIAL SITE PREPARATION PHASE. HOWEVER, UNDERDRAIN PIPES AND FINAL COVER PIPES BENEATH THE CONVEYANCE CHANNELS AND BENCHES SHALL ONLY BE INSTALLED AS INDIVIDUAL AREAS ARE DEVELOPED. BASE GRADING, EXCEPT WHICH IS NECESSARY TO CONSTRUCT THE CONVEYANCE CHANNELS, AND FINAL BENCH GRADING, SHALL BE PERFORMED AS INDIVIDUAL AREAS ARE DEVELOPED.
7. PLACE A MINIMUM 20' x 20' LAYER OF NSA R-7 RIPRAP, 2.5' THICK, AT THE END OF SLOPE DRAIN CHANNELS C5, C6, AND C7. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE.
8. FOR SLOPE DRAINS C5 AND C6, SEE FINAL COVER DRAINAGE PIPE OUTLET DETAIL 7/14
9. PERIMETER CHANNEL INVERTS SHOWN ON THE DRAWING REPRESENT FINAL CHANNEL SURFACE AFTER COMPLETION. CHANNEL SLOPE IS CONSTANT BETWEEN INVERT LOCATIONS SHOWN.
10. THE SUBGRADE CONTOURS SHOWN INDICATE THE BASE GRADE ELEVATIONS FOR THE LINER SYSTEM.
11. THE CONTOURS SHOWN FOR THE PRELIMINARY BENCH GRADING ARE FOR BENCH GRADING WITHOUT THE TEMPORARY TOPSOIL COVER. SEE SHEET 13 FOR DETAILS AND DIMENSIONS.

LEGEND

- 1570 — EXISTING TOPOGRAPHY
- 1550 — SUBGRADE CONTOUR FOR LINER SYSTEM
- DIRECTION OF DRAINAGE
- TOP OF SLOPE
- TOE OF SLOPE
- APPROXIMATE CREST OF GRADING
- SLOPE DRAIN
- B-16 (MW-12) — MONITORING WELL/BORING LOCATION
- B-17 — BORING LOCATION
- MW-20 — PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
- P3 — ON-SITE CONVEYANCE CHANNEL
- D2 — OFF-SITE DIVERSION CHANNEL
- LEACHATE CONVEYANCE PIPE 7/16
- LIMITS OF SEDIMENTATION POND
- LIMITS OF CLEARING AND GRADING
- AREA C — PROPOSED SITE DEVELOPMENT AREA (ACTUAL AREA MAY BE ADJUSTED DURING CONSTRUCTION)
- B/12 — SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION; SHEET NUMBER ON WHICH SECTION IS DRAWN
- 1/12 — DETAIL IDENTIFICATION NUMBER AND LOCATION; SHEET NUMBER ON WHICH DETAIL IS DRAWN
- SECTION A/B — SECTION IDENTIFICATION LETTER; SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
- DETAIL 1/5 6, 7 — DETAIL IDENTIFICATION NUMBER; SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SCALE: 1" = 100'

200' 100' 0 100' 200'

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

BASE GRADE PLAN
COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30102

ARCH.	ELEC.	MECH.	STR.

SCALE: 1"=100'
DR: JPS
CH: MRL
SO.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

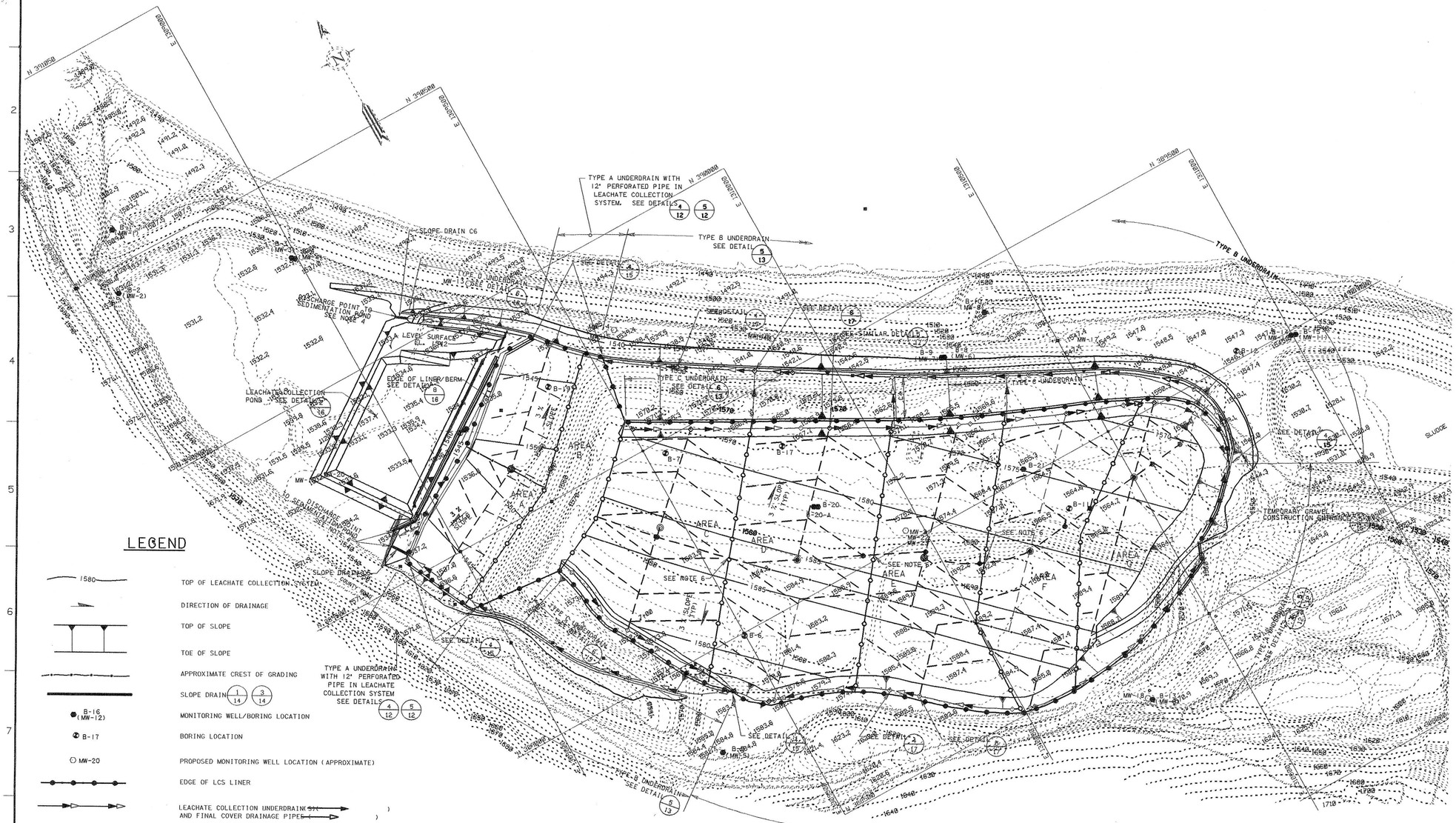
SHEET 3 OF 21

gai CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-9630

GAI Dwg. File No. 90-364-F8

	DRAFTING		ENGINEERING		
INITIALS	JPS	GRL	MRL	DWO	
DATE	7-26-94	29-92	4-29-92	4-29-92	

G:\DWG FILE\ 0364F008.DGN 12/8/93



LEGEND

- TOP OF LEACHATE COLLECTION SYSTEM
- DIRECTION OF DRAINAGE
- TOP OF SLOPE
- TOE OF SLOPE
- APPROXIMATE CREST OF GRADING
- SLOPE DRAIN (1/14) (3/14)
- B-16 (MW-12) MONITORING WELL/BORING LOCATION
- B-17 BORING LOCATION
- MW-20 PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
- EDGE OF LCS LINER
- LEACHATE COLLECTION UNDERDRAIN(S) AND FINAL COVER DRAINAGE PIPES
- PIPE CLEANOUT (4/17) (5/17) (6/17)
- LEACHATE CONVEYANCE PIPE (7/18)
- LEACHATE PIPE BELOW VERTICAL DRAIN (WITH CONNECTIONS TO LEACHATE COLLECTION PIPE NETWORK)
- LEACHATE COLLECTION PIPE NETWORK
- AREA C — PROPOSED SITE DEVELOPMENT AREA (ACTUAL AREA MAY BE ADJUSTED DURING CONSTRUCTION)
- VERTICAL LEACHATE COLLECTION PIPE (4/21) (5/21)
- A/10 — SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / SHEET NUMBER ON WHICH SECTION IS DRAWN
- 1/12 — DETAIL IDENTIFICATION NUMBER AND LOCATION / SHEET NUMBER ON WHICH DETAIL IS DRAWN
- SECTION A/9 — SECTION IDENTIFICATION LETTER / SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
- DETAIL 1/9 & 7 — DETAIL IDENTIFICATION NUMBER / SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SCALE: 1" = 100'

200' 100' 0 100' 200'

GAI DWG FILE: 036F9005.DGN 12/8/93

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

NOTES:

1. SEE DETAIL SHEETS 12 AND 13 TO DETERMINE EXACT LOCATION OF THE UNDERDRAIN AND FINAL COVER DRAINAGE PIPES.
2. ENGINEERING MODIFICATIONS TO BE CONSTRUCTED AS INDIVIDUAL AREAS ARE DEVELOPED.
3. TYPE A AND TYPE B UNDERDRAIN PIPES AND FINAL COVER PIPES UNDER PERIMETER DRAINAGE CHANNELS SHALL BE INSTALLED AS INDIVIDUAL AREAS ARE DEVELOPED.
4. PLACE A MINIMUM 20' x 20' LAYER OF NSA R-7 RIPRAP, 2.5' THICK, AT THE END OF SLOPE DRAIN CHANNELS C5, C6, AND C7. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE.
5. VERTICAL LEACHATE COLLECTION PIPES SHALL BE CONNECTED TO THE LEACHATE COLLECTION PIPE NETWORK WITH TEE CONNECTIONS. MAKE ALL CONNECTIONS IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS. SEE SHEET 21 FOR ADDITIONAL DETAILS.
6. TEMPORARILY CAP LEACHATE PIPE. CONTINUE PIPE DURING THE NEXT PHASE OF CONSTRUCTION.
7. THE OUTLET OF SLOPE DRAIN C4 SHALL BE CONSTRUCTED AS SHOWN ON DETAIL (8/14) OR (9/14)

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

ENGINEERING MODIFICATION PLAN
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30103

ARCH.		ELEC.		MECH.		STR.	
SCALE: 1"=100'		ENGINEERING DIVISION					
DR: JPS							
CH: MRL		DESIGN DIVISION					
SO.LDR: GRL							
DATE: 4-29-92							

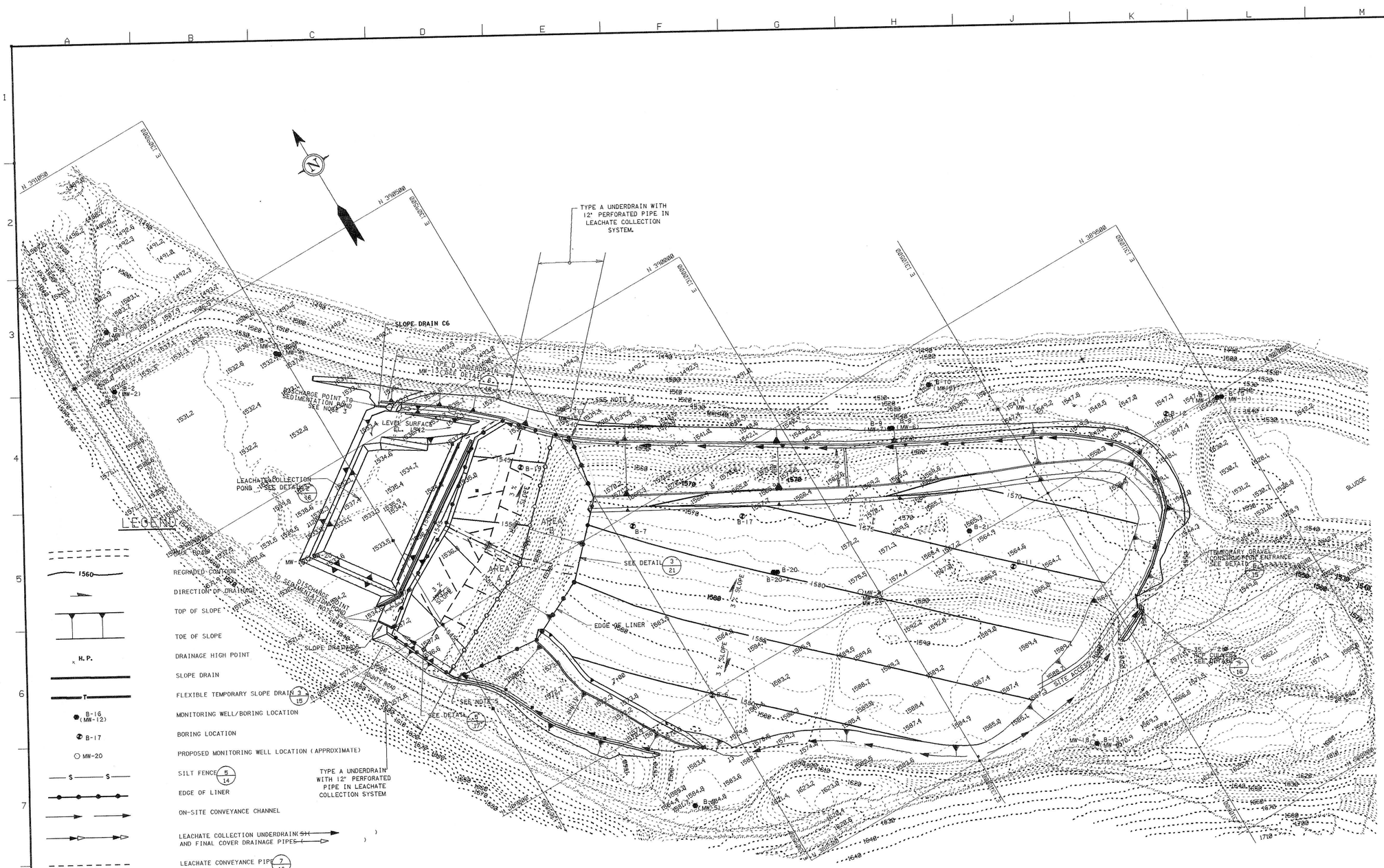
AMERICAN ELECTRIC POWER SERVICE CORP.

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, Pa
412-856-6400

GAI Dwg. File No. 90-364-F9

	DRAFTING		ENGINEERING		
	INITIALS	DWG.	INC.	MRL	DWD
DATE	7-26-9	4-29-92	4-29-92	4-29-92	

SHEET 4 OF 21



LEGEND:

- 1560 — REGRADED CONTOUR
- DIRECTION OF DRAINAGE
- TOP OF SLOPE
- TOE OF SLOPE
- H.P. — DRAINAGE HIGH POINT
- SLOPE DRAIN
- FLEXIBLE TEMPORARY SLOPE DRAIN 3/15
- B-16 (MW-12) — MONITORING WELL/BORING LOCATION
- B-17 — BORING LOCATION
- MW-20 — PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
- S S — SILT FENCE 5/14
- EDGE OF LINER
- ON-SITE CONVEYANCE CHANNEL
- LEACHATE COLLECTION UNDERDRAIN (SIZE) AND FINAL COVER DRAINAGE PIPES (SIZE)
- LEACHATE CONVEYANCE PIPE 7/16
- APPROX. CREST OF LEACHATE COLLECTION SYSTEM (LCS)
- PIPE CLEANOUT 5/17
- LEACHATE COLLECTION PIPE NETWORK
- PROPOSED SITE DEVELOPMENT AREA (ACTUAL AREA MAY BE ADJUSTED DURING CONSTRUCTION)
- VERTICAL LEACHATE COLLECTION PIPE 14/21
- 20' WIDE VERTICAL DRAIN 14/21
- SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / SHEET NUMBER ON WHICH SECTION IS DRAWN
- DETAIL IDENTIFICATION NUMBER AND LOCATION / SHEET NUMBER ON WHICH DETAIL IS DRAWN
- SECTION IDENTIFICATION LETTER / SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
- DETAIL IDENTIFICATION NUMBER / SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SECTION A/8
DETAIL 1/5, 6, 7

SCALE: 1"=100'

200' 100' 0 100' 200'

NOTES:

1. THIS PLAN DEPICTS THE INITIAL STAGE OF AREA A/B; SEE SHEET 18 FOR DETAILED PLANS OF AREA A/B DEVELOPMENT.
2. SEE DETAIL SHEET 12 FOR THE DETAIL/LOCATION OF THE UNDERDRAIN AND FINAL COVER DRAINAGE PIPES.
3. PLACE A MINIMUM 20' x 20' LAYER OF NSA R-7 RIPRAP, 2.5' THICK, AT THE END OF SLOPE DRAIN CHANNELS C5, C6, AND C7. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE.
4. THIS PLAN DEPICTS THE PHASED INSTALLATION OF THE UNDERDRAIN PIPES AND PIPE CLEANOUTS. ALL ON-SITE CONVEYANCE CHANNELS AND PRELIMINARY BENCH GRADING SHALL HAVE BEEN COMPLETED DURING INITIAL SITE PREPARATION. AS UNDERDRAIN PIPES ARE INSTALLED, ALL CHANNELS AND BENCHES SHALL BE RESTORED TO FINAL GRADE AND CONDITION. SEE SHEET 3 FOR CONVEYANCE CHANNEL INVERT ELEVATIONS AND CHANNEL DESIGNATIONS.
5. END UNDERDRAIN PIPES HERE. TEMPORARILY CAP ALL PIPES.

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

AREAS A AND B
CONSTRUCTION ITEMS AND QUANTITIES

CONSTRUCTION ITEM	UNIT	QUANTITY
CAP/COVER		
VEGETATION	S.F.	217,200
SOIL	C.Y.	12,215
VDOT #57 STONE	C.Y.	19
6" PERF. FINAL COVER DRAINAGE PIPE	L.F.	400
NONWOVEN FILTER GEOTEXTILE	S.F.	214,400
SANDY FINE GRAVEL (DRAINAGE LAYER)	C.Y.	3,904
NONWOVEN CUSHION GEOTEXTILE	S.F.	234,400
PVC CAP (30 MIL)	S.F.	218,000
LEACHATE COLLECTION SYSTEM		
SANDY FINE GRAVEL	C.Y.	11,541
WOVEN FILTER GEOTEXTILE	S.F.	198,400
6" PERF. PIPE (UNDER FILL)	L.F.	1,563
12" PERF. PIPE (UNDER DITCHES)	L.F.	400
VDOT #57 STONE	C.Y.	89
BOTTOM ASH/SAND AND GRAVEL IN VERTICAL DRAIN AND 1'-0 LAYER ABOVE L.C.S.	C.Y.	13,026
LINER		
NONWOVEN CUSHION GEOTEXTILE	S.F.	224,800
PVC LINER (30 MIL)	S.F.	211,600
FLY ASH FILL-VOLUME	C.Y.	110,859
AREA	ACRES	4.6

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

PHASING PLAN, 1 OF 5
COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30104

ARCH.	ELEC.	MECH.	STR.
SCALE: 1"=100'		ENGINEERING DIVISION	
DR: JPS			
CH: MRL		DESIGN DIVISION	
SD.LER: GRL			
DATE: 4-29-92			

APPROVED BY

AMERICAN ELECTRIC POWER SERVICE CORP.

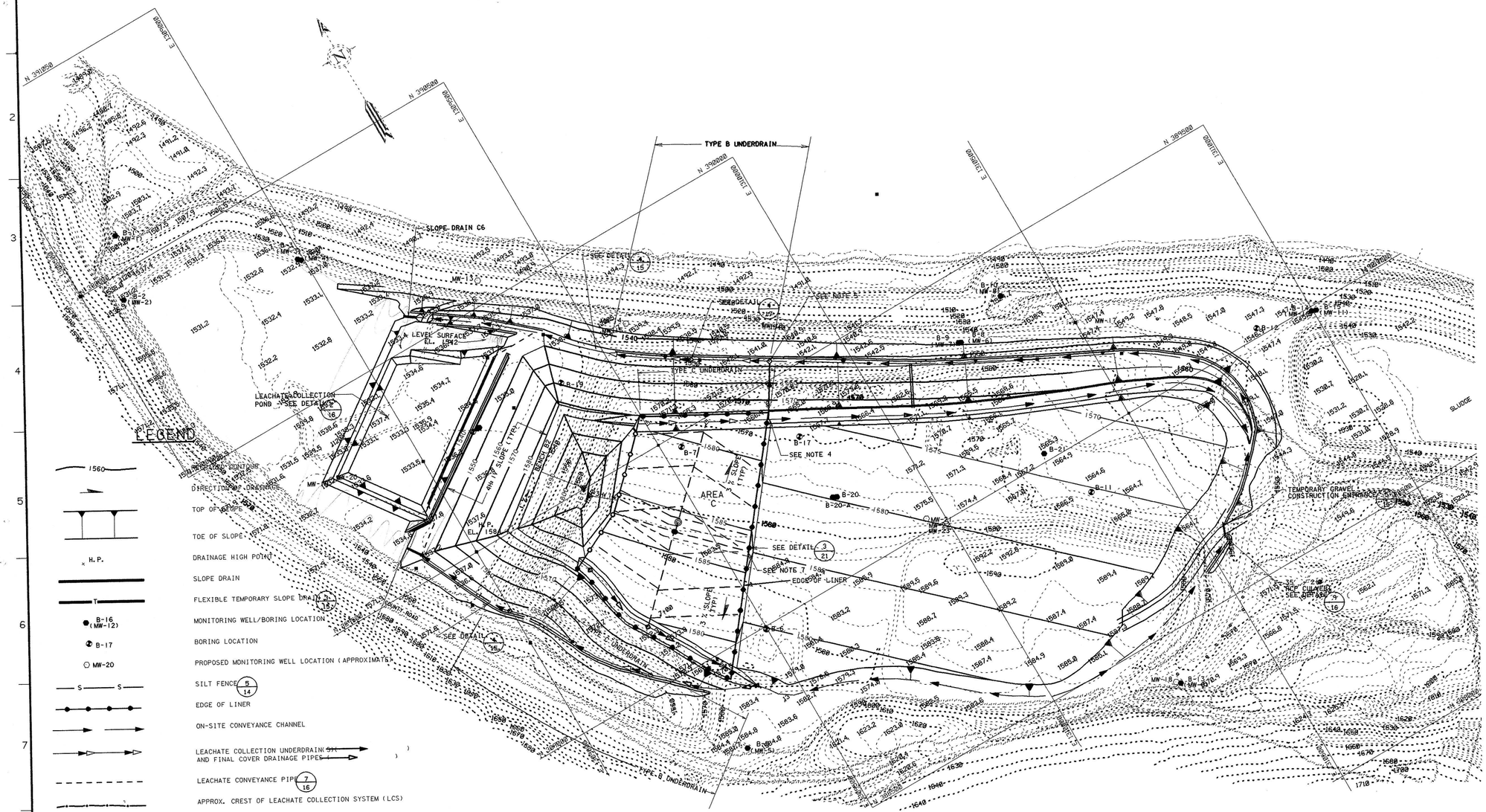
SHEET 5 OF 21

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-6400

GAI Dwg. 90-364-F10
File No.

	DRAFTING		ENGINEERING	
SYMBOL	DES.	DRN.	CHK.	APP.
JPS	GRL	MRL	DWD	
DATE	8-9-91	4-29-92	4-29-92	4-29-93

GAI DWG FILE: 03640F10.DGN 6/24/93



LEGEND

- 1560 — CONTOUR
- DIRECTION OF DRAINAGE
- TOP OF SLOPE
- TOE OF SLOPE
- H.P. — DRAINAGE HIGH POINT
- SLOPE DRAIN
- FLEXIBLE TEMPORARY SLOPE DRAIN (5/15)
- B-16 (MW-12) — MONITORING WELL/BORING LOCATION
- B-17 — BORING LOCATION
- MW-20 — PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
- S S — SILT FENCE (5/14)
- EDGE OF LINER
- ON-SITE CONVEYANCE CHANNEL
- LEACHATE COLLECTION UNDERDRAIN (S/K) AND FINAL COVER DRAINAGE PIPES (—)
- LEACHATE CONVEYANCE PIPE (7/16)
- APPROX. CREST OF LEACHATE COLLECTION SYSTEM (LCS)
- LEACHATE PIPE BELOW VERTICAL DRAIN (WITH CONNECTIONS TO LEACHATE COLLECTION PIPE NETWORK)
- PIPE CLEANOUT (4/17) (5/17) (6/17)
- LEACHATE COLLECTION PIPE NETWORK
- AREA C — PROPOSED SITE DEVELOPMENT AREA (ACTUAL AREA MAY BE ADJUSTED DURING CONSTRUCTION)
- VERTICAL LEACHATE COLLECTION PIPE (15/21)
- 20' WIDE VERTICAL DRAIN (16/21)
- BASE LOCATION OF VERTICAL DRAIN
- SECTION (A/6): SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION; SHEET NUMBER ON WHICH SECTION IS DRAWN
- DETAIL (1/5, 6, 7): DETAIL IDENTIFICATION NUMBER AND LOCATION; SHEET NUMBER ON WHICH DETAIL IS DRAWN; SECTION IDENTIFICATION LETTER; SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED; DETAIL IDENTIFICATION NUMBER; SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SCALE: 1" = 100'

200' 100' 0 100' 200'

NOTES:

1. THIS PLAN DEPICTS THE INITIAL STAGE OF AREA C. SEE SHEET 19 FOR DETAILED PLANS OF AREA C DEVELOPMENT.
2. SEE DETAIL SHEET 13 FOR THE DETAIL/LOCATION OF THE UNDERDRAIN AND FINAL COVER DRAINAGE PIPES.
3. CONTINUE FINAL COVER DRAINAGE PIPE AROUND ENTIRE BENCH. SEE DETAIL (2/14)
4. CONTINUE THE LEACHATE COLLECTION UNDERDRAIN USING AN UNDERDRAIN CONNECTOR PIPE AS SHOWN IN DETAIL (18/13). TEMPORARILY CAP THE OPEN END OF THE TEE CONNECTION. FINAL COVER DRAINAGE PIPES SHALL OUTLET INTO THE PRELIMINARY BENCH GRADING CHANNELS.
5. END UNDERDRAIN PIPES HERE. TEMPORARILY CAP ALL PIPES.
6. THIS PLAN DEPICTS THE PHASED INSTALLATION OF THE UNDERDRAIN PIPES AND PIPE CLEANOUTS. ALL ON-SITE CONVEYANCE CHANNELS AND PRELIMINARY BENCH GRADING SHALL HAVE BEEN COMPLETED DURING INITIAL SITE PREPARATION. AS UNDERDRAIN PIPES ARE INSTALLED, ALL CHANNELS AND BENCHES SHALL BE RESTORED TO FINAL GRADE AND CONDITION. SEE SHEET 3 FOR CONVEYANCE CHANNEL INVERT ELEVATIONS AND CHANNEL DESIGNATIONS.
7. TEMPORARILY CAP LEACHATE PIPE. CONTINUE PIPE DURING THE NEXT PHASE OF CONSTRUCTION.

AREA C
CONSTRUCTION ITEMS AND QUANTITIES

CONSTRUCTION ITEM	UNIT	QUANTITY
CAP/COVER		
VEGETATION	S.F.	299,260
SOIL	C.Y.	16,921
VDOT #57 STONE	C.Y.	83
6" PERF. FINAL COVER DRAINAGE PIPE	L.F.	1,730
NONWOVEN FILTER GEOTEXTILE	S.F.	262,370
SANDY FINE GRAVEL (DRAINAGE LAYER)	C.Y.	4,663
NONWOVEN CUSHION GEOTEXTILE	S.F.	366,730
PVC CAP (30 MIL)	S.F.	302,720
LEACHATE COLLECTION SYSTEM		
SANDY FINE GRAVEL	C.Y.	9,472
WOVEN FILTER GEOTEXTILE	S.F.	164,214
8" PERF. PIPE (UNDER DITCHES)	L.F.	770
6" PERF. PIPE (UNDER FILL)	L.F.	2,655
12" NON-PERF. PIPE	L.F.	960
8" NON-PERF. PIPE (UNDERDRAIN CONNECTORS)	L.F.	140
VDOT #57 STONE	C.Y.	351
BOTTOM ASH/SAND AND GRAVEL IN VERTICAL DRAIN AND 1'-0 LAYER ABOVE L.C.S.	C.Y.	19,507
LINER		
NONWOVEN CUSHION GEOTEXTILE	S.F.	216,700
PVC LINER (30 MIL)	S.F.	189,750
FLY ASH FILL VOLUME	C.Y.	149,382
AREA	ACRES	3.7

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600'. AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

PHASING PLAN, 2 OF 5
COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30105

SHEET 6 OF 21

ARCH.	ELEC.	MECH.	STR.

SCALE: 1"=100'	APPROVED BY:	ENGINEERING DIVISION
DR: JPS		
CH: MRL		DESIGN DIVISION
SQ.LDR: GRL		
DATE: 4-29-92		

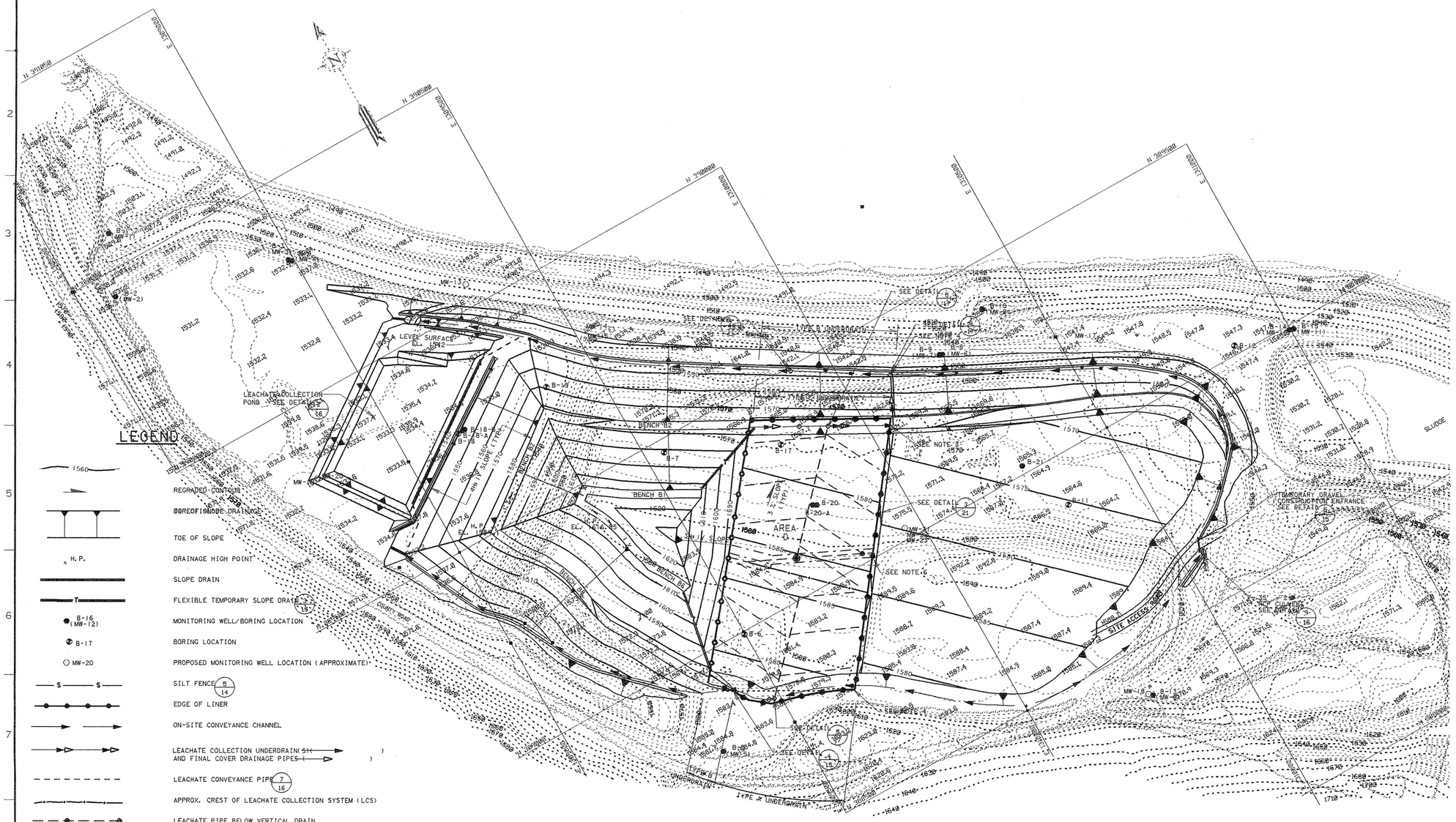
AMERICAN ELECTRIC POWER SERVICE CORP.

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 15146 412-856-6400

GAI Dwg. File No. 90-364-F11

	DRAFTING		ENGINEERING	
	INITIATE	CHK.	INIT.	CHK.
	JPS	GRL	MRL	DWO
DATE	7-26-9	4-29-92	4-29-92	4-29-92

CAI DWG FILE: 0364F011.DGN 12/8/93



LEGEND

- 1560 — REGRADED CONTOUR
- BOREOFIBLODE DRAINAGE
- TOE OF SLOPE
- H.P. — DRAINAGE HIGH POINT
- SLOPE DRAIN
- FLEXIBLE TEMPORARY SLOPE DRAIN (5/15)
- B-16 (MW-12) — MONITORING WELL/BORING LOCATION
- B-17 — BORING LOCATION
- MW-20 — PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
- S — S — SILT FENCE (5/14)
- EDGE OF LINER
- ON-SITE CONVEYANCE CHANNEL
- LEACHATE COLLECTION UNDERDRAIN (SIZE) AND FINAL COVER DRAINAGE PIPES (SIZE)
- LEACHATE CONVEYANCE PIPE (7/16)
- APPROX. CREST OF LEACHATE COLLECTION SYSTEM (LCS)
- LEACHATE PIPE BELOW VERTICAL DRAIN (WITH CONNECTIONS TO LEACHATE COLLECTION PIPE NETWORK)
- PIPE CLEANOUT (4/17) (5/17) (6/17)
- LEACHATE COLLECTION PIPE NETWORK
- AREA C — PROPOSED SITE DEVELOPMENT AREA (ACTUAL AREA MAY BE ADJUSTED DURING CONSTRUCTION)
- VERTICAL LEACHATE COLLECTION PIPE (4/21)
- 20' WIDE VERTICAL DRAIN (4/21) (5/21)
- BASE LOCATION OF VERTICAL DRAIN
- SECTION (A/8): SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / SHEET NUMBER ON WHICH SECTION IS DRAWN
- DETAIL (1/12): DETAIL IDENTIFICATION NUMBER AND LOCATION / SHEET NUMBER ON WHICH DETAIL IS DRAWN
- SECTION (A/8): SECTION IDENTIFICATION LETTER / SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
- DETAIL (1/5 & 6, 7): DETAIL IDENTIFICATION NUMBER / SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SCALE: 1"=100'

200' 100' 0 100' 200'

GAI DWG FILE: 0364F05L.DGN 12/8/93

NOTES:

1. THIS PLAN DEPICTS THE INITIAL STAGE OF AREA D; SEE SHEET 19 FOR SIMILAR DETAILED PLANS OF AREA C DEVELOPMENT.
2. SEE DETAIL SHEETS 12 AND 13 FOR THE DETAIL/ LOCATION OF THE UNDERDRAIN AND FINAL COVER DRAINAGE PIPES.
3. CONTINUE THE LEACHATE COLLECTION UNDERDRAIN USING AN UNDERDRAIN CONNECTOR PIPE AS SHOWN IN DETAIL 1/14. TEMPORARILY CAP THE OPEN END OF THE TEE CONNECTION. FINAL COVER DRAINAGE PIPES SHALL OUTLET INTO THE PRELIMINARY BENCH GRADING CHANNELS.
4. END UNDERDRAIN PIPES HERE. TEMPORARILY CAP ALL PIPES.
5. THIS PLAN DEPICTS THE PHASED INSTALLATION OF THE UNDERDRAIN PIPES AND PIPE CLEANOUTS. ALL ON-SITE CONVEYANCE CHANNELS AND PRELIMINARY BENCH GRADING SHALL HAVE BEEN COMPLETED DURING INITIAL SITE PREPARATION. AS UNDERDRAIN PIPES ARE INSTALLED, ALL CHANNELS AND BENCHES SHALL BE RESTORED TO FINAL GRADE AND CONDITION. SEE SHEET 3 FOR CONVEYANCE CHANNEL INVERT ELEVATIONS AND CHANNEL DESIGNATIONS.
6. TEMPORARILY CAP LEACHATE PIPE. CONTINUE PIPE DURING THE NEXT PHASE OF CONSTRUCTION.

AREA D
CONSTRUCTION ITEMS AND QUANTITIES

CONSTRUCTION ITEM	UNIT	QUANTITY
CAP/COVER		
VEGETATION	S.F.	282,410
SOIL	C.Y.	15,945
VDOT #57 STONE	C.Y.	53
6" PERF. FINAL COVER DRAINAGE PIPE	L.F.	1,110
NONWOVEN FILTER GEOTEXTILE	S.F.	263,930
SANDY FINE GRAVEL (DRAINAGE LAYER)	C.Y.	4,748
NONWOVEN CUSHION GEOTEXTILE	S.F.	326,900
PVC CAP (30 MIL)	S.F.	284,630
LEACHATE COLLECTION SYSTEM		
SANDY FINE GRAVEL	C.Y.	12,300
WOVEN FILTER GEOTEXTILE	S.F.	211,196
8" PERF. PIPE (UNDER DITCHES)	L.F.	720
6" PERF. PIPE (UNDER FILL)	L.F.	3,070
8" NON-PERF. PIPE (UNDERDRAIN CONNECTORS)	L.F.	120
12" NON-PERF. PIPE	L.F.	390
VDOT #57 STONE	C.Y.	247
BOTTOM ASH/SAND AND GRAVEL IN VERTICAL DRAIN AND 1'-0 LAYER ABOVE L.C.S.	C.Y.	22,262
LINER		
NONWOVEN CUSHION GEOTEXTILE	S.F.	259,400
PVC LINER (30 MIL)	S.F.	234,800
FLY ASH FILL (VOLUME)	C.Y.	175,219
AREA	ACRES	4.8

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

REVISIONS

"THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE AEP SERVICE CORP., FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST AND IS TO BE RETURNED UPON REQUEST"

APPALACHIAN POWER COMPANY

GLEN LYN PLANT

PHASING PLAN, 3 OF 5
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30106

ARCH.	ELEC.	MECH.	STR.

SCALE: 1"=100'
DR: JPS
CH: MRL
SQ.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

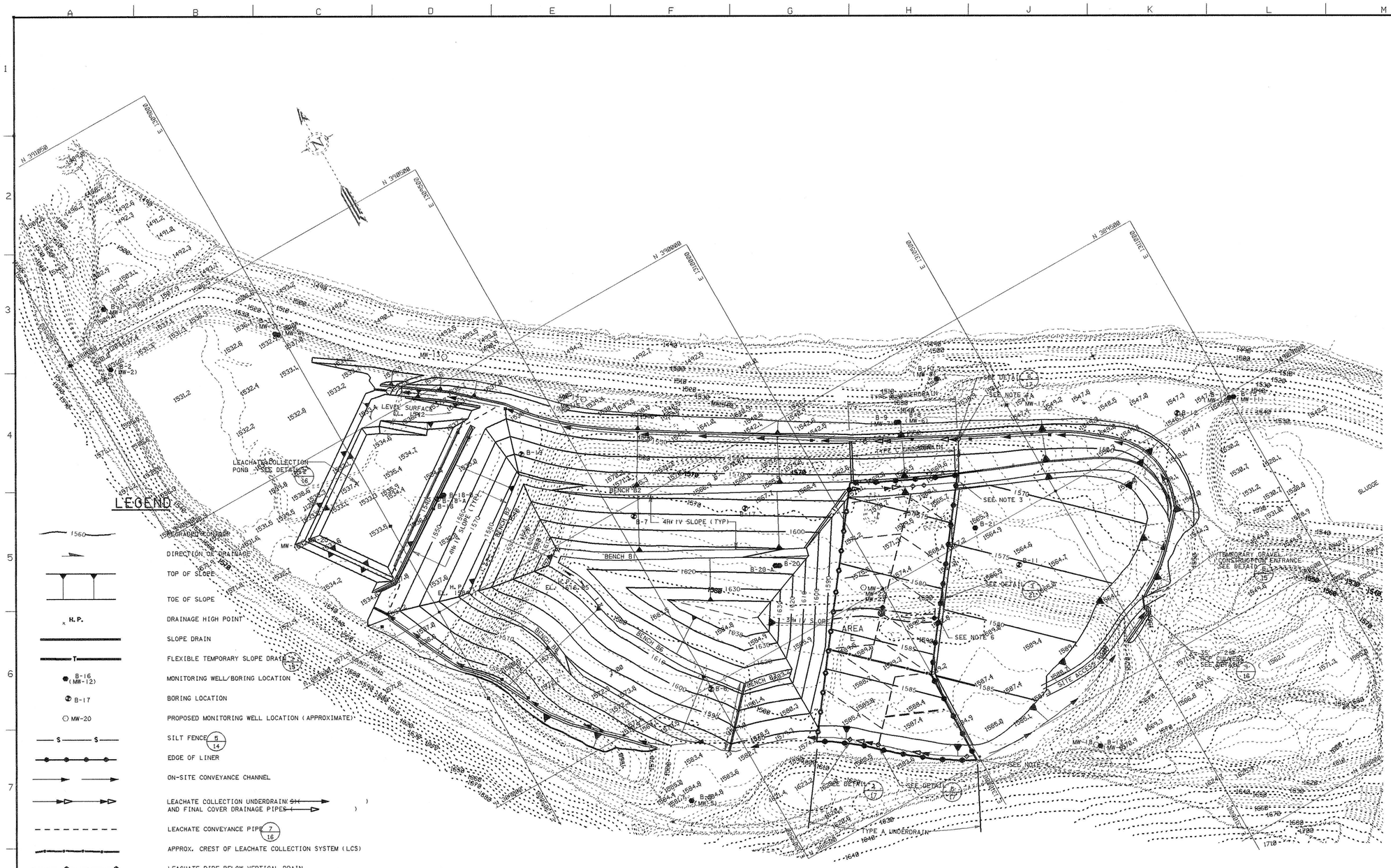
AMERICAN ELECTRIC POWER SERVICE CORP.

SHEET 6A OF 21

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, PA
412-856-2400

GAI Dwg. File No. 90-364-F34

	DRAFTING		ENGINEERING	
	SURVEY	CHKD.	ENG.	REV.
DATE	JPS	GRL	MRL	DWO
	4-26-92	4-29-92	4-29-92	9-93


N 391050
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N 389000
DISTRICT 3
MW-13D
MW-13S
MW-13I
MW-14
MW-15
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MW-17
MW-18
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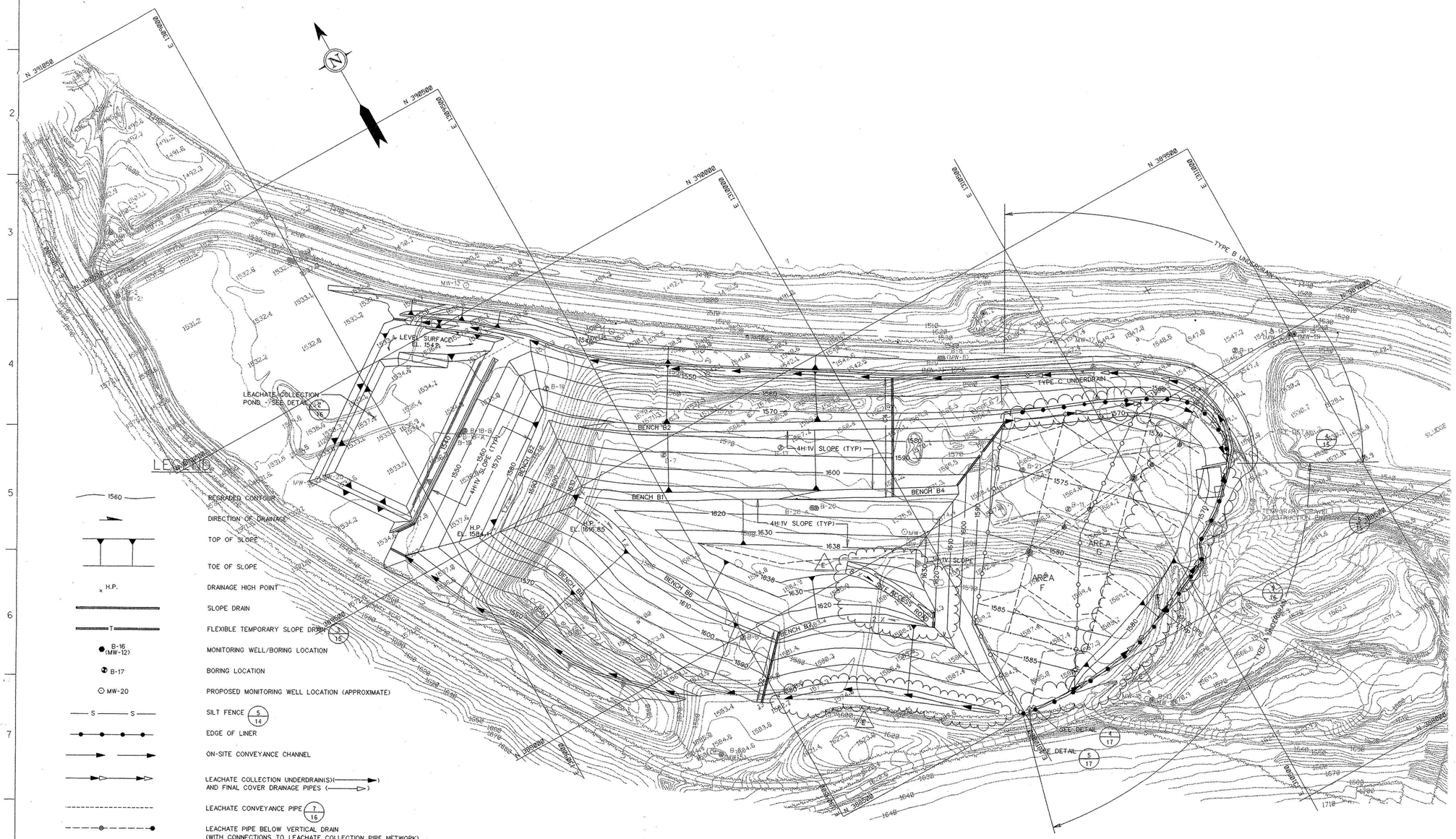

NOTES:

1. THIS PLAN DEPICTS THE INITIAL STAGE OF AREA F/G: SEE SHEET 20 FOR DETAILED PLANS OF AREA F/G DEVELOPMENT.
2. SEE DETAIL SHEETS 12 AND 13 FOR THE DETAIL/ LOCATION OF THE UNDERDRAIN AND FINAL COVER DRAINAGE PIPES.
3. FOR BENCH DETAILS, SEE DETAIL 2/14
4. THIS PLAN DEPICTS THE PHASED INSTALLATION OF THE UNDERDRAIN PIPES AND PIPE CLEANOUTS. ALL ON-SITE CONVEYANCE CHANNELS AND PRELIMINARY BENCH GRADING SHALL HAVE BEEN COMPLETED DURING INITIAL SITE PREPARATION. AS UNDERDRAIN PIPES ARE INSTALLED, ALL CHANNELS AND BENCHES SHALL BE RESTORED TO FINAL GRADE AND CONDITION. SEE SHEET 3 FOR CONVEYANCE CHANNEL INVERT ELEVATIONS AND CHANNEL DESIGNATIONS.

E REVISED TOE OF SUBGRADE AND SITE ACCESS ROAD TO AGREE WITH CHANGES TO SHEET 8 OF 21. EXTENDED LEACHATE COLLECTION SYSTEM AS REQUIRED.

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

AREAS F AND G
CONSTRUCTION ITEMS AND QUANTITIES

CONSTRUCTION ITEM	UNIT	QUANTITY
CAP/COVER		
VEGETATION	S.F.	394,620
SOIL	C.Y.	21,811
VDOT #57 STONE	C.Y.	107
6" PERF. FINAL COVER DRAINAGE PIPE	L.F.	2,235
NONWOVEN FILTER GEOTEXTILE	S.F.	350,410
SANDY FINE GRAVEL (DRAINAGE LAYER)	C.Y.	6,207
NONWOVEN CUSHION GEOTEXTILE	S.F.	468,690
PVC CAP (30 MIL)	S.F.	387,340
LEACHATE COLLECTION SYSTEM		
SANDY FINE GRAVEL	C.Y.	17,380
WOVEN FILTER GEOTEXTILE	S.F.	287,600
8" PERF. PIPE (UNDER DITCHES)	L.F.	1,555
6" PERF. PIPE (UNDER FILL)	L.F.	4,360
12" PERF. PIPE	L.F.	805
VDOT #57 STONE	C.Y.	474
BOTTOM ASH/SAND AND GRAVEL IN VERTICAL DRAIN AND 1'-0 LAYER ABOVE L.C.S.	C.Y.	25,430
LINER		
NONWOVEN CUSHION GEOTEXTILE	S.F.	384,420
PVC LINER (30 MIL)	S.F.	336,010
FLY ASH FILL VOLUME	C.Y.	244,975
AREA	ACRES	6.6

COMMONWEALTH OF VIRGINIA
DENNIS W. OKORN
No. 021654
PROFESSIONAL ENGINEER

DATE	NO.	DESCRIPTION	APPD.
7-21-00	E	DRAWING MODIFICATIONS	DJS
12-8-93	D	DRAWING MODIFICATIONS	DWO
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

PHASING PLAN, 5 OF 5
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30108

ARCH. | ELEC. | MECH. | STR.

SCALE: 1"=100' | ENGINEERING DIVISION
DR: JPS
CH: MRL | DESIGN DIVISION
SO-LDR: GRL
DATE: 4-29-92

APPROVED BY

SHEET 7 OF 21

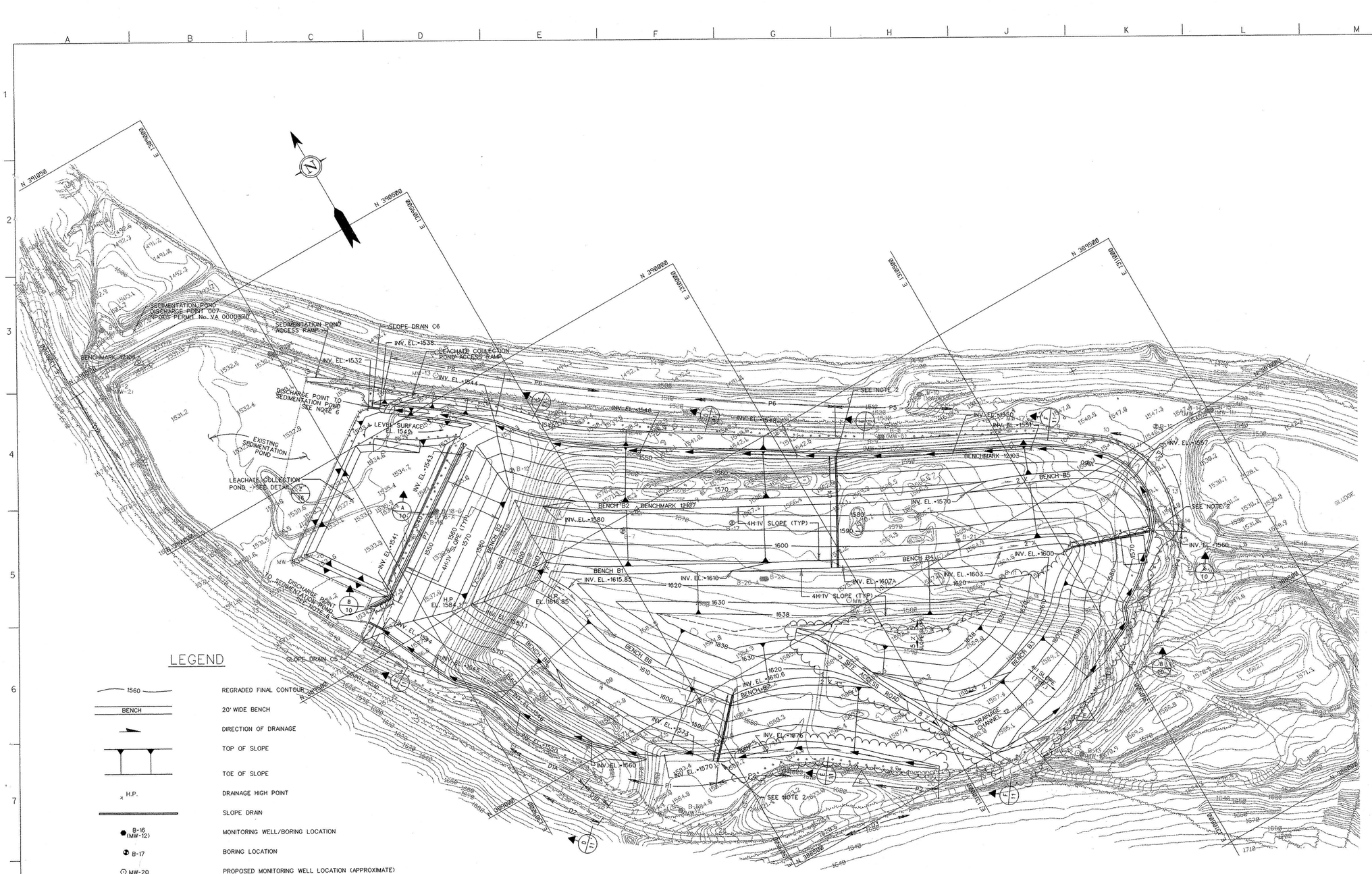
GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 15146 412-856-9400

GAI Dwg. File No. 90-364-F12

	DRAFTING		ENGINEERING	
	INIT.	CHKD.	ENG.	SUR.
	JPS	GRL	MRL	DWO
DATE	7-26-91	4-29-92	4-29-92	4-29-92

AMERICAN ELECTRIC POWER SERVICE CORP.

GAI DWG FILE: 0364F012.DGN 07/27/00



LEGEND

1560	REGRADED FINAL CONTOUR
BENCH	20' WIDE BENCH
	DIRECTION OF DRAINAGE
	TOP OF SLOPE
	TOE OF SLOPE
H.P.	DRAINAGE HIGH POINT
	SLOPE DRAIN
B-16 (MW-12)	MONITORING WELL/BORING LOCATION
B-17	BORING LOCATION
MW-20	PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
P3	ON-SITE CONVEYANCE CHANNEL
D2	OFF-SITE DIVERSION CHANNEL
	LEACHATE CONVEYANCE PIPE
	LIMITS OF PERMANENT VEGETATION
	LIMITS OF SEDIMENT BASIN
	BENCHMARK LOCATION
	SITE BOUNDARY (LIMITS OF CLEARING AND GRADING)
A 10	SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / SHEET NUMBER ON WHICH SECTION IS DRAWN
1 12	DETAIL IDENTIFICATION NUMBER AND LOCATION / SHEET NUMBER ON WHICH DETAIL IS DRAWN
SECTION A 8	SECTION IDENTIFICATION LETTER / SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
DETAIL 1 5 6, 7	DETAIL IDENTIFICATION NUMBER / SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SCALE: 1"=100'

200' 100' 0 100' 200'

D:\AGING FILE\ 0364F013.DGN 07/27/00

NOTES:

1. SEE DETAIL SHEETS 12 AND 13 TO DETERMINE EXACT LOCATION OF ON-SITE CONVEYANCE CHANNELS AND FINAL COVER DRAINAGE PIPES.
2. PLACE A MINIMUM 20' x 20' LAYER OF RIPRAP 1.5' THICK WITHIN THE CONVEYANCE CHANNEL AT THE END OF THE SLOPE DRAIN CHANNEL. USE NSA R-6 RIPRAP. EXTEND THE RIPRAP TO THE FAR BANK OF THE CONVEYANCE CHANNEL. SURFACE OF RIPRAP SHALL BE LEVEL WITH CHANNEL BOTTOM. THE OUTLET OF SLOPE DRAINS C2, C3, AND C4 SHALL BE CONSTRUCTED AS SHOWN ON DETAIL 8/14 OR 9/14
3. FOR ON-SITE CONVEYANCE CHANNEL DIMENSIONS - SEE DETAIL 4/14
4. FOR SLOPE DRAIN CHANNEL DIMENSIONS - SEE DETAILS 1/14 & 3/14
5. FOR BENCH CHANNEL DIMENSIONS - SEE DETAIL 2/14
6. PLACE A MINIMUM 20' WIDE x 20' LONG, 2.5' THICK LAYER OF NSA R-7 RIPRAP AT THE END OF SLOPE DRAIN CHANNELS C5, C6, AND C7. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE
7. FOR SITE ACCESS ROAD DETAILS - SEE DETAIL 1/16
8. OFF-SITE DIVERSION CHANNEL D1 IS EXISTING AND IS TO BE MODIFIED AS SHOWN ON DETAILS 1/15 2/15 OFF-SITE DIVERSION CHANNELS D2 AND D3 ARE ALSO EXISTING BUT DO NOT REQUIRE ANY ADDITIONAL MODIFICATIONS.
9. ACREAGE WITHIN THE SITE BOUNDARY OF THE FACILITY, AS CALCULATED BY THE METHOD OF RECTANGULAR COORDINATES, IS 42.8 ACRES.

E RELOCATED BEGINNING OF SITE ACCESS ROAD FROM APPROXIMATELY N388,645, E1,310,102. ELIMINATED 21" DIA. RCP CULVERT UNDER OLD HAULROAD. EXPANED THE FACE OF THE DISPOSAL PILE IN THE AREA SHOWN AND RELOCATED BENCH B3. DITCHES P2 AND P3 WERE SHORTENED TO PROVIDE SPACE FOR RELOCATED SITE ACCESS ROAD.

SITE BOUNDARY COORDINATES		
POINT NO.	NORTH	EAST
1	390,228	1,309,048
2	390,136	1,309,142
3	390,016	1,309,292
4	389,936	1,309,410
5	389,880	1,309,463
6	389,810	1,309,548
7	389,636	1,309,796
8	389,360	1,310,234
9	389,154	1,310,623
10	389,056	1,310,748
11	389,007	1,310,786
12	388,940	1,310,810
13	388,864	1,310,806
14	388,775	1,310,797
15	388,710	1,310,719
16	388,532	1,310,442
17	388,475	1,310,299
18	388,458	1,310,134
19	388,474	1,310,028
20	388,530	1,309,916
21	388,703	1,309,692
22	388,744	1,309,600
23	388,750	1,309,524
24	388,702	1,309,466
25	388,694	1,309,384
26	388,724	1,309,314
27	388,846	1,309,224
28	388,894	1,309,166
29	389,000	1,309,124
30	389,130	1,309,023
31	389,240	1,309,002
32	389,337	1,308,900
33	389,780	1,308,638

BENCHMARK	ELEVATION	COORDINATES
12103	1553.64	N 389159.908 E 1310516.533
12106	1536.61	N 390464.566 E 1308686.040
12107	1580.86	N 389494.701 E 1309600.725

MAP REFERENCE:

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2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

COMMONWEALTH OF VIRGINIA
DENNIS W. OKORN
No. 021654
PROFESSIONAL ENGINEER

DATE	NO.	DESCRIPTION	APPD.
7-27-00	E	DRAWING MODIFICATIONS	DTS
12-8-93	D	DRAWING MODIFICATIONS	DWO
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

FINAL TOPOGRAPHY PLAN
COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30109

SHEET 8 OF 21

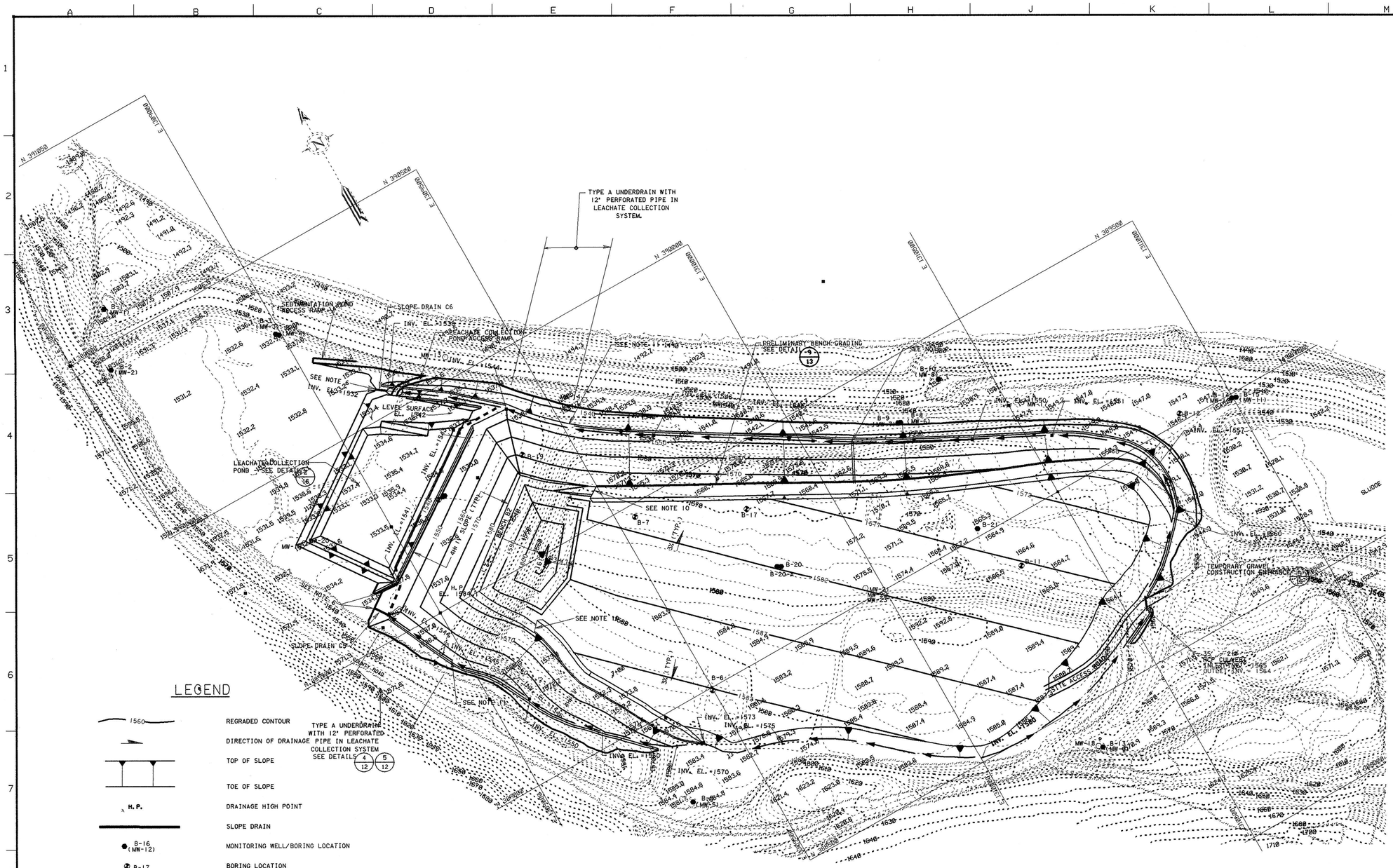
gai CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 15146 412-856-9400

GAI Dwg. File No. 90-364-F13

	DRAFTING		ENGINEERING	
	DES.	DWN.	DES.	MGR.
	JPS	GRL	MRL	DWO
DATE	7-25-91	8-26-92	8-26-92	8-26-92

ARCH.	ELEC.
MECH.	STR.
SCALE: 1"=100'	
DR: JPS	
CH: MRL	
SO. LDR: GRL	
DATE: 8-26-92	
APPROVED BY: ENGINEERING DIVISION	
APPROVED BY: DESIGN DIVISION	

AMERICAN ELECTRIC POWER SERVICE CORP.



NOTES:

1. SEE DETAIL SHEET 12 TO DETERMINE EXACT LOCATION OF ON-SITE CONVEYANCE CHANNELS AND FINAL COVER DRAINAGE PIPES.
2. PLACE A MINIMUM 20' x 20' LAYER OF RIPRAP 1.5' THICK WITHIN THE CONVEYANCE CHANNEL AT THE END OF THE SLOPE DRAIN CHANNEL. USE NSA R-6 RIPRAP. EXTEND THE RIPRAP TO THE FAR BANK OF THE CONVEYANCE CHANNEL. SURFACE OF RIPRAP SHALL BE LEVEL WITH CHANNEL BOTTOM.
3. FOR ON-SITE CONVEYANCE CHANNEL DIMENSIONS - SEE DETAIL 4/14
4. FOR ON-SITE SLOPE DRAIN CHANNEL DIMENSIONS - SEE DETAILS 1/14 3/14
5. FOR BENCH CHANNEL DIMENSIONS - SEE DETAIL 2/14
6. PLACE A MINIMUM 20' WIDE x 20' LONG, 2.5' THICK LAYER OF NSA R-7 RIPRAP AT THE END OF SLOPE DRAIN CHANNELS C5, C6, AND C7. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE.
7. SEE SHEET 3 FOR ON-SITE CONVEYANCE CHANNEL DESIGNATIONS.
8. SEE SHEET 5 FOR LIMITS OF LEACHATE COLLECTION SYSTEM LINER.
9. AREAS THAT DO NOT RECEIVE ADDITIONAL ASH SHALL BE COVERED WITH A PVC CAP, FINAL COVER DRAINAGE LAYER, AND A FINAL COVER SOIL. SEE SHEET 12 FOR FINAL COVER DETAILS. HOWEVER, A LEACHATE COLLECTION SYSTEM AND LEACHATE UNDERDRAIN WILL NOT BE REQUIRED. THIS APPLIES ONLY TO THE INTERMEDIATE CLOSURE OF THE SITE.
10. FINAL COVER DRAINAGE PIPES SHALL OUTLET INTO THE PRELIMINARY BENCH GRADING CHANNELS.
11. END LEACHATE COLLECTION UNDERDRAIN HERE AND PERMANENTLY CAP END(S). THE FINAL COVER DRAINAGE PIPE SHALL CONTINUE WITHIN THE ON-SITE CONVEYANCE CHANNELS.

LEGEND

- 1560 — REGRADED CONTOUR
- TYPE A UNDERDRAIN WITH 12" PERFORATED PIPE IN LEACHATE COLLECTION SYSTEM SEE DETAILS 4/12 5/12 — DIRECTION OF DRAINAGE
- TOP OF SLOPE
- TOE OF SLOPE
- H.P. — DRAINAGE HIGH POINT
- SLOPE DRAIN
- B-16 (MW-12) — MONITORING WELL/BORING LOCATION
- B-17 — BORING LOCATION
- MW-20 — PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
- S S — SILT FENCE
- APPROXIMATE CREST OF GRADING
- ON-SITE CONVEYANCE CHANNEL
- LEACHATE CONVEYANCE PIPE
- PIPE CLEANOUT
- A/10 — SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / SHEET NUMBER ON WHICH SECTION IS DRAWN
- 1/12 — DETAIL IDENTIFICATION NUMBER AND LOCATION / SHEET NUMBER ON WHICH DETAIL IS DRAWN
- SECTION A/6 — SECTION IDENTIFICATION LETTER / SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
- DETAIL 1/5 & 7 — DETAIL IDENTIFICATION NUMBER / SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED

SCALE: 1" = 100'

200' 100' 0 100' 200'

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
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DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

INTERMEDIATE CLOSURE PLAN
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30110

ARCH. | ELEC. | MECH. | STR.

SCALE: 1" = 100'
DR: JPS
CH: MRL
SQ.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

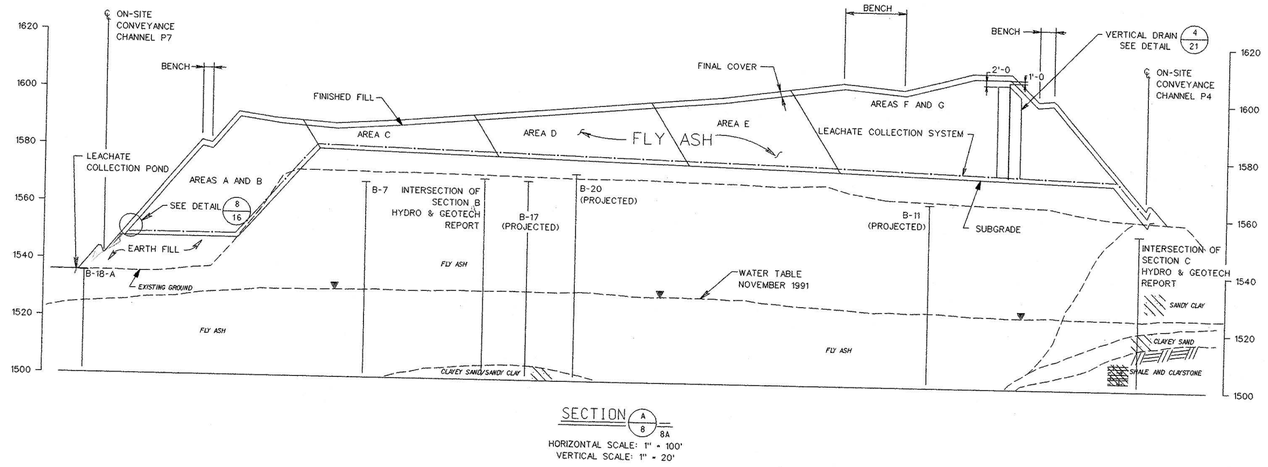
SHEET 9 OF 21

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-8400

GAI Dwg. File No. 90-364-F31

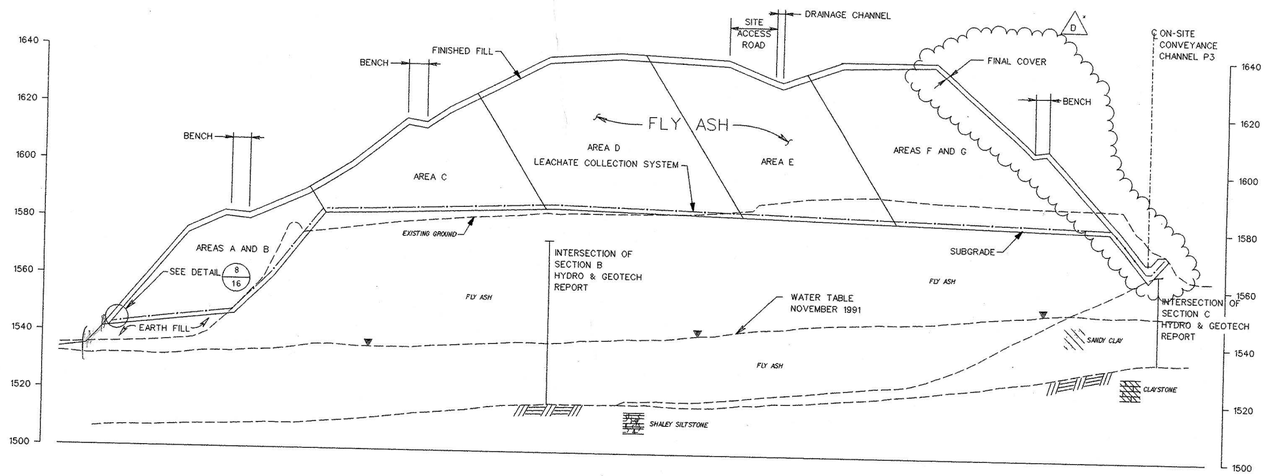
	DRAFTING		ENGINEERING	
INITIALS	JPS	GRL	MRL	DWD
DATE	2-26-92	4-29-92	9-29-92	4-29-93

GAI DWG FILE: 0364F031.DGN 12/8/93



SECTION A/8 8A

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION B/8 8A

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'

* EXPANDED PILE FACE TO INCORPORATE MODIFICATIONS TO PILE AS SHOWN ON SHEET 8 OF 21.

HORIZONTAL SCALE: 1"=100'
200' 100' 0 100' 200'
VERTICAL SCALE: 1"=20'
40' 20' 0 20' 40'

THE GEOLOGIC DATA PROVIDED ON THE CROSS SECTIONS HAS BEEN INFERRED FROM THE CONTROL POINTS SPECIFIED ON EACH SECTION.

COMMONWEALTH OF VIRGINIA
DENNIS W. OKORN
No. 021654
PROFESSIONAL ENGINEER

DATE	NO.	DESCRIPTION	APPD.
07-21-00	D	DRAWING MODIFICATIONS	DJS
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

CROSS-SECTIONS, 1 OF 2
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30111

SHEET 10 OF 21

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, PA 15146
412-856-9400

GAI Dwg. File No. 90-364-F14

	DRAFTING		ENGINEERING	
	DSGN.	DWN.	CHK.	APP.
DATE	TLO	GRL	MRL	DWO
	7-25-91	8-26-92	8-26-92	8-26-92

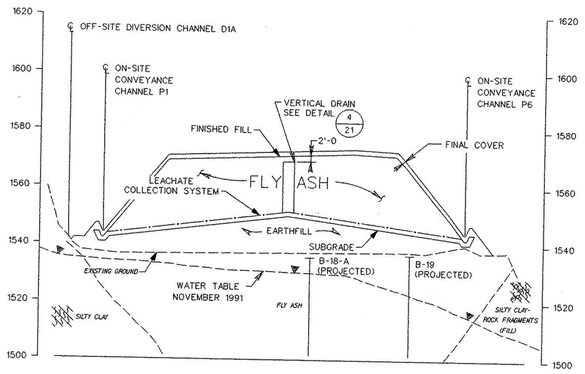
ARCH. | ELEC. | MECH. | STR.

SCALE: NOTED
DR: TLO
CH: MRL
SO.LDR: GRL
DATE: 8-26-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

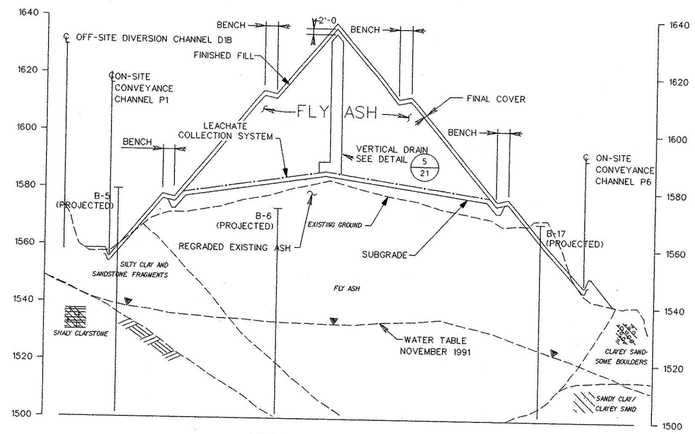
CADWG FILE: 0364F01N.DGN 07/27/00



SECTION C/8 8A

(AREA A)

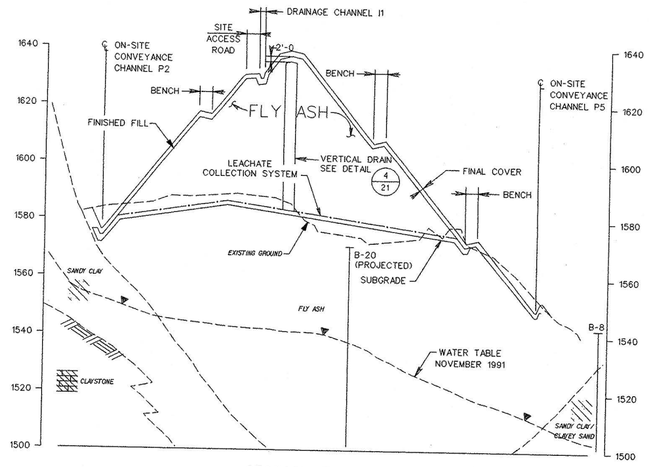
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION D/8 8A

(AREAS C AND D)

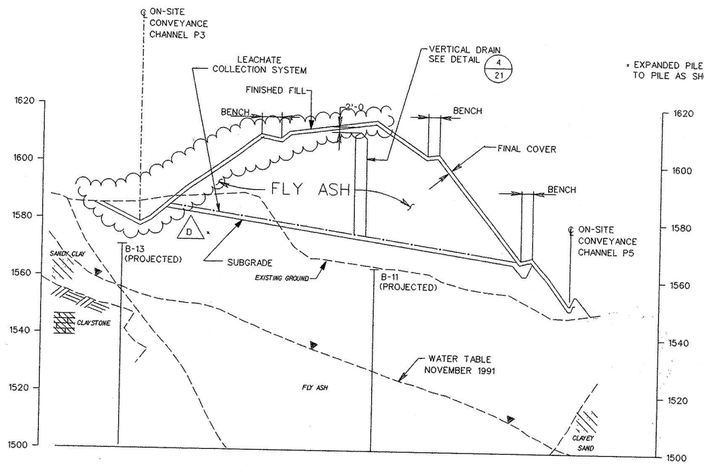
HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION E/8 8A

(AREA E)

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION F/8 8A

(AREAS F AND G)

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'

* EXPANDED PILE FACE TO INCORPORATE MODIFICATIONS TO PILE AS SHOWN ON SHEET 8 OF 21.

HORIZONTAL SCALE: 1"=100'
200' 100' 0 100' 200'
VERTICAL SCALE: 1"=20'
40' 20' 0 20' 40'

THE GEOLOGIC DATA PROVIDED ON THE CROSS SECTIONS HAS BEEN INFERRED FROM THE CONTROL POINTS SPECIFIED ON EACH SECTION.

GAIDWG FILE: 0364F015.DGN 07/27/00

COMMONWEALTH OF VIRGINIA
DENNIS W. OKORN
No. 021654
PROFESSIONAL ENGINEER

SHEET 11 OF 21

7-25-00	D	DRAWING MODIFICATIONS	JSS
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO
DATE	NO.	DESCRIPTION	APPD.

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GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, PA 15146
412-856-9400

GAI Dwg. File No. 90-364-F15

	DRAFTING		ENGINEERING	
	DSN:	DRN:	ENG:	WDK:
DATE	TLO	GRL	MRL	DWO
	7-25-91	8-26-92	8-26-92	8-26-92

APPALACHIAN POWER COMPANY

GLEN LYN PLANT

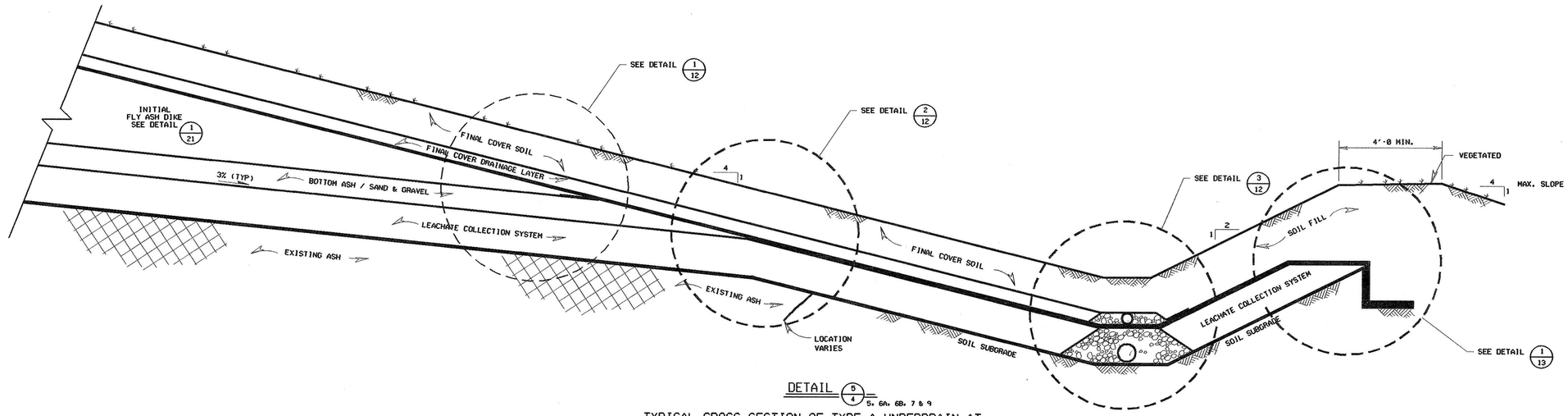
CROSS-SECTIONS, 2 OF 2
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30112

ARCH.	ELEC.	MECH.	STR.

SCALE: NOTED	APPROVED BY	ENGINEERING DIVISION
DR: TLO		
CH: MRL		DESIGN DIVISION
SO.LDR: GRL		
DATE: 8-26-92		

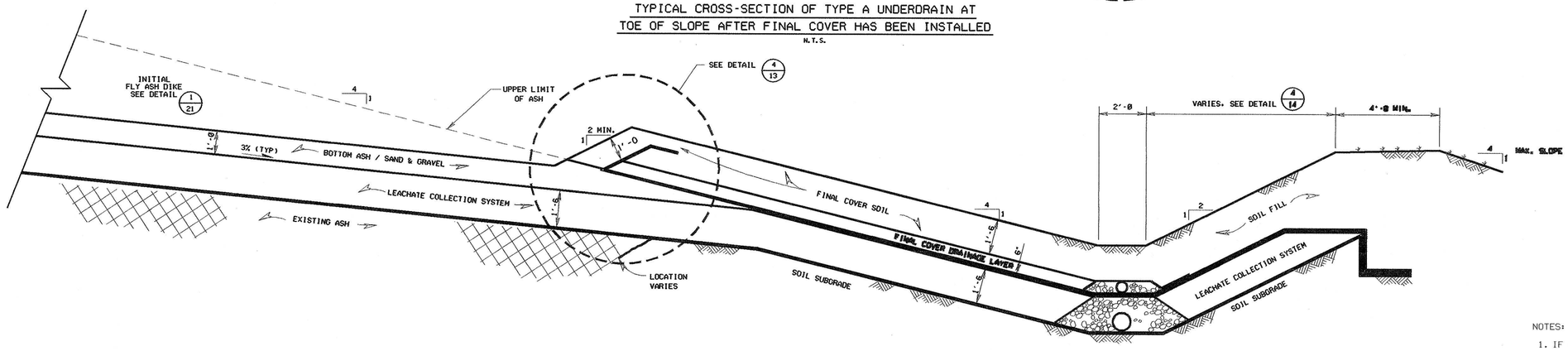
AMERICAN ELECTRIC POWER SERVICE CORP.



DETAIL 5/4 = 5, 6A, 6B, 7 & 9

TYPICAL CROSS-SECTION OF TYPE A UNDERDRAIN AT TOE OF SLOPE AFTER FINAL COVER HAS BEEN INSTALLED

N.T.S.



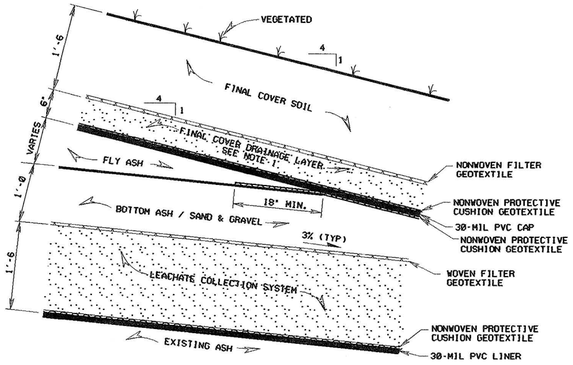
DETAIL 4/4 = 5, 6A, 6B, 7, 9 & 21

TYPICAL CROSS-SECTION OF TYPE A UNDERDRAIN AT TOE OF SLOPE PRIOR TO FINAL COVER INSTALLATION

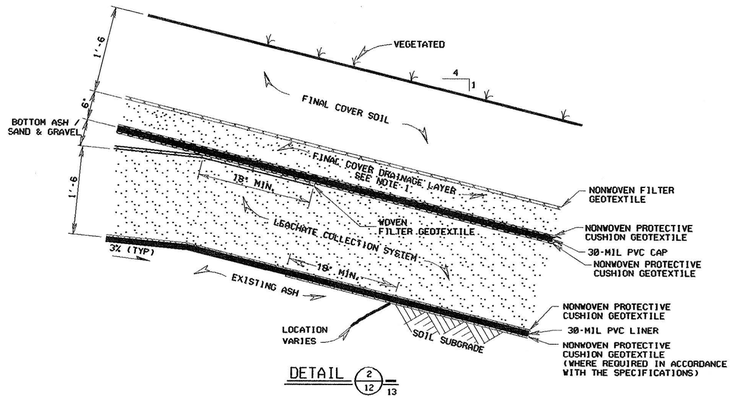
N.T.S.

NOTES:

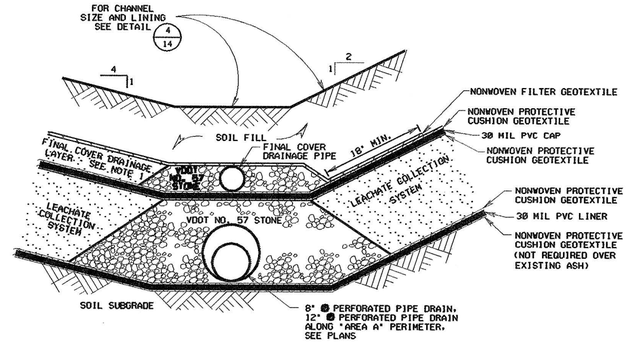
1. IF GEONET FINAL COVER DRAINAGE LAYER IS USED, SEE DETAILS 1/17, 2/17 AND 3/17



DETAIL 1/12 = 13 & 14



DETAIL 2/12 = 13



DETAIL 3/12 = 13, 14

DATE	NO.	DESCRIPTION	APPD.
12-8-93	C	DRAWING MODIFICATIONS	
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

DETAILS, 1 OF 6
COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30113

ARCH.		ELEC.		MECH.		STR.	

SCALE: NTS
DR: JPS
CH: MRL
SO.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

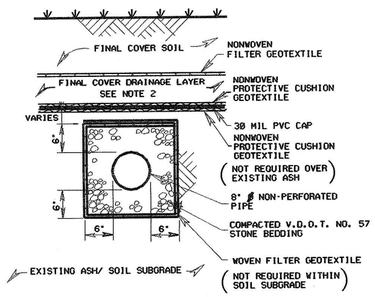
SHEET 12 OF 21

GAI Dwg. File No. 90-364-F16

	DRAFTING		ENGINEERING	
DISTRIBUTE	JPS	GRL	MRL	DWD
DATE	7-24-9	4-29-92	4-29-92	4-29-9

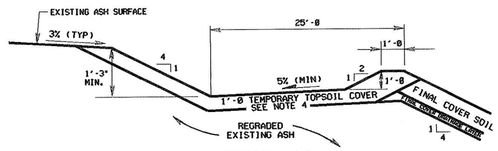
GAI Consultants, Inc.
570 Beatty Road
Monroeville, PA
412-856-6400

GAI DWG FILE: 9364F816.DGN 12/8/93



DETAIL 8/6
6A, 6B, 13, 17

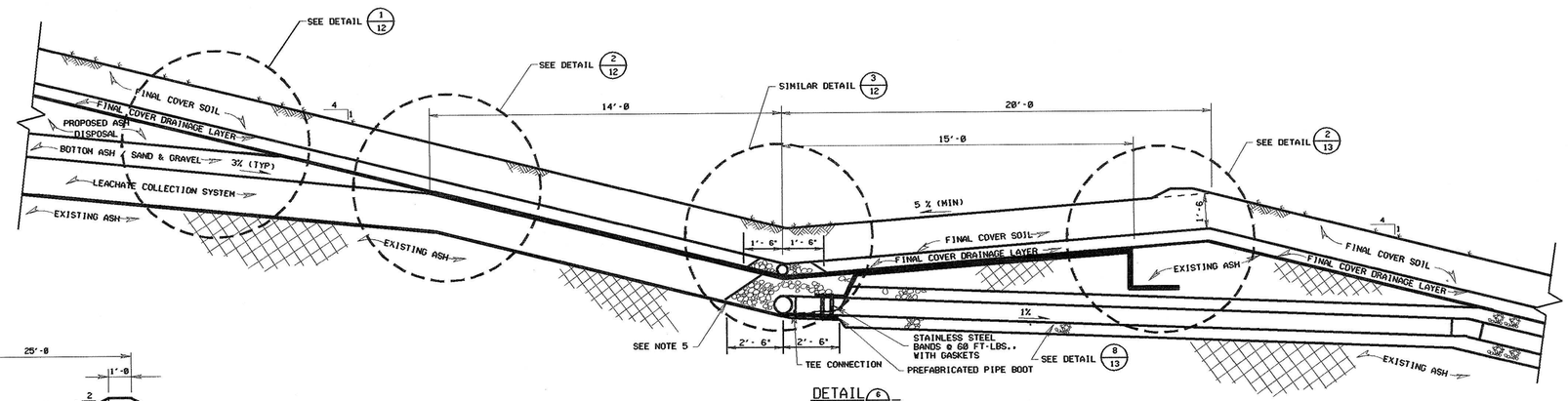
UNDERDRAIN CONNECTOR PIPE



DETAIL 9/3
6

PRELIMINARY BENCH GRADING
(TYPE C UNDERDRAIN LOCATIONS)

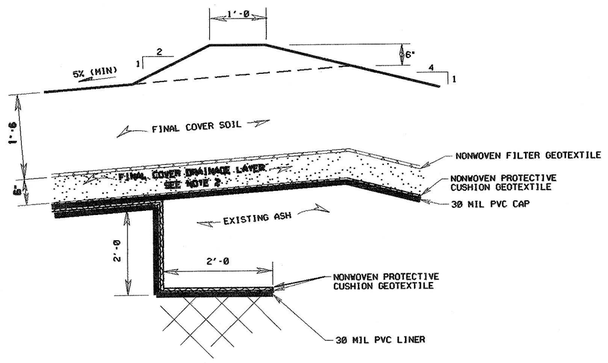
N.T.S.



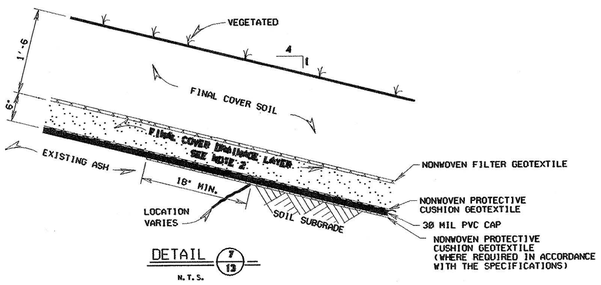
DETAIL 6/4
6, 6A, 6B, 7, 13 & 14

TYPICAL CROSS-SECTION OF TYPE C UNDERDRAIN

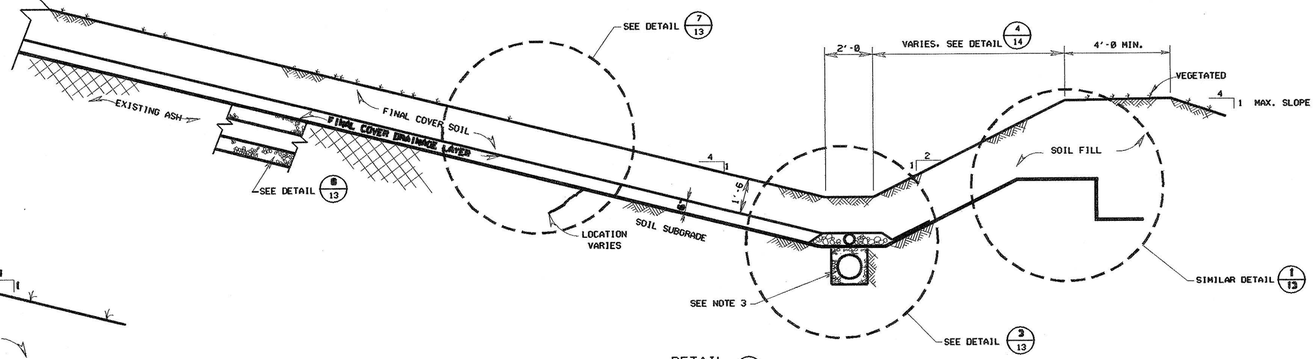
N.T.S.



DETAIL 2/13
N.T.S.



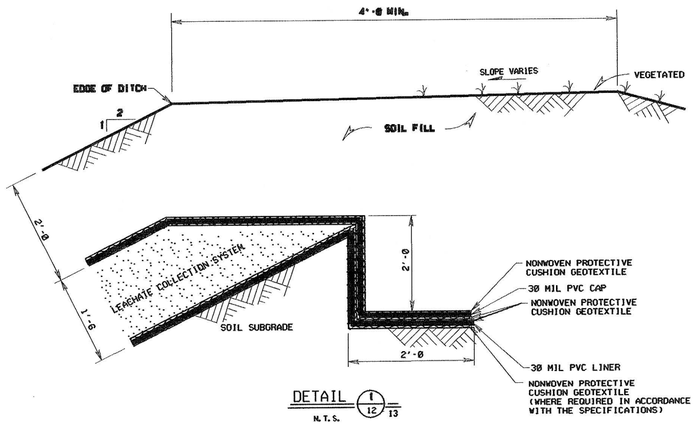
DETAIL 7/13
N.T.S.



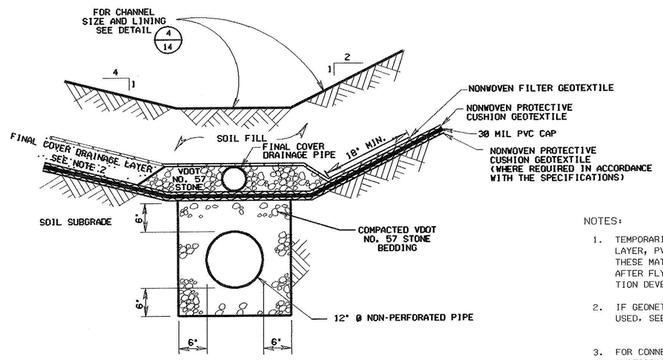
DETAIL 5/4
6, 6A, 6B, 7 & 13

TYPICAL CROSS-SECTION OF TYPE B UNDERDRAIN

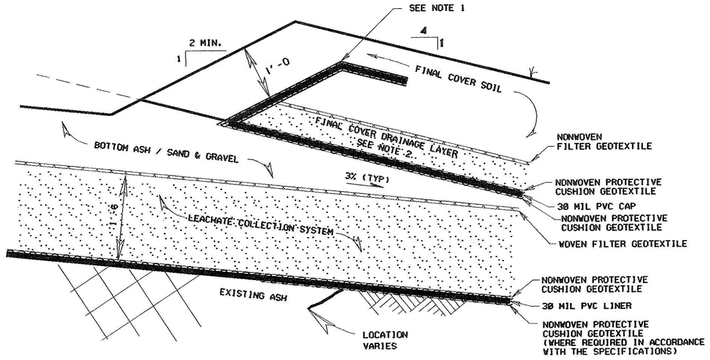
N.T.S.



DETAIL 1/12 13
N.T.S.



DETAIL 3/13
N.T.S.



DETAIL 4/12

NOTES:

1. TEMPORARILY TERMINATE FINAL COVER DRAINAGE LAYER, PVC CAP AND ASSOCIATED GEOTEXTILES. THESE MATERIALS WILL BE CONTINUED UP SLOPE AFTER FLY ASH DIKE IS PLACED. FOR CONSTRUCTION DEVELOPMENT OF CELLS, SEE SHEETS 18-21.
2. IF GEONET FINAL COVER DRAINAGE LAYER IS USED, SEE DETAILS 1/17, 2/17 AND 3/17
3. FOR CONNECTION DETAILS OF THE 8" Ø NON-PERFORATED UNDERDRAIN CONNECTOR PIPE TO THE 12" Ø NON-PERFORATED UNDERDRAIN PIPE, SEE DETAIL 6/17
4. THE TEMPORARY TOPSOIL COVER IS TO BE PLACED AFTER PRELIMINARY BENCH GRADING.
5. THE TYPICAL CROSS-SECTION AS SHOWN IS FOR ALL LOCATIONS EXCEPT AT THE SLOPE DRAIN C4 LOCATION SEE SHEET 14 FOR SLOPE DRAIN DETAILS.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
5-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

DETAILS, 2 OF 6
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30114

ARCH.		ELEC.		MECH.		STR.	
SCALE: NTS							
DR.	JPS					ENGINEERING DIVISION	
CH.	MRL					DESIGN DIVISION	
SO.LDR:	GRL						
DATE:	4-29-94						

APPROVED BY

AMERICAN ELECTRIC POWER SERVICE CORP.

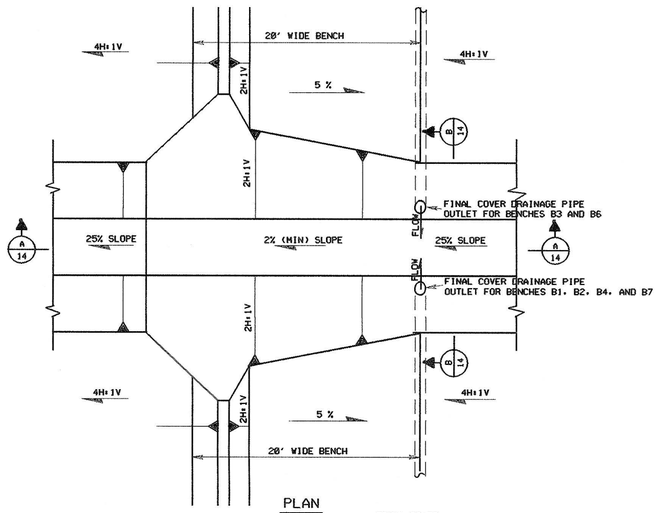
SHEET 13 OF 2[illegible]

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-9400

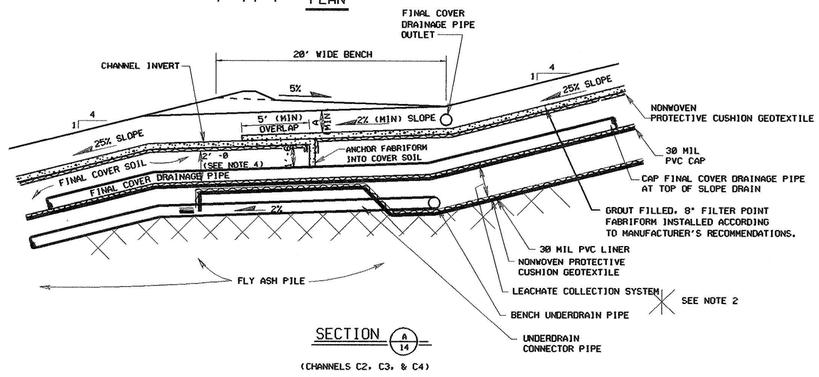
GAI Dwg. 90-364-F17
File No.

DRAFTING		ENGINEERING	
DES.	CHK.	ENG.	MGR.
JPS	GRL	MRL	DWD
DATE	7-24-9[illegible]	4-29-9[illegible]	4-29-9[illegible]

GAI DWG FILE: 8064F017.DGN 12/8/93

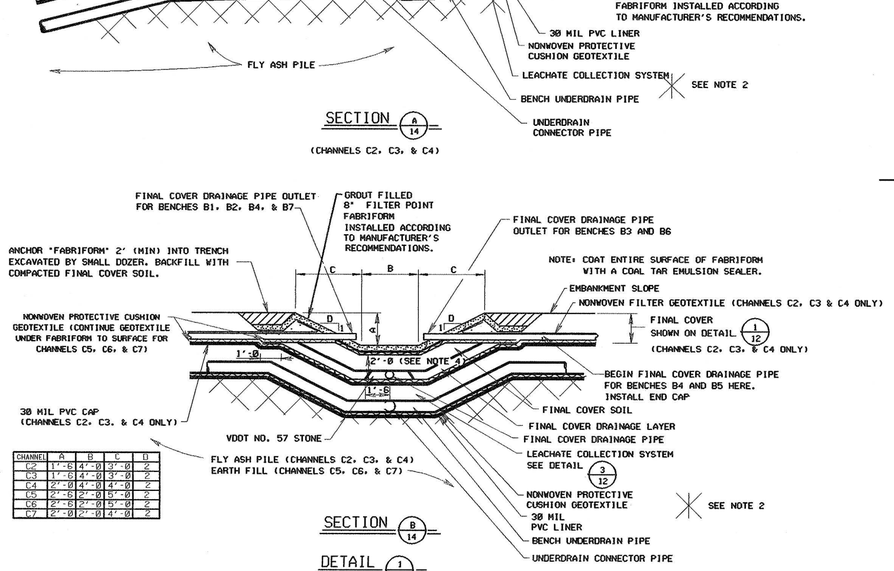


PLAN



SECTION A 14

(CHANNELS C2, C3, & C4)



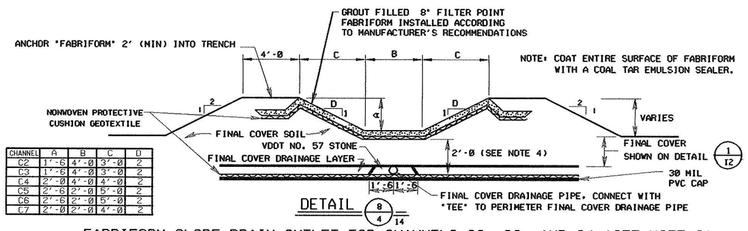
CHANNEL	A	B	C	D
C2	1'-6	4'-0	3'-0	2
C3	1'-6	4'-0	3'-0	2
C4	2'-0	4'-0	4'-0	2
C5	2'-6	2'-0	5'-0	2
C6	2'-6	2'-0	5'-0	2
C7	2'-0	2'-0	4'-0	2

SECTION B 14

DETAIL 1 3 4, 6A, 8, 9 & 16

FABRIFORM SLOPE DRAIN

NTS

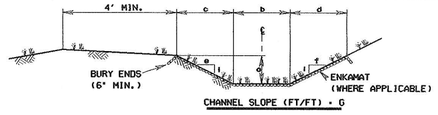


CHANNEL	A	B	C	D
C2	1'-6	4'-0	3'-0	2
C3	1'-6	4'-0	3'-0	2
C4	2'-0	4'-0	4'-0	2
C5	2'-6	2'-0	5'-0	2
C6	2'-6	2'-0	5'-0	2
C7	2'-0	2'-0	4'-0	2

DETAIL 8 4 14

FABRIFORM SLOPE DRAIN OUTLET FOR CHANNELS C2, C3, AND C4 (SEE NOTE 3)

NTS



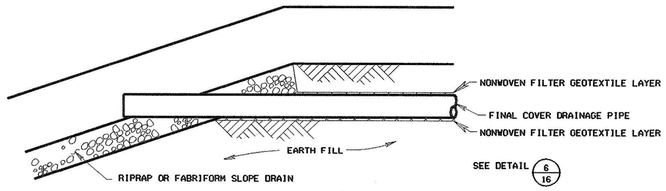
CHANNEL SLOPE (FT/FT) = G

CHANNEL	a	b	c	d	e	f	LINING	G
P1	2'-6	2'-0	5'-0	10'-0	2	4	GRASS W/ENKAMAT	0.005-0.05
P2	1'-6	2'-0	3'-0	6'-0	2	4	GRASS	0.01
P3	1'-6	2'-0	3'-0	6'-0	2	4	GRASS	0.03
P4	1'-6	2'-0	3'-0	6'-0	2	4	GRASS	0.02
P5	2'-6	2'-0	5'-0	10'-0	2	4	GRASS W/ENKAMAT	0.005-0.02
P6	3'-0	2'-0	6'-0	12'-0	2	4	GRASS	0.005
P7	2'-0	2'-0	4'-0	8'-0	2	4	GRASS	0.005
P8	3'-0	2'-0	9'-0	9'-0	3	3	GRASS W/ENKAMAT	0.02
I1	1'-6	2'-0	3'-0	3'-0	2	2	GRASS W/ENKAMAT	0.09

DETAIL 4 3 8, 9, 12, 13, 16 & 17

GRASS LINED CONVEYANCE CHANNEL

N.T.S.

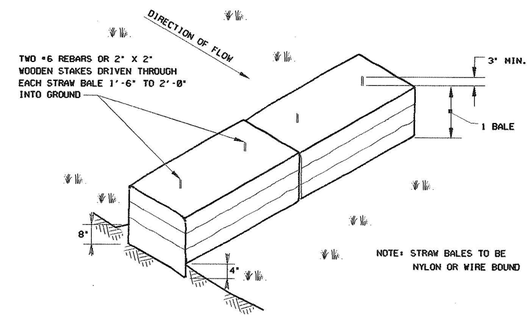


DETAIL 7 3 16

FINAL COVER DRAINAGE PIPE OUTLET

(CHANNELS C5 AND C6)

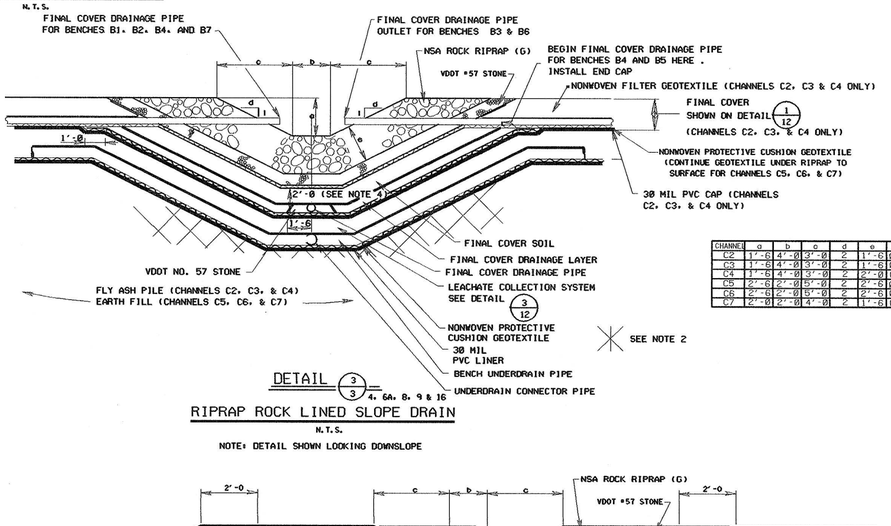
N.T.S.



DETAIL 6 14

TYPICAL STRAW BALE SILT BARRIER

N.T.S.



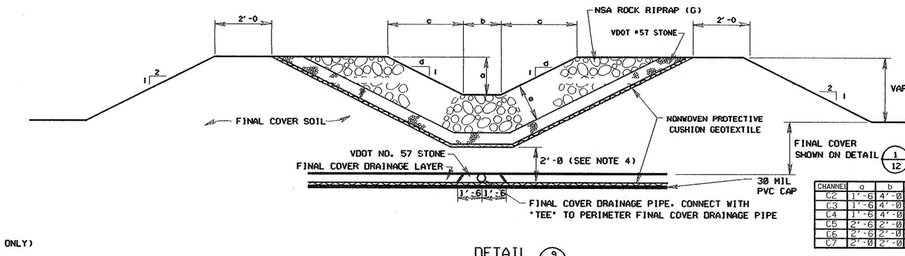
CHANNEL	a	b	c	d	e	f	G
C2	1'-6	4'-0	2'-0	2	1'-6	0'-6	R-4
C3	1'-6	4'-0	3'-0	2	1'-6	0'-6	R-4
C4	1'-6	4'-0	3'-0	2	2'-0	0'-6	R-5
C5	2'-6	2'-0	5'-0	2	2'-6	0'-6	R-7
C6	2'-6	2'-0	5'-0	2	2'-6	0'-6	R-7
C7	2'-0	2'-0	4'-0	2	1'-6	0'-6	R-4

DETAIL 3 3 4, 6A, 8, 9 & 16

RIPRAP ROCK LINED SLOPE DRAIN

N.T.S.

NOTE: DETAIL SHOWN LOOKING DOWNSLOPE



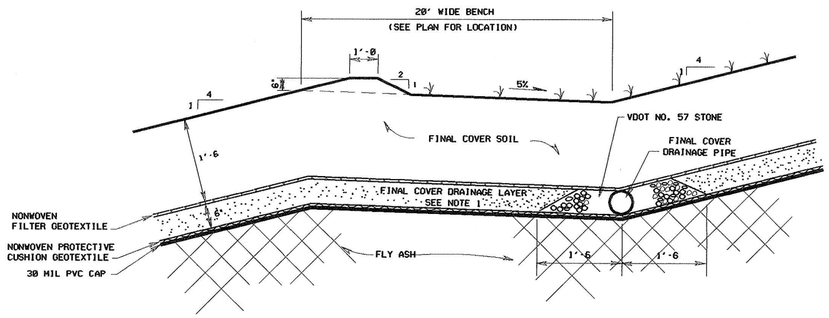
CHANNEL	a	b	c	d	e	f	G
C2	1'-6	4'-0	3'-0	2	1'-6	0'-6	R-4
C3	1'-6	4'-0	3'-0	2	1'-6	0'-6	R-4
C4	1'-6	4'-0	3'-0	2	2'-0	0'-6	R-5
C5	2'-6	2'-0	5'-0	2	2'-6	0'-6	R-7
C6	2'-6	2'-0	5'-0	2	2'-6	0'-6	R-7
C7	2'-0	2'-0	4'-0	2	1'-6	0'-6	R-4

DETAIL 9 4 14

RIPRAP ROCK LINED SLOPE DRAIN OUTLET FOR CHANNELS C2, C3, & C4 (SEE NOTE 3)

N.T.S.

NOTE: DETAIL SHOWN LOOKING DOWNSLOPE



DETAIL 2 6 7, 8 & 9

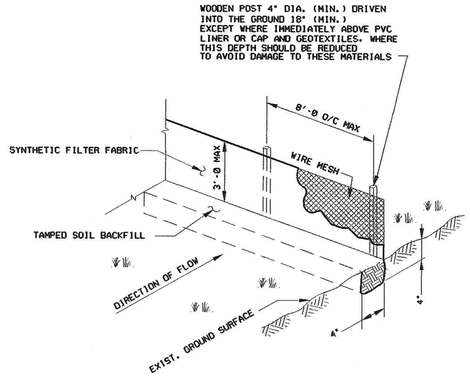
BENCH CHANNEL AND BENCH DRAIN

(BENCH CHANNELS B1, B2 (PARTIAL), B3, B4, B6, AND B7

N.T.S.

NOTES:

1. IF GEONET FINAL COVER DRAINAGE LAYER IS USED, SEE DETAILS 1 17, 2 17 AND 3 17
2. THE UNDERDRAIN PIPES AND LEACHATE COLLECTION SYSTEM SHOWN ARE ONLY APPLICABLE TO CHANNEL C4 AT BENCHES B2 AND B5. AT OTHER LOCATIONS OF CHANNELS C2, C3, AND C4, FLY ASH WILL BE DIRECTLY BELOW THE 30-MIL PVC CAP. THE UNDERDRAIN SYSTEM, INCLUDING PIPES, PIPE BOOTS, LINER TERMINATION, AND OTHER DETAILS SHALL BE CONSTRUCTED AS SHOWN ON DETAIL 6 13
3. AT THE LOCATIONS WHERE CHANNELS C2, C3, & C4 OUTLET INTO THE PERIMETER CONVEYANCE CHANNELS, THE CHANNEL CROSS-SECTION SHALL BE CONSTRUCTED ACCORDING TO DETAILS 8 14 OR 9 14 THE CHANNEL SHALL THEN BE CONSTRUCTED UP THE PILE AT A SLOPE OF 10 PERCENT UNTIL THE TOP OF THE CHANNEL IS LEVEL WITH THE FINAL COVER SURFACE, AT WHICH POINT THE CHANNEL SHALL CONTINUE TO BE CONSTRUCTED UP THE PILE AT A 25 PERCENT SLOPE. THIS 10 PERCENT TRANSISTION LENGTH IS TYPICALLY 10 TO 20 FEET LONG.
4. TWO FEET OF COVER MUST BE MAINTAINED BETWEEN THE SLOPE DRAIN LINING MATERIAL AND THE 30-MIL PVC CAP.



DETAIL 5 18 19, 20 & 21

TYPICAL SILT FENCE

N.T.S.

DATE	NO.	DESCRIPTION	APPD.
12-8-94	D	DRAWING MODIFICATIONS	
6-24-94	C	DRAWING MODIFICATIONS	DWD
5-24-94	B	DRAWING MODIFICATIONS	DWD
10-6-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

DETAILS, 3 OF 6
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30115

ARCH.	ELEC.	MECH.	STR.

SCALE: NTS
DR: JPS
CH: MRL
SG.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION, DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

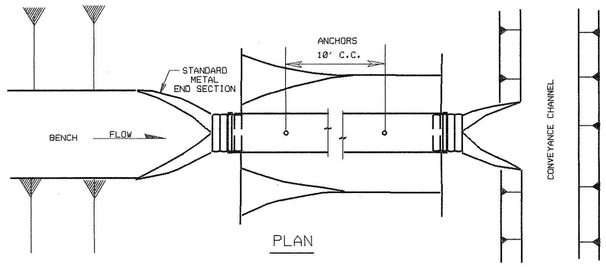
SHEET 14 OF 21

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-6400

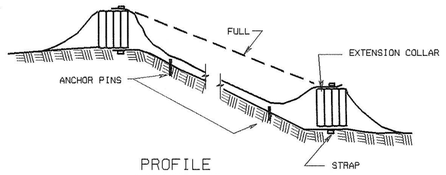
GAI Dwg. File No. 90-364-F18

	DRAFTING		ENGINEERING	
	INITIALS	DWG.	ENG.	WDR.
	JPS	GRL	MRL	DWD
DATE	7-24-9	4-29-92	4-29-92	4-29-9

DWG FILE: 90364F018.DGN 12/8/93



PLAN



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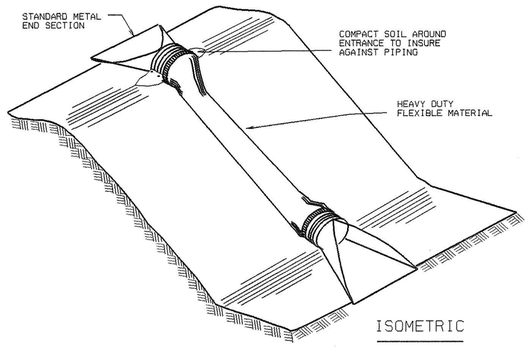


ISOMETRIC

DETAIL 3/5 — 6, 6A, 6B & 7

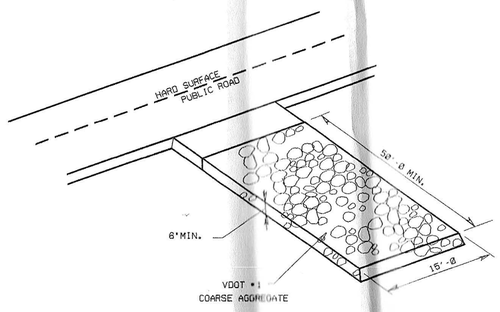
FLEXIBLE TEMPORARY SLOPE DRAIN

N.T.S.

TEMPORARY SLOPE DRAINS SHALL BE SIZED ACCORDING TO THE FOLLOWING TABLE:

SIZE OF SLOPE DRAIN

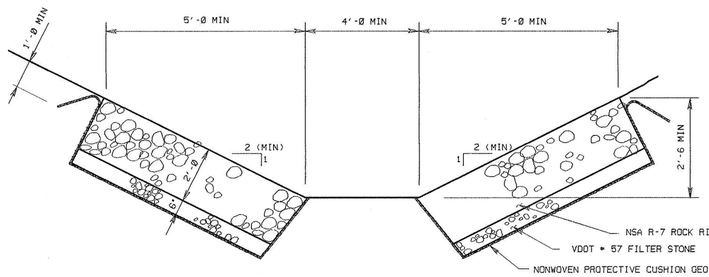
MAXIMUM DRAINAGE AREA (ACRES)	PIPE DIAMETER, D (IN)
0.5	12
1.5	18
2.5	21
3.5	24
5.0	30



DETAIL 6/3 — 4, 5, 6, 6A, 6B, 7 & 9

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

N.T.S.



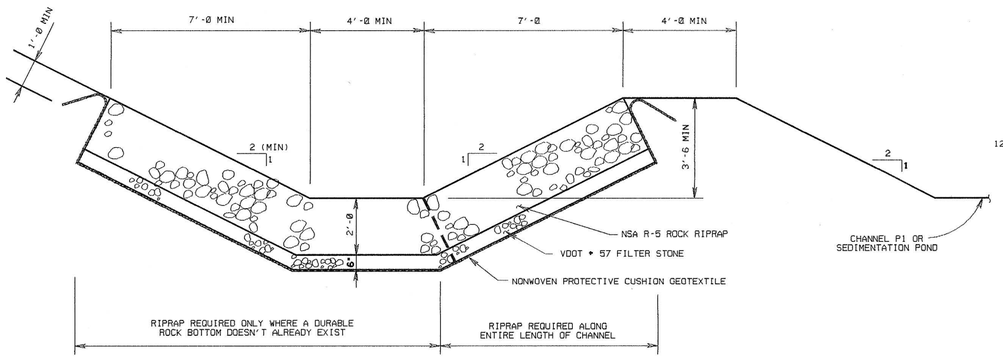
NOTES:

NSA R-7 ROCK RIPRAP SIDESLOPES ARE ONLY NECESSARY IF DURABLE ROCK SIDESLOPES DO NOT EXIST. TERMINATE BOTTOM OF SIDESLOPES WHEN DURABLE ROCK IS ENCOUNTERED.

DETAIL 2/3 — 8

TYPICAL SECTION OF CHANNEL D1B

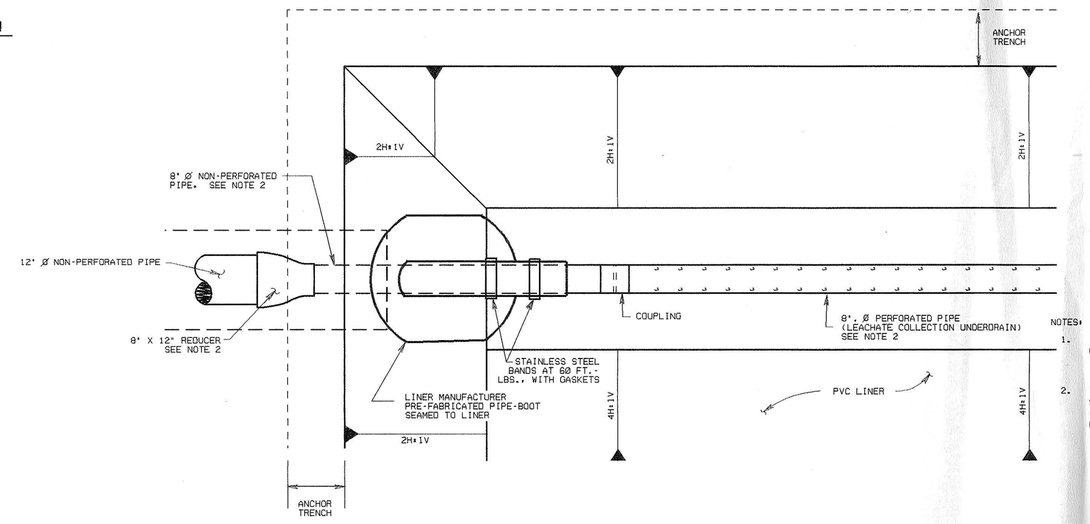
N.T.S.



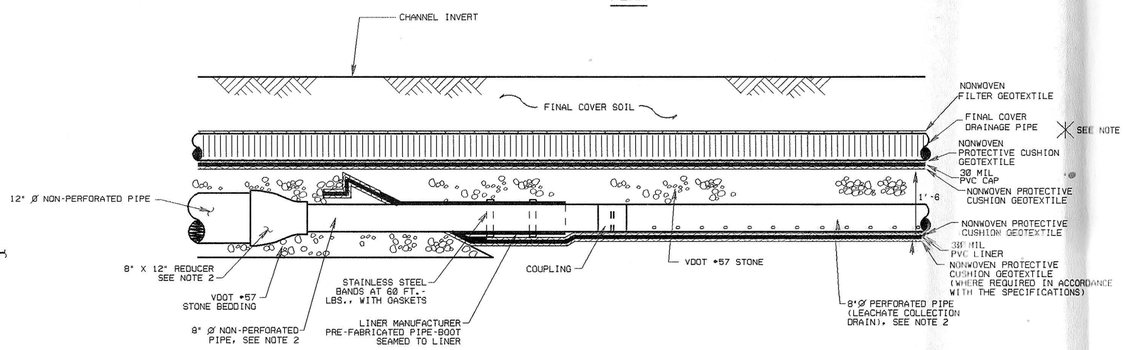
DETAIL 1/3 — 8

TYPICAL SECTION OF CHANNEL D1A

N.T.S.



PLAN



PROFILE

DETAIL 4/4 — 6, 6A, 6B, 7 & 15

CONNECTION BETWEEN TYPE A AND TYPE B UNDERDRAIN, AND CONNECTION BETWEEN TYPE A UNDERDRAIN AND LEACHATE CONVEYANCE PIPE

N.T.S.

NOTES:

1. IF GEONET FINAL COVER DRAINAGE LAYER IS USED, SEE DETAILS 1/17, 2/17 AND 3/17
2. THE PERFORATED COLLECTION PIPE WITHIN AREA 'A' SHALL BE A 12" Ø TYPE A UNDERDRAIN. SEE SHEET 4. THUS, FOR AREA 'A', ALL 8" Ø PIPE SHOWN ON DETAIL 4/16 SHALL BE 12" Ø PIPE AND THE 8" X 12" REDUCER IS NOT REQUIRED.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

DETAILS, 4 OF 6
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30116

ARCH.		ELEC.		MECH.		STR.	

SCALE:	NTS
DR:	JPS
CH:	MRL
SQ.LER:	GRL
DATE:	4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

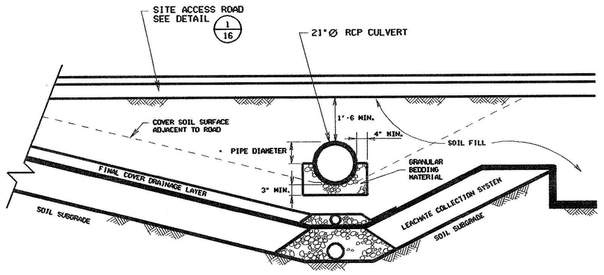
SHEET 15 OF 21

GAI Dwg. File No. 90-364-F19

	DRAFTING	ENGINEERING
SUBM.	JPS	MRL
CHKD.	GRL	DWD
DATE	7-25-9	4-29-92

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-1400

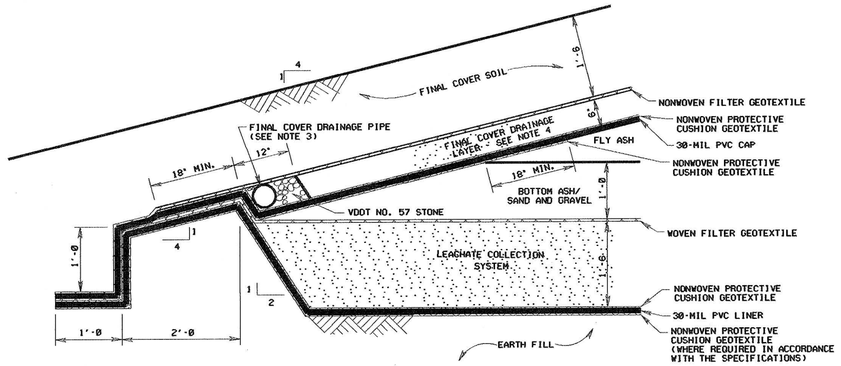
DAI DWG FILE: 8064F819.DGN 12/8/93



DETAIL 9/4 5, 6, 6A, 6B, & 7

RCP CULVERT BELOW SITE ACCESS ROAD (SEE NOTE 7)

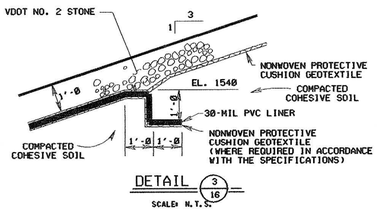
N.T.S.



DETAIL 8/4 10

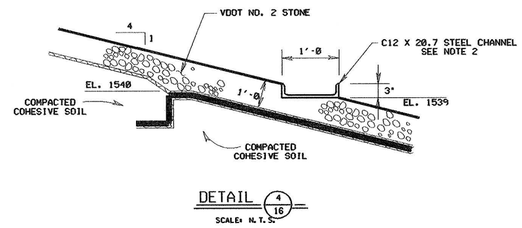
EDGE OF LINER/BERM

SCALE: N.T.S.



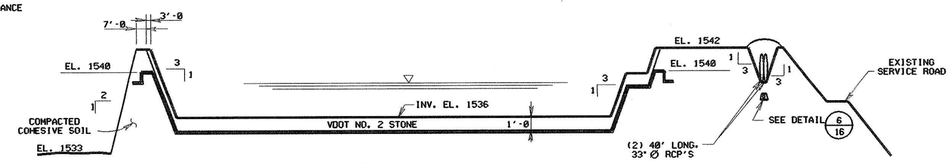
DETAIL 3/16

SCALE: N.T.S.



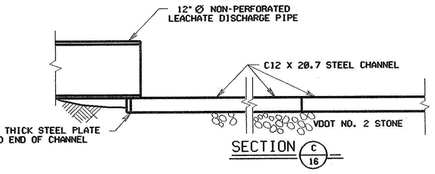
DETAIL 4/16

SCALE: N.T.S.

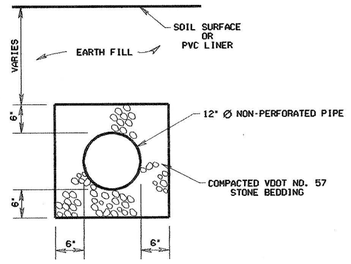


SECTION A/16

HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 5'



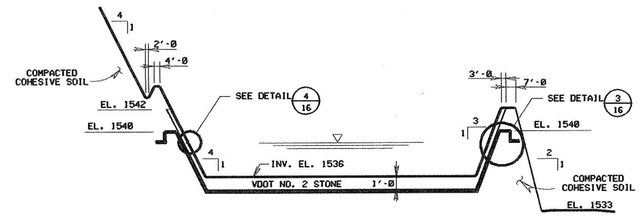
SECTION C/16



DETAIL 7/3

SCALE: N.T.S.

4, 5, 6, 6A, 6B, 7, 8 & 16

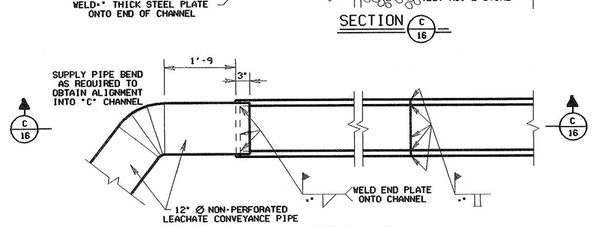


SECTION B/16

HORIZ. SCALE: 1" = 40'
VERT. SCALE: 1" = 5'

NOTES:

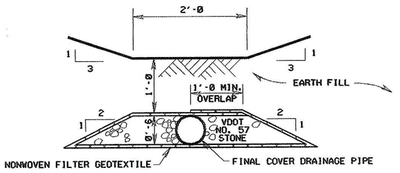
1. PLACE A MINIMUM 20' X 20' LAYER OF NSA R-7 RIPRAP, 2.5' THICK, AT END OF SLOPE DRAIN CHANNEL. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE.
2. INVERT ELEVATION OF STEEL "C" CHANNEL IS 1539 ALONG ENTIRE LENGTH. SHIM CHANNEL AS NECESSARY.
3. CONNECT FINAL COVER DRAINAGE PIPE TO THE FINAL COVER DRAINAGE PIPES UNDER CONVEYANCE CHANNELS P1 AND P6 USING "TEE" CONNECTIONS.
4. IF GEONET FINAL COVER DRAINAGE LAYER IS USED, SEE DETAILS 1/17, 2/17 AND 3/17
5. THE OUTLET OF THE 12" Ø STEEL PIPES SHALL BE PROTECTED FROM EROSION BY INSTALLING A 1.5' THICK LAYER OF NSA R-5 RIPRAP AS SHOWN ON THE DRAWINGS. THE RIPRAP SHALL BE UNDERLAID BY NON-WOVEN PROTECTIVE CUSHION GEOTEXTILE.
6. FOR FINAL COVER DRAINAGE PIPE OUTLET DETAIL, SEE DETAIL 7/14
7. DIMENSIONS FOR THE LEACHATE COLLECTION SYSTEM AND FINAL COVER DRAINAGE LAYER ARE THE SAME AS ON DETAIL 5/12



DETAIL 5/16

FABRICATION OF STEEL C CHANNEL

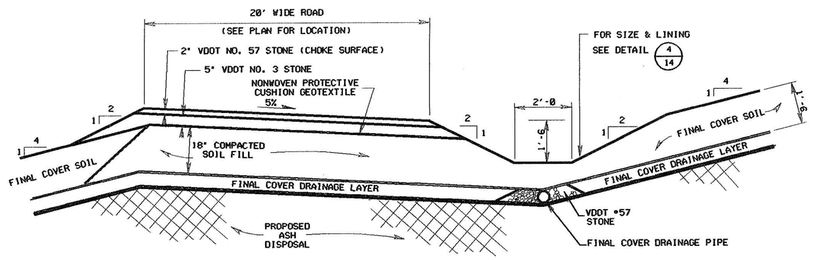
SCALE: N.T.S.



DETAIL 6/4 14 & 16

TYPE D UNDERDRAIN

SCALE: N.T.S.

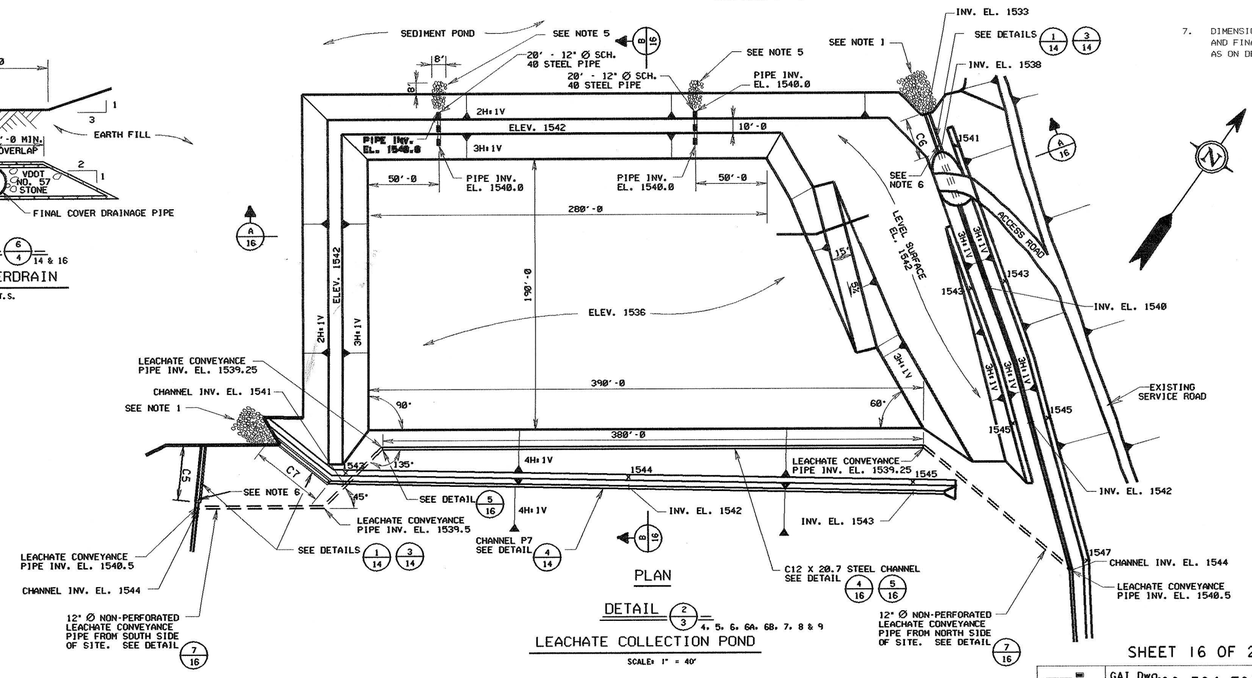


DETAIL 1/8

N.T.S.

SITE ACCESS ROAD

(SEE PLAN FOR LOCATION)



PLAN

DETAIL 2/3 4, 5, 6, 6A, 6B, 7, 8 & 9

LEACHATE COLLECTION POND

SCALE: 1" = 40'

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

DETAILS, 5 OF 6

COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30117

ARCH.	ELEC.	MECH.	STR.
SCALE: NOTED		ENGINEERING DIVISION	
DR: JPS			
CH: MRL		DESIGN DIVISION	
SG.LDR: GRL			
DATE: 4-29-92			

AMERICAN ELECTRIC POWER SERVICE CORP.

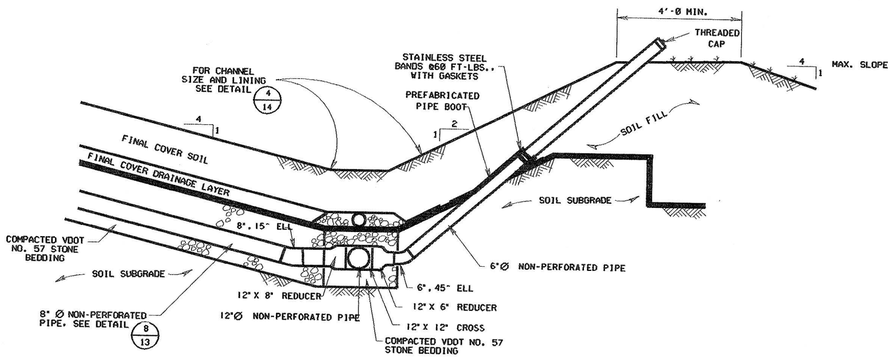
SHEET 16 OF 2

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 15146 412-856-6400

GAI Dwg. File No. 90-364-F20

	DRAFTING		ENGINEERING	
	STARTED	ENDED	DWG.	REV.
DATE	JPS	GRL	MRL	DWD
	8-15-94	4-29-92	4-29-92	9-29-93

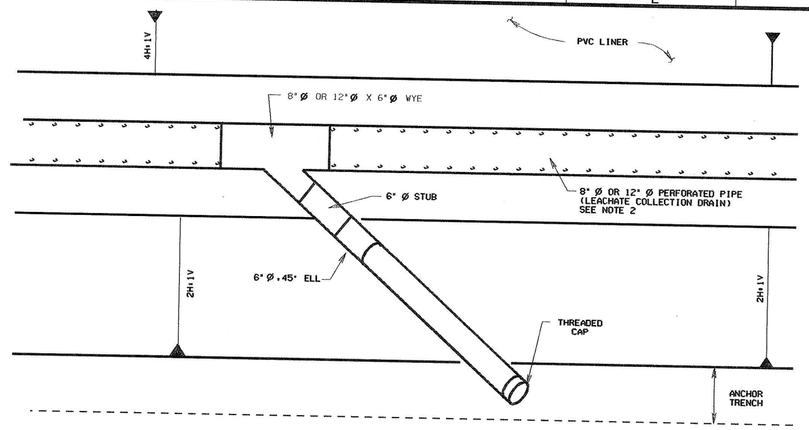
GAI DWG FILE: B364F020.DGN 12/8/93



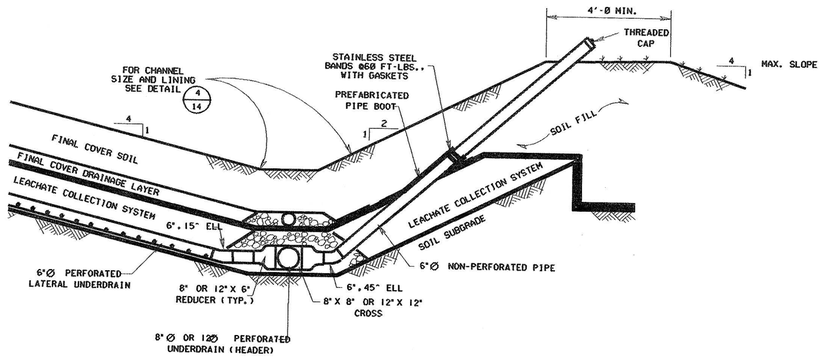
DETAIL 6/4 5, 6, 6A, 6B, 7 & 13

PIPE CLEANOUT DETAIL
AT UNDERDRAIN CONNECTOR PIPE

N.T.S.



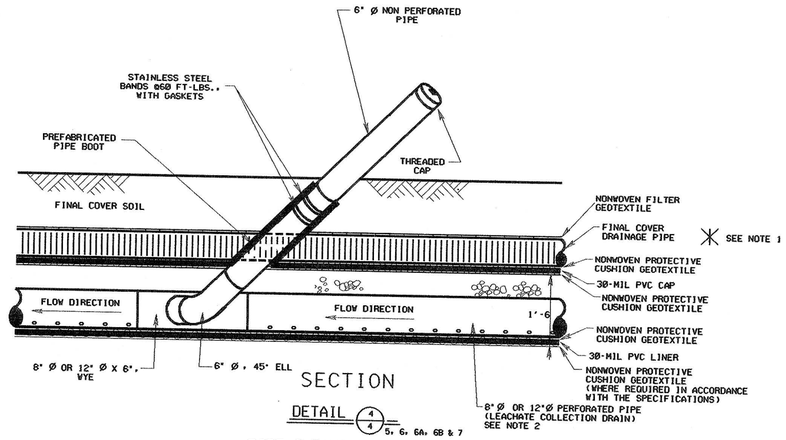
PLAN



DETAIL 5/4 5, 6, 6A, 6B & 7

PIPE CLEANOUT DETAIL
AT LATERAL UNDERDRAIN

N.T.S.



SECTION

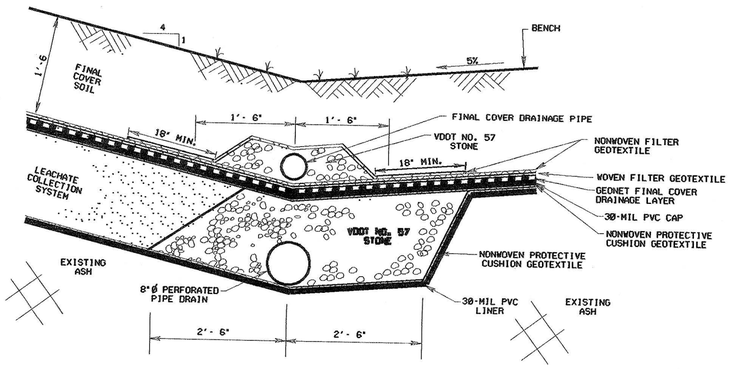
DETAIL 4/4 5, 6, 6A, 6B & 7

PIPE CLEANOUT DETAIL
ON MAIN UNDERDRAIN

N.T.S.

NOTES:

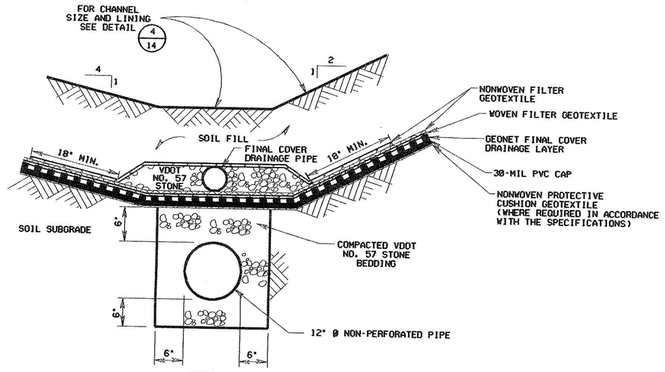
1. IF GEONET FINAL COVER DRAINAGE LAYER IS USED, SEE DETAILS 1/17, 2/17 AND 3/17
2. THE PERFORATED LEACHATE COLLECTION DRAIN IS FOR TYPE A UNDERDRAINS ONLY. THE LEACHATE COLLECTION DRAIN FOR TYPE B UNDERDRAINS SHALL BE 12" Ø NON-PERFORATED PIPE.



DETAIL 3/12 13, 14, 15, 16 & 17

TYPE C UNDERDRAIN
ALTERNATE FINAL COVER DESIGN - GEONET DRAINAGE LAYER

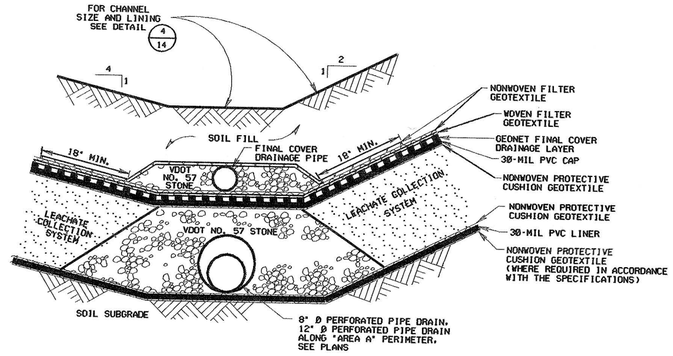
N.T.S.



DETAIL 2/12 13, 14, 15, 16 & 17

TYPE B UNDERDRAIN
ALTERNATE FINAL COVER DESIGN - GEONET DRAINAGE LAYER

N.T.S.



DETAIL 1/12 13, 14, 15, 16 & 17

TYPE A UNDERDRAIN
ALTERNATE FINAL COVER DESIGN - GEONET DRAINAGE LAYER

N.T.S.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

DETAILS, 6 OF 6
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30118

ARCH.		ELEC.		MECH.		STR.	
SCALE: NTS						APPROVED BY	ENGINEERING DIVISION
DR: JPS							
CH: MRL							DESIGN DIVISION
SQ.LDR: GRL							
DATE: 4-29-92							

AMERICAN ELECTRIC POWER SERVICE CORP.

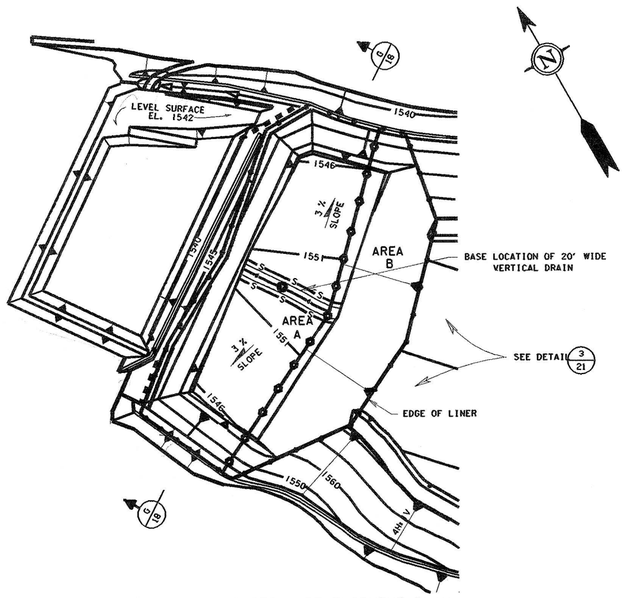
SHEET 17 OF 21

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 15146-1571 412-856-4000

GAI Dwg. File No. 90-364-F32

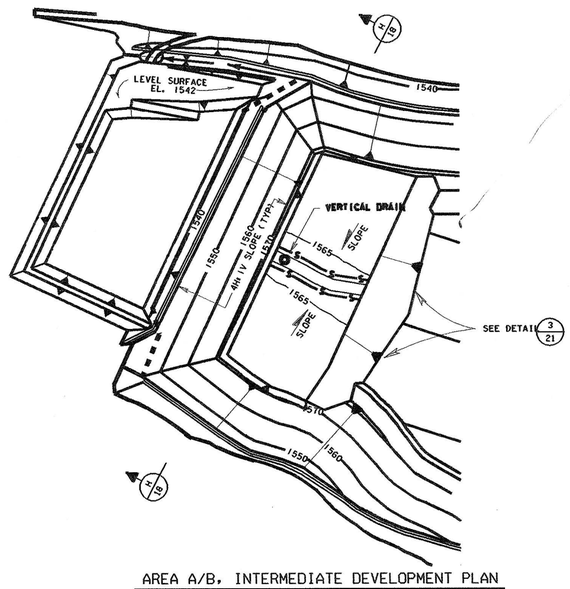
	DRAFTING		ENGINEERING	
	INITIALS	DWG.	TRS.	WKS.
	JPS	GRL	MRL	DWO
DATE	7-24-9	4-29-92	4-29-92	4-29-92

GAI DWG FILE: 8364F832.DGN 12/8/93



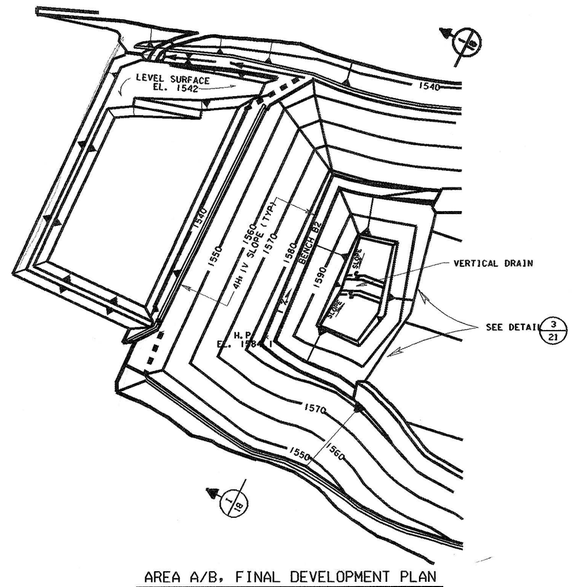
AREA A/B, INITIAL DEVELOPMENT PLAN

SCALE: 1" = 100'



AREA A/B, INTERMEDIATE DEVELOPMENT PLAN

SCALE: 1" = 100'

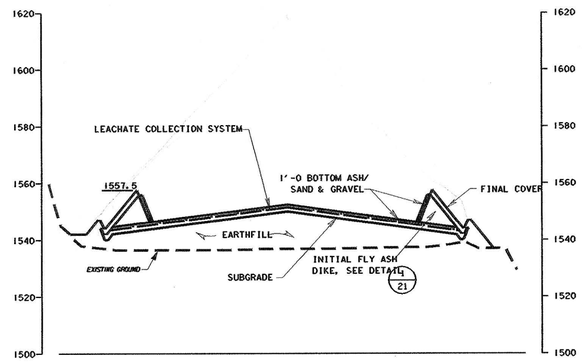


AREA A/B, FINAL DEVELOPMENT PLAN

SCALE: 1" = 100'

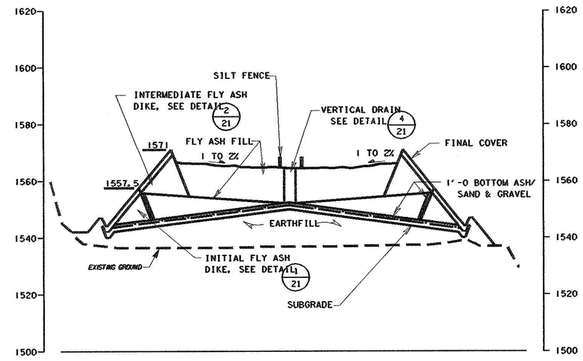
NOTES:

1. STAGES OF DEVELOPMENT MAY BE ALTERED DURING CONSTRUCTION.
2. FINAL TOP AREA SHALL BE GRADED TO SLOPES SHOWN ON FINAL TOPOGRAPHY PLAN, SHEET 8 OF 21. ELEVATIONS SHOWN INCLUDE FINAL COVER.
3. VERTICAL DRAINS TO BE CONSTRUCTED OF BOTTOM ASH OR SAND & GRAVEL, AS MATERIAL SUPPLY DICTATES.
4. SEE SHEET 5 FOR LOCATIONS OF LEACHATE COLLECTION PIPE NETWORK, UNDERDRAINS, AND FINAL COVER DRAINAGE PIPES.



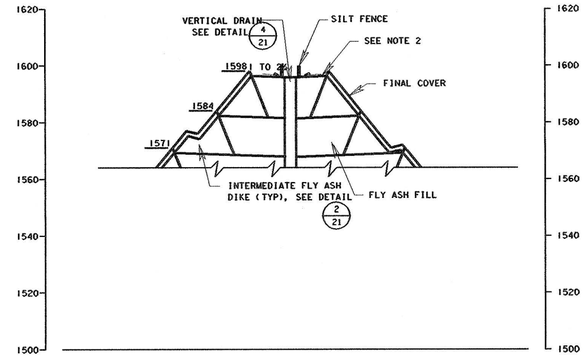
SECTION G/18

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION H/18

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION I/18

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'

LEGEND

SEE PHASING PLAN, 1 OF 5, SHEET 5 OF 21

HORIZONTAL SCALE: 1"=100'

200' 100' 0 100' 200'

VERTICAL SCALE: 1"=20'

40' 20' 0 20' 40'

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWO
5-24-93	B	DRAWING MODIFICATIONS	DWO
10-8-92	A	DRAWING MODIFICATIONS	DWO

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

AREA DEVELOPMENT PLAN, 1 OF 3
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30119

ARCH.	ELEC.	MECH.	STR.

SCALE: NOTED
DR: JPS
CH: MRL
SO.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

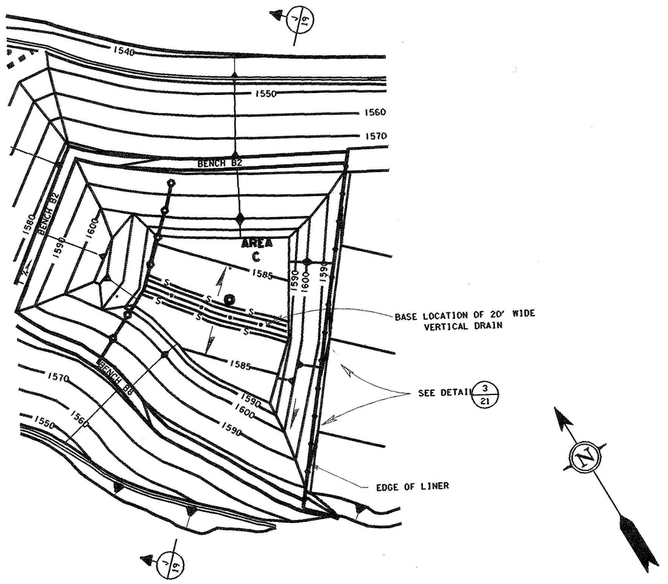
SHEET 18 OF 21

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, PA
412-856-8400

GAI Dwg. File No. 90-364-F21

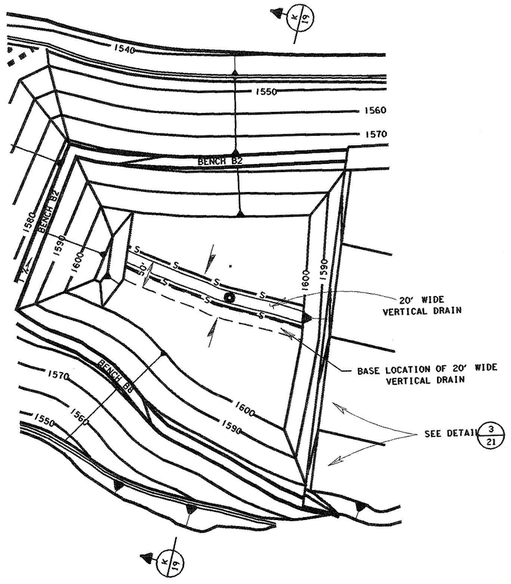
	DRAFTING		ENGINEERING	
STRUCTURE	JPS	GRL	MRL	DWO
DATE	2-11-92	4-29-92	4-29-92	

GAI DWG FILE: 0364F021.DGN 10/8/93



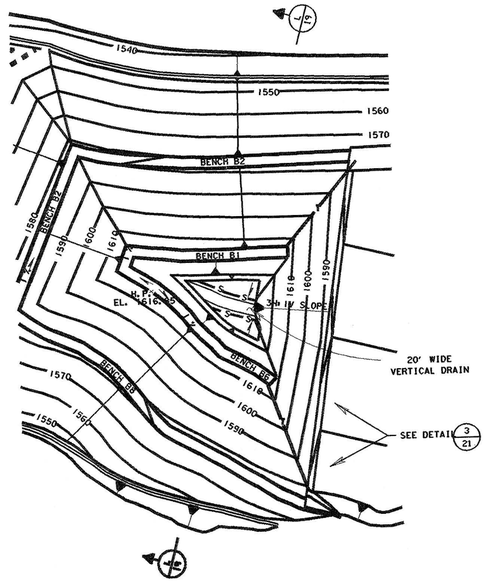
AREA C, INITIAL DEVELOPMENT PLAN

SCALE: 1" = 100'



AREA C, INTERMEDIATE DEVELOPMENT PLAN

SCALE: 1" = 100'

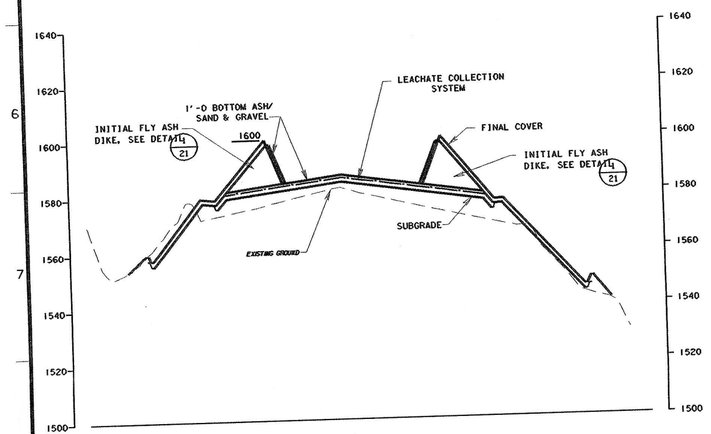


AREA C, FINAL DEVELOPMENT PLAN

SCALE: 1" = 100'

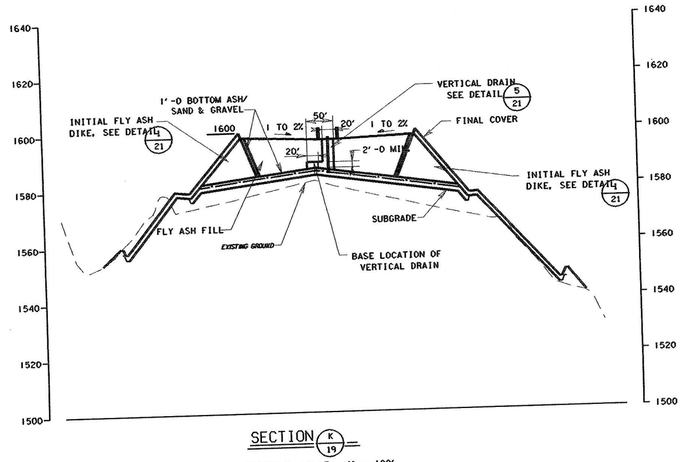
NOTES:

1. STAGES OF DEVELOPMENT MAY BE ALTERED DURING CONSTRUCTION.
2. FINAL TOP AREA SHALL BE GRADED TO SLOPES SHOWN ON FINAL TOPOGRAPHY PLAN, SHEET 8 OF 21. ELEVATIONS SHOWN INCLUDE FINAL COVER.
3. VERTICAL DRAINS TO BE CONSTRUCTED OF BOTTOM ASH OR SAND & GRAVEL, AS MATERIAL SUPPLY DICTATES.
4. SEE SHEET 6 FOR LOCATIONS OF LEACHATE COLLECTION PIPE NETWORK, UNDERDRAINS, AND FINAL COVER DRAINAGE PIPES.
5. AREA DEVELOPMENT FOR AREAS D AND E WILL BE SIMILAR TO THE PROCEDURE SHOWN FOR AREA C.



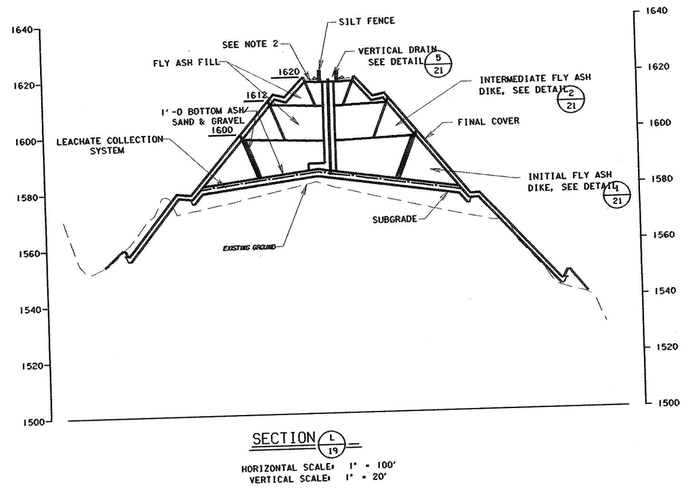
SECTION J 19

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION K 19

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION L 19

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'

LEGEND

SEE PHASING PLAN, 2 OF 5, SHEET 6 OF 21

HORIZONTAL SCALE: 1"=100'

200' 100' 0 100' 200'

VERTICAL SCALE: 1"=20'

40' 20' 0 20' 40'

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	DWD
6-24-93	C	DRAWING MODIFICATIONS	DWD
4-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

AREA DEVELOPMENT PLAN, 2 OF 3
COAL COMBUSTION BY-PRODUCT DISPOSAL FACILITY

DWG. NO. 56-30120

ARCH.	ELEC.	MECH.	STR.
SCALE: NOTED	APPROVED BY	ENGINEERING DIVISION	
DR: JPS			
CH: MRL		DESIGN DIVISION	
SO.LDR: GRL			
DATE: 4-29-92			

AMERICAN ELECTRIC POWER SERVICE CORP.

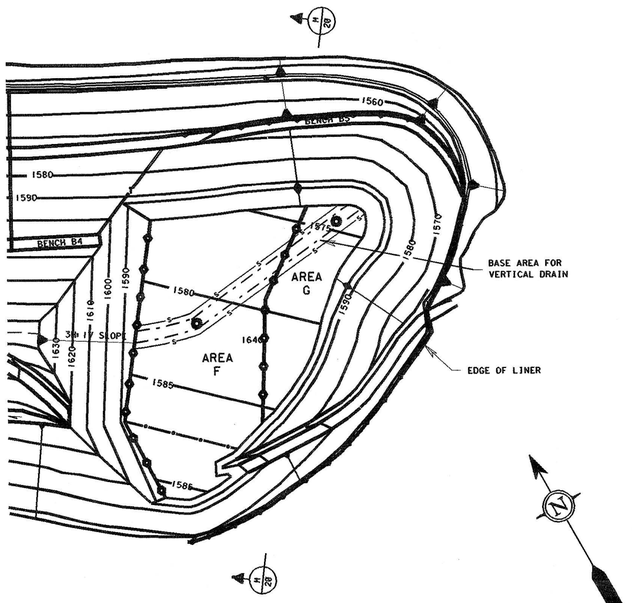
SHEET 19 OF 21

GAI CONSULTANTS, INC.
570 Beatty Road
Monroeville, PA
412-856-4000

GAI Doc. File No. 90-364-F22

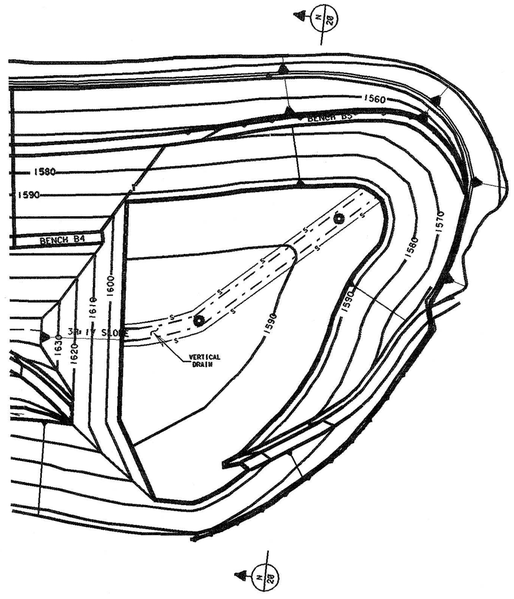
	DRAFTING		ENGINEERING	
	SYSTEMS	DRWG.	ENGR.	MGR.
	JPS	GRL	MRL	DWD
DATE	2-14-92	4-29-92	4-29-92	4-29-92

GAI DWG FILE: 03640F022.DGN 12/8/93



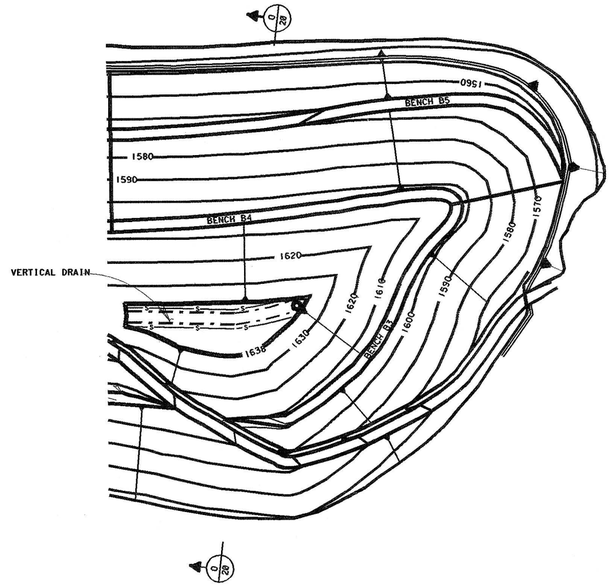
AREA F/G, INITIAL DEVELOPMENT PLAN

SCALE: 1" = 100'



AREA F/G, INTERMEDIATE DEVELOPMENT PLAN

SCALE: 1" = 100'

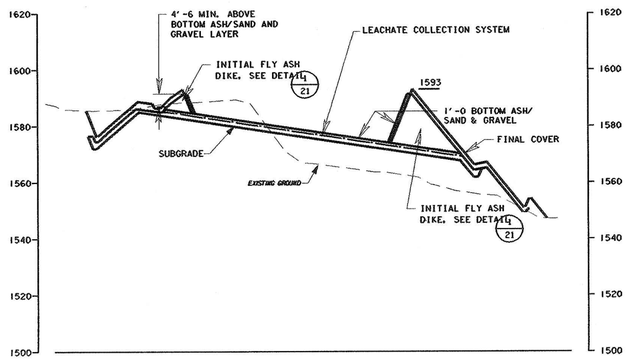


AREA F/G, FINAL DEVELOPMENT PLAN

SCALE: 1" = 100'

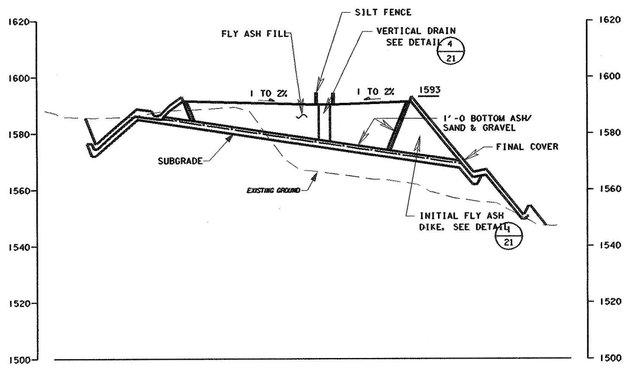
NOTES:

1. STAGES OF DEVELOPMENT MAY BE ALTERED DURING CONSTRUCTION.
2. FINAL TOP AREA SHALL BE GRADED TO SLOPES SHOWN ON FINAL TOPOGRAPHY PLAN, SHEET 8 OF 21. ELEVATIONS SHOWN INCLUDE FINAL COVER.
3. VERTICAL DRAINS TO BE CONSTRUCTED OF BOTTOM ASH OR SAND & GRAVEL, AS MATERIAL SUPPLY DICTATES.
4. SEE SHEET 7 FOR LOCATIONS OF LEACHATE COLLECTION PIPE NETWORK, UNDERDRAINS, AND FINAL COVER DRAINAGE PIPES.



SECTION N/20

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'



SECTION N/20

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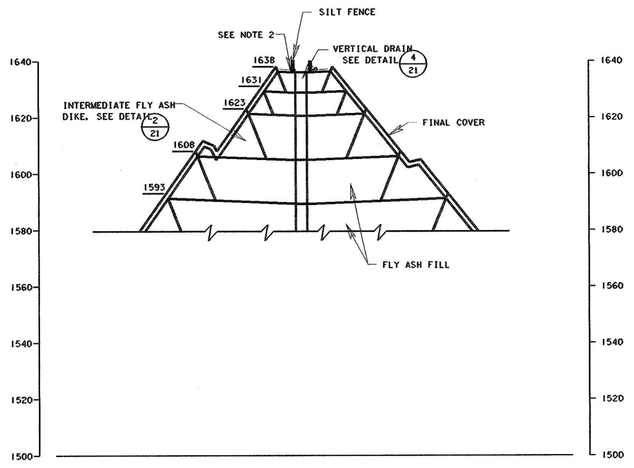
VERTICAL SCALE: 1" = 20'



SECTION O/20

HORIZONTAL SCALE: 1" = 100'
VERTICAL SCALE: 1" = 20'

LEGEND

SEE PHASING PLAN, 5 OF 5, SHEET 7 OF 21

HORIZONTAL SCALE: 1"=100'

200' 100' 0 100' 200'

VERTICAL SCALE: 1"=20'

40' 20' 0 20' 40'

DATE	NO.	DESCRIPTION	APPD.
12-8-93	D	DRAWING MODIFICATIONS	
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

AREA DEVELOPMENT PLAN, 3 OF 3
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30121

ARCH.	ELEC.	MECH.	STR.

SCALE: NOTED
DR: JPS
CH: MRL
SO.LDR: GRL
DATE: 4-29-92

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

SHEET 20 OF 21

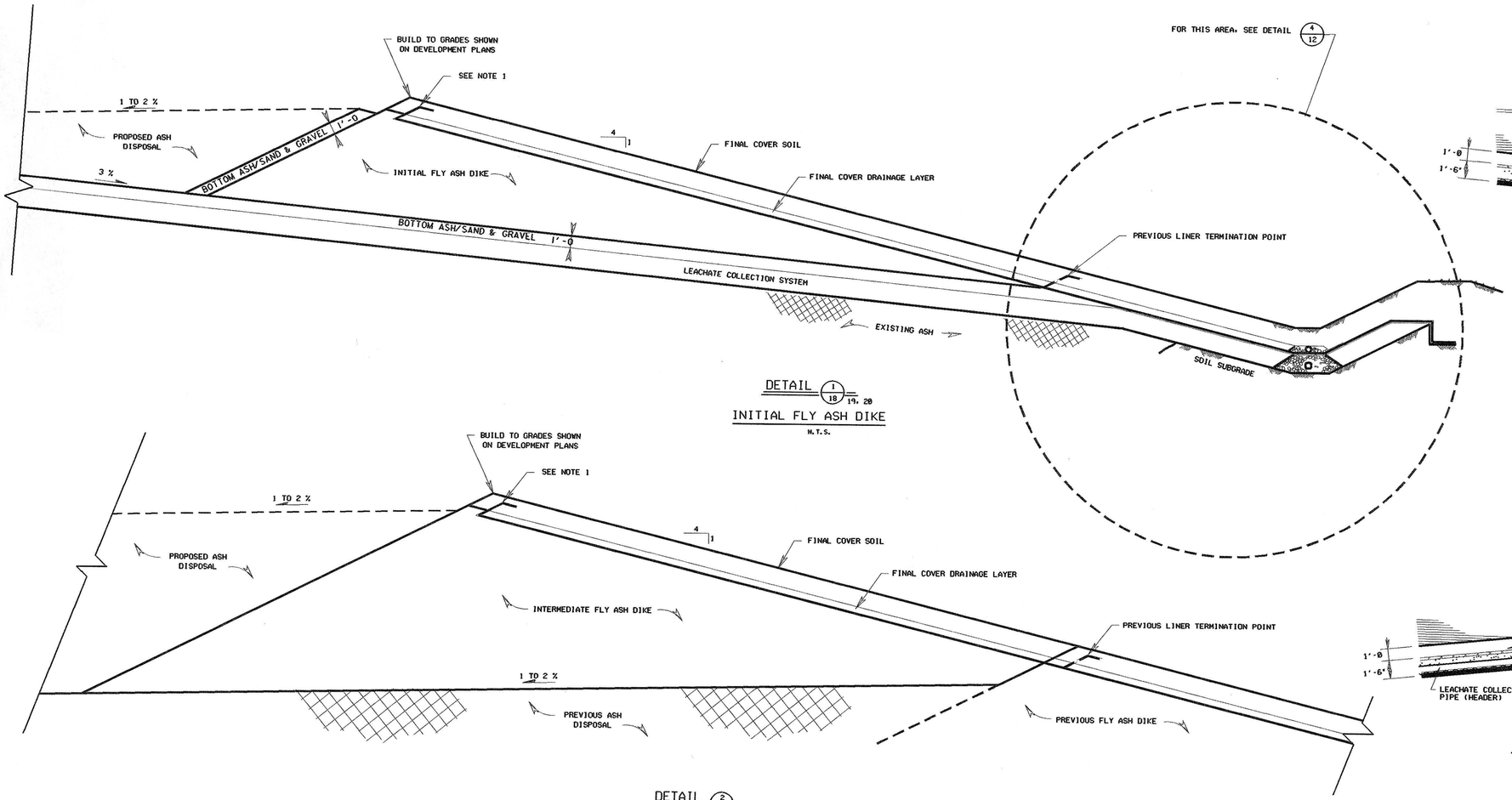
GAI Proj. No. 90-364-F23
File No.

DRAFTING		ENGINEERING	
TYPIST	ORIG.	TRACE	WDS
JPS	GRL	MRL	DWD

DATE 2-14-92 4-29-92 4-29-92

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-6400

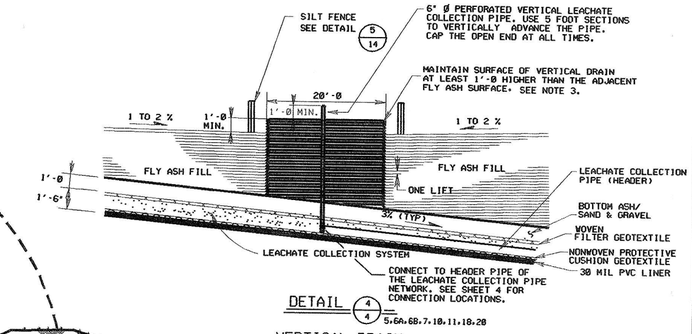
GAI DWG FILE: 0364F025.DGN 12/8/93



DETAIL 1/18 = 19, 20

INITIAL FLY ASH DIKE

N.T.S.



DETAIL 4/4 = 5, 6A, 6B, 7, 10, 11, 18, 20

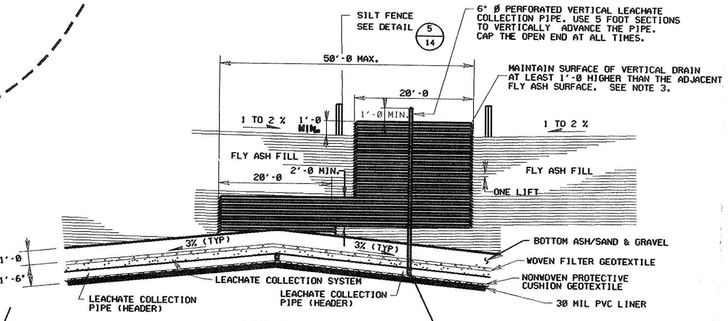
VERTICAL DRAIN

N.T.S.

DETAIL 2/18 = 19, 20

INTERMEDIATE FLY ASH DIKE

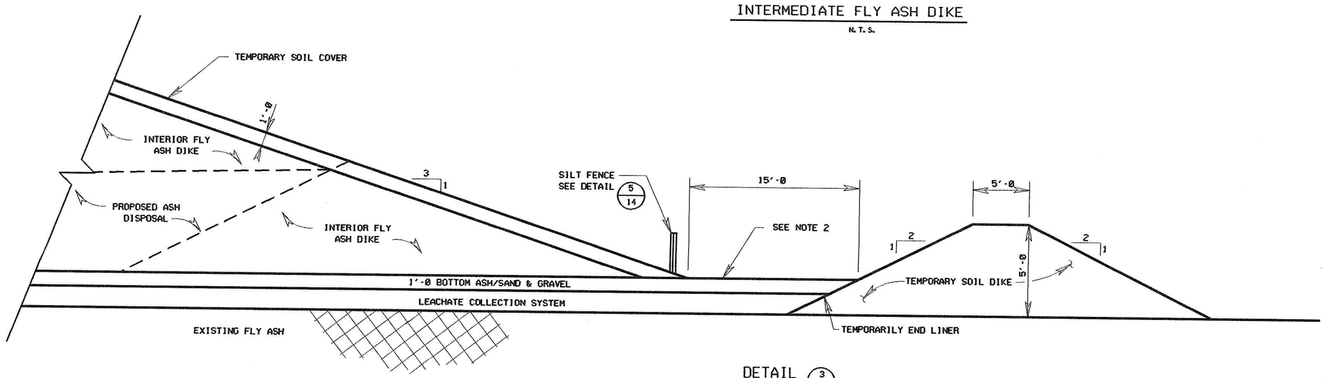
N.T.S.



DETAIL 5/4 = 6, 6A, 11, 19

OFFSET VERTICAL DRAIN

N.T.S.



DETAIL 3/5 = 6, 6A, 6B, 18, & 19

TEMPORARY INTERIOR SLOPE

N.T.S.

NOTES:

1. TEMPORARILY TERMINATE FINAL COVER DRAINAGE LAYER, PVC CAP AND ASSOCIATED GEOTEXTILES. THESE MATERIALS WILL BE CONTINUED UP SLOPE AFTER FLY ASH DIKE IS PLACED.
2. AREA TO COLLECT AND DRAIN RUNOFF FROM FLY ASH AND TEMPORARY SLOPE. AREA MUST BE KEPT FREE OF SEDIMENTS TO ALLOW DRAINAGE.
3. SURFACE OF VERTICAL DRAIN MUST BE KEPT FREE OF FLY ASH SEDIMENTS TO ALLOW DRAINAGE. SILT FENCE SHALL BE USED AROUND THE DRAIN FOR THIS PURPOSE. THE SURFACE OF THE VERTICAL DRAIN SHALL BE CLEANED OF ALL FLY ASH DEPOSITS OR OTHER MATERIALS PRIOR TO THE PLACEMENT OF THE NEXT BOTTOM ASH/ SAND & GRAVEL LIFT.

DATE	NO.	DESCRIPTION	APPD.
12-8-93	C	DRAWING MODIFICATIONS	
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

AREA DEVELOPMENT DETAILS
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30122

ARCH.	ELEC.	MECH.	STR.

SCALE: NTS
DR: JPS
CH: MRL
SQ.LDR: GRL
DATE: 4-29-93

APPROVED BY: ENGINEERING DIVISION; DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

SHEET 21 OF 2

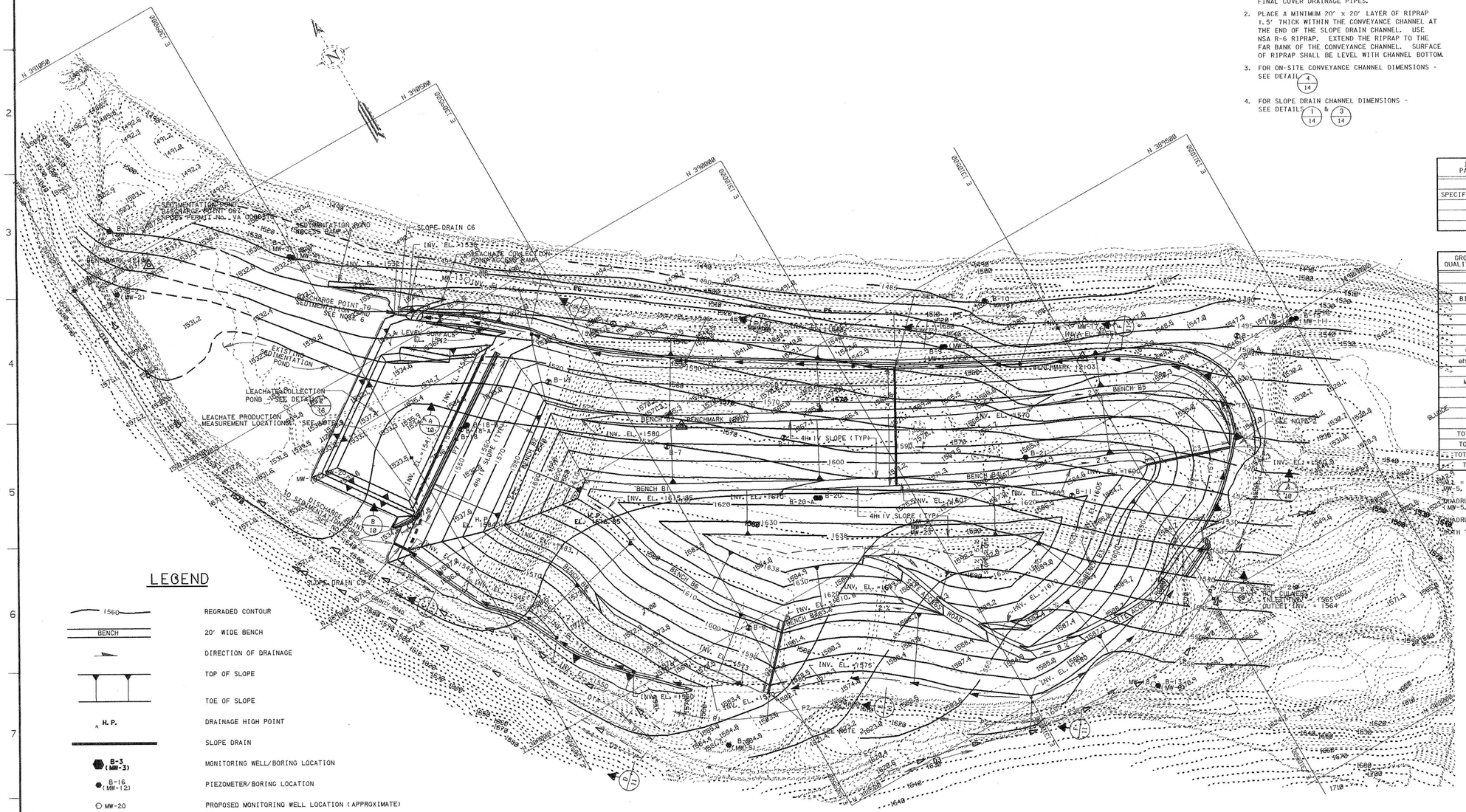
gai CONSULTANTS, INC. 570 Beatty Road Monroeville, Pa 412-856-6400

gai Doc. File No. 90-364-F24

DRAFTING		ENGINEERING	
SYM.	DWG.	INC.	RES.
JPS	GRL	MRL	DWD

DATE: 2-17-92 4-29-92 4-29-93 4-29-93

DAI DWG FILE: 8364FB24.DGN 12/8/93



NOTES:

1. SEE DETAIL SHEETS 12 AND 13 TO DETERMINE EXACT LOCATION OF ON-SITE CONVEYANCE CHANNELS AND FINAL COVER DRAINAGE PIPES.
2. PLACE A MINIMUM 20' x 20' LAYER OF RIPRAP 1.5' THICK WITHIN THE CONVEYANCE CHANNEL AT THE END OF THE SLOPE DRAIN CHANNEL. USE NSA R-6 RIPRAP. EXTEND THE RIPRAP TO THE FAR BANK OF THE CONVEYANCE CHANNEL. SURFACE OF RIPRAP SHALL BE LEVEL WITH CHANNEL BOTTOM.
3. FOR ON-SITE CONVEYANCE CHANNEL DIMENSIONS - SEE DETAIL 4/14
4. FOR SLOPE DRAIN CHANNEL DIMENSIONS - SEE DETAILS 1/14 & 3/14
5. FOR BENCH CHANNEL DIMENSIONS - SEE DETAIL 2/14
6. PLACE A MINIMUM 20' WIDE x 20' LONG, 2.5' THICK LAYER OF NSA R-7 RIPRAP AT THE END OF SLOPE DRAIN CHANNELS C5, C6 AND C7. THE RIPRAP SHALL BE UNDERLAID BY NONWOVEN PROTECTIVE CUSHION GEOTEXTILE.
7. FOR SITE ACCESS ROAD DETAILS - SEE DETAIL 1/16
8. OFF-SITE DIVERSION CHANNEL D1 IS EXISTING AND IS TO BE MODIFIED AS SHOWN ON DETAILS 1/15 & 2/15. OFF-SITE DIVERSION CHANNELS D2 AND D3 ARE ALSO EXISTING BUT DO NOT REQUIRE ANY ADDITIONAL MODIFICATIONS.
9. FOR A MORE COMPLETE DESCRIPTION OF LEACHATE MONITORING, REFER TO SECTION 7.5 OF THE OPERATION MANUAL.

INDICATOR PARAMETERS	WELLS TO BE SAMPLED	FREQUENCY DURING FIRST YEAR A WELL IS SAMPLED	FREQUENCY AFTER FIRST YEAR A WELL IS SAMPLED
ph	ALL[1]	QUARTERLY[2]	SEMI-ANNUALLY[3]
SPECIFIC CONDUCTANCE	ALL	QUARTERLY[2]	SEMI-ANNUALLY[3]
TOC	ALL	QUARTERLY[2]	SEMI-ANNUALLY[3]
TOX	ALL	QUARTERLY[2]	SEMI-ANNUALLY[3]

GROUND WATER QUALITY PARAMETERS	WELLS TO BE SAMPLED	FREQUENCY DURING FIRST YEAR A WELL IS SAMPLED	FREQUENCY AFTER FIRST YEAR A WELL IS SAMPLED
ARSENIC[4]	ALL	QUARTERLY	ANNUALLY
BARIUM[4]	ALL	QUARTERLY	ANNUALLY
BICARBONATE	ALL	QUARTERLY	ANNUALLY
BORON[4]	ALL	QUARTERLY	ANNUALLY
CADMIUM[4]	ALL	QUARTERLY	ANNUALLY
CALCIUM[4]	ALL	QUARTERLY	ANNUALLY
CHLORIDE[4]	ALL	QUARTERLY	ANNUALLY
CHROMIUM[4]	ALL	QUARTERLY	ANNUALLY
ph POTENTIAL	ALL	QUARTERLY	ANNUALLY
LEAD[4]	ALL	QUARTERLY	ANNUALLY
MAGNESIUM[4]	ALL	QUARTERLY	ANNUALLY
SELENIUM[4]	ALL	QUARTERLY	ANNUALLY
SODIUM[4]	ALL	QUARTERLY	ANNUALLY
SULFATE	ALL	QUARTERLY	ANNUALLY
TDS	ALL	QUARTERLY	ANNUALLY
TOTAL COPPER	ALL	QUARTERLY	ANNUALLY
TOTAL NICKEL	ALL	QUARTERLY	ANNUALLY
TOTAL VANADIUM	ALL	QUARTERLY	ANNUALLY
TOTAL ZINC	ALL	QUARTERLY	ANNUALLY

[1] = MW-3, MW-6, MW-7, MW-8, MW-13, MW-14, MW-16, MW-17 DOWNGRADIENT; MW-5, MW-9, MW-18 UPGRADIENT

[2] QUADRUPLICATE SAMPLES SHOULD BE COLLECTED FOR UPGRADIENT WELLS ONLY (MW-5, MW-9, MW-18)

[3] QUADRUPLICATE SAMPLES SHOULD BE COLLECTED FOR ALL WELLS

[4] BOTH TOTAL AND DISSOLVED METALS ANALYSES WILL BE CONDUCTED

LEGEND

1560	REGRADED CONTOUR
BENCH	20' WIDE BENCH
	DIRECTION OF DRAINAGE
	TOP OF SLOPE
	TOE OF SLOPE
H.P.	DRAINAGE HIGH POINT
	SLOPE DRAIN
B-3 (MW-3)	MONITORING WELL/BORING LOCATION
B-16 (MW-12)	PIEZOMETER/BORING LOCATION
MW-20	PROPOSED MONITORING WELL LOCATION (APPROXIMATE)
B-17	BORING LOCATION
P3	ON-SITE CONVEYANCE CHANNEL
D2	OFF-SITE DIVERSION CHANNEL
	LEACHATE CONVEYANCE PIPE
	LIMITS OF SEDIMENT BASIN
	BENCHMARK LOCATION
A/10	SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / SHEET NUMBER ON WHICH SECTION IS DRAWN
1/12	DETAIL IDENTIFICATION NUMBER AND LOCATION / SHEET NUMBER ON WHICH DETAIL IS DRAWN
SECTION A/8	SECTION IDENTIFICATION LETTER / SHEET NUMBER ON WHICH SECTION CUTTING PLANE IS LOCATED
DETAIL 1/9 6, 7	DETAIL IDENTIFICATION NUMBER / SHEET NUMBER(S) ON WHICH DETAIL IS LOCATED
1560	GROUNDWATER CONTOUR
1560	INTERPOLATED GROUNDWATER CONTOUR

SCALE: 1" = 100'

200' 100' 0 100' 200'

BENCHMARK	ELEVATION	COORDINATES
12103	1553.64	N 389159.908 E 1310516.533
12106	1536.61	N 390464.566 E 1308686.040
12107	1580.86	N 389494.701 E 1309600.725

MAP REFERENCE:

1. THE BASE MAP FOR THIS DRAWING WAS PREPARED BY L. ROBERT KIMBALL AND ASSOCIATES AT A SCALE OF 1" = 100' WITH CONTOUR INTERVALS OF 2 FOOT, FROM AERIAL PHOTOGRAPHY EXPOSED ON JANUARY 20, 1993, AT A SCALE OF 1" = 600', AND MEETS OR EXCEEDS NATIONAL MAP ACCURACY STANDARDS.
2. THE HORIZONTAL DATUM IS THE NORTH AMERICAN DATUM, ADJUSTMENT OF 1927, INDIANA WEST ZONE. THE VERTICAL DATUM IS THE NATIONAL GEODETIC VERTICAL DATUM, ADJUSTMENT OF 1929.

NO.	BY	DESCRIPTION	APPD.
3-03-94	E	DRAWING MODIFICATIONS	SGW
12-8-93	D	DRAWING MODIFICATIONS	SGW
6-24-93	C	DRAWING MODIFICATIONS	DWD
5-24-93	B	DRAWING MODIFICATIONS	DWD
10-8-92	A	DRAWING MODIFICATIONS	DWD

REVISIONS

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APPALACHIAN POWER COMPANY

GLEN LYN PLANT

SITE MONITORING SHEET
COAL COMBUSTION BY-PRODUCT
DISPOSAL FACILITY

DWG. NO. 56-30123

ARCH. | ELEC. | MECH. | STR.

SCALE: 1"=100'
DR: JPS
CH: MRL
SQ.LDR: GRL
DATE: 8-26-92

APPROVED BY: ENGINEERING DIVISION / DESIGN DIVISION

AMERICAN ELECTRIC POWER SERVICE CORP.

GAI CONSULTANTS, INC. 570 Beatty Road Monroeville, PA 412-856-9400

GAI Dwg. File No. 90-364-F36

	DRAFTING		ENGINEERING	
SYSTEMS	JPS	GRL	MRL	DWD
DATE	7-27-92	8-26-92	8-26-92	8-26-92

SHEET 8A OF 21

GAI DWG FILE: 0364F036.DGN 12/8/93

DWG. NO. 56-30300

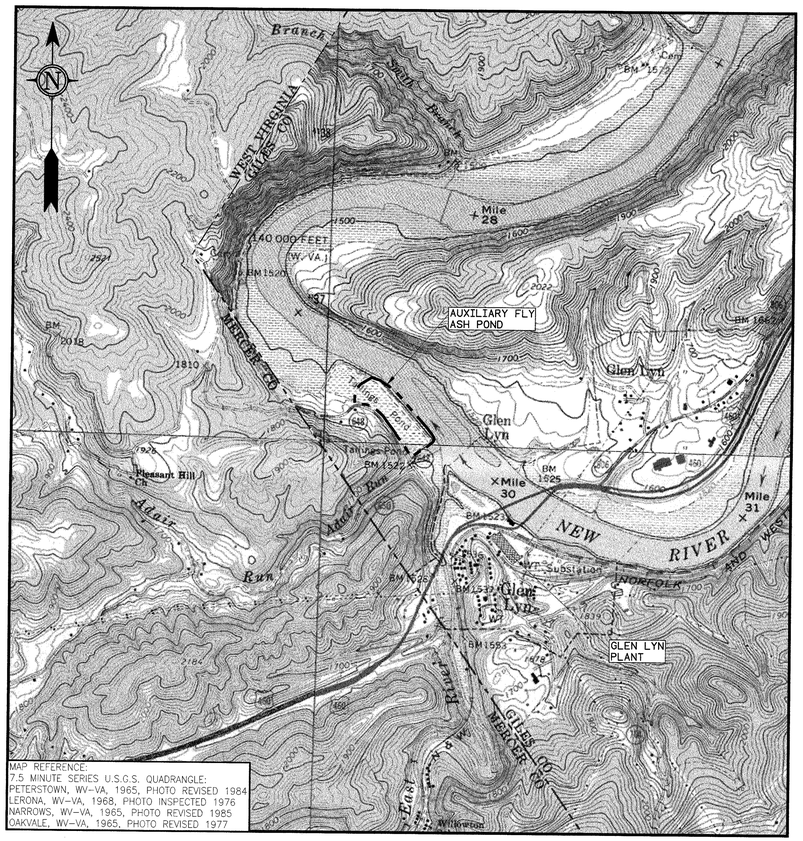
GLEN LYN PLANT

AUXILIARY FLY ASH POND CLOSURE

OWNED AND OPERATED BY:

APPALACHIAN POWER COMPANY

GLEN LYN, VIRGINIA



MAP REFERENCE:
7.5 MINUTE SERIES U.S.G.S. QUADRANGLE:
PETERSTOWN, WV-VA, 1965, PHOTO REVISED 1984
LERONA, WV-VA, 1968, PHOTO INSPECTED 1976
NARROWS, WV-VA, 1965, PHOTO REVISED 1985
OAKVALE, WV-VA, 1965, PHOTO REVISED 1977

LOCATION MAP

SCALE: 1" = 1000'
1000 0 1000 2000

PREPARED BY:

AMERICAN ELECTRIC POWER SERVICE CORP.

1 RIVERSIDE PLAZA, COLUMBUS, OHIO 43215

FEBRUARY 2013

DRAWING INDEX			
DRAWING NUMBER	GAI DRAWING NUMBER	SHEET NUMBER	DRAWING TITLE
56-30300	C121043-00-001-00-E-M008	1 OF 11	TITLE SHEET AND LOCATION MAP
56-30301	C121043-00-001-00-E-M009	2 OF 11	EXISTING SITE CONDITIONS PLAN
56-30302	C121043-00-001-00-E-M010	3 OF 11	PREPARED SUBGRADE PLAN
56-30303	C121043-00-001-00-E-M011	4 OF 11	FINAL CLOSURE PLAN
56-30304	C121043-00-001-00-E-M016	5 OF 11	SITE PROFILE AND DETAILS
56-30305	C121043-00-001-00-E-M019	6 OF 11	GEOTECHNICAL CROSS SECTIONS
56-30306	C121043-00-001-00-E-M015	7 OF 11	FINAL COVER DETAILS
56-30307	C121043-00-001-00-E-M013	8 OF 11	DETAILS
56-30308	C121043-00-001-00-E-M017	9 OF 11	EROSION AND SEDIMENT CONTROL PLAN - SHEET 1
56-30309	C121043-00-001-00-E-M018	10 OF 11	EROSION AND SEDIMENT CONTROL PLAN - SHEET 2
56-30310	C121040-00-001-00-E-M014	11 OF 11	EROSION AND SEDIMENT CONTROL DETAILS

DATE	NO.	DESCRIPTION	APPD.
1/16/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

TITLE SHEET AND LOCATION MAP

DWG. NO. 56-30300-A

SCALE:

DR:

CH

ENGR.

PROJ. ENGR.

DATE:

APPROVED BY

CIVIL ENGINEERING DIVISION

COMMONWEALTH OF VIRGINIA
DONALD J. SWARTZ
028E.NO.0480
PROFESSIONAL ENGINEER
3/4/13

gai consultants
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN JDS APPROVED MRL
CHECKED CRM DATE 1/27/13

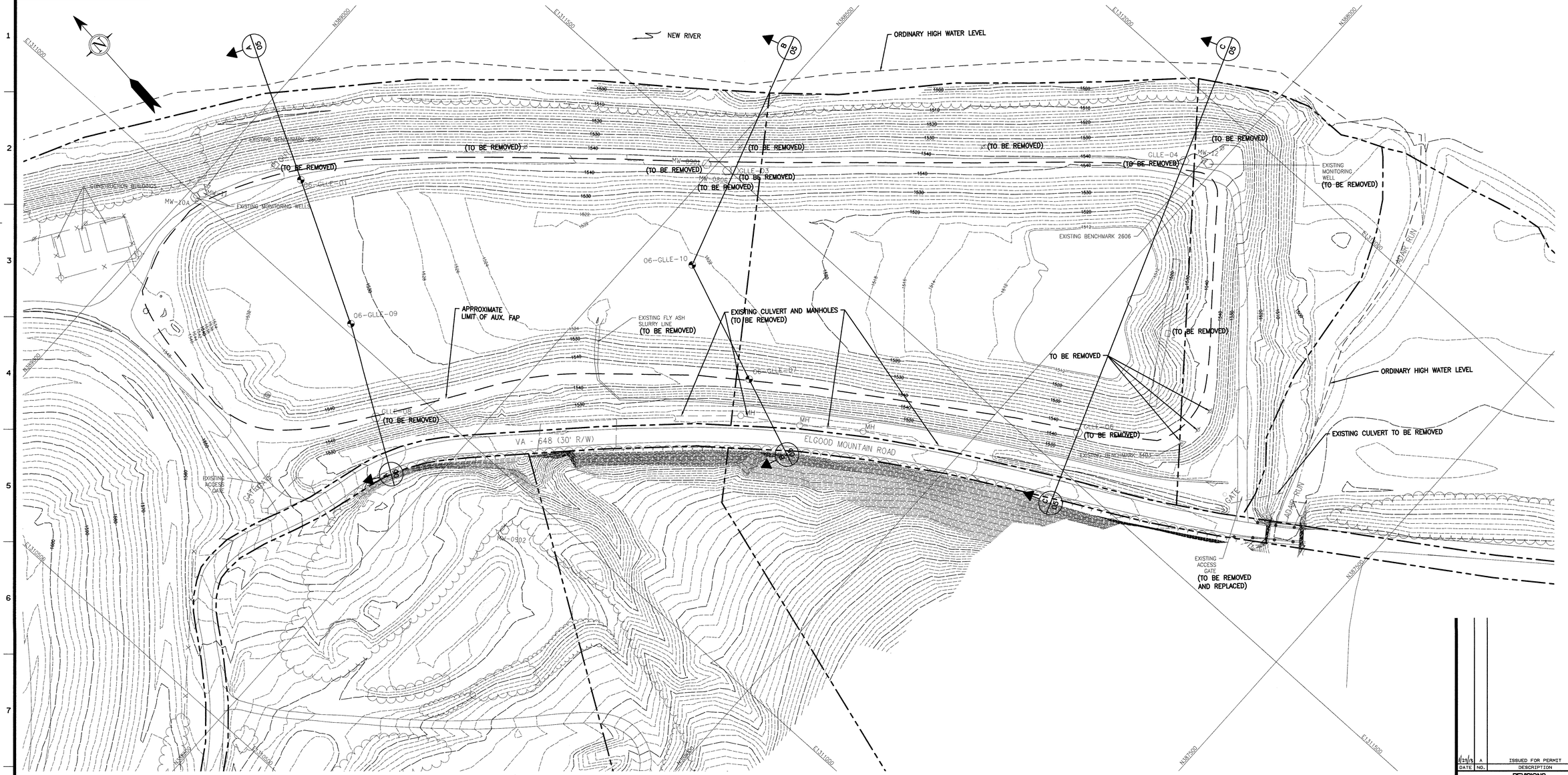
DRAWING NUMBER
C121043-00-001-00-E-M008 A REV.
SHT. NO. 1 OF 11

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGS1092
Z:\ENERGY\2012\C121043.00 - AEP - GLEN LYN POND CLOSU\CAD\PRODUCTION DRAWINGS\C121043-00-001-00-E-M008.DWG 10/26/12

SYSTEM DATE: DD-MMM-YYYY
SYSTEM TIME: HOUR:MINUTE

DWG. NO. 56-30301



THIS MAP COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY DATED 3-4-06 AND FIELD MAPPING DATED JANUARY 17, 2008 AND FEBRUARY 6, 2008. GRID BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD 1927. VERTICAL DATUM BASED ON NGVD 1929.

ADDITIONAL EXISITING TOPOGRAPHY SHOWING ADAIR RUN PROVIDED BY AEP. TOPOGRAPHY ORIGINALLY PROVIDED TO AEP ON NOVEMBER 25, 1997. GRID BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD 1983. VERTICAL DATUM BASED ON NGVD 1988.

LEGEND

- 1550 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 1900 — PROPOSED MAJOR CONTOURS
- PROPOSED MINOR CONTOURS
- x — x — FENCE
- ROAD
- STRUCTURE
- TREE LINE
- CENTERLINE ADAIR RUN (APPROX.)
- APPROXIMATE PROPERTY LINE/ RIGHT-OF-WAY LIMITS
- UTILITY POLE
- BENCH MARKS
- MW-10A — EXISTING MONITORING WELL
- 06-GLLE-10 — BORING LOCATION
- GLLE-04 — EXISTING MONITORING WELL
- ORDINARY HIGH WATER LEVEL
- APPROXIMATE LIMIT OF FAP
- B / 05 — SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30305)

NOTES

1. THE PROPERTY LINES WERE OBTAINED FROM GIS DATABASE AND ARE APPROXIMATE.

EXISTING BENCHMARKS			
POINT NO.	NORTHING	EASTING	ELEVATION
2605	388986.827	1311018.549	1545.897
2606	388018.507	1311933.597	1540.179
3403	387788.338	1311633.992	1541.260

SCALE: 1" = 50'
50 0 50 100

COMMONWEALTH OF VIRGINIA
DONALD J. STAEDEL
Lic. No. 045761
PROFESSIONAL ENGINEER
3/14/13

gai consultants
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN JDS — APPROVED MRL
CHECKED CRM — DATE 1/29/13
DRAWING NUMBER C121043-00-001-00-E-M009 — REV A
SHT. NO. 2 OF 11

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.
GLEN LYN PLANT
GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE
EXISTING SITE CONDITIONS PLAN

DWG. NO. 56-30301-A

SCALE: — CIVIL ENGINEERING DIVISION
DR: — APPROVED BY
CH:
ENGR.
PROJ. ENGR.
DATE:

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE-DD-MMM-YYYY
SYSTEM TIME-HOUR:MINUTE
15th FLR. CED

IGS1092
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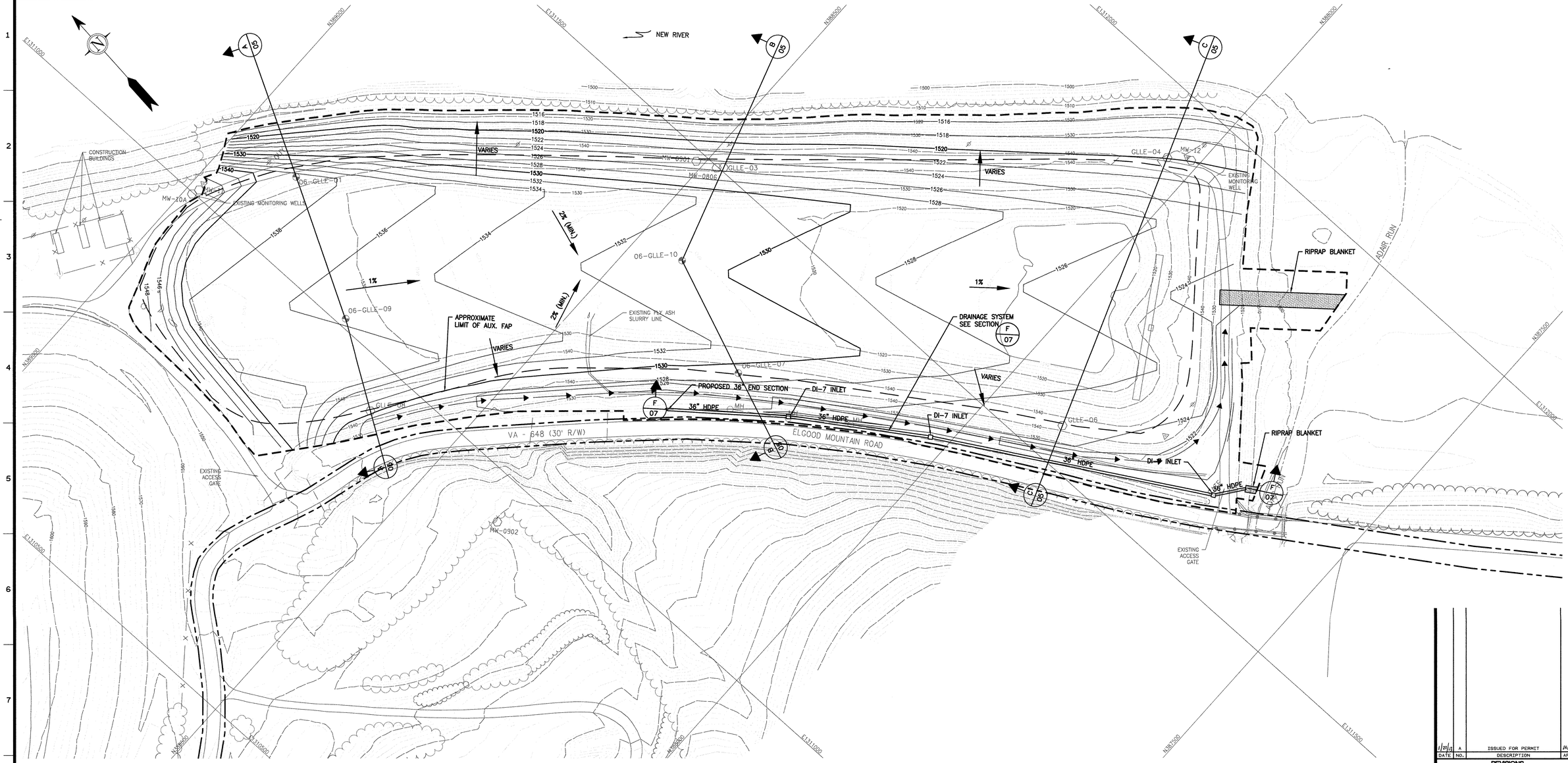
DWG. NO. 56-30302



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LEGEND

- 1550 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 1900 — PROPOSED MAJOR CONTOURS
- PROPOSED MINOR CONTOURS
- FENCE
- ROAD
- STRUCTURE
- TREE LINE
- CENTERLINE ADAIR RUN (APPROX.)
- APPROXIMATE RIGHT-OF-WAY LIMITS
- APPROXIMATE LIMIT OF GRADING
- UTILITY POLE
- BENCH MARKS
- MW-10A — EXISTING MONITORING WELL
- 06-GLLE-10 — BORING LOCATION
- GLLE-10 — EXISTING MONITORING WELL
- COLLECTION CHANNEL
- 1% — SLOPE OF PROPOSED SURFACE
- APPROXIMATE LIMIT OF FAP
- RIPRAP BLANKET
- 1/03 — DETAIL IDENTIFICATION NUMBER AND LOCATION / DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30303)
- B/05 — SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30305)

SCALE: 1" = 50'
50 0 50 100

COMMONWEALTH OF VIRGINIA
DONALD J. SPAEDER
Lic. No. 040710
PROFESSIONAL ENGINEER
3/12/13

gai consultants
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN JDS | APPROVED MRL
CHECKED CRM | DATE 1/29/13
DRAWING NUMBER C121043-00-001-00-E-M010 A REV
SHT. NO. 3 OF 11

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

PREPARED SUBGRADE PLAN

DWG. NO. 56-30302-A

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:
APPROVED BY

CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE-DD-MMM-YYYY
SYSTEM TIME-HOUR:MINUTE
16th FLR. CED

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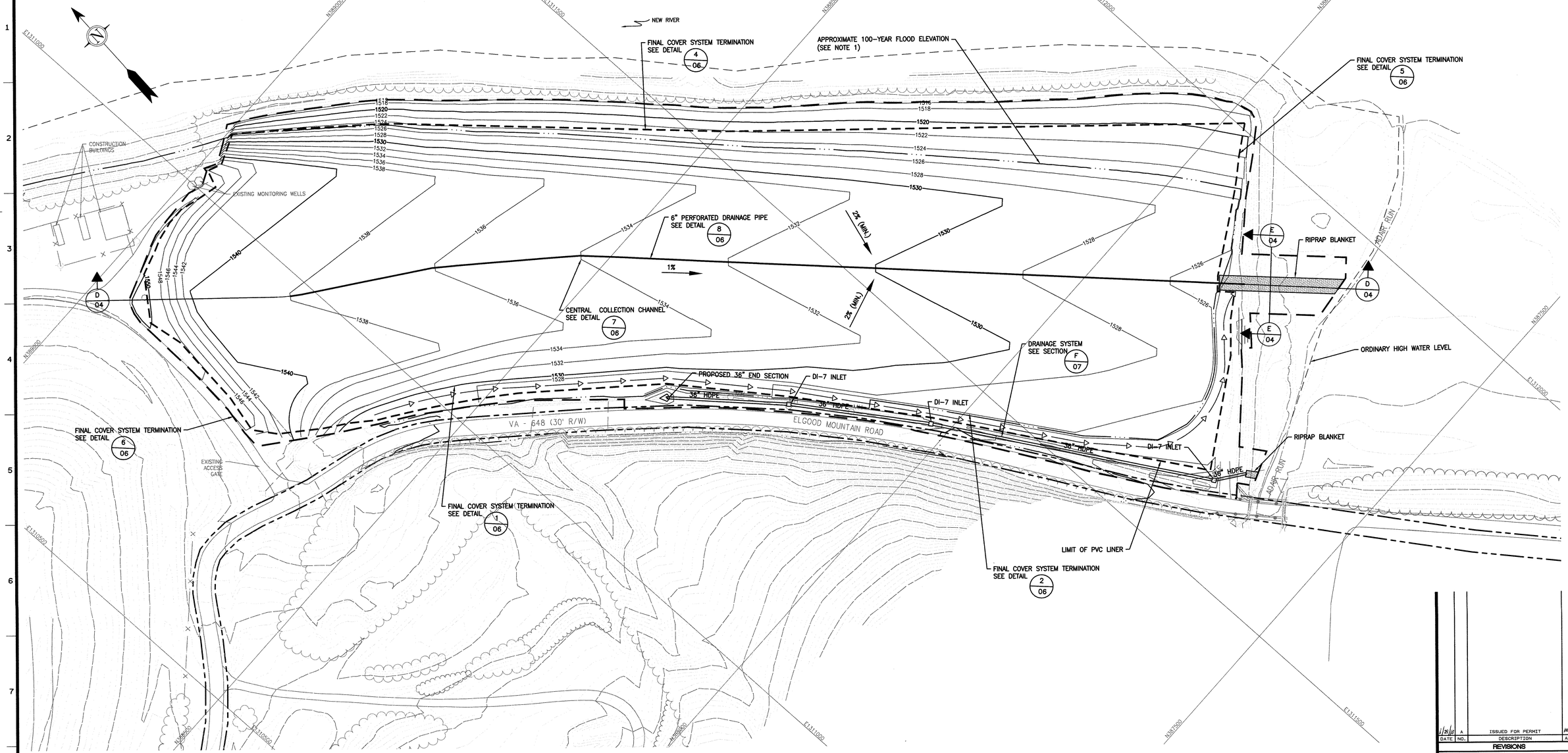

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LEGEND

- 1550 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- 1900 — PROPOSED MAJOR CONTOURS
- PROPOSED MINOR CONTOURS
- FENCE
- ROAD
- STRUCTURE
- TREE LINE
- CENTERLINE ADAIR RUN (APPROX.)
- BENCH MARKS
- MW-10A — EXISTING MONITORING WELL
- PERMANENT COLLECTION CHANNEL
- RIPRAP BLANKET
- APPROXIMATE RIGHT-OF-WAY LIMITS
- APPROXIMATE LIMIT OF PVC LINER
- APPROXIMATE LIMIT OF GRADING
- 100-YEAR FLOOD ELEVATION
- ORDINARY HIGH WATER LEVEL
- 1% — SLOPE OF PROPOSED SURFACE
- 1/03 — DETAIL IDENTIFICATION NUMBER AND LOCATION / DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30303)
- B/05 — SECTION IDENTIFICATION LETTER AND SECTION CUTTING PLANE LOCATION / DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30305)

SCALE: 1" = 50'
50 0 50 100

NOTES:
1. APPROXIMATE 100-YEAR FLOOD ELEVATION BASED ON GILES COUNTY, VA FLOOD INSURANCE RATE MAP. MAP #51071C0176C, EFFECTIVE DATE SEPTEMBER 25, 2009

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

FINAL CLOSURE PLAN

DWG. NO. 56-30303-A

SCALE: | DR: | CH: | ENGR. | PROJ. ENGR. | DATE:

CIVIL ENGINEERING DIVISION

APPROVED BY

DRAWN JDS | CHECKED CAM | APPROVED MRL | DATE 1/29/13

DRAWING NUMBER C121043-00-001-00-E-M011 A REV

SHT. NO. 4 OF 11

COMMONWEALTH OF VIRGINIA DONALD J. SPARDER Lic. No. 04870 PROFESSIONAL ENGINEER 3/12/13

gai consultants

PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA COLUMBUS, OH 43215

SYSTEM DATE-DD-MMM-YYYY SYSTEM TIME-HOUR:MINUTE 16th FLR. CED

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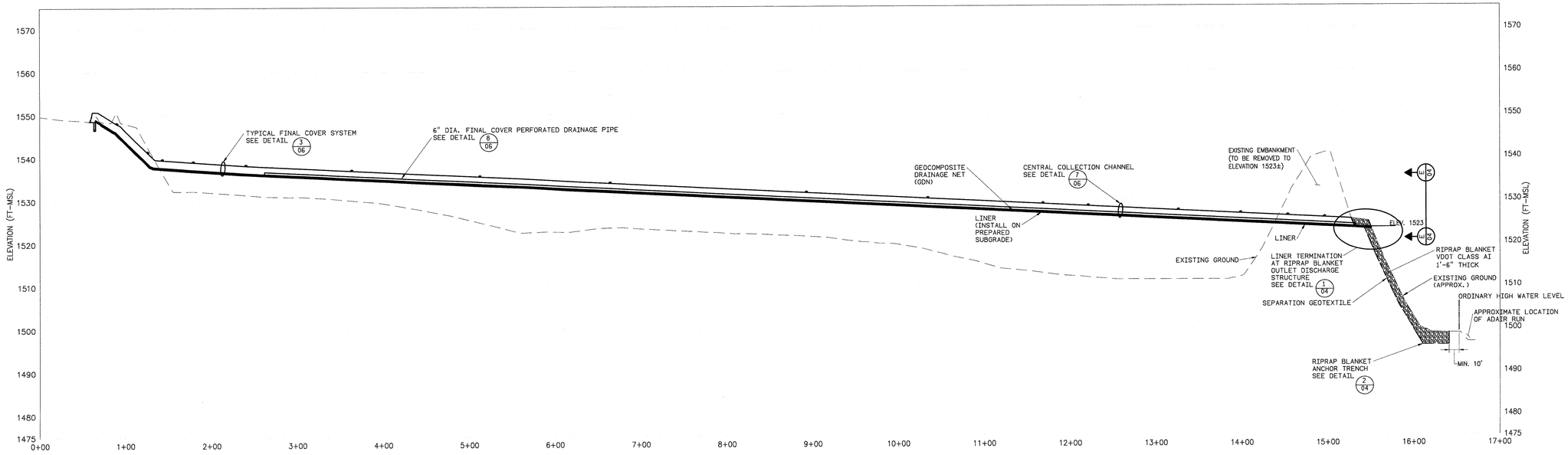
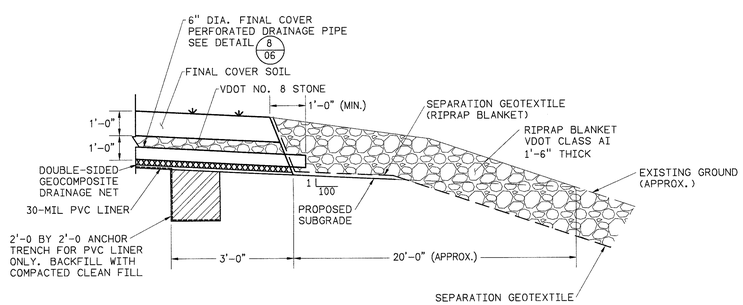
DWG. NO. 56-30304



SECTION D/03

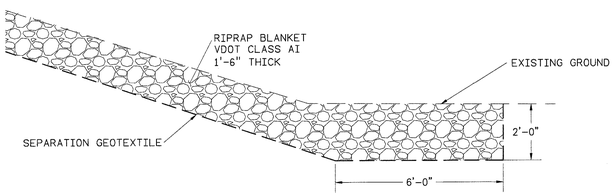
HORIZONTAL SCALE: 1" = 50'-0
VERTICAL SCALE: 1" = 10'-0



DETAIL 1/04

LINER TERMINATION AT
RIPRAP BLANKET OUTLET DISCHARGE STRUCTURE

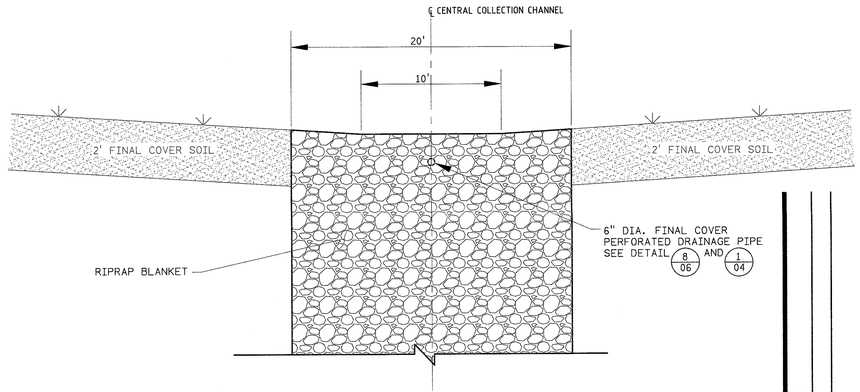
NTS



DETAIL 2/04

RIPRAP BLANKET ANCHOR TRENCH

NTS



SECTION E/03, 04, 09

RIPRAP BLANKET OUTLET DISCHARGE STRUCTURE

NTS

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

SITE PROFILE AND DETAILS

DWG. NO. 56-30304-A

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:

CIVIL ENGINEERING DIVISION

APPROVED BY

COMMONWEALTH OF VIRGINIA
DONALD J. SHAEDEN
Lic. No. 046710
PROFESSIONAL ENGINEER
3/12/13

gai consultants

DRAWN JCN
CHECKED CRM
APPROVED MRL
DATE 1/29/13
DRAWING NUMBER C121043-00-001-00-E-M016
SHT. NO. 5 OF 11
REV A

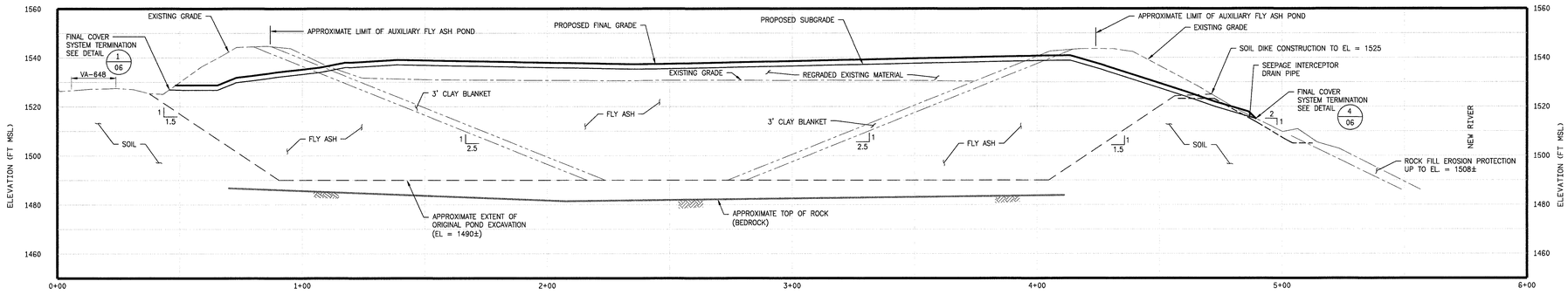
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

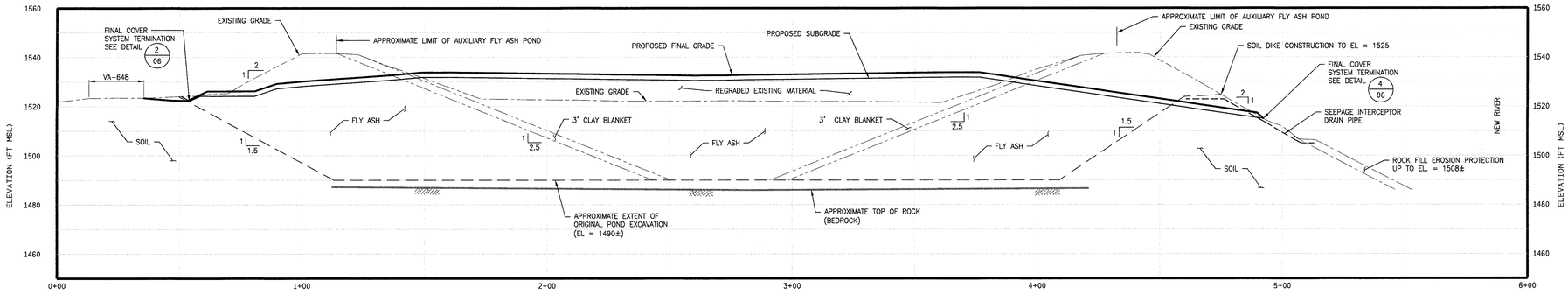
SYSTEM DATE-DD-MMM-YYYY
SYSTEM TIME-HOUR MINUTE
18th FLR. CED

IGS1092
Z:\ENERGY\2012\C121043.00 - AEP - GLEN LYN POND CLOSU\CAD\PRODUCTION DRAWINGS\C121043-00-001-00-E-M016.DWG 11/8/12

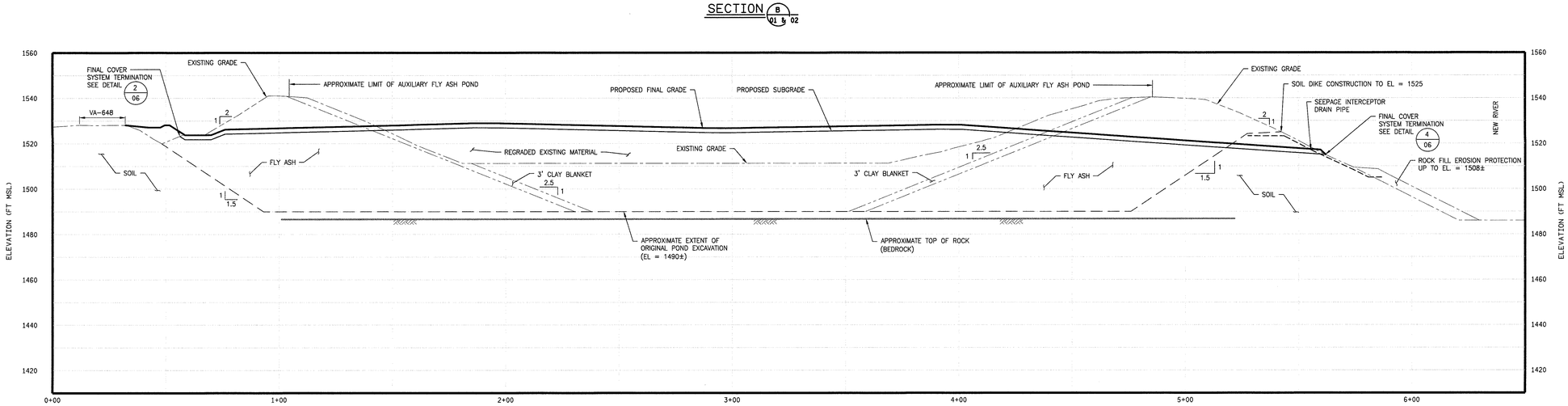
DWG. NO. 56-30305



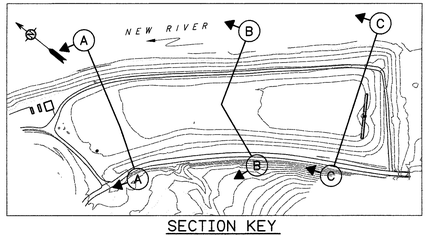
SECTION A 01 & 02



SECTION B 01 & 02



SECTION C 01 & 02



SECTION KEY

LEGEND:

- EXISTING GRADE
- SOIL DIKE CONSTRUCTION
- ROCK FILL EROSION PROTECTION
- CLAY BLANKET
- PROPOSED SUBGRADE
- PROPOSED FINAL GRADE
- APPROXIMATE TOP OF ROCK (BEDROCK)

HORIZ. & VERT. SCALE 1"=20'

20' 0 20' 40'

COMMONWEALTH OF VIRGINIA
DONALD J. SPAETER
Lic. No. 048781
PROFESSIONAL ENGINEER
3/12/13

gai consultants
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN JDS APPROVED DJS
CHECKED CRM DATE 1/29/13
DRAWING NUMBER
C121043-00-001-00-E-M019
SHT. NO. 6 OF 11
A REV

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	DJS

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

GEOTECHNICAL CROSS SECTIONS

DWG. NO. 56-30305-A

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:

CIVIL ENGINEERING DIVISION

AM GROUP APP

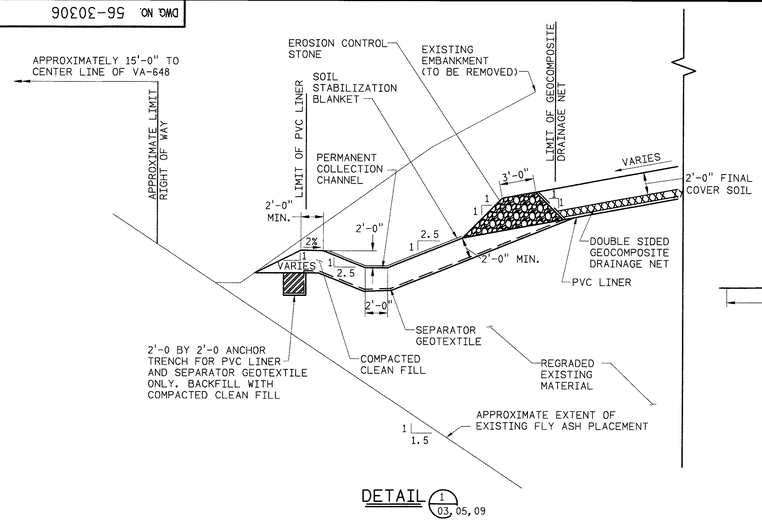
AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

IGS1092
Z:\ENERGY\2012\C121043.00 - AEP - GLEN LYN POND CLOSU\CAD\PRODUCTION DRAWINGS\C121043-00-001-00-E-M019.DWG 11/30/12

SYSTEM DATE=DD-MMM-YYYY
SYSTEM TIME=HOUR:MINUTE
105h PLM, CED

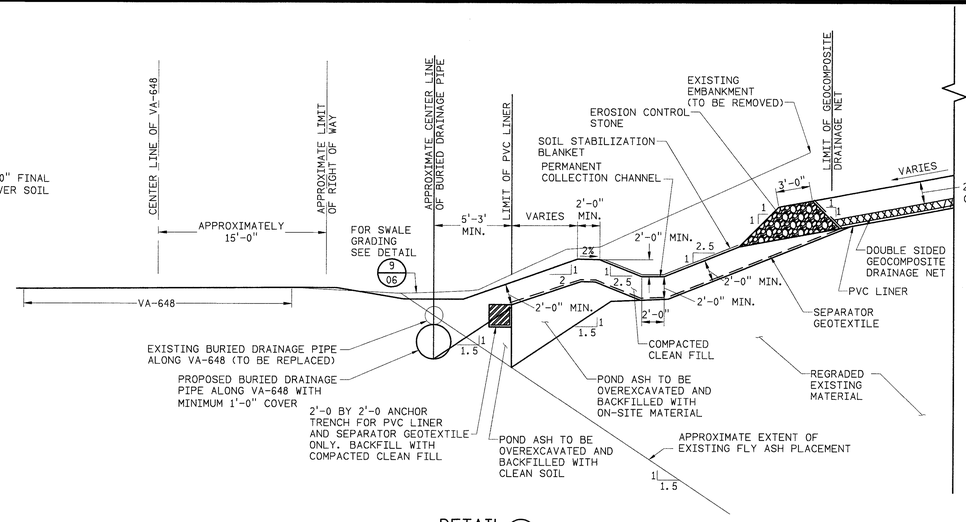
DWG. NO. 56-30306



DETAIL (1/03, 05, 09)

TYPICAL FINAL COVER SYSTEM TERMINATION ALONG VA ROUTE 648 (WITH DRAINAGE DITCH)

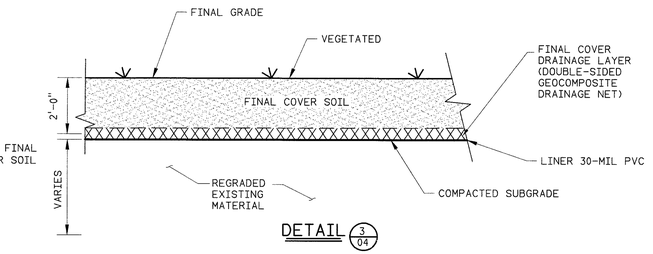
SCALE: N.T.S.



DETAIL (2/03, 05, 09)

TYPICAL FINAL COVER SYSTEM TERMINATION ALONG VA ROUTE 648 (WITH BURIED PIPE)

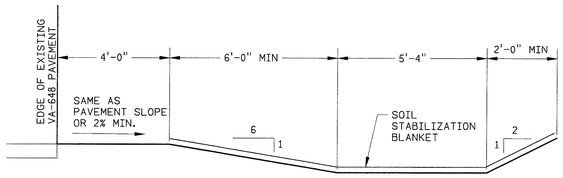
SCALE: N.T.S.



DETAIL (3/04)

TYPICAL FINAL COVER SYSTEM

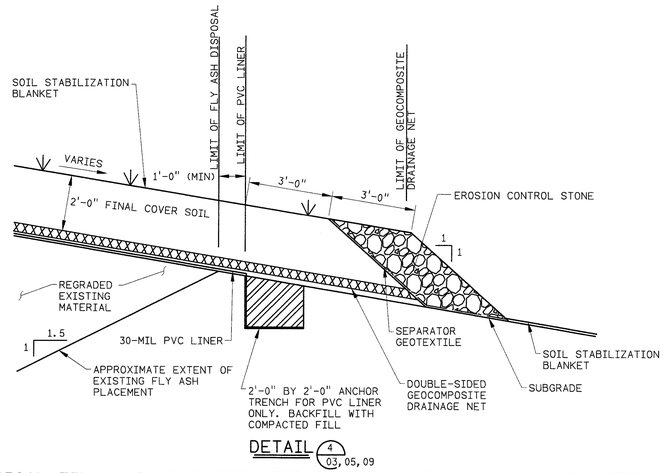
SCALE: 1"=2'



DETAIL (9/06)

TYPICAL SWALE ALONG VA-648 (WITH BURIED PIPE)

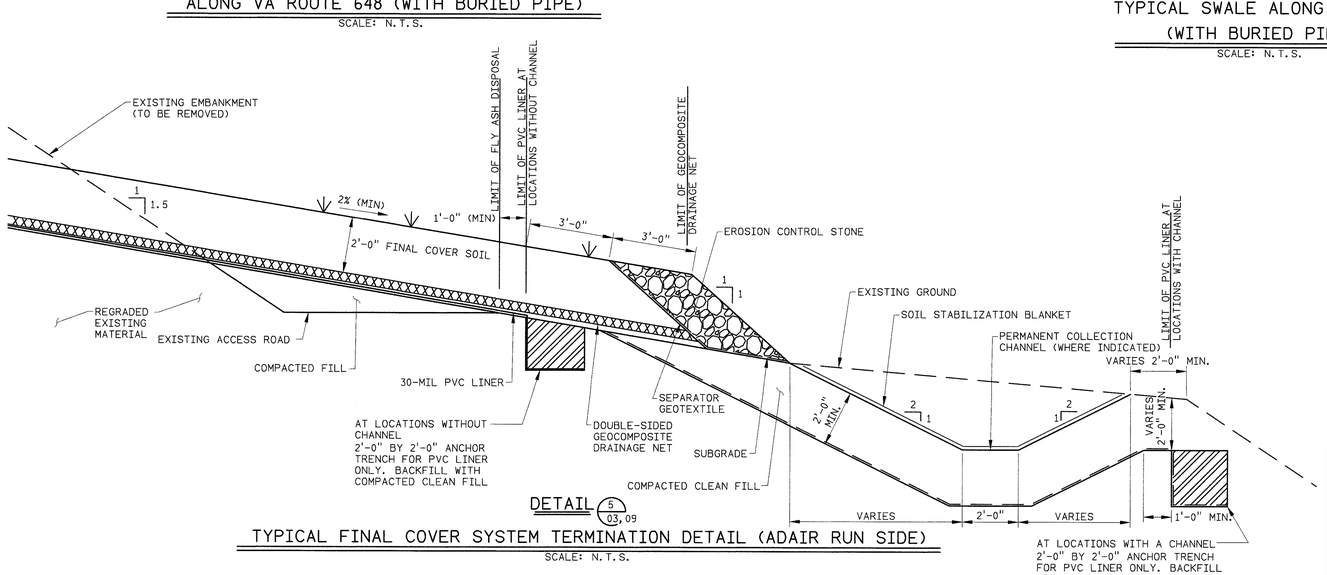
SCALE: N.T.S.



DETAIL (4/03, 05, 09)

TYPICAL FINAL COVER SYSTEM TERMINATION DETAIL (NEW RIVER SIDE)

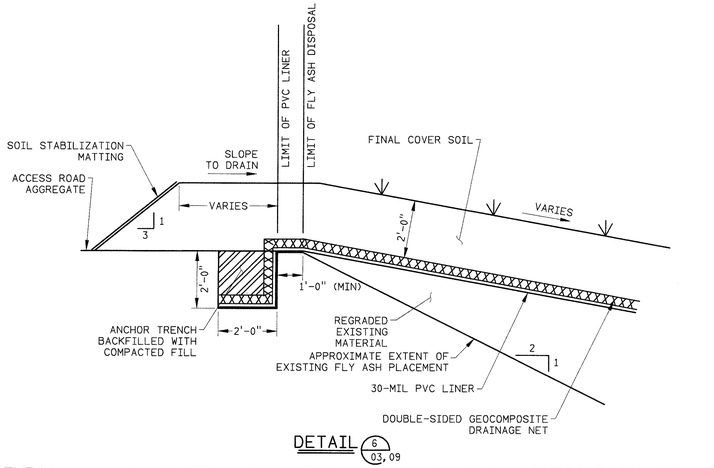
SCALE: N.T.S.



DETAIL (5/03, 09)

TYPICAL FINAL COVER SYSTEM TERMINATION DETAIL (ADAIR RUN SIDE)

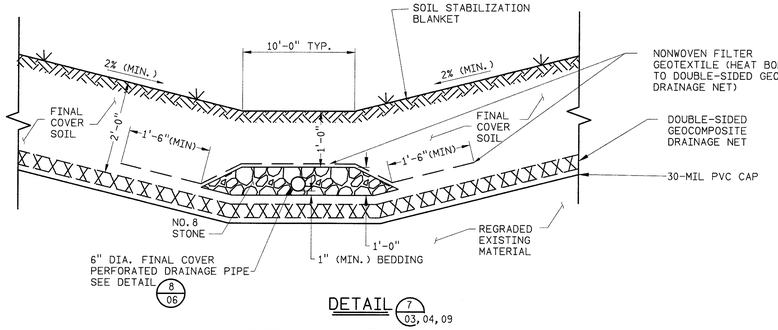
SCALE: N.T.S.



DETAIL (6/03, 09)

TYPICAL FINAL COVER SYSTEM TERMINATION DETAIL (ACCESS ROAD SIDE)

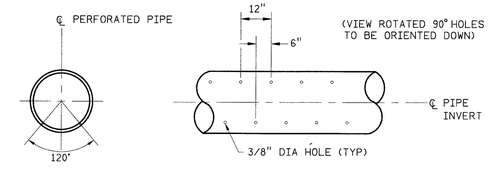
SCALE: N.T.S.



DETAIL (7/03, 04, 09)

CENTRAL COLLECTION CHANNEL

SCALE: N.T.S.



DETAIL (8/03, 04, 06, 09)

PIPE PERFORATION PATTERNS

SCALE: N.T.S.

DATE	NO.	DESCRIPTION	APPD.
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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

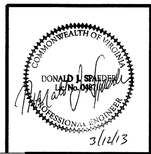
DETAILS

DWG. NO. 56-30306-A

SCALE:
DR:
CH:
ENGR.
PROJ. ENGR.
DATE:

APPROVED BY

CIVIL ENGINEERING DIVISION



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DRAWN JDS | APPROVED MRL
CHECKED CRM | DATE 1/29/13

DRAWING NUMBER C121043-00-001-00-E-M015 (A REV)

SHT. NO. 7 OF 11

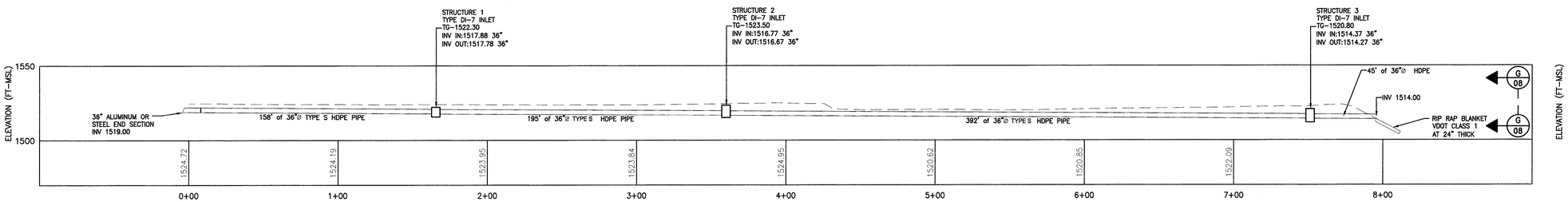
AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SYSTEM DATE: DD-MMM-YYYY
SYSTEM TIME: HOUR:MINUTE 16hh FLR. CED

IGS1092
Z:\ENERGY\2012\C121043.00 - AEP - GLEN LYN POND CLOSU\CAD\PRODUCTION DRAWINGS\C121043-00-001-00-E-M015.DWG 10/26/12

DWG. NO. 56-30307



SECTION F 02, 03

HORIZONTAL SCALE: 1" = 30'

30 0 30 60

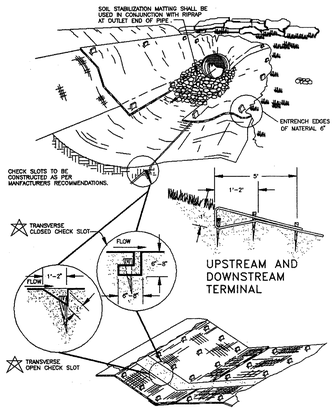
VERTICAL SCALE: 1" = 30'

30 0 30 60

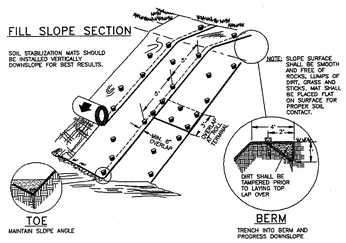
NOTE:

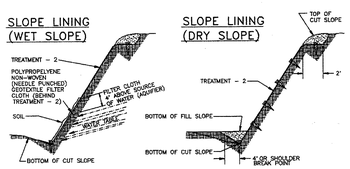
1. ALL PIPE, INLETS, END SECTIONS, AND RIPRAP MATERIAL AND INSTALLATION SHALL COMPLY WITH VIRGINIA DOT STANDARDS AND SPECIFICATIONS.
2. HDPE = HIGH DENSITY POLYETHYLENE PIPE.

TYPICAL TREATMENT-2 SOIL STABILIZATION MATTING INSTALLATION

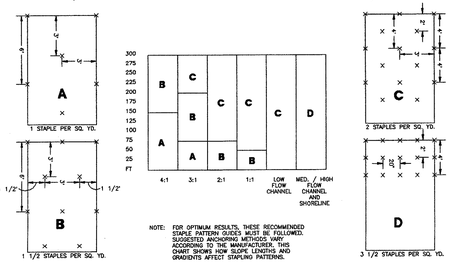


TYPICAL TREATMENT – 2 SOIL STABILIZATION MATTING SLOPE INSTALLATION



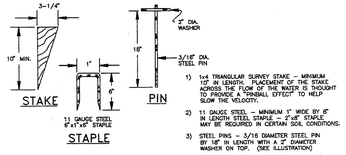


GENERAL STAPLE PATTERN GUIDE AND RECOMMENDATIONS FOR TREATMENT – 2 (SOIL STABILIZATION MATTING)



NOTE: FOR OPTIMUM RESULTS, THESE RECOMMENDED STAPLE PATTERN GUIDES MUST BE FOLLOWED. SUGGESTED ANCHORING METHODS VARY ACCORDING TO THE MANUFACTURER. THIS CHART SHOWS HOW SLOPE LENGTHS AND GRADIENTS AFFECT STAPLING PATTERNS.

STAKES, STAPLES, & PINS FOR INSTALLATION OF TREATMENT – 2 SOIL STABILIZATION MATTING



1) 1x1 TRIANGULAR SURVEY STAKE – MINIMUM 10" IN LENGTH. PLACEMENT OF THE STAKE ACROSS THE FLOW OF THE WATER IS THOUGHT TO PROVIDE A "RINGBALL EFFECT" TO HELP SLOW THE VELOCITY.
2) 11 GAUGE STEEL – MINIMUM 1" WIDE BY 6" IN LENGTH STEEL STAPLE – 2"x6" STAPLE MAY BE REQUIRED IN CERTAIN SOIL CONDITIONS.
3) STEEL PINS – 3/16 DIAMETER STEEL PIN BY 18" IN LENGTH WITH A 2" DIAMETER WASHER ON TOP. (SEE ILLUSTRATION)

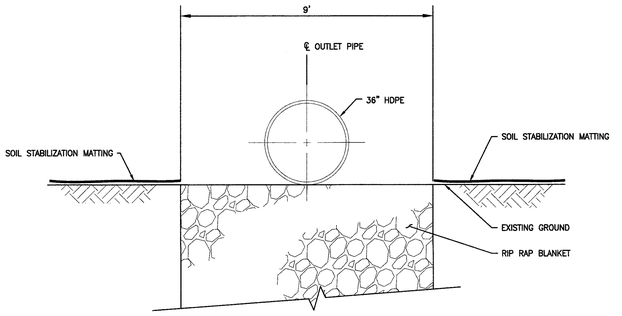
DETAIL 3 08, 09

SOIL STABILIZATION MATTING

SCALE: N.T.S

NOTE:

1. INSTALL SOIL STABILIZATION MATTING AFTER FINAL COVER SOIL HAS BEEN REACHED.
2. INSTALL IN ACCORDANCE WITH VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK AND/OR MANUFACTURE'S INSTRUCTIONS. REFERENCE: VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK (3.36)



SECTION G 08

RIP RAP BLANKET AT DRAINAGE PIPE DISCHARGE

SCALE: N.T.S

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

DETAILS

DWG. NO. 56-30307-A

COMMONWEALTH OF VIRGINIA DONALD L. SHEDDEN 027462 PROFESSIONAL ENGINEER 3/12/13

gai consultants

PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN	DMM	APPROVED	MRL
CHECKED	CRM	DATE	1/29/13

DRAWING NUMBER C121043-00-001-00-E-M013

SHT. NO. 8 OF 11 — A REV

SCALE: — DR: — CHI: — ENGR. — PROJ. ENGR. — DATE: — APPROVED BY

CIVIL ENGINEERING DIVISION

AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA COLUMBUS, OH 43215

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SYSTEM DATE: DD-MMM-YYYY
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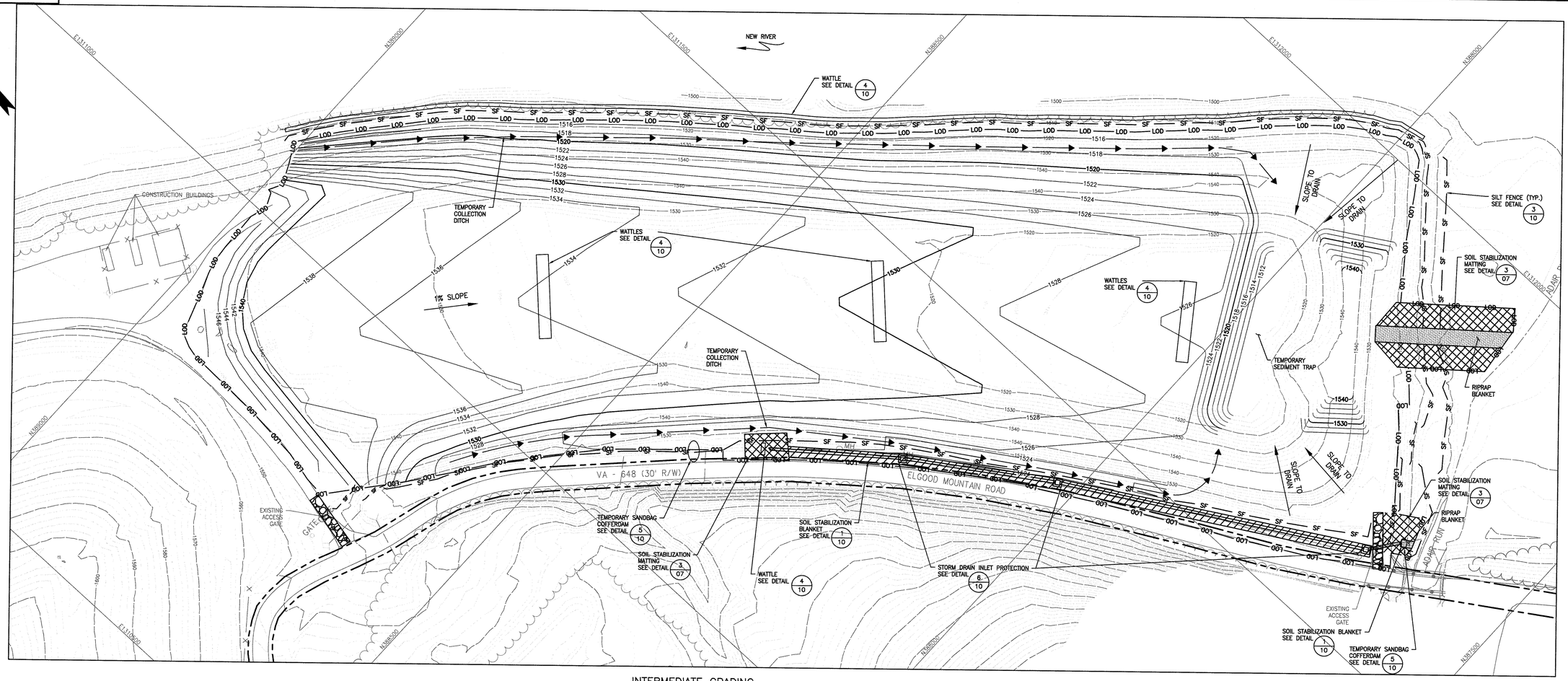
16th PLA. CED

DWG. NO. 56-30308

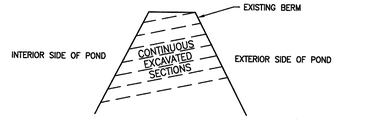


INTERMEDIATE GRADING

PROPOSED POND CONTOURS SHOWN ARE SUBGRADE

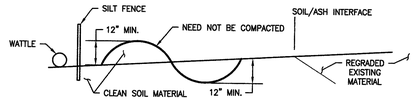
SUGGESTED GENERAL CONSTRUCTION SEQUENCE

1. PREPARE AND INSTALL PERIMETER AND SITE ACCESS EROSION AND SEDIMENT CONTROL MEASURES, INCLUDING SILT FENCE AND WATTLES, AS SHOWN ON THE DRAWING. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK AND CONTRACT DOCUMENTS.
2. REMOVE THE PRINCIPAL SPILLWAY DISCHARGE STRUCTURE AT THE SOUTHEASTERN END OF THE AUX FAP. GROUT SHUT ANY PORTIONS OF THE PRINCIPAL SPILLWAY PIPE TO REMAIN THROUGH THE EMBANKMENT.
3. A DEPRESSION SHALL BE MAINTAINED AT THE SOUTHEAST END OF THE AUX FAP AND BE UTILIZED AS A TEMPORARY SEDIMENT TRAP DURING THE POND CLOSURE OPERATIONS. THE TEMPORARY SEDIMENT TRAP SHALL BE PUMPED EMPTY OF PONDED WATER WITHIN 48 HOURS AFTER EACH SUBSTANTIAL RAIN EVENT AND REMAIN WITHOUT PONDED WATER BETWEEN THE RAIN EVENTS. THIS WATER SHALL BE CONVEYED TO THE EXISTING LANDFILL LEACHATE POND.
4. SUGGESTED RE-GRADING SHALL COMMENCE WITH THE DIKES SO THAT THE DIKE MATERIAL CAN BE PULLED INTO THE POND. EXCAVATE THE BERM IN LAYERS WHILE SLOPING THE EXPOSED SURFACE TO PROVIDE FOR A POSITIVE SLOPE TOWARDS THE POND INTERIOR (SEE DETAIL BELOW).



EXCAVATION FOR ENTRAPPING STORMWATER RUNOFF
N.T.S.

5. INSTALL TEMPORARY COLLECTION DITCH ALONG VA-648. THE GRADED SUBGRADE OF THE PERIMETER COLLECTION CHANNEL ALONG THE VA-648 SIDE OF THE POND WILL FUNCTION AS A TEMPORARY COLLECTION DITCH DURING CONSTRUCTION.
6. RE-GRADING OF THE DIKES WILL INVOLVE REMOVAL AND SALVAGING OF THE EXISTING SLURRY LINES ALONG/WITHIN THE EMBANKMENTS ALONG STATE ROUTE VA-648, REMOVAL AND SALVAGING OF UTILITY POLES ALONG THE NEW RIVER EMBANKMENT, AND REMOVING AND CLOSING EXISTING MONITORING WELLS WITHIN THE EXCAVATION AREA. AN EXISTING PIPE DRAINAGE SYSTEM WITHIN THE DIKE ALONG THE NEW RIVER MAY BE ENCOUNTERED DURING THE EXCAVATION PROCESS. THIS PIPING SHOULD BE REMOVED, AND THE INLETS TO ANY PIPES CONTINUING DOWN THE OUTSIDE OF THE EMBANKMENT THAT ARE BELOW PROPOSED GRADING WILL BE CAPPED.
7. THE EXISTING CULVERT DRAINAGE SYSTEM AND A PORTION OF THE EXISTING CHANNEL LOCATED BETWEEN THE POND AND VA-648 SHALL BE REMOVED AND A NEW DRAINAGE SYSTEM CONSTRUCTED. CONSTRUCTION OF THE DRAINAGE SYSTEM WILL BE ACCOMPLISHED BY INSTALLING A TEMPORARY SANDBAG COFFERDAM IN THE EXISTING CHANNEL UPSLOPE OF THE WORK AREA AND UTILIZING A PUMP BYPASS SYSTEM TO DIVERT ANY OFFSITE RUNOFF AROUND THE WORK AREA. WATER THAT COLLECTS IN THE EXCAVATED AREAS DURING THE DRAINAGE SYSTEM CONSTRUCTION SHALL BE CONVEYED TO THE EXISTING LANDFILL LEACHATE POND OR TEMPORARY SEDIMENT TRAP. ANY ASH ENCOUNTERED DURING CONSTRUCTION OF THE DRAINAGE SYSTEM SHALL BE OVEREXCAVATED AND REPLACED WITH CLEAN SOIL FILL AS SHOWN ON THE DETAILS. THE DRAINAGE SYSTEM CONSTRUCTION SHALL BE IN ACCORDANCE WITH VIRGINIA DOT ROAD AND BRIDGE STANDARDS.
8. AFTER THE INLETS HAVE BEEN CONSTRUCTED, INSTALL STORM DRAIN INLET PROTECTION AROUND THEM. AFTER THE END SECTION HAS BEEN CONSTRUCTED, PLACE WATTLES ACROSS THE ENTRANCE TO IT.
9. PLACE TEMPORARY AND PERMANENT SEEDING, MULCHING, SOIL STABILIZATION BLANKET, AND SOIL STABILIZATION MATTING AT THE LOCATIONS SHOWN ON THE DRAWINGS, AND IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK.
10. THE TEMPORARY SEDIMENT TRAP AT THE SOUTHEAST PORTION OF THE POND WILL REMAIN AS RE-GRADING CONTINUES. CONTINUE SUGGESTED DIKE EXCAVATION AND POND RE-GRADING FOR THE MAJORITY OF THE POND AREA.
11. AS DIKE RE-GRADING CONTINUES ALONG THE NEW RIVER SIDE, A TEMPORARY COLLECTION DITCH SHALL BE CONSTRUCTED DOWNSLOPE OF THE SOIL-ASH INTERFACE ALONG THE OUTER SLOPE OF THE RE-GRADED DIKES (SEE DETAIL BELOW).



TEMPORARY COLLECTION DITCH ALONG NEW RIVER
N.T.S.

12. THE TEMPORARY COLLECTION CHANNELS ARE TO BE UTILIZED TO PREVENT OFF-SITE RUNOFF AND PROMOTE INFILTRATION AND DRAINAGE FROM RE-GRADED AREAS TO THE TEMPORARY SEDIMENT TRAP AT THE SOUTHEAST END OF THE POND.
13. THE TEMPORARY SEDIMENT TRAP AT THE SOUTHEAST PORTION OF THE POND WILL REMAIN AS RE-GRADING CONTINUES, AND WILL REDUCE IN SIZE AS FINAL SUBGRADE RE-GRADING IS ACHIEVED FOR THE MAJORITY OF THE POND. A MINIMUM STORAGE VOLUME OF 132,000 CUBIC FEET WITH 2 FT OF FREEBOARD SHALL BE MAINTAINED IN THE TEMPORARY SEDIMENT TRAP THROUGHOUT THE CAPPING OPERATIONS FOR THE MAJORITY OF THE POND'S AREA. DURING THESE RE-GRADING ACTIVITIES, ALLOW FOR ENOUGH MATERIAL TO BE EXCAVATED FROM THE BERM ALONG ADAIR RUN TO PROVIDE FOR FINAL GRADING OF THE POND SITE.
14. MAINTAIN THE TEMPORARY SEDIMENT TRAP. THE TEMPORARY SEDIMENT TRAP SHALL BE PUMPED EMPTY OF PONDED WATER WITHIN 48 HOURS AFTER EACH SUBSTANTIAL RAIN EVENT AND REMAIN WITHOUT PONDED WATER BETWEEN THE RAIN EVENTS. THIS WATER SHALL BE CONVEYED TO THE EXISTING LANDFILL LEACHATE POND.
15. INSTALL THE RIPRAP BLANKET DOWN THE FACE OF THE SOUTHEAST DIKE TO TRANSITION THE FLOW INTO SHEET FLOW AS THE FLOW ENTERS ADAIR RUN. INSTALLATION OF THE RIPRAP BLANKET SHALL BE PERFORMED STARTING AT THE TOE OF THE DIKE AND WORKING UP THE SLOPE.
16. PLACE TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, AND SOIL STABILIZATION BLANKET AT THE LOCATIONS SHOWN ON THE DRAWING, AND IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK.

SCALE: 1" = 50'
50 0 50 100

LEGEND

- EXISTING MAJOR CONTOUR (1550)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOURS (1900)
- PROPOSED MINOR CONTOURS
- FENCE
- ROAD
- STRUCTURE
- TREE LINE
- CENTERLINE ADAIR RUN (APPROX.)
- VA-648 RIGHT OF WAY
- LOD — LOD — LIMIT OF DISTURBANCE
- SF — SF — SILT FENCE
- RIPRAP BLANKET
- ROCK CONSTRUCTION ENTRANCE
- SOIL STABILIZATION BLANKET
- 1% SLOPE — SLOPE OF PROPOSED SURFACE
- TEMPORARY COLLECTION DITCH
- SOIL STABILIZATION MATTING
- 1/03 — DETAIL IDENTIFICATION NUMBER AND LOCATION / DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30303)

COMMONWEALTH OF VIRGINIA
DONALD A. SNEDEKER, JR.
Lic. No. 047171
PROFESSIONAL ENGINEER
3/12/13

DATE	NO.	DESCRIPTION	APPD.
1/24/13	A	ISSUED FOR PERMIT	MAL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

EROSION AND SEDIMENT CONTROL PLAN - SHEET 1

DWG. NO. 56-30308-A

SCALE: CIVIL ENGINEERING DIVISION

DRI: CH: ENGR: PROJ. ENGR.: DATE: APPROVED BY:

gai consultants

DRAWN JCN APPROVED MAL
CHECKED C.K.M. DATE 1/24/13

DRAWING NUMBER C121043-00-001-00-E-M017 A REV.

SHT. NO. 9 OF 11

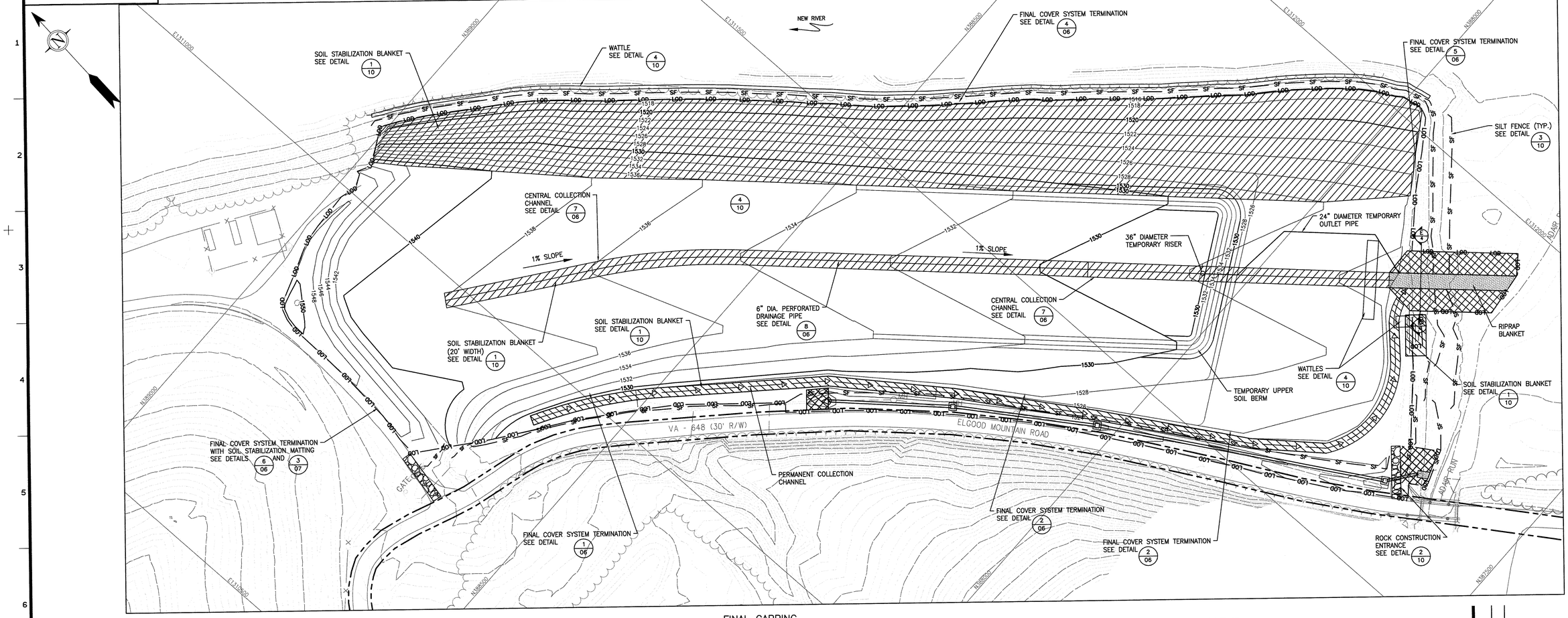
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

AEP AMERICAN ELECTRIC POWER — 1 RIVERSIDE PLAZA COLUMBUS, OH 43215

IGS1092
Z:\ENERGY\2012\C121043.00 - AEP - GLEN LYN POND CLOSU\CAD\PRODUCTION DRAWINGS\C121043-00-001-00-E-M017.DWG 11/9/12

SYSTEM DATE-DD-MMM-YYYY

DWG. NO. 56-30309



FINAL CAPPING

PROPOSED POND CONTOURS SHOWN ARE FINAL COVER

SUGGESTED GENERAL CONSTRUCTION SEQUENCE

17. CONTINUE CONSTRUCTION TO CAP THE MAJORITY OF THE POND SITE WHILE THE TEMPORARY SEDIMENT TRAP REMAINS FUNCTIONAL. THE FINAL COVER SYSTEM CONSISTS OF THE GEOMEMBRANE, GEOCOMPOSITE DRAINAGE NET, AND 2 FEET OF SOIL. THE PROPOSED CENTERLINE DRAINAGE PIPE AND PIPE ENVELOPE WILL BE CONSTRUCTED AS PART OF THE FINAL COVER SYSTEM.

18. ONCE THESE ACTIVITIES HAVE BEEN COMPLETED FOR THE MAJORITY OF THE SITE, CONSTRUCT A TEMPORARY RISER PIPE, TEMPORARY OUTLET PIPE, AND A TEMPORARY SOIL BERM ACROSS THE CENTER CHANNEL OF THE UPPER AREA AS SHOWN ON THE DRAWINGS. THE OUTLET PIPE BEYOND THE UPPER BERM LIMITS WILL OCCASIONALLY BE REPOSITIONED TO AVOID CONSTRUCTION ACTIVITIES IN THE DOWNSLOPE AREA.

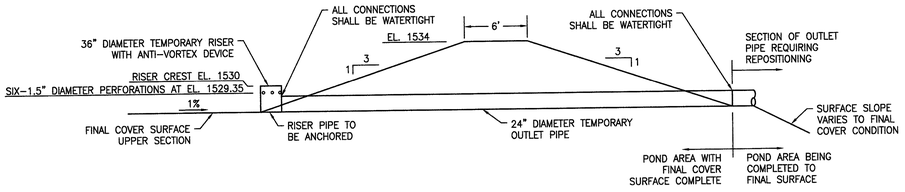
19. ONCE THE TEMPORARY UPPER SOIL BERM IS INSTALLED, FINAL GRADING AND CAPPING OPERATIONS MAY PROCEED FOR THE REMAINING AREAS OF THE POND. DURING THESE OPERATIONS, NO ASH CONTACT RUNOFF IS PERMITTED TO DISCHARGE OFFSITE. ANY PONDED WATER SHALL BE PUMPED TO THE EXISTING LANDFILL LEACHATE POND WITHIN 48 HOURS AFTER EACH SUBSTANTIAL RAIN EVENT.

20. THE FINAL COVER SYSTEM CONSISTS OF THE GEOMEMBRANE, GEOCOMPOSITE DRAINAGE NET, AND 2 FEET OF SOIL. THE PROPOSED CENTERLINE DRAINAGE PIPE AND PIPE ENVELOPE WILL BE CONSTRUCTED AS PART OF THE FINAL COVER SYSTEM.

21. AFTER THE FINAL COVER SYSTEM HAS BEEN INSTALLED, PLACE A WATTLE ACROSS THE PERMANENT COLLECTION CHANNEL ALONG THE ADAIR RUN SIDE OF THE SITE, AND ACROSS THE CENTRAL COLLECTION CHANNEL.

22. PLACE TEMPORARY SEEDING, PERMANENT SEEDING, MULCHING, AND SOIL STABILIZATION BLANKET IN ACCORDANCE WITH THE VIRGINIA EROSION AND SEDIMENT CONTROL HANDBOOK.

23. THE TEMPORARY SOIL BERM, WATTLES, AND THE PERIMETER EROSION AND SEDIMENT CONTROL MEASURES SHALL REMAIN UNTIL AREAS WHICH CONTRIBUTE RUNOFF TO THEM ARE ADEQUATELY STABILIZED. WHEN ANY OF THESE CONTROLS ARE REMOVED, RESTORE DISTURBED AREAS TO PRE-INSTALLATION CONTOURS THEN PERFORM PERMANENT SEEDING AND MULCHING.



RISER PIPE AND OUTLET PIPE FOR FINAL COVER TEMPORARY SOIL BERM AREA

N.T.S.

LEGEND

- EXISTING MAJOR CONTOUR (1550)
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOURS (1900)
- PROPOSED MINOR CONTOURS
- FENCE
- ROAD
- STRUCTURE
- TREE LINE
- CENTERLINE ADAIR RUN (APPROX.)
- VA-648 RIGHT OF WAY
- LOD — LOD — LIMIT OF DISTURBANCE
- SF — SF — SILT FENCE
- RIPRAP BLANKET
- ROCK CONSTRUCTION ENTRANCE
- SOIL STABILIZATION BLANKET
- 1% SLOPE — SLOPE OF PROPOSED SURFACE
- PERMANENT COLLECTION CHANNEL
- SOIL STABILIZATION MATTING
- 1/03 — DETAIL IDENTIFICATION NUMBER AND LOCATION / DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 56-30303)

SCALE: 1" = 50'

50 0 50 100

COMMONWEALTH OF VIRGINIA
DONALD T. SHAFFER
22462 No. 0401
PROFESSIONAL ENGINEER
3/14/13

gai consultants
PITTSBURGH OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN JCN | APPROVED MRL
CHECKED C&M | DATE 1/29/13
DRAWING NUMBER C121043-00-001-00-E-M018 | A REV
SHT. NO. 10 OF 11

AEP AMERICAN ELECTRIC POWER
1 RIVERSIDE PLAZA COLUMBUS, OH 43215

DATE	NO.	DESCRIPTION	APPD.
1/29/13	A	ISSUED FOR PERMIT	MRL

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

EROSION AND SEDIMENT CONTROL PLAN - SHEET 2

DWG. NO. 56-30309-A

SCALE: | DRN: | CHK: | ENGR.: | PROJ. ENGR.: | DATE: | APPROVED BY:

CIVIL ENGINEERING DIVISION

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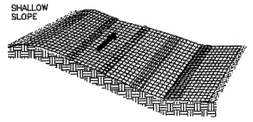
SYSTEM DATE: DD-MMM-YYYY
SYSTEM TIME: HOUR:MINUTE
16th PLN. CSD

DWG NO. 56-30310

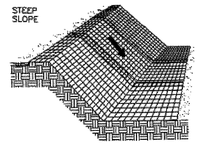
TREATMENT – 1 (SOIL STABILIZATION BLANKET)



ON SHALLOW SLOPES, STRIPS OF NETTING PROTECTIVE COVERINGS MAY BE APPLIED ACROSS THE SLOPE.



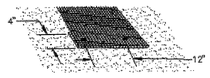
WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE MATERIAL OVER THE BERM AND ANCHOR IT BEHIND THE BERM.

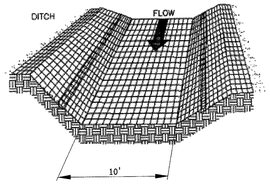


ON STEEP SLOPES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

3H:1V & STEEPER SLOPES

BRING MATERIAL DOWN TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 4" AND STAPLE AT 12" INTERVALS.

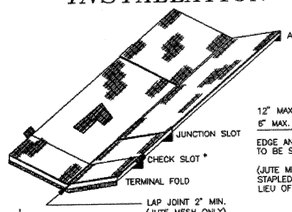




IN DITCHES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS AS REQUIRED. AVOID JOINING MATERIAL IN THE CENTER OF THE DITCH IF AT ALL POSSIBLE.

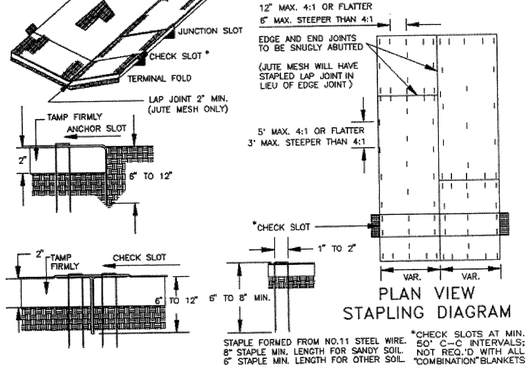
CENTERLINE SWALE

(SOIL STABILIZATION BLANKET) INSTALLATION CRITERIA



NOTES

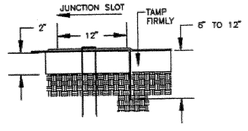
APPROXIMATELY 200 STAPLES REQUIRED PER 100 SQ. YDS. OF MATERIAL ROLL. ANCHOR SLOTS, JUNCTION SLOTS & CHECK SLOTS TO BE BURIED 6" TO 12".

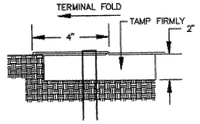


PLAN VIEW
STAPLING DIAGRAM

STAPLE FORMED FROM NO.11 STEEL WIRE. 8" STAPLE MIN. LENGTH FOR SANDY SOIL 6" STAPLE MIN. LENGTH FOR OTHER SOIL.

*CHECK SLOTS AT MIN. 50' C-C INTERVALS; NOT REQ'D WITH ALL "COMBINATION" BLANKETS





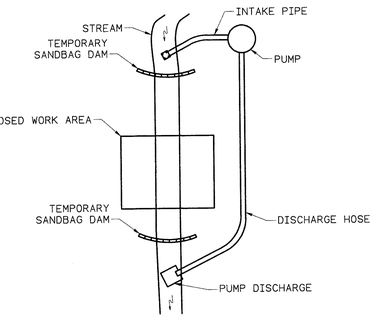
DETAIL 1 / 08, 09

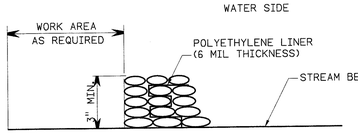
SOIL STABILIZATION BLANKET

SCALE: N. T. S.

NOTES:
1. INSTALL SOIL STABILIZATION BLANKET AFTER FINAL COVER SOIL HAS BEEN REACHED.
2. INSTALL IN ACCORDANCE WITH THE VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK AND/OR MANUFACTURER'S INSTRUCTIONS.

REFERENCE: VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK (3.36)



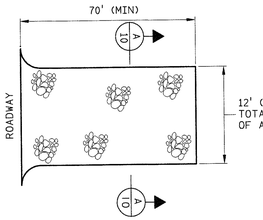


SANDBAG DAM

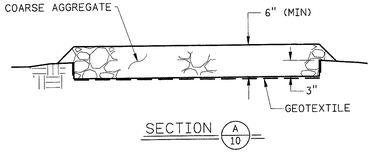
DETAIL 5 / 08

TEMPORARY COFFERDAM AND PUMP BYPASS

SCALE: N. T. S.



PLAN VIEW



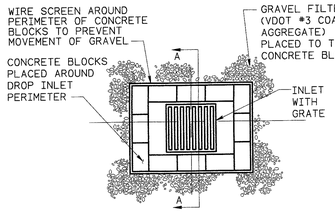
SECTION A / 10

DETAIL 2 / 08, 09

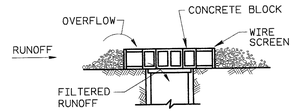
TEMPORARY CONSTRUCTION ENTRANCE (TYP)

SCALE: N. T. S.

NOTES:
1. THE AGGREGATE LAYER MUST BE AT LEAST 6" THICK, WITH A MINIMUM 3" OF AGGREGATE PLACED IN A CUT SECTION.
2. INSTALL TEMPORARY CONSTRUCTION ENTRANCE(S) IN ACCORDANCE WITH THE VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK.



PLAN VIEW



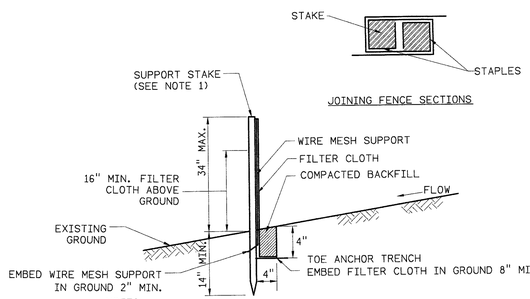
SECTION A-A

NOTES:
1. GRAVEL FILTERS MAY BE USED ON PAVEMENT OR BARE GROUND.
2. ALL GRAVEL FILTERS INSTALLED AROUND AREA DRAINS SHOULD BE INSPECTED AND REPAIRED AFTER EACH RUNOFF EVENT. SEDIMENT SHOULD BE REMOVED WHEN MATERIAL IS AT THE CREST OF THE FIRST SET OF CONCRETE BLOCKS. PERIODICALLY, THE GRAVEL SHOULD BE RAKED TO INCREASE INFILTRATION AND FILTERING OF RUNOFF WATERS.
3. SEDIMENT SHOULD BE REMOVED IMMEDIATELY FROM ANY TRAVELED WAY OF ROADS AND STREETS.

DETAIL 6 / 09

STORM DRAIN INLET PROTECTION

SCALE: N. T. S.

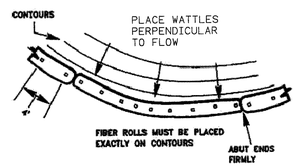


NOTES:
1. USE 2" X 2" OAK, OR 4"X4" PINE, OR 1.33 LB/LF STEEL STAKES. ALL STAKES SHALL BE A MINIMUM OF 5 FEET LONG. STAKES SHALL BE SPACED A MAXIMUM OF 10 FEET APART.
2. WIRE MESH REINFORCEMENT FOR SUPPORT SHALL BE A MINIMUM OF 14 GAUGE AND SHALL HAVE A MAXIMUM MESH SPACING OF 6 INCHES. FASTEN WIRE MESH TO UPSLOPE SIDE OF THE STAKES USING HEAVY DUTY WIRE STAPLES AT LEAST ONE INCH LONG, TIE WIRES, OR HOG RINGS.
3. FILTER CLOTH SHALL BE STANDARD STRENGTH AND MUST MEET SPECIFICATIONS LISTED IN TABLE 3.05-B, IN VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK. THE FABRIC SHALL BE STAPLED OR WIRED TO THE WIRE FINCE.
4. INSTALL SILT FENCE DOWN-GRADIENT WHERE SHOWN ON THE PLANS. INSTALL SILT FENCE AS NECESSARY FOR INSTALLATION OF OUTLET PIPES AND OUTFALL PROTECTION.
5. SILT FENCE MUST BE PLACED AT LEVEL EXISTING GRADE. BOTH ENDS OF THE FENCE MUST BE EXTENDED AT LEAST 8 FEET UP SLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT.
6. SEDIMENT MUST BE REMOVED WHEN ACCUMULATIONS REACH 1/2 THE HEIGHT OF THE FENCE.

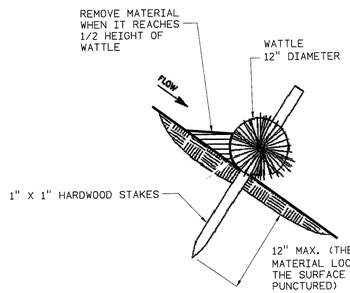
DETAIL 3 / 08, 09

SILT FENCE

SCALE: N. T. S.



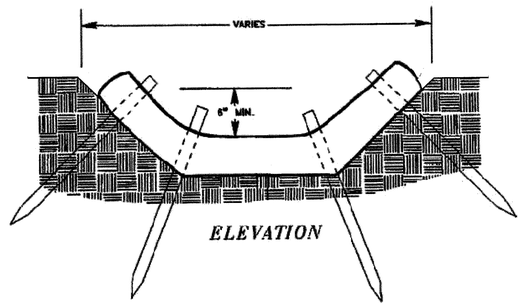
NON-CHANNEL PLACEMENT



DETAIL 4 / 08, 09

WATTLES

SCALE: N.T.S.



CHANNEL PLACEMENT

COMMONWEALTH OF VIRGINIA
DONALD J. SPADER JR.
Lic. No. 0401
PROFESSIONAL ENGINEER
5/14/13

DATE	NO.	DESCRIPTION	APPD.
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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

AUXILIARY FLY ASH POND CLOSURE

EROSION AND SEDIMENT CONTROL DETAILS

DWG. NO. 56-30310-A

SCALE:	CIVIL ENGINEERING DIVISION
DR:	
CH:	
ENGR.	
PROJ. ENGR.	
DATE:	

APPROVED BY

gai consultants
PITTSBURGH, OFFICE • 385 EAST WATERFRONT DRIVE, HOMESTEAD, PA 15120-5005

DRAWN JDS	APPROVED MRL
CHECKED C&M	DATE 1/29/13

DRAWING NUMBER C121043-00-001-00-E-M014 A REV

SHT. NO. 11 OF 11

AEP AMERICAN ELECTRIC POWER

1 RIVERSIDE PLAZA COLUMBUS, OH 43215

SYSTEM DATE-DD-MMM-YYYY
SYSTEM TIME-HOUR:MINUTE
10th PLN. CED

IGS1092
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DRAWING NUMBER: 56-30360

CROSS REFS:

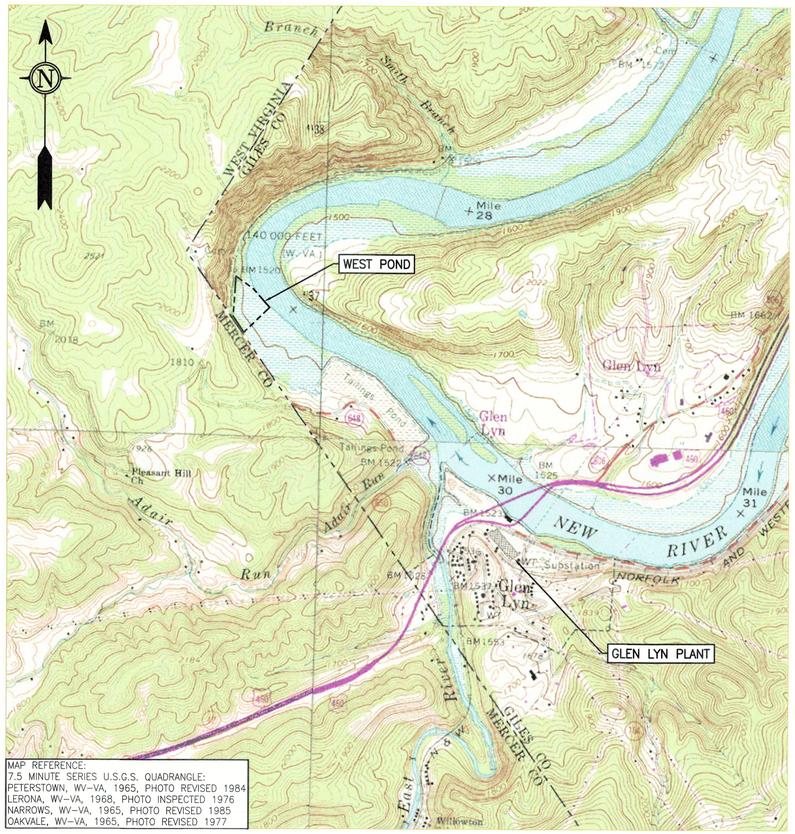
GLEN LYN PLANT

WEST POND TEMPORARY SPILLWAY

OWNED AND OPERATED BY:

APPALACHIAN POWER COMPANY

GLEN LYN, VIRGINIA



LOCATION MAP

SCALE: 1" = 1000'

1000 0 1000 2000

DRAWING INDEX	
DRAWING NUMBER	DRAWING TITLE
56-30360	TITLE SHEET AND LOCATION MAP
56-30361	EXISTING SITE CONDITIONS PLAN
56-30362	SUBGRADE PLAN
56-30363	SITE PLAN
56-30364	SPILLWAY SECTIONS
56-30365	SPILLWAY DETAILS
56-30366	E&S DETAILS

PREPARED BY:

AMERICAN ELECTRIC POWER SERVICE CORP.

1 RIVERSIDE PLAZA, COLUMBUS, OHIO 43215

JANUARY 2019

DATE	NO.	DESCRIPTION	APPD.

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COMMONWEALTH OF VIRGINIA
ARICA LEE DITULLO
Lic. No. 040235299
PROFESSIONAL ENGINEER
1/25/19

gai consultants

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND TEMPORARY SPILLWAY

TITLE SHEET AND LOCATION MAP

UNIT:	DRAWING NUMBER: 56-30360	REV:
SCALE:		
DR: MAYHOEJ	APPROVED BY:	
CH: PONZOMM		
SUP:		
ENG: DITULAL		
DATE: 01/10/2019		

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

SCALE: 1" FULL SIZE, 1/2 SCALE 12", 1/4 SCALE 24", 1/8 SCALE 36"

CROSS REFS:

GAI FILE PATH: Z:\ENERGY\2012\C121043.07_-_AEP_GLENLYN_WP_SPILLWAY_CAD\PRODUCTION_DWGS\56-30360.DWG PLOTTED: 01/10/2019 BY: ED MAYHOOD

DRAWING NUMBER: 56-30361

CROSS REFS:

E 1308!

E 1309!

EXISTING DIVERSION CHANNEL

NEW RIVER

EXISTING CHANNEL TO NEW RIVER

MW-1\B-1
(TO BE REMOVED)

100-YR

B-2

EXISTING ACCESS ROAD

EXISTING DISCHARGE OUTFALL STRUCTURE

EXISTING DIVERSION CHANNEL

WEST POND NORMAL POOL ELEV. 1528.8 +/-

EXISTING ACCESS ROAD

VIRGINIA STATE LINE
WEST VIRGINIA STATE LINE

100 YEAR FLOOD PLAIN

WEST POND

MW-13

SHEPPARD HOLLOW ROAD

LEGEND

- EXISTING MAJOR CONTOUR (1550)
- EXISTING MINOR CONTOUR
- 100 YEAR FLOODPLAIN (100-YR)
- EXISTING ROAD
- EDGE OF WATER
- VA-WV STATE LINE
- APPROXIMATE EXISTING LIMIT OF LEACHATE POND LINER
- LIMIT OF LANDFILL EARTH FILL
- BORING OR MONITORING WELL

REFERENCES:
BASE MAP CREATED FROM AERIAL PHOTOGRAPHY DATED 11-25-1997 BY GEO ONE, AND REVISED 07-15-1999 BY DOLAN LAB. GRID BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD 1983. VERTICAL DATUM BASED ON NAVD 1988. SUPPLEMENTED WITH TOPOGRAPHIC SURVEY DATA COLLECTED BY AMERICAN ELECTRIC POWER ON SEPTEMBER 28, 2017 AND FEBRUARY 14, 2018.

FLOOD PLAIN ELEVATION REFERENCED FROM "FLOOD LEVEL AND FLOODWAY STUDY, NO-RISE CERTIFICATION" PREPARED BY GAI CONSULTANTS, NOVEMBER 2014, REVISED JULY 2016. (ELEVATION CONVERTED TO NAVD 1988).

SCALE: 1" = 40'
40 0 40 80

ARICA LEE DITULLIO
Lic. No. 0402055299
COMMONWEALTH OF VIRGINIA
PROFESSIONAL ENGINEER
1/28/19

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DATE	NO.	DESCRIPTION	APPD.

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND TEMPORARY SPILLWAY

EXISTING CONDITIONS PLAN

UNIT:	DRAWING NUMBER:	REV:
	56-30361	

SCALE:

DR: MAYHOEJ
CH: PONZOMM
SUP:
ENG: DITULAL
DATE: 01/10/2019

APPROVED BY

AEP AMERICAN ELECTRIC POWER

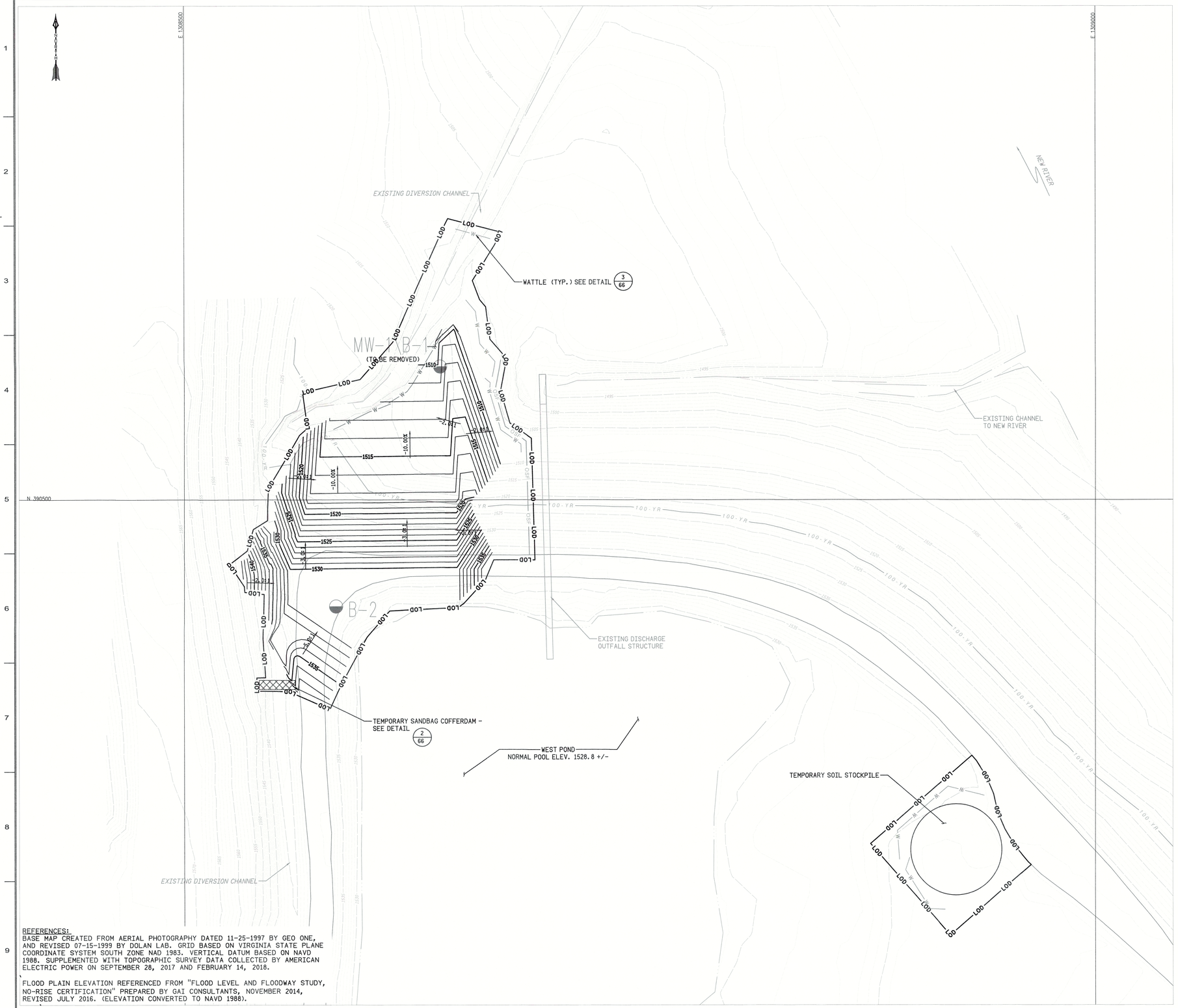
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 11-29-2018
PLOT TIME: 11:29:00
PLOTTED BY: ED MAYHOOD

CROSS REFS:

GAI FILE PATH: Z:\eNERGY\2012\a0120143.07 - AEP GLEN LYN WP SPILLWAY\CAD\PRODUCTION\ DWGS\56-30361.DWG PLOTTED: 01/11/2019 BY: ED MAYHOOD

DRAWING NUMBER: 56-30362



LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOURS
- PROPOSED MINOR CONTOURS
- 100 YEAR FLOODPLAIN
- EXISTING ROAD
- EDGE OF WATER
- LIMIT OF DISTURBANCE
- ORANGE CONSTRUCTION FENCE
- WATTLE
- SANDBAG COFFERDAM
- BORING OR MONITORING WELL
- DETAIL IDENTIFICATION NUMBER — DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 63 FOR 56-30363)
- SECTION IDENTIFICATION LETTER — DRAWING NUMBER ON WHICH SECTION IS DRAWN (I.E. 63 FOR 56-30363)

NOTE:

1. ALL EXCAVATED MATERIAL SHALL REMAIN WITHIN THE CONFINES OF THE WEST POND.
2. INSTALL WATTLES ON UNDISTURBED GROUND DOWN SLOPE OF THE WORK AREA. REMOVE/ RELOCATED WATTLES AS EXCAVATION PROCEEDS.
3. USE DEWATERING BAGS AS NEEDED DURING DEWATERING AND PUMP-AROUND ACTIVITIES SEE DETAIL 5/66
4. SEE DRAWING 56-30363 FOR SOIL STABILIZATION BLANKET LIMITS.
5. PLACE TEMPORARY SEEDING ON DISTURBED AREAS THAT WILL NOT BE WORKED ON FOR MORE THAT 14 DAYS.

REFERENCES:
BASE MAP CREATED FROM AERIAL PHOTOGRAPHY DATED 11-25-1997 BY GEO ONE, AND REVISED 07-15-1999 BY DOLAN LAB. GRID BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD 1983. VERTICAL DATUM BASED ON NAVD 1988. SUPPLEMENTED WITH TOPOGRAPHIC SURVEY DATA COLLECTED BY AMERICAN ELECTRIC POWER ON SEPTEMBER 28, 2017 AND FEBRUARY 14, 2018.

FLOOD PLAIN ELEVATION REFERENCED FROM "FLOOD LEVEL AND FLOODWAY STUDY, NO-RISE CERTIFICATION" PREPARED BY GAI CONSULTANTS, NOVEMBER 2014, REVISED JULY 2016. (ELEVATION CONVERTED TO NAVD 1988).

SCALE: 1" = 20'
20 0 20 40

ARICA LEE DITULLIO
Lic. No. 042025299
COMMONWEALTH OF VIRGINIA
PROFESSIONAL ENGINEER
1/28/19

gai consultants

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DATE	NO.	DESCRIPTION	APPD.
		REVISIONS	

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND TEMPORARY SPILLWAY

SUBGRADE PLAN

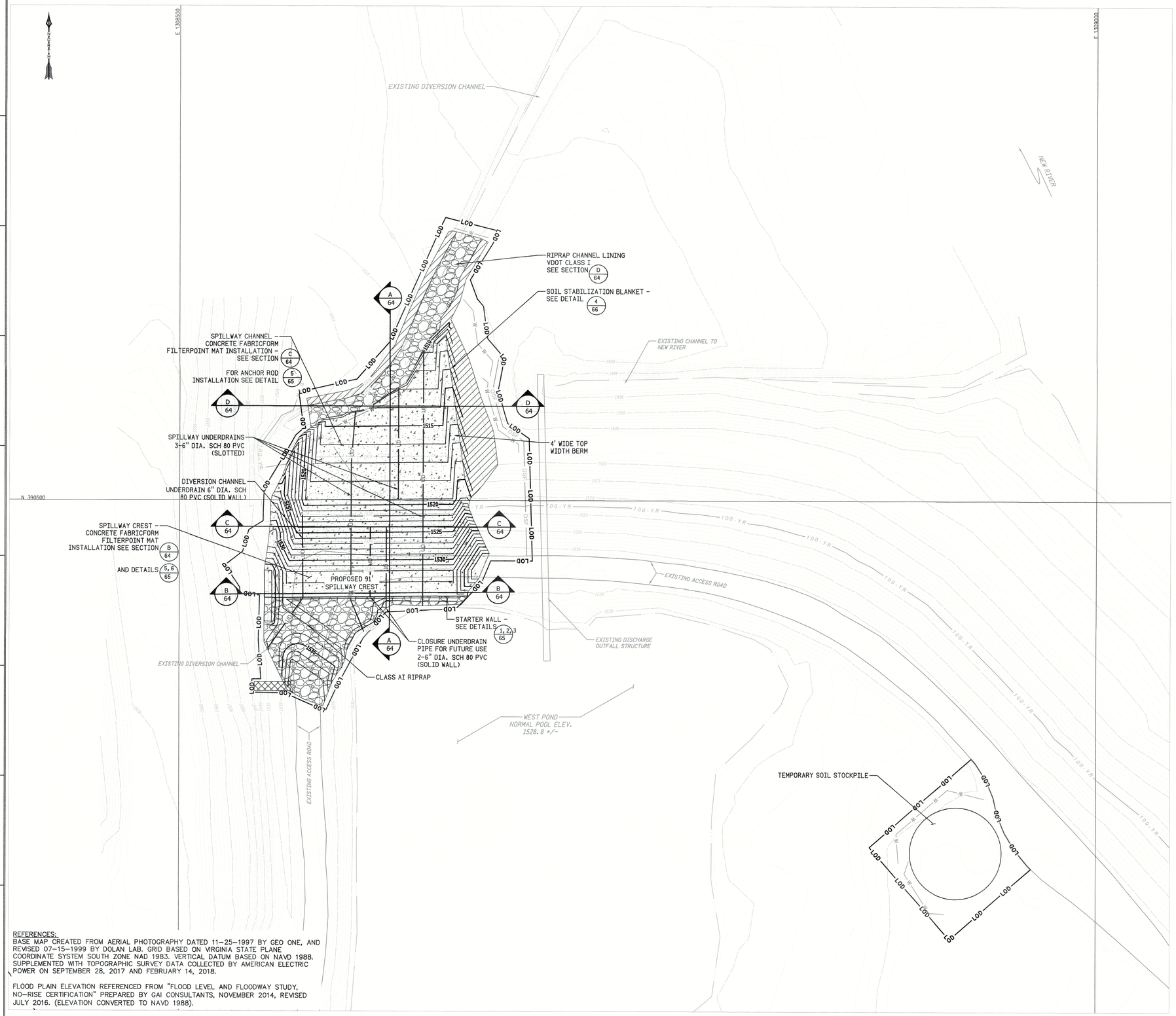
UNIT:	DRAWING NUMBER: 56-30362	REV:
SCALE:		
DR: MAYHOEJ	APPROVED BY	
CH: PONZOMM		
SUP:		
ENG: DITULAL		
DATE: 01/10/2019		

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 22-JAN-2019
PLOT BY: MAYHOEJ
24 X 36 BACKUP.PRM

CROSS REFS:

GAI FILE PATH: Z:_ENERGY\2012\K12\045.07 - AEP GLEN LYN WP SPILLWAY\CADD\PRODUCTION DWGS\56-30362.DWG PLOTTED: 01/22/2019 BY: ED MAYHOOD



LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOURS
- PROPOSED MINOR CONTOURS
- 100 YEAR FLOODPLAIN
- EXISTING ROAD
- EDGE OF WATER
- LIMIT OF DISTURBANCE
- WATTLE
- ORANGE CONSTRUCTION FENCE
- UNDERDRAIN
- RIPRAP
- FABRICFORM INSTALLATION
- SOIL STABILIZATION BLANKET
- SANDBAG COFFERDAM
- BORING OR MONITORING WELL
- DETAIL IDENTIFICATION NUMBER
  DRAWING NUMBER ON WHICH DETAIL IS DRAWN (I.E. 63 FOR 56-30363)
- SECTION IDENTIFICATION LETTER
  DRAWING NUMBER ON WHICH SECTION IS DRAWN (I.E. 63 FOR 56-30363)

NOTE:

1. ALL EXCAVATED MATERIAL SHALL REMAIN WITHIN THE CONFINES OF THE WEST POND.
2. INSTALL WATTLES ON UNDISTURBED GROUND DOWN SLOPE OF THE WORK AREA. REMOVE/ RELOCATED WATTLES AS EXCAVATION PROCEEDS.
3. INSTALL SOIL STABILIZATION BLANKET ON DISTURBED AREAS WHEN NO LONGER ACTIVE. SEE DETAIL 4 66
4. USE DEWATERING BAGS AS NEEDED DURING DEWATERING AND PUMP-AROUND ACTIVITIES SEE DETAIL. 5 66
5. PLACE TEMPORARY SEEDING ON DISTURBED AREAS THAT WILL NOT BE WORKED ON FOR MORE THAT 14 DAYS.

REFERENCES:
BASE MAP CREATED FROM AERIAL PHOTOGRAPHY DATED 11-25-1997 BY GEO ONE, AND REVISED 07-15-1999 BY DOLAN LAB. GRID BASED ON VIRGINIA STATE PLANE COORDINATE SYSTEM SOUTH ZONE NAD 1983. VERTICAL DATUM BASED ON NAVD 1988. SUPPLEMENTED WITH TOPOGRAPHIC SURVEY DATA COLLECTED BY AMERICAN ELECTRIC POWER ON SEPTEMBER 28, 2017 AND FEBRUARY 14, 2018.

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SCALE: 1" = 20'
20 0 20 40

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND TEMPORARY SPILLWAY

SITE PLAN

COMMONWEALTH OF VIRGINIA
ARICA LEE DITULLIO
Lic. No. 0402053299
PROFESSIONAL ENGINEER
1/22/19

gai consultants

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UNIT:	DRAWING NUMBER: 56-30363	REV:
SCALE:		
DR: MAYHOEJ	APPROVED BY	
CH: PONZOMM		
SUP:		
ENG: DITULAL		
DATE: 01/10/2019		

AEP AMERICAN ELECTRIC POWER
AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

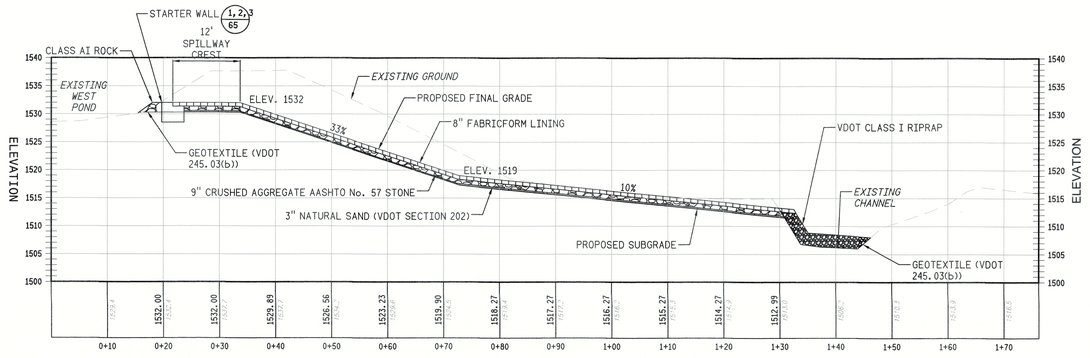
PLOT DATE: 22-Jan-2019
PLOTTED BY: ditullal

CROSS REFS:

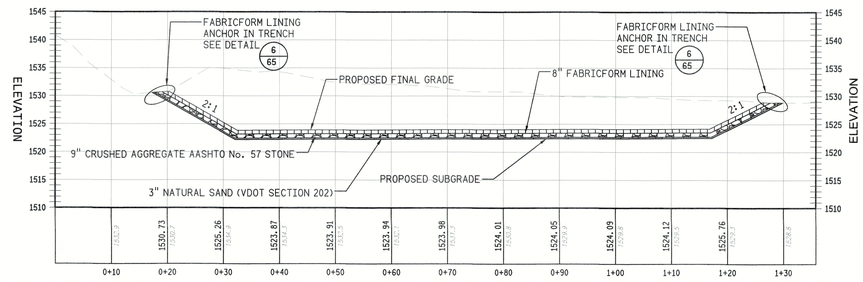
GAI FILE PATH: Z:\eNERGY\2012\G120143.07 - AEP GLENLYN WP SPILLWAY\CAD\PRODUCTION\ DWGS\56-30363.DWG PLOTTED: 01/22/2019 BY: ED MAYHOOD

DRAWING NUMBER 56-30364

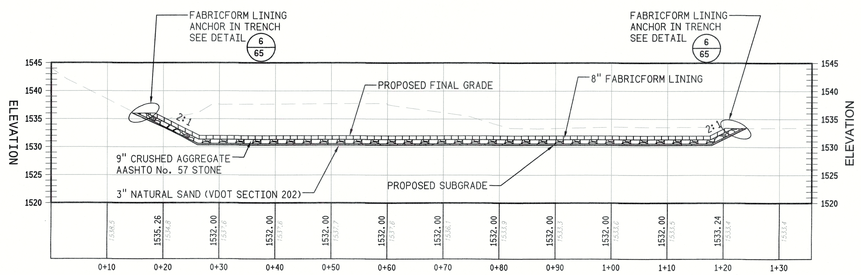
CROSS REFS:



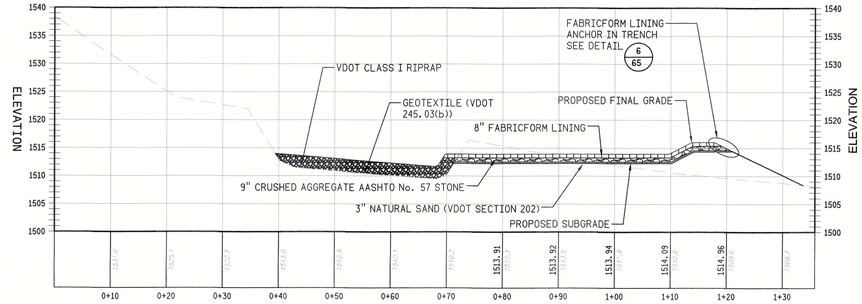
SECTION A
SCALE: 1"=10' HORIZ.
1"=10' VERT.



SECTION C
SCALE: 1"=10' HORIZ.
1"=10' VERT.



SECTION B
SCALE: 1"=10' HORIZ.
1"=10' VERT.



SECTION D
SCALE: 1"=10' HORIZ.
1"=10' VERT.

SCALE: 1" = 10'
10 0 10 20

DATE	NO.	DESCRIPTION	APPD.

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COMMONWEALTH OF VIRGINIA
ARICA LEE DITULLIO
Lic. No. 0402055299
PROFESSIONAL ENGINEER
1/23/19

gai consultants

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND SPILLWAY

SPILLWAY SECTIONS

UNIT:	DRAWING NUMBER: 56-30364	REV:
SCALE:		
DR: MAYHOEJ		
CH: PONZOMM		
SUP:		
ENG: DITULAL		
DATE: 01/10/2019		

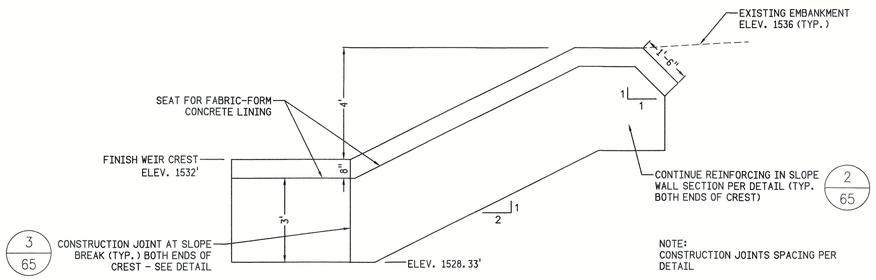
APPROVED BY

AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 13-Feb-2019
PLOT TIME: 1:24PM
BY: E MAYHOOD

CAE FILE PATH: Z:\ENERGY\2012\G121043.07 - AEP GLEN LYN WP SPILLWAY\CAD\PRODUCTION\DWGS\56-30364.DWG, PLOTTED: 01/11/2019 BY: ED MAYHOOD

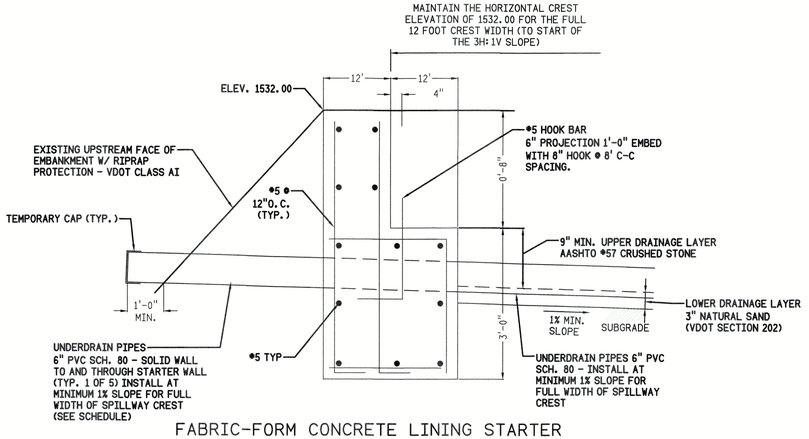


STRUCTURAL SECTION - LOOKING UPSTREAM

DETAIL 1 63,64

FABIC-FORM CONCRETE LINING STARTER WALL

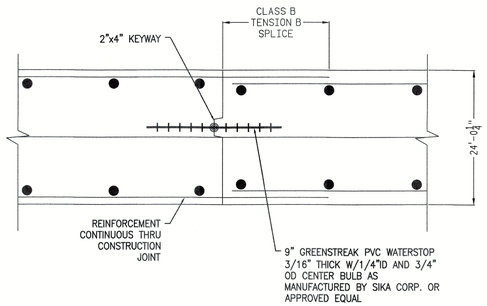
SCALE: N.T.S.



FABRIC-FORM CONCRETE LINING STARTER WALL TYPICAL REINFORCING

SCALE: N.T.S.

2 63,64



PLAN VIEW

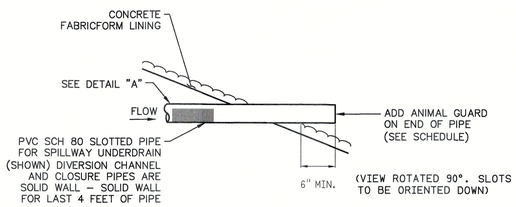
TYPICAL STARTER BLOCK WALL CONSTRUCTION JOINT DETAIL

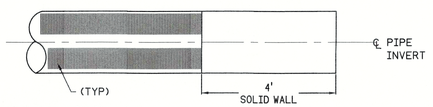
SCALE: N.T.S.

3 63,64

UNDERDRAIN SCHEDULE	NUMBER	SIZE	TYPE	INV. ELEVATION
DIVERSION CHANNEL	1	6"	PVC, SCH. 80 SOLID WALL	1530.58
SPILLWAY	2	6"	PVC, SCH. 80, SLOTTED[1]	1530.58
SPILLWAY	1	6"	PVC, SCH. 80, SLOTTED	1517.40
CLOSURE	2	6"	PVC, SCH. 80, SOLID WALL	1530.58

[1]SPILLWAY UNDERDRAIN PIPES - START SLOTTED PIPE 1' FROM STARTER WALL TO OUTLET OF PIPE PER DETAIL 4 65





DETAIL "A"

NOTE:
NUMBER AND SIZE OF UNDERDRAIN
PIPES ARE INDICATED ON PLANS.

UNDERDRAIN SCHEDULE		NUMBER AND SIZE	OUTLET INV. ELEVATION
DIVERSION CHANNEL UNDERDRAIN PIPE	PROVIDE ANIMAL GUARD CAP AT OUTLET	1 @ 6"	1524.0 ±
CLOSURE UNDERDRAIN PIPE	PROVIDE ANIMAL GUARD CAP AT OUTLET	2 @ 6"	1524.0 ±
SPILLWAY UNDERDRAIN PIPE	PROVIDE ANIMAL GUARD CAP AT OUTLET	3 @ 6"	1512.6 ±, 1511.6 ±, 1509.6 ±

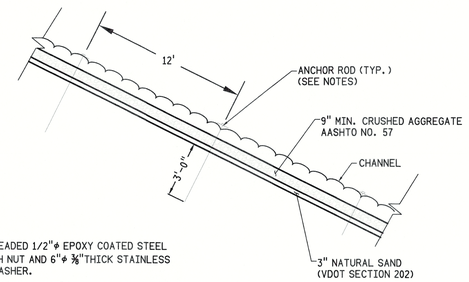
DETAIL 4 63

TYPICAL UNDERDRAIN PIPE PENETRATION AT OUTLET

SCALE: N.T.S.

NOTES:

1. THE DIVERSION CHANNEL UNDERDRAIN PIPE AND THE CLOSURE UNDERDRAIN PIPES ARE TO OUTLET ON THE 3H:1V SPILLWAY SLOPE. EXTEND PIPES THROUGH FABRICFORM TO ALLOW INSTALLATION OF ANIMAL GUARD.
2. THE SPILLWAY UNDERDRAIN PIPES ARE TO OUTLET TO THE DIVERSION CHANNEL AT THE END OF THE SPILLWAY.



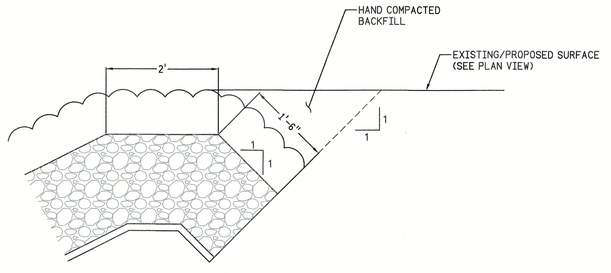
NOTES:

1. USE THREADED 1/2"ϕ EPOXY COATED STEEL ROD WITH NUT AND 6"ϕ ⅜"THICK STAINLESS STEEL WASHER.
2. ANCHOR RODS SHALL BE PLACED IN THE SPILLWAY IN A SQUARE GRID AT A MAXIMUM SPACING OF 12' X 9c.

FABRIC-FORM CONCRETE LINING ANCHOR RODS DETAIL

SCALE: N.T.S.

5 63



DETAIL 6 64

FABIC-FORM CONCRETE LINING ANCHOR IN TRENCH

SCALE: N.T.S.

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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COMMONWEALTH OF VIRGINIA
ARICA LEE DITULLIO
Lic. No. 0402055299
PROFESSIONAL ENGINEER
1/23/19

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND TEMPORARY SPILLWAY

SPILLWAY DETAILS

UNIT:	DRAWING NUMBER:	REV:
	56-30365	

SCALE:	
DR: MAYHOEJ	APPROVED BY:
CH: PONZOMM	
SUP:	
ENG: DITULAL	
DATE: 01/10/2019	

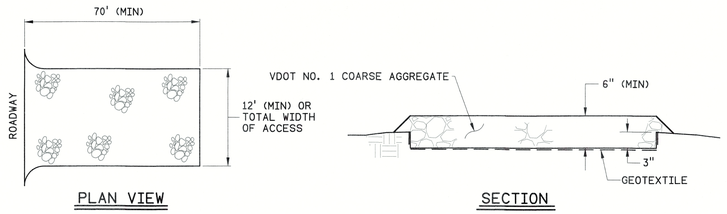
AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 1/24/2019
PLOT TIME: 7:37 AM
BY: ED MAYHOOD

CROSS REFS:

GAI FILE PATH: Z:\ENERGY\2012\G121043.07 - AEP GLEN LYN WP SPILLWAY\CAD\PRODUCTION\DWGS\56-30365.DWG PLOTTED: 01/24/2019 BY: ED MAYHOOD

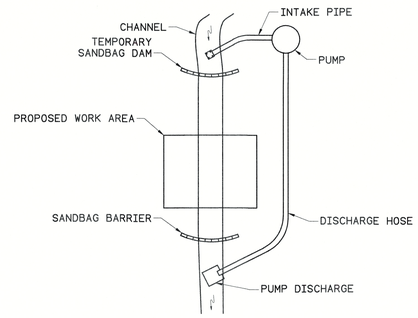


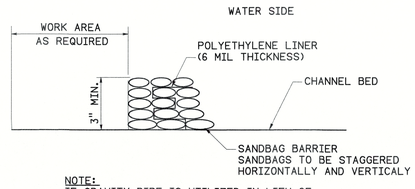
DETAIL 1/66

TEMPORARY CONSTRUCTION ENTRANCE (TYP)

SCALE: N.T.S.

NOTES:
1. THE AGGREGATE LAYER MUST BE AT LEAST 6" THICK, WITH A MINIMUM 3" OF AGGREGATE PLACED IN A CUT SECTION.
2. INSTALL TEMPORARY CONSTRUCTION ENTRANCE FROM THE WEST POND PERIMETER ACCESS ROAD IN ACCORDANCE WITH THE VIRGINIA DCR EROSION AND SEDIMENT CONTROL HANDBOOK AT THE LOCATION DESIGNATED BY THE OWNER.



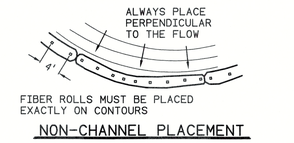


NOTE:
IF GRAVITY PIPE IS UTILIZED IN LIEU OF PUMP, FOLLOW DETAIL AND UTILIZE PIPE INSTEAD OF PUMP AND DISCHARGE HOSE

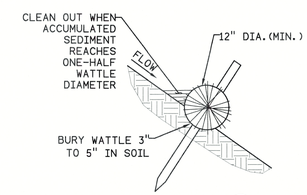
DETAIL 2/62

TEMPORARY COFFERDAM AND PUMP OR GRAVITY PIPE BYPASS

SCALE: N.T.S.



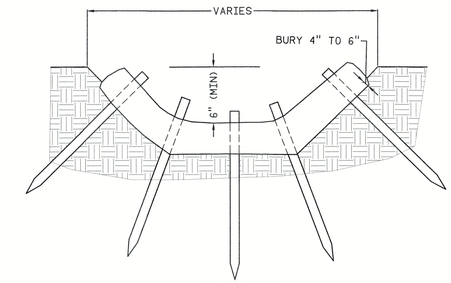
NON-CHANNEL PLACEMENT



DETAIL 3/62,63

WATTLES

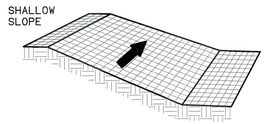
N.T.S.



ELEVATION

CHANNEL PLACEMENT

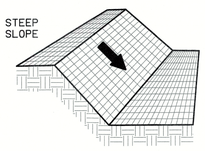
NOTES:
1. WATTLES SHALL BE A MINIMUM 12 INCHES IN DIAMETER.
2. REMOVE MATERIAL WHEN IT REACHES 1/2 HEIGHT OF WATTLES.
3. ALTERNATE STAKING METHODS OF WATTLES (MIN. 4 STAKES ON DOWNSTREAM SIDE, 2 STAKES ON UPSTREAM SIDE, ALTERNATING) MAY BE USED WITH U-STAPLES OR LACING OF STAKES TO HOLD WATTLES IN PLACE.



ON SHALLOW SLOPES, STRIPS OF NETTING PROTECTIVE COVERINGS MAY BE APPLIED ACROSS THE SLOPE.

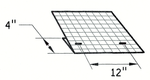


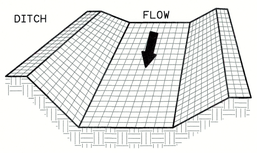
WHERE THERE IS A BERM AT THE TOP OF THE SLOPE, BRING THE MATERIAL OVER THE BERM AND ANCHOR IT BEHIND THE BERM.



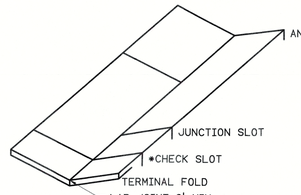
ON STEEP SLOPES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW AND ANCHOR SECURELY.

BRING MATERIAL DOWN TO A LEVEL AREA BEFORE TERMINATING THE INSTALLATION. TURN THE END UNDER 4" AND STAPLE AT 12" INTERVALS.

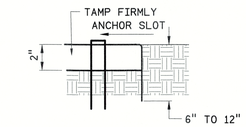


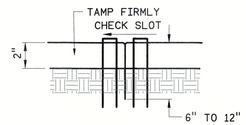


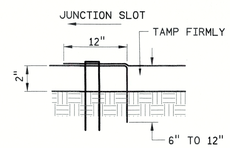
IN DITCHES, APPLY PROTECTIVE COVERING PARALLEL TO THE DIRECTION OF FLOW. USE CHECK SLOTS AS REQUIRED. AVOID JOINING MATERIAL IN THE CENTER OF THE DITCH IF AT ALL POSSIBLE.

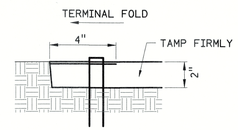


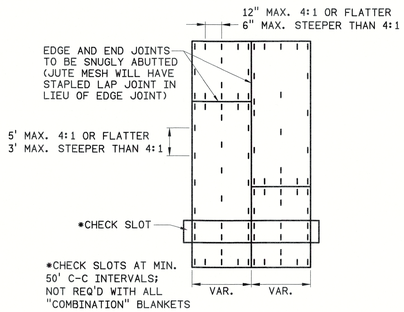
NOTES:
APPROXIMATELY 200 STAPLES REQUIRED PER 100 SQ. YDS. OF MATERIAL ROLL. ANCHOR SLOTS, JUNCTION SLOTS, & CHECK SLOTS TO BE BURIED 6" TO 12".



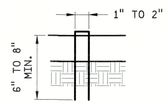








*CHECK SLOTS AT MIN. 50' C-C INTERVALS; NOT REQ'D WITH ALL "COMBINATION" BLANKETS

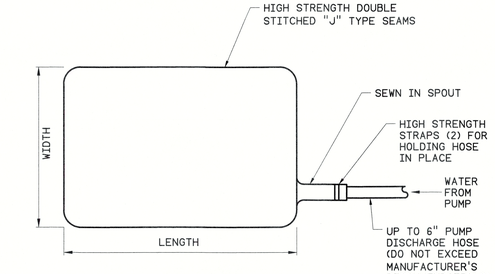


STAPLE FORMED FROM NO.11 STEEL WIRE.
8" STAPLE MIN. LENGTH FOR SANDY SOIL
6" STABLE MIN. LENGTH FOR OTHER SOIL

DETAIL 4/63

SOIL STABILIZATION BLANKET INSTALLATION

SCALE: N.T.S.



TOP VIEW



SIDE VIEW

DETAIL 5/62,63

DEWATERING BAG

SCALE: N.T.S.

DATE	NO.	DESCRIPTION	APPD.

REVISIONS

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APPALACHIAN POWER CO.

GLEN LYN PLANT

GLEN LYN, VIRGINIA

WEST POND TEMPORARY SPILLWAY

EROSION AND SEDIMENT CONTROL DETAILS

COMMONWEALTH OF VIRGINIA
ARICA LEE DITULLIO
Lic. No. 0402055220
PROFESSIONAL ENGINEER
1/25/19

UNIT:	DRAWING NUMBER:	REV:
	56-30366	

SCALE:	
DR: MAYHOEJ	APPROVED BY
CH: PONZOMM	
SUP:	
ENG: DITULAL	
DATE: 01/10/2019	

gai consultants

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AEP AMERICAN ELECTRIC POWER

AEP SERVICE CORP.
1 RIVERSIDE PLAZA
COLUMBUS, OH 43215

PLOT DATE: 01/25/2019
PLOT TIME: 1:53 PM
BY: EDITULAL

CROSS REFS:

GAI FILE PATH: Z:\ENERGY\2012\C121043.07 - AEP_GLENLYN_WP_SPILLWAY\CAD\PRODUCTION DWGS\56-30366.DWG PLOTTED: 01/10/2019 BY: ED MAYHOOD

ATTACHMENT E

Hydraulic Capacity Calculations

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 1 of 7

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INTRODUCTION

Due to the closure of the Glen Lyn Power Plant, the existing Auxiliary Fly Ash Pond (Aux FAP) is to be capped and closed. Closure of the pond will involve the necessary re-grading of the existing perimeter dikes in order to achieve a final cap system that will prevent the impounding of water after closure. The final surface will be graded to drain towards the south for ultimate discharge to Adair Run. The final grading will result essentially in a swale, which is analyzed for capacity and lining stability to conform to the design criteria set forth in the 1992 Virginia DCR Erosion and Sediment Control Handbook.

PROJECT PARAMETERS

Hydrology

The design will look at both unvegetated and vegetated conditions, given a 25-year, 24-hour storm event.

	Reference
Curve Number: 72	TR-55 Manual (vegetated) and proposed site topography
Curve Number: 89	TR-55 Manual (unvegetated) and existing site topography
Precipitation: 3.96 in.	NOAA Precipitation Frequency Data Server (25-yr, 24-hr)
Drainage Area: 7.28 Acres	AutoCAD Civil 3D 2012

Proposed Swale

Swale Features	
Bottom Width	10 ft
Total Depth	2 ft +/-
Side Slopes	50H:1V*
Bed Slope	0.01 ft/ft
Manning's n	0.055

*Swale side slopes vary slightly, with 50H:1V representing a reasonable average value.

**Manning's n of 0.055 represents an unvegetated condition in which the proposed flow depth is at or below 0.5 ft. (See attached Reference: Tensar: North American Green – S75BN Erosion Control Blanket Specification Sheet)

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 2 of 7

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TIME OF CONCENTRATION

Unvegetated Condition:

Sheet Flow

Segment ID	1	
Surface Description (Table 3-1)	Soil	
Manning's Roughness Coefficient, n	0.03	Mix of smooth/fallow (TR-55)
Flow Length, L	69	ft
Two-year 24-hour Rainfall, P_2	2.45	in
Land Slope, s	0.12	ft/ft
Travel Time, $T_t = (0.007*(n*L)^{0.8}) / (P_2^{0.5}*s^{0.4})$	**0.0189**	**hrs**

Shallow Concentrated Flow

Segment ID	2	
Surface Description (Paved / Unpaved)	Unpaved	
Surface Description Coefficient, C	16.1435	
Flow Length, L	134	ft
Watercourse Slope, s	0.01	ft/ft
Average Velocity, $V = C*s^{0.5}$	1.97	ft/sec
Travel Time, $T_t = (L) / (3600*V)$	**0.0189**	**hrs**

Swale Flow

Segment ID	3	ECB/TRM
Section Base, b	10	
Section Depth, d	0.52	
Section Side Slope, z	50	
Cross Sectional Flow Area, $a = b*d + z*d^2$	18.7	
Wetted Perimeter, $p_w = b + (2*d)*(z^2 + 1)^{0.5}$	62.01	
Hydraulic Radius, $r = a / p_w$	0.30	
Channel Slope, s	0.010	
Manning's Roughness Coefficient, n	0.053	
Average Velocity, $V = (1.49*r^{2/3}*s^{1/2}) / (n)$	1.27	ft/sec
Flow Length, L	1275	ft
Travel Time, $T_t = (L) / (3600*V)$	**0.2799**	**hrs**

Time of Concentration

Sheet Flow T_t	0.0189	
Shallow Concentrated Flow T_t	0.0189	
Channel Flow T_t	0.2799	
Time of Concentration, T_c	**0.3178**	**hrs**
	19.07	**min**

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 3 of 7

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Vegetated Condition:

Sheet Flow

Segment ID	1	
Surface Description (Table 3-1)	Grass	
Manning's Roughness Coefficient, n	0.15	(TR-55)
Flow Length, L	69	ft
Two-year 24-hour Rainfall, P_2	2.45	in
Land Slope, s	0.12	ft/ft
Travel Time, $T_t = (0.007*(n*L)^{0.8}) / (P_2^{0.5}*s^{0.4})$	**0.0687**	**hrs**

Shallow Concentrated Flow

Segment ID	2	
Surface Description (Paved / Unpaved)	Unpaved	
Surface Description Coefficient, C	16.1435	
Flow Length, L	134	ft
Watercourse Slope, s	0.01	ft/ft
Average Velocity, $V = C*s^{0.5}$	1.97	ft/sec
Travel Time, $T_t = (L) / (3600*V)$	**0.0189**	**hrs**

Swale Flow

Segment ID	3	ECB/TRM
Section Base, b	10	
Section Depth, d	0.35	
Section Side Slope, z	50	
Cross Sectional Flow Area, $a = b*d + z*d^2$	9.6	
Wetted Perimeter, $p_w = b + (2*d)*(z^2 + 1)^{0.5}$	45.01	
Hydraulic Radius, $r = a / p_w$	0.21	
Channel Slope, s	0.010	
Manning's Roughness Coefficient, n	0.055	
Average Velocity, $V = (1.49*r^{2/3}*s^{1/2}) / (n)$	0.97	ft/sec
Flow Length, L	1275	ft
Travel Time, $T_t = (L) / (3600*V)$	**0.3656**	**hrs**

Time of Concentration

Sheet Flow T_t	0.0687	
Shallow Concentrated Flow T_t	0.0189	
Channel Flow T_t	0.3656	
Time of Concentration, T_c	**0.4531**	**hrs**
	27.19	**min**

PEAK FLOWS

The computer program Hydraflow Hydrographs 2004 was used to calculate the peak flow in the swale resulting from a 25-year, 24-hour storm, and the hydrograph outputs for the unvegetated and final vegetated conditions are shown below.

Hydrograph Plot

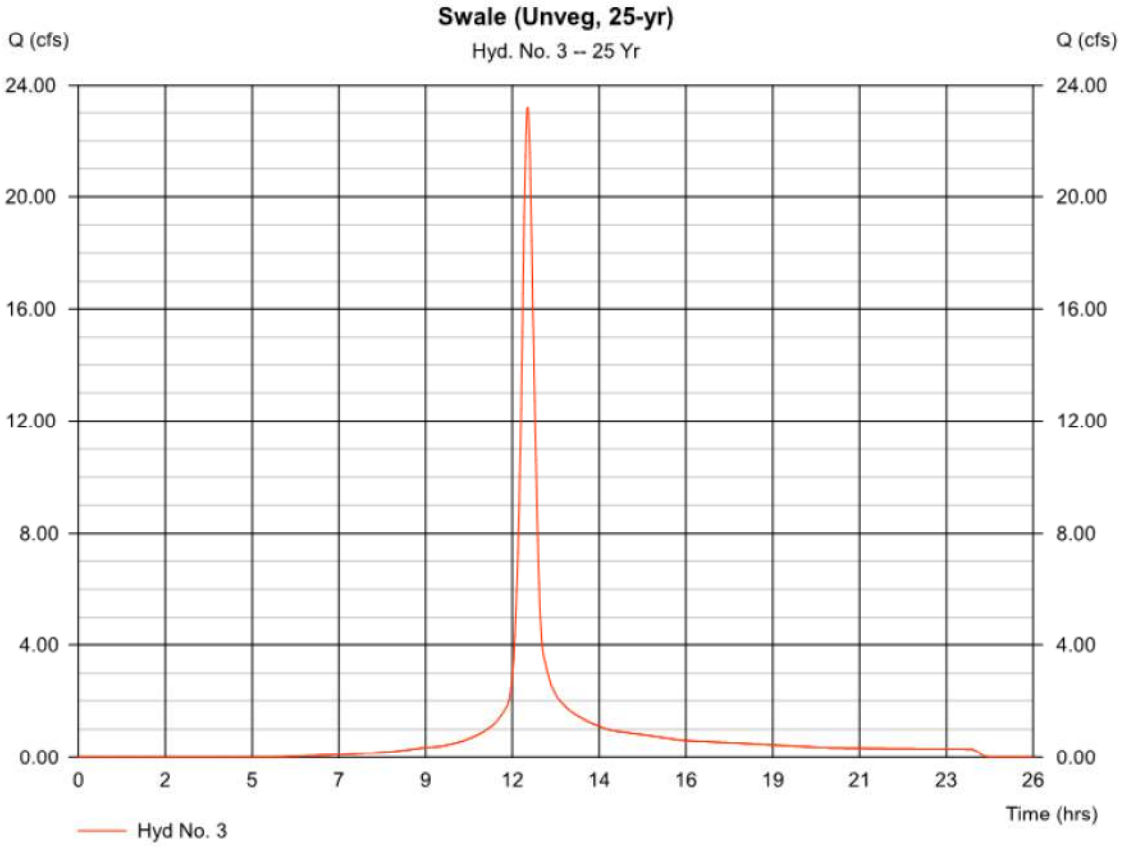
Hydraflow Hydrographs by Intelisolve — Wednesday, Jan 9 2013, 3:18 PM

Hyd. No. 3

Swale (Unveg, 25-yr)

Hydrograph type	= SCS Runoff	Peak discharge	= 23.19 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 7.280 ac	Curve number	= 89
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 19.10 min
Total precip.	= 3.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 73,612 cuft



SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 5 of 7

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Hydrograph Plot

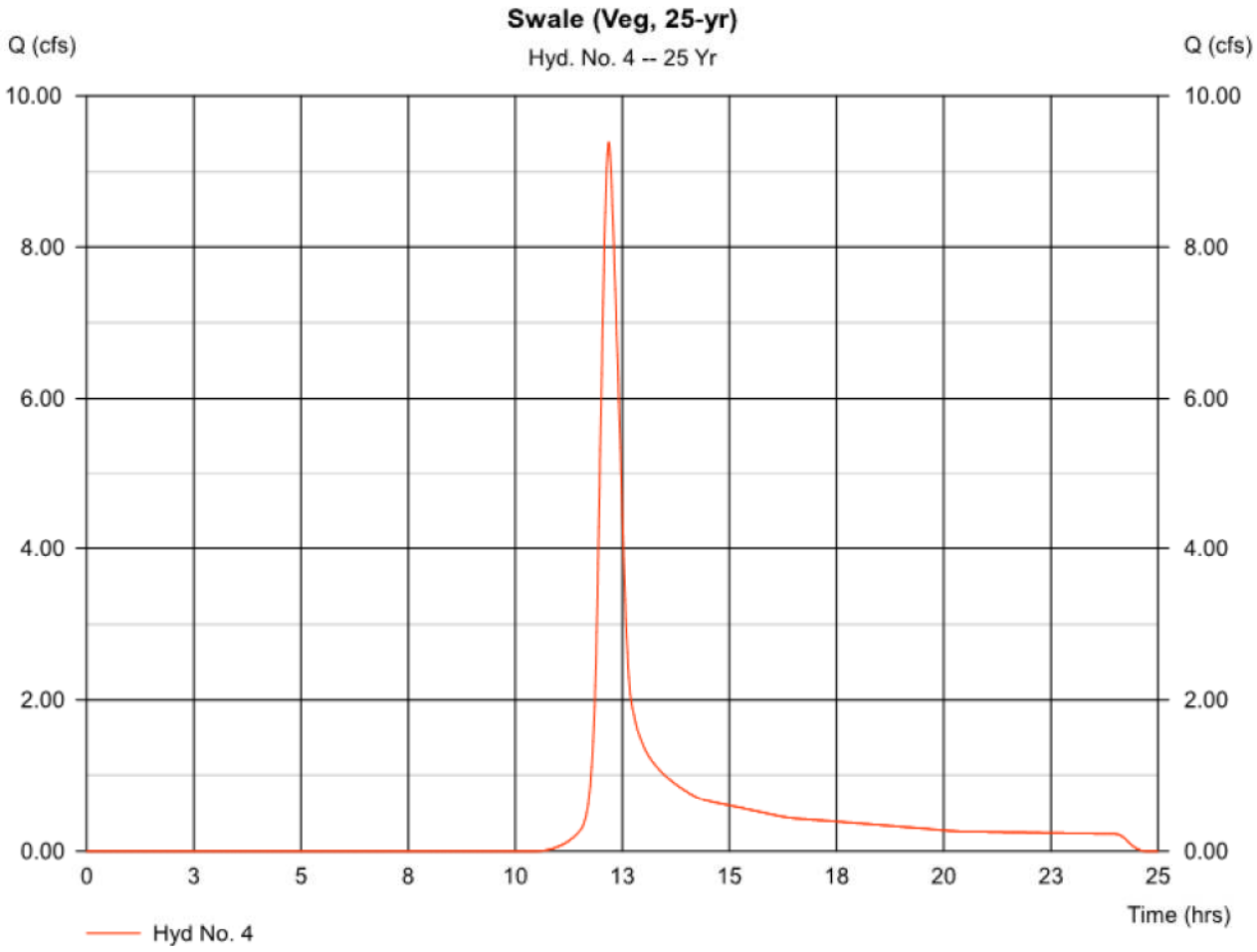
Hydraflow Hydrographs by Intelisolve — Wednesday, Jan 9 2013, 3:19 PM

Hyd. No. 4

Swale (Veg, 25-yr)

Hydrograph type	= SCS Runoff	Peak discharge	= 9.40 cfs
Storm frequency	= 25 yrs	Time interval	= 1 min
Drainage area	= 7.280 ac	Curve number	= 72
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= USER	Time of conc. (Tc)	= 27.20 min
Total precip.	= 3.96 in	Distribution	= Type II
Storm duration	= 24 hrs	Shape factor	= 484

Hydrograph Volume = 37,567 cuft



SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 6 of 7

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SWALE DESIGN

The calculation below analyzes the use of an erosion control blanket (soil stabilization blanket) as a temporary liner along the centerline of the swale. It can be seen that the peak shear stress and peak velocity do not exceed the maximum allowed for the product in question (North American Green, S75BN Erosion Control Blanket), and for the vegetated swale. The specification sheet for the S75BN Erosion Control Blanket can be seen on the following sheet.

Channel	Center Swale	
Protective Lining	S75BN (Unveg.)	S75BN (Veg.)
Channel Top Width (ft)	210	210
Channel Width at Flow Depth (ft)	61.5	45.1
Channel Side Slopes (H:V)	50	50
Channel Bottom Width (ft)	10	10
Flow Depth (ft)	0.515	0.351
Area (square feet)	18.4	9.7
Wetted Perimeter (ft)	61.5	45.1
Hydraulic Radius (ft)	0.30	0.21
Slope	0.010	0.010
Vegetative Lining Retardance	C	C
Manning's n	0.053	0.055
Velocity at Flow Depth (ft/s)	1.26	0.97
Flow at Flow Depth (cfs)	23.2	9.4
Required Capacity (cfs)	23.2	9.4
Minimum Required Freeboard (ft)	0.30	0.30
Total Depth Required (ft)	0.82	0.65
Actual Depth (ft)	2.00	2.00
Allowable Velocity (ft/s)	5.00	3.00
Actual Velocity (ft/s)	1.26	0.97
Shear Stress at Flow Depth (lb /sf)	0.32	0.22
Max. Allowable Shear Stress (lb/sf)	1.60	N/A
Froude Number	0.41	0.37

The design of the channel shows that the capacity and channel lining is adequate to pass the 25-year, 24-hour storm peak flow.

SUBJECT GLEN LYN AUXILIARY FLY ASH POND CLOSURE

PROPOSED SWALE

BY KMB2 DATE 1/9/2013 PROJ. NO. C121043.00

CHKD. BY CRM DATE 1/28/13 SHEET NO. 7 of 7

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Tensar | NORTH AMERICAN GREEN

Tensar International Corporation
5401 St. Wendel-Cynthiana Road
Poseyville, Indiana 47633
Tel. 800.772.2040
Fax 812.867.0247
www.nagreen.com

Material and Performance Specification
S75BN Erosion Control Blanket

Description
The short-term single net erosion control blanket shall be a machine-produced mat of 100% agricultural straw with a functional longevity of up to 12 months. (NOTE: functional longevity may vary depending upon climatic conditions, soil, geographical location, and elevation). The blanket shall be of consistent thickness with the straw evenly distributed over the entire area of the mat. The blanket shall be covered on the top side with a 100% biodegradable woven natural organic fiber net. The netting shall consist of machine directional strands formed from two intertwined yarns with across directional strands interwoven through the twisted machine strands (commonly referred to as a Leno weave) to form approximate 0.50 x 1.0 (1.27 x 2.54 cm) mesh. The blanket shall be sewn together on 1.50 inch (3.81 cm) centers with degradable thread. The blanket shall be manufactured with a colored thread stitched along both outer edges (approximately 2-5 inches [5-12.5 cm] from the edge) as an overlap guide for adjacent mats. The S75BN shall meet Type 2.C specification requirements established by the Erosion Control Technology Council (ECTC) and Federal Highway Administration's (FHWA) *FP-03 Section 713.17*

Index Property	Test Method	Typical
Thickness	ASTM D6525	0.24 in (6.1 mm)
Resiliency	ECTC Guidelines	81.4%
Water Absorbency	ASTM D1117	257%
Mass/Unit Area	ASTM 6475	9.99 oz/yd^2 (339.7 g/m^2)
Swell	ECTC Guidelines	15.7%
Smolder Resistance	ECTC Guidelines	Yes
Stiffness	ASTM D1388	6.92 oz-in
Light Penetration	ECTC Guidelines	9.1%
Tensile Strength –MD	ASTM D6818	187.2 lbs/ft (2.78 kN/m)
Elongation – MD	ASTM D6818	6.7%
Tensile Strength – TD	ASTM D6818	193.2 lbs/ft (2.86 kN/m)
Elongation – TD	ASTM D6818	8.5%

Material Content		
Matrix	100% Straw Fiber	0.5 lbs/yd^2 (0.27 kg/m^2)
Netting	Top side only, Leno woven 100% biodegradable natural organic fiber	9.3 lb/1000 ft^2 (4.5 kg/100 m^2) approx. weight
Thread	biodegradable	

Maximum Permissible Shear Stress	
Unvegetated Shear Stress	1.60 lbs/ft^2 (76 Pa)
Unvegetated Velocity	5.00 ft/s (1.52 m/s)

Standard Roll Sizes		
Width	6.67 ft (2.03 m)	8.0 ft (2.44 m)
Length	108 ft (32.92 m)	112 ft (34.14 m)
Weight ± 10%	46.4 lbs (21.05 kg)	58 lbs (26.31 kg)
Area	80 yd^2 (66.9 m^2)	100 yd^2 (83.61 m^2)

Slope Design Data: C Factors			
	Slope Gradients (S)		
Slope Length (L)	≤ 3:1	3:1 – 2:1	≥ 2:1
≤ 20 ft (6 m)	0.029	NA	NA
20-50 ft	0.11	NA	NA
≥ 50 ft (15.2 m)	0.19	NA	NA

Bench Scale Testing (NTPEP)		
Test Method	Parameters	Results
ECTC 2 Rainfall	50 mm (2 in)/hr-30 min 100mm (4 in)/hr-30 min 150 mm (6 in)/hr-30 min	SLR** = 6.63 SLR** = 7.25 SLR** = 7.92
ECTC 3 Shear Res.	Shear at 0.50 inch soil loss	2.07 lbs/ft^2
ECTC 4 Germination	Top Soil, Fescue, 21 day incubation	464% improvement of biomass

* Bench Scale tests should not be used for design purposes
** Soil Loss Ratio = Soil Loss Bare Soil/Soil Loss with RECP

Roughness Coefficients- Unveg.	
Flow Depth	Manning's n
≤ 0.50 ft (0.15 m)	0.055
0.50 – 2.0 ft	0.055 – 0.021
≥ 2.0 ft (0.60 m)	0.021

Proud Participant of:

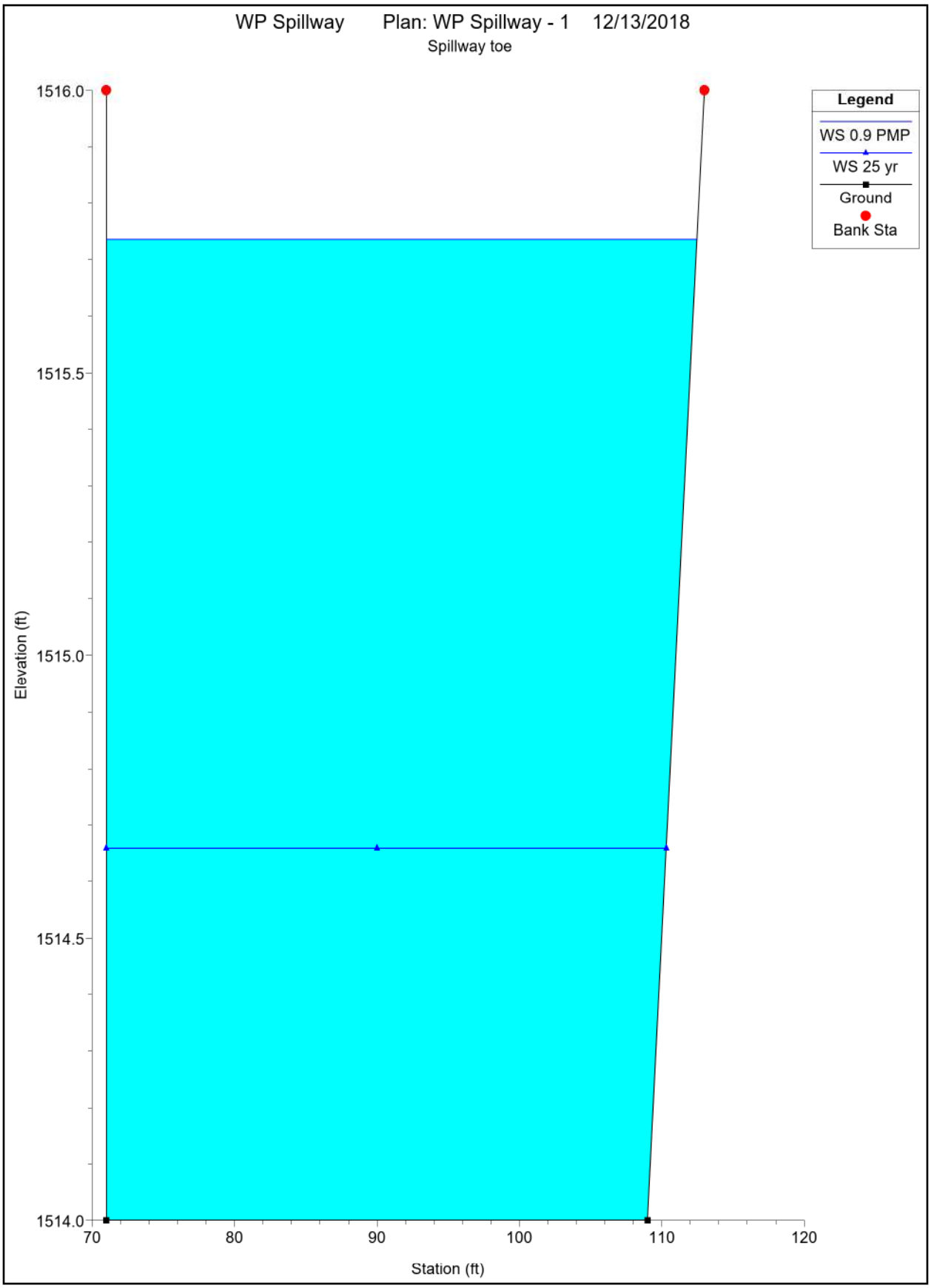
Tensar International Corporation warrants that at the time of delivery the product furnished hereunder shall conform to the specification stated herein. Any other warranty including merchantability and fitness for a particular purpose, are hereby executed. If the product does not meet specifications on this page and Tensar is notified prior to installation, Tensar will replace the product at no cost to the customer. **This product specification supersedes all prior specifications for the product described above is and is not applicable to any products shipped prior to January 1, 2011.**

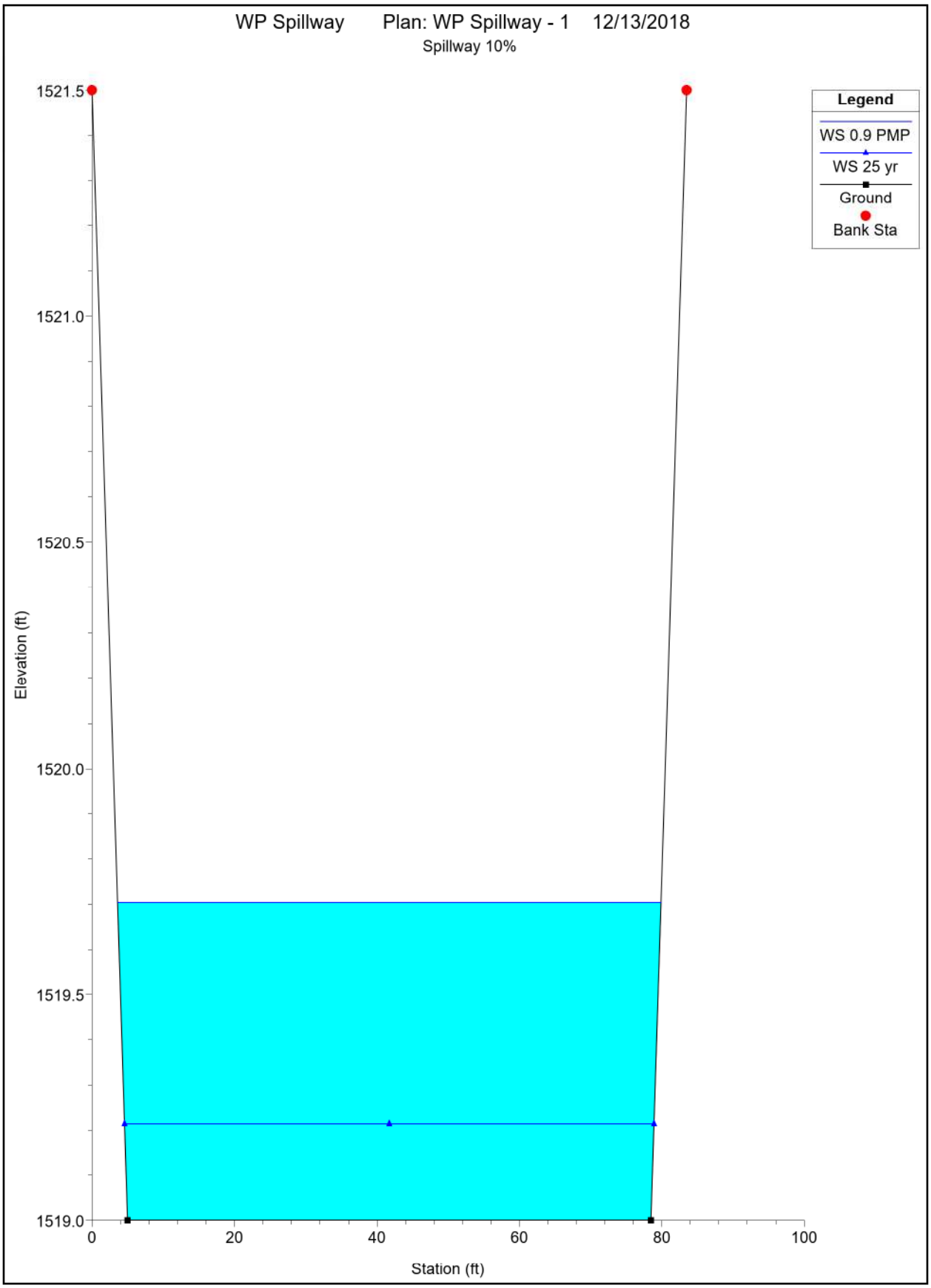
HEC-RAS MODELING

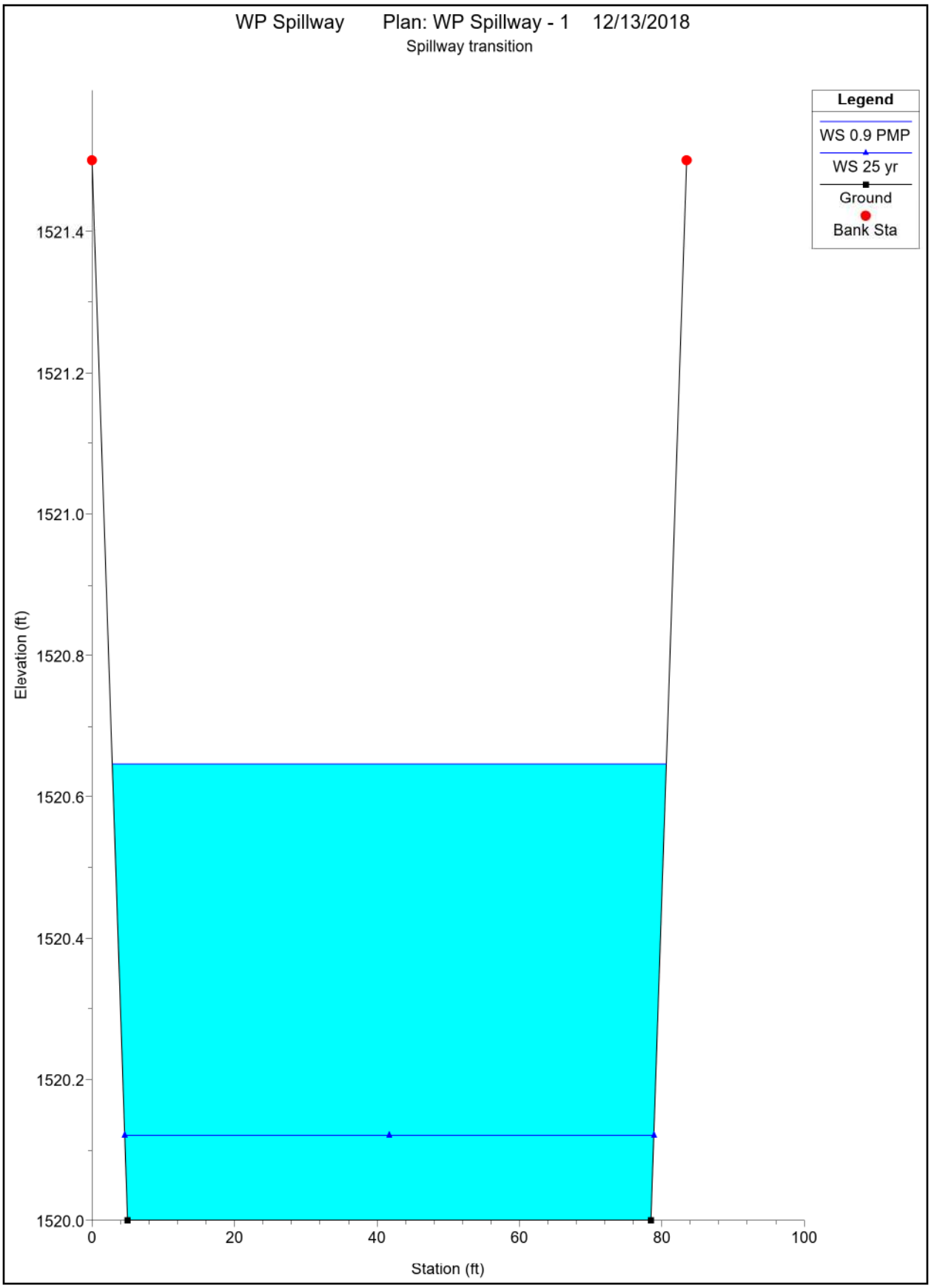
The computer program HEC-RAS (RAS) is used as a check to determine if the proposed temporary spillway configuration can convey the 0.9 PMP storm event as well as the 25-year storm without overtopping. The RAS inputs are presented as follows:

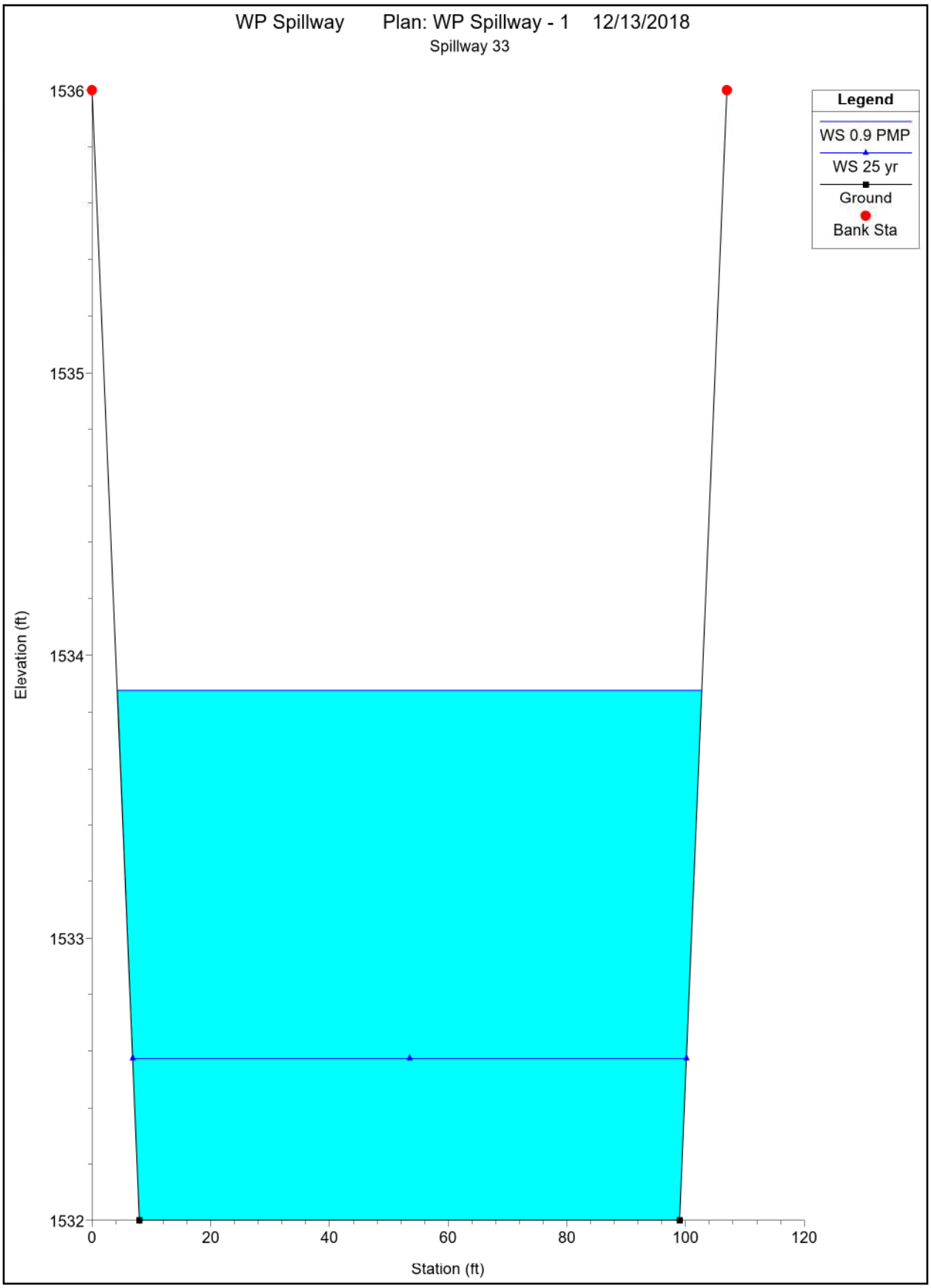
Cross sections are obtained from the proposed Site Plan at the spillway toe, in the lower 10% slope channel section, at the slope transition within the channel, and in the upper 33% slope channel section. Steady flows of 227 cfs and 1,360 cfs are used to model the 25-year storm and 0.9 PMP storm event, respectively.

The RAS outputs are presented on the following cross sections, output summary table, and profile:


WP Spillway Plan: WP Spillway - 1 12/13/2018
Spillway toe
Legend
WS 0.9 PMP
WS 25 yr
Ground
Bank Sta
1516.0
1515.5
1515.0
1514.5
1514.0
Elevation (ft)
70
80
90
100
110
120
Station (ft)


WP Spillway Plan: WP Spillway - 1 12/13/2018
Spillway 10%
Legend
WS 0.9 PMP
WS 25 yr
Ground
Bank Sta
1521.5
1521.0
1520.5
1520.0
1519.5
1519.0
Elevation (ft)
0
20
40
60
80
100
Station (ft)

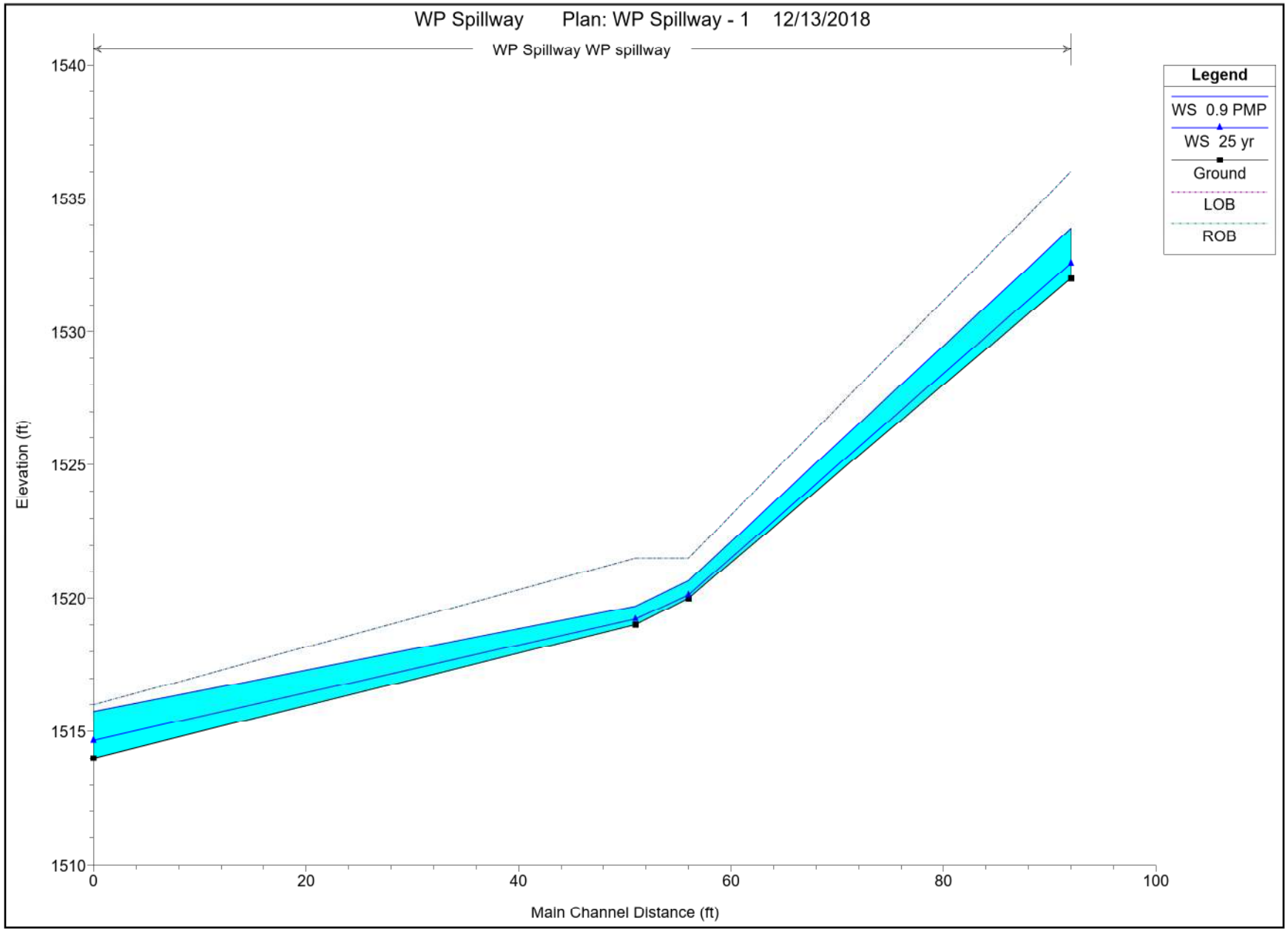

WP Spillway Plan: WP Spillway - 1 12/13/2018
Spillway transition
Legend
WS 0.9 PMP
WS 25 yr
Ground
Bank Sta
Elevation (ft)
1521.4
1521.2
1521.0
1520.8
1520.6
1520.4
1520.2
1520.0
0
20
40
60
80
100
Station (ft)


WP Spillway Plan: WP Spillway - 1 12/13/2018
Spillway 33
Legend
WS 0.9 PMP
WS 25 yr
Ground
Bank Sta
Elevation (ft)
1536
1535
1534
1533
1532
0
20
40
60
80
100
120
Station (ft)

HEC-RAS Plan: temp spillway 1 River: WP Spillway Reach: WP spillway

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
WP spillway	3	0.9 PMP	1360.00	1532.00	1533.87	1533.87	1534.79	0.009097	7.66	177.58	98.50	1.01
WP spillway	3	25 yr	227.00	1532.00	1532.57	1532.57	1532.86	0.013245	4.29	52.90	93.30	1.00
WP spillway	2	0.9 PMP	1360.00	1520.00	1520.65	1522.11	1532.66	0.484498	27.81	48.91	77.81	6.18
WP spillway	2	25 yr	227.00	1520.00	1520.12	1520.66	1530.18	3.677416	25.44	8.92	74.30	12.94
WP spillway	1	0.9 PMP	1360.00	1519.00	1519.70	1521.15	1530.06	0.369365	25.81	52.69	76.31	5.48
WP spillway	1	25 yr	227.00	1519.00	1519.21	1519.66	1522.42	0.548259	14.37	15.80	74.35	5.49
WP spillway	0	0.9 PMP	1360.00	1514.00	1515.74	1517.28	1521.77	0.070852	19.71	69.01	41.47	2.69
WP spillway	0	25 yr	227.00	1514.00	1514.66	1515.03	1515.90	0.049107	8.92	25.45	39.32	1.95

0.9 PMP and 25-yr Storm Profiles



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Based on the HEC-RAS outputs for the 0.9 PMP storm event, the 91 ft. wide temporary spillway described in the HMS section has the capacity to pass the 0.9 PMP design storm, and the spillway channel has the capacity to convey the 0.9 PMP design storm, such that the water is contained within the spillway channel.