FINAL REPORT

Dam Safety Assessment of CCR Impoundments

TVA SHAWNEE FOSSIL POWER PLANT

United States Environmental Protection Agency
Washington, DC

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Dam Safety Assessment of CCR Impoundments

TVA Shawnee Fossil Power Plant

Prepared for:
US Environmental Protection Agency
Washington, DC

ROBERT R. BOWERS, P.E. – VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

TIMOTHY W. KRAUS, P.E.. – VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

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1. INTRODUCTION

1.1. GENERAL

In response to the coal combustion residuals (CCR) impoundment failure at the TVA/Kingston coal-fired electric generating station in December of 2008, the U. S. Environmental Protection Agency (USEPA) has initiated a nationwide program of structural integrity and safety assessments of coal combustion residuals impoundments or "management units". A CCR management unit is defined as a surface impoundment or similar diked or bermed management unit or management units designated as landfills that receive liquid-borne material and are used for the storage or disposal of residuals or by-products from the combustion of coal, including, but not limited to, fly ash, bottom ash, boiler slag, or flue gas emission control residuals. Management units also include inactive impoundments that have not been formally closed in compliance with applicable federal or state closure/reclamation regulations.

The USEPA has authorized O'Brien & Gere to provide site specific impoundment assessments at selected facilities. This project is being conducted in accordance with the terms of BPA# EP10W000673, Order EP-B11S-00079, dated August 11, 2011.

1.2. PROJECT PURPOSE AND SCOPE

The purpose of this work is to provide Dam Safety Assessment of CCR management units, including the following:

- Identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures
- Note the extent of deterioration, status of maintenance, and/or need for immediate repair
- Evaluate conformity with current design and construction practices
- Determine the hazard potential classification for units not currently classified by the management unit owner or by state or federal agencies

O'Brien & Gere's scope of services for this project includes performing a site specific dam safety assessment of all CCR management units at the subject facility. Specifically, the scope includes the following tasks:

- Perform a review of pertinent records (prior inspections, engineering reports, drawings, etc.) made available at the time of the site visit (or shortly thereafter) to review previously documented conditions and safety issues and gain an understanding of the original design and modifications of the facility.
- Perform a site visit and visual inspection of each CCR management unit and complete the visual inspection checklist to document conditions observed.
- Perform an evaluation of the adequacy of the outlet works, structural stability, quality and adequacy of the management unit's inspection, maintenance, and operations procedures.
- Identify critical infrastructure within 5 miles down gradient of management units.
- Evaluate the risks and effects of potential overtopping and evaluate effects of flood loading on the management units.
- Immediate notification of conditions requiring emergency or urgent corrective action.
- Identify all environmental permits issued for the management units
- Identify all leaks, spills, or releases of any kind from the management units within the last 5 years.
- Prepare a report summarizing the findings of the assessment, conclusions regarding the safety and structural integrity, recommendations for maintenance and corrective action, and other action items as appropriate.

This report addresses the above issues for the Ash Pond #2 at Tennessee Valley Authority (TVA) Shawnee Fossil power plant in Paducah, Kentucky. The above impoundment is owned and operated by TVA. In the course of this assessment, O'Brien & Gere obtained information from representatives of TVA and their consultants, Stantec Consulting Services, Inc.

2. PROJECT/FACILITY DESCRIPTION

The Shawnee Fossil Plant is located along the south side of the Ohio River at 7900 Metropolis Lake Road, West Paducah, McCraken County, Kentucky. Centralized coordinates for the Shawnee Fossil Plant are: Latitude 37.15559 deg, Longitude -88.785579 deg. A Site Location Map is included as Figure 1. The coal-fired power plant was constructed from 1951 through 1957 and includes 10 generating units producing a total of about 1750 megawatts of electricity. The plant consumes about 9,600 tons of coal per day. Coal combustion waste that is produced during power generation is managed on-site with one CCR impoundment and a "dry" landfill.

The facility utilizes one impoundment known as *Ash Pond No. 2* for liquid-borne CCR management. A landfill known as the *Consolidated Waste Dry Stack* is utilized for storage of dry fly ash collected from electro-static precipitors. Since the Consolidated Waste Dry Stack does not actively impound liquid-borne CCR, it was not included in this assessment. This safety assessment report summarizes the September 2011 inspection of the Ash Pond No. 2 management unit at the Shawnee Fossil Plant.

2.1. MANAGEMENT UNIT IDENTIFICATION

The location of the CCR impoundment inspected during this safety assessment is identified on Figure 2 – Photo Location Plan.

2.1.1. Ash Pond No. 2

The Ash Pond No. 2 was initially constructed in 1971 with 15-foot high compacted clay dikes. The dikes were reportedly raised 10 feet using the upstream method of dike raising with compacted clay fill, founded partially on bottom ash and partially on the original dike crest. Coal combustion residuals stored in the pond consists of bottom ash that is wet sluiced into the pond via influent lines located at the southeast corner of the impoundment. The bottom ash is periodically dredged from the influent channel using long-stick excavators, which place the material in stockpiles within the eastern portion of the impoundment. Water is routed through a wide channel along the northern dike. The channel opens up into a larger pond area, which is divided by an internal dike. The internal dike separates the main ash pond from the stilling basin. Water that is routed through the pond is discharged from the stilling basin via a multi-riser structure which outfalls into an outlet channel and ultimately back to the Ohio River. The discharge is permitted under Kentucky Pollutant Discharge Elimination System (KDPES) Permit No. KY0004219.

2.2. HAZARD POTENTIAL CLASSIFICATION

The Commonwealth of Kentucky classifies dams or embankments in accordance with the Kentucky Revised Statutes (KRS) and Kentucky Administrative Regulations (KAR). The regulations are administrated by the Kentucky Department for Environmental Protection (KDEP), Division of Water, Dam Safety and Floodplain Compliance Section of the Water Infrastructure Branch. The KRS defines a dam as any structure that is 25 feet in height, measured from the outboard toe to the crest of the dam, or has a minimum impounding capacity of 50 acre-feet or more at the top of the structure (KRS Chapter 151.100).

The KDEP Dam Safety Section does not regulate the Ash Pond No. 2; therefore, no state hazard classification has been assigned to this impoundment. In the absence of a State Hazard Potential Classification, the FEMA guidelines, *Hazard Potential Classification System for Dams* (2004) have been applied in this assessment to recommend a hazard potential classification for the impoundment.

A potential breach of the impounding dikes of Ash Pond No. 2 would likely result in release of water and CCR directly into the Ohio River or into Little Bayou Creek to the south before flowing into the Ohio River. The nearest downstream population center on the Ohio River is Joppa, IL located on the opposite bank of the river at about 3.8 miles downstream. No critical infrastructure outside of TVA property is known to be present within the likely inundation area. The flood wave generated by release of the impoundment into the Ohio River is not likely to have an effect on the river water level given its size.

TVA and their consultants, Stantec, Inc., have assigned the Ash Pond No. 2 a Significant hazard classification, primarily due to the proximity of the Ohio River and the environmental impacts to the river (Waters of the U.S.) posed by a potential release of CCR.

The definitions for the four hazard potentials (Less than Low, Low, Significant and High) to be used in this assessment are included in the USEPA CCR checklist found in Appendix A. Based on the checklist definitions and as a result of this assessment, the hazard potential rating recommended for the Ash Pond No. 2 is **SIGNIFICANT.** A failure of embankments impounding the Ash Pond No. 2 could cause significant environmental damage given that CCR would likely be released into the Ohio River; thereby damaging the surrounding area, wildlife and habitat, and threatening the drinking water supplies of the downstream communities. Loss of human life or damage to critical infrastructure or lifeline facilities in the event of a dike breach failure is unlikely.

2.3. IMPOUNDING STRUCTURE DETAILS

The following sections summarize the structural components and basic operations of the Ash Pond No. 2. The location of the impoundment on the plant grounds along with labels of its major features are shown on Figure 2. It should be noted that the aerial photo shown in Figure 2 was taken in 2011 and may not depict all current features. Additionally, photos taken during the visual inspection are incorporated in a Photographic Log provided as Appendix B.

2.3.1. Embankment Configuration

The Ash Pond No. 2 is a diked earthen embankment structure that impounds an area of approximately 142 acres. The Ash Pond No. 2 is diked on the majority of its perimeter except on the south and southeast sides of the pond which abut either the consolidated waste dry stack or the coal yard, both of which are elevated above the crest of the impoundment dikes. The crest is at approximately elevation (EL) 349 feet. The northern dike, which parallels the Ohio River, is the highest at approximately 25 feet above the outboard toe of slope. The inboard dike slopes are reported to range from 2H:1V to 3.5H:1V. The outboard slopes range from 2.5H:1V to 3H:1V from the crest to about elevation 335 feet; 4.5H:1V to 6H:1V from about elevation 335 feet to the dike toe.

Ash Pond No. 2 incorporates a stilling pond for decanting clarified water to the outlet structure. The stilling pond is separated from the main disposal area by a divider dike. A narrow channel through the divider dike allows water to pass into the stilling pond area.

2.3.2. Type of Materials Impounded

Currently, influent into the Ash Pond No. 2 includes water with solids consisting of primarily bottom ash. Approximately 40,000 tons of bottom ash are wet-sluiced to the pond each year. The bottom ash is dredged using excavators and stockpiled to dewater and finally removed to the Consolidated Waste Dry Stack for final disposal. Prior to the plant's switch to dry fly ash handling in the mid-1980's, both bottom ash and fly ash were discharged to Ash Pond No. 2.

2.3.3. Outlet Works

The Ash Pond No. 2 is a diked impoundment that has been designed to receive sluice flows and direct precipitation. The ash pond outlet structure, located in the stilling pond within the southwestern portion of the impoundment, consists of five, 48-inch RCP riser weirs with steel skimmers. The risers transition into horizontal outlet pipes that penetrate the western dike and terminate at a concrete headwall at the dike toe. (See Appendix B - Photo 15) A grouted rip rap apron is present downstream of the outlet, which provides protection from scour. The pond discharge outfalls into the effluent drainage ditch, an excavated channel that runs parallel to the toe of the northern dike. The effluent ditch conveys the pond discharge water to the main plant discharge channel to the east of the pond, and ultimately into the Ohio River. The pond discharge is permitted under Kentucky Pollutant Discharge Elimination System (KPDES) No. KY0004219.

At the time of the site inspection, a construction project was underway to replace the above outlet structure with a new concrete weir with six chambers. Stop logs are used on the upstream side of each chamber to control pool level. The new weir/outlet structure will be constructed with six, 30-inch I.D, HDPE outlet pipes. The outlet pipes will be routed to follow the contour of the existing dike cross-section with top of pipe at a depth of approximately 2 feet below grade. The outlet pipes will terminate at a concrete headwall, adjacent to the south side of the old headwall. The existing RCP riser and horizontal outlet pipes will be abandoned in place by filling with grout.

3. RECORDS REVIEW

A review of the available records related to design, construction, operation and inspection of the Ash Pond was performed as part of this assessment. The documents provided by TVA are listed below:

Table 3.1 *Summary of Ash Pond No. 2 Documents Reviewed*

Document	Dates	By	Description
TVA Coal Combustion Products (CCP) Management Program	12/07/2009	URS Corp.	Master programmatic document for companywide management of CCP facilities
Design Report and Calculations—Spillway Replacement Project—Ash Pond No. 2	05/04/2010	Stantec	Design report detailing the results of hydrologic and hydraulics analysis and structural design of the new spillway
Seepage Action Plan	06/25/2010	Stantec	Document detailing seepage inspection, monitoring, and corrective action procedures
Report of Geotechnical Exploration and Slope Stability Analysis*	7/14/2010	Stantec	Geotechnical assessment of dikes
2010 Annual Inspection of Facilities and Ponds*	8/25/2010	Stantec	Dam Safety Inspection
Emergency Response Plan	11/15/2010	TVA	Emergency action procedural and notification document
Construction drawings for spillway replacement	12/09/2010	Stantec	Engineering plans for construction of new spillway/outlet structure
CCP 2011 5-yr Annual Inspection Plan	03/10/2011	TVA	Schedule of inspections for all TVA CCP facilities
Operations Support Document	7/2011	TVA	Detailed operations and maintenance manual for the CCP handling facilities
Dam Safety Hazard Classification Review—Shawnee Ash Pond No. 2	10/2011	Stantec	Hazard classification assessment for the embankment dam forming the impoundment
Instrumentation Summary Reports (multiple)	8/2011, 9/2011	Stantec	Summary of piezometer and inclinometer data readings
Letter Report—Results of Seismic Stability Analysis—Ash Pond No. 2	10/05/2011	Stantec	Pseudostatic slope stability analysis based on 500-year return period earthquake
Construction Certification Report—Ash Pond No. 2 Spillway Replacement Project	01/06/2012	Stantec	Summary of construction documentation and QA/QC testing reports for spillway replacement project
Seismic Stability Analysis	10/03/2012	Stantec	Liquefaction Potential Assessment and Post-Earthquake Static Stability Analysis

* Includes a historical records section review within the document

3.1. ENGINEERING DOCUMENTS

Review of the above documents revealed information on the design details, construction chronology, and modifications of the Ash Pond No. 2, which are summarized below.

- The ash pond was originally constructed in 1971 and consisted of perimeter dikes constructed to EL 340 feet.
- In 1979, the dikes were raised 10 feet using upstream construction by which a portion of the new dike was founded on sluiced ash and a portion founded on and keyed into the original dike.
- Both the original and raised dike sections were constructed of compacted clay
- The current maximum height is about 25 feet from crest to toe, with the highest section at the northern dike that parallels the Ohio River
- The dike slopes range from about 2.5H:1V to 3H:1V
- Historical geotechnical issues include minor non-flowing, but widespread wet areas along the toe of the northeast dike section
- Construction of a new reverse graded filter has been recently completed to mitigate the minor seepage along the toe of the northeast dike
- No breaches of the perimeter dikes or releases of impounded CCR have occurred
- Construction of the new spillway replacement and abandonment of the old spillway outlet pipe penetrations is complete
- Recent geotechnical explorations and slope stability evaluations indicate that all dike sections analyzed have a factor of safety greater than or equal to 1.5 for static, steady-state seepage conditions
- Pseudostatic stability analyses indicate the dikes to be stable (FS=1) for a 340-year return period earthquake, but the factor of safety is less than one for greater magnitude earthquakes.
- Liquefaction potential assessment indicates that the sluiced ash and underlying sand below the critical dike section are anticipated to undergo liquefaction during the 2,500 year earthquake.
- A post-earthquake static stability analysis was run using the residual strengths of the liquefied material, which indicated that the slope will remain stable (FS >/= 1) and will not undergo significant deformations.

3.1.1. Hydrologic/Hydraulic Safety

O'Brien & Gere reviewed the design report for the new spillway for Ash Pond No. 2 prepared by Stantec, dated April 30, 2010. The report indicates that the contributing drainage area for Ash Pond No. 2 is approximately 410 acres and includes the Ash Pond No. 2, the coal yard, and the consolidated dry stack. The new spillway was designed to safely pass the inflow generated by the 6-hr Probable Maximum Precipitation (PMP) event, which is approximately 35.4 inches. The inflow hydrograph generated by the design storm indicates a peak inflow of approximately 4,800 cfs. The new spillway was designed to pass a peak discharge estimated at approximately 283 cubic feet per second (cfs).

3.1.2. Stability Analyses

O'Brien & Gere reviewed the Report of Geotechnical Exploration and Slope Stability Analysis for the Shawnee Ash Pond facility, prepared by Stantec and dated July 14, 2010. This report documents stability analyses for nine cross-sections representing the existing conditions of the impoundment dikes. The loading conditions analyzed include long term steady-state seepage under normal pool for the outboard slope and rapid drawdown analysis for the upstream slope.

Soil shear strength parameters used in the slope stability analyses were based on a combination of laboratory shear strength testing and correlation to Standard Penetration Test "N-values". Both drained and undrained strength parameters were evaluated for the dike and foundation materials. The selection of shear strength parameters used in the analyses appear to be appropriate and consistent with standard engineering practice.

The position of the phreatic line through the embankment as modeled in the slope stability analyses was based on one, or a combination of the following data:

1. Finite element seepage analysis
2. Piezometer instrumentation data

The position of the phreatic line as modeled in the stability analyses appeared to be appropriate based on a review of the above data presented in the available technical documentation.

O'Brien & Gere reviewed the letter report prepared by Stantec and dated October 3, 2012, which presents the results of a liquefaction potential assessment and additional slope stability analysis. Based on the results of the liquefaction potential assessment, a post-earthquake static slope stability analysis was run using reduced residual shear strengths for the materials that were anticipated to undergo liquefaction during the 2,500 year earthquake. This approach to the seismic stability analysis is consistent with standard engineering practice. The results of that analysis indicate that the slope will remain stable (FS >/= 1) under the assumed conditions and will not undergo significant deformations.

The results of the slope stability analyses indicate factors of safety for the long-term steady state seepage loading condition to be greater than 1.5, which meets accepted minimums for embankment dams. For the rapid drawdown case, the factors of safety were greater than 1.2, which also meets accepted minimums for this load case. The following table provides a summary of the minimum computed factors of safety for slope stability. The entire geotechnical exploration report, prepared by Stantec, that fully documents the stability analyses for Ash Pond No. 2 is included in Appendix C. In addition, the liquefaction potential assessment and post-earthquake static stability analysis discussed above are included in Appendix C.

Summary of Minimum Computed Factors of Safety for Slope Stability – Ash Pond 2

Cross-Section	Rapid Drawdown Minimum FS	Long-Term Minimum FS	Seismic Mininum FS
A-A'	1.7	2.1	
C-C'	1.9	2.3	
E-E'	1.6	2.1	
F-F'	1.7	2.3	
H-H'	1.9	2.4	
N-N'	1.6	1.9	1.0
P-P'	1.7	2.0	
R-R'	1.8	2.2	
U-U'	1.7	2.1	

3.1.3. Modifications from Original Construction

Ash Pond No. 2 was put into service in 1971. The original perimeter dikes were approximately 15 feet high with a crest at EL 340 feet. In 1979, the dikes were raised approximately 10 feet with lean clay fill to their current elevation of 350 feet. The raised dikes were constructed using the upstream offset method where the expanded dike is constructed inboard of the original crest on a base of bottom ash placed above sluiced ash. Originally and up to about the mid-1980's, the ash pond received both sluiced bottom ash and fly ash, but later only received sluiced bottom ash.

3.1.4. Instrumentation

In order to evaluate and monitor phreatic conditions within the dikes and their foundation material, Stantec installed up to 30 open standpipe piezometers in 2009 to 2010 along the perimeter dikes of Ash Pond No. 2. In summary, the piezometer readings indicated that the water level in the deeper piezometers, set within the native soils making up the foundation of the dike, generally fluctuated with the rise and fall of the Ohio River. The piezometers set within the dike fill material indicated relatively stable water levels with only slight fluctuation. This data was used to calibrate the seepage analysis for the dikes. In turn, the seepage analysis data was input directly into the slope stability model to simulate the pore water pressure and its effect on slope stability.

Two slope inclinometers were installed by Stantec in 2009 to monitor potential slope movements within the perimeter dikes of Ash Pond No. 2. After 5 months of monitoring, no slope movement was detected in either of the two inclinometers.

3.2. PREVIOUS INSPECTIONS

A comprehensive inspection of Ash Pond No. 2 was conducted by Stantec in July of 2010. The report of this inspection, dated August 25, 2010 was provided to O'Brien & Gere for review. A summary of notable observations and deficiencies cited in the 2010 inspection report is provided below:

- Non-flowing wet area along toe of northeast dike indicating minor seepage
- Slight separation of one discharge pipe from concrete headwall

The seepage noted above was mitigated by TVA by constructing a graded filter over the surface of the wet toe, which will prevent migration of soils with the seepage and increase the factor of safety against piping. The pipe separation issue was corrected by constructing a new spillway and abandoning the old one. The report indicates all other features of the dikes to be in satisfactory condition.

3.3. OPERATOR INTERVIEWS

Numerous plant and corporate personnel took part in the assessment proceedings. The following is a list of participants for the assessment of the Ash Pond No. 2:

Name	Affiliation
Greg Jones	TVA
Jacob Horton	TVA
Matthew Phillins	TVA
Nathan Bader, PE	Stantec
Gary Melton	Worley Parsons
Steve Shamblin	TVA
Darlene Keller	TVA
Dreher Whetstone, PE	O'Brien & Gere
Timothy W. Kraus, PE	O'Brien & Gere
Mortaza Rabiee	Kentucky DEP Div. of Water
Glen Alexander	Kentucky DEP Div. of Water
Michael Scott Turnbow	TVA—CCP Engineering
David W. Robinson	TVA EPC
Warren Radburn	TVA—CCP Engineering

Facility personnel provided a good working knowledge of the Ash Pond No. 2, provided general plant operation background and provided requested historical documentation. In addition to the facility personnel, the plant's engineering consultant from Stantec was present to provide additional information from previous impoundment inspections, geotechnical investigations, and current construction projects. These personnel also accompanied O'Brien & Gere staff throughout the visual inspections to answer questions and to provide additional information as needed in the field.

4. VISUAL INSPECTION

The following sections summarize the inspection of the Ash Pond No. 2, which occurred on September 22, 2011. At the time of the inspection, O'Brien & Gere completed an EPA inspection checklist for the ash pond, which was submitted electronically to EPA on October 3, 2011. A copy of the completed inspection checklist is included as Appendix A.

4.1. GENERAL

The weather on the dates of the inspection was overcast and approximately 70 degrees. The visual inspection consisted of a thorough site walk along the perimeter of the ash pond. O'Brien & Gere team members made observations along the toe, outboard slope, and crest of the embankments, and along exposed portions of the inboard slopes. We also observed the inlet/outlet structure and current operation.

Photos of relevant features and conditions observed during the inspection were taken by O'Brien & Gere and are provided in Appendix B for the Ash Pond No. 2. A Photo Location Plan of the Ash Pond No. 2 is presented as Figure 2, which provide photograph locations and directions and identify other features of the impoundment.

4.2. SUMMARY OF FINDINGS

The following observations were made during the inspection:

- Sluiced CCR discharge enters the pond near the southeast corner and is routed to the northern and western portions of the pond through a channel that has been excavated into the accumulated bottom ash deposits (Appendix B –Photo 1).
- The CCR has accumulated above the normal pool level over an estimated 75 percent of the pond area. Open water in the pond is isolated to primarily the western half of the pond.
- Approximately 4 to 5 feet of freeboard was present at the time of inspection.
- The outboard slope and crest were covered with well maintained grass. The crest has been rutted by the mowing tractor in a few isolated locations.
- A seepage mitigation project was under construction at the time of the site visit. Even though no flowing seepage has been observed in this area, TVA elected to proceed with the project, which consisted of a reverse graded filter placed along the toe of the northeast slope as an added precaution against piping. (Photo 4)
- A few erosion repair areas were noted along the northern outboard slope. These areas reportedly exhibited sparse vegetation or minor gully erosion.
- The outboard slopes are covered with well-maintained grass, with no woody vegetation present.
- No sloughs, slides, bulges, or other indicators of slope instability were observed during the visual inspection.
- The crest of the dikes is utilized as an access road around the impoundment. The crest was covered with crushed stone and was in good condition with no significant depressions, erosion, or mis-alignment. (Photo 7)
- The inboard slopes above the pool level were observed to be adequately vegetated or covered with riprap where susceptible to erosion from wave action in the pond.
- At the time of inspection, the new spillway was under construction and approximately 75 percent complete (Photo 12)
- Flow in the old spillway had been shut off and a temporary siphon system was in place to manage pond discharge until the new spillway construction was complete.

In general, the Ash Pond No. 2 appeared to be in overall good condition, with no major deficiencies noted. Based on our conversations with plant personnel, no releases have occurred from the Ash Pond No. 2 impoundment. No patchwork on the embankments appears to have been performed.

5. CONCLUSIONS

Based on the ratings defined in the USEPA Task Order Performance Work Statement (Satisfactory, Fair, Poor and Unsatisfactory), the information reviewed and the visual inspection, the overall condition of the Ash Pond No. 2 is considered to be **SATISFACTORY.** Acceptable performance is expected under all applicable loading conditions and no existing or potential safety deficiencies were noted during the course of this assessment.

The slope stability analyses reviewed during this assessment indicate satisfactory factors of safety for all applicable loading conditions. Liquefaction potential analyses indicate that the sluiced ash supporting a portion of the upper dike and the native sand forming the dike foundation will undergo liquefaction during the 2,500 year earthquake; however, post-earthquake stability analyses using reduced residual shear strengths for the liquefied materials indicate that the dike is not anticipated to undergo significant deformation as a result of the liquefaction and the factor of safety meets applicable criteria. The analyses appear to have been performed in accordance with standard engineering practice, and O'Brien & Gere concurs with the results of the analyses.

Based on the new spillway design report prepared by Stantec, the hydrologic/hydraulic capacity of the pond is capable of safely passing the 6-hr PMP storm event, which is considered adequate.

The engineering technical documentation is adequate. TVA has implemented a programmatic regular inspections and maintenance procedure which allow for tracking of identified deficiencies and maintenance items, followed by corrective action in a timely manner.

Our interviews with TVA personnel responsible for the operation of the impoundment indicate that a regular operations plan is in use at the Ash Pond No. 2 unit. The regular operating procedures of the facility do not appear to be impacting the structural integrity of the impounding embankments.

The plant engineering staff maintains all design documents and inspection reports in a well organized manner. The plant operations personnel have received training in dam safety inspections and implement daily, weekly, monthly, and annual internal inspections, supported by periodic inspections by an outside consultant. Based on these findings, the operations and maintenance procedures practiced at the Ash Pond No. 2 appear adequate.

6. RECOMMENDATIONS

No urgent action is needed for continued safe and reliable operation of Ash Pond No. 2.

6.1. MONITORING AND FUTURE INSPECTION

TVA's programmatic operations and maintenance document is a well organized plan that clearly specifies the roles and responsibilities of CCR management unit operations personnel and provides detailed schedules and procedures outlining internal inspection frequencies and documentation practices. O'Brien & Gere recommends continued internal inspections by personnel trained in dam safety and periodic inspections by independent licensed dam safety engineers.

6.2. CERTIFICATION STATEMENT

I acknowledge that the Ash Pond No. 2 CCR management unit referenced herein was personally inspected by me on September 22, 2011. The unit's structural soundness condition is classified as **SATISFACTORY.**

STATE OF KENTUCKY
TIMOTHY W. KRAUS
16,209
LICENSED
PROFESSIONAL ENGINEER

Signature: ______________________ Date: 4 FEBRUARY 2013

Timothy W. Kraus, PE
KY PE # 16209

FIGURES

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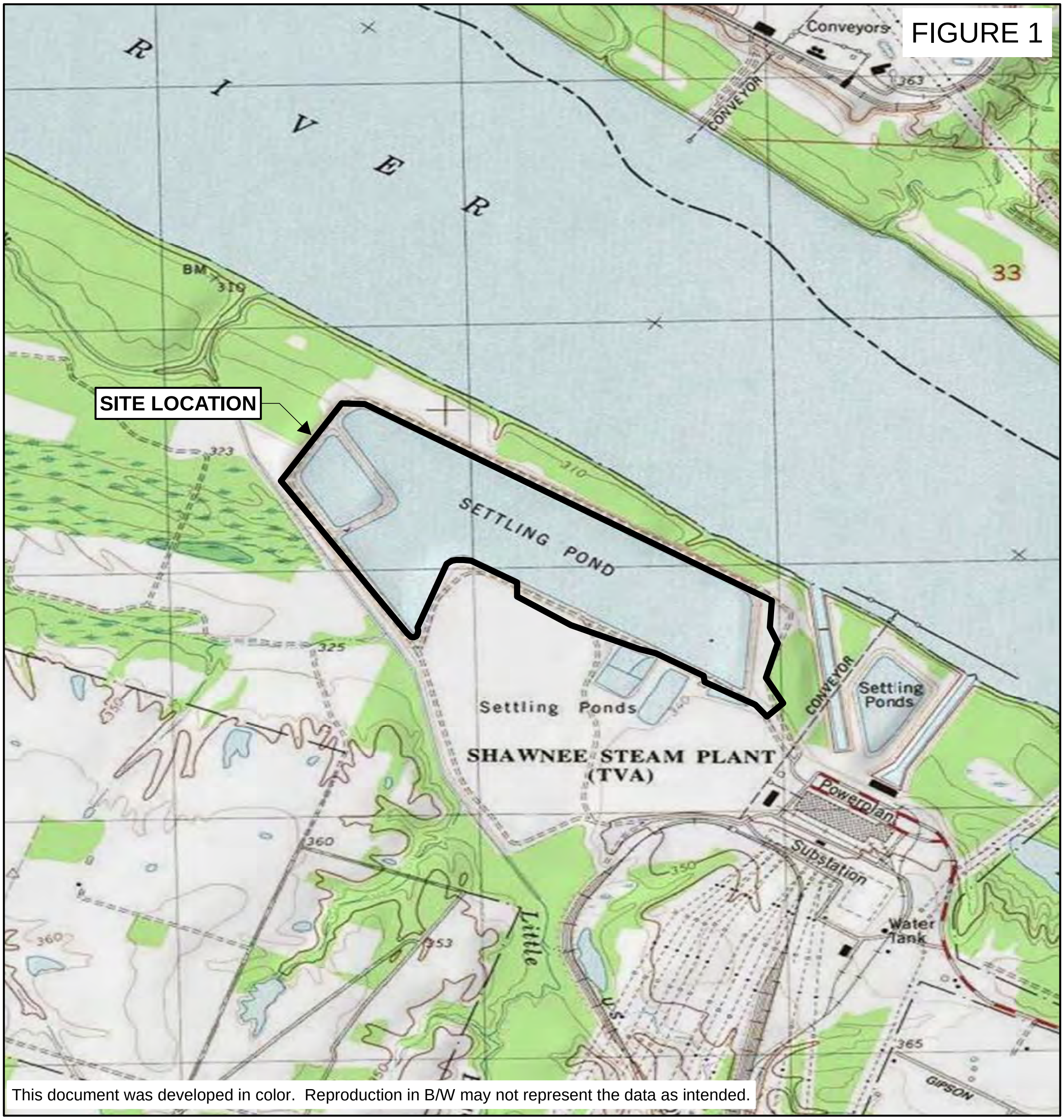
PLOTDATE: 1/31/2012 DRK



ADAPTED FROM: JOPPA, KENTUCKY USGS QUADRANGLE

TENNESSEE VALLEY AUTHORITY
SHAWNEE FOSSIL PLANT
WEST PADUCAH, KENTUCKY

MAP LOCATION

N

SITE LOCATION

0 1,000 2,000 4,000 6,000 8,000

Feet

FEBRUARY 2013
13498/46122

1:24,000

O'BRIEN & GERE

FIGURE 2

This document was developed in color. Reproduction in B/W may not represent the data as intended.

N

LEGEND

- ASH POND NO. 2
- INACTIVE DREDGE CELL
- 1 PHOTO LOCATION/ DIRECTION

TENNESSEE VALLEY AUTHORITY
SHAWNEE FOSSIL PLANT
WEST PADUCAH, KENTUCKY

PHOTO LOCATION PLAN

0 300 600 1,200
Feet

FEBRUARY 2013
13498/46122

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PLOTDATE: 1/31/2013 DRK

APPENDIX A

Visual Inspection Checklist

Coal Combustion Dam Inspection Checklist Form

US Environmental Protection Agency

Site Name:	TVA Shawnee	Date:	9/22/11
Unit Name:	Ash Pond #2	Operator's Name:	TVA
Unit I.D.:		Hazard Potential Classification:	High Significant ✓ Low
Inspector's Name:	Dreher Whetstone, Tim Kraus		

Check the appropriate box below. Provide comments when appropriate. If not applicable or not available, record "N/A". Any unusual conditions or construction practices that should be noted in the comments section. For large diked embankments, separate checklists may be used for different embankment areas. If separate forms are used, identify approximate area that the form applies to in comments.

	Yes	No
1. Frequency of Company's Dam Inspections?		
2. Pool elevation (operator records)?	344.5	
3. Decant inlet elevation (operator records)?	344.0	
4. Open channel spillway elevation (operator records)?	NA	
5. Lowest dam crest elevation (operator records)?	348.9	
6. If instrumentation is present, are readings recorded (operator records)?	✓	
7. Is the embankment currently under construction?	✓	
8. Foundation preparation (remove vegetation,stumps, topsoil in area where embankment fill will be placed)?	✓	
9. Trees growing on embankment? (If so, indicate largest diameter below)		✓
10. Cracks or scarps on crest?		✓
11. Is there significant settlement along the crest?		✓
12. Are decant trashracks clear and in place?	✓	
13. Depressions or sinkholes in tailings surface or whirlpool in the pool area?		✓
14. Clogged spillways, groin or diversion ditches?		✓
15. Are spillway or ditch linings deteriorated?		✓
16. Are outlets of decant or underdrains blocked?		✓
17. Cracks or scarps on slopes?		✓

	Yes	No
18. Sloughing or bulging on slopes?		✓
19. Major erosion or slope deterioration?		✓
20. Decant Pipes:		
Is water entering inlet, but not exiting outlet?		✓
Is water exiting outlet, but not entering inlet?		✓
Is water exiting outlet flowing clear?	✓	
21. Seepage (specify location, if seepage carries fines, and approximate seepage rate below):		
From underdrain? NA		
At isolated points on embankment slopes?		✓
At natural hillside in the embankment area?		✓
Over widespread areas?		✓
From downstream foundation area?		✓
"Boils" beneath stream or ponded water?		✓
Around the outside of the decant pipe?		✓
22. Surface movements in valley bottom or on hillside?		✓
23. Water against downstream toe?		✓
24. Were Photos taken during the dam inspection?	✓	

Major adverse changes in these items could cause instability and should be reported for further evaluation. Adverse conditions noted in these items should normally be described (extent, location, volume, etc.) in the space below and on the back of this sheet.

Inspection Issue # Comments

1. Daily, weekly, monthly, quarterly, annually. Annual Report
2. Formerly Elv. 346 ft.; reduced to 344.5 ft. with new outlet structure.
3. Monthly
7. For outlet structure construction
8. Per boring data.

U. S. Environmental Protection Agency

Coal Combustion Waste (CCW)
Impoundment Inspection

Impoundment NPDES Permit # KY0004219 INSPECTOR D. Whetstone/T. Kraus
Date 9/21/11

Impoundment Name Ash Pond #2
Impoundment Company TVA
EPA Region 4
State Agency (Field Office) Addresss KY DEP Div. Water

Name of Impoundment Ash Pond #2
(Report each impoundment on a separate form under the same Impoundment NPDES Permit number)

New ________ Update __________

	Yes	No
Is impoundment currently under construction?	X	
Is water or ccw currently being pumped into the impoundment?	X	

IMPOUNDMENT FUNCTION: Settling and storage of bottom ash

Nearest Downstream Town : Name Joppa, IL
Distance from the impoundment 3.8 miles
Impoundment
Location: Longitude 37 Degrees 09 Minutes 59.94 Seconds
Latitude 88 Degrees 47 Minutes 41.64 Seconds
State KY County McCraken

Does a state agency regulate this impoundment? YES ______ NO X

If So Which State Agency?________________________________

HAZARD POTENTIAL (In the event the impoundment should fail, the following would occur):

______ **LESS THAN LOW HAZARD POTENTIAL:** Failure or misoperation of the dam results in no probable loss of human life or economic or environmental losses.

______ **LOW HAZARD POTENTIAL:** Dams assigned the low hazard potential classification are those where failure or misoperation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the owner's property.

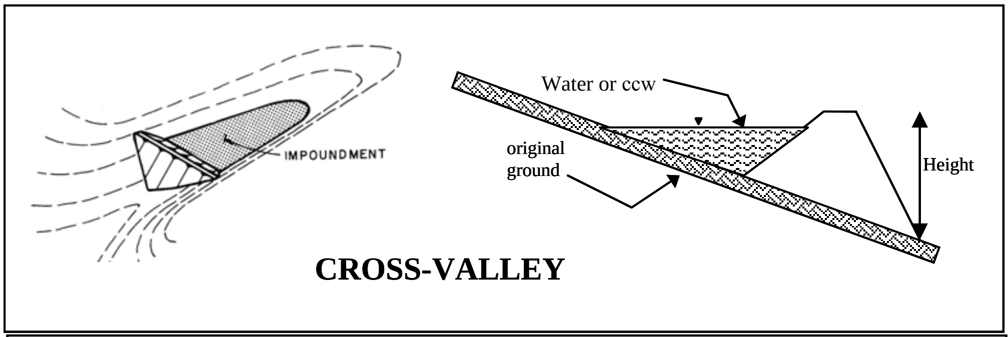
__X___ **SIGNIFICANT HAZARD POTENTIAL:** Dams assigned the significant hazard potential classification are those dams where failure or misoperation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

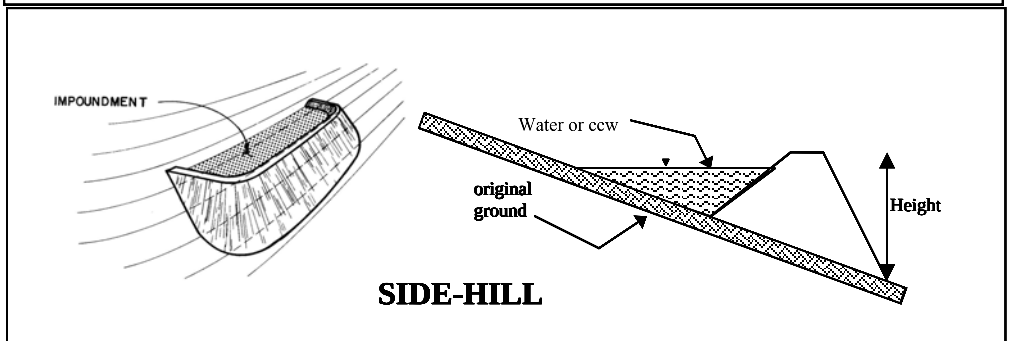
______ **HIGH HAZARD POTENTIAL:** Dams assigned the high hazard potential classification are those where failure or misoperation will probably cause loss of human life.

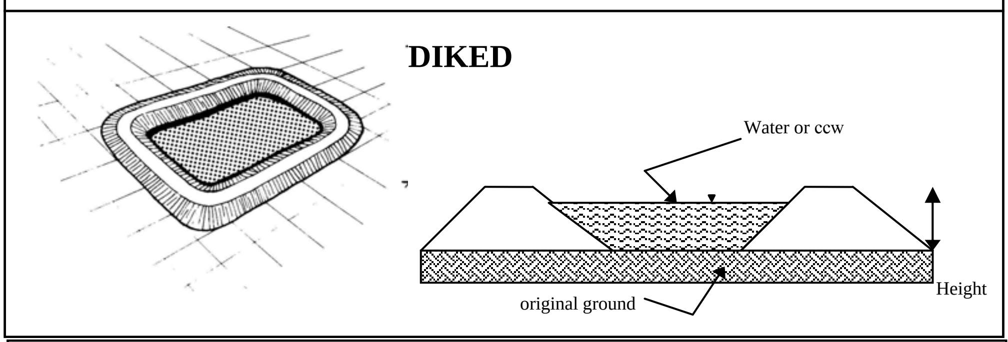
DESCRIBE REASONING FOR HAZARD RATING CHOSEN:

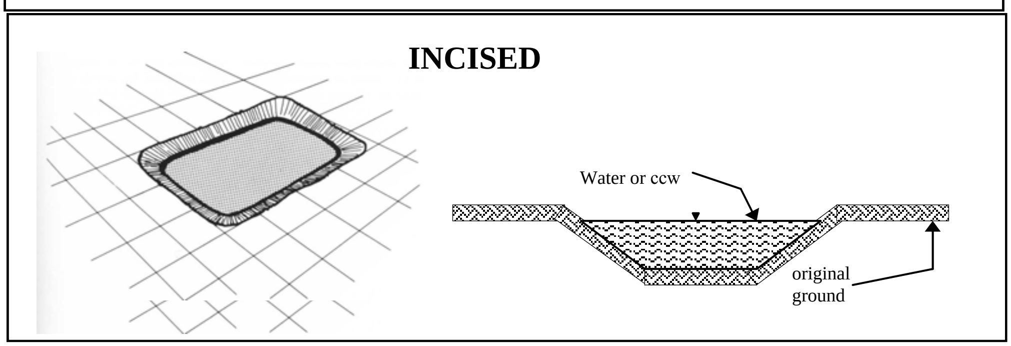
Proximity to Ohio River whereby release would likely impact the water.

CONFIGURATION: Initial construction in 1971 (14' tall) raised 10 ft. in 1979.









______ Cross-Valley
______ Side-Hill
__X__ Diked
______ Incised (form completion optional)
______ Combination Incised/Diked

Embankment Height 25 +/- feet   Embankment Material Primarily compacted lean clay
Pool Area 142 acres acres   Liner None
Current Freeboard 4.4 ft feet   Liner Permeability __________

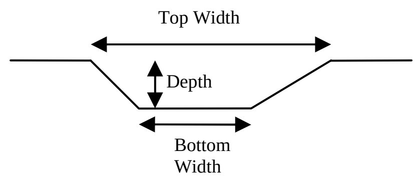
proposed after construction of new outlet

TYPE OF OUTLET (Mark all that apply)

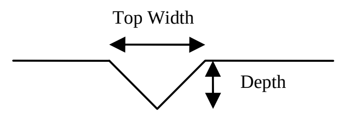
______ **Open Channel Spillway**
______ Trapezoidal
______ Triangular
______ Rectangular
______ Irregular

______ depth
______ bottom (or average) width
______ top width

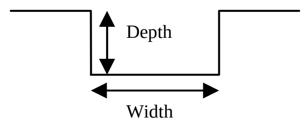
TRAPEZOIDAL



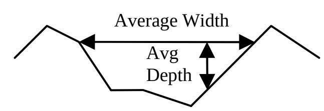
TRIANGULAR



RECTANGULAR



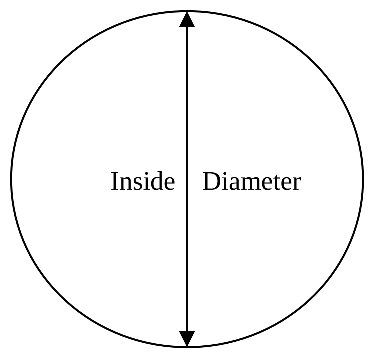
IRREGULAR



__X__ **Outlet**

6-30" I.D. inside diameter

Siphon system in place



Material
______ corrugated metal
______ welded steel
______ concrete
__X__ plastic (hdpe, pvc, etc.) DR-17 Smooth
______ other (specify) ______________________

Outlet system under construction.
Siphon system in service at time of inspection.

Is water flowing through the outlet? YES ________ NO __x__

______ **No Outlet**

______ **Other Type of Outlet** (specify) ________________________________

The Impoundment was Designed By TVA - in house personnel

____

Has there ever been a failure at this site? YES ___________ NO ___X___

If So When? ______________________________

If So Please Describe : ______________________________

Internal dike failure of temporary ash dike in 1984 that released dredged ash from internal cell back into ash pond. No release outside of main pond.

Has there ever been significant seepages at this site? YES ________ NO __x____

If So When? ___________________________

IF So Please Describe: ____

Some historical minor seepage along southeast dike toe. Nothing substantial; no turbid flow.

Has there ever been any measures undertaken to monitor/lower Phreatic water table levels based on past seepages or breaches at this site? YES ________NO ___X____

If so, which method (e.g., piezometers, gw pumping,...)? ___________________

If so Please Describe : ____

Additional Inspection Questions

Concerning the embankment foundation, was the embankment construction built over wet ash, slag, or other unsuitable materials? If there is no information just note that.

No, Ash Pond 2 built over native clay

The inboard slope of the upper 10 feet of dike is founded on sluiced ash overlain by a layer of compacted bottom ash.

Did the dam assessor meet with, or have documentation from, the design Engineer-of-Record concerning the foundation preparation?

NO

From the site visit or from photographic documentation, was there evidence of prior releases, failure, or patchwork on the dikes?

No, nothing other than the seepage filter under construction at time of inspection and some minor erosion/surface repair areas,

APPENDIX B

Photographs

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Shawnee Fossil Plant	Location: Paducah, Kentucky

Orientation: SE	
Description: CCR discharge pipes into sluice channel. Five cast iron discharge pipes	
Date: 9/22/11	
Photo Number: 1	
Photographer: Tim Kraus	
Orientation: S	
Description: Sluice channel downstream of the discharge pipes.	
Date: 9/22/11	
Photo Number: 2	
Photographer: Tim Kraus	

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Shawnee Fossil Plant	Location: Paducah, Kentucky

Orientation:
S

Description:
Sluice channel downstream of the discharge pipes.

Date: 9/22/11

Photo Number:
3

Photographer:
Tim Kraus

Orientation:
N

Description:
Large seepage mitigation project. Crushed stone being placed over sand as a reverse-graded filter. Riprap run-off ditch to the right.

Date: 9/22/11

Photo Number:
4

Photographer:
Tim Kraus

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Shawnee Fossil Plant	Location:	Paducah, Kentucky

Orientation: N Description: Ruts that are caused due to mowing of the side slopes. Note seep repair project to the right. Date: 9/22/11 Photo Number: 5 Photographer: Tim Kraus	
Orientation: N Description: Road on crest of the north dike. Piezometer and inclinometer instrumentation visible in the background at the bend in the dike. Date: 9/22/11 Photo Number: 6 Photographer: Tim Kraus	

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Shawnee Fossil Plant	Location: Paducah, Kentucky

Orientation:

Description:
Crest of dike – road is generally placed to the outside of the crest section. The sluice channel is on the left and the outboard slope of the dike is on the right.

Date: 9/22/11

Photo Number: 7

Photographer: Tim Kraus

Orientation: S

Description:
Inlet from the coal runoff discharge pond – ties into the sluice channel

Date: 9/22/11

Photo Number: 8

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Shawnee Fossil Plant	Location: Paducah, Kentucky

Orientation: NE Description: Overview of the inboard slope of the north dike. Sluice channel is to the left – dike crest road is to the right Date: 9/22/11 Photo Number: 9 Photographer: Tim Kraus	
Orientation: N Description: Piezometer monitoring along the dike. Note erosion repair areas at toe of outboard slope. Date: 9/22/11 Photo Number: 10 Photographer: Tim Kraus	

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Shawnee Fossil Plant	Location: Paducah, Kentucky

Orientation: SW

Description: Overview of ash disposal area of pond. Channel to stilling pond is visible in the background.

Date: 9/22/11

Photo Number: 11

Photographer: Tim Kraus

Orientation: SW

Description: Construction of the new spillway from the stilling pond

Date: 9/22/11

Photo Number: 12

Photographer: Tim Kraus

PHOTOGRAPHIC LOG

Client:	US EPA	Project Number:	46122
Site Name:	Shawnee Fossil Plant	Location:	Paducah, Kentucky

Orientation:	
Description: Old risers out of the stilling pond	
Date: 9/22/11	
Photo Number: 13	
Photographer: Tim Kraus	

Orientation:	
Description: Overview of stilling pond. Turbidity curtains placed around temporary siphon system inlet.	
Date: 9/22/11	
Photo Number: 14	
Photographer: Tim Kraus	

PHOTOGRAPHIC LOG

Client: US EPA	Project Number: 46122
Site Name: Shawnee Fossil Plant	Location: Paducah, Kentucky

Orientation: E Description: Headwall and dishcharge pipes of old spillway. Date: 9/22/11 Photo Number: 15 Photographer: Tim Kraus	
Orientation: E Description: Headwall and dishcharge pipes of new spillway. Date: 9/22/11 Photo Number: 16 Photographer: Tim Kraus	

APPENDIX C

Stantec Report of Geotechnical Exploration

Report of Geotechnical Exploration and Slope Stability Evaluation

Ash Pond 1 & 2 and Consolidated Waste Dry Stack
Shawnee Fossil Plant
Paducah, Kentucky

Stantec Consulting Services Inc.
One Team. Infinite Solutions
1901 Nelson Miller Parkway
Louisville KY 40223-2177
Tel: (502) 212-5000 • Fax: (502) 212-5055
www.stantec.com

Prepared for:
Tennessee Valley Authority
Chattanooga, Tennessee

July 14, 2010

Stantec Consulting Services, Inc.
1901 Nelson Miller Parkway
Louisville, KY 40223-2177
Tel: (502) 212-5000
Fax: (502) 212-5055

July 14, 2010 rpt_001_175559023/175559035

Mr. Michael S. Turnbow
Tennessee Valley Authority
1101 Market Street, LP 2G-C
Chattanooga, Tennessee 37402

Re: Report of Geotechnical Exploration and Slope Stability Evaluation
Ash Pond 1 & 2 and Consolidated Waste Dry Stack
Shawnee Fossil Plant
Paducah, Kentucky

Dear Mr. Turnbow:

As requested, Stantec Consulting Services Inc. (Stantec) has completed our Geotechnical Exploration and Slope Stability Evaluation for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack at the Shawnee Fossil Plant. The report documents the subsurface conditions, results of laboratory testing, findings from the historical document reviews, results of our analyses and evaluation, and recommendations for these facilities. The purpose of this study was to perform a general evaluation of slope stability and seepage conditions. More detailed evaluations may be required during design of future phases or mitigation. These services were performed under Engineering Service Requests ESR/TAO 978, 1226 and 1227 in accordance with the terms and provisions established in our System-Wide Services Agreement dated December 22, 2008.

Stantec appreciates the opportunity to provide engineering services for this project. If you have any questions, or if we may be of further assistance, feel free to contact our office.

Sincerely,

STANTEC CONSULTING SERVICES INC.

Jason R. Curtsinger, PE
Project Engineer

Nathan A. Bader, PE
Associate

Enclosures

Report of Geotechnical Exploration and Slope Stability Evaluation

Ash Pond 1 & 2 and Consolidated Waste Dry Stack
Shawnee Fossil Plant
Paducah, Kentucky

Prepared for:

Tennessee Valley Authority
Chattanooga, Tennessee

July 14, 2010

Report of Geotechnical Exploration and Slope Stability Evaluation

Ash Pond 1 & 2 and Consolidated Waste Dry Stack
Shawnee Fossil Plant
Paducah, Kentucky

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Executive Summary

Stantec Consulting Services Inc. (Stantec) has completed the Geotechnical Exploration and Slope Stability Evaluation at Shawnee Fossil Plant's Ash Pond 1 and 2 dikes and the Consolidated Waste Dry Stack. This study was performed to evaluate general slope stability and seepage, where applicable, for the facilities' existing conditions and to review the stability analyses performed during the previous 2006 design of the Consolidated Waste Dry Stack expansion when fully built-out. More detailed evaluations may be required during design of future phases or mitigation, if needed.

Background Information

<u>Ash Pond 1:</u> Ash Pond 1 was constructed by building dikes on the north and west sides using ash and the pond tied into existing grade along the south and east sides. One dike raising using ash was reported in 1967. The only dike visible in this area is the west dike for Ash Pond 1 and is about 2,800 feet in length and consists of 15 to 20 foot tall ash dikes with a crest elevation between about 345 and 350 feet. The dike slopes along this side are relatively steep on the order of 1.5H:1V to 2H:1V flattening to 3H:1V or flatter to the south and are heavily wooded. The original Consolidated Waste Dry Stack is situated over the original Ash Pond 1 disposal area for the plant. This perimeter dike is offset from the toe of the stack roughly 50 to 70 feet.

Historical geotechnical issues along the Ash Pond 1 dike include minor sloughing that has been reported over the years. Stantec has also noticed minor sloughing and slope instability along the north section of dike since January, 2009. These areas of minor sloughing are small and numerous and as such, specific locations are not identified within this report. Based on historical information reviewed, slope stability analyses were performed to evaluate the dike during planning for the adjacent stack in 1984. The analyses showed factors of safety less than 1.3 for these slopes, but rather than flattening these slopes to improve stability, it was decided to limit dry stacking operations at the adjacent stack such that the toe of the stack was roughly 50 feet or more from the dike.

<u>Ash Pond 2:</u> Ash Pond 2 is approximately 143 acres in area, and is enclosed by a perimeter dike system that is approximately 9,200 feet in total length (about 7,600 feet of perimeter dike surrounding the ash pond and an additional 1,600 feet along the closed Inactive Dredge Cell within the pond). In 1971, the first phase of Ash Pond 2, consisting of dikes constructed to a crest of El. 340 feet, was constructed and put into service. In 1979, the dikes were raised 10 feet using upstream construction methods (constructing inwardly over sluiced ash). The overall constructed height of the perimeter dike system now varies from approximately 20 to 25 feet. Dike slopes are approximately 2.5H:1V to 3H:1V.

TVA has recently classified Ash Pond 2 as a "significant hazard" impoundment because of the size of the impoundment and the consequences of failure. Currently, TVA is considering a program wide conversion to dry operations which would result in ultimate closure of the pond. However, this conversion may not be implemented for 10 years or more.

Historical geotechnical issues include seepage areas located along the northeast corner of the pond. The seepage has been occurring along the toe of the northeast dike since about 2001. The seepage is widespread along the toe of the slope in this area and extends from the far south end of the Ash Pond 2 dike north about 1,000 feet to the corner of the pond in

this area. The seepage has been monitored by TVA with little or no change being reported through the years. The seepage areas are wet and soft, but there is typically no, to minimal, flow of water and no visible piping of dike materials. The documents reviewed for Ash Pond 2 do not indicate a history of slope instability other than some minor, shallow sloughing reported over the years along the north upstream slope face of the pond. Repairs along the north upstream face have included placement of rip rap protection along the slope face. Based on reviews by Stantec, the rip rap wave and slope protection has been successful in minimizing sloughing and erosion of the upstream slope faces. Additionally, no signs of exterior slope instability have been observed in the field by Stantec throughout the course of this work.

The outlet system for Ash Pond 2 consists of five 48-inch diameter reinforced concrete pipe (RCP) riser sections that discharge through five 36-inch RCP sections into a discharge channel. In 1984, failure of the two southernmost riser sections was reported due to a wave in the stilling pond caused by a failure of the interior dike for the adjacent dredge cell. The risers were reportedly reconnected but no further information relative to the limits of the release and repairs was reported. Over the years, the historical documentation also reports that some sediment build up and the formation of a sinkhole has occurred likely due to separation between the pipe sections. These issues were reportedly repaired. A new spillway system is currently being constructed to replace the current riser sections. Construction for the new spillways and abandonment of the existing spillways began in June 2010.

Consolidated Waste Dry Stack: The Consolidated Waste Dry Stack is located over the original Ash Pond 1 disposal area. Dry ash was placed over the old Ash Pond 1 beginning in 1984 with the original portions of the stack fully built-out and closed along the south portion in the late 1990s. Current disposal activity is to the north within the horizontal stack expansion area designed in 2006. This current stacking plan consists of expanding the stack to the north over Ash Pond 2. The original portions of the stack are closed and are approximately 110 acres in area and about 100 feet in height. Side slopes are on the order of 2.7H:1V to 3H:1V with benches located at approximate elevations 380 and 405 feet and perimeter ditches and downdrains at regular intervals to convey runoff. The current expansion will be approximately 105 acres in area and is following the stacking plan developed in 2000 and updated in 2006. This current stacking plan will have an ultimate height of 270 feet with 3H:1V slopes and benches every 50 feet in height.

Historical documents reviewed for the Consolidated Waste Dry Stack do not indicate a history of slope instability other than some minor erosion in various areas along the slope faces reported over the years. Additionally, no signs of slope instability have been observed in the field by Stantec throughout the course of this work.

Scope of Geotechnical Exploration

This study began with a review of TVA-provided historical information along with site inspections. A geotechnical exploration program was then developed and executed with some environmental sampling being performed to evaluate the depth of contamination associated with the contamination plume which exists below the plant as a result of past leakage from the Paducah Gaseous Diffusion Plant. The geotechnical portion of the exploration consisted of drilling soil test/sample borings at 99 locations. Piezometers were installed at 58 locations and two slope inclinometers were also installed. Drilling locations were positioned along 26 cross-sections and within areas of the current dry stack expansion.

The laboratory testing program included moisture content, classification, moisture-density, permeability, consolidation and shear strength testing to establish key index properties and strength parameters.

Results of Exploration and Engineering Analyses

Ash Pond 1: The results from the geotechnical exploration for Ash Pond 1 indicate that the perimeter dike system is constructed of ash materials. The exploration program did confirm the presence of sluiced ash behind/upstream of the perimeter dike. The dike is underlain by native clays, silts, sands and gravel.

Following the drilling and laboratory testing program, slope stability analyses were performed to quantify factors of safety for current conditions. The dikes were assessed under static, long-term, steady state and rapid drawdown conditions. Rapid drawdown conditions were analyzed due to the proximity of the dike to Little Bayou Creek and the Ohio River and the 100-year flood elevation extending up the slope of the dikes. The analysis focused on two of the four cross-sections that were selected to represent typical conditions along the closed Ash Pond 1 dike. The stability analyses focused on the potential for deep (global) and shallow (non-global, or maintenance-type) failures along the exterior ash dike and both circular and non-circular surfaces were considered. No seepage analyses were performed for the dike because this disposal facility is closed and no longer impounds water and piezometric levels were used to model the phreatic conditions in lieu of seepage models.

The results of the slope stability analyses demonstrate that the factors of safety along the steeper portions of the Ash Pond 1 dike (represented by cross-sections I-I' and J-J') against long-term and rapid drawdown slope stability are below the recommended target values (1.5 for long-term and 1.2 for rapid drawdown) adopted by TVA based on USACE criteria. These lower factors of safety represent shallow, maintenance-type failure surfaces. See Figure 2.1 for the location of these sections. For deeper critical slip surfaces extending into the dike to affect the crest along these sections (representing more of a global failure surface), the factors of safety are greater than or equal to the recommended target values.

Along the portions of the ash dike where slopes flatten to 4H:1V or flatter (represented by cross-sections K-K' and L-L'), the analyses demonstrate that the factors of safety against long-term and rapid drawdown slope stability failure are greater than the target values.

In conclusion, the steeper, northern portion of the old Ash Pond 1 dike exhibits deficient factors of safety against slope stability. This does not imply that the dike is in immediate danger of failure, but TVA should undertake mitigation efforts to improve long-term stability. To improve the long-term stability conditions, it is recommended that TVA implement a mitigation design and construction program for the steeper portions of the Ash Pond 1 dike, depending on timing and as decided by TVA. If TVA decides to perform mitigation, features for improvements should include a combination of stabilizing berms and/or walls, flattening of dike slopes, relocation of the existing access road, and provisions for collecting and controlling groundwater, if needed.

Ash Pond 2: The results from the geotechnical exploration indicate that the upper and lower perimeter dike system for Ash Pond 2 is constructed of clay materials. The capacity of the pond was expanded by constructing the upper dikes inwardly over sluiced ash. The exploration program did confirm the presence of sluiced ash beneath the upper dike. The dikes are underlain by native clays, silts, sands and gravel.

Following the drilling and laboratory testing program, slope stability and seepage analyses were performed to quantify factors of safety for current conditions. The dikes were assessed under static, long-term, steady state and rapid drawdown conditions due to their proximity to the adjacent Ohio River and the 100-year flood elevation extending up the dike slope. The analysis focused on nine of the nineteen cross-sections that were selected to represent typical conditions around the pond.

To evaluate the seepage conditions within the dikes, a finite element model was developed for each of the nine critical cross-sections. On the modeled cross-sections, the maximum upward gradient occurs near or beyond the toe of the lower dikes. In most cases, a critical exit point was not predicted by the models or the vertical gradient at the critical exit point was very low resulting in factors of safety against piping well above 4. The exception is at section N-N' where past seepage has been observed. See Figure 2.1 for the location of this cross-section. The calculated factor of safety at this section was 2.0. Stantec recommends a target factor of safety against piping of 4 based on information contained in United States Army Corps of Engineers (USACE) manual EM 1110-2-1901. At section N-N', Ash Pond 2 does not meet the recommended target factor of safety for piping at the critical seepage exit point located along the dike toe. This section, where the lowest factor of safety occurred, represents the northeast corner of the pond. This condition could create the potential to initiate soil piping if exit gradients are high enough. Thus, the results indicate the seepage criterion is not currently being met at the toe area of one out of the nine cross-sections analyzed for Ash Pond 2.

The slope stability of the Ash Pond 2 dikes was also evaluated. Factors of safety for slope stability were computed using Spencer's method of analysis, circular slip surfaces, and search routines that help to identify the critical (minimum factor of safety) failure surface. The slope stability models were evaluated using pore pressures predicted with the seepage models. The results of the slope stability analyses demonstrate that the factors of safety against long-term and rapid drawdown slope stability are greater than 1.5 and 1.2, respectively.

In conclusion, along the northeast portion of Ash Pond 2, the current configuration exhibits deficient factors of safety against piping. It is recommended that TVA undertake mitigation efforts to improve seepage conditions. Improvements could be incorporated into upcoming design of pond closure, or a separate interim mitigation program could be implemented, depending on timing and as decided by TVA.

Consolidated Waste Dry Stack: The results from the geotechnical exploration indicate that the stack consists of a mix of fly and bottom ash. Inside the dikes and existing ground surrounding the stack, the exploration detected sluiced ash ranging from about 20 to 30 feet thick. The disposal area is underlain by native clays, silts, sands and gravel.

Following the drilling and laboratory testing program, slope stability analyses were performed to quantify factors of safety for existing conditions. The analysis focused on four of the seven cross-sections that were selected to represent typical conditions for the closed portion of the facility. One additional cross-section was also created and evaluated to represent the final buildout of the ongoing stack expansion to the north in an effort to check the design previously prepared in 2006. See Figure 2.1 for the location of these cross-sections. The stack slopes were assessed under static, long-term (fully drained) loading conditions and static undrained loading conditions within the saturated ash. The stability analyses focused on the potential for deep (global) and shallow (non-global, or maintenance-type) failures along the exterior stack slopes and both circular and non-circular surfaces were considered. No seepage analyses were performed for the stack because this disposal facility does not impound water and groundwater levels at the time of this study were well below the existing ground surface. As a result, piezometric levels were used to model the phreatic conditions in lieu of seepage models. Last, Stantec performed undrained analysis for failure surfaces at Section AA-AA' to represent loading conditions that will be induced during continued ash placement for the current stack expansion in this area.

The results of the slope stability analyses demonstrate that the factors of safety against long-term, steady state slope instability (fully drained conditions) are all greater than 1.5 for both non-global and deeper global-type failure surfaces within the Consolidated Waste Dry Stack based on USACE criteria. The results of the slope stability analyses for the undrained loading condition demonstrate that the factors of safety against undrained slope stability failure are all equal to or greater than 1.3, which is greater than the target minimum factor of safety for undrained conditions. As indicated above, Stantec also performed undrained analysis for failure surfaces representing loading conditions that will be induced during continued ash placement for the current stack expansion to the north. Based on the information provided by TVA, no more than about 5 feet of ash material is expected to be placed in any given month. For the purpose of the loading analysis performed, Stantec conservatively assumed a buildout of 10 feet. The undrained analysis representing this buildout produced a factor of safety of 1.6, which is greater than the target factor of safety.

In conclusion, no further mitigation measures are recommended at this time for the Consolidated Waste Dry Stack. Inspection and maintenance activities should continue.

Report of Geotechnical Exploration and Slope Stability Evaluation

Ash Pond 1 & 2 and Consolidated Waste Dry Stack
Shawnee Fossil Plant
Paducah, Kentucky

1. Introduction

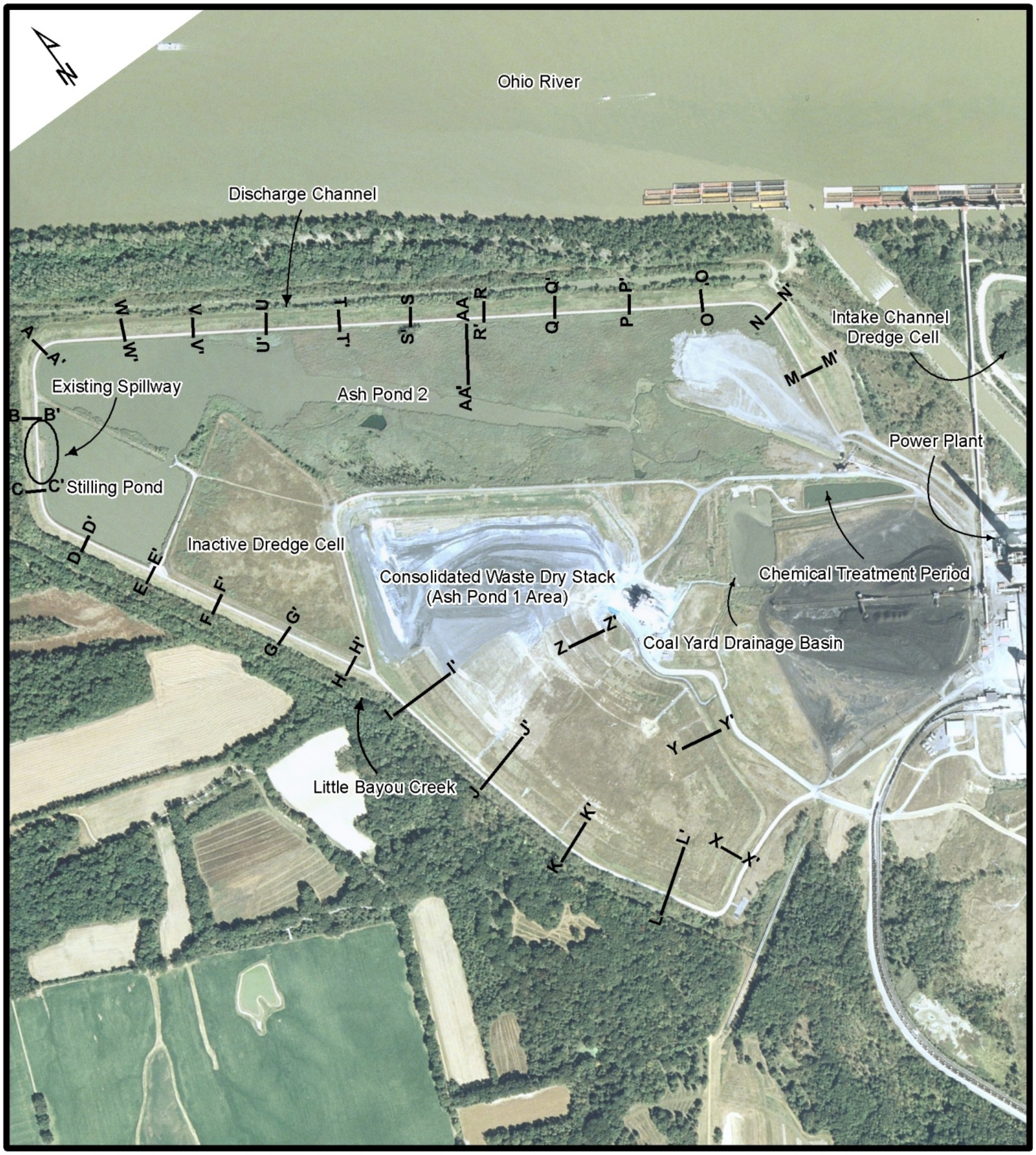
In January 2009, the Tennessee Valley Authority (TVA) requested Stantec Consulting Services Inc. (Stantec) conduct assessments of its coal combustion product (CCP) disposal facilities at one closed, and eleven active, fossil plants. The plants are located in the states of Kentucky, Tennessee and Alabama. The assessments were performed for the purpose of determining if conditions were present to indicate an unstable condition that could possibly cause a release of CCP's into the environment.

Stantec's scope of services for the assessments was developed within the framework of current dam safety practice, and was performed in phases. Phase 1 included review of available documentation, site reconnaissance, field measurements, and providing recommendations for interim corrective measures, improvements, and further engineering studies. The Report of Phase 1 Facility Assessment for Coal Combustion Product Impoundments and Disposal Facilities for the two Kentucky plants was completed on June 24, 2009. The conclusions and recommendations for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack at the Shawnee Fossil Plant (SHF) are included in that Phase 1 report. In addition to issues that require maintenance-type remedial activities, the Phase 1 recommendations included conducting a Phase 2 geotechnical exploration to evaluate slope stability and seepage for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack at SHF. As a result, the following geotechnical evaluation was authorized by TVA under Engineering Services Requests ESR/TAO 978, 1226 and 1227. This report documents the scope and results of the study and contains Stantec's conclusions and recommendations concerning slope stability and seepage for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack.

2. Site Description and Geology

2.1. Location and Description

The Shawnee Fossil Plant is located in Paducah, McCracken County, Kentucky on the south bank of the Ohio River near river mile 946. Both the Consolidated Waste Dry Stack and Ash Ponds are situated just northwest of the plant's powerhouse. The Consolidated Waste Dry Stack is located within the plan limits of the original Ash Pond 1 for the plant, which was previously closed. However, current stacking operations include an expansion to the north, which extends over portions of the current active ash pond (Ash Pond 2). Ash Pond 2 is situated adjacent and connected to the old Ash Pond 1 disposal area and current stack to the north and west. Both facilities are bordered by the Ohio River to the north, the powerplant to the east, and by Little Bayou Creek and the Discharge Channel to the south and west, respectively. Figure 2.1 on the following page provides a plan view of the Shawnee Fossil Plant and Disposal Areas and shows the locations of the cross-sections reviewed.



Shawnee Fossil Plant, Ash Pond 1 & 2 and Consolidated Waste Dry Stack Paducah, Kentucky

Stantec

Figure 2.1. Shawnee Ash Pond 1 & 2 and Consolidated Waste Dry Stack Overview

The current active ash pond (Ash Pond 2) is approximately 143 acres in area, and is enclosed by a perimeter dike system that is approximately 9,200 feet in total length (about 7,600 feet of perimeter dike surrounding the ash pond and an additional 1,600 feet along the closed Inactive Dredge Cell within the pond). The dike crest supports a gravel access road and is currently at an average approximate elevation of 350 feet. The overall constructed height of the perimeter dike system varies from approximately 20 to 25 feet. Dike slopes are approximately 2.5:1V to 3H:1V and are vegetated with thick grasses. A few trees once existed at various locations around the pond (primarily along the interior slopes), but have since been removed. Currently, approximately 40,000 tons per year of bottom ash is wet-sluiced to Ash Pond 2. Dewatered bottom ash is removed from Ash Pond 2 and stacked within the adjacent Consolidated Waste Dry Stack along with dry fly ash from the adjacent silos. Outlet for Ash Pond 2 is provided through five 48-inch RCP stacked riser spillways that discharge through five 36-inch RCP pipes into an open discharge channel.

TVA has recently classified Ash Pond 2 as a “significant hazard” impoundment because of the size of the impoundment and the consequences of failure. Currently, TVA is considering a program wide conversion to dry operations which would result in ultimate closure of the pond. However, this conversion may not be implemented for 10 years or more.

The original Consolidated Waste Dry Stack is situated over the original Ash Pond 1 disposal area for the plant. The original portions of the stack are closed and are approximately 110 acres in area. A perimeter dike for the old Ash Pond 1 is present along the southwest side of the original stack. This perimeter dike is approximately 2,800 feet in total length and consists of a dike crest that supports a gravel access road and is offset from the toe of the stack roughly 50 to 70 feet. The crest of the old Ash Pond 1 perimeter dike is currently at approximate elevation 345 to 350 feet with an overall constructed height of approximately 15 to 20 feet. Dike slopes range from approximately 1.5:1V to 2.5H:1V or flatter and are heavily wooded. Dry ash was placed over the old Ash Pond 1 beginning in 1984 with the height of the original, closed portions of the stack on the order of about 100 feet. Slopes of the closed portion of the dry stack are approximately 2.7H:1V to 3H:1V, with benches located at approximate elevations 380 and 405 feet. The benches are sloped towards the stack and to downdrains at various locations around the stack. Perimeter drainage ditches along the toe of the stack collect runoff from the downdrains. The dry stacking operation is following a stacking plan believed to be developed in 1984 and updated in 2000 and 2006, with the most recent updated stacking plan being used. This current stacking plan consists of expanding the stack to the north over Ash Pond 2. The ultimate height of the horizontal expansion stack will be 270 feet and the expansion will be approximately 105 acres in area. The expansion will be constructed on 3H:1V slopes with benches every 50 feet in height. Dry stacking operations for the expansion have only recently begun and are currently being performed in accordance with Phase 1 of the construction sequence. The Consolidated Waste Dry Stack has roughly 25 years of capacity left based on the available estimates from the 2006 stack expansion plans.

2.2. Geology

The Consolidated Waste Dry Stack and Ash Pond 1 & 2 at the Shawnee Fossil Plant are located in western Kentucky along the south shore of the Ohio River just east (upstream) of the confluence of the river and Bayou Creek. Available geologic mapping (Geologic Map of Part of the Joppa Quadrangle, McCracken County, Kentucky, USGS, 1967) indicates that quaternary age alluvium deposits are mapped as being exposed at the surface within the vicinity of the plant. The geologic mapping indicates these materials are underlain by

Quaternary age continental deposits and the Upper Cretaceous and Tertiary age Clayton and McNairy Formations. The mapping describes the alluvium as consisting of clean fine sands to sandy clays and silts varying from about 0 to 40 feet in thickness. The underlying continental deposits consist of gravel and poorly sorted fine to coarse quartz and chert sand, exhibit cemented zones, vary from clean to clayey, and are locally micaceous. The Clayton and McNairy Formations consist of fine to medium quartz sand interbedded with black or brown clay that is commonly micaceous. Based on available geologic mapping, bedrock within the area is estimated to be 300 feet or more in depth.

3. Review of Available Information

3.1. General

During the Phase 1 Facility Assessment, Stantec's engineers reviewed documents provided by TVA pertaining to Ash Pond 1 & 2 and the Consolidated Waste Dry Stack. The main objective of the document review was to develop a historical knowledge base of the facilities. The documents reviewed included drawings, cross-sections of dikes, old contour maps, annual dike stability reports, permit documents, and old geotechnical reports. A complete listing of the reviewed documents is included in the Phase 1 report.

Of particular interest and use in this study are the following documents and drawings:

- <u>Special Waste Landfill Permit – Horizontal Expansion – Consolidated Waste Stack Disposal Area – Shawnee Fossil Plant</u>, Volumes I through IV, FMSM Engineers, June, 2006.

- <u>Geologic Map of Part of the Joppa Quadrangle, McCracken County, Kentucky</u>, Warren I. Finch, US Geologic Survey, 1967.

- TVA Drawing Numbers 10A240R2, 10N206, 209, 271-274, 284, 10W229, 269, 10W220-01 through 220-52, and 10W221-1 through 221-18.

- TVA Annual Inspection Reports, 1971 to 2009 (Ash Pond 1 & 2) and 1984 to 2009 (Consolidated Waste Dry Stack).

These documents included site plans, cross-sections, boring plans, boring logs, results of laboratory tests, and geologic information. The information gained was evaluated and used to supplement the information obtained during Stantec's geotechnical exploration.

3.2. Site History

Construction began at Shawnee Fossil Plant in 1951 and was completed in 1957. Shawnee currently contains ten coal-fired generating units and burns approximately 9,600 tons of coal per day. Initially, ash materials were sluiced into Ash Pond 1, located to the west of the powerhouse adjacent to the coal storage area. Sluicing to this area stopped in 1971 following construction of the current Ash Pond 2 disposal area. Ash Pond 1 was closed shortly thereafter. TVA began stacking reclaimed ash from Ash Pond 2 in this area from 1984 until the present. A summary of the specific historical information associated with each of these facilities is provided in the following paragraphs.

Ash Pond 1: The pond was constructed by building dikes on the north and west sides using ash and the pond tied into existing grade along the south and east sides. One dike raising using ash was reported in 1967, but no construction records were available. The only dike visible in this area is the west dike for Ash Pond 1 and it consists of 15 to 20 foot tall ash dikes with a crest elevation between about 345 and 350 feet. The dike slopes along this side are relatively steep on the order of 1.5H:1V to 2H:1V or flatter and are heavily wooded. In addition to the dike construction, Little Bayou Creek was also rerouted to the north to construct this disposal area.

Ash Pond 2: In 1970, the first phase of Ash Pond 2 was constructed and put into service in 1971. The first phase consisted of construction of 15-foot tall dikes to a crest of El. 340 feet. The majority of the initial dike construction occurred along the north and west sides and tied into the existing Ash Pond 1 dikes or into existing grade at either end. On the northeast side, the new dike extended the original plan limits of the old disposal area closer to the Ohio River. In 1979, the dikes were raised 10 feet to their current elevation 350 feet using upstream construction methods (constructing inwardly over a bottom ash base placed over sluiced pond ash). The dike crest supports a gravel access road and the overall constructed height of the perimeter dike system varies from approximately 20 to 25 feet. Dike slopes are approximately 2.5:1V to 3H:1V and are vegetated with thick grasses. Up to about the mid 1980s, both fly ash and bottom ash were sluiced into Ash Pond 2, but the pond later began to receive only sluiced bottom ash and fly ash was pneumatically placed into silos and hauled to the adjacent Consolidated Waste Dry Stack. Various dredge cells along the interior of Ash Pond 2 were constructed and used over the years between 1983 and 1995. These cells typically consisted of ash dikes and have since been closed and covered. One such cell is identified on Figure 2.1 as the Inactive Dredge Cell.

Consolidated Waste Dry Stack: The most recent ash disposal area to be developed on the Shawnee reservation is the Consolidated Waste Dry Stack located over the original Ash Pond 1 disposal area. Dry ash was placed over the old Ash Pond 1 beginning in 1984 with the original portions of the stack fully built-out and closed along the south portion in the late 1990s. Current disposal activity is to the north within the horizontal stack expansion area designed in 2006. This expansion area extends the original stack over portions of Ash Pond 2 and the Inactive Dredge Cell to the north and west. At present, dry fly ash is collected in silos and hauled to this disposal area along with reclaimed and dried bottom ash from Ash Pond 2. The original, closed portion of the stack is on the order of about 100 feet in height with slopes on the order of 2.7H:1V to 3H:1V and benches located at approximate elevations 380 and 405 feet. The current expansion is following the stacking plan developed in 2000 and updated in 2006. This current stacking plan will have an ultimate height of 270 feet with 3H:1V slopes and benches every 50 feet in height. Dry stacking operations for the expansion have only recently begun and are currently being performed in accordance with Phase 1 of the construction sequence.

3.3. Historical Geotechnical and Environmental Issues

As discussed in Section 1, the Phase 1 work included review of historical documents. A few primary issues that were found from the documents for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack are discussed in the following paragraphs.

3.3.1. Ash Pond 1 - Slope Stability

The southwest side of the Ash Pond 1 dike was constructed of ash on slopes as steep as about 1.5H:1V. The slope is currently heavily wooded and minor sloughing has been reported over the years. Stantec has also noticed minor sloughing and slope instability along this section of dike since January, 2009. These areas of sloughing are small and numerous and as such, specific locations are not identified within this report. Based on historical information reviewed, slope stability analyses were performed to evaluate the dike during planning for the adjacent stack in 1984. The analyses showed factors of safety less than 1.3 for these slopes. Rather than flattening Ash Pond 1 dike slopes to improve stability, it was decided to set back the toe of the dry stack roughly 50 feet or more from the dike.

3.3.2. Ash Pond 2 – Seepage, Slope Stability, and Spillway Outlets

Historical documentation indicates that seepage has been occurring along the toe of the northeast dike since about 2001. The seepage is widespread along the toe of the slope in this area and extends from the far south end of the Ash Pond 2 dike north about 1,000 feet to the corner of the pond in this area. Several small, isolated seepage areas exists along this interval. The seepage has been monitored by TVA with little or no change being reported through the years and no visible piping of dike materials. In addition, Stantec has also noticed minimal change in seepage conditions at these locations since January, 2009. Currently, there is minimal to no flow occurring with large portions at the base of the slope holding standing water. A seepage collection system was designed by Stantec in 2009 to collect and remove the seepage from this area. However, due to the length of time associated with permitting the outfall of the collection system (a year or more), installation of this system is being re-evaluated.

The documents reviewed for Ash Pond 2 do not indicate a history of slope instability other than some minor, shallow sloughing reported over the years along the north upstream slope face of the pond. Repairs along the north upstream face have included placement of rip rap protection along the slope face. Based on reviews by Stantec, the rip rap wave and slope protection has been successful in minimizing sloughing and erosion of the upstream slope faces. Additionally, no signs of exterior slope instability have been observed in the field by Stantec throughout the course of this work.

The outlet system for Ash Pond 2 consists of five 48-inch diameter RCP riser sections that discharge through five 36-inch RCP sections into a discharge channel. Several issues associated with the spillway structures have been reported over the years. In 1984, failure of the two southernmost riser sections was reported due to a wave in the stilling pond. The wave was caused by a failure of the interior dike for the adjacent dredge cell resulting in the release of sluiced ash into the stilling pond. The top 11 feet of these risers was reportedly reconnected but no further information relative to the limits of the release and repairs was reported. Over the years, the historical documentation reports that some sediment build up within the outlet pipes has also occurred likely due to separation between the pipe sections. A sinkhole was also reported on the downstream dike face at the northernmost outlet pipe in 1994. This sinkhole was reportedly repaired in 1995 by repairing the separated pipe section and filling the sinkhole with compacted clay. A new spillway system is currently being designed by Stantec to replace the current riser sections. This plan will also include abandonment of the existing spillway risers. Construction for the new spillways and abandonment of the existing spillways began in June 2010.

3.3.3. Consolidated Waste Dry Stack - Slope Stability

The documents reviewed for the Consolidated Waste Dry Stack do not indicate a history of slope instability other than some minor erosion along the slope faces reported over the years. Additionally, no signs of slope instability have been observed in the field by Stantec throughout the course of this work. However, a geotechnical exploration and slope stability evaluation were performed for the current stack expansion, but no record of stability evaluations performed for the original portion of the stack were reported.

3.3.4. Environmental Issues

In addition to the geotechnical issues identified above, the Shawnee Fossil Plant also has historical environmental issues at the plant. The Paducah Gaseous Diffusion Plant, which produces enriched uranium for use in commercial reactors, is located approximately 3 miles southwest of the Shawnee Fossil Plant. From a review of historical documents and discussions with TVA, a contamination plume exists below the Shawnee Fossil Plant that resulted from leakage from the Paducah Gaseous Diffusion Plant and the migration of contaminants through the permeable soils of the area. The contamination plume extends within the Regional Groundwater Aquifer (RGA) in the area and extends below the western portions of the Shawnee Fossil Plant. The RGA varies in elevation between about El. 300 and 325 feet. The contaminants known to be present are trichloroethylene (TCE) and technetium-99 (Tc-99).

4. Scope of Exploration

Prior to beginning the field work, Stantec and TVA performed a review of the proposed boring positions to determine which locations would be affected by the reported contamination plume extending below portions of the plant. Based on this review, it was determined that borings along the extreme north and east portions of Ash Pond 2 could be advanced to approximate El. 290 feet without encountering contamination and without the need for special hazardous drilling protocols. These borings were performed September 1 through September 22, 2009 and included those from STN-32 and extending around the north portion of the pond to STN-8. The remainder of the borings for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack were determined to be in areas identified as being environmentally sensitive. As a result, environmental sampling was performed to determine appropriate depths for the remaining geotechnical borings and to determine if hazardous drilling protocols would be necessary.

The geoprobe borings (GP-D through GP-L) were performed September 21 through September 26, 2009 and groundwater samples were obtained at various depths from each of the borings with the exception of GP-J where refusal was encountered at higher elevations. A sample from a nearby TVA monitoring well was used to provide information in the vicinity of GP-J. The samples were submitted to TVA for laboratory testing. Based on the results of the environmental laboratory testing, bottom depths for each of the remaining borings were determined to minimize the need for special hazardous drilling operations. Laboratory test results, depths, and locations for the environmental samples obtained are included in the appendices, but no further discussion of these results or the scope of the environmental drilling are provided in this report.

Once determination of the scope for the remaining geotechnical borings was complete, field work to complete the geotechnical exploration was performed January 6 through February 25, 2010. The remaining borings included those from STN-9 and extending around the south portion of the ponds to STN-28, and STN-101 through STN-129 for the adjacent dry stack. Because of the heavy woods and steep slopes along the toe of the perimeter dike for old Ash Pond 1, borings STN-29 and 30 were eliminated.

These services were performed in general accordance with various Corps of Engineers procedures, along with standard procedures for geotechnical and environmental engineering practice.

Overall, Stantec personnel advanced 66 conventional geotechnical sample borings for Ash Pond 1 & 2, and 33 conventional geotechnical sample borings for the Consolidated Waste Dry Stack. The borings were advanced using a combination of track-mounted and truck-mounted drill rigs. In general, the borings were positioned along the perimeter dike crest, perimeter dike toe, and the crest, toe, and various bench levels of the dry stack. Several of the borings consisted of offset borings to install instrumentation and/or collect additional samples for laboratory testing. Borings were positioned along 26 cross-sections and within areas of the current dry stack expansion. Nineteen sections are located along the perimeter dikes for Ash Pond 2 and seven are positioned along the dry stack and adjacent perimeter dike for old Ash Pond 1. The borings were terminated at depths corresponding to the elevations previously evaluated during the environmental phase of the project. The exception to this is borings STN-24 and STN-118 which were advanced below the environmental sampling depths to gain an understanding of the general subsurface horizons at greater depths. These borings were advanced using hazardous drilling protocols and all samples obtained below the environmental sampling depths were discarded. The procedures and methods used for advancing and sampling these borings are outlined in the separate Health and Safety Plan prepared and submitted to TVA for this work. The locations of the borings are shown on the Boring Layout Plan in Appendix G. TVA's survey crew located the borings and profiled the ground lines at the twenty six cross-sections.

The subsurface exploration was performed using 3¼- and 4¼-inch (ID) hollow stem augers equipped with a carbide-tipped tooth bit. Standard Penetration Testing (SPT) was performed in selected sample borings at intervals ranging from continuous up to 10-foot. A standard penetration test consists of dropping a 140-pound hammer to drive a split-spoon sampler 18 inches. The consistency or relative density of soil is estimated by the number of blows it takes to drive the spoon the last 12 inches. This method is typically used to obtain soil samples, estimate the consistency or relative density of the soil, and also to estimate the vertical limits of the subsurface soil horizons. In addition, undisturbed samples (Shelby tubes) were obtained in selected borings using a fixed head piston sampler from selected depth intervals within the cohesive materials to provide samples for subsequent laboratory strength testing. After completion of the drilling and sampling procedures, the boreholes were checked for subsurface water and backfilled with cement bentonite grout.

Stantec installed 30 piezometers and 2 slope inclinometers for Ash Pond 1 & 2 as a part of the overall stability evaluation to provide data on piezometric levels and movement within the existing dikes and native foundation soils. Stantec also installed 28 piezometers for the Consolidated Waste Dry Stack to provide data on piezometric levels within the sluiced ash beneath the dry stack and native foundation soils for this facility. Piezometer construction consisted of one-inch diameter Schedule 40 PVC, well screen, and riser pipe. The annular backfill consisted of a sand filter pack to some distance above the screened interval followed by a bentonite seal. After allowing the bentonite to hydrate, the remaining annulus was backfilled with cement-bentonite grout tremmied into place. Flush-mounted or riser-type protective covers were set in concrete to protect the piezometers and inclinometers. These instruments were monitored by Stantec through May 2010.

An engineer/geologist was present with each drill crew throughout the drilling operations. The engineer/geologist directed the drill crews, logged the subsurface materials encountered during the exploration, and collected samples. Particular attention was given to the material's color, texture, moisture content, and consistency or relative density. The samples extracted from the borings were transported to Stantec laboratories for testing. Some samples were also transported to GeoTesting Express, Inc. laboratories in Alpharetta, Georgia for testing.

In the laboratory, SPT samples were subjected to natural moisture content determination in accordance with ASTM D 2216. Selected SPT samples were also combined and subjected to soil classification tests that included Atterberg limits testing (ASTM D 4318), specific gravity tests (ASTM D 854) and sieve and hydrometer analyses (ASTM D 422). Select bulk samples were also collected and subjected to standard moisture-density (Proctor) testing (ASTM D 698). Undisturbed samples were extruded and subjected to unit weight determination, falling head permeability testing (ASTM D 5084), one dimensional consolidation testing (ASTM D2435), and consolidated undrained triaxial compression testing with pore pressure measurements (ASTM D 4767).

The results of the field and laboratory testing services were used to develop cross-sections for slope stability and seepage analyses. Based on the results of the field exploration, cross-section geometry, and the preliminary slope stability analyses, Stantec selected fourteen cross-sections to analyze (nine for the Ash Pond 2 dikes, two for the old Ash Pond 1 dike, and five for the Consolidated Waste Dry Stack).

5. Results of Geotechnical Exploration

5.1. Summary of Borings

Stantec developed a boring plan for the field exploration for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack after a review of historical information and existing site conditions. TVA survey personnel established boring locations and elevations. The boring layout plan is contained in Appendix G and boring logs are presented in Appendix A. A summary of the boring information is presented in Table 5.1 (all measurements are expressed in feet).

Table 5.1. Summary of Borings

Boring No.	Surface Elevation	Northing	Easting	Boring Termination Depth	Bottom of Hole Elevation
STN-1	326.9	317,797.70	1,112,894.71	37.0	289.9
STN-2	351.1	317,685.89	1,112,914.65	60.0	291.1
STN-3	351.2	317,685.06	1,112,908.87	60.0	291.2
STN-4	328.1	317,392.53	1,112,524.92	36.0	292.1
STN-5	351.6	317,333.36	1,112,605.34	60.0	291.6

Table 5.1. Summary of Borings

Boring No.	Surface Elevation	Northing	Easting	Boring Termination Depth	Bottom of Hole Elevation
STN-6	328.6	316,969.98	1,112,248.35	30.0	298.6
STN-7	Boring not drilled.				
STN-8	351.9	316,915.52	1,112,335.31	60.0	291.9
STN-8A	351.9	316,921.21	1,112,325.90	20.0	331.9
STN-8P	351.9	316,924.83	1,112,319.91	24.5	327.4
STN-9	328.6	316,418.46	1,112,301.70	33.5	295.1
STN-10	350.7	316,454.21	1,112,370.24	55.5	295.2
STN-11	327.3	315,974.74	1,112,535.84	32.3	295.0
STN-12	351.0	316,016.50	1,112,610.36	56.0	295.0
STN-13	350.8	316,012.54	1,112,611.83	20.0	330.8
STN-14	327.5	315,536.24	1,112,778.56	27.5	300.0
STN-15	350.5	315,586.82	1,112,855.70	51.0	299.5
STN-16	328.5	315,098.19	1,113,021.92	25.5	303.0
STN-17	350.3	315,137.42	1,113,091.63	47.0	303.3
STN-18	350.4	315,133.53	1,113,093.60	25.0	325.4
STN-19	328.5	314,652.04	1,113,265.95	21.9	306.6
STN-20	350.1	314,698.36	1,113,341.04	43.5	306.6
STN-21	349.7	314,231.64	1,113,471.65	45.5	304.2
STN-22	349.7	314,238.31	1,113,470.52	22.0	327.7
STN-23	349.0	313,495.53	1,113,645.65	44.0	305.0
STN-24	349.0	313,499.27	1,113,645.11	68.9	280.1
STN-25	349.9	312,778.59	1,113,804.66	41.5	308.4
STN-26	349.9	312,774.78	1,113,806.04	29.7	320.2
STN-27	349.4	312,133.86	1,114,170.06	37.5	311.9
STN-28	349.4	312,131.19	1,114,171.87	37.0	312.4
STN-29	Boring not drilled due to access restraints.				
STN-30	Boring not drilled due to access restraints.				
STN-31	327.0	314,432.30	1,117,155.39	36.0	291.0
STN-32	350.6	314,454.28	1,117,034.48	61.5	289.1
STN-32A	350.6	314,457.23	1,117,058.23	24.0	326.6
STN-32B	350.6	314,455.26	1,117,057.91	25.0	325.6
STN-32P	350.6	314,461.18	1,117,058.88	24.0	326.6
STN-33	327.6	314,954.00	1,117,204.67	36.5	291.1
STN-33-SI	327.4	314,949.58	1,117,204.80	36.0	291.4
STN-34	350.5	314,943.07	1,117,089.94	27.0	323.5
STN-35	350.7	314,938.34	1,117,090.74	61.5	289.2
STN-35-SI	350.2	314,947.72	1,117,089.80	60.0	290.2
STN-36	324.6	315,351.57	1,116,807.82	36.0	288.6
STN-37	351.3	315,250.60	1,116,750.94	61.5	289.8
STN-38	322.9	315,618.68	1,116,395.32	36.0	286.9
STN-39	350.5	315,524.60	1,116,324.97	30.0	320.5
STN-39A	350.5	315,541.32	1,116,337.61	25.0	325.5
STN-39B	350.5	315,538.57	1,116,334.63	14.5	336.0
STN-39C	350.5	315,533.05	1,116,333.74	9.0	341.5
STN-40	350.7	315,521.49	1,116,330.97	61.5	289.2
STN-41	326.6	315,894.30	1,115,966.79	36.0	290.6
STN-42	350.1	315,805.38	1,115,896.21	61.5	288.6

Table 5.1. Summary of Borings

Boring No.	Surface Elevation	Northing	Easting	Boring Termination Depth	Bottom of Hole Elevation
STN-43	327.4	316,162.64	1,115,545.71	36.0	291.4
STN-44	350.4	316,072.06	1,115,478.40	31.0	319.4
STN-45	350.8	316,070.97	1,115,485.44	61.5	289.3
STN-46	328.2	316,427.81	1,115,126.31	39.0	289.2
STN-47	350.5	316,346.29	1,115,063.75	60.0	290.5
STN-48	326.6	316,712.60	1,114,710.52	40.0	286.6
STN-49	350.5	316,611.94	1,114,653.63	60.0	290.5
STN-50	350.6	316,615.65	1,114,648.22	60.0	290.6
STN-50A	350.6	316,622.47	1,114,652.40	21.0	329.6
STN-50P	350.6	316,630.15	1,114,657.10	25.0	325.6
STN-51	325.7	316,984.36	1,114,289.89	36.0	289.7
STN-52	350.4	316,890.61	1,114,224.53	60.0	290.4
STN-53	326.0	317,251.66	1,113,870.22	36.0	290.0
STN-54	350.6	317,164.29	1,113,807.60	60.0	290.6
STN-55	350.2	317,161.11	1,113,811.71	60.0	290.2
STN-56	325.1	317,528.33	1,113,453.65	36.0	289.1
STN-57	350.4	317,429.25	1,113,392.39	60.0	290.4
STN-101	345.6	314,239.59	1,113,599.85	41.0	304.6
STN-102	375.9	314,242.14	1,113,701.41	55.0	320.9
STN-103	375.9	314,237.20	1,113,701.82	70.9	305.0
STN-104	411.3	314,242.09	1,113,825.68	91.5	319.8
STN-105	347.7	313,503.36	1,113,698.42	38.0	309.7
STN-105A	347.7	313,498.36	1,113,698.42	31.0	316.7
STN-106	375.3	313,516.57	1,113,784.54	53.5	321.8
STN-107	408.1	313,531.32	1,113,908.57	98.1	310.0
STN-108	350.3	312,796.11	1,113,871.67	40.0	310.3
STN-109	386.0	312,824.38	1,113,978.97	70.1	315.9
STN-110	385.9	312,829.42	1,113,977.17	76.1	309.8
STN-111	351.0	312,163.61	1,114,222.26	38.9	312.1
STN-112	381.8	312,209.67	1,114,305.60	71.0	310.8
STN-113	403.6	312,261.99	1,114,359.00	86.5	317.1
STN-114	349.6	312,043.43	1,114,723.51	38.6	311.0
STN-115	388.2	312,148.78	1,114,670.38	60.0	328.2
STN-116	388.2	312,151.06	1,114,675.00	77.0	311.2
STN-117	348.1	312,849.17	1,115,060.52	37.0	311.1
STN-118	348.2	312,843.34	1,115,059.61	65.3	282.9
STN-119	380.9	312,857.74	1,114,949.90	68.5	312.4
STN-120	380.8	312,862.75	1,114,950.57	59.7	321.1
STN-121	405.6	312,853.82	1,114,867.54	86.5	319.1
STN-122	360.0	313,845.00	1,114,860.16	48.5	311.5
STN-123	386.3	313,861.58	1,114,760.17	75.5	310.8
STN-124	413.9	313,889.25	1,114,655.68	105.2	308.7
STN-125	444.5	313,973.57	1,114,166.63	133.0	311.5
STN-126	441.9	313,245.28	1,114,516.15	131.0	310.9
STN-127	441.4	312,463.74	1,114,532.22	130.0	311.4
STN-128	348.5	315,914.33	1,115,215.99	58.0	290.5
STN-128A	348.5	315,910.33	1,115,215.99	45.0	303.5

Table 5.1. Summary of Borings

Boring No.	Surface Elevation	Northing	Easting	Boring Termination Depth	Bottom of Hole Elevation
STN-128B	348.5	315,906.33	1,115,215.99	42.0	306.5
STN-129	349.3	315,283.90	1,116,404.12	58.0	291.3
STN-129A	349.3	315,275.92	1,116,404.53	54.0	295.3

5.2. Subsurface Conditions

Using the boring logs and laboratory tests from this geotechnical exploration, the boring information contained in previous geotechnical studies at the facility, TVA design drawings, old contour maps, and other historical information, Stantec developed a general profile for each stability cross-section at Ash Pond 1 & 2 and the Consolidated Waste Dry Stack. The general profiles depict predominant material horizons (or “layers”) that are described below in sequence of descending lithology. The stability sections contained in Appendix G show these layers in graphical manner. In addition, the graphical logs shown on the stability sections also depict the material Unified Soil Classification System (USCS) classifications. The classifications are based on a combination of laboratory test results and visual observations where samples were not selected for such testing. The subsurface logs presented in Appendix A include more detailed descriptions of the materials encountered at the specific boring locations.

5.2.1. Ash Pond 2

The “Upper Dike” extends upwardly from approximate El. 340 feet (crest of initial starter dike) to approximate El. 351 feet (current crest) and represents the most recent dike raising which occurred in 1979. The upper dike materials are clay soils with USCS classifications of CL, and with textural descriptions of lean clay, lean clay with sand and sandy lean clay. The clays are moist in moisture content and predominately reddish brown or gray in color, with occasional gray mottling. Based on SPT N-values and laboratory strength testing, the upper dike clays have strength consistencies ranging from stiff to very stiff with isolated medium stiff zones.

The “Lower Dike” extends upwardly from original native ground to approximate El. 340 feet (crest of the initial dike construction) and represents the initial dike constructed in 1970. The lower dike materials are clay soils with USCS classifications of mostly CL and textural descriptions of lean clay, sandy lean clay and lean clay with sand. In one instance, a thin sand horizon was encountered within the lower dike with a USCS classification of SP-SM and a textural description of poorly graded sand with silt. This sand horizon was brown in color, moist, and medium dense in strength consistency. The clays are mostly moist in moisture content with some isolated wet zones encountered and predominantly brown to gray in color. Based on SPT N-values and laboratory strength testing, the lower dike clays have strength consistencies ranging mostly from medium to very stiff, with a few isolated instances of very soft to soft consistencies.

Below the “Lower Dike” material, “Native Clay” and/or “Native Silt” was encountered extending downwardly to varying depths. In a few instances, native clays and/or silts were interbedded within the lower sands while in other instances, native sands were encountered below the lower dike with no native clays being encountered. Based on laboratory tests and on visual classifications, the “Native Clay” has USCS classifications of CL and textural descriptions of lean clay, lean clay with sand and sandy lean clay. The “Native Silt” has classifications of ML with textural descriptions of sandy silt and silt. The “Native Silt” is typically less predominant. These horizons are typically brown and gray in color, and moist to wet in moisture content. Based on SPT N-values and laboratory strength testing, the clays and silts have strength consistencies ranging mostly from soft to very stiff.

Below the “Native Clay” and “Native Silt” horizons, “Native Sand” and “Native Sand and Gravel” were encountered. In a few borings, native sands were encountered immediately below the lower dike. The “Native Sand” has USCS classifications of SM, SP and SP-SM and textural descriptions of poorly graded sand, poorly graded sand with silt, poorly graded sand with gravel, poorly graded sand with silt and gravel, and silty sand. The “Native Sand and Gravel” has classifications of GW-GM with a textural description of well graded gravel with silt and sand. The “Native Sand and Gravel” is typically less predominant and encountered at greater depths. These horizons are mostly described as brown to gray in color and moist to wet in moisture content. Based on SPT N-values, the native sands and native sands and gravel have relative densities ranging mostly from medium dense to very dense with isolated very loose and loose zones also being present in areas.

Hydraulically placed (sluiced) fly ash and bottom ash were also encountered beneath the upper dike in borings drilled through the crest. The ash was typically encountered below El. 340 feet and extended to an average depth of approximately 15 feet below the upper dike. The borings typically encountered sluiced bottom ash overlying sluiced fly ash. Historical documents indicate that the pond was also used for disposal of fly ash in the past, in addition to the current bottom ash disposal. Classification testing performed on selected bottom ash samples resulted in USCS classifications of SM with a textural description of silty sand with gravel. Classification testing performed on selected fly ash samples resulted in a USCS classification of ML with a textural description of silt with sand. The ash materials are black in color and moist to wet in moisture content. SPT N-values indicate mostly loose to medium relative densities for the bottom ash with isolated dense zones also present, and very soft to medium stiff strength consistencies for the fly ash with isolated stiff and very stiff zones.

It should be noted that materials matching the “slime layer” as described in AECOM’s findings relative to the failure at the Kingston Fossil Plant were not encountered during this study. These “slime” materials (as described by AECOM) are typically thin laminated layers of silt and fly ash that contain unusual index properties such as very high moisture contents and very high liquidity indices.

5.2.2. Ash Pond 1 and Consolidated Waste Dry Stack

“Clay Cover” represents a thin horizon of materials used to cover the old Ash Pond 1 and dike and existing/closed portion of the Consolidated Waste Dry Stack to the south. Based on laboratory tests and on visual classifications, the “Clay Cover” has USCS classifications of CL and ML with textural descriptions of lean clay, sandy lean clay, sandy silt and silt. The horizon is typically brown and gray in color, and moist in moisture content. Based on SPT N-values, the clays and silts have strength consistencies ranging mostly from soft to very stiff.

“Stacked Ash” represents landfilled dry fly and bottom ash that has been placed within the limits of the Ash Pond 1 perimeter dikes above the sluiced ash (sluiced ash initially deposited in this area until 1970). Dry ash was placed over the old Ash Pond 1 beginning in 1984 with the original portions of the stack fully built-out and closed along the south portion in the late 1990s. Current disposal activity is to the north within the horizontal stack expansion area designed in 2006. This expansion area extends the original stack over portions of Ash Pond 2 and the Inactive Dredge Cell to the north and west. The bottom of the stacked ash is located at about El. 342 feet to El. 352 feet and the top is currently at about El. 445 feet at the highest point along the closed south side. The stacked ash consists of both bottom and fly ash with a USCS classification of ML, with textural descriptions of silt and silt with sand. The ash materials are black in color and moist to wet in moisture content. The moisture content typically increases near the bottom of the stacked ash. Based on SPT N-values and laboratory testing, the stacked ash has strength consistencies typically ranging primarily from medium to very stiff, with some zones of lesser strength consistencies also being encountered.

The “Ash Dike” materials represent the materials used to construct the perimeter dike system for Ash Pond 1. The pond was constructed by building dikes on the north and west sides using ash and the pond tied into existing grade along the south and east sides. One dike raising using ash was reported in 1967. The only dike visible in this area is the west dike and it consists of 15 to 20 foot tall ash dikes with a crest elevation between about 345 and 350 feet. The dike materials consist of both bottom and fly ash with USCS classifications of ML, and a textural description of silt. The ash dike materials are typically moist to wet in moisture content and black to gray in color. Based on SPT N-values and laboratory testing, the ash dike has strength consistencies ranging mostly from very soft to medium stiff, with a few isolated instances of stiff to very stiff consistencies.

Hydraulically placed “Sluiced Ash” was encountered beneath the stacked ash inside the perimeter dike system. The ash was placed prior to 1970 when the disposal area originally operated as a dredge cell. The sluiced ash was typically encountered at approximate EL. 340 to EL. 346 feet, and is mostly about 20 to 30 feet thick. Classification testing performed on selected sluiced ash samples resulted in USCS classifications of ML and SM, with textural descriptions of silt, silt with sand, and silty sand. The ash materials are black in color and moist to wet in moisture content. SPT N-values and laboratory strength testing indicate very soft to medium stiff strength consistencies with isolated zones of stiff to very stiff consistency also being encountered.

Below the perimeter dike and ash materials, “Native Clay” and “Native Silt” materials were encountered followed at greater depth by “Native Sand” and “Native Sand and Gravel”. These horizons have similar characteristics as those encountered within the Ash Pond 2 area. Refer to the descriptions provided in 5.2.1. for more detailed information relative to these horizons.

In addition, similar to the conditions encountered at Ash Pond 2, it should be noted that materials matching the “slime layer” as described in AECOM’s findings relative to the failure at the Kingston Fossil Plant were not encountered within the Ash Pond 1 and Consolidated Waste Dry Stack areas.

5.3. Phreatic Conditions

At select boring locations, piezometers were installed to measure pore water pressures. In general, initial piezometer readings were taken at approximate monthly intervals. Stantec completed the final set of readings associated with this study in May 2010. Refer to Appendix B for piezometer installation details and readings (up to most recent set of readings). Piezometer locations and tip elevations are summarized in Table 5.2 below.

Table 5.2. Summary of Piezometers

Boring No.	Concrete Pad Elevation (Feet)	Piezometer Tip Elevation (Feet)
STN-1	326.9	290.4 (native clay/silt)
STN-3	351.2	291.3 (native clay)
STN-6	328.6	298.7 (native sand)
STN-8	351.9	292.0 (native sand)
STN-8P	351.9	327.5 (lower dike)
STN-11	327.3	295.3 (native sand)
STN-12	351.0	296.0 (native silt/sand)
STN-13	350.8	331.8 (lower dike)
STN-16	328.5	303.5 (native sand)
STN-17	350.3	304.3 (native sand)
STN-18	350.4	326.4 (lower dike)
STN-21	349.7	304.3 (native sand)
STN-22	349.7	328.2 (ash dike)
STN-23	349.0	305.5 (native sand)
STN-25	349.9	308.9 (native sand/gravel)
STN-26	349.9	321.9 (ash dike)
STN-27	349.4	312.4 (native sand)
STN-32P	350.6	327.6 (lower dike)
STN-33	327.6	291.6 (native sand)
STN-35	350.7	292.7 (native sand)
STN-38	322.9	287.9 (native sand)
STN-39A	350.5	326.5 (lower dike)
STN-40	350.7	290.7 (native sand)
STN-43	327.4	291.9 (native sand)
STN-45	350.8	290.3 (native sand)
STN-48	326.6	287.1 (native sand)
STN-50	350.6	290.7 (native sand)

Table 5.2. Summary of Piezometers

Boring No.	Concrete Pad Elevation (Feet)	Piezometer Tip Elevation (Feet)
STN-50P	350.6	326.6 (lower dike)
STN-53	326.0	290.5 (native sand)
STN-55	350.2	290.3 (native sand)
STN-101	345.6	305.1 (native sand/gravel)
STN-102	375.9	321.9 (sluiced ash)
STN-103	375.9	306.9 (native sand)
STN-104	411.3	321.3 (sluiced ash)
STN-105	347.7	309.9 (native sand)
STN-106	375.3	323.2 (sluiced ash)
STN-107	408.1	310.1 (native sand)
STN-108	350.3	310.5 (native sand)
STN-109	386.0	316.0 (sluiced ash)
STN-110	385.9	309.9 (native sand)
STN-111	351.0	312.2 (native sand)
STN-112	381.8	312.8 (native sand)
STN-113	403.6	319.3 (sluiced ash)
STN-114	349.6	311.1 (native clay)
STN-115	388.2	328.4 (sluiced ash)
STN-116	388.2	313.7 (native silt)
STN-117	348.1	311.3 (native sand)
STN-119	380.9	314.4 (native clay)
STN-120	380.8	322.8 (sluiced ash/native clay)
STN-121	405.6	320.4 (native clay)
STN-122	360.0	312.0 (native clay)
STN-123	386.3	313.3 (sluiced ash)
STN-124	413.9	308.8 (native sand/sluiced ash)
STN-125	444.5	314.5 (native sand)
STN-126	441.9	313.9 (sluiced ash)
STN-127	441.4	311.5 (native silt/sand)
STN-128	348.5	290.6 (native sand)
STN-129	349.3	291.4 (native sand)

Several sets of piezometer readings have been obtained and reviewed throughout the course of this geotechnical evaluation. Readings were obtained on monthly intervals following installation. Based on piezometer data and on observations, the following trends and observations can be made regarding groundwater within the Ash Pond 1 & 2 dikes and the Consolidated Waste Dry Stack area.

- Along Ash Pond 2, the series of readings to date have shown that water levels within the piezometers set within the native soils have fluctuated with the adjacent Ohio River levels. These fluctuations are likely attributed to the fairly permeable nature of the native soil deposits and the close proximity to the Ohio River. The series of readings for the piezometers set within the dikes have shown that water levels have remained fairly consistent and at higher elevations within the dikes, with only slight fluctuations being observed. These fluctuations are likely attributed to equalization of the water level within the piezometers over time. However, it should be noted that water levels can also fluctuate due to the seasons, precipitation events, and other factors.

- Along the old Ash Pond 1 dike, the series of readings to date have shown that water levels within the piezometers set within the dike have remained fairly consistent and at higher elevations than those piezometers set within the native soils. Little fluctuation has been observed in either set of piezometers.

- Phreatic levels indicated by readings from piezometers installed within the sluiced ash beneath the Consolidated Waste Dry Stack are typically very similar to the readings taken from adjacent piezometers that have been installed within native materials. The readings indicate that groundwater is generally within the sluiced ash and little fluctuation was observed between readings. This indicates that the groundwater beneath the stack within the old Ash Pond 1 does not appear to be hydraulically connected to groundwater outside the dikes and stack area but is likely recharged by precipitation events and/or the adjacent Ash Pond 2.

5.4. Slope Inclinometers

Slope inclinometers were installed in borings STN-33-SI and STN-35-SI to monitor any current or future movement within the Ash Pond 2 dike. Slope inclinometers were installed at these initial locations along the northeast corner of the pond due to the reported seepage in this area over the years and the potential for instability as a result of this seepage. Slope inclinometer readings were obtained soon after installation of the slope inclinometer casing so that a baseline reading could be established. Readings were then taken monthly along with the piezometers installed throughout the Ash Ponds and Consolidated Waste Dry Stack. Based on the readings taken to date, there has been no significant movement in either of the slope inclinometers installed along the northeast portion of the dike for Ash Pond 2. Refer to Appendix B for inclinometer installation details and readings (up to most recent set of readings).

6. Laboratory Testing

6.1. General

The results of laboratory testing performed are included within the appendices. ASTM testing specifications were observed. In particular, natural moisture content test results are shown on the attached boring logs in Appendix A and are also shown on the drafted stability sections in Appendix G. The results of the classification testing, moisture-density testing, shear strength testing, consolidation testing, and permeability testing are included in Appendix C. The USCS classifications associated with each horizon are also discussed in Section 5.2 above. No further discussion relative to the results of moisture content and classification testing are provided in this section. The discussion that follows is limited to the laboratory testing associated with evaluation of the dike compaction characteristics and shear strengths of the cohesive soil horizons and ash materials.

6.2. Cohesive Soils/Undisturbed (Shelby) Tube Samples

The borings drilled for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack included 3-inch diameter undisturbed (Shelby) tube sampling within cohesive soil horizons and within stacked and sluiced ash. Stantec's and GeoTesting Express, Inc. laboratories extruded the tubes and trimmed 6-inch long specimens. Lab personnel determined visual classifications, unit weights (wet and dry), and natural moisture for each 6-inch specimen prior to submitting a summary of the extruded specimens to a geotechnical engineer for assignment of lab testing. Select 6-inch specimens extruded from Shelby tubes were then subjected to consolidated-undrained (CU) triaxial testing, one-dimensional consolidation testing, and permeability testing. The results of these tests are included in Appendix C and discussed below. It should be noted that higher quantities of silt and sand were encountered within the majority of the cohesive samples obtained within the ash dike and stack materials. As a result, several of the samples obtained from these horizons were too friable to trim for testing and the resulting number of test specimens was reduced.

6.2.1. Consolidated Undrained (CU) Triaxial Testing

Stantec performed CU triaxial testing with pore pressure measurements on selected 6-inch long specimens extruded from 3-inch diameter Shelby tubes obtained during drilling. CU testing provides indicators of effective-stress and total-stress shear strength parameters for slope stability analyses. The results of the CU triaxial tests are presented on the stability sections in Appendix G, and are summarized in Table 6.1. The stress path envelopes derived from CU triaxial testing are also presented in Appendix C.

Table 6.1. Summary of Consolidated – Undrained Triaxial Testing

Boring No.	Sample Interval (feet)	Soil Horizon	CU Triaxial Strength c' (psf)	CU Triaxial Strength φ' (degrees)	CU Triaxial Strength c (psf)	CU Triaxial Strength φ (degrees)
STN-3	28.1 – 28.7	Native Clay	8	31.9	252	24.1
	28.7 – 29.3					
	29.3 – 29.9					
STN-8	5.2 – 5.8	Upper Clay Dike	382	29.9	878	28.7
	5.8 – 6.4					
	10.4 – 11.0					
STN-8P	18.6 – 19.1	Lower Clay Dike	80	30.2	500	21.8
	22.6 – 23.1					
STN-12	25.1 – 25.6	Native Clay	103	33.9	259	18.5
	25.7 – 26.2					
STN-12	4.6 – 5.1	Upper Clay Dike	1,200	23.7	1,400	14.6
	5.2 – 5.7					
STN-15	4.6 – 5.1					
STN-12	16.4 – 16.9	Lower Clay Dike	0	34.2	380	20.5
STN-17	16.1 – 16.6					
STN-17	7.7 – 8.2	Upper Clay Dike	0	40.0	576	28.0
	11.3 – 11.8					
STN-17	16.7 – 17.2	Lower Clay Dike	82	35.8	187	28.0
	24.1 – 24.6					
	24.7 – 25.2					
STN-17	35.6 – 36.1	Native Clay	163	32.3	317	24.5
	40.1 – 40.6					
	40.7 – 41.2					
STN-21	9.1 – 9.6	Ash Dike	0	35.8	500	15.4
STN-25	29.1 – 29.6					
STN-21	34.5 – 35.0	Native Clay	0	35.8	800	20.5
	35.1 – 35.6					
	35.7 – 36.2					
STN-23	25.1 – 25.6	Ash Dike	400	28.7	1,900	3.4
	25.7 – 26.2					
STN-32A	7.1 – 7.6	Upper Clay Dike	600	28.4	800	20.6
	7.7 – 8.2					
	12.1 – 12.6					
STN-32B	19.1 – 19.6	Lower Clay Dike	480	24.1	700	13.9
STN-32A	22.1 – 22.6					
	22.7 – 23.2					
STN-33-SI	8.1 – 8.6	Native Clay	420	29.6	1,656	15.0
	8.6 – 9.2					
	9.2 – 9.8					
STN-39	4.8 – 5.4	Upper Clay Dike	432	34.1	1,670	33.8
	5.4 – 6.0					
	6.9 – 7.8					
STN-39	26.8 – 27.3	Native Clay	4	35.5	288	26.0
	28.7 – 29.3					

Table 6.1. Summary of Consolidated – Undrained Triaxial Testing

Boring No.	Sample Interval (feet)	Soil Horizon	CU Triaxial Strength c' (psf)	CU Triaxial Strength ϕ' (degrees)	CU Triaxial Strength c (psf)	CU Triaxial Strength ϕ (degrees)
STN-39	29.3 – 30.0	Native Clay	4	35.5	288	26.0
STN-39A	20.1 – 20.6	Lower Clay Dike	180	25.7	360	18.2
	21.1 – 21.6					
	21.7 – 22.2					
STN-50	29.4 – 30.0	Native Clay	300	30.3	360	28.6
	38.6 – 39.2					
STN-50P	4.1 – 4.6	Upper Clay Dike	960	27.0	1,000	17.7
	4.7 – 5.2					
	6.0 – 6.5					
STN-50P	19.6 – 20.1	Lower Clay Dike	60	33.0	160	20.6
	20.2 – 20.7					
	21.6 – 22.1					
STN-101	20.1 – 20.6	Sluiced Ash	40	38.6	400	27.4
	20.7 – 21.2					
STN-105A	25.1 – 25.6	Native Clay	80	36.1	300	22.1
	25.7 – 26.2					
	26.3 – 26.8					
STN-108	28.2 – 28.7	Sluiced Ash	160	35.3	500	18.3
	28.8 – 29.3					
STN-110	40.1 – 40.6	Sluiced Ash	0	35.8	1,600	22.4
	40.7 – 41.2					
STN-111	31.1 – 31.6	Native Silt	580	33.7	1,600	22.1
	31.6 – 32.2					
	32.3 – 32.8					
STN-114	5.2 – 5.8	Sluiced Ash	520	29.5	1,400	18.8
	5.9 – 6.4					
	9.6 – 10.1					
STN-114	28.1 – 28.6	Native Silt	340	31.4	700	19.9
	28.7 – 29.2					
	29.3 – 29.8					
STN-116	15.6 – 16.1	Stacked Ash	0	36.7	200	27.7
STN-118	26.2 – 26.7	Native Clay	640	33.7	800	29.4
	26.8 – 27.3					
STN-122	5.2 – 5.7	Stacked/Sluiced Ash	740	32.2	1,400	21.5
	20.1 – 20.6					
	20.7 – 21.2					
STN-128A	10.1 – 10.6	Sluiced Ash	0	36.3	1,000	24.5
	10.7 – 11.2					
	11.3 – 11.8					
STN-128B	39.1 – 39.6	Native Clay	60	33.5	200	21.8
	39.7 – 40.2					
	40.3 – 40.8					

6.2.2. Permeability Testing

The following table summarizes the testing results from the falling head permeability testing. Permeability values are used in seepage analyses.

Table 6.2. Summary of Falling Head Permeability Testing

Boring No.	Sample Interval (feet)	Soil Horizon	Permeability (cm/sec)
STN-8P	6.0-8.0	Upper Clay Dike	2.4 E-09
STN-9	9.7-10.2	Native Clay	2.0 E-08
STN-10	7.5-9.5	Upper Clay Dike	5.3 E-09
STN-10	20.0-22.0	Lower Clay Dike	1.4 E-08
STN-20	10.6-11.1	Upper Clay Dike	3.2 E-08
STN-20	34.1-34.6	Native Clay	2.0 E-07
STN-23	27.0-27.5	Native Clay	1.9 E-07
STN-25	29.8-30.3	Ash Dike	1.3 E-07
STN-28	30.1-30.6	Native Clay	1.8 E-04
STN-32A	3.0-5.0	Upper Clay Dike	5.2 E-09
STN-32B	23.0-25.0	Lower Clay Dike	6.4 E-09
STN-33-SI	16.0-16.3	Native Clay	4.4 E-08
STN-35	37.5-37.8	Native Clay	3.7 E-08
STN-39	4.5-4.8	Upper Clay Dike	7.4 E-08
STN-39A	19.0-21.0	Lower Clay Dike	6.1 E-09
STN-50	8.7-9.0	Upper Clay Dike	5.9 E-08
STN-50	38.2-38.5	Native Clay	5.1 E-08
STN-50P	17.5-19.5	Lower Clay Dike	7.1 E-09
STN-105A	23.1-23.6	Sluiced Ash	6.3 E-05
STN-105A	29.0-31.0	Native Clay	9.2 E-08
STN-106	15.0-17.0	Stacked Ash	8.2 E-05
STN-111	38.0-40.0	Native Sand	8.3 E-05
STN-114	4.5-6.1	Sluiced Ash	3.21 E-05

Table 6.2. Summary of Falling Head Permeability Testing

Boring No.	Sample Interval (feet)	Soil Horizon	Permeability (cm/sec)
STN-114	33.0-34.0	Native Clay	5.6 E-08
STN-122	34.0-36.0	Sluiced Ash	3.0 E-05
STN-128A	20.0-22.0	Sluiced Ash	1.6 E-05
STN-128B	41.0-42.0	Native Clay	5.1 E-06

6.3. Moisture-Density Relationships

Bag samples were obtained of materials associated with the upper and lower clay dikes, the ash dike, and the stacked ash. The results of the standard moisture-density tests performed on these samples are summarized in Table 6.3.

Table 6.3. Standard Moisture-Density (Proctor) Test Results

Sample Location	Sample Depth Interval (feet)	Location	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
STN-5	4.0’ – 8.0’	Upper Dike	118.2	13.1
STN-8P	20.0’ – 24.5’	Lower Dike	117.1	12.1
STN-12	4.0’ – 6.0’	Upper Dike	114.9	14.7
STN-13	16.0’ – 20.0’	Lower Dike	113.7	11.6
STN-23	15.0’ – 18.0’	Ash Dike	92.2	19.8
STN-32P	18.0’ – 20.0’	Lower Dike	113.4	15.0
STN-37	8.0’ – 10.0’	Upper Dike	119.1	11.7
STN-50P	16.0’ – 19.0’	Lower Dike	109.3	17.0
STN-52	4.0’ – 10.0’	Upper Dike	118.4	13.1
STN-109	12.0’ – 25.0’	Stacked Ash	71.2	35.4
STN-123	10.0’ – 12.0’	Stacked Ash	75.7	29.5

Following completion of the moisture-density testing, undisturbed samples taken within dike and ash materials were extruded and unit weight and moisture content determinations were made in association with triaxial shear strength testing. The results of the unit weight and moisture content determinations for triaxial test samples are shown in Table 6.4. A comparison between the moisture-density test results and the unit weight determinations obtained from the undisturbed samples are also included. The comparison was made by using the moisture-density test results that were nearest to the undisturbed sample locations (and which also had like classifications) to estimate relative compaction.

Table 6.4. Comparison Between Undisturbed Sample Conditions and Moisture-Density Test Results

Boring Location	Sample Depth Interval (feet)	Location	Unit Weight Dry (pcf)	Moisture Content (%)	Maximum Dry Density (pcf)	Percent Maximum Dry Density (%)	Optimum Moisture Content (%)	Moisture Content Variation (%)
STN-8	5.2-5.8	Upper Dike	112.9	14.3	118.2	95.5	13.1	+1.2
STN-8	5.8-6.4	Upper Dike	112.7	15.6	118.2	95.3	13.1	+2.5
STN-8	10.4-11.0	Upper Dike	110.8	14.6	118.2	93.7	13.1	+1.5
STN-8P	18.6-19.1	Lower Dike	110.8	18.2	117.1	94.6	12.1	+6.1
STN-8P	22.6-23.1	Lower Dike	113.8	13.8	117.1	97.2	12.1	+1.7
STN-12	4.6-5.1	Upper Dike	114.2	15.7	114.9	99.4	14.7	+1.0
STN-12	5.2-5.7	Upper Dike	114.3	15.7	114.9	99.5	14.7	+1.0
STN-15	4.6-5.1	Upper Dike	119.5	13.2	114.9	100+	14.7	-1.5
STN-12	16.4-16.9	Lower Dike	110.1	19.0	113.7	96.8	11.6	+7.4
STN-17	16.1-16.6	Lower Dike	105.2	21.9	113.7	92.5	11.6	+10.3
STN-17	7.7-8.2	Upper Dike	116.5	15.8	114.9	100+	14.7	+1.1
STN-17	11.3-11.8	Upper Dike	115.4	15.1	114.9	100+	14.7	+0.4
STN-17	16.7-17.2	Lower Dike	102.9	23.9	113.7	90.5	11.6	+12.3
STN-17	24.1-24.6	Lower Dike	99.9	26.1	113.7	87.9	11.6	+14.5
STN-17	24.7-25.2	Lower Dike	115.3	16.0	113.7	100+	11.6	+4.4
STN-21	9.1-9.6	Ash Dike	109.9	17.7	92.2	100+	19.8	-2.1
STN-25	29.1-29.6	Ash Dike	87.0	31.0	92.2	94.4	19.8	+11.2
STN-23	25.1-25.6	Ash Dike	98.9	21.5	92.2	100+	19.8	+1.7
STN-23	25.7-26.2	Ash Dike	100.2	25.2	92.2	100+	19.8	+5.4
STN-32A	7.1-7.6	Upper Dike	113.4	13.4	119.1	95.2	11.7	+1.7
STN-32A	7.7-8.2	Upper Dike	115.4	15.4	119.1	96.9	11.7	+3.7
STN-32A	12.1-12.6	Upper Dike	112.1	15.1	119.1	94.1	11.7	+3.4
STN-32A	22.1-22.6	Lower Dike	100.4	24.2	113.4	88.5	15.0	+9.2
STN-32A	22.7-23.2	Lower Dike	102.3	23.0	113.4	90.2	15.0	+8.0
STN-32B	19.1-19.6	Lower Dike	108.1	19.1	113.4	95.3	15.0	+4.1
STN-39	4.8-5.4	Upper Dike	121.8	14.2	119.1	100+	11.7	+2.5
STN-39	5.4-6.0	Upper Dike	114.8	16.9	119.1	96.4	11.7	+5.2
STN-39	6.9-7.8	Upper Dike	119.6	14.5	119.1	100+	11.7	+2.8
STN-39A	20.1-20.6	Lower Dike	102.8	22.5	109.3	94.1	17.0	+5.5
STN-39A	21.1-21.6	Lower Dike	98.5	23.9	109.3	90.1	17.0	+6.9
STN-39A	21.7-22.2	Lower Dike	107.9	19.5	109.3	98.7	17.0	+2.5
STN-50P	4.1-4.6	Upper Dike	112.7	15.2	118.4	95.2	13.1	+2.1
STN-50P	4.7-5.2	Upper Dike	117.4	14.5	118.4	99.2	13.1	+1.4
STN-50P	6.0-6.5	Upper Dike	114.8	15.3	118.4	97.0	13.1	+2.2
STN-50P	19.6-20.1	Lower Dike	100.5	22.2	109.3	91.9	17.0	+5.2
STN-50P	20.2-20.7	Lower Dike	98.8	25.3	109.3	90.4	17.0	+8.3
STN-50P	21.6-22.1	Lower Dike	104.8	21.1	109.3	95.9	17.0	+4.1

Along Ash Pond 2, the existing in-situ dry densities were determined to range from about 94 percent to greater than 100 percent of the standard Proctor dry densities for the upper clay dike materials and from about 88 percent to greater than 100 percent for the lower clay dike materials with most being 93 or greater. The corresponding moisture values were mostly in the range of about minus 1 to 5 percent above the optimum moisture value for the upper clay dike and from about 2 to 15 percent above the optimum moisture value for the lower clay dike. The higher moisture values and corresponding lower densities in the lower dike materials are likely attributed to the dike materials being saturated by long-term steady-state seepage conditions. In general, this data indicates that the dike materials appear to have been compacted in a controlled manner when compared to typically accepted target densities of 95 percent or greater for compacted clay soils in an earth dike. However, it should be noted that no construction documentation has been provided to confirm this comparison.

Along the old Ash Pond 1 dike, the existing in-situ dry densities were determined to range from about 94 percent to greater than 100 percent of the standard Proctor dry densities for the ash dike materials. The corresponding moisture values were mostly in the range of about minus 2 to 11 percent above the optimum moisture value. The higher moisture values are likely attributed to the dike materials being saturated by long-term seepage of trapped water from within the abandoned pond. In general, this data indicates that the dike materials appear to have been compacted in a controlled manner; however, no construction documentation has been provided to confirm this comparison.

6.4. One Dimensional Consolidation Test Samples

Stantec selected Shelby tube samples for one-dimensional consolidation testing to provide void ratios to aid in calculation of critical gradients to determine factors of safety against piping from the seepage analyses and to provide data for future settlement analyses, if performed during closure design. Void ratios are presented on the consolidation test summary sheets presented in Appendix C. No settlement analyses were performed for this study.

6.5. Standard Penetration Test Samples

Recovered soil specimens from SPT sampling were subjected to natural moisture content determinations and select samples were combined for engineering classification testing. The engineering classification testing consisted of Atterberg limits, specific gravity, and sieve and hydrometer analyses. The results of the classification testing were used in conjunction with the N-values from SPT's to estimate soil strength based on published correlations of such data. The results of the moisture content tests and classification testing are included on the boring logs and stability section drawings in Appendixes A and G, respectively. Soil classification summaries are also provided in Appendix C.

7. Engineering Analysis

7.1. General

Geotechnical engineering analyses included evaluations of strength and permeability parameters, seepage analyses, and slope stability analyses. Prior to beginning the analyses, the geotechnical data and cross-sections were combined and the geometry of the existing dikes, dry stack and soil horizons were approximated using current and historical information. Once the geometry of the sections was approximated, each section was reviewed and evaluated to determine the critical cross-sections for analyses. Selection of critical sections was based on the steepness of slopes, heights of dikes, geometry of the sections, phreatic surface, seepage conditions, and subsurface conditions. Based on this evaluation, nine representative cross-sections were selected for analyses along Ash Pond 2

(Sections A-A’, C-C’, E-E’, F-F’, H-H’, N-N’, P-P’, R-R’, and U-U’) and five cross-sections were selected for analyses along Ash Pond 1 and the Consolidated Waste Dry Stack (Sections J-J’, K-K’, Y-Y’, Z-Z’, and AA-AA’). The locations of the sections are shown on the layout drawing presented in Appendix G and on Figure 2.1. Results of the analyses and evaluations are summarized in the following paragraphs, and are shown on drawings/computer output provided in Appendices F and G.

It should be noted that construction records indicating the methods used to construct dikes, as-built dike configurations, etc. were not available for review. As a result, assumptions and generalizations in soil parameters and section geometry were needed to construct the seepage and stability models.

7.2. Soil Horizons

Based on the results of the drilling, laboratory testing, historical documentation, and drawings, the materials on site were divided into different soil layers for seepage and stability analyses. Refer to the stability sections in Appendix G for locations of the soil horizons. The soil horizons are briefly described as follows (refer to Sections 5.2.1 and 5.2.2 for further descriptions):

Ash Pond 2

- *Upper Dike:* This represents the material used for the 1979 construction of the raised dikes. Historical data shows that this dike was constructed to a crest of El. 351 feet above the initial “lower dike” and over sluiced ash. Historical data also shows that this dike was constructed with interior side slopes of 2H:1V and exterior side slopes of 2.5:1V to 3H:1V.

- *Lower Dike:* This represents the material used for construction of the initial perimeter dike constructed in 1970. Historical data shows that this dike was constructed to a crest of El. 340 feet, with interior side slopes of 2H:1V to 2.5H:1V and exterior side slopes of about 3H:1V and transitioning to 6H:1V below approximate El. 335 feet. The majority of the initial dike construction occurred along the north and west sides and tied into the existing Ash Pond 1 dikes or into existing grade at either end.

- *Native Clay and/or Native Silt:* This represents the uppermost layers of native clay and/or silty materials beneath the perimeter dikes and pond.

- *Native Sand and/or Native Sand and Gravel:* This represents horizons of alluvial silty and clayey sand and gravel that were encountered in some instances below the native clay/silt materials.

- *Hydraulically Placed (sluiced) Ash:* This represents sluiced bottom ash/fly ash that is contained by the upper and lower dikes.

Ash Pond 1 and Consolidated Waste Dry Stack

- *Clay Cover:* This represents clay materials used to cover the Ash Pond 1 and dike and existing/closed portion of the Consolidated Waste Dry Stack to the south.

- *Stacked Ash:* This represents landfilled dry fly and bottom ash that has been placed within the limits of the Ash Pond 1 perimeter dikes above the sluiced ash (sluiced ash initially deposited in this area until 1970). Dry ash was placed over the old Ash Pond 1 beginning in 1984 with the original portions of the stack fully built-out and closed along the south portion in the late 1990s. Current disposal activity is to the north within the horizontal stack expansion area designed in 2006. The bottom of the stacked ash is located at about El. 342 to El. 352, and the top is currently at about El. 445 at the highest point along the closed south side. The original, closed portion of the stack consists of slopes on the order of 2.7H:1V to 3H:1V and benches located at approximate elevations 380 and 405 feet. The current expansion will have an ultimate height of as much as 270 feet with 3H:1V slopes and benches every 50 feet in height. Dry stacking operations for the expansion have only recently begun and are currently being performed in accordance with Phase 1 of the construction sequence.

- *Ash Dike:* This horizon represents material used to construct the west dike of Ash Pond 1. This side of the dike was constructed of ash with one dike raising reported in 1967 and a height ranging from 15 to 20 feet with a crest elevation between about 345 and 350 feet. The dike slopes range approximately from 1.5H:1V to 2H:1V or flatter and are heavily wooded.

- *Hydraulically Placed (sluiced) Ash:* This represents sluiced bottom ash/fly ash that is contained beneath the stacked ash inside the perimeter dike system.

- *Native Clay and/or Native Silt:* This represents the uppermost layers of native clay and/or silty materials beneath the perimeter dike and stack.

- *Native Sand and/or Native Sand and Gravel:* This represents horizons of alluvial silty and clayey sand and gravel that were encountered in some instances below the native clay/silt materials.

7.3. Seepage Analysis

Seepage analyses were performed to evaluate existing seepage conditions and to evaluate rapid drawdown conditions along the Ash Pond 2 dikes following a flood event. The following sections summarize the assumptions, parameters, etc. used in these separate seepage models.

No seepage analyses were performed on the stack since the disposal facility is not impounding water and is situated above the 100-year flood elevation. No seepage analyses were also performed for the Ash Pond 1 dike because this disposal facility is closed and no longer impounds water. Due to the proximity of the Ash Pond 1 dike to Little Bayou Creek, rapid drawdown analyses were performed at selected sections, but because the facility does not impound water, piezometric levels were used to model the rapid drawdown conditions in lieu of seepage models.

7.3.1. SEEP/W Model

Analysis of steady state seepage through the Ash Pond 2 dikes was performed to estimate the magnitude of seepage gradients (for the evaluation of potential piping) and pore water pressures within the soils (for the evaluation of slope stability). For the rapid drawdown conditions, two steady state seepage models, corresponding respectively to water levels before and after the drawdown within the dikes, were analyzed. The computed pore water pressures at each finite element nodal point from these two analyses were extracted for the subsequent rapid drawdown stability analyses discussed further in Section 7.4. The numerical seepage models were developed using SEEP/W 2007 (Version 7.14), a finite element code tailored for modeling groundwater seepage in soil and rock. SEEP/W is distributed by GEO-SLOPE International, Ltd, of Calgary, Alberta, Canada (www.geo-slope.com).

SEEP/W uses soil properties, geometry, and boundary conditions provided by the user to compute the total hydraulic head at nodal points within the modeled cross-section. Among other features, SEEP/W includes a graphical user interface, semi-automated mesh generation routines, iterative algorithms for solving unconfined flow problems, specialized boundary conditions (seepage faces, etc.), capabilities for steady-state or transient analyses, and features for visualizing model predictions. The code also includes material models that allow tracking both saturated and unsaturated flow, including the transition in seepage characteristics for soils that become saturated or unsaturated during the problem simulation.

Nine dike cross-sections through Ash Pond 2 were modeled with SEEP/W, and then were subsequently evaluated for slope stability (Section 7.4). For the numerical analysis, each cross-section was subdivided into a mesh of elements, consisting of first-order quadrilateral and triangular finite elements. For seepage problems, where the primary unknown (hydraulic head) is a scalar quantity, first-order elements provide for efficient, effective modeling. Given appropriate hydraulic conductivity properties and applied boundary conditions, the finite element method (as implemented in the SEEP/W code) was then used to simulate steady seepage across the mesh. The total hydraulic head is computed at each nodal location, from which pore water pressures and seepage gradients can be determined.

7.3.2. Boundary Conditions

Steady-state seepage was assumed for the analysis along Ash Pond 2, with the static pool level placed at approximate El. 346 feet (based on TVA provided survey data).

Boundary conditions for the SEEP/W analysis were assumed as follows. Along the vertical, upstream edge of the model, the hydraulic head at each node was constant with depth and equal to the pool elevation for the sluiced ash and native materials when not separated by a horizon of less permeable native clay. When horizons of native clay were encountered between the sluiced ash and native sands creating a hydraulic barrier between the two, a no-flow boundary condition was applied to the upstream vertical edge of the native clay while the upstream vertical edge of the native sands was treated as being hydraulically tied to the river. The hydraulic head along this horizon was set at approximate El. 321 feet, which is a conservative elevation based on piezometer readings within the native soils along the toe of the ash pond. A total head equal to the pool level was also applied to all submerged nodes along the ground surface of the upstream side (submerged sluiced ash and interior upper dike, where applicable). Along the vertical, downstream edge of the model, the hydraulic head at each node was constant with depth and equal to approximate El. 321 feet, which is a conservative elevation based on piezometer readings along the toe of the ash pond. Other nodes along the ground surface were treated as potential seepage exits. At various steps in the computer analysis, if the software determines that water flows from the mesh at these nodes along the ground surface, SEEP/W assigned a head equal to the elevation of the node. This routine effectively models the seepage exit to the ground surface. The horizontal boundary at the base of the model was set at the program default and was modeled as a seepage barrier near approximate El. 250 feet, with vertical flow across the boundary nodes not being allowed.

Boundary conditions for the rapid drawdown SEEP/W models were the same as described above with the exception that along the vertical downstream edge of the model, the hydraulic head at each node was constant with depth and equal to the assumed flood elevation. A total head equal to the flood level was also applied to all submerged nodes along the ground surface for the flood case. The horizontal boundary at the base of the model was the same as listed above.

7.3.3. Seepage Properties

For each modeled cross-section, a representative subsurface profile was compiled based on boring logs, available record drawings, and the known project history. Material properties were estimated based on available laboratory data, correlations with classification data, and on typical values for similar materials. Material properties used in the seepage analysis are summarized in Table 7.1.

Table 7.1. Material Properties for SEEP/W Analysis

Soil Horizon	Saturated k_v (cm/s)	Ratio k_h / k_v	Specific Gravity G_s	Void Ratio E	Volumetric Water Content		Basis
					Saturated (%)	Residual (%)	
Lower Dike	1.4e-8 to 8.4e-9	2 to 5	2.69	0.61	38	2	Available Laboratory Data and Correlation w/ Typical Values
Upper Dike	3.0e-8 to 3.0e-9	5	2.69	0.46	32	2	Available Laboratory Data and Correlation w/ Typical Values
Hydraulically Placed (Sluiced) Ash	2.6e-5	20	2.52	0.97	49	1	Available Laboratory Data and Correlation w/ Typical Values
Native Clay	9.0e-8	20	2.70	0.60	38	2	Available Laboratory Data and Correlation w/ Typical Values
Native Silt	1.0e-4	30	2.70	0.92	48	1	Available Laboratory Data and Correlation w/ Typical Values
Native Sand	1.5e-2	50	2.70	0.55	35	0	Available Laboratory Data and Correlation w/ Typical Values

Table 7.1. Material Properties for SEEP/W Analysis

Soil Horizon	Saturated k_v (cm/s)	Ratio k_h / k_v	Specific Gravity G_s	Void Ratio E	Volumetric Water Content Saturated (%)	Volumetric Water Content Residual (%)	Basis
Native Sand and Gravel	1.5e-2	50	2.70	0.19	16	0	Available Laboratory Data and Correlation w/ Typical Values

Note: SEEP/W requires input parameters k_h and ratio of k_v/k_h

Significant engineering judgment is needed to select appropriate hydraulic properties for earth/soil materials. Unlike other key properties, hydraulic conductivity can vary over several orders of magnitude for a range of soils, often with substantial anisotropy for seepage in horizontal versus vertical directions. Laboratory test samples often do not represent important variations within a larger soil deposit. For Ash Pond 2, an iterative process of parametric calibration (Section 7.3.4) was used to arrive at final estimates of the seepage properties. Results from trial simulations were compared to field data (measured piezometric levels and observed seepage) and the material parameters were then varied until the solutions reasonably matched the field data. The final set of parameters (Table 7.1) resulted in the comparisons presented in Section 7.3.4.

The ratio of horizontal hydraulic conductivity (kh) to vertical hydraulic conductivity (kv) was estimated based on placement, depositional characteristics, and origin of the materials. An isotropic material would have kh/kv = 1, while deposits of horizontally layered soils will have much higher values. For Ash Pond 2, higher ranges of ratios were used for sluiced ash and native materials, whereas a lower range of ratios was assumed for compacted dike materials.

The governing equations in SEEP/W are formulated to consider seepage through unsaturated soils. In the simulations for Ash Pond 2, this formulation is used to locate the phreatic surface for unconfined seepage through the dike cross-sections. To represent the change in hydraulic conductivity due to de-saturation of each soil, SEEP/W implements a model based on two curves, a hydraulic conductivity function and a volumetric water content function. Three parameters are needed to define this behavior: the saturated hydraulic conductivity, saturated water content, and residual water content (water content of air dried soil). Of these, only the residual water contents were not previously estimated for each material. Values were estimated based on typical values for similar soils. The simulation results are not sensitive to the selection of these values.

7.3.4. Comparison to Field Observations

After the initial seepage parameters were estimated, results from the SEEP/W model were compared to pore water pressures measured in piezometers installed within Ash Pond 2. Data from the 24 piezometers were used in this evaluation. Nodes were placed in the model at the screened piezometer intervals so that the average head across these nodes could be compared to the corresponding piezometer reading. The material properties in each modeled cross-section were then varied until a reasonable match was obtained between the seepage predictions and field data. Specifically, the saturated hydraulic conductivity and the kh/kv ratios were adjusted (while still maintaining the parameters within expected ranges) to give model predictions as consistent as possible with field measurements and observations.

The comparison between the field piezometer measurements and final SEEP/W predictions show the predicted groundwater table mostly within the range of about 3 feet below to 2 feet above the readings obtained in the piezometers installed within the dike crest. For the dike toe areas, the seepage model consistently predicted the water table position to be from about 1 foot below to 2 feet above actual toe piezometer readings (or closer to the ground surface). Actual field conditions at crest piezometers were more difficult to match within the seepage model due to the varying soil horizons encountered. For all locations, the maximum difference between the predictions and measurements is about 6 feet. These differences are judged to be acceptable given the limited information available and unknown conditions between the modeled cross-sections and borings.

The results from the seepage model can also be compared to field observations of seepage. For Ash Pond 2, historical seepage has been present along the far northeast portion of the dikes. The outbreak of the observed seepage typically begins at the toe of the dike. These observations correlate well with the seepage model for cross-section N-N' which shows the shape of the predicted phreatic surface extending to the surface along the toe of the lower dike in this area.

In summary, the seepage models appear to give a reasonable prediction of the phreatic surface location when compared to field observations and piezometer measurements.

7.3.5. Critical Exit Gradients

Seepage forces, resulting from hydrodynamic drag on the soil particles, can destabilize earthen structures. Excessive hydraulic gradients near the ground surface can lead to the initiation of soil erosion and piping, which has caused numerous dam failures in the past. Hydraulic gradients (computed where seepage exits at the ground surface) can be evaluated to understand the potential severity of this problem.

Where upward seepage through a uniform soil exits the ground surface, the factor of safety with respect to soil piping (FS_{piping}) is as defined below.

$$FS_{piping} = \frac{i_{crit}}{i} \qquad \textbf{Eqn. 7.1}$$

Where "i" is the vertical gradient in the soil at the exit point. The critical gradient (i_{crit}) is related to the submerged unit weight of the soil, and can be computed as:

$$i_{crit} = \frac{\gamma_{sub}}{\gamma_w} = \frac{G_s - 1}{1 + e} \qquad \textbf{Eqn. 7.2}$$

where γ_{sub} is the submerged unit weight of the soil, γ_w is the unit weight of water, G_s is the specific gravity of the soil particles, and e is the void ratio. For nearly all soils, the critical gradient is between about 0.6 and 1.4, with a typical value near 1.

When $FS_{piping} = 1$, the effective stress is zero and the near-surface soils are subject to piping or heaving, but only for vertical seepage that actually exits to the ground surface. If the phreatic surface is buried, then the FS_{piping} will be greater than 1 even when $i=i_{crit}$.

7.3.6. Results of Seepage Analysis

Plots from the SEEP/W analyses of the nine cross-sections through the Ash Pond 2 dikes are presented in Appendix F. The plots show the finite element mesh, material zones, and boundary conditions used in each analysis. The results are depicted in contour plots of total head, pore water pressure, and seepage gradients. For the slope stability analyses (Section 7.4), the pore water pressures along the considered slip surfaces were determined by interpolation between the nodal pore pressures predicted with the SEEP/W model. The seepage gradients were assessed for maximum exit gradients and the potential for soil piping.

On each modeled cross-section, examination of the output (predicted phreatic surface and vertical gradients) can be made to look for areas where the potential for excessive vertical gradients might exist that could possibly initiate the erosion or piping of material. In general, areas of potential concern are where water seeps laterally out onto a sloping ground surface, or where vertical, upward seepage occurs at the ground surface. The potential for piping was evaluated using the factor of safety equation as defined in Section 7.3.5. First, contour plots of vertical gradient (Appendix F) were examined to determine the general location of the maximum vertical exit gradient. On the modeled cross-sections, the maximum upward gradient occurs near or beyond the toe of the lower dikes. For the factor of safety calculations, vertical gradients from these locations were then used along with the critical gradients determined from the soil properties. The calculated factors of safety against piping are summarized in Table 7.2. In several cases, a critical exit point was not predicted by the models or the vertical gradient at the critical exit point was very low resulting in factors of safety against piping well above 4. The exception is at section N-N' where past seepage has been observed. The calculated factor of safety at this section was 2.0. Stantec recommends a target factor of safety against piping of 4 for the evaluation of Ash Pond 2, based on information contained in United States Army Corps of Engineers (USACE) manual EM 1110-2-1901. At section N-N', Ash Pond 2 does not meet the recommended target factor of safety for piping at the critical seepage exit point located along the dike toe. This section, where the lowest factor of safety occurred, represents the northeast corner of the pond.

Table 7.2. Summary of Computed Exit Gradients and Minimum Factors of Safety against Piping

Cross Section*	Vertical Gradient (i) at Critical Exit Pt	Location of Critical Exit Point	Material	Critical Gradient (i_{crit})	FS_{piping}
A-A'	0.02	Toe	Native Clay	1.06	> 4
C-C'	0.03	Toe	Native Clay	1.06	> 4
E-E'	0.03	Toe	Native Clay	1.06	> 4
F-F'	Critical Exit Point Not Identified by Model	N/A	N/A	N/A	> 4
H-H'	Critical Exit Point Not Identified by Model	N/A	N/A	N/A	> 4
N-N'	0.54	Toe	Native Clay	1.06	2.0
P-P'	Critical Exit Point Not Identified by Model	N/A	N/A	N/A	> 4
R-R'	Critical Exit Point Not Identified by Model	N/A	N/A	N/A	> 4
U-U'	0.12	Toe	Native Clay	1.06	> 4

*Refer to Appendix G for locations of cross-sections.

7.4. Slope Stability Analyses

7.4.1. SLOPE/W and UTEXAS4 Models

The stability of the Ash Pond 1 & 2 dikes and the Consolidated Waste Dry Stack slopes was evaluated under fully drained conditions (static long-term, steady state seepage) using limit equilibrium methods as implemented in the SLOPE/W software. Additional static analysis was also performed using the UTEXAS4 software to evaluate slope stability of the ash pond dikes during a rapid drawdown flood event and to evaluate the dry stack in the event of the sudden development of an undrained loading condition within saturated ash materials where reduced shear strength can prevail (i.e. undrained conditions in saturated ash can be triggered under low strains induced by high fills or stacks).

The SLOPE/W software is available from GEO-SLOPE International, Ltd., of Calgary, Alberta, Canada (www.geo-slope.com). SLOPE/W is a special-purpose computer code designed to analyze the stability of earth slopes using two-dimensional, limit equilibrium methods. Stability analyses for the Ash Pond 1 dike and the Consolidated Waste Dry Stack were performed using data obtained from piezometer readings for modeling of groundwater conditions since these facilities do not impound water. For the Ash Pond 2 dikes, the phreatic conditions/steady-state pore pressures obtained from the SEEP/W model were used.

The UTEXAS4 software was developed by Dr. Stephen G. Wright and is available from Shinoak Software, Austin, Texas. The undrained analysis is based on a three-stage stability assessment of the potential for an undrained failure developed by Duncan, Wright, and Wong and as outlined in EM 1110-2-1902 (USACE). As discussed above, rapid drawdown stability analyses for the Ash Pond 1 dike were performed using piezometer readings for modeling of groundwater conditions, rapid drawdown stability analyses for the Ash Pond 2 dikes were performed using pore pressures obtained from the SEEP/W model, and the stability analyses for the Consolidated Waste Dry Stack were performed using data obtained from piezometer readings for modeling of groundwater conditions.

7.4.2. Limit Equilibrium Methods

Limit equilibrium methods for evaluating slope stability consider the static equilibrium of a soil mass above a potential failure surface. For conventional, two-dimensional methods of analysis; the slide mass above an assumed failure surface is first divided into vertical slices, then stresses are evaluated along the sides and base of each slice. The factor of safety against a slope failure (FS_{slope}) is defined as:

$$FS_{slope} = \frac{\text{shear strength of soil}}{\text{shear stress required for equilibrium}}$$ **Eqn. 7.3**

where the strengths and stresses are computed along a defined failure surface located at the base of the vertical slices. The shearing resistance along the potential slip surface is computed, with appropriate Mohr-Coulomb strength parameters, as a function of the total or effective normal stress.

Spencer's solution procedure (Spencer 1967; USACE 2003; Duncan and Wright 2005), which satisfies all of the conditions of equilibrium for each slice, was used in this study. Spencer's procedure computes FS_{slope} for an assumed failure surface. A search must be made to find the critical slip surface corresponding to the lowest FS_{slope}. Both circular and noncircular potential failure surfaces can be evaluated.

7.4.3. Analysis Approach

The slope stability analyses for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack were performed on the exterior/downstream faces of the dikes/slopes. SLOPE/W and UTEXAS4 incorporates various search routines to locate the critical slip surface. For the analyses for the Ash Pond 1 & 2 dikes and for the Consolidated Waste Dry Stack, deep (global) and shallow (non-global, or maintenance-type) failure surfaces were considered. SLOPE/W software was used to evaluate static, long-term (fully drained) loading conditions, while the UTEXAS4 software was used to evaluate slope stability for static undrained loading conditions within the saturated ash for the Consolidated Waste Dry Stack and rapid drawdown conditions within the Ash Pond 1 & 2 dikes.

7.4.4. Selection of Shear Strength Parameters

The dikes for Ash Pond 1 & 2 have existed in their current cross sectional geometry (slopes and crest elevation) for at least 30 years. Hence, excess pore pressures generated in the underlying soil during construction have had sufficient time to dissipate and steady state seepage conditions have developed within the dikes for the long-term loading case. For this condition, soil unit weights and drained strength parameters (c' and ϕ') are needed. For the rapid drawdown loading case, undrained strength parameters (c and ϕ) are also incorporated into the analyses along with the drained strength parameters. The stability analyses presented in this report will focus only on static steady state seepage conditions (no earthquake or other dynamic loads).

For the Consolidated Waste Dry Stack, static slope stability was evaluated for both drained and undrained loading conditions. Drained conditions represent long-term loading conditions where excess pore pressures have had sufficient time to dissipate and steady state conditions prevail. For these conditions, soil unit weights and effective stress strength parameters (c' and ϕ') are needed. For the three-stage undrained analysis, determination of the shear strength along a potential failure plane is based on two limiting strength envelopes representing both the fully drained (effective stress) strength and the undrained (total stress) strength. For the undrained analysis of the stack, this approach is applied to the portion of the fly ash that is saturated (or located below the water table). Thus, the total stress (undrained) strength parameters (c and ϕ) are needed for the saturated ash in addition to the effective stress parameters.

The drained shear strength parameters used for the ash, clay dikes, and clay foundation materials were derived using results of laboratory triaxial tests, along with consideration given to standard penetration test data and laboratory classification test data. In addition, the strength parameters selected were further refined or confirmed by comparisons with the strength parameters listed in the TVA-provided historical reports. Representative strengths for each horizon were selected using the methodology outlined in the US Army Corps of Engineers Engineer Manual EM 1110-2-1902 as a guide. Results of triaxial testing were evaluated and effective stress p' versus q scatter plots and total stress p versus q scatter plots were prepared of all of the data points. The maximum effective principal stress ratio was used to determine failure criteria for the drained conditions for selection of the p' and q values within the laboratory test results. For undrained conditions, the peak deviator stress was used to determine failure criteria for selection of the total stress p and q values. Once the plots were prepared, a failure envelope was then selected such that all but one of the plotted values were on or above the envelope. The effective stress p' versus q plots and total stress p versus q plots selection of the failure envelope are shown for each horizon on the graphs presented in Appendix E. The strength parameters were rounded to the nearest degree with regards to ϕ and ϕ'. The effective cohesion intercept point (c') was limited to a maximum of 200 pounds per square foot.

For non-cohesive native silts and sands, shear strength parameters were estimated using published relationships which correlate SPT N-values with relative density, specific soil types and angles of internal friction. Shear strength parameters for ash materials were estimated using historical data, typical values, and published correlations using SPT N-values where triaxial data was not available.

The following table provides a summary of the total and effective stress shear strengths selected for use in the slope stability analyses for Ash Pond 1 & 2 and the Consolidated Waste Dry Stack.

Table 7.3. Selected Strength Parameters for Stability Analyses

Soil Horizon	Unit Weight (pcf)	Total Stress Strength Parameters		Effective Stress Strength Parameters	
		c (psf)	Ø (degrees)	c' (psf)	Ø' (degrees)
Upper Dike (Ash Pond 2)	130	800	19	200	30
Lower Dike (Ash Pond 2)	127	460	17	130	26
Ash Dike (Ash Pond 1)	105	300	13	0	30
Native Clay (Ash Pond 2)	128	325	13	110	28
Native Clay (Ash Pond 1 and Dry Stack)	128	500	16	200	29
Sluiced Ash (Ash Pond 1 & 2 and Stack)	85	400	10	0	26
Clay Cover (Dry Stack)	120	200	16	100	24
Stacked Ash (Dry Stack)	105	N/A	N/A	0	32
Native Silt (Ash Pond 1 & 2 and Stack)	110	0	29	0	29
Native Sand (Ash Pond 1 & 2 and Stack)	130	0	32	0	32
Native Sand and Gravel (Ash Pond 1 & 2 and Stack)	130	0	35	0	35

7.4.5. Results of Slope Stability Analysis

Using the strength parameters listed in Table 7.3, in conjunction with the results of the seepage analyses and piezometer data, the existing dike and stack configurations were analyzed at the selected cross-sections. Analyses were performed using Spencer's method.

7.4.5.1. Ash Pond 2

The stability analyses for Ash Pond 2 focused on the potential for failure along the exterior dike face. Failure surfaces from these analyses are presented on the drafted sheets in Appendix G. The results are summarized in Table 7.4 below.

Table 7.4. Summary of Minimum Computed Factors of Safety for Slope Stability – Ash Pond 2

Cross-Section[1]	Rapid Drawdown Minimum FS[2]	Long-Term Minimum FS
A-A’	1.7	2.1
C-C’	1.9	2.3
E-E’	1.6	2.1
F-F’	1.7	2.3
H-H’	1.9	2.4
N-N’	1.6	1.9
P-P’	1.7	2.0
R-R’	1.8	2.2
U-U’	1.7	2.1

[1]Refer to Appendix G for plan view of cross-section locations.
[2]Rapid Drawdown performed using 100-year flood at El. 334 feet.

Based on discussions with TVA and to be in accordance with current prevailing geotechnical practice, a minimum target factor of safety of 1.5 was established for long-term loading conditions using the guidelines presented in USACE Manual EM 1110-2-1902 “Slope Stability”, the URS programmatic document recently prepared for TVA, and the Kentucky Division of Water publication “Guidelines for the Geotechnical Investigation and Analysis of Existing Earth Dams”. Using the same guidelines listed above, a minimum target factor of safety of 1.2 was established for rapid drawdown conditions.

The results of the slope stability analyses demonstrate that the factors of safety against long-term and rapid drawdown slope stability are greater than 1.5 and 1.2, respectively. The critical slip surfaces extending into the dike to affect the crest and representing a global failure surface are those depicted in Appendix G. There was no indication in the slope stability analyses that a noncircular failure surface would give a factor of safety lower than that obtained for circular surfaces. Overall, the geometry of the dike cross-sections and the foundation stratigraphy do not appear to be susceptible to sliding along a planar surface. The optimization scheme available within SLOPE/W was used to consider noncircular, curved slip surfaces for the long term case. Optimization was not used to evaluate noncircular slip surfaces within the rapid drawdown analyses performed using UTEXAS4.

7.4.5.2. Ash Pond 1

The stability analyses for Ash Pond 1 focused on the potential for deep (global) and shallow (non-global, or maintenance-type) failures along the exterior ash dike. Failure surfaces from these analyses are presented on the drafted sheets in Appendix G. Both circular and non-circular surfaces were considered. The results are summarized in Table 7.5 below.

Table 7.5. Summary of Minimum Computed Factors of Safety for Slope Stability – Ash Pond 1 Dike

Cross-Section[1]	Rapid Drawdown Minimum FS[2]		Long-Term Minimum FS	
	Non-Global	Global	Non-Global	Global
J-J’	0.9	1.2	1.2	1.5
K-K’	1.6	N/A	1.7	N/A

[1]Refer to Appendix G for plan view of cross-section locations.
[2]Rapid Drawdown performed along the Ash Pond 1 dike using 100-year flood at El. 334 feet.

The results of the slope stability analyses demonstrate that the factors of safety along the steeper portions of the Ash Pond 1 dike (represented by cross-sections I-I’ and J-J’) against long-term and rapid drawdown slope stability are below the recommended target values listed above for shallow, maintenance-type failure surfaces. For deeper critical slip surfaces extending into the dike to affect the crest (representing more of a global failure surface), the factors of safety are greater than or equal to the recommended target values. Along the portions of the ash dike where slopes flatten to 4H:1V or flatter (represented by cross-sections K-K’ and L-L’), the analyses demonstrate that the factors of safety against long-term and rapid drawdown slope stability failure are greater than the target values.

7.4.5.3. Consolidated Waste Dry Stack

For the stack, existing conditions were analyzed for the closed portions of the stack with added analyses being performed for section AA-AA’ to identify factors of safety for the final buildout of the stack expansion. Section AA-AA’ was analyzed in an effort to check the previous design of the expansion prepared in 2006. Long-term (fully drained) loading conditions and static undrained loading conditions within the saturated ash were analyzed for the Consolidated Waste Dry Stack. The stability analyses focused on the potential for deep (global) and shallow (non-global, or maintenance-type) failures along the stack slopes. Failure surfaces from these analyses are presented on the drafted sheets in Appendix G. Both circular and non-circular surfaces were considered. The results are summarized in Table 7.6 below.

Table 7.6. Summary of Minimum Computed Factors of Safety for Slope Stability – Consolidated Waste Dry Stack

Cross-Section[1]	Drained Conditions Minimum FS		Undrained Conditions Minimum FS		Undrained/Buildout Loading Condition Minimum FS
	Non-Global	Global	Non-Global	Global	Non-Global
J-J’	1.8	2.1	1.8	1.8	N/A
K-K’	1.8	2.1	1.8	1.7	N/A
Y-Y’	1.9	1.9	N/A[2]	1.7	N/A
Z-Z’	2.1	2.4	N/A[2]	1.9	N/A
AA-AA’	1.9[3]	2.0[3]	1.6[3]	1.7[3]	1.6

[1]Refer to Appendix G for plan view of cross-section locations.
[2]The minimum factor of safety for undrained conditions along these cross-sections represent a global failure. Higher factors of safety were achieved for shallower non-global failure surfaces and as a result, the non-global failure surfaces are not shown.
[3]These analyses shown for cross-section AA-AA’ were performed for the ultimate buildout of the stack expansion at this section.

Based on discussions with TVA and to be in accordance with current prevailing geotechnical practice, a minimum target factor of safety of 1.5 was established for long-term, steady state (fully drained conditions) using the guidelines presented in USACE Manual EM 1110-2-1902 "Slope Stability". The results of the slope stability analyses demonstrate that the factors of safety against long-term, steady state slope instability (fully drained conditions) are all greater than 1.5 for both non-global and deeper global-type failure surfaces.

The results of the slope stability analyses for the undrained loading condition demonstrate that the factors of safety against undrained slope stability failure are all equal to or greater than 1.3. Based on discussions with TVA, Stantec recommends a minimum target factor of safety of 1.3 for undrained loading conditions. Hence, the results indicate that these factors of safety are acceptable for both non-global and deeper global-type failure surfaces.

Last, Stantec performed undrained analysis for failure surfaces at Section AA-AA' to represent loading conditions that will be induced during continued ash placement for the current stack expansion in this area. Based on the information provided by TVA, no more than about 5 feet of ash material is expected to be placed in any given month. For the purpose of the loading analysis performed, Stantec conservatively assumed placement of 10 feet per month. The undrained analysis representing this buildout produced a factor of safety of 1.6. The acceptability of this loading condition is judged by calculating the target factor of safety using the following calculation:

$$\text{Target } FS_{ul} = \frac{2 \times FS_u}{1 + FS_u} \qquad \textbf{Eqn. 7.4.}$$

Based on this, the target factor of safety for undrained loading conditions of the assumed buildout is approximately 1.2 for the non-global surface at Section AA-AA'. Hence, the resulting factor of safety is acceptable.

8. Conclusions and Recommendations

The conclusions and recommendations that follow are based on Stantec's understanding of Ash Pond 1 & 2 and the Consolidated Waste Dry Stack, as outlined in this report, and on TVA's plans for future closure of Ash Pond 2 and the Consolidated Waste Dry Stack. This understanding has been developed from review of historical information, discussions with TVA personnel, and from the results of this geotechnical exploration.

8.1. General

8.1.1. The root cause analysis of the December 22, 2008 dredge cell pond failure at TVA's Kingston Fossil plant identified the four following destabilizing factors contributing to the breach of the containment dike and subsequent failure. Stantec's scope of work included a review of the historic documentation, results of the drilling and laboratory testing program, and current dike and stack configurations with respect to these contributing factors to assess the potential for these conditions to exist at the Ash Pond 1 & 2 dikes and the Consolidated Waste Dry Stack.

- Weak Silt/Ash Foundation – As indicated in Section 5.2, materials matching the “slime layer” were not encountered during this study within the Ash Pond 1 & 2 and Consolidated Waste Dry Stack borings. As a result, this factor is not applicable.

- Hydraulically Placed, Loose, Wet Ash – Based on the borings performed, hydraulically placed “sluiced” ash is present upstream of the Ash Pond 1 & 2 dikes, beneath the Upper Dike along Ash Pond 2, and beneath both the existing and on-going expansion portions of the Consolidated Waste Dry Stack. With regards to the Ash Pond 1 & 2 dikes, the results of the stability analyses show critical failure surfaces which either don’t extend into the sluiced ash or just barely extend into the sluiced ash with factors of safety above the target values. The exception to this is along the Ash Pond 1 dike where shallow failure surfaces (not extending into the sluiced ash) resulted in lower factors of safety; however, recommendations for repairs to this area to improve factors of safety are included in Section 8.3 and the presence of sluiced ash had little to no effect on the stability results. As a result, the presence of sluiced ash has little effect on the stability of the Ash Pond 1 & 2 dikes. With regards to the stability analyses performed for both the existing and on-going expansion portions of the Consolidated Waste Dry Stack, long-term (drained) analyses along with undrained analyses based on a three-stage stability assessment of the potential for sudden undrained failure within the sluiced ash were performed. The factors of safety for these analyses were above the target values.

- Increased Loads Due to Embankment/Fill Height – Construction of the expansion for the Consolidated Waste Dry Stack will continue until TVA decides to close the facility. As such, the stack will continue to increase in height (in phases) and additional load will be applied to the underlying sluiced ash and foundation materials. Drained and undrained slope stability analyses were performed to represent the loading conditions induced during continued ash placement and to represent ultimate buildout of the stack expansion. The factors of safety for these analyses were above the target values.

- Embankment Geometry Setback – The current stack expansion limits are set back over 150 feet from the existing Ash Pond 2 perimeter dike along the north side. The existing portion of the stack to the south is also set back 50 to 70 feet from the old Ash Pond 1 perimeter dike. The factors of safety from the slope stability analyses for the stack were greater than the target values with the failure surfaces all surfacing upstream of the existing perimeter dikes.

Stantec’s review of historical documentation and the results of this study indicate the potential for three of these factors, with the exception of the weak silt/ash foundation, to be present within the stack and perimeter dike systems. However, the results of slope stability analyses indicate factors of safety for the Ash Pond 2 dikes and the Consolidated Waste Dry Stack are above the recommended target factors of safety. As a result, these factors do not create destabilizing conditions for the static cases analyzed. To minimize the effect of the offset geometry on the current stack expansion and further improve slope stability factors of safety, TVA could consider some regrading during upcoming closure of the Consolidated Waste Dry Stack to extend the plan limits of the north side of the expansion closure to the perimeter dike.

As discussed above, the Ash Pond 1 perimeter dike exhibited factors of safety below the target values but the failure surfaces are so shallow, they were unaffected by the presence of the sluiced ash. Mitigation of these slopes is being recommended.

8.2. Ash Pond 2

8.2.1. The results of the seepage analyses for Ash Pond 2 were reviewed to identify conditions where seepage and possible piping may occur. Seepage outbreaks along the slopes can create the potential for the initiation of soil piping if excessive vertical gradients exist. On the modeled cross-sections, the maximum upward gradient occurs near or beyond the toe of the lower dikes. In several cases, a critical exit point was not predicted by the models or the vertical gradient at the critical exit point was very low resulting in factors of safety against piping well above 4. The exception is at section N-N' where past seepage has been observed. The calculated factor of safety at this section was 2.0, which is less than the recommended target of 4. Thus, for one of the nine cross-sections analyzed, the factor of safety against piping at the location of the maximum exit gradient is less than the recommended target value. This section, where the lowest factor of safety occurred, represents the northeast corner of the pond.

8.2.2. A low piping factor of safety was predicted along the northeast portion of the Ash Pond 2 dike where seepage has been reported for years. As a result, it is recommended that TVA implement a mitigation design and construction program to mitigate the potential for piping in this area. Improvements could be incorporated into upcoming design of pond closure, or a separate interim mitigation program could be implemented, depending on timing and as decided by TVA. Mitigation design should include a graded filter system to filter the seepage water and prevent piping. A target factor of safety of four is recommended. Based on the analyses performed and the interviews with TVA, this system should be constructed at the toe along the length of the northeast dike extending a sufficient distance to include the past reported seepage areas. Stantec proposes to prepare a scope of services and fee proposal for preparing a work plan for seepage mitigation.

8.2.3. The results of the slope stability analyses indicate that factors of safety against long-term slope stability and rapid drawdown slope failure along the Ash Pond 2 dikes are greater than the target values of 1.5 for long-term and 1.2 for rapid drawdown.

8.2.4. It is recommended that an instrumentation monitoring program be established (including evaluation of piezometric levels and calculation of “alert” piezometric levels which would result in slope stability factors of safety falling below 1.5). It is also recommended that TVA continue dike inspections/monitoring to look for changes or conditions that might affect dike integrity. The frequency of inspections should be daily (Site Foreman or PAE), weekly (Field Supervisor) and monthly (Construction Manager). This is consistent with the TVA's new programmatic inspection schedule. Inspections should also be performed following any extreme flood events to check for signs of sloughing along the exterior slopes. Any such conditions observed should be repaired as soon as possible.

8.3. Ash Pond 1

8.3.1. The previous Ash Pond 1 dike is located along the southwest side of the original, closed portion of the Consolidated Waste Dry Stack. This dike was constructed of ash on slopes as steep as about 1.5H:1V (represented by cross-sections I-I' and J-J') and flattening to 4H:1V to the south (represented by cross-sections K-K' and L-L'). The slope is currently heavily wooded and minor sloughing has been reported over the years along the steeper portions. Stantec has also noticed minor sloughing and slope instability along this section of dike since January, 2009. The results of the slope stability analyses performed for this study indicate that factors of safety against long-term slope stability and rapid drawdown slope failure along the steeper portions of the Ash Pond 1 dike are less than the target values of 1.5 for long-term and 1.2 for rapid drawdown. These lower factors of safety represent shallow maintenance-type failure surfaces. For deeper critical slip surfaces extending into the dike to affect the crest (representing more of a global failure surface), the factors of safety are greater than or equal to the recommended target values. Along the portions of the ash dike where slopes flatten to 4H:1V or flatter (represented by cross-sections K-K' and L-L'), the analyses demonstrate that the factors of safety against long-term and rapid drawdown slope stability failure are greater than the target values.

8.3.2. To improve the long-term stability conditions, it is recommended that TVA implement a mitigation design and construction program for the steeper portions of the Ash Pond 1 dike to improve factors of safety against slope stability in areas where deficiencies are identified. Final mitigation design should increase factors of safety to at least 1.5 for long term slope stability, and to at least 1.2 for rapid drawdown slope stability. If TVA decides to perform mitigation, features for improvements should include a combination of stabilizing berms and/or walls, flattening of dike slopes, relocation of the existing access road, and provisions for collecting and controlling groundwater if needed. Stantec proposes to prepare a scope of services and fee proposal for preparing a work plan for slope stability mitigation.

8.3.3. Until improvements can be made that will permanently improve stability conditions, it is recommended that TVA continue inspections/monitoring of the Ash Pond 1 dike and the adjacent banks of Little Bayou Creek to look for changes or conditions that might affect the integrity of the Ash Pond 1 dike. The frequency of inspections should be consistent with the TVA's new programmatic inspection schedule. The dike and native creek slopes are currently heavily wooded and some shallow sloughing has been observed. Any sloughing of these dikes and creek banks that does occur appears to generally be shallow and considered maintenance-type failures, and should not adversely impact the Consolidated Waste Dry Stack slopes, which are 50 feet or more away. Repairs of shallow sloughing should be made if they occur.

8.3.4. As discussed above, once repairs to the Ash Pond 1 dike are completed, it is recommended that an instrumentation monitoring program be established (including evaluation of piezometric levels and calculation of "alert" piezometric levels which would result in slope stability factors of safety falling below 1.5).

8.3.5. No seepage analyses were performed for the Ash Pond 1 dike because this disposal facility is closed and no longer impounds water. Due to the proximity of the Ash Pond 1 dike to Little Bayou Creek, rapid drawdown analyses were performed at selected sections, but because the facility does not impound water, piezometric levels were used to model the rapid drawdown conditions in lieu of seepage models.

8.4. Consolidated Waste Dry Stack

8.4.1. The results of the slope stability analyses demonstrate that the factors of safety against long-term, steady state slope instability (fully drained conditions) are all greater than 1.5 for both non-global and deeper global-type failure surfaces within the Consolidated Waste Dry Stack. The results of the slope stability analyses for the undrained loading condition demonstrate that the factors of safety against undrained slope stability failure are all equal to or greater than 1.3.

Last, Stantec performed undrained analysis for failure surfaces at Section AA-AA' to represent loading conditions that will be induced during continued ash placement for the current stack expansion in this area. Based on the information provided by TVA, no more than about 5 feet of ash material is expected to be placed in any given month. For the purpose of the loading analysis performed, Stantec conservatively assumed placement of 10 feet per month. The undrained analysis representing this buildout produced a factor of safety of 1.6, which is greater than the target factor of safety.

8.4.2. No seepage analyses were performed for the Consolidated Waste Dry Stack because this disposal facility does not impound water and measured groundwater levels at the time of this study were well below the existing ground surface. Because the facility does not impound water, piezometric levels were used to model the phreatic conditions in lieu of seepage models. Based on the information gained throughout this study, it is Stantec's conclusion that groundwater levels within the stack and foundation soils are dependent upon rainfall infiltration into the stack and the drainage conditions around the perimeter of the stack. Instrumentation readings indicate that rainfall for early spring 2010 did not result in significant rises in the groundwater levels.

8.4.3. It is recommended that an instrumentation monitoring program be established (including evaluation of piezometric levels and calculation of "alert" piezometric levels which would result in slope stability factors of safety falling below 1.5). It is also recommended that TVA continue stack inspections/monitoring to look for changes or conditions that might affect stack integrity. The frequency of inspections should be consistent with the TVA's new programmatic inspection schedule and following any extreme rain events to check for signs of sloughing along the exterior slopes. Any such conditions observed should be repaired as soon as possible.

9. Closure and Limitations of Study

9.1. The scope of this study was limited only to the evaluation of the potential risks to the Ash Pond 1 & 2 dikes due to excessive seepage and/or slope instability under long-term, steady-state seepage loading conditions and rapid drawdown loading conditions along the downstream face where a critical stability condition may exist when the river floods and then recedes leaving the embankment saturated. For the Consolidated Waste Dry Stack, the evaluation was limited to consider the potential risks due to slope instability under static long-term, drained (steady-state) and undrained loading conditions. This assessment did not consider potential failure modes related to spillway capacity and overtopping or seepage along penetrations through the embankment (including the buried spillway pipes). The assessment also did not consider potential failure modes associated with dynamic loading conditions resulting from seismic events.

9.2. These conclusions and recommendations are based on data and subsurface conditions from the borings advanced during this investigation using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of conditions between borings.

9.3. The boring logs and related information presented in this report depict approximate subsurface conditions only at the specific boring locations noted and at the time of drilling. Conditions at other locations may differ from those occurring at the boring locations. Also, the passage of time may result in a change in the subsurface conditions at the boring locations.

10. References

The following is a list of documents that were the main references for gaining historical information used to evaluate Ash Pond 1 & 2 and the Consolidated Waste Dry Stack and prepare this report:

Of particular interest and use in this study are the following documents and drawings:

- Special Waste Landfill Permit – Horizontal Expansion – Consolidated Waste Stack Disposal Area – Shawnee Fossil Plant, Volumes I through IV, FMSM Engineers, June, 2006.

- Geologic Map of Part of the Joppa Quadrangle, McCracken County, Kentucky, Warren I. Finch, US Geologic Survey, 1967.

- TVA Drawing Numbers 10A240R2, 10N206, 209, 271-274, 284, 10W229, 269, 10W220-01 through 220-52, and 10W221-1 through 221-18.

- TVA Annual Inspection Reports, 1971 to 2009 (Ash Pond 1 & 2) and 1984 to 2009 (Consolidated Waste Dry Stack).

Additional reference documents:

- Slope Stability, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-2-1902, October 31, 2003.

- Seepage Analysis and Control for Dams, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-2-1901, April 30, 1993.

- Stability of Earth and Rock Fill Dams, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-2-1902 and Duncan and Wright (2005).

- Geotechnical Investigations, Department of the Army, US Army Corps of Engineers, Engineering Manual EM 1110-1-1804, January 1, 2001.

- GeoStudio, Computer Software. GEO-Slope International Ltd. Ver. 7.14, 2007.

- UTEXAS4, Computer Software. Stephen G. Wright, University of Texas at Austin, Ver. 4.1.0.3.

- Soil Mechanics Design Manual 7.1, Department of the Navy – Navy Facilities Engineering Command, May 1982.

- Terzaghi, K., Peck, R.B., and Gholamreza, M., Soil Mechanics in Engineering Practice, 3rd Edition, New York, John Wiley and Sons, 1996.

Appendix A

Typed Boring Logs

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 317797.70, E 1112894.71 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-1** Total Depth 37.0 ft
Location	McCracken County, Kentucky	Surface Elevation	326.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/21/09 Completed 9/21/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	25.5 ft Date/Time 9/21/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
326.9'	0.0'	Top of Hole							
		Fill: LEAN CLAY, light brown and gray, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	1.3	4-6-9	16	Boring advanced using 4.25" hollow stem augers.
				SPT-2	1.5 - 3.0	1.5	5-9-11	18	
				SPT-3	3.0 - 4.5	1.5	7-7-7	20	
320.9'	6.0'			SPT-4	4.5 - 6.0	1.0	5-6-8	23	
		LEAN CLAY, mottled reddish brown and gray to gray, moist to wet, soft to very stiff, silty		SPT-5	6.0 - 7.5	1.5	3-3-3	27	
				SPT-6	7.5 - 9.0	1.5	0-1-3	23	
				SPT-7	9.0 - 10.5	1.0	2-3-4	25	
				SPT-8	10.5 - 12.0	1.0	2-2-2	25	
				SPT-9	12.0 - 13.5	1.5	2-3-3	23	
				SPT-10	13.5 - 15.0	1.0	2-2-3	24	
				SPT-11	15.0 - 16.5	1.5	2-3-4	25	
				SPT-12	16.5 - 18.0	1.5	3-4-4	25	
				SPT-13	18.0 - 19.5	1.5	3-5-5	26	
				SPT-14	19.5 - 21.0	1.5	2-3-5	23	
		-Trace manganese concretions and fine to medium sand below 21.0 ft.		SPT-15	21.0 - 22.5	1.5	5-7-9	24	
				SPT-16	22.5 - 24.0	1.5	5-6-9	24	
				SPT-17	24.0 - 25.5	1.5	5-6-6	24	
				SPT-18	25.5 - 27.0	1.5	2-2-4	25	
				SPT-19	27.0 - 28.5	1.5	2-3-5	25	
				SPT-20	28.5 - 30.0	1.5	2-2-3	26	
				SPT-21	30.0 - 31.5	1.5	2-3-4	28	
293.9'	33.0'	-Sandy from 31.5 to 33.0 ft.		SPT-22	31.5 - 33.0	1.5	2-2-2	23	See "Piezometer Installation Detail" for backfill materials, and amounts used.
		SANDY SILT, gray, wet, soft, -Clayey from 33.0 to 34.5 ft.		SPT-23	33.0 - 34.5	1.5	1-1-3	55	
289.9'	37.0'			SPT-24	34.5 - 36.0	1.5	1-1-3	34	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 317685.89, E 1112914.65 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-2** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	351.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/20/09 Completed 9/20/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	21.0 ft Date/Time 9/20/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Sample # / RQD	Depth / Run	Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.1'	0.0'	Top of Hole						
		Fill: LEAN CLAY, tan and gray, moist, stiff to very stiff, silty, occasional fine gravel and organics	SPT-1	0.0 - 1.5	1.0	5-6-9	16	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.3	5-6-7	17	
			SPT-3	3.0 - 4.5	1.3	5-6-7	16	Bulk sample obtained from 4.0 to 8.0 ft.
			SPT-4	4.5 - 6.0	1.5	10-13-14	18	
			SPT-5	6.0 - 7.5	0.2	6-8-9	12	
			SPT-6	7.5 - 9.0	1.3	5-10-6	16	
			SPT-7	9.0 - 10.5	1.3	4-6-7	15	
340.3'	10.8'	Fill: BOTTOM ASH, black, moist, medium dense to very dense	SPT-8	10.5 - 12.0	1.0	27-50+/0.5'	15	
			SPT-9	12.0 - 13.5	0.5	50+/0.5'	13	
			SPT-10	13.5 - 15.0	1.0	27-50+/0.5'	14	
			SPT-11	15.0 - 16.5	1.1	18-21-20	14	
			SPT-12	16.5 - 18.0	1.3	10-15-13	18	
332.6'	18.5'	Fill: FLY ASH, gray and black, moist to wet, very soft to very stiff	SPT-13	18.0 - 19.5	1.2	9-12-10	19	
			SPT-14	19.5 - 21.0	1.1	10-9-8	24	
			SPT-15	21.0 - 22.5	0.8	8-6-2	26	
			SPT-16	22.5 - 24.0	1.5	1-2-2	25	
			SPT-17	24.0 - 25.5	0.3	1-1-1	22	
325.6'	25.5'	Fill: LEAN CLAY, mottled reddish brown and gray, moist to wet, soft to stiff, silt lenses throughout	SPT-18	25.5 - 27.0	0.7	2-2-2	26	
			SPT-19	27.0 - 28.5	0.9	4-6-7	27	
323.2'	27.9'	LEAN CLAY, mottled reddish brown and gray to gray, moist to wet, soft to stiff, silty lenses throughout	SPT-20	28.5 - 30.0	1.1	6-6-7	26	
			SPT-21	31.0 - 32.5	0.5	3-3-5	27	Bulk sample obtained from 32.0 to 40.0 ft.
		-Roots at 33.5 ft.	SPT-22	33.5 - 35.0	0.8	2-4-4	30	
			SPT-23	36.0 - 37.5	1.2	1-3-4	28	
			SPT-24	38.5 - 40.0	1.4	3-4-5	28	
			SPT-25	41.0 - 42.5	1.5	2-4-4	26	

Project No.	175559023	Location	N 317685.89, E 1112914.65 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-2** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		LEAN CLAY, mottled reddish brown and gray to gray, moist to wet, soft to stiff, silty lenses throughout *(Continued)*		SPT-26	43.5 - 45.0	1.5	5-6-7	28	
				SPT-27	46.0 - 47.5	1.2	1-1-3	28	
				SPT-28	48.5 - 50.0	1.3	3-2-4	24	
		-Sandy from 51.2 to 53.9 ft.		SPT-29	51.0 - 52.5	1.0	1-4-5	23	
				SPT-30	53.5 - 55.0	1.0	2-2-3	24	
				SPT-31	56.0 - 57.5	1.5	2-2-2	26	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
291.1'	60.0'			SPT-32	58.5 - 60.0	0.4	4-5-6	27	
		No Refusal / Bottom of Hole							

Project No.	175559023	Location	N 317685.06, E 1112908.87 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-3** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	351.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/20/09 Completed 9/20/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
351.2'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-2							
				ST-1	4.0 - 6.0	1.6		14	
				ST-2	8.0 - 10.0	1.2		15	
				ST-3	28.0 - 30.0	2.0		24	
				ST-4	38.0 - 40.0	2.0		27	

Project No.	175559023	Location	N 317685.06, E 1112908.87 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-3** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		OVERBURDEN, see boring log STN-2 *(Continued)*							
				ST-5	56.0 - 58.0	1.8		23	See "Piezometer Installation Detail" for backfill materials and amounts used.
291.2'	60.0'								
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 317392.53, E 1112524.92 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-4** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	328.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/22/09 Completed 9/22/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	30.0 ft Date/Time 9/22/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
328.1'	0.0'	Top of Hole							
		Fill: LEAN CLAY, brown and gray, moist, stiff, sandy		SPT-1	0.0 - 1.5	1.5	3-5-10	20	Boring advanced with 3.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.0	3-5-9	17	
323.6'	4.5'			SPT-3	3.0 - 4.5	1.5	6-5-4	20	
		LEAN CLAY, mottled brown and gray to gray and reddish brown, moist, soft to very stiff		SPT-4	4.5 - 6.0	1.5	6-5-4	23	
				SPT-5	6.0 - 7.5	1.5	2-5-5	25	
				SPT-6	7.5 - 9.0	1.5	5-6-8	26	
		-Organics at 9.0 ft.		SPT-7	9.0 - 10.5	1.5	3-7-8	24	
				SPT-8	10.5 - 12.0	1.5	4-8-11	21	
		-Silty beginning at 12.0 ft.		SPT-9	12.0 - 13.5	1.5	5-7-8	20	
				SPT-10	13.5 - 15.0	1.5	4-6-5	25	
				SPT-11	15.0 - 16.5	1.5	2-2-2	25	
				SPT-12	16.5 - 18.0	1.5	2-2-2	30	
				SPT-13	18.0 - 19.5	1.5	1-2-4	23	
				SPT-14	19.5 - 21.0	1.5	2-3-5	21	
		-Sandy from 21.0 to 22.5 ft.		SPT-15	21.0 - 22.5	1.5	5-5-6	19	
		-Occasional manganese concretions from 22.5 to 30.0 ft.		SPT-16	22.5 - 24.0	1.5	3-5-7	25	
				SPT-17	24.0 - 25.5	1.5	4-4-6	27	
				SPT-18	25.5 - 27.0	1.5	4-5-8	25	
				SPT-19	27.0 - 28.5	1.5	3-4-5	27	
298.1'	30.0'			SPT-20	28.5 - 30.0	1.5	3-4-10	24	
		POORLY GRADED SAND with Silt, reddish brown, wet, medium dense to dense		SPT-21	30.0 - 31.5	1.0	5-20-20	19	
				SPT-22	31.5 - 33.0	1.0	3-5-10	24	Boring backfilled with bentonite grout from 0.0 to 36.0 ft.
				SPT-23	33.0 - 34.5	1.0	10-14-19	18	
292.1'	36.0'			SPT-24	34.5 - 36.0	1.2	10-16-26	14	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 317333.36, E 1112605.34 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-5** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	351.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/21/09 Completed 9/21/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	18.0 ft Date/Time 9/21/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.6'	0.0'	Top of Hole						
		Fill: LEAN CLAY with Sand, reddish brown and gray, moist, stiff to very stiff, silty, occasional fine gravel	SPT-1	0.0 - 1.5	1.2	10-5-6	7	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.1	10-10-12	17	
			SPT-3	3.0 - 4.5	1.3	10-12-13	11	Bulk sample obtained from 4.0 to 8.0 ft.
			SPT-4	4.5 - 6.0	1.2	12-14-15	16	
			SPT-5	6.0 - 7.5	1.3	5-7-7	13	
			SPT-6	7.5 - 9.0	1.2	5-8-8	15	
			SPT-7	9.0 - 10.5	1.4	3-4-4	11	
			SPT-8	10.5 - 12.0	1.5	7-9-9	14	
338.6'	13.0'		SPT-9	12.0 - 13.5	1.4	10-13-15	24	
		Fill: FLY ASH, black, moist to wet, medium dense to loose	SPT-10	13.5 - 15.0	1.0	5-11-13	24	
			SPT-11	15.0 - 16.5	1.5	6-8-12	20	
			SPT-12	16.5 - 18.0	1.5	4-4-4	19	
			SPT-13	18.0 - 19.5	1.3	1-2-2	28	
330.6'	21.0'		SPT-14	19.5 - 21.0	1.4	1-2-2	23	
		Fill: LEAN CLAY, brown and gray, moist, medium stiff to stiff, silty	SPT-15	21.0 - 22.5	0.5	6-4-1	26	
			SPT-16	22.5 - 24.0	0.7	1-2-2	26	
			SPT-17	24.0 - 25.5	0.7	4-5-5	28	
			SPT-18	25.5 - 27.0	0.9	3-4-4	24	
323.0'	28.6'							
		LEAN CLAY, reddish brown and gray, moist to wet, soft to very stiff, with occasional silt lenses and fine gravel	SPT-19	28.5 - 30.0	0.8	2-2-2	28	Bulk sample obtained from 30.0 to 38.0 ft.
			SPT-20	31.0 - 32.5	1.5	2-3-5	25	
			SPT-21	33.5 - 35.0	1.2	2-4-5	27	
			SPT-22	36.0 - 37.5	1.2	4-5-6	25	
			SPT-23	38.5 - 40.0	1.0	3-3-3	28	
		-Silty and trace managanese concretions beginning at 41.0 ft.	SPT-24	41.0 - 42.5	1.3	4-6-7	21	

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SUBSURFACE LOG

Project No.	175559023	Location	N 317333.36, E 1112605.34 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-5** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		LEAN CLAY, reddish brown and gray, moist to wet, soft to very stiff, with occasional silt lenses and fine gravel *(Continued)*		SPT-25	43.5 - 45.0	1.4	4-4-5	22	
				SPT-26	46.0 - 47.5	1.5	6-7-10	24	
				SPT-27	48.5 - 50.0	1.5	3-5-6	26	
				SPT-28	51.0 - 52.5	1.4	3-4-3	21	
295.6'	56.0'	-Gravelly from 53.5 to 56.0 ft.		SPT-29	53.5 - 55.0	1.4	12-14-50	23	
		POORLY GRADED SAND with Silt and Gravel, reddish brown, wet, very dense		SPT-30	56.0 - 57.5	0.8	4-6-13	17	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
291.6'	60.0'			SPT-31	58.5 - 60.0	0.7	5-17-40	13	

No Refusal /
Bottom of Hole

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316969.98, E 1112248.35 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-6** Total Depth 30.0 ft
Location	McCracken County, Kentucky	Surface Elevation	328.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/22/09 Completed 9/22/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	21.0 ft Date/Time 9/22/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
328.6'	0.0'	Top of Hole							
325.6'	3.0'	Fill: SANDY LEAN CLAY, reddish brown, moist, stiff, occasional roots		SPT-1	0.0 - 1.5	1.5	4-6-8	16	Boring advanced with 4.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.5	6-6-8	9	
315.1'	13.5'	SANDY LEAN CLAY, reddish brown to gray and tan, moist, soft to stiff, occasional roots in upper 4.5 ft		SPT-3	3.0 - 4.5	1.5	5-4-4	18	
				SPT-4	4.5 - 6.0	0.8	2-3-4	15	
				SPT-5	6.0 - 7.5	1.0	2-2-3	31	
				SPT-6	7.5 - 9.0	1.0	2-1-2	18	
				SPT-7	9.0 - 10.5	1.0	1-2-4	17	
				SPT-8	10.5 - 12.0	1.5	1-1-2	23	
				SPT-9	12.0 - 13.5	1.5	2-3-4	22	
298.6'	30.0'	POORLY GRADED SAND with Silt and Gravel, reddish brown, moist to wet, medium dense to dense, occasional clay pockets		SPT-10	13.5 - 15.0	1.5	7-7-8	17	
				SPT-11	15.0 - 16.5	1.5	7-8-7	15	
				SPT-12	16.5 - 18.0	1.5	5-7-7	11	
				SPT-13	18.0 - 19.5	1.5	5-10-16	13	
				SPT-14	19.5 - 21.0	1.5	14-17-18	14	
				SPT-15	21.0 - 22.5	1.5	8-10-21	18	
				SPT-16	22.5 - 24.0	1.1	5-18-32	19	
				SPT-17	24.0 - 25.5	1.5	6-12-17	17	
				SPT-18	25.5 - 27.0	1.5	8-24-28	23	See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

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Project No.	175559023	Location	N 316915.52, E 1112335.31 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-8** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	351.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/20/09 Completed 9/21/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	16.0 ft Date/Time 9/21/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.9'	0.0'	Top of Hole							
		Fill: LEAN CLAY with Sand, mottled brown and gray, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	1.0	8-9-9	15	Boring advanced with 4.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.5	8-19-22	16	
				SPT-3	3.0 - 4.5	1.4	14-15-18	14	Bulk sample obtained between 4.0 to 8.0 ft.
				ST-1	4.5 - 6.5	1.8		14	
				SPT-4	6.5 - 8.0	1.5	4-4-7	17	
				SPT-5	8.0 - 9.5	1.5	7-9-10	13	
340.4'	11.5'			ST-2	9.5 - 11.5	1.5		13	
		Fill: FLY ASH, dark gray and black, moist to wet, very soft to very stiff		SPT-6	11.5 - 13.0	1.2	11-13-14	19	
				SPT-7	13.0 - 14.5	1.0	9-13-14	17	
				SPT-8	14.5 - 16.0	1.2	7-9-9	28	
				SPT-9	16.0 - 17.5	1.5	1-1-1	40	
				SPT-10	17.5 - 19.0	1.2	0-1-1	28	
331.4'	20.5'			SPT-11	19.0 - 20.5	1.5	0-1-1	29	
		Fill: SANDY LEAN CLAY, brown and gray, wet, stiff to very stiff		SPT-12	20.5 - 22.0	0.0	1-1-7	--	
				SPT-13	22.0 - 23.5	1.3	6-7-9	25	
				SPT-14	23.5 - 25.0	1.4	3-4-5	18	
324.4'	27.5'			SPT-15	26.0 - 27.5	1.2	5-7-8	7	
		POORLY GRADED SAND with Silt and Gravel, reddish brown, moist to wet, loose to dense		SPT-16	28.5 - 30.0	0.9	3-6-7	5	
				SPT-17	31.0 - 32.5	1.1	4-7-7	11	
				SPT-18	33.5 - 35.0	1.1	4-4-5	9	
				SPT-19	36.0 - 37.5	1.2	4-5-6	8	
				SPT-20	38.5 - 40.0	1.2	4-6-8	16	
				SPT-21	41.0 - 42.5	1.0	11-12-15	15	

Project No.	175559023	Location	N 316915.52, E 1112335.31 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-8** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		POORLY GRADED SAND with Silt and Gravel, reddish brown, moist to wet, loose to dense *(Continued)*		SPT-22	43.5 - 45.0	0.8	7-12-8	14	
				SPT-23	46.0 - 47.5	1.2	5-5-4	18	
				SPT-24	48.5 - 50.0	0.9	1-1-3	18	
				SPT-25	51.0 - 52.5	0.8	12-13-16	14	
				SPT-26	53.5 - 55.0	1.3	7-9-9	18	
				SPT-27	56.0 - 57.5	1.4	6-14-32	15	See "Piezometer Installation Detail" for backfill materials and amounts used.
291.9'	60.0'			SPT-28	58.5 - 60.0	1.5	7-8-9	19	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316921.21, E 1112325.90 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-8A** Total Depth 20.0 ft
Location	McCracken County, Kentucky	Surface Elevation	351.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/11/10 Completed 1/11/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.9'	0.0'	Top of Hole						
351.4'	0.5'	CRUSHED STONE						Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY with Sand, mottled brown and gray, moist, stiff to very stiff, silty						
			SPT-1	5.0 - 6.5	1.0	3-12-15	12	
			SPT-2	6.5 - 8.0	0.8	15-17-25	11	
			SPT-3	8.0 - 9.5	0.4	15-25-25	12	
			SPT-4	9.5 - 11.0	1.2	5-14-14	13	
			SPT-5	11.0 - 12.5	1.2	5-9-14	13	
337.9'	14.0'		SPT-6	12.5 - 14.0	1.3	9-13-16	14	
		Fill: LEAN CLAY, brown and gray, moist, stiff to very stiff	SPT-7	14.0 - 15.5	0.8	5-6-7	14	
			SPT-8	15.5 - 17.0	1.5	6-7-8	18	
			SPT-9	17.0 - 18.5	0.7	8-8-10	22	Boring backfilled with bentonite grout from 0.0 ft. to 20.0 ft.
331.9'	20.0'	-Fly ash from 18.0 ft. to 18.1 ft.	SPT-10	18.5 - 20.0	0.6	10-10-12	22	

No Refusal /
Bottom of Hole

Offset 11 ft. northwest of STN-8.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Stantec

Project No.	175559023	Location	N 316924.83, E 1112319.91 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-8P** Total Depth 24.5 ft
Location	McCracken County, Kentucky	Surface Elevation	351.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/7/10 Completed 1/7/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.9'	0.0'	Top of Hole							
351.4'	0.5'	TOPSOIL							Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY with Sand, mottled brown and gray, moist, very stiff, silty							
				ST-1	4.0 - 6.0	1.6		10	
				ST-2	6.0 - 8.0	1.7		13	
				SPT-1	8.0 - 9.5	1.3	6-10-12	13	
				SPT-2	9.5 - 11.0	0.8	18-22-24	13	
				SPT-3	11.0 - 12.5	1.3	14-14-16	14	
337.9'	14.0'			SPT-4	12.5 - 14.0	0.9	12-14-14	16	
		Fill: LEAN CLAY, light brown, moist, stiff to very stiff, occasional fine to medium sand		SPT-5	14.0 - 15.5	0.5	4-5-6	15	
				SPT-6	15.5 - 17.0	0.9	4-4-7	19	
				SPT-7	17.0 - 18.5	0.8	7-9-12	21	
				ST-3	18.5 - 20.5	1.5		19	Bulk sample taken from 20.0 to 24.5 ft.
				ST-4	20.5 - 22.5	1.8		20	See "Piezometer Installation Detail" for backfill materials and amounts used.
327.4'	24.5'			ST-5	22.5 - 24.5	1.3		16	

No Refusal /
Bottom of Hole

Offset 18 ft. northwest of STN-8.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316418.46, E 1112301.70 (NAD27)		
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-9**	Total Depth	33.5 ft
Location	McCracken County, Kentucky	Surface Elevation	328.6 ft. (NGVD29)		
Project Type	Geotechnical Exploration	Date Started	2/1/10	Completed	2/1/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	11.0 ft	Date/Time	2/1/10
Logged By	C. Millhollin	Automatic Hammer ☐	Safety Hammer ☒	Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
328.6'	0.0'	Top of Hole						
328.4'	0.2'	TOPSOIL	SPT-1	0.0 - 1.5	1.0	3-3-7	21	Boring advanced with 3.25" hollow stem augers.
		Fill: SANDY LEAN CLAY, light brown and gray, moist to wet, medium stiff to very stiff	SPT-2	1.5 - 3.0	1.1	10-12-16	16	
324.1'	4.5'		SPT-3	3.0 - 4.5	1.1	15-16-19	18	
		LEAN CLAY with Sand, reddish brown and gray, moist, medium stiff to very stiff	SPT-4	4.5 - 6.0	1.0	3-3-5	20	
			SPT-5	6.0 - 7.5	0.9	6-4-3	21	
			SPT-6	7.5 - 9.0	0.7	2-3-2	30	
			ST-1	9.0 - 11.0			24	
			SPT-7	11.0 - 12.5	1.3	7-12-13	23	
		-Wet, light gray fat clay from 14.0 to 15.5 ft.	SPT-8	12.5 - 14.0	1.3	13-17-19	20	
313.1'	15.5'		SPT-9	14.0 - 15.5	1.5	2-3-2	29	
		POORLY GRADED SAND with Silt, reddish brown to dark gray, moist to wet, medium dense to very dense	SPT-10	15.5 - 17.0	0.9	2-5-8	22	
			SPT-11	17.0 - 18.5	1.3	8-9-9	23	
			SPT-12	18.5 - 20.0	1.5	13-13-12	20	
			SPT-13	20.0 - 21.5	1.0	5-8-18	24	
			SPT-14	21.5 - 23.0	1.2	25-38-37	14	
		-Gravelly from 20.0 to 26.0 ft.	SPT-15	23.0 - 24.5	1.5	25-21-26	11	
			SPT-16	24.5 - 26.0	1.1	13-13-11	21	
			SPT-17	26.0 - 27.5	1.2	10-10-15	18	
			SPT-18	27.5 - 29.0	1.4	11-19-12	15	
			SPT-19	29.0 - 30.5	0.9	13-17-19	12	
		-Gravelly from 29.0 to 32.0 ft.	SPT-20	30.5 - 32.0	1.2	32-35-29	15	Boring backfilled with bentonite grout from 0.0 to 33.5 ft.
295.1'	33.5'		SPT-21	32.0 - 33.5	1.5	9-9-12	18	
		No Refusal / Bottom of Hole						

SUBSURFACE LOG

Project No.	175559023	Location	N 316454.21, E 1112370.24 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-10** Total Depth 55.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/13/10 Completed 1/13/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	22.0 ft Date/Time 1/13/10
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.7'	0.0'	Top of Hole						
350.2'	0.5'	CRUSHED STONE	SPT-1	0.0 - 1.5	0.5	32-6-7	13	Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY, light brown and gray, moist, stiff to very stiff, silty, occasional fine gravel and sand	SPT-2	1.5 - 3.0	0.9	12-12-14	13	
			SPT-3	3.0 - 4.5	1.2	32-42-11	15	
			SPT-4	4.5 - 6.0	0.8	5-9-9	13	
			SPT-5	6.0 - 7.5	0.9	8-10-12	17	
			ST-1	7.5 - 9.5	1.4		13	
			SPT-6	9.5 - 11.0	1.1	10-12-12	13	
			SPT-7	11.0 - 12.5	1.5	12-14-14	14	
			SPT-8	12.5 - 14.0	0.8	13-15-15	15	
335.8'	14.9'		SPT-9	14.0 - 15.5	0.6	3-5-5	15	
335.1'	15.6'	Fill: BOTTOM ASH, black, moist to wet, loose	SPT-10	15.5 - 17.0	1.5	5-5-5	15	
		Fill: LEAN CLAY, brown and gray, moist, stiff to very stiff, silty, trace amounts of sand throughout -Sandy from 15.6 to 18.5 ft.	SPT-11	17.0 - 18.5	0.8	4-4-5	19	
			SPT-12	18.5 - 20.0	0.7	7-8-8	18	
			ST-2	20.0 - 22.0	1.7		16	
327.2'	23.5'		SPT-13	22.0 - 23.5	1.3	10-10-16	22	
		POORLY GRADED SAND with Silt, yellowish brown to reddish brown, moist to wet, loose to medium dense	SPT-14	26.0 - 27.5	1.5	3-6-3	22	
		-Clay layer from 30.0 to 31.5 ft.	SPT-15	30.0 - 31.5	1.5	4-4-4	21	
			SPT-16	31.5 - 33.0	0.8	8-12-14	18	
			SPT-17	34.0 - 35.5	0.6	4-6-8	10	
			SPT-18	36.5 - 38.0	0.6	5-8-12	9	
			SPT-19	39.0 - 40.5	0.8	5-7-7	15	
			SPT-20	41.5 - 43.0	0.9	0-2-2	27	

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SUBSURFACE LOG

Project No.	175559023	Location	N 316454.21, E 1112370.24 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-10** Total Depth 55.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		-Coarse sand below 44.0 ft. POORLY GRADED SAND with Silt, yellowish brown to reddish brown, moist to wet, loose to medium dense *(Continued)*		SPT-21	44.0 - 45.5	1.2	7-10-14	19	
				SPT-22	46.5 - 48.0	0.8	0-3-3	19	
				SPT-23	49.0 - 50.5	0.7	8-10-14	16	
				SPT-24	51.5 - 53.0	0.1	3-3-3	13	Boring backfilled with bentonite grout from 0.0 to 55.5 ft.
295.2'	55.5'			SPT-25	54.0 - 55.5	0.1	3-6-3	8	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 315974.74, E 1112535.84 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-11** Total Depth 32.3 ft
Location	McCracken County, Kentucky	Surface Elevation	327.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/30/10 Completed 1/31/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	21.0 ft Date/Time 1/31/10
Logged By	C. Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology: Elevation	Lithology: Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
327.3'	0.0'	Top of Hole						
327.1'	0.2'	TOPSOIL	SPT-1	0.0 - 1.5	1.0	4-5-5	18	Boring advanced with 3.25" hollow stem augers.
		Fill: SANDY LEAN CLAY, reddish brown, moist, stiff to very stiff	SPT-2	1.5 - 3.0	1.2	5-6-8	20	
322.8'	4.5'		SPT-3	3.0 - 4.5	1.0	7-9-11	17	
		LEAN CLAY, reddish brown to light gray, moist, stiff to very stiff -Organics at 4.5 ft.	SPT-4	4.5 - 6.0	1.5	8-6-7	21	
			SPT-5	6.0 - 7.5	1.0	7-9-9	26	
		-Highly plastic clay and roots intermixed from 6.0 to 7.5 ft and 10.5 to 12.0 ft.	SPT-6	7.5 - 9.0	1.3	8-10-11	19	
			SPT-7	9.0 - 10.5	1.1	4-4-4	26	
			SPT-8	10.5 - 12.0	0.9	4-5-7	28	
			SPT-9	12.0 - 13.5	0.8	4-6-9	25	
			SPT-10	13.5 - 15.0	1.2	3-4-5	28	
310.8'	16.5'		SPT-11	15.0 - 16.5	1.5	5-5-6	26	
		LEAN CLAY with Sand, light gray and tan, moist to wet, stiff to very stiff, silty	SPT-12	16.5 - 18.0	1.3	5-6-7	24	
			SPT-13	18.0 - 19.5	1.4	9-11-13	24	
			SPT-14	19.5 - 21.0	1.2	6-7-10	23	
			SPT-15	21.0 - 22.5	1.2	3-4-5	23	
		-Fat clay pocket from 24.3 to 24.5 ft.	SPT-16	22.5 - 24.0	1.2	5-5-6	24	
302.8'	24.5'		SPT-17	24.0 - 25.5	0.8	2-4-2	30	
		POORLY GRADED SAND with Silt, reddish brown to dark gray, moist to wet, loose to very dense, occasional organics	SPT-18	25.5 - 27.0	1.3	0-2-4	21	
			SPT-19	27.0 - 28.5	1.5	11-14-19	20	
			SPT-20	28.5 - 30.0	1.5	6-16-20	24	See "Piezometer Installation Detail" for backfill materials and amounts used.
295.0'	32.3'	-Gravelly beginning at 30.0 ft.	SPT-21	30.0 - 31.5	1.5	30-36-50/0.4'	16	
		No Refusal / Bottom of Hole						

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Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 316016.50, E 1112610.36 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-12** Total Depth 56.0 ft
Location	McCracken County, Kentucky	Surface Elevation	351.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/14/10 Completed 1/14/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	10.0 ft Date/Time 1/14/10
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.0'	0.0'	Top of Hole							
350.7'	0.3'	CRUSHED STONE		SPT-1	0.0 - 1.5	1.1	30-15-15	14	Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY, light brown and gray, moist, very stiff, silty, occasional sand and gravel		SPT-2	1.5 - 3.0	1.0	15-12-12	15	
				SPT-3	3.0 - 4.5	0.8	20-20-16	12	Bulk sample taken from 4.0 to 6.0 ft.
				ST-1	4.5 - 6.5	1.8		16	
				SPT-4	6.5 - 8.0	1.2	7-10-12	11	
				SPT-5	8.0 - 9.5	1.3	11-14-16	12	
				SPT-6	9.5 - 11.0	0.9	4-7-9	14	
				SPT-7	11.0 - 12.5	1.0	7-12-15	15	
337.6'	13.4'			SPT-8	12.5 - 14.0	1.1	15-15-14	18	
336.3'	14.7'	Fill: FLY ASH, dark gray, moist to wet, loose to medium dense		SPT-9	14.0 - 15.5	1.2	11-7-3	24	
		Fill: SANDY LEAN CLAY, reddish brown, moist, soft to very stiff		ST-2	15.5 - 17.5	1.9		18	
				SPT-10	17.5 - 19.0	0.5	0-3-3	18	
				SPT-11	19.0 - 20.5	0.8	3-3-3	20	
				SPT-12	20.5 - 22.0	0.6	1-1-1	23	
				SPT-13	22.0 - 23.5	0.8	5-10-9	15	
326.0'	25.0'			SPT-14	23.5 - 25.0	0.6	7-10-10	16	
		LEAN CLAY with Sand, reddish brown and gray to light gray, moist, medium stiff to very stiff, organics throughout, silty		ST-3	25.0 - 27.0	2.0		21	
				SPT-15	27.0 - 28.5	0.8	5-6-12	14	
				SPT-16	28.5 - 30.0	0.6	10-10-11	14	
		-Sandy from 28.5 to 34.0 ft.		SPT-17	30.0 - 31.5	1.5	8-8-8	21	
				SPT-18	31.5 - 33.0	1.0	4-7-9	20	
				ST-4	33.0 - 35.0	2.0		18	
				SPT-19	35.0 - 36.5	0.7	1-2-3	27	
313.0'	38.0'			SPT-20	36.5 - 38.0	0.8	4-4-4	28	
		LEAN CLAY, brown and gray, moist to wet, soft to stiff, highly plastic clay intermixed, trace amounts of sand		SPT-21	38.0 - 39.5	0.4	4-4-4	26	
				SPT-22	39.5 - 41.0	0.5	4-5-5	22	
				SPT-23	41.0 - 42.5	0.7	4-3-3	24	
				SPT-24	42.5 - 44.0	1.0	5-4-5	27	

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Project No.	175559023	Location	N 316016.50, E 1112610.36 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-12** Total Depth 56.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		LEAN CLAY, brown and gray, moist to wet, soft to stiff, highly plastic clay intermixed, trace amounts of sand *(Continued)*		SPT-25	44.0 - 45.5	1.5	5-5-5	25	
				SPT-26	45.5 - 47.0	1.5	2-2-2	28	
302.5'	48.5'			SPT-27	47.0 - 48.5	1.0	2-2-3	27	
		SANDY SILT, gray and reddish brown, moist to wet, medium to stiff		SPT-28	48.5 - 50.0	1.2	3-3-4	24	
				SPT-29	50.0 - 51.5	1.5	5-4-5	21	
298.0'	53.0'			SPT-30	51.5 - 53.0	0.8	2-3-6	23	See "Piezometer Installation Detail" for backfill materials and amounts used.
		POORLY GRADED SAND with Silt, reddish brown, wet, dense		SPT-31	53.0 - 54.5	0.9	23-17-15	17	
295.0'	56.0'			SPT-32	54.5 - 56.0	1.0	15-16-19	15	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 316012.54, E 1112611.83 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-13** Total Depth 20.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.8 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/15/10 Completed 1/15/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	10.0 ft Date/Time 1/15/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
350.8'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-12							Boring advanced with 3.25" hollow stem augers. Bulk sample taken from 16.0 to 20.0 ft. See "Piezometer Installation Detail" for backfill materials and amounts used.
330.8'	20.0'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 315536.24, E 1112778.56 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-14** — Total Depth 27.5 ft
Location	McCracken County, Kentucky	Surface Elevation	327.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/28/10 — Completed 1/29/10
Supervisor	C. Millhollin — Driller S. Wilks	Depth to Water	21.5 ft — Date/Time 1/29/10
Logged By	C. Millhollin	Automatic Hammer ☐	Safety Hammer ☒ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
327.5'	0.0'	Top of Hole							
		Fill: LEAN CLAY, reddish brown and gray, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	1.0	2-5-9	21	Boring advanced with 3.25" hollow stem augers.
				SPT-2	1.5 - 3.0	1.0	8-9-11	17	
323.0'	4.5'			SPT-3	3.0 - 4.5	1.2	10-10-12	20	
		LEAN CLAY with Sand, reddish brown and gray to light gray, moist to wet, medium stiff to very stiff, silty -Highly plastic clay intermixed from 7.5 to 9.0 ft.		SPT-4	4.5 - 6.0	1.5	5-4-4	22	
				SPT-5	6.0 - 7.5	0.8	5-4-4	18	
				SPT-6	7.5 - 9.0	0.8	4-4-7	24	
				ST-1	9.0 - 11.0	2.0		22	
				SPT-7	11.0 - 12.5	0.5	1-1-3	27	
		-Organics from 11.0 to 14.0 ft.		SPT-8	12.5 - 14.0	0.9	2-2-3	22	
				SPT-9	14.0 - 15.5	1.3	4-4-6	26	
				SPT-10	15.5 - 17.0	1.2	6-6-6	22	
				SPT-11	17.0 - 18.5	1.5	10-10-9	23	
307.5'	20.0'			SPT-12	18.5 - 20.0	1.5	3-5-5	26	
		LEAN CLAY with Sand, light brown and gray, moist to wet, stiff to very stiff, silty		SPT-13	20.0 - 21.5	1.5	4-4-5	24	
				SPT-14	21.5 - 23.0	1.5	5-8-8	19	
				SPT-15	23.0 - 24.5	1.3	3-4-4	25	
302.0'	25.5'			SPT-16	24.5 - 26.0	0.8	5-7-12	24	Boring backfilled with bentonite grout from 0.0 to 27.5 ft.
300.0'	27.5'	POORLY GRADED SAND with Silt, yellowish brown, wet, dense		SPT-17	26.0 - 27.5	1.1	15-13-19	15	
		No Refusal / Bottom of Hole							

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 315586.82, E 1112855.70 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-15** Total Depth 51.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/15/10 Completed 1/15/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	24.0 ft Date/Time 1/15/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.5'	0.0'	Top of Hole						
350.0'	0.5'	CRUSHED STONE	SPT-1	0.0 - 1.5	1.0	10-14-14	14	Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY with Sand, light brown to gray, moist, very stiff, silty, occasional fine gravel	SPT-2	1.5 - 3.0	0.8	15-15-12	13	
			SPT-3	3.0 - 4.5	0.6	25-20-17	10	
			ST-1	4.5 - 6.5	2.0		14	
			SPT-4	6.5 - 8.0	1.0	10-10-10	16	
			SPT-5	8.0 - 9.5	0.5	8-7-9	11	
			SPT-6	9.5 - 11.0	1.2	14-12-13	9	
			SPT-7	11.0 - 12.5	1.0	6-10-12	13	
			SPT-8	12.5 - 14.0	0.7	12-11-12	15	
336.0'	14.5'		SPT-9	14.0 - 15.5	1.0	6-6-6	14	
		Fill: BOTTOM ASH, dark gray, moist, medium dense, clay intermixed	SPT-10	15.5 - 17.0	1.3	8-8-9	18	
332.0'	18.5'		SPT-11	17.0 - 18.5	0.5	6-8-10	23	
		Fill: SANDY LEAN CLAY, brown and gray, moist, stiff to very stiff	SPT-12	18.5 - 20.0	0.8	4-4-5	18	
			ST-2	20.0 - 22.0	1.3		14	
			SPT-13	22.0 - 23.5	0.7	4-10-10	18	
324.5'	26.0'		SPT-14	24.5 - 26.0	0.4	2-4-7	16	
		LEAN CLAY with Sand, brown and gray to light gray, moist, stiff to very stiff -Wet zone 28.5 to 30.0 ft.	SPT-15	27.0 - 28.5	0.8	3-6-8	16	
			SPT-16	28.5 - 30.0	1.0	5-5-9	28	
			ST-3	30.0 - 32.0	1.5		33	
			SPT-17	32.0 - 33.5	0.9	10-12-14	17	
			SPT-18	34.5 - 36.0	1.5	6-6-7	21	
			SPT-19	37.0 - 38.5	0.7	6-7-12	17	
309.0'	41.5'		SPT-20	39.5 - 41.0	0.6	5-5-5	22	
306.5'	44.0'	SANDY SILT, gray, moist, stiff	SPT-21	42.0 - 43.5	0.9	3-5-5	20	

SUBSURFACE LOG

Project No.	175559023	Location	N 315586.82, E 1112855.70 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-15** Total Depth 51.0 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		SILTY SAND, light gray, wet, loose to medium dense, occasional gravel and clay pockets *(Continued)*		SPT-22	44.5 - 46.0	0.9	6-9-9	19	
				SPT-23	47.0 - 48.5	0.7	3-3-9	23	Boring backfilled with bentonite grout from 0.0 to 51.0 ft.
299.5'	51.0'			SPT-24	49.5 - 51.0	1.0	3-3-5	22	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 315098.19, E 1113021.92 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-16** Total Depth 25.5 ft
Location	McCracken County, Kentucky	Surface Elevation	328.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/28/10 Completed 1/28/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	20.0 ft Date/Time 1/28/10
Logged By	C. Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
328.5'	0.0'	Top of Hole							
		Fill: LEAN CLAY with Sand, reddish brown and gray, moist, stiff to very stiff, occasional organics		SPT-1	0.0 - 1.5	1.0	3-5-7	22	Boring advanced with 3.25" hollow stem augers.
				SPT-2	1.5 - 3.0	0.7	14-14-13	15	
				SPT-3	3.0 - 4.5	0.9	11-11-11	15	
322.5'	6.0'			SPT-4	4.5 - 6.0	1.5	5-8-8	24	
		LEAN CLAY, yellowish brown and gray, moist to wet, medium stiff to very stiff, silty, trace amounts of sand, increasing sand content with depth		SPT-5	6.0 - 7.5	1.0	5-5-4	24	
				SPT-6	7.5 - 9.0	1.2	11-14-15	15	
				SPT-7	9.0 - 10.5	1.1	4-3-3	22	
				SPT-8	10.5 - 12.0	1.2	4-4-7	20	
				SPT-9	12.0 - 13.5	1.5	6-6-5	19	
				SPT-10	13.5 - 15.0	1.0	5-7-7	22	
				SPT-11	15.0 - 16.5	1.5	2-3-4	20	Bulk sample taken from 15.0 to 18.0 ft.
				SPT-12	16.5 - 18.0	1.1	2-3-3	19	
				SPT-13	18.0 - 19.5	1.0	4-4-6	19	
308.3'	20.2'			SPT-14	19.5 - 21.0	1.3	6-7-4	21	
		POORLY GRADED SAND with Silt and Gravel, reddish brown to gray, wet, medium dense to dense, occasional clay pockets		SPT-15	21.0 - 22.5	1.5	9-18-19	18	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-16	22.5 - 24.0	0.7	17-11-14	12	
303.0'	25.5'			SPT-17	24.0 - 25.5	1.2	7-8-9	20	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559023	Location	N 315137.42, E 1113091.63 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-17** Total Depth 47.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/25/10 Completed 1/26/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	27.0 ft Date/Time 1/26/10
Logged By	C. Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.3'	0.0'	Top of Hole						
350.1'	0.2'	CRUSHED STONE	SPT-1	0.0 - 1.5	0.8	5-8-11	15	Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY, light brown, moist, stiff to very stiff, occasional gravel and sand in upper 6.0 ft	SPT-2	1.5 - 3.0	0.9	12-16-21	14	
			SPT-3	3.0 - 4.5	0.8	16-17-17	17	
			SPT-4	4.5 - 6.0	0.5	13-20-15	13	
			SPT-5	6.0 - 7.5	0.8	7-16-20	22	
			ST-1	7.5 - 9.5	1.0		13	Bulk sample taken from 6.0 to 10.0 ft.
			SPT-6	9.5 - 11.0	1.2	5-7-10	15	
			ST-2	11.0 - 13.0	1.1		17	
			SPT-7	13.0 - 14.5	1.0	3-4-7	33	
335.3'	15.0'		SPT-8	14.5 - 16.0	1.3	11-11-12	52	
		Fill: LEAN CLAY, reddish brown and gray, moist, stiff to very stiff, silty -Fly ash intermixed with clay from 15.0 to 15.2 ft.	ST-3	16.0 - 18.0	2.0		21	
			SPT-9	18.0 - 19.5	1.3	5-6-8	21	
			SPT-10	19.5 - 21.0	1.0	7-7-7	19	
			SPT-11	21.0 - 22.5	1.1	6-10-15	18	
		-Sandy from 21.0 to 26.0 ft.	SPT-12	22.5 - 24.0	1.1	12-12-14	20	
			ST-4	24.0 - 26.0	1.8		19	
324.3'	26.0'	LEAN CLAY, reddish brown and gray to light gray, moist to wet, medium stiff to very stiff, silty -Organics at 26.0 ft.	SPT-13	26.0 - 27.5	1.2	5-4-3	21	
			SPT-14	27.5 - 29.0	1.1	5-5-10	22	
			SPT-15	29.0 - 30.5	1.2	6-8-8	21	
			SPT-16	30.5 - 32.0	1.1	8-11-15	18	
			SPT-17	32.0 - 33.5	1.2	7-8-7	23	
			SPT-18	33.5 - 35.0	1.3	4-5-4	24	
			ST-5	35.0 - 37.0	2.0		22	
			SPT-19	37.0 - 38.5	1.3	3-7-13	25	
			SPT-20	38.5 - 40.0	1.4	3-12-11	20	
309.1'	41.2'		ST-6	40.0 - 42.0	2.0		19	
			SPT-21	43.0 - 44.5	1.5	7-20-27	19	See "Piezometer Installation Detail"

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SUBSURFACE LOG

Project No.	175559023	Location	N 315137.42, E 1113091.63 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-17** Total Depth 47.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
303.3'	47.0'	POORLY GRADED SAND with Silt, yellowish brown, wet, dense, occasional gravel and clay pockets *(Continued)*		SPT-22	45.5 - 47.0	1.5	7-20-29	22	for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

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Project No.	175559023	Location	N 315133.53, E 1113093.60 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-18** Total Depth 25.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/26/10 Completed 1/26/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
350.4'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-17							Boring advanced with 3.25" hollow stem augers.
				ST-1	6.0 - 8.0	1.1		15	
				ST-2	14.0 - 16.0	1.7		17	Bulk sample #1 taken from 16.0 to 18.0 ft.
				ST-3	18.0 - 20.0	2.0		21	
				ST-4	22.0 - 24.0	1.7		20	Bulk sample #2 taken from 22.0 to 25.0 ft.
325.4'	25.0'	No Refusal / Bottom of Hole							See "Piezometer Installation Detail" for backfill materials and amounts used.

SUBSURFACE LOG

Project No.	175559023	Location	N 314652.04, E 1113265.95 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-19** Total Depth 21.9 ft
Location	McCracken County, Kentucky	Surface Elevation	328.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/27/10 Completed 1/27/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	20.5 ft Date/Time 1/27/10
Logged By	C. Millhollin	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
328.5'	0.0'	Top of Hole							
		Fill: LEAN CLAY, brown, moist, stiff to very stiff, silty, trace amounts of sand		SPT-1	0.0 - 1.5	0.9	3-2-6	23	Boring advanced with 3.25" hollow stem augers.
				SPT-2	1.5 - 3.0	0.8	9-8-9	21	
323.7'	4.8'	-Organics from 4.5 to 4.8 ft.		SPT-3	3.0 - 4.5	0.9	8-8-7	24	
		LEAN CLAY with Sand, light brown and gray, moist, medium stiff to very stiff, silty		SPT-4	4.5 - 6.0	1.3	3-2-5	21	
				SPT-5	6.0 - 7.5	1.0	8-12-12	19	
				SPT-6	7.5 - 9.0	1.2	11-14-12	20	
318.0'	10.5'	-Organics from 9.0 to 10.5 ft.		SPT-7	9.0 - 10.5	1.5	3-3-2	24	Bulk sample taken from 9.0 to 11.0 ft.
		SILT, light gray, moist, medium stiff to stiff, occasional clay pockets		SPT-8	10.5 - 12.0	1.5	2-3-2	27	
				SPT-9	12.0 - 13.5	1.2	2-3-4	26	
				SPT-10	13.5 - 15.0	1.5	4-4-5	24	
				SPT-11	15.0 - 16.5	1.3	7-7-7	25	
				SPT-12	16.5 - 18.0	1.5	6-7-14	26	
309.0'	19.5'			SPT-13	18.0 - 19.5	1.5	7-5-5	15	Boring backfilled with bentonite grout from 0.0 to 21.9 ft.
		WELL GRADED GRAVEL with Silt and Sand, yellowish brown, wet, medium dense to very dense		SPT-14	19.5 - 21.0	1.0	11-13-16	16	
306.6'	21.9'			SPT-15	21.0 - 21.9	0.4	18-50+/0.4'	18	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 314698.36, E 1113341.04 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-20** Total Depth 43.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/28/10 Completed 1/29/10
Supervisor	C. Millhollin Driller S. Wilks	Depth to Water	32.5 ft Date/Time 1/28/10
Logged By	C. Millhollin	Automatic Hammer ☐	Safety Hammer ☒ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.1'	0.0'	Top of Hole						
349.9'	0.2'	CRUSHED STONE	SPT-1	0.0 - 1.5	1.0	18-12-17	12	Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY with Sand, brown to brown and gray, moist, very stiff, manganese concretions throughout, occasional gravel	SPT-2	1.5 - 3.0	0.9	20-25-18	13	
			SPT-3	3.0 - 4.5	0.7	16-16-15	15	
			SPT-4	4.5 - 6.0	1.5	13-14-20	13	
			SPT-5	6.0 - 7.5	1.0	12-17-26	12	
			SPT-6	7.5 - 9.0	1.4	25-26-32	13	
		-Silty from 7.5 to 13.0 ft.	SPT-7	9.0 - 10.5	1.3	9-9-10	12	Bulk sample #1 taken from 9.0 to 11.0 ft.
			ST-1	10.5 - 12.5	1.0		15	
337.1'	13.0'							
336.9'	13.2'	Fill: FLY ASH, gray, moist, soft	SPT-8	12.5 - 14.0	1.2	4-4-3	21	
334.6'	15.5'	Fill: LEAN CLAY, brown, moist, medium stiff to stiff, silty	SPT-9	14.0 - 15.5	1.0	3-4-6	21	
			SPT-10	15.5 - 17.0	1.2	10-11-13	15	
331.6'	18.5'	Fill: POORLY GRADED SAND with Silt, brown, moist, medium dense, intermixed with ash	SPT-11	17.0 - 18.5	1.3	11-13-13	15	
330.1'	20.0'		SPT-12	18.5 - 20.0	1.1	3-5-4	26	
		Fill: LEAN CLAY, brown and gray, moist, stiff, silty	ST-2	20.0 - 22.0	1.9		21	
		LEAN CLAY, brown and gray, moist, medium stiff to very stiff, silty, trace amounts of sand throughout	SPT-13	22.0 - 23.5	1.1	4-5-6	23	
			SPT-14	23.5 - 25.0	1.2	5-8-11	19	
		-Organics at 25.0 ft.	SPT-15	25.0 - 26.5	1.1	3-4-7	21	Bulk sample #2 taken from 25.0 to 28.0 ft.
			SPT-16	26.5 - 28.0	0.8	5-6-7	26	
			SPT-17	28.0 - 29.5	0.9	6-6-7	23	
			SPT-18	29.5 - 31.0	1.3	2-3-4	24	
		-Organics at 31.0 ft.	SPT-19	31.0 - 32.5	1.2	3-4-7	27	
			SPT-20	32.5 - 34.0	1.2	7-8-7	20	
314.1'	36.0'		ST-3	34.0 - 36.0	2.0		22	
		SILT, light gray and brown, moist to wet, stiff to very stiff	SPT-21	36.0 - 37.5	1.1	3-5-7	21	
			SPT-22	37.5 - 39.0	1.3	8-8-7	23	
			SPT-23	39.0 - 40.5	1.5	8-8-8	22	
		-Sandy and gravelly from 40.5 to 43.5 ft.	SPT-24	40.5 - 42.0	1.5	10-9-10	17	Boring backfilled with bentonite grout from 0.0 to 43.5 ft.
306.6'	43.5'		SPT-25	42.0 - 43.5	1.0	17-32-30	15	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 314231.64, E 1113471.65 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-21** Total Depth 45.5 ft
Location	McCracken County, Kentucky	Surface Elevation	349.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/1/10 Completed 2/2/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	19.0 ft Date/Time 2/1/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
349.7'	0.0'	Top of Hole						
349.2'	0.5'	CRUSHED STONE	SPT-1	0.0 - 1.5	0.6	4-4-3	6	Boring advanced with 4.25" hollow stem augers.
		Fill: LEAN CLAY, brown, moist, medium stiff, occasional gravel	SPT-2	1.5 - 3.0	0.2	4-3-3	20	
			SPT-3	3.0 - 4.5	0.8	5-6-5	16	
343.7'	6.0'		SPT-4	4.5 - 6.0	1.2	2-2-4	22	WOH = Weight of Hammer
		Fill: BOTTOM ASH, black, moist, loose to very dense	SPT-5	6.0 - 7.5	0.8	4-41-50+/0.3	9	
			SPT-6	7.5 - 9.0	1.0	48-14-10	10	
338.7'	11.0'		ST-1	9.0 - 11.0	1.8		16	
		Fill: FLY ASH, gray, moist to wet, very loose to loose, clay intermixed throughout	SPT-7	11.0 - 12.5	0.6	1-1-3	26	
			SPT-8	12.5 - 14.0	1.4	3-3-3	27	
			SPT-9	14.0 - 15.5	0.9	4-3-2	34	
			ST-2	15.5 - 17.5	1.3		23	
			SPT-10	17.5 - 19.0	1.3	1-1-1	32	
			SPT-11	19.0 - 20.5	1.4	1-1-1	50	
327.2'	22.5'		ST-3	20.5 - 22.5	1.6		24	
		SANDY LEAN CLAY, brown and gray, moist, medium stiff	SPT-12	22.5 - 24.0	1.2	4-4-4	25	
323.9'	25.8'		SPT-13	24.0 - 25.5	1.1	1-2-2	22	
		LEAN CLAY, light gray, moist to wet, very soft to stiff, occasional clay pockets	SPT-14	25.5 - 27.0	0.3	WOH	20	
			SPT-15	27.0 - 28.5	1.0	WOH	21	
			SPT-16	28.5 - 30.0	0.6	1-1-2	21	
			SPT-17	30.0 - 31.5	1.1	2-4-4	19	
			SPT-18	31.5 - 33.0	1.3	7-7-8	21	
			SPT-19	33.0 - 34.5	1.4	6-6-8	21	
313.2'	36.5'		ST-4	34.5 - 36.5	2.0		19	
		WELL GRADED GRAVEL with Silt and Sand, yellowish brown, moist to wet, dense to very dense	SPT-20	36.5 - 38.0	0.8	5-10-22	18	
			SPT-21	38.0 - 39.5	1.0	21-32-34	16	
			SPT-22	39.5 - 41.0	0.9	8-15-18	11	
			SPT-23	41.0 - 42.5	1.2	21-30-35	13	See "Piezometer Installation Detail" for backfill materials
			SPT-24	42.5 - 44.0	1.5	29-35-37	15	

SUBSURFACE LOG

Project No.	175559023	Location	N 314231.64, E 1113471.65 (NAD27)		
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-21**	Total Depth	45.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
304.2'	45.5'			SPT-25	44.0 - 45.5	1.2	15-23-41	13	and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314238.31, E 1113470.52 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-22** Total Depth 22.0 ft
Location	McCracken County, Kentucky	Surface Elevation	349.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/1/10 Completed 2/1/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
349.7'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-21							Boring advanced with 4.25" hollow stem augers.
327.7'	22.0'								
		No Refusal / Bottom of Hole							See "Piezometer Installation Detail" for backfill materials and amounts used.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 313495.53, E 1113645.65 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-23** Total Depth 44.0 ft
Location	McCracken County, Kentucky	Surface Elevation	349.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/28/10 Completed 1/29/10
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
349.0'	0.0'	Top of Hole						
		OVERBURDEN, see boring log STN-24						Boring advanced with 4.25" hollow stem augers.
								Bulk sample #1 taken from 15.0 to 18.0 ft.
			ST-1	15.0 - 17.0	1.1		12	
			ST-2	17.0 - 19.0	0.0		--	
								Bulk sample #2 taken from 24.0 to 26.0 ft.
			ST-3	25.0 - 27.0	2.0		24	
			ST-4	27.0 - 29.0	2.0		17	
								See "Piezometer Installation Detail" for backfill materials and amounts used.
305.0'	44.0'							
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559023	Location	N 313499.27, E 1113645.11 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-24** Total Depth 68.9 ft
Location	McCracken County, Kentucky	Surface Elevation	349.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/25/10 Completed 1/27/10
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	18.0 ft Date/Time 1/25/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
349.0'	0.0'	Top of Hole						
348.5'	0.5'	CRUSHED STONE	SPT-1	0.0 - 1.5	0.5	5-3-4	8	Boring advanced with 4.25" hollow stem augers.
347.2'	1.8'	Fill: LEAN CLAY, light brown and gray, moist, medium stiff	SPT-2	1.5 - 3.0	1.2	8-30-45	17	
		Fill: BOTTOM ASH, black and brown, moist, medium dense to very dense	SPT-3	3.0 - 4.5	0.2	50+/0.3'	21	
			SPT-4	4.5 - 6.0	1.0	22-21-35	13	WOH = Weight of Hammer
			SPT-5	6.0 - 7.5	0.9	26-25-28	7	
			SPT-6	7.5 - 9.0	1.0	27-24-19	8	
338.5'	10.5'		SPT-7	9.0 - 10.5	0.8	9-9-6	9	
		Fill: FLY ASH, gray, moist to wet, very loose to loose	SPT-8	10.5 - 12.0	0.9	6-3-3	20	
			SPT-9	12.0 - 13.5	1.0	3-4-3	20	
			SPT-10	13.5 - 15.0	1.1	3-4-2	28	
			SPT-11	15.0 - 16.5	0.7	4-3-3	17	
			SPT-12	16.5 - 18.0	1.4	1-1-1	51	
			SPT-13	18.0 - 19.5	1.5	1-1-2	55	
			SPT-14	19.5 - 21.0	1.5	2-1-0	45	
			SPT-15	21.0 - 22.5	1.3	0-1-0	42	
		-Silt intermixed from 23.7 to 25.5 ft.	SPT-16	22.5 - 24.0	1.2	0-1-2	31	
323.5'	25.5'		SPT-17	24.0 - 25.5	1.5	2-1-0	24	
		LEAN CLAY, light gray, moist to wet, very soft to medium stiff, occasional clay pockets	SPT-18	25.5 - 27.0	1.2	WOH	24	
			SPT-19	27.0 - 28.5	1.5	WOH	23	
319.0'	30.0'		SPT-20	28.5 - 30.0	1.1	2-2-4	19	
		POORLY GRADED SAND with Silt, yellowish brown to reddish brown and light gray, wet, dense to very dense	SPT-21	30.0 - 31.5	1.0	20-29-24	11	
			SPT-22	31.5 - 33.0	1.2	33-29-27	14	
			SPT-23	33.0 - 34.5	0.8	36-50+/0.3'	16	
			SPT-24	34.5 - 36.0	0.9	18-21-36	17	
			SPT-25	37.5 - 39.0	1.0	18-22-27	12	
			SPT-26	40.0 - 41.5	1.2	18-44-50+/0.3'	11	
			SPT-27	42.5 - 44.0	0.8	19-32-30	13	

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SUBSURFACE LOG

Project No.	175559023	Location	N 313499.27, E 1113645.11 (NAD27)		
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-24**	Total Depth	68.9 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		POORLY GRADED SAND with Silt, yellowish brown to reddish brown and light gray, wet, dense to very dense *(Continued)*		SPT-28	44.0 - 45.5	1.3	15-16-45	--	
298.5'	50.5'			SPT-29	49.0 - 50.5	1.3	14-17-19	--	
		WELL GRADED Gravel with Silt and Sand, yellowish brown, wet, dense to very dense		SPT-30	54.0 - 55.5	1.5	19-26-39	--	
				SPT-31	59.0 - 60.5	1.4	20-22-21	--	
				SPT-32	64.0 - 65.5	1.5	24-23-38	--	
280.1'	68.9'			SPT-33	67.5 - 68.9	1.4	21-45-50+/0.4'	--	Boring backfilled with bentonite grout from 0.0 to 68.9 ft.

No Refusal /
Bottom of Hole

Environmental water sample collected by TVA following drilling operations.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 312778.59, E 1113804.66 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-25** Total Depth 41.5 ft
Location	McCracken County, Kentucky	Surface Elevation	349.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/29/10 Completed 1/29/10
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	23.0 ft Date/Time 1/29/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
349.9'	0.0'	Top of Hole						
349.4'	0.5'	TOPSOIL	SPT-1	0.0 - 1.5	0.6	6-7-7	15	Boring advanced with 4.25" hollow stem augers.
347.8'	2.1'	Fill: LEAN CLAY, light brown and gray, moist, stiff, silty	SPT-2	1.5 - 3.0	1.0	7-40-32	19	
		Fill: BOTTOM ASH, black, moist, medium dense to very dense	SPT-3	3.0 - 4.5	1.2	36-36-3	12	
			SPT-4	4.5 - 6.0	1.3	10-17-27	7	
			SPT-5	6.0 - 7.5	1.4	28-30-28	7	
			SPT-6	7.5 - 9.0	1.0	19-22-33	8	
			SPT-7	9.0 - 10.5	1.3	23-14-11	16	
337.9'	12.0'		SPT-8	10.5 - 12.0	1.4	7-8-7	15	
		Fill: FLY ASH, gray, moist to wet, very loose to loose	SPT-9	12.0 - 13.5	1.2	3-4-6	24	
			SPT-10	13.5 - 15.0	0.9	4-4-5	21	
			ST-1	15.0 - 17.0	2.0		5	Bulk sample taken from 16.0 to 19.0 ft.
			SPT-11	17.0 - 18.5	0.4	3-3-3	16	
			SPT-12	18.5 - 20.0	0.8	2-3-2	20	
			SPT-13	20.0 - 21.5	1.5	2-2-2	27	
			SPT-14	21.5 - 23.0	1.5	2-2-2	43	
			SPT-15	23.0 - 24.5	1.5	3-2-1	39	
			SPT-16	24.5 - 26.0	1.5	1-1-1	47	
			SPT-17	26.0 - 27.5	1.5	1-1-2	52	
			SPT-18	27.5 - 29.0	1.5	1-2-4	44	
318.9'	31.0'		ST-2	29.0 - 31.0	2.0		32	
317.4'	32.5'	SANDY SILT, olive, wet, soft	SPT-19	31.0 - 32.5	1.1	1-2-2	27	
		WELL GRADED GRAVEL with Silt and Sand, yellowish brown, wet, medium dense to very dense	SPT-20	32.5 - 34.0	0.8	1-2-8	17	
			SPT-21	34.0 - 35.5	0.9	10-19-21	13	
			SPT-22	35.5 - 37.0	1.2	14-30-32	10	
			SPT-23	37.0 - 38.5	1.0	14-27-30	9	See "Piezometer Installation Detail" for backfill materials and amounts used.
			SPT-24	38.5 - 40.0	0.9	21-50+/0.4'	9	
308.4'	41.5'		SPT-25	40.0 - 41.5	1.3	17-42-40	13	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559023	Location	N 312774.78, E 1113806.04 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-26** Total Depth 29.7 ft
Location	McCracken County, Kentucky	Surface Elevation	349.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/31/10 Completed 1/31/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
349.9'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-25							Boring advanced with 4.25" hollow stem augers. See "Piezometer Installation Detail" for backfill materials and amounts used.
320.2'	29.7'	No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 312133.86, E 1114170.06 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-27** Total Depth 37.5 ft
Location	McCracken County, Kentucky	Surface Elevation	349.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/18/10 Completed 1/18/10
Supervisor	S. Lange Driller M.Wethington	Depth to Water	16.5 ft Date/Time 1/18/10
Logged By	S. Lange	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
349.4'	0.0'	Top of Hole							
		Fill: FLY ASH, dark gray, moist to wet, very loose to medium dense		SPT-1	0.0 - 1.5	0.3	9-16-10	33	Boring advanced with 4.25" hollow stem augers.
				SPT-2	1.5 - 3.0	0.3	17-13-13	5	
		-Rock fragments from 0.0 to 3.0 ft.		SPT-3	3.0 - 4.5	1.0	7-4-4	35	
				SPT-4	4.5 - 6.0	1.5	3-2-1	40	WOH = Weight of Hammer
				SPT-5	6.0 - 7.5	1.5	2-2-1	47	
				SPT-6	7.5 - 9.0	1.5	3-3-3	37	
				SPT-7	9.0 - 10.5	1.5	2-1-1	28	
				SPT-8	10.5 - 12.0	1.5	5-2-2	30	
				SPT-9	12.0 - 13.5	1.5	3-2-1	29	
				SPT-10	13.5 - 15.0	1.0	1-3-3	14	
				SPT-11	15.0 - 16.5	1.5	1-1-1	45	
		-Organics at 16.5 ft.		SPT-12	16.5 - 18.0	0.3	1-1-1	57	
				SPT-13	18.0 - 19.5	0.3	1-0-0	46	
				SPT-14	19.5 - 21.0	1.5	1-1-1	31	
				SPT-15	21.0 - 22.5	1.5	1-2-1	34	
				SPT-16	22.5 - 24.0	1.5	1-2-3	37	
				SPT-17	24.0 - 25.5	1.5	1-4-1	31	
				SPT-18	25.5 - 27.0	1.5	1-0-1	26	
320.9'	28.5'			SPT-19	27.0 - 28.5	1.5	WOH	30	
		LEAN CLAY, brown and gray, wet, very soft to soft, with organics		SPT-20	28.5 - 30.0	1.0	1-0-1	34	
317.9'	31.5'			SPT-21	30.0 - 31.5	1.5	0-1-3	32	
		SILTY SAND, light gray and brown, wet, very loose to medium dense, with organics		SPT-22	31.5 - 33.0	1.5	4-1-1	21	
				SPT-23	33.0 - 34.5	1.0	1-2-2	19	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-24	34.5 - 36.0	1.5	3-9-6	30	
311.9'	37.5'	-Clayey from 36.0 to 37.5 ft.		SPT-25	36.0 - 37.5	1.5	5-8-10	20	
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project No.	175559023	Location	N 312131.19, E 1114171.87 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-28** Total Depth 37.0 ft
Location	McCracken County, Kentucky	Surface Elevation	349.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/19/10 Completed 1/19/10
Supervisor	S. Lange Driller M.Wethington	Depth to Water	N/A Date/Time N/A
Logged By	S. Lange	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
349.4'	0.0'	Top of Hole						
		OVERBURDEN, see boring log STN-27						Boring advanced with 4.25" hollow stem auger.
			ST-1	10.0 - 12.0	1.5		37	
			ST-2	15.0 - 17.0	0.9		35	
			ST-3	30.0 - 32.0	1.5		25	
								Boring backfilled with bentonite grout from 0.0 to 37.0 ft.
312.4'	37.0'		ST-4	35.0 - 37.0	0.0		--	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559023	Location	N 314432.30, E 1117155.39 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-31** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	327.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/1/09 Completed 9/1/09
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	7.5 ft Date/Time 9/1/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
327.0'	0.0'	Top of Hole						
		SANDY LEAN CLAY, mottled reddish brown and grayish brown, moist, soft to stiff, silty	SPT-1	0.0 - 1.5	1.0	2-1-1	15	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.3	2-4-4	17	
			SPT-3	3.0 - 4.5	1.5	3-6-6	19	
			SPT-4	4.5 - 6.0	1.2	4-6-7	23	
319.5'	7.5'		SPT-5	6.0 - 7.5	1.3	5-6-7	10	
		POORLY GRADED SAND with Gravel, tan and gray, wet, very loose to medium dense, occasional clay pockets	SPT-6	7.5 - 9.0	1.5	3-3-4	28	
			SPT-7	9.0 - 10.5	1.3	1-0-0	19	
			SPT-8	10.5 - 12.0	1.5	9-7-5	18	
			SPT-9	12.0 - 13.5	1.5	7-4-3	17	
			SPT-10	13.5 - 15.0	1.5	5-4-2	18	
			SPT-11	15.0 - 16.5	1.5	1-0-0	25	
			SPT-12	16.5 - 18.0	1.5	1-1-1	23	
			SPT-13	18.0 - 19.5	0.8	1-1-1	36	
		-Clay layer from 19.5 to 20.5 ft.	SPT-14	19.5 - 21.0	1.0	2-2-2	33	
304.5'	22.5'		SPT-15	21.0 - 22.5	0.9	3-3-2	22	
		SANDY LEAN CLAY, gray and reddish brown, moist to wet, soft	SPT-16	22.5 - 24.0	1.2	1-1-2	34	
301.5'	25.5'		SPT-17	24.0 - 25.5	1.5	1-2-2	27	
		POORLY GRADED SAND, reddish brown, wet, loose to medium dense	SPT-18	25.5 - 27.0	1.0	2-2-3	22	
			SPT-19	27.0 - 28.5	1.1	4-6-10	22	
			SPT-20	28.5 - 30.0	0.7	6-5-6	25	
			SPT-21	30.0 - 31.5	0.9	5-4-6	24	
			SPT-22	31.5 - 33.0	1.0	9-7-13	21	Boring backfilled with bentonite grout from 0.0 to 36.0 ft.
			SPT-23	33.0 - 34.5	0.8	9-7-7	20	
291.0'	36.0'		SPT-24	34.5 - 36.0	1.1	4-4-7	23	
		No Refusal / Bottom of Hole						

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 314454.28, E 1117034.48 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-32** Total Depth 61.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/8/09 Completed 9/8/09
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	15.0 ft Date/Time 9/8/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.6'	0.0'	Top of Hole							
		Fill: SANDY LEAN CLAY, mottled light brown and gray, moist, stiff to very stiff, silty, gravelly		SPT-1	0.0 - 1.5	1.5	4-9-11	10	Boring advanced with 3.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.0	9-11-12	10	
				SPT-3	3.0 - 4.5	0.9	5-6-6	27	
				SPT-4	4.5 - 6.0	1.0	4-8-9	13	
				SPT-5	6.0 - 7.5	1.1	4-4-7	13	
341.6'	9.0'			SPT-6	7.5 - 9.0	1.5	11-17-21	14	
		Fill: BOTTOM ASH, black, moist to wet, loose to very dense		SPT-7	9.0 - 10.5	1.5	17-35-42	11	
				SPT-8	10.5 - 12.0	1.3	25-42-50+/0.3'	11	
				SPT-9	12.0 - 13.5	0.3	50+/0.3'	15	
				SPT-10	13.5 - 15.0	0.4	50+/0.4'	13	
				SPT-11	15.0 - 16.5	1.0	22-30-33	15	
				SPT-12	16.5 - 18.0	1.3	25-47-50+/0.3'	14	
				SPT-13	18.0 - 19.5	1.5	23-47-44	14	
				SPT-14	19.5 - 21.0	1.5	5-6-9	13	
				SPT-15	21.0 - 22.5	1.5	9-11-14	13	
				SPT-16	22.5 - 24.0	1.5	7-10-13	17	
				SPT-17	24.0 - 25.5	1.3	11-8-6	19	
324.1'	26.5'			SPT-18	25.5 - 27.0	0.8	20-7-1	8	
		SANDY LEAN CLAY, reddish brown and gray, moist to wet, medium stiff to very stiff		SPT-19	27.0 - 28.5	1.4	2-5-6	19	
				SPT-20	28.5 - 30.0	0.7	17-25-32	14	
				SPT-21	30.0 - 31.5	0.5	7-13-17	19	
				SPT-22	31.5 - 33.0	0.6	3-5-6	19	
				SPT-23	33.0 - 34.5	0.8	8-6-5	21	
314.6'	36.0'			SPT-24	34.5 - 36.0	0.7	3-3-3	22	
		POORLY GRADED SAND, reddish brown, moist to wet, medium dense		SPT-25	37.5 - 39.0	0.8	5-7-8	15	
310.6'	40.0'								
		LEAN CLAY with Sand, mottled light gray and brown, moist, stiff to very stiff, silt pockets throughout		SPT-26	40.0 - 41.5	1.5	5-7-8	32	
				SPT-27	42.5 - 44.0	1.5	3-4-6	23	

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314454.28, E 1117034.48 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-32**
		Total Depth	61.5 ft

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		LEAN CLAY with Sand, mottled light gray and brown, moist, stiff to very stiff, silt pockets throughout *(Continued)*		SPT-28	45.0 - 46.5	1.5	3-5-9	23	
				SPT-29	47.5 - 49.0	1.5	4-6-11	22	
				SPT-30	50.0 - 51.5	1.5	4-6-8	23	
295.6'	55.0'			SPT-31	52.5 - 54.0	1.5	4-4-4	28	
		POORLY GRADED SAND, reddish brown, wet, loose to medium dense		SPT-32	55.0 - 56.5	1.0	3-6-8	25	
		-Clayey from 57.5 to 59.0 ft.		SPT-33	57.5 - 59.0	0.7	1-1-5	33	Boring backfilled with bentonite grout from 0.0 to 61.5 ft.
289.1'	61.5'			SPT-34	60.0 - 61.5	0.9	3-10-18	21	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314457.23, E 1117058.23 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-32A** Total Depth 24.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/6/10 Completed 1/6/10
Supervisor	N. Puckett Driller S. Wilks	Depth to Water	17.0 ft Date/Time 1/6/10
Logged By	N. Puckett	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.6'	0.0'	Top of Hole						
350.0'	0.6'	CRUSHED STONE						Boring advenced with 3.25" hollow stem augers.
		Fill: SANDY LEAN CLAY, mottled light brown and gray, moist, very stiff, silty, occasional gravel	ST-1	1.0 - 3.0	1.8		18	
			ST-2	3.0 - 5.0	1.9		12	
			ST-3	5.0 - 7.0	0.9		11	
			ST-4	7.0 - 9.0	1.6		13	
			SPT-1	9.0 - 10.5	1.4	9-10-12	15	
			ST-5	12.0 - 14.0	0.7		15	
334.6'	16.0'		SPT-2	15.0 - 16.5	1.0	6-28-27	12	
333.1'	17.5'	Fill: BOTTOM ASH, black and gray, moist to wet, medium dense						
		Fill: LEAN CLAY, mottled brown and gray, moist, stiff to very stiff, silty, trace amounts of sand	SPT-3	17.5 - 19.0	1.2	4-7-9	24	
			SPT-4	20.0 - 21.5	0.9	3-4-7	23	Boring backfilled with bentonite grout from 0.0 ft. to 24.0 ft.
326.6'	24.0'		ST-6	22.0 - 24.0	2.0		22	
		No Refusal / Bottom of Hole						

Offset 24 ft. east and 5 ft. north of STN-32.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314455.26, E 1117057.91 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-32B** Total Depth 25.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/6/10 Completed 1/6/10
Supervisor	N. Puckett Driller S. Wilks	Depth to Water	15.5 ft Date/Time 1/6/10
Logged By	N. Puckett	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.6'	0.0'	Top of Hole							
350.2'	0.4'	CRUSHED STONE							Boring advanced with 3.25" hollow stem augers.
		Fill: SANDY LEAN CLAY, mottled light brown and gray, moist, stiff to very stiff, silty							
335.4'	15.2'			SPT-1	14.0 - 15.5	1.3	5-8-32	19	
333.6'	17.0'	Fill: BOTTOM ASH, black and gray, moist to wet, medium dense		SPT-2	15.5 - 17.0	1.1	27-18-12	15	
		Fill: LEAN CLAY, brown and tan, moist, very stiff		SPT-3	17.0 - 18.5	0.8	3-6-9	22	
				ST-1	19.0 - 21.0	2.0		21	
				ST-2	21.0 - 23.0	0.0		--	Boring backfilled with bentonite grout from 0.0 ft. to 25.0 ft.
325.6'	25.0'			ST-3	23.0 - 25.0	2.0		21	

No Refusal /
Bottom of Hole

Offset 24 ft. east and 3 ft. north of STN-32.

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SUBSURFACE LOG

Project No.	175559023	Location	N 314461.18, E 1117058.88 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-32P** Total Depth 24.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/6/10 Completed 1/6/10
Supervisor	N. Puckett Driller S. Wilks	Depth to Water	N/A Date/Time N/A
Logged By	N. Puckett	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.6'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-32A							Boring advanced with 3.25" hollow stem augers.
				ST-1	18.0 - 20.0	2.0		17	Bulk sample taken from 18.0 ft. to 20.0 ft.
				ST-2	20.0 - 22.0	1.8		24	See "Piezometer Installation Detail" for backfill materials and amounts used.
326.6'	24.0'								

No Refusal /
Bottom of Hole

Offset 24 ft. east and 9 ft. north of STN-32.

SUBSURFACE LOG

Project No.	175559023	Location	N 314954.00, E 1117204.67 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-33** Total Depth 36.5 ft
Location	McCracken County, Kentucky	Surface Elevation	327.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/16/09 Completed 9/16/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	30.0 ft Date/Time 9/16/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
327.6'	0.0'	Top of Hole							
		Fill: LEAN CLAY, brown and gray, moist, very stiff, silty		SPT-1	0.0 - 1.5	1.0	7-7-8	23	Boring advanced with 4.25" hollow stem auger.
324.6'	3.0'			SPT-2	1.5 - 3.0	1.2	7-8-9	16	
		LEAN CLAY, brown and gray, moist, stiff to very stiff, silty		SPT-3	3.0 - 4.5	1.0	7-7-9	18	
				SPT-4	4.5 - 6.0	0.4	4-6-7	22	
320.1'	7.5'			SPT-5	6.0 - 7.5	1.2	4-13-10	12	
		LEAN CLAY, mottled brown and gray, moist, soft to stiff, silty, occasional manganese concretions		SPT-6	7.5 - 9.0	0.3	4-5-3	19	
				SPT-7	9.0 - 10.5	0.5	2-2-1	24	
				SPT-8	10.5 - 12.0	0.7	2-2-1	23	
		-Sandy from 7.5 to 12.0 ft.		SPT-9	12.0 - 13.5	1.2	2-2-2	23	
				SPT-10	13.5 - 15.0	1.4	1-2-3	23	
				SPT-11	15.0 - 16.5	1.4	2-3-4	27	
				SPT-12	16.5 - 18.0	1.3	2-3-5	23	
				SPT-13	18.0 - 19.5	1.5	3-4-6	25	
				SPT-14	19.5 - 21.0	1.4	3-3-6	25	
				SPT-15	21.0 - 22.5	1.5	2-3-5	23	
				SPT-16	22.5 - 24.0	1.5	2-2-4	23	
				SPT-17	26.0 - 27.5	1.5	2-2-2	27	
297.6'	30.0'			SPT-18	28.5 - 30.0	1.5	2-2-3	28	
		POORLY GRADED SAND, reddish brown, wet, medium dense		SPT-19	31.0 - 32.5	1.2	4-6-10	27	See "Piezometer Installation Detail" for backfill materials and amounts used.
		-Occasional clay pockets from 31.0 to 32.5 ft.		SPT-20	33.5 - 35.0	1.2	5-9-9	23	
291.1'	36.5'			SPT-21	35.0 - 36.5	1.3	3-8-6	19	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314949.58, E 1117204.80 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-33-SI** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	327.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/17/09 Completed 9/17/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
327.4'	0.0'	Top of Hole						
		OVERBURDEN, see boring log STN-33						Boring advanced with 4.25" hollow stem auger.
			ST-1	4.0 - 6.0	0.9		17	
			ST-2	8.0 - 10.0	2.0		23	
			ST-3	15.0 - 17.0	1.8		24	
			ST-4	30.0 - 32.0	1.8		25	See "Slope Inclinometer Installation Detail" for backfill materials and amounts used.
291.4'	36.0'							
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559023	Location	N 314943.07, E 1117089.94 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-34** Total Depth 27.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/12/09 Completed 9/12/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.5'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-35							Boring advanced with 3.25" hollow stem auger.
				ST-1	23.0 - 25.0	0.9		--	Boring backfilled with bentonite grout from 0.0 to 27.0 ft.
				ST-2	25.0 - 27.0	0.0		--	
323.5'	27.0'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314938.34, E 1117090.74 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-35** Total Depth 61.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/9/09 Completed 9/12/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	12.0 ft Date/Time 9/11/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.7'	0.0'	Top of Hole						
		Fill: LEAN CLAY, mottled reddish brown and gray, moist, stiff to very stiff, silty, occasional fine gravel	SPT-1	0.0 - 1.5	1.2	5-6-8	11	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.1	5-6-9	11	
			SPT-3	3.0 - 4.5	1.3	4-7-9	16	
			SPT-4	4.5 - 6.0	1.5	4-8-9	16	
			SPT-5	6.0 - 7.5	1.2	10-15-17	13	
			SPT-6	7.5 - 9.0	0.0	8-12-15	--	
340.2'	10.5'		SPT-7	9.0 - 10.5	1.5	5-10-22	13	
		Fill: BOTTOM ASH, black, moist to wet, loose to very dense	SPT-8	10.5 - 12.0	0.7	5-18-50+/0.2'	15	
			SPT-9	12.0 - 13.5	0.5	50+/0.5'	18	
			SPT-10	13.5 - 15.0	0.7	2-17-18	16	
			SPT-11	15.0 - 16.5	1.5	6-10-13	17	
			SPT-12	16.5 - 18.0	1.5	8-11-13	15	
			SPT-13	18.0 - 19.5	1.0	2-4-5	15	
329.7'	21.0'		SPT-14	19.5 - 21.0	0.8	7-10-11	15	
		Fill: FLY ASH, black, wet, very soft to soft	SPT-15	21.0 - 22.5	1.4	1-1-2	41	
			SPT-16	22.5 - 24.0	0.4	2-1-2	26	
325.2'	25.5'		SPT-17	24.0 - 25.5	1.2	2-1-1	38	
323.7'	27.0'	LEAN CLAY, brown and gray, moist, stiff	SPT-18	25.5 - 27.0	1.0	1-3-10	23	
		POORLY GRADED SAND, dark gray, wet, medium dense	SPT-19	27.0 - 28.5	0.7	13-16-14	21	
			SPT-20	28.5 - 30.0	0.9	3-8-11	21	
			SPT-21	30.0 - 31.5	0.8	2-8-10	21	
317.7'	33.0'							
		LEAN CLAY, greenish gray to mottled reddish brown and gray, moist to wet, soft to stiff, silty, trace fine to medium sand	SPT-22	33.0 - 34.5	1.0	3-7-8	26	
			SPT-23	35.0 - 36.5	1.5	2-3-4	27	
			ST-1	36.5 - 38.5	2.0		23	
		-Organics at 33.0 ft.	SPT-24	38.5 - 40.0	1.5	2-2-5	23	
			ST-2	42.0 - 44.0	2.0		26	

Project No.	175559023	Location	N 314938.34, E 1117090.74 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-35** Total Depth 61.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
298.2'	52.5'	LEAN CLAY, greenish gray to mottled reddish brown and gray, moist to wet, soft to stiff, silty, trace fine to medium sand *(Continued)*		SPT-25	45.0 - 46.5	1.5	1-1-3	26	
				SPT-26	47.5 - 49.0	1.5	3-5-7	23	
				SPT-27	50.0 - 51.5	1.5	0-0-3	27	
289.2'	61.5'	POORLY GRADED SAND with Silt, reddish brown, wet, medium dense to dense		SPT-28	52.5 - 54.0	1.0	0-3-9	21	
				SPT-29	55.0 - 56.5	0.8	8-12-20	18	
				SPT-30	57.5 - 59.0	1.0	15-18-21	17	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-31	60.0 - 61.5	0.9	11-10-12	16	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 314947.72, E 1117089.80 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-35-SI** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/16/09 Completed 9/16/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.2'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-35							Boring advanced with 4.25" hollow stem augers.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559023	Location	N 314947.72, E 1117089.80 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-35-SI** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		OVERBURDEN, see boring log STN-35 *(Continued)*							See "Slope Inclinometer Installation Detail" for backfill materials and amounts used.
290.2'	60.0'								
		No Refusal / Bottom of Hole							

Project No.	175559023	Location	N 315351.57, E 1116807.82 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-36** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	324.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/1/09 Completed 9/1/09
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	22.5 ft Date/Time 9/1/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
324.6'	0.0'	Top of Hole							
		LEAN CLAY, mottled reddish brown and grayish brown, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	0.8	3-5-7	11	Boring advanced with 3.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.2	5-5-7	15	
				SPT-3	3.0 - 4.5	1.5	8-9-10	19	
				SPT-4	4.5 - 6.0	1.3	9-10-13	18	
317.1'	7.5'	-Sandy from 6.0 to 7.5 ft.		SPT-5	6.0 - 7.5	1.2	9-13-13	23	
		LEAN CLAY with Sand, light brown and gray, moist, medium stiff to stiff		SPT-6	7.5 - 9.0	1.1	4-3-4	26	
				SPT-7	9.0 - 10.5	1.5	2-2-3	24	
				SPT-8	10.5 - 12.0	1.4	2-3-2	25	
				SPT-9	12.0 - 13.5	1.5	3-2-3	23	
				SPT-10	13.5 - 15.0	0.8	2-2-3	24	
				SPT-11	15.0 - 16.5	0.9	3-3-3	25	
				SPT-12	16.5 - 18.0	1.3	7-6-7	23	
				SPT-13	18.0 - 19.5	1.5	2-3-2	24	
				SPT-14	19.5 - 21.0	1.5	1-2-3	23	
				SPT-15	21.0 - 22.5	1.5	2-3-4	24	
300.6'	24.0'			SPT-16	22.5 - 24.0	1.5	3-3-10	21	
		POORLY GRADED SAND with Gravel, reddish brown, wet, medium dense to dense		SPT-17	24.0 - 25.5	1.5	16-14-20	15	
				SPT-18	25.5 - 27.0	1.5	12-13-15	14	
				SPT-19	27.0 - 28.5	1.5	15-13-14	12	
				SPT-20	28.5 - 30.0	1.5	10-13-14	14	
				SPT-21	30.0 - 31.5	1.5	8-12-13	18	
				SPT-22	31.5 - 33.0	1.0	10-18-16	14	Boring backfilled with bentonite grout from 0.0 to 36.0 ft.
				SPT-23	33.0 - 34.5	1.3	12-10-12	12	
288.6'	36.0'			SPT-24	34.5 - 36.0	0.6	11-11-12	21	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 315250.60, E 1116750.94 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	STN-37 — Total Depth 61.5 ft
Location	McCracken County, Kentucky	Surface Elevation	351.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/12/09 — Completed 9/12/09
Supervisor	D. Chapman — Driller J. Wethington	Depth to Water	15.0 ft — Date/Time 9/12/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
351.3'	0.0'	Top of Hole							
		Fill: LEAN CLAY, brown and gray, moist, stiff to very stiff, silty, occasional gravel		SPT-1	0.0 - 1.5	1.3	8-5-8	13	Boring advanced with 3.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.1	10-11-11	13	
				SPT-3	3.0 - 4.5	1.5	10-7-9	9	
				SPT-4	4.5 - 6.0	1.2	7-8-11	11	
				SPT-5	6.0 - 7.5	1.5	11-14-14	15	
				SPT-6	7.5 - 9.0	1.5	9-13-16	12	Bulk sample obtained from 8.0 to 10.0 ft.
340.8'	10.5'			SPT-7	9.0 - 10.5	1.3	8-10-13	15	
		Fill: BOTTOM ASH, black, moist to wet, loose to very dense		SPT-8	10.5 - 12.0	1.0	12-27-50+/0.3'	12	
				SPT-9	12.0 - 13.5	0.3	50+/0.3'	13	
				SPT-10	13.5 - 15.0	1.1	20-22-25	13	
				SPT-11	15.0 - 16.5	1.5	10-14-20	16	
				SPT-12	16.5 - 18.0	0.8	10-10-13	22	
				SPT-13	18.0 - 19.5	0.6	3-6-6	25	
				SPT-14	19.5 - 21.0	1.0	7-8-8	14	
328.8'	22.5'			SPT-15	21.0 - 22.5	0.8	2-2-2	33	
		Fill: LEAN CLAY, mottled reddish brown and gray, moist to wet, very soft to medium stiff, silty		SPT-16	22.5 - 24.0	0.6	1-2-3	27	
324.8'	26.5'			SPT-17	25.0 - 26.5	0.3	6-1-1	22	
		LEAN CLAY, brown and gray, moist, medium stiff to very stiff, silty		SPT-18	27.5 - 29.0	0.5	3-4-5	19	
		- Sand layer from 30.0 to 31.5 ft.		SPT-19	30.0 - 31.5	0.7	3-5-9	19	
		-Saturated zone from 30.0 to 34.0 ft.		SPT-20	32.5 - 34.0	1.5	2-2-3	25	
				SPT-21	35.0 - 36.5	1.5	2-5-5	23	
				SPT-22	37.5 - 39.0	1.3	5-9-9	23	
				SPT-23	40.0 - 41.5	1.5	2-4-7	24	
				SPT-24	42.5 - 44.0	1.5	3-5-6	26	

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Project No.	175559023	Location	N 315250.60, E 1116750.94 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-37**
		Total Depth	61.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
303.8'	47.5'	LEAN CLAY, brown and gray, moist, medium stiff to very stiff, silty *(Continued)*		SPT-25	45.0 - 46.5	1.5	4-7-8	25	
289.8'	61.5'	POORLY GRADED SAND, gray and tan to tan, wet, medium dense to dense		SPT-26	47.5 - 49.0	0.2	4-5-7	19	
				SPT-27	50.0 - 51.5	0.7	3-6-8	27	
				SPT-28	52.5 - 54.0	0.8	5-8-11	17	
				SPT-29	55.0 - 56.5	1.0	7-13-18	13	
				SPT-30	57.5 - 59.0	1.3	7-13-15	17	Boring backfilled with bentonite grout from 0.0 to 61.5 ft.
				SPT-31	60.0 - 61.5	1.1	5-9-14	13	
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project No.	175559023	Location	N 315618.68, E 1116395.32 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-38** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	322.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/1/09 Completed 9/1/09
Supervisor	D. Chapman Driller M.Wethington	Depth to Water	12.0 ft Date/Time 9/1/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
322.9'	0.0'	Top of Hole						
		LEAN CLAY, mottled reddish brown and grayish brown, moist, very stiff, silty, trace fine to medium sand	SPT-1	0.0 - 1.5	0.8	6-9-10	13	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	0.7	12-12-12	15	
			SPT-3	3.0 - 4.5	0.7	8-10-12	17	
			SPT-4	4.5 - 6.0	1.0	6-7-10	20	
			SPT-5	6.0 - 7.5	1.1	3-8-9	19	
313.9'	9.0'		SPT-6	7.5 - 9.0	1.2	7-7-9	22	
		LEAN CLAY, dark gray to brown, moist, stiff to medium stiff, trace fine to medium sand	SPT-7	9.0 - 10.5	1.1	4-5-6	24	
			SPT-8	10.5 - 12.0	1.2	2-2-6	26	
			SPT-9	12.0 - 13.5	1.5	3-2-2	30	
307.9'	15.0'		SPT-10	13.5 - 15.0	0.7	1-2-3	31	
		SANDY SILT, reddish brown and gray, moist to wet, soft	SPT-11	15.0 - 16.5	0.6	1-2-2	24	
304.9'	18.0'		SPT-12	16.5 - 18.0	0.9	2-1-2	28	
		LEAN CLAY, mottled reddish brown and grayish brown, wet, soft to stiff, silty, trace fine to medium sand	SPT-13	18.0 - 19.5	1.1	1-1-1	22	
			SPT-14	19.5 - 21.0	0.8	3-4-4	24	
			SPT-15	21.0 - 22.5	1.2	1-3-2	21	
			SPT-16	22.5 - 24.0	1.4	3-3-5	23	
			SPT-17	24.0 - 25.5	0.8	2-3-4	25	
		-Sandy from 25.5 to 30.0 ft.	SPT-18	25.5 - 27.0	0.8	3-3-4	23	
			SPT-19	27.0 - 28.5	0.9	3-2-5	23	
292.9'	30.0'		SPT-20	28.5 - 30.0	0.7	3-4-6	21	
		POORLY GRADED SAND, light gray, wet, very loose to medium dense, occasional gravel and clay pockets	SPT-21	30.0 - 31.5	0.9	1-1-1	21	
			SPT-22	31.5 - 33.0	0.8	2-6-7	22	See "Piezometer Installation Detail" for backfill materials and amounts used.
			SPT-23	33.0 - 34.5	1.0	1-1-1	23	
286.9'	36.0'		SPT-24	34.5 - 36.0	0.7	3-5-10	17	
		No Refusal / Bottom of Hole						

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SUBSURFACE LOG

Project No.	175559023	Location	N 315524.60, E 1116324.97 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-39** Total Depth 30.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/13/09 Completed 9/13/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.5'	0.0'	Top of Hole						
		OVERBURDEN, see boring log STN-40						Boring advanced with 3.25" hollow stem auger.
			ST-1	4.0 - 6.0	2.0		15	
			ST-2	6.0 - 8.0	1.3		14	
			ST-3	26.0 - 28.0	1.3		18	Boring backfilled with bentonite grout from 0.0 to 30.0 ft.
320.5'	30.0'		ST-4	28.0 - 30.0	1.3		20	
		No Refusal / Bottom of Hole						

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SUBSURFACE LOG

Project No.	175559023	Location	N 315541.32, E 1116337.61 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-39A** Total Depth 25.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/7/10 Completed 1/7/10
Supervisor	N. Puckett Driller M.Wethington	Depth to Water	N/A Date/Time N/A
Logged By	N. Puckett	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.5'	0.0'	Top of Hole							
350.0'	0.5'	CRUSHED STONE							Boring advanced with 4.25" hollow stem augers.
		Fill: LEAN CLAY, reddish brown and gray, moist, very stiff, silty, occasional gravel		SPT-1	10.0 - 11.5	1.4	7-10-11	14	
336.5'	14.0'								
		Fill: LEAN CLAY, light brown, moist, very stiff, silty		SPT-2	15.0 - 16.5	1.5	9-10-13	16	
				ST-1	17.0 - 19.0	1.1		22	
				ST-2	19.0 - 21.0	2.0		22	Bulk sample taken from 20.0 ft. to 25.0 ft.
				ST-3	21.0 - 23.0	1.8		21	See "Piezometer Installation Detail" for backfill materials and amounts used.
325.5'	25.0'			ST-4	23.0 - 25.0	1.9		20	

No Refusal /
Bottom of Hole

Offset 19 ft. northeast and 4 ft. north of STN-39.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 315538.57, E 1116334.63 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-39B** Total Depth 14.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/7/10 Completed 1/7/10
Supervisor	N. Puckett Driller M.Wethington	Depth to Water	N/A Date/Time N/A
Logged By	N. Puckett	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.5'	0.0'	Top of Hole							
350.0'	0.5'	CRUSHED STONE							Boring advanced with 4.25" hollow stem augers.
		Fill: LEAN CLAY, reddish brown and gray, moist, very stiff, silty, occasional gravel		SPT-1	5.0 - 6.5	1.4	7-11-15	10	
				SPT-2	10.0 - 11.5	1.1	7-12-17	16	
338.5'	12.0'	Fill: LEAN CLAY with Sand, light brown, moist, very stiff, occasional manganese concretions		SPT-3	11.5 - 13.0	1.0	23-25-21	15	Boring backfilled with bentonite grout from 0.0 ft. to 14.5 ft.
336.0'	14.5'			SPT-4	13.0 - 14.5	1.4	7-7-11	18	
		No Refusal / Bottom of Hole							

Offset 16 ft. northeast and 7 ft. north of STN-39.

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SUBSURFACE LOG

Project No.	175559023	Location	N 315533.05, E 1116333.74 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	STN-39C Total Depth 9.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/7/10 Completed 1/7/10
Supervisor	N. Puckett Driller M.Wethington	Depth to Water	N/A Date/Time N/A
Logged By	N. Puckett	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.5'	0.0'	Top of Hole							
350.0'	0.5'	CRUSHED STONE							Boring advenced with 4.25" hollow stem augers.
		Fill: LEAN CLAY, reddish brown and gray, moist, very stiff		SPT-1	5.0 - 6.5	1.5	9-11-14	14	Boring backfilled with bentonite grout from 0.0 ft. to 9.0 ft.
341.5'	9.0'			SPT-2	7.5 - 9.0	1.5	10-15-19	13	

No Refusal /
Bottom of Hole

Offset 11 ft. northeast and 4.5 ft north of STN-39.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 315521.49, E 1116330.97 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-40** Total Depth 61.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/12/09 Completed 9/13/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	13.5 ft Date/Time 9/12/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.7'	0.0'	Top of Hole						
		Fill: LEAN CLAY, reddish brown and gray, moist, stiff to very stiff, silty, occasional gravel	SPT-1	0.0 - 1.5	1.0	2-4-7	12	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	0.9	7-9-14	14	
			SPT-3	3.0 - 4.5	0.6	4-7-7	13	
			SPT-4	4.5 - 6.0	1.5	5-7-8	16	
			SPT-5	6.0 - 7.5	1.0	7-9-13	14	
341.7'	9.0'		SPT-6	7.5 - 9.0	0.2	7-9-12	15	Bulk sample obtained from 8.0 to 10.0 ft.
		Fill: BOTTOM ASH, black and gray, moist to wet, loose to very dense	SPT-7	9.0 - 10.5	0.4	7-11-19	10	
			SPT-8	10.5 - 12.0	0.8	32-50+/0.3'	12	
			SPT-9	12.0 - 13.5	1.3	24-33-35	14	
			SPT-10	13.5 - 15.0	1.2	11-15-11	16	
			SPT-11	15.0 - 16.5	1.5	5-7-8	17	Bulk sample obtained from 16.0 to 18.0 ft.
			SPT-12	16.5 - 18.0	0.8	6-6-5	12	
		-Fly ash layer from 18.0 to 21.0 ft.	SPT-13	18.0 - 19.5	0.6	3-2-2	33	
			SPT-14	19.5 - 21.0	0.7	11-11-12	23	
			SPT-15	21.0 - 22.5	0.8	2-3-2	18	
326.7'	24.0'	-Fly ash layer from 22.5 to 24.0 ft.	SPT-16	22.5 - 24.0	0.2	0-0-1	29	
324.2'	26.5'	Fill: LEAN CLAY, dark greenish gray, moist, very soft	SPT-17	24.0 - 25.5	0.2	3-1-1	26	
		LEAN CLAY, mottled reddish brown and gray, moist, stiff to very stiff	SPT-18	27.5 - 29.0	0.1	3-5-5	19	
			SPT-19	30.0 - 31.5	0.2	4-8-9	21	
		-Silty with traces of sand from 32.5 to 37.5 ft.	SPT-20	32.5 - 34.0	0.7	3-3-5	21	
			SPT-21	35.0 - 36.5	1.5	3-4-6	27	
310.7'	40.0'		SPT-22	37.5 - 39.0	1.5	6-6-7	27	
			SPT-23	40.0 - 41.5	0.7	3-9-11	23	
			SPT-24	42.5 - 44.0	0.6	4-4-4	23	

Project No.	175559023	Location	N 315521.49, E 1116330.97 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-40** Total Depth 61.5 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		POORLY GRADED SAND, dark greenish gray to reddish brown, wet, loose to medium dense, occasional clay pockets and fine gravel *(Continued)*		SPT-25	45.0 - 46.5	0.6	5-10-13	15	
				SPT-26	47.5 - 49.0	1.4	6-9-13	22	
				SPT-27	50.0 - 51.5	0.8	8-10-12	16	
				SPT-28	52.5 - 54.0	0.0	4-3-4	--	
				SPT-29	55.0 - 56.5	0.9	3-3-5	23	
				SPT-30	57.5 - 59.0	1.2	10-10-18	20	See "Piezometer Installation Detail" for backfill materials and amounts used.
289.2'	61.5'			SPT-31	60.0 - 61.5	1.0	8-10-19	22	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 315894.30, E 1115966.79 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-41** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	326.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/17/09 Completed 9/17/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	16.5 ft Date/Time 9/17/09
Logged By	G. Budd	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
326.6'	0.0'	Top of Hole							
		LEAN CLAY, mottled brown and gray, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	1.5	4-6-9	17	Boring advanced with 3.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.5	9-8-9	13	
				SPT-3	3.0 - 4.5	1.5	8-8-9	13	
				SPT-4	4.5 - 6.0	1.2	5-6-5	16	
				SPT-5	6.0 - 7.5	1.5	4-7-9	17	
				SPT-6	7.5 - 9.0	1.5	3-4-7	21	
316.1'	10.5'	-Sandy from 10.0 to 10.5 ft.		SPT-7	9.0 - 10.5	1.5	4-7-9	16	
		POORLY GRADED SAND, reddish brown, moist to wet, very loose to medium dense		SPT-8	10.5 - 12.0	1.0	3-4-8	11	
				SPT-9	12.0 - 13.5	1.0	3-4-5	13	
				SPT-10	13.5 - 15.0	1.0	2-3-4	11	
		-Clayey from 10.5 to 12.0 ft.		SPT-11	15.0 - 16.5	1.0	3-3-4	22	
				SPT-12	16.5 - 18.0	1.5	1-2-3	24	
		-Silty from 18.0 to 21.0 ft.		SPT-13	18.0 - 19.5	1.5	1-2-3	23	
				SPT-14	19.5 - 21.0	1.2	1-1-1	21	
				SPT-15	21.0 - 22.5	1.0	1-1-2	23	
		-Clayey from 22.5 to 24.0 ft.		SPT-16	22.5 - 24.0	1.3	1-1-1	24	
				SPT-17	24.0 - 25.5	1.1	1-2-4	22	
				SPT-18	25.5 - 27.0	1.5	1-2-2	25	
				SPT-19	27.0 - 28.5	1.5	2-2-2	27	
				SPT-20	28.5 - 30.0	0.8	2-3-5	23	
295.1'	31.5'	-Clayey from 30.0 to 31.5 ft.		SPT-21	30.0 - 31.5	1.2	2-2-3	28	
		POORLY GRADED SAND with Silt, reddish brown, wet, loose to medium dense		SPT-22	31.5 - 33.0	1.2	1-4-7	24	Boring backfilled with bentonite grout from 0.0 to 36.0 ft.
				SPT-23	33.0 - 34.5	1.3	1-3-3	18	
290.6'	36.0'	-Clay layer from 35.0 to 35.8 ft.		SPT-24	34.5 - 36.0	1.5	3-3-5	28	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 315805.38, E 1115896.21 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-42** Total Depth 61.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/13/09 Completed 9/14/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	12.0 ft Date/Time 9/13/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.1'	0.0'	Top of Hole						
		Fill: LEAN CLAY, mottled reddish brown and gray, moist, stiff to very stiff, silty, occasional gravel	SPT-1	0.0 - 1.5	1.1	3-5-6	16	Boring advanced with 3.25" hollow stem auger. WOH = Weight of Hammer
			SPT-2	1.5 - 3.0	1.3	7-9-10	14	
			SPT-3	3.0 - 4.5	1.5	6-7-9	13	
			SPT-4	4.5 - 6.0	1.1	6-9-10	16	
			SPT-5	6.0 - 7.5	1.2	9-14-17	12	
341.1'	9.0'		SPT-6	7.5 - 9.0	1.3	7-10-11	10	
		Fill: BOTTOM ASH, black, moist, dense to very dense	SPT-7	9.0 - 10.5	1.4	12-22-50+/0.4'	14	
338.1'	12.0'		SPT-8	10.5 - 12.0	0.7	2-9-23	17	
		Fill: FLY ASH, black, wet, very soft to stiff	SPT-9	12.0 - 13.5	0.8	3-5-5	42	
			SPT-10	13.5 - 15.0	1.2	1-1-2	31	
			SPT-11	15.0 - 16.5	1.1	0-0-1	35	
			SPT-12	16.5 - 18.0	1.2	WOH	25	
			SPT-13	18.0 - 19.5	1.0	WOH	25	
329.1'	21.0'		SPT-14	19.5 - 21.0	1.5	0-1-1	33	
		Fill: LEAN CLAY, light brown and gray, moist, medium stiff, silty	SPT-15	21.0 - 22.5	0.7	2-3-4	25	
			SPT-16	22.5 - 24.0	0.5	1-2-3	27	
324.6'	25.5'		SPT-17	24.0 - 25.5	0.9	2-3-3	23	
		LEAN CLAY, mottled reddish brown and gray, moist, medium stiff to very stiff -Sandy from 27.5 to 29.0 ft.	SPT-18	27.5 - 29.0	1.2	2-2-3	21	
		-Silty with trace amounts of sand from 30.0 to 45.0 ft.	SPT-19	30.0 - 31.5	1.5	3-5-6	22	
			SPT-20	32.5 - 34.0	1.5	5-7-11	25	
			SPT-21	35.0 - 36.5	1.4	2-5-7	28	
			SPT-22	37.5 - 39.0	1.5	5-6-11	27	
			SPT-23	40.0 - 41.5	1.5	3-5-8	25	
			SPT-24	42.5 - 44.0	1.5	4-5-8	24	

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 315805.38, E 1115896.21 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-42** Total Depth 61.5 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
305.1'	45.0'								
		POORLY GRADED SAND, reddish brown, wet, very loose to medium dense		SPT-25	45.0 - 46.5	0.7	1-4-4	24	
				SPT-26	47.5 - 49.0	0.7	0-0-2	22	
				SPT-27	50.0 - 51.5	0.8	2-2-2	24	
				SPT-28	52.5 - 54.0	0.8	2-4-10	25	
				SPT-29	55.0 - 56.5	0.8	3-3-12	24	
		-Clay layers intermixed from 57.5 to 61.5 ft.		SPT-30	57.5 - 59.0	0.5	6-6-4	29	Boring backfilled with bentonite grout from 0.0 to 61.5 ft.
288.6'	61.5'			SPT-31	60.0 - 61.5	1.0	3-3-4	37	

No Refusal /
Bottom of Hole

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316162.64, E 1115545.71 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	STN-43 — Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	327.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/18/09 — Completed 9/18/09
Supervisor	G. Budd — Driller J. Bowerman	Depth to Water	22.5 ft — Date/Time 9/18/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
327.4'	0.0'	Top of Hole							
325.9'	1.5'	Fill: LEAN CLAY, dark brown and gray, moist, stiff, silty		SPT-1	0.0 - 1.5	1.5	3-4-6	18	Boring advanced with 4.25" hollow stem auger.
319.9'	7.5'	LEAN CLAY, dark brown and gray, moist, stiff to very stiff, silty, occasional manganese concretions		SPT-2	1.5 - 3.0	1.0	6-8-9	17	
				SPT-3	3.0 - 4.5	1.3	5-9-8	15	
				SPT-4	4.5 - 6.0	1.2	4-5-7	20	
				SPT-5	6.0 - 7.5	1.5	3-4-6	24	
310.9'	16.5'	LEAN CLAY, brown and gray, moist, stiff, silt lenses throughout -Roots at 7.5 ft.		SPT-6	7.5 - 9.0	1.5	3-4-5	20	
				SPT-7	9.0 - 10.5	1.5	2-3-5	27	
				SPT-8	10.5 - 12.0	1.5	2-3-5	23	
				SPT-9	12.0 - 13.5	1.5	2-4-6	23	
				SPT-10	13.5 - 15.0	1.5	2-4-6	24	
				SPT-11	15.0 - 16.5	1.5	2-5-6	24	
306.4'	21.0'	SANDY LEAN CLAY, reddish brown, moist to wet, medium stiff, occasional silt lenses, trace manganese concretions		SPT-12	16.5 - 18.0	1.5	2-3-4	20	
				SPT-13	18.0 - 19.5	1.5	2-3-4	22	
				SPT-14	19.5 - 21.0	1.5	2-3-4	22	
303.4'	24.0'	SILTY SAND, reddish brown, wet, loose		SPT-15	21.0 - 22.5	1.5	2-2-3	22	
				SPT-16	22.5 - 24.0	1.5	1-1-5	24	
291.4'	36.0'	POORLY GRADED SAND with Silt, reddish brown, wet, loose to dense, occasional clay pockets -Intermixed clay layers from 31.5 to 33.0 ft.		SPT-17	24.0 - 25.5	1.2	1-2-3	22	
				SPT-18	25.5 - 27.0	1.5	1-3-5	24	
				SPT-19	27.0 - 28.5	0.8	1-1-3	27	
				SPT-20	28.5 - 30.0	1.5	3-5-6	27	
				SPT-21	30.0 - 31.5	1.5	3-5-9	23	
				SPT-22	31.5 - 33.0	1.5	2-5-7	30	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-23	33.0 - 34.5	1.2	3-6-9	20	
				SPT-24	34.5 - 36.0	1.1	7-12-20	20	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316072.06, E 1115478.40 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-44** Total Depth 31.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/15/09 Completed 9/15/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.4'	0.0'	Top of Hole						
		OVERBURDEN, see boring log STN-45						Boring advanced with 3.25" hollow stem auger.
			ST-1	4.0 - 6.0	1.8		--	
			ST-2	6.0 - 8.0	1.6		12	
			ST-3	17.0 - 19.0	1.4		22	
			ST-4	19.0 - 21.0	0.0		--	
			ST-5	27.0 - 29.0	0.0		--	Boring backfilled with bentonite grout from 0.0 to 31.0 ft.
319.4'	31.0'		ST-6	29.0 - 31.0	0.0		--	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316070.97, E 1115485.44 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-45** Total Depth 61.5 ft
Location	McCracken County, Kentucky	Surface Elevation	350.8 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/14/09 Completed 9/14/09
Supervisor	D. Chapman Driller J. Wethington	Depth to Water	13.5 ft Date/Time 9/14/09
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.8'	0.0'	Top of Hole						
		Fill: LEAN CLAY, reddish brown to olive brown, moist, stiff to very stiff, silty	SPT-1	0.0 - 1.5	1.2	4-7-12	15	Boring advanced with 3.25" hollow stem auger. WOH = Weight of Hammer
			SPT-2	1.5 - 3.0	1.0	7-8-12	12	
			SPT-3	3.0 - 4.5	1.1	7-10-10	9	
			SPT-4	4.5 - 6.0	1.2	7-6-10	17	
			SPT-5	6.0 - 7.5	1.0	4-11-15	13	
341.8'	9.0'		SPT-6	7.5 - 9.0	1.4	5-6-9	14	
		Fill: BOTTOM ASH, black and gray, moist, medium dense to very dense	SPT-7	9.0 - 10.5	0.2	7-9-14	8	
			SPT-8	10.5 - 12.0	1.2	10-32-50+/0.4'	10	
337.3'	13.5'		SPT-9	12.0 - 13.5	1.5	16-22-28	15	
		Fill: FLY ASH, black, wet, very soft to medium stiff	SPT-10	13.5 - 15.0	0.9	8-4-3	37	
			SPT-11	15.0 - 16.5	1.5	1-1-0	34	
			SPT-12	16.5 - 18.0	0.6	WOH	34	
			SPT-13	18.0 - 19.5	0.3	WOH	30	
			SPT-14	19.5 - 21.0	0.8	0-1-1	38	
			SPT-15	21.0 - 22.5	0.9	1-1-1	33	
326.8'	24.0'		SPT-16	22.5 - 24.0	0.0	WOH	--	
325.3'	25.5'	Fill: LEAN CLAY, reddish brown and gray, moist, very soft, silty	SPT-17	24.0 - 25.5	0.6	WOH	30	
		LEAN CLAY, mottled reddish brown and gray, moist, stiff to very stiff, silty -Trace amounts of sand below 27.5 ft.	SPT-18	25.5 - 27.0	1.0	0-3-8	25	
			SPT-19	27.5 - 29.0	0.7	4-7-8	20	
			SPT-20	30.0 - 31.5	0.8	2-5-7	22	
			SPT-21	32.5 - 34.0	1.0	4-6-10	24	
313.3'	37.5'		SPT-22	35.0 - 36.5	1.1	3-9-12	25	
		POORLY GRADED SAND, reddish brown to greenish gray, wet, very loose to medium dense	SPT-23	37.5 - 39.0	0.8	4-5-9	20	
			SPT-24	40.0 - 41.5	1.0	4-7-9	22	
			SPT-25	42.5 - 44.0	0.9	1-3-5	24	

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SUBSURFACE LOG

Project No.	175559023	Location	N 316070.97, E 1115485.44 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-45** Total Depth 61.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		POORLY GRADED SAND, reddish brown to greenish gray, wet, very loose to medium dense *(Continued)*		SPT-26	45.0 - 46.5	1.0	4-4-5	23	
				SPT-27	47.5 - 49.0	1.3	2-5-8	24	
				SPT-28	50.0 - 51.5	0.7	1-7-8	23	
		-Clayey from 52.5 to 55.0 ft.		SPT-29	52.5 - 54.0	0.8	0-1-2	33	
				SPT-30	55.0 - 56.5	0.3	2-3-3	23	
				SPT-31	57.5 - 59.0	0.7	0-7-11	25	See "Piezometer Installation Detail" for backfill materials and amounts used.
289.3'	61.5'			SPT-32	60.0 - 61.5	0.8	1-3-3	29	

No Refusal /
Bottom of Hole

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559023	Location	N 316427.81, E 1115126.31 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-46** Total Depth 39.0 ft
Location	McCracken County, Kentucky	Surface Elevation	328.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/18/09 Completed 9/18/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	18.0 ft Date/Time 9/18/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
328.2'	0.0'	Top of Hole						
		Fill: LEAN CLAY, brown and tan, moist, very stiff, silty, trace fine to medium sand	SPT-1	0.0 - 1.5	1.5	4-6-9	16	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.2	4-10-10	16	
			SPT-3	3.0 - 4.5	1.5	9-8-9	16	WOH = Weight of Hammer
322.2'	6.0'		SPT-4	4.5 - 6.0	1.0	4-7-8	19	
		LEAN CLAY, reddish brown and gray, moist, stiff, silt pockets throughout	SPT-5	6.0 - 7.5	1.5	6-4-6	19	
			SPT-6	7.5 - 9.0	1.5	3-4-6	22	
			SPT-7	9.0 - 10.5	1.5	3-3-6	26	Bulk sample obtained from 9.0 to 15.0 ft.
			SPT-8	10.5 - 12.0	1.5	3-4-5	25	
			SPT-9	12.0 - 13.5	1.1	2-4-6	25	
			SPT-10	13.5 - 15.0	1.5	3-5-6	23	
			SPT-11	15.0 - 16.5	1.5	2-5-7	22	
310.2'	18.0'	-Sandy from 16.5 to 18.0 ft.	SPT-12	16.5 - 18.0	1.5	2-4-4	18	
		POORLY GRADED SAND, reddish brown, wet, very loose to loose	SPT-13	18.0 - 19.5	1.0	1-2-3	24	
			SPT-14	19.5 - 21.0	0.8	1-3-3	24	
			SPT-15	21.0 - 22.5	1.0	2-2-3	27	
			SPT-16	22.5 - 24.0	1.5	3-3-3	23	
			SPT-17	24.0 - 25.5	1.5	3-4-4	20	
			SPT-18	25.5 - 27.0	1.5	2-3-5	24	
299.7'	28.5'		SPT-19	27.0 - 28.5	1.5	2-1-2	23	
		LEAN CLAY, gray, wet, very soft, silty, trace medium sand	SPT-20	28.5 - 30.0	1.5	WOH	30	
			SPT-21	30.0 - 31.5	1.5	0-0-1	25	
295.2'	33.0'		SPT-22	31.5 - 33.0	1.5	WOH	30	
		POORLY GRADED SAND, light gray, wet, loose	SPT-23	33.0 - 34.5	1.1	5-4-5	31	
			SPT-24	34.5 - 36.0	1.5	1-2-2	34	Boring backfilled with bentonite grout from 0.0 to 39.0 ft.
		-Clay pockets from 33.0 to 36.0 ft.	SPT-25	36.0 - 37.5	0.7	2-4-6	22	
289.2'	39.0'		SPT-26	37.5 - 39.0	0.5	3-4-3	24	
		No Refusal / Bottom of Hole						

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Project No.	175559023	Location	N 316346.29, E 1115063.75 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-47** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/17/09 Completed 9/17/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	13.5 ft Date/Time 9/17/09
Logged By	C. Millhollin	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.5'	0.0'	Top of Hole						
		Fill: LEAN CLAY, mottled tan and gray, moist, very stiff, silty, occasional fine gravel	SPT-1	0.0 - 1.5	1.2	10-9-8	16	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.5	9-14-15	17	
			SPT-3	3.0 - 4.5	1.5	11-17-19	23	WOH = Weight of Hammer
			SPT-4	4.5 - 6.0	1.5	12-21-18	12	Bulk sample obtained from 6.0 to 8.0 ft.
			SPT-5	6.0 - 7.5	1.3	9-10-12	16	
			SPT-6	7.5 - 9.0	1.0	7-9-13	15	
340.5'	10.0'		SPT-7	9.0 - 10.5	1.1	11-18-24	13	
		Fill: BOTTOM ASH, gray and black, moist to wet, medium dense	SPT-8	10.5 - 12.0	1.0	5-10-10	13	
			SPT-9	12.0 - 13.5	1.5	5-10-8	18	
			SPT-10	13.5 - 15.0	1.2	5-7-8	20	
334.0'	16.5'		SPT-11	15.0 - 16.5	1.0	4-6-7	19	Bulk sample obtained from 15.0 to 17.0 ft.
		Fill: FLY ASH, gray to black, wet, very soft	SPT-12	16.5 - 18.0	1.3	1-1-1	30	
			SPT-13	18.0 - 19.5	1.5	WOH	34	
			SPT-14	19.5 - 21.0	1.3	0-0-1	37	
			SPT-15	21.0 - 22.5	1.3	0-0-1	36	
326.5'	24.0'		SPT-16	22.5 - 24.0	1.1	WOH	27	
324.5'	26.0'	Fill: LEAN CLAY, light brown and gray, moist, very soft, silty	SPT-17	24.0 - 25.5	0.8	0-1-1	28	
		LEAN CLAY, light brown and gray, moist to wet, stiff, silty	SPT-18	26.0 - 27.5	1.3	3-5-7	25	
			SPT-19	28.5 - 30.0	0.0	5-6-6	--	
			SPT-20	31.0 - 32.5	1.2	3-4-4	27	
			SPT-21	33.5 - 35.0	1.0	5-6-6	27	
			SPT-22	36.0 - 37.5	1.5	5-6-9	25	
309.5'	41.0'	-Sandy from 38.0 to 40.0 ft.	SPT-23	38.5 - 40.0	1.0	4-5-5	22	
		POORLY GRADED SAND, reddish brown, wet, very loose to medium dense	SPT-24	41.0 - 42.5	1.5	1-1-1	23	

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SUBSURFACE LOG

Project No.	175559023	Location	N 316346.29, E 1115063.75 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-47** Total Depth 60.0 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		POORLY GRADED SAND, reddish brown, wet, very loose to medium dense *(Continued)*		SPT-25	43.5 - 45.0	1.5	1-1-1	24	
				SPT-26	46.0 - 47.5	1.0	5-5-6	25	
				SPT-27	48.5 - 50.0	1.0	2-3-5	24	
				SPT-28	51.0 - 52.5	1.5	3-4-8	25	
		-Clayey from 53.5 to 57.5 ft.		SPT-29	53.5 - 55.0	1.3	3-3-1	26	
				SPT-30	56.0 - 57.5	1.5	6-6-14	26	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
290.5'	60.0'	-Gray sand layer from 59.5 to 60.0 ft.		SPT-31	58.5 - 60.0	1.5	2-2-1	25	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559023	Location	N 316712.60, E 1114710.52 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	STN-48 Total Depth 40.0 ft
Location	McCracken County, Kentucky	Surface Elevation	326.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/19/09 Completed 9/19/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	18.5 ft Date/Time 9/19/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
326.6'	0.0'	Top of Hole						
325.1'	1.5'	Fill: LEAN CLAY, brown and gray, moist, stiff, silty	SPT-1	0.0 - 1.5	0.0	5-7-7	--	Boring advanced with 4.25" hollow stem auger.
		LEAN CLAY, mottled brown and gray, moist, stiff to very stiff, silty, trace manganese concretions	SPT-2	1.5 - 3.0	1.3	8-9-11	15	
			SPT-3	3.0 - 4.5	1.5	5-6-8	17	
			SPT-4	4.5 - 6.0	1.5	2-5-7	20	
			SPT-5	6.0 - 7.5	1.5	5-6-8	21	
317.6'	9.0'		SPT-6	7.5 - 9.0	1.5	2-3-6	22	
		LEAN CLAY, brown and gray to reddish brown, moist, stiff to very stiff, trace silt lenses and manganese concretions throughout -Trace organics from 9.0 to 10.5 ft.	SPT-7	9.0 - 10.5	1.5	2-4-7	22	
			SPT-8	10.5 - 12.0	1.5	2-3-7	23	
			SPT-9	12.0 - 13.5	1.5	3-5-6	24	
			SPT-10	13.5 - 15.0	1.5	3-5-7	26	
			SPT-11	15.0 - 16.5	1.5	5-6-10	24	
308.6'	18.0'	-Sandy from 16.5 to 18.0 ft.	SPT-12	16.5 - 18.0	1.5	3-5-7	18	
		POORLY GRADED SAND, reddish brown, wet, very loose to dense, occasional clay pockets throughout -Clayey from 18.0 to 21.0 ft.	SPT-13	18.0 - 19.5	1.5	3-4-4	24	
			SPT-14	19.5 - 21.0	1.5	0-0-1	30	
			SPT-15	21.0 - 22.5	1.5	2-2-3	22	
			SPT-16	22.5 - 24.0	1.5	3-5-7	24	
			SPT-17	24.0 - 25.5	0.3	5-7-7	24	
			SPT-18	25.5 - 27.0	1.5	5-7-10	26	
			SPT-19	27.0 - 28.5	1.5	3-8-14	25	
			SPT-20	28.5 - 30.0	1.0	1-6-5	23	
			SPT-21	30.0 - 31.5	1.5	4-10-13	24	
			SPT-22	31.5 - 33.0	1.5	9-14-16	24	
			SPT-23	33.0 - 34.5	1.5	4-8-16	22	
			SPT-24	34.5 - 36.0	1.5	1-5-8	20	See "Piezometer Installation Detail" for backfill materials and amounts used.
		-Gravelly from 36.0 to 40.0 ft.	SPT-25	36.0 - 37.5	1.0	9-11-16	18	
			SPT-26	37.5 - 39.0	1.0	11-18-22	13	
286.6'	40.0'							
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 316611.94, E 1114653.63 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-49** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/17/09 Completed 9/17/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	17.0 ft Date/Time 9/17/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.5'	0.0'	Top of Hole							
		Fill: LEAN CLAY, mottled brown and gray to gray, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	1.1	5-6-9	14	Boring advanced with 3.25" hollow stem auger. WOH = Weight of Hammer
				SPT-2	1.5 - 3.0	1.0	12-12-13	14	
				SPT-3	3.0 - 4.5	1.3	12-13-16	16	
				SPT-4	4.5 - 6.0	1.2	11-14-16	15	
				SPT-5	6.0 - 7.5	1.1	5-5-7	18	
				SPT-6	7.5 - 9.0	1.0	6-5-7	17	
340.3'	10.2'			SPT-7	9.0 - 10.5	1.3	5-6-13	17	
		Fill: FLY ASH, gray to black, moist to wet, very soft to very stiff, trace amounts of bottom ash throughout		SPT-8	10.5 - 12.0	1.2	13-21-24	16	
				SPT-9	12.0 - 13.5	1.2	12-17-18	20	
				SPT-10	13.5 - 15.0	1.1	7-9-10	20	
				SPT-11	15.0 - 16.5	1.2	6-8-9	22	
				SPT-12	16.5 - 18.0	1.1	4-5-9	13	
				SPT-13	18.0 - 19.5	1.3	3-3-4	30	
				SPT-14	19.5 - 21.0	0.0	2-5-8	--	
				SPT-15	21.0 - 22.5	1.5	WOH	39	
326.5'	24.0'			SPT-16	22.5 - 24.0	1.0	WOH	32	
324.5'	26.0'	Fill: LEAN CLAY, reddish brown and gray, moist, medium stiff		SPT-17	24.0 - 25.5	0.8	1-2-3	26	
		LEAN CLAY, reddish brown and gray to light brown and gray, moist, medium stiff to stiff, silt lenses throughout		SPT-18	26.0 - 27.5	1.2	4-5-5	24	
				SPT-19	28.5 - 30.0	1.4	6-6-7	25	
				SPT-20	31.0 - 32.5	1.5	4-5-8	22	
		-Trace amounts of sand and manganese concretions from 26.0 to 33.5 ft.		SPT-21	33.5 - 35.0	1.5	5-6-7	23	
				SPT-22	36.0 - 37.5	0.0	5-5-6	--	
				SPT-23	38.5 - 40.0	1.5	4-5-5	26	
				SPT-24	41.0 - 42.5	1.5	3-5-6	25	

Project No.	175559023	Location	N 316611.94, E 1114653.63 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-49** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
				SPT-25	43.5 - 45.0	1.4	3-2-3	23	
304.0'	46.5'								
		POORLY GRADED SAND, reddish brown, wet, loose to medium dense		SPT-26	46.0 - 47.5	1.5	3-3-4	30	
				SPT-27	48.5 - 50.0	1.5	2-2-4	24	
				SPT-28	51.0 - 52.5	1.5	1-1-3	25	
				SPT-29	53.5 - 55.0	1.5	1-1-4	26	
		-Clayey from 56.0 to 60.0 ft.		SPT-30	56.0 - 57.5	1.3	3-3-3	34	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
290.5'	60.0'			SPT-31	58.5 - 60.0	1.5	2-4-8	30	
		No Refusal / Bottom of Hole							

SUBSURFACE LOG

Project No.	175559023	Location	N 316615.65, E 1114648.22 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-50** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/17/09 Completed 9/18/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.6'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-49							Boring advanced with 4.25" hollow stem auger.
				ST-1	4.0 - 6.0	1.7		--	
				ST-2	8.0 - 10.0	1.5		16	Bulk sample obtained from 8.0 to 10.0 ft.
				ST-3	28.0 - 30.0	2.0		23	
				ST-4	38.0 - 40.0	2.0		26	

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SUBSURFACE LOG

Project No.	175559023	Location	N 316615.65, E 1114648.22 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-50** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
290.6'	60.0'	OVERBURDEN, see boring log STN-49 *(Continued)*							See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316622.47, E 1114652.40 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-50A** Total Depth 21.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/12/10 Completed 1/12/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	15.0 ft Date/Time 1/12/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.6'	0.0'	Top of Hole						
350.1'	0.5'	CRUSHED STONE						Boring advanced with 3.25" hollow stem augers.
		Fill: LEAN CLAY, mottled brown and gray to gray, moist, stiff to very stiff, silty						
			ST-1	5.0 - 7.0	1.2		12	
			SPT-1	9.0 - 10.5	0.7	10-10-10	12	
			SPT-2	10.5 - 12.0	0.5	5-10-11	16	
			SPT-3	12.0 - 13.5	1.1	5-6-6	13	
336.5'	14.1'	Fill: FLY ASH, dark gray, moist to wet, medium dense to dense, trace amounts of bottom ash	SPT-4	13.5 - 15.0	1.3	6-10-17	18	
			SPT-5	15.0 - 16.5	0.9	5-9-14	20	
			SPT-6	16.5 - 18.0	1.0	10-15-18	20	
			SPT-7	18.0 - 19.5	1.5	12-12-12	23	Boring backfilled with bentonite grout from 0.0 to 21.0 ft.
330.4'	20.2'	Fill: LEAN CLAY, light brown and gray, moist to wet, soft, trace organics, silty	SPT-8	19.5 - 21.0	1.5	2-1-2	24	
329.6'	21.0'	No Refusal / Bottom of Hole						

Offset 8 ft. northeast of STN-50.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316630.15, E 1114657.10 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-50P** Total Depth 25.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/12/10 Completed 1/12/10
Supervisor	D. Chapman Driller S. Wilks	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.6'	0.0'	Top of Hole						
		Fill: LEAN CLAY, mottled brown and gray to gray, moist, very stiff, silty						Boring advanced with 3.25" hollow stem augers.
			ST-1	4.0 - 6.0	2.0		15	
			ST-2	6.0 - 8.0	1.0		13	
			SPT-1	8.0 - 9.5	1.2	8-8-8	16	
			SPT-2	9.5 - 11.0	1.5	6-7-14	16	
			SPT-3	11.0 - 12.5	1.0	4-10-12	15	
337.6'	13.0'		SPT-4	12.5 - 14.0	1.2	8-14-14	17	
		Fill: LEAN CLAY, light brown, moist, stiff to very stiff, silty -Ash/clay mix from 13.0 to 13.2 ft.	SPT-5	14.0 - 15.5	1.1	4-6-7	18	
			ST-3	15.5 - 17.5	1.7		16	Bulk sample taken from 16.0 to 19.0 ft.
			ST-4	17.5 - 19.5	2.0		23	
			ST-5	19.5 - 21.5	2.0		24	
			ST-6	21.5 - 23.5	2.0		24	See "Piezometer Installation Detail" for backfill materials and amounts used.
325.6'	25.0'							

No Refusal /
Bottom of Hole

Offset 17 ft. northeast of STN-50.

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316984.36, E 1114289.89 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-51** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	325.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/20/09 Completed 9/20/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	19.5 ft Date/Time 9/20/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
325.7'	0.0'	Top of Hole							
324.2'	1.5'	Fill: LEAN CLAY, mottled brown and gray, moist, stiff, silty		SPT-1	0.0 - 1.5	1.5	5-6-8	15	Boring advanced with 3.25" hollow stem auger.
		LEAN CLAY, reddish brown and gray, moist, medium stiff to very stiff, silt lenses and manganese concretions throughout		SPT-2	1.5 - 3.0	1.5	3-6-8	15	
				SPT-3	3.0 - 4.5	1.5	6-7-8	18	
				SPT-4	4.5 - 6.0	1.5	4-6-8	21	
				SPT-5	6.0 - 7.5	1.5	3-3-4	22	
				SPT-6	7.5 - 9.0	1.5	1-2-3	27	
				SPT-7	9.0 - 10.5	1.5	1-2-3	25	
				SPT-8	10.5 - 12.0	1.5	1-2-4	25	
				SPT-9	12.0 - 13.5	1.5	3-3-6	24	
				SPT-10	13.5 - 15.0	1.5	4-6-9	25	
				SPT-11	15.0 - 16.5	1.5	5-7-11	25	
307.7'	18.0'	-Sandy from 16.5 to 18.0 ft.		SPT-12	16.5 - 18.0	1.5	3-5-6	20	
		POORLY GRADED SAND with Silt, reddish brown, wet, very loose to medium dense, occasional clay pockets -Clayey from 18.5 to 19.5 ft.		SPT-13	18.0 - 19.5	1.5	1-2-3	23	
				SPT-14	19.5 - 21.0	0.6	0-0-1	26	
				SPT-15	21.0 - 22.5	1.5	3-3-3	25	
				SPT-16	22.5 - 24.0	1.5	1-4-9	24	
				SPT-17	24.0 - 25.5	1.5	2-3-6	24	
				SPT-18	25.5 - 27.0	1.5	2-5-7	11	
				SPT-19	27.0 - 28.5	1.5	4-4-8	24	
				SPT-20	28.5 - 30.0	1.5	4-6-6	30	
				SPT-21	30.0 - 31.5	1.0	4-7-9	29	
				SPT-22	31.5 - 33.0	1.5	4-11-18	24	Boring backfilled with bentonite grout from 0.0 to 36.0 ft.
		-Gravelly from 33.0 to 34.5 ft.		SPT-23	33.0 - 34.5	1.0	25-5-18	15	
289.7'	36.0'			SPT-24	34.5 - 36.0	1.0	3-9-12	23	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 316890.61, E 1114224.53 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-52** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/18/09 Completed 9/18/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	15.0 ft Date/Time 9/18/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.4'	0.0'	Top of Hole						
		Fill: LEAN CLAY with Sand, mottled light brown and gray, moist, very stiff, silty -Sandy from 0.0 to 1.5 ft.	SPT-1	0.0 - 1.5	1.1	8-10-8	11	Boring advanced with 3.25" hollow stem auger.
			SPT-2	1.5 - 3.0	1.3	7-8-10	16	
			SPT-3	3.0 - 4.5	1.5	7-18-22	17	Bulk sample obtained from 4.0 to 10.0 ft.
			SPT-4	4.5 - 6.0	1.2	10-12-17	18	
			SPT-5	6.0 - 7.5	0.0	5-5-15	--	WOH = Weight of Hammer
			SPT-6	7.5 - 9.0	0.4	8-15-16	11	
			SPT-7	9.0 - 10.5	0.4	7-18-30	12	
339.9'	10.5'							
		Fill: BOTTOM ASH, black and gray, moist, medium dense, occasional fly ash	SPT-8	10.5 - 12.0	1.2	12-11-16	20	
			SPT-9	12.0 - 13.5	1.1	8-13-11	22	
			SPT-10	13.5 - 15.0	1.4	8-11-11	21	
335.4'	15.0'							
		Fill: FLY ASH, black, wet, very soft to stiff	SPT-11	15.0 - 16.5	1.2	3-6-6	22	
			SPT-12	16.5 - 18.0	1.5	2-3-2	21	
			SPT-13	18.0 - 19.5	0.2	0-2-2	23	
			SPT-14	19.5 - 21.0	1.5	2-2-1	26	
			SPT-15	21.0 - 22.5	1.2	0-0-1	35	
			SPT-16	22.5 - 24.0	1.2	WOH	41	
			SPT-17	24.0 - 25.5	0.2	1-2-2	30	
324.4'	26.0'		SPT-18	25.5 - 27.0	1.3	2-4-4	22	
		LEAN CLAY, reddish brown and gray, moist, stiff, silt lenses throughout, occasional manganese concretions	SPT-19	28.5 - 30.0	1.3	3-4-6	20	
			SPT-20	31.0 - 32.5	1.5	3-5-7	19	Bulk sample obtained from 32.0 to 36.0 ft.
			SPT-21	33.5 - 35.0	0.9	4-5-6	23	
			SPT-22	36.0 - 37.5	1.3	2-5-5	21	
			SPT-23	38.5 - 40.0	1.5	3-5-6	20	
			SPT-24	41.0 - 42.5	1.5	4-4-5	20	

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559023	Location	N 316890.61, E 1114224.53 (NAD27)		
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-52**	Total Depth	60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		LEAN CLAY, reddish brown and gray, moist, stiff, silt lenses throughout, occasional manganese concretions *(Continued)*		SPT-25	43.5 - 45.0	1.5	3-4-5	21	
				SPT-26	46.0 - 47.5	1.5	4-4-6	20	
300.9'	49.5'			SPT-27	48.5 - 50.0	1.5	1-1-3	20	
		POORLY GRADED SAND, reddish brown, wet, very loose to medium dense, occasional clay pockets		SPT-28	51.0 - 52.5	1.5	1-1-2	24	
				SPT-29	53.5 - 55.0	1.4	2-3-2	26	
				SPT-30	56.0 - 57.5	1.5	7-10-10	27	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
290.4'	60.0'			SPT-31	58.5 - 60.0	1.0	2-3-4	27	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 317251.66, E 1113870.22 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-53** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	326.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/20/09 Completed 9/20/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	27.0 ft Date/Time 9/20/09
Logged By	G. Budd	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
326.0'	0.0'	Top of Hole						
		Fill: LEAN CLAY, mottled light brown and gray, moist, stiff to very stiff, silty	SPT-1	0.0 - 1.5	1.5	4-7-7	20	Boring advanced with 4.25" hollow stem auger.
323.0'	3.0'		SPT-2	1.5 - 3.0	1.0	7-8-8	18	
		LEAN CLAY, brown and gray to reddish brown and gray, moist to wet, soft to stiff, silt lenses, trace amounts of sand, and manganese concretions throughout -Sandy from 7.0 to 10.0 ft.	SPT-3	3.0 - 4.5	1.5	5-6-8	20	
			SPT-4	4.5 - 6.0	1.5	4-8-12	19	
			SPT-5	6.0 - 7.5	1.0	3-5-6	14	
			SPT-6	7.5 - 9.0	1.5	3-3-3	20	
			SPT-7	9.0 - 10.5	1.0	2-2-3	23	
			SPT-8	10.5 - 12.0	1.2	2-2-3	24	
			SPT-9	12.0 - 13.5	1.5	2-2-3	24	
			SPT-10	13.5 - 15.0	1.5	1-2-2	26	
			SPT-11	15.0 - 16.5	1.5	2-4-5	25	
			SPT-12	16.5 - 18.0	1.5	3-3-6	25	
			SPT-13	18.0 - 19.5	1.5	2-3-6	25	
			SPT-14	19.5 - 21.0	1.5	3-6-7	25	
			SPT-15	21.0 - 22.5	1.5	3-5-8	22	
			SPT-16	22.5 - 24.0	1.5	2-4-8	23	
			SPT-17	24.0 - 25.5	1.5	2-4-6	23	
			SPT-18	25.5 - 27.0	1.5	3-4-5	29	
		-Sandy from 27.0 to 31.5 ft.	SPT-19	27.0 - 28.5	1.5	1-1-2	33	
			SPT-20	28.5 - 30.0	1.5	0-2-2	24	
294.5'	31.5'		SPT-21	30.0 - 31.5	1.5	2-2-2	26	
		POORLY GRADED SAND with Silt, reddish brown, wet, loose to dense	SPT-22	31.5 - 33.0	1.5	7-5-11	16	See "Piezometer Installation Detail" for backfill materials and amounts used.
			SPT-23	33.0 - 34.5	1.5	1-2-3	19	
290.0'	36.0'		SPT-24	34.5 - 36.0	1.5	23-16-16	16	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559023	Location	N 317164.29, E 1113807.60 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-54** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/19/09 Completed 9/19/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	12.0 ft Date/Time 9/19/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.6'	0.0'	Top of Hole							
		Fill: LEAN CLAY, mottled brown and gray, moist, very stiff, silty, trace amounts of sand and manganese concretions		SPT-1	0.0 - 1.5	1.1	11-13-15	12	Boring advanced with 3.25" hollow stem auger. WOH = Weight of Hammer
				SPT-2	1.5 - 3.0	1.0	14-15-12	11	
				SPT-3	3.0 - 4.5	1.0	7-11-12	12	
				SPT-4	4.5 - 6.0	1.3	13-15-18	15	
				SPT-5	6.0 - 7.5	0.8	7-8-10	12	
				SPT-6	7.5 - 9.0	1.2	14-14-15	13	
340.8'	9.8'			SPT-7	9.0 - 10.5	1.3	18-23-27	13	
		Fill: BOTTOM ASH, gray to black, moist to wet, loose to dense		SPT-8	10.5 - 12.0	1.3	12-13-15	16	
				SPT-9	12.0 - 13.5	1.2	5-5-6	17	
				SPT-10	13.5 - 15.0	1.1	5-5-4	17	
				SPT-11	15.0 - 16.5	1.2	2-2-3	16	
332.6'	18.0'			SPT-12	16.5 - 18.0	1.1	2-2-2	18	
331.1'	19.5'	Fill: FLY ASH, black, wet, very soft		SPT-13	18.0 - 19.5	1.5	0-1-1	44	
		Fill: LEAN CLAY, brown with gray mottling, moist to wet, very soft to medium stiff, trace amounts of sand throughout		SPT-14	19.5 - 21.0	1.3	WOH	36	
				SPT-15	21.0 - 22.5	1.0	2-3-3	55	
326.6'	24.0'			SPT-16	22.5 - 24.0	0.8	2-3-4	24	
		LEAN CLAY, reddish brown and gray, moist, medium stiff to very stiff, silty		SPT-17	24.0 - 25.5	1.3	2-6-6	24	
				SPT-18	26.0 - 27.5	1.5	5-9-4	22	
				SPT-19	28.5 - 30.0	1.5	3-5-5	24	
				SPT-20	31.0 - 32.5	1.5	2-2-3	24	
				SPT-21	33.5 - 35.0	1.5	3-4-5	24	
				SPT-22	36.0 - 37.5	1.5	5-8-9	24	
				SPT-23	38.5 - 40.0	1.3	3-6-6	27	
308.6'	42.0'			SPT-24	41.0 - 42.5	1.5	4-4-4	30	

SUBSURFACE LOG

Project No.	175559023	Location	N 317164.29, E 1113807.60 (NAD27)		
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-54**	Total Depth	60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		POORLY GRADED SAND, reddish brown, wet, very loose to dense, occasional clay pockets and gravel *(Continued)* -Clayey from 42.0 to 43.5 ft.		SPT-25	43.5 - 45.0	1.5	1-1-1	28	
				SPT-26	46.0 - 47.5	1.5	1-2-1	28	
				SPT-27	48.5 - 50.0	1.5	WOH	26	
				SPT-28	51.0 - 52.5	1.5	1-5-5	28	
				SPT-29	53.5 - 55.0	1.5	6-8-13	19	
				SPT-30	56.0 - 57.5	1.5	18-21-23	21	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
290.6'	60.0'			SPT-31	58.5 - 60.0	1.5	6-13-25	22	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 317161.11, E 1113811.71 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-55** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/19/09 Completed 9/19/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
350.2'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-54							Boring advanced with 4.25" hollow stem auger.
				ST-1	4.0 - 6.0	1.8		17	
				ST-2	8.0 - 10.0	0.0		--	
				ST-3	28.0 - 30.0	2.0		23	
				ST-4	38.0 - 40.0	0.0		--	

SUBSURFACE LOG

Project No.	175559023	Location	N 317161.11, E 1113811.71 (NAD27)		
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-55**	Total Depth	60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
290.2'	60.0'	OVERBURDEN, see boring log STN-54 *(Continued)*							See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559023 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559023	Location	N 317528.33, E 1113453.65 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-56** Total Depth 36.0 ft
Location	McCracken County, Kentucky	Surface Elevation	325.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/21/09 Completed 9/21/09
Supervisor	G. Budd Driller J. Bowerman	Depth to Water	13.4 ft Date/Time 9/20/09
Logged By	G. Budd	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
325.1'	0.0'	Top of Hole							
		Fill: LEAN CLAY, mottled light brown and gray, moist, stiff to very stiff, silty, trace manganese concretions		SPT-1	0.0 - 1.5	1.2	3-5-6	18	Boring advanced with 3.25" hollow stem auger.
322.1'	3.0'			SPT-2	1.5 - 3.0	1.5	6-8-10	19	
		SANDY LEAN CLAY, reddish brown, moist, medium stiff to stiff		SPT-3	3.0 - 4.5	1.5	5-5-6	17	
				SPT-4	4.5 - 6.0	1.5	3-3-4	23	
				SPT-5	6.0 - 7.5	1.5	4-4-3	19	
				SPT-6	7.5 - 9.0	1.5	2-2-2	22	
				SPT-7	9.0 - 10.5	1.5	2-2-2	23	
				SPT-8	10.5 - 12.0	1.5	2-2-3	24	
311.6'	13.5'			SPT-9	12.0 - 13.5	1.5	2-2-3	32	
		LEAN CLAY, mottled brown and gray to gray, moist, very soft to stiff, silty -Trace amounts of sand from 13.5 to 21.0 ft.		SPT-10	13.5 - 15.0	1.5	2-2-3	16	
				SPT-11	15.0 - 16.5	1.5	3-3-4	20	
				SPT-12	16.5 - 18.0	1.5	3-3-3	25	
				SPT-13	18.0 - 19.5	1.5	2-3-5	27	
				SPT-14	19.5 - 21.0	1.5	3-4-5	27	
				SPT-15	21.0 - 22.5	1.5	1-3-4	27	
				SPT-16	22.5 - 24.0	1.5	2-3-5	28	
				SPT-17	24.0 - 25.5	1.5	3-4-4	28	
				SPT-18	25.5 - 27.0	1.5	2-2-4	30	
				SPT-19	27.0 - 28.5	1.5	3-4-4	27	
				SPT-20	28.5 - 30.0	1.5	0-2-2	50	
		-Trace amounts of sand below 30.0 ft.		SPT-21	30.0 - 31.5	1.5	0-0-1	36	
				SPT-22	31.5 - 33.0	1.1	2-2-3	42	Boring backfilled with bentonite grout from 0.' to 36.0 ft.
290.6'	34.5'			SPT-23	33.0 - 34.5	1.5	3-3-3	28	
289.1'	36.0'	POORLY GRADED SAND with Silt, grayish brown, wet, dense, occasional clay pockets		SPT-24	34.5 - 36.0	1.0	1-9-22	24	
		No Refusal / Bottom of Hole							

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SUBSURFACE LOG

Project No.	175559023	Location	N 317429.25, E 1113392.39 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-57** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	9/19/09 Completed 9/19/09
Supervisor	C. Millhollin Driller J. Huntoon	Depth to Water	15.0 ft Date/Time 9/19/09
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
350.4'	0.0'	Top of Hole							
		Fill: LEAN CLAY, mottled light brown and gray, moist, stiff to very stiff, silty, sandy -Trace organics and fine gravel from 0.0 to 3.0 ft.		SPT-1	0.0 - 1.5	1.0	8-9-9	13	Boring advanced with 3.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.0	12-15-13	12	
				SPT-3	3.0 - 4.5	1.5	5-5-9	17	
				SPT-4	4.5 - 6.0	1.2	4-5-5	20	
				SPT-5	6.0 - 7.5	1.2	3-6-5	14	
				SPT-6	7.5 - 9.0	1.5	3-7-8	17	
339.9'	10.5'			SPT-7	9.0 - 10.5	1.5	7-7-9	12	
		Fill: BOTTOM ASH, gray to black, moist to wet, very loose to loose		SPT-8	10.5 - 12.0	1.2	7-6-3	15	
				SPT-9	12.0 - 13.5	0.9	1-1-0	19	
				SPT-10	13.5 - 15.0	0.9	2-2-2	16	
				SPT-11	15.0 - 16.5	1.0	1-2-2	17	
				SPT-12	16.5 - 18.0	0.6	2-2-3	20	
				SPT-13	18.0 - 19.5	1.3	1-2-6	18	
329.4'	21.0'			SPT-14	19.5 - 21.0	1.2	12-4-1	15	
		Fill: LEAN CLAY, light brown and gray, moist, medium stiff, silty		SPT-15	21.0 - 22.5	1.1	2-3-5	26	
326.4'	24.0'			SPT-16	22.5 - 24.0	0.8	3-3-5	22	
		LEAN CLAY, reddish brown and gray, moist to wet, very stiff to soft, silt lenses throughout		SPT-17	24.0 - 25.5	1.0	4-7-12	23	
				SPT-18	26.0 - 27.5	1.5	5-9-10	23	
				SPT-19	28.5 - 30.0	1.4	5-7-8	26	
		-Trace amounts of sand below 31.0 ft.		SPT-20	31.0 - 32.5	1.2	3-4-5	25	
				SPT-21	33.5 - 35.0	0.8	1-1-2	27	
				SPT-22	36.0 - 37.5	1.4	2-2-2	21	
				SPT-23	38.5 - 40.0	1.1	2-4-4	27	
				SPT-24	41.0 - 42.5	1.3	3-3-4	29	

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SUBSURFACE LOG

Project No.	175559023	Location	N 317429.25, E 1113392.39 (NAD27)
Project Name	SHF Ash Pond 1 & 2	Boring No.	**STN-57** Total Depth 60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		LEAN CLAY, reddish brown and gray, moist to wet, very stiff to soft, silt lenses throughout *(Continued)*		SPT-25	43.5 - 45.0	1.5	4-7-7	31	
				SPT-26	46.0 - 47.5	1.5	2-4-5	26	
				SPT-27	48.5 - 50.0	1.5	2-2-2	28	
				SPT-28	51.0 - 52.5	1.5	6-6-7	30	
294.4'	56.0'			SPT-29	53.5 - 55.0	0.7	2-2-3	31	
		POORLY GRADED SAND, reddish brown, wet, loose, occasional clay layers		SPT-30	56.0 - 57.5	1.0	2-2-4	25	Boring backfilled with bentonite grout from 0.0 to 60.0 ft.
290.4'	60.0'			SPT-31	58.5 - 60.0	0.6	2-3-4	31	

No Refusal /
Bottom of Hole

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SUBSURFACE LOG

Stantec

Project No.	175559035	Location	N 314239.59, E 1113599.85 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-101** Total Depth 41.0 ft
Location	McCracken County, Kentucky	Surface Elevation	345.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/19/10 Completed 1/19/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	13.0 ft Date/Time 1/19/10
Logged By	B. Bline	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
345.6'	0.0'	Top of Hole						
		Fill: LEAN CLAY, light brown, moist, stiff to very stiff, silty, organics, occasional fly ash intermixed	SPT-1	0.0 - 1.5	1.5	2-4-5	11	Boring advanced with 4.25" hollow stem auger.
342.1'	3.5'		SPT-2	1.5 - 3.0	1.1	6-8-9	16	
		Fill: SLUICED FLY ASH, light gray to dark gray, moist to wet, very soft to very stiff	SPT-3	3.0 - 4.5	1.5	14-13-11	20	
			SPT-4	4.5 - 6.0	1.5	7-6-5	30	Bulk sample taken from 4.5 to 6.0 ft.
			ST-1	6.0 - 8.0	1.7		15	WOH = Weight of Hammer
			SPT-5	8.0 - 9.5	1.5	3-2-2	39	
			SPT-6	9.5 - 11.0	1.5	3-2-3	35	
			SPT-7	11.0 - 12.5	1.5	2-2-2	40	
			SPT-8	12.5 - 14.0	1.5	3-2-2	42	
			ST-2	14.0 - 15.5			12	Shelby tube pushed at 14.0 ft and refused at 15.5 ft with no sample recovery. A split spoon was used to obtain grab sample.
			SPT-9	15.5 - 17.0	1.5	2-2-1	17	
			SPT-10	17.0 - 18.5	1.5	1-1-1	51	
			SPT-11	18.5 - 20.0	1.2	WOH	49	
			ST-3	20.0 - 22.0	2.0		48	
322.1'	23.5'		SPT-12	22.0 - 23.5	1.5	1-0-0	48	
		LEAN CLAY, light gray, moist to wet, soft to stiff, occasional organics	SPT-13	23.5 - 25.0	1.3	1-2-2	18	
			SPT-14	25.0 - 26.5	1.2	0-0-3	26	
			SPT-15	26.5 - 28.0	1.2	4-4-7	22	
			ST-4	28.0 - 29.0	1.0		23	
315.1'	30.5'		SPT-16	29.0 - 30.5	1.5	11-7-7	18	
		SILTY SAND, yellowish brown and gray, moist to wet, medium dense to very dense, occasional gravel	SPT-17	30.5 - 32.0	1.5	10-9-5	20	
			SPT-18	32.0 - 33.5	1.2	0-3-8	24	
			SPT-19	33.5 - 35.0	1.5	8-6-3	20	
			ST-5	35.0 - 36.0	0.0		--	
308.1'	37.5'		SPT-20	36.0 - 37.5	0.7	27-50+/0.2'	15	
		WELL GRADED GRAVEL with Silt and Sand, yellowish brown, wet, dense to very dense	SPT-21	37.5 - 39.0	0.1	50+/0.4'	13	See "Piezometer Installation Detail" for backfill materials and amounts used.
304.6'	41.0'		SPT-22	39.0 - 40.5	1.5	39-23-24	20	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 314242.14, E 1113701.41 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-102** Total Depth 55.0 ft
Location	McCracken County, Kentucky	Surface Elevation	375.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/10/10 Completed 2/10/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
375.9'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-103							Boring advanced with 4.25" hollow stem auger.

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SUBSURFACE LOG

Project No.	175559035	Location	N 314242.14, E 1113701.41 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-102
		Total Depth	55.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
320.9'	55.0'	OVERBURDEN, see boring log STN-103 *(Continued)*							See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 314237.20, E 1113701.82 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-103** Total Depth 70.9 ft
Location	McCracken County, Kentucky	Surface Elevation	375.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/8/10 Completed 2/9/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	42.0 ft Date/Time 2/9/10
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Depth	Description	Sample # / RQD	Depth / Run	Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
375.9'	0.0'	Top of Hole						
		Fill: LEAN CLAY, light brown, moist, medium stiff, silty	SPT-1	0.0 - 1.5	0.7	0-2-2	23	Boring was advanced with 4.25" hollow stem auger.
373.0'	2.9'							
		Fill: STACKED FLY ASH, dark gray to black, moist, stiff to very stiff, occasional powdered limestone pockets	SPT-2	2.5 - 4.0	1.2	4-5-9	37	WOH = Weight of Hammer
			SPT-3	5.0 - 6.5	1.3	4-20-24	48	
			SPT-4	7.5 - 9.0	1.5	13-20-27	44	
			SPT-5	10.0 - 11.5	1.2	4-15-35	45	
			SPT-6	12.5 - 14.0	1.4	16-25-50+/0.4'	45	
			SPT-7	15.0 - 16.5	1.5	15-38-47	42	
			SPT-8	17.5 - 19.0	1.5	17-22-29	40	
			SPT-9	20.0 - 21.5	1.5	15-32-42	41	
			SPT-10	22.5 - 24.0	1.5	17-20-24	40	
			SPT-11	25.0 - 26.5	1.5	13-17-21	44	
			SPT-12	27.5 - 29.0	1.5	15-21-33	38	
			SPT-13	30.0 - 31.5	0.7	33-50+/0.2'	40	
			SPT-14	32.5 - 34.0	1.2	15-23-26	43	
340.9'	35.0'							
		Fill: SLUICED FLY ASH, dark gray, moist to wet, very soft to stiff	SPT-15	35.0 - 36.5	1.4	9-4-5	30	
			SPT-16	37.5 - 39.0	0.8	6-5-6	30	
			ST-1	40.0 - 42.0	1.5		38	Bulk sample obtained from 43.0 to 46.0 ft.
			SPT-17	42.5 - 44.0	1.5	3-4-4	49	

SUBSURFACE LOG

Project No.	175559035	Location	N 314237.20, E 1113701.82 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-103** Total Depth 70.9 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: SLUICED FLY ASH, dark gray, moist to wet, very soft to stiff *(Continued)*		SPT-18	45.0 - 46.5	1.5	2-3-4	48	
				SPT-19	47.5 - 49.0	1.5	3-2-2	47	
				SPT-20	50.0 - 51.5	1.5	2-1-1	38	
				SPT-21	52.5 - 54.0	1.5	2-1-1	43	
318.9'	57.0'			SPT-22	55.0 - 56.5	1.5	WOH	48	
		LEAN CLAY, light gray, moist, stiff to very stiff		SPT-23	57.5 - 59.0	1.2	4-4-5	25	
313.9'	62.0'			SPT-24	60.0 - 61.5	1.3	16-20-16	18	
		POORLY GRADED SAND with Silt, yellowish brown and gray, moist to wet, loose to very dense		SPT-25	62.5 - 64.0	1.1	5-4-5	17	
				SPT-26	65.0 - 66.5	0.9	6-6-10	18	
305.0'	70.9'	-Gravelly below 67.0 ft.		SPT-27	67.5 - 69.0	0.8	9-50+/0.4'	17	See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 314242.09, E 1113825.68 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-104** Total Depth 91.5 ft
Location	McCracken County, Kentucky	Surface Elevation	411.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/10/10 Completed 2/11/10
Supervisor	C. Millhollin Driller M. Wethington	Depth to Water	80.5 ft Date/Time 2/11/10
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
411.3'	0.0'	Top of Hole						
410.8'	0.5'	Fill: TOPSOIL	SPT-1	0.0 - 1.5	1.5	0-1-1	22	Boring advanced with 4.25" hollow stem auger.
409.3'	2.0'	Fill: LEAN CLAY, light brown and gray, moist to wet, soft, organics						
		Fill: STACKED FLY ASH, dark gray and black, moist, stiff to very stiff	SPT-2	5.0 - 6.5	1.0	5-7-7	43	
			SPT-3	10.0 - 11.5	1.5	10-22-33	48	
			SPT-4	15.0 - 16.5	1.5	12-23-42	47	
			SPT-5	20.0 - 21.5	0.9	27-50+/0.4'	44	
			SPT-6	25.0 - 26.5	1.5	16-15-24	42	
			SPT-7	30.0 - 31.5	0.4	50+/0.4'	49	
			SPT-8	35.0 - 36.5	0.9	16-50+/0.4'	46	
			SPT-9	40.0 - 41.5	1.5	26-42-50+/0.1'	53	

Project No.	175559035	Location	N 314242.09, E 1113825.68 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-104** Total Depth 91.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: STACKED FLY ASH, dark gray and black, moist, stiff to very stiff *(Continued)*		SPT-10	45.0 - 46.5	1.5	15-12-27	47	
				SPT-11	50.0 - 51.5	0.8	39-50+/0.3	48	
				SPT-12	55.0 - 56.5	1.3	4-11-8	39	
				ST-1	60.0 - 62.0	2.0		20	
				SPT-13	65.0 - 66.5	1.4	2-3-5	23	
341.3'	70.0'	Fill: SLUICED FLY ASH, dark gray, moist to wet, medium stiff to very stiff		SPT-14	70.0 - 71.5	1.5	4-10-11	20	
				ST-2	75.0 - 77.0	2.0		58	
				SPT-15	80.0 - 81.5	1.5	3-3-5	50	
				SPT-16	85.0 - 86.5	1.5	2-3-4	43	See "Piezometer Installation Detail" for backfill materials and amounts used.
320.3'	91.0'	LEAN CLAY, gray, wet, soft, silty		SPT-17	90.0 - 91.5	1.4	2-1-3	31	
319.8'	91.5'	No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 313503.36, E 1113698.42 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-105** Total Depth 38.0 ft
Location	McCracken County, Kentucky	Surface Elevation	347.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/26/10 Completed 1/29/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	17.5 ft Date/Time 1/26/10
Logged By	B. Bline	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
347.7'	0.0'	Top of Hole						
345.9'	1.8'	Fill: LEAN CLAY, light brown, moist, stiff, organics	SPT-1	0.0 - 1.5	1.5	3-5-5	18	Boring advanced with 4.25" hollow stem auger.
		Fill: SLUICED FLY ASH, gray, moist to wet, very soft to very stiff	SPT-2	1.5 - 3.0	1.5	13-10-10	44	
			ST-1	3.0 - 3.5	0.5		23	
			SPT-3	4.0 - 5.5	1.5	16-15-13	20	
			SPT-4	5.5 - 7.0	1.0	9-9-5	23	
			ST-2	7.0 - 9.0	1.9		27	
			SPT-5	9.0 - 10.5	1.5	3-2-2	31	
			SPT-6	10.5 - 12.0	1.5	2-2-4	31	
			SPT-7	12.0 - 13.5	1.5	2-3-3	35	
			SPT-8	13.5 - 15.0	1.5	3-2-2	38	
			ST-3	15.0 - 17.0	1.7		38	
			SPT-9	17.0 - 18.5	1.5	2-1-2	44	
			SPT-10	18.5 - 20.0	1.5	2-1-1	43	
			SPT-11	20.0 - 21.5	1.5	1-1-0	47	
324.2'	23.5'		SPT-12	21.5 - 23.0	1.5	1-0-0	45	
		SANDY LEAN CLAY, gray and light brown, moist to wet, very soft to very stiff, silty, occasional gravel	SPT-13	23.0 - 24.5	1.5	1-1-1	33	
			SPT-14	24.5 - 26.0	1.5	2-1-2	22	
			SPT-15	26.0 - 27.5	1.2	6-8-18	16	
			SPT-16	27.5 - 29.0	1.5	17-21-26	11	
316.2'	31.5'		SPT-17	29.0 - 30.5	1.3	17-27-36	14	
		POORLY GRADED SAND with Silt and Gravel, yellowish brown, moist to wet, very dense	SPT-18	31.5 - 33.0	0.4	50+/0.4	15	
			SPT-19	33.0 - 34.5	0.4	50+/0.4	14	See "Piezometer Installation Detail" for backfill materials and amounts used.
			SPT-20	34.5 - 36.0	1.2	23-43-50+/0.2	10	
309.7'	38.0'		SPT-21	36.0 - 37.5	1.2	35-40-50+/0.2	11	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559035	Location	N 313498.36, E 1113698.42 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-105A** Total Depth 31.0 ft
Location	McCracken County, Kentucky	Surface Elevation	347.7 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/24/10 Completed 2/24/10
Supervisor	B. Bline Driller T. Caudill	Depth to Water	N/A Date/Time N/A
Logged By	B. Bline	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
347.7'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-105							Boring advanced with 4.25" hollow stem auger.
				ST-1	23.0 - 25.0	2.0		40	
				ST-2	25.0 - 27.0	2.0		23	
				ST-3	27.0 - 29.0	1.5		13	Boring backfilled with bentonite grout from 0.0 to 31.0 ft.
316.7'	31.0'			ST-4	29.0 - 31.0	0.8		15	
		No Refusal / Bottom of Hole							
		Offset 5 ft south of STN-105.							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559035	Location	N 313516.57, E 1113784.54 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-106 Total Depth 53.5 ft
Location	McCracken County, Kentucky	Surface Elevation	375.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/24/10 Completed 2/24/10
Supervisor	C. Millhollin Driller S. Bradford	Depth to Water	33.5 ft Date/Time 2/24/10
Logged By	C. Millhollin	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
375.3'	0.0'	Top of Hole							
374.8'	0.5'	Fill: TOPSOIL		SPT-1	0.0 - 1.5	0.9	2-3-5	20	Boring advanced with 4.25" hollow stem auger. WOH = Weight of Hammer
370.8'	4.5'	Fill: LEAN CLAY, light brown and gray, moist, stiff, silty, organics		SPT-2	2.5 - 4.0	0.8	6-6-7	22	
		Fill: STACKED FLY ASH, gray and black, moist to wet, medium stiff to very stiff, occasional powdered limestone pockets		SPT-3	5.0 - 6.5	1.3	3-4-4	44	
				SPT-4	7.5 - 9.0	1.3	10-8-7	48	
				SPT-5	10.0 - 11.5	1.5	36-27-21	54	
				SPT-6	12.5 - 14.0	1.1	2-3-2	42	
				ST-1	15.0 - 17.0	1.2		50	
				SPT-7	18.0 - 19.5	1.1	9-14-27	34	
				SPT-8	20.5 - 22.0	1.5	9-12-16	56	
				SPT-9	23.0 - 24.5	1.5	4-6-5	44	
				SPT-10	25.5 - 27.0	1.5	1-2-1	52	
				ST-2	28.0 - 30.0	1.9		58	
341.3'	34.0'			SPT-11	31.0 - 32.5	1.5	1-1-9	46	
340.8'	34.5'	Fill: LEAN CLAY, light brown, moist, stiff, silty		SPT-12	33.5 - 35.0	1.5	6-7-8	36	
		Fill: SLUICED FLY ASH, gray and black, moist to wet, very soft to stiff, occasional bottom ash		SPT-13	36.0 - 37.5	1.2	2-3-5	30	
				SPT-14	38.5 - 40.0	1.4	3-5-6	24	
				SPT-15	41.0 - 42.5	1.5	2-3-5	31	

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SUBSURFACE LOG

Project No.	175559035	Location	N 313516.57, E 1113784.54 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-106** Total Depth 53.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: SLUICED FLY ASH, gray and black, moist to wet, very soft to stiff, occasional bottom ash *(Continued)*		SPT-16	43.5 - 45.0	1.3	2-4-5	42	
				ST-3	45.0 - 47.0	0.0		--	
				SPT-17	47.0 - 48.5	1.5	WOH	49	
				SPT-18	49.5 - 51.0	1.5	1-1-1	53	See "Piezometer Installation Detail" for backfill materials and amounts used.
322.5'	52.8'			SPT-19	52.0 - 53.5	1.1	3-3-4	27	
321.8'	53.5'	LEAN CLAY, light gray and brown, moist to wet, medium stiff, organics							

No Refusal /
Bottom of Hole

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 313531.32, E 1113908.57 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-107** Total Depth 98.1 ft
Location	McCracken County, Kentucky	Surface Elevation	408.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/11/10 Completed 2/12/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	60.0 ft Date/Time 2/12/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
408.1'	0.0'	Top of Hole						
407.6'	0.5'	Fill: TOPSOIL	SPT-1	0.0 - 1.5	0.7	1-1-1	23	Boring advanced with 4.25" hollow stem auger.
406.1'	2.0'	Fill: LEAN CLAY, light brown and gray, moist, very soft, silty						
		Fill: STACKED FLY ASH, dark gray and black, moist, stiff to very stiff	SPT-2	5.0 - 6.5	0.5	4-50+	25	
			SPT-3	10.0 - 11.5	1.5	5-5-5	61	
			SPT-4	15.0 - 16.5	1.5	9-10-11	62	
			SPT-5	20.0 - 21.5	1.5	14-36-35	53	
			SPT-6	25.0 - 26.5	1.1	12-8-10	40	
			SPT-7	30.0 - 31.5	1.5	5-7-9	42	
			SPT-8	35.0 - 36.5	1.3	5-6-20	49	
			SPT-9	40.0 - 41.5	1.5	18-28-22	38	

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SUBSURFACE LOG

Project No.	175559035	Location	N 313531.32, E 1113908.57 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-107** Total Depth 98.1 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: STACKED FLY ASH, dark gray and black, moist, stiff to very stiff *(Continued)*		SPT-10	45.0 - 46.5	0.4	50+/0.4'	38	
				SPT-11	50.0 - 51.5	1.5	26-28-44	45	
				SPT-12	55.0 - 56.5	0.7	48-50+/0.2'	41	
				SPT-13	60.0 - 61.5	0.7	5-5-4	49	
343.1'	65.0'								
341.1'	67.0'	Fill: SILT, olive brown, moist, stiff		SPT-14	65.0 - 66.5	1.1	7-7-7	22	
		Fill: SLUICED FLY ASH, dark gray and black, moist to wet, medium stiff		ST-1	70.0 - 72.0	2.0		21	
				ST-2	75.0 - 77.0	2.0		40	
				SPT-15	80.0 - 81.5	1.2	1-4-3	42	
322.1'	86.0'			SPT-16	85.0 - 86.5	1.5	1-2-2	49	
		LEAN CLAY, gray to light brown and gray, moist to wet, very stiff, organics		SPT-17	90.0 - 91.5	1.3	4-11-17	19	
315.6'	92.5'								

SUBSURFACE LOG

Project No.	175559035	Location	N 313531.32, E 1113908.57 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-107** Total Depth 98.1 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
310.0'	98.1'	POORLY GRADED SAND with Silt and Gravel, yellowish brown, wet, very dense *(Continued)*		SPT-18	95.0 - 96.5	0.7	47-50+/0.4'	15	See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Stantec

Project No.	175559035	Location	N 312796.11, E 1113871.67 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-108** Total Depth 40.0 ft
Location	McCracken County, Kentucky	Surface Elevation	350.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/29/10 Completed 1/31/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	32.0 ft Date/Time 1/31/10
Logged By	B. Bline	Automatic Hammer ☐	Safety Hammer ☒ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
350.3'	0.0'	Top of Hole							
348.6'	1.7'	Fill: LEAN CLAY, light brown, moist, very stiff, silty, organics		SPT-1	0.0 - 1.5	0.9	2-5-13	17	Boring advanced with 4.25" hollow stem auger.
		Fill: SLUICED FLY ASH, gray, moist to wet, medium stiff to very stiff		SPT-2	1.5 - 3.0	1.2	15-20-30	18	
				SPT-3	3.0 - 4.5	1.4	5-12-23	17	
				SPT-4	4.5 - 6.0	1.3	15-22-20	33	
				SPT-5	6.0 - 7.5	1.5	6-5-7	33	
				SPT-6	7.5 - 9.0	1.5	5-7-7	18	
				SPT-7	9.0 - 10.5	1.5	3-3-4	18	
				SPT-8	10.5 - 12.0	1.5	4-4-6	27	
				ST-1	12.0 - 14.0	1.2		28	Bulk sample obtained from 12.0 to 14.0 ft.
				SPT-9	14.0 - 15.5	1.5	4-5-7	26	
				SPT-10	15.5 - 17.0	1.5	3-4-4	40	
				SPT-11	17.0 - 18.5	1.5	5-6-7	35	
				SPT-12	18.5 - 20.0	1.5	3-5-6	35	
				SPT-13	20.0 - 21.5	1.5	3-5-5	47	
				ST-2	21.5 - 23.5	1.5		37	
				ST-3	23.5 - 25.5	2.0		41	
				ST-4	25.5 - 27.5	2.0		50	
				ST-5	27.5 - 29.5	2.0		46	
318.3'	32.0'			ST-6	29.5 - 31.5	2.0		--	
		POORLY GRADED SAND with Silt, yellowish brown, moist to wet, loose to very dense, occasional gravel		SPT-14	31.5 - 33.0	1.1	5-5-5	15	
				SPT-15	33.0 - 34.5	1.2	4-4-7	21	
				SPT-16	34.5 - 36.0	0.5	2-2-6	12	
				SPT-17	36.0 - 37.5	1.0	9-15-30	12	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-18	37.5 - 39.0	1.0	17-46-36	11	
310.3'	40.0'			SPT-19	39.0 - 40.0	0.8	14-33	16	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312824.38, E 1113978.97 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-109** Total Depth 70.1 ft
Location	McCracken County, Kentucky	Surface Elevation	386.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/24/10 Completed 2/24/10
Supervisor	B. Bline Driller T. Caudill	Depth to Water	N/A Date/Time N/A
Logged By	B. Bline	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
386.0'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-110							Boring advanced with 4.25" hollow stem auger.
									Bulk Sample obtained from 12.0 to 25.0 ft.

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 312824.38, E 1113978.97 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-109**
		Total Depth	70.1 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		OVERBURDEN, see boring log STN-110 *(Continued)*							See "Piezometer Installation Detail" for backfill materials and amounts used.
315.9'	70.1'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312829.42, E 1113977.17 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-110** Total Depth 76.1 ft
Location	McCracken County, Kentucky	Surface Elevation	385.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/22/10 Completed 2/23/10
Supervisor	B. Bline Driller T. Caudill	Depth to Water	65.0 ft Date/Time 2/23/10
Logged By	B. Bline	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
385.9'	0.0'	Top of Hole							
		Fill: LEAN CLAY, light brown and gray, moist, soft to very stiff, silty, organics		SPT-1	0.0 - 1.5	1.3	1-1-3	22	Boring advanced with 4.25" hollow stem auger.
				SPT-2	2.5 - 4.0	1.5	6-8-9	19	
379.4'	6.5'			SPT-3	5.0 - 6.5	1.5	3-6-6	21	
		Fill: STACKED FLY ASH, gray and black, moist to wet, soft to very stiff, occasional bottom ash and powdered limestone pockets		SPT-4	7.5 - 9.0	1.4	25-48-50+/0.4'	40	
				SPT-5	10.0 - 11.5	1.5	8-21-21	50	
				SPT-6	13.0 - 14.0	1.0	9-13	42	Attempted Shelby tube at 12.5 ft and refused.
				SPT-7	15.0 - 16.5	1.5	3-1-4	50	
				SPT-8	18.5 - 20.0	0.4	50+/0.4'	69	Attempted Shelby tube at 18.0 ft and refused.
				SPT-9	20.0 - 21.5	1.5	17-14-15	56	
				SPT-10	22.5 - 24.0	1.5	9-10-15	62	
				SPT-11	25.0 - 26.5	1.5	34-29-33	37	
				SPT-12	27.5 - 29.0	1.5	19-27-30	40	
				SPT-13	30.0 - 31.5	1.5	4-5-5	44	
				SPT-14	32.5 - 34.0	1.5	2-4-6	49	
				SPT-15	35.0 - 36.5	1.5	6-4-4	59	Attempted Shelby tube at 35.0 ft and refused.
346.9'	39.0'			SPT-16	37.5 - 39.0	1.5	2-1-3	60	
		Fill: SLUICED FLY ASH, gray and black, moist to wet, very soft to stiff, occasional bottom ash		ST-1	40.0 - 42.0	1.5		32	

SUBSURFACE LOG

Stantec

Project No.	175559035	Location	N 312829.42, E 1113977.17 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-110** Total Depth 76.1 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: SLUICED FLY ASH, gray and black, moist to wet, very soft to stiff, occasional bottom ash *(Continued)*		ST-2	43.0 - 45.0	1.9		30	
				SPT-17	45.0 - 46.5	1.5	3-3-3	33	
				SPT-18	47.5 - 49.0	1.5	1-4-3	31	
				SPT-19	50.0 - 51.5	1.5	3-3-4	35	
				SPT-20	52.5 - 54.0	1.5	2-3-4	39	
				SPT-21	55.0 - 56.5	1.5	4-4-8	27	
				SPT-22	57.5 - 59.0	1.5	1-4-5	38	
				SPT-23	60.0 - 61.5	1.5	5-4-6	40	
				SPT-24	62.5 - 64.0	1.5	1-2-4	44	
				SPT-25	65.0 - 66.5	1.5	2-1-3	38	
				SPT-26	67.5 - 69.0	1.5	1-1-1	41	
314.9'	71.0'			SPT-27	70.0 - 71.5	1.5	0-0-2	34	Attempted Shelby tube at 72.0 ft and refused.
		POORLY GRADED SAND with Silt and Gravel, gray to yellowish brown, wet, dense to very dense		SPT-28	72.5 - 74.0	1.5	11-10-20	14	See "Piezometer Installation Detail" for backfill materials and amounts used.
309.8'	76.1'	-Clayey from 71.0 to 71.5 ft.		SPT-29	74.5 - 76.0	1.3	34-46-50	14	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 312163.61, E 1114222.26 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-111** Total Depth 38.9 ft
Location	McCracken County, Kentucky	Surface Elevation	351.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/17/10 Completed 1/17/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	15.5 ft Date/Time 1/17/10
Logged By	B. Bline	Automatic Hammer ☐	Safety Hammer ☒ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
351.0'	0.0'	Top of Hole							
		Fill: LEAN CLAY, light brown and gray, moist, stiff to very stiff, silty		SPT-1	0.0 - 1.5	1.2	4-7-7	21	Boring advanced with 4.25" hollow stem auger.
				SPT-2	1.5 - 3.0	1.2	6-7-11	22	
				SPT-3	3.0 - 4.5	1.5	1-3-7	25	
345.8'	5.2'			SPT-4	4.5 - 6.0	1.4	10-18-12	24	
		Fill: SLUICED FLY ASH, light gray to dark gray, moist to wet, very soft to very stiff, occasional bottom ash		SPT-5	6.0 - 7.5	1.0	7-10-9	28	
				SPT-6	7.5 - 9.0	1.5	5-4-4	28	Bulk sample taken from 7.5 to 9.0 ft.
				SPT-7	9.0 - 10.5	1.5	4-4-4	33	
				ST-1	10.5 - 12.5	1.8		23	
				SPT-8	12.5 - 14.0	1.5	3-3-2	35	
				SPT-9	14.0 - 15.5	1.5	2-2-0	32	
				ST-2	15.5 - 17.5	1.8		40	
				SPT-10	17.5 - 19.0	1.5	3-2-4	37	
				SPT-11	19.0 - 20.5	1.5	2-1-1	29	
				SPT-12	20.5 - 22.0	1.5	2-5-3	29	
				SPT-13	22.0 - 23.5	1.5	2-8-10	34	
				SPT-14	23.5 - 25.0	1.5	4-1-5	42	
				SPT-15	25.0 - 26.5	1.5	0-0-8	27	
				SPT-16	26.5 - 28.0	1.5	2-3-3	38	
321.5'	29.5'			SPT-17	28.0 - 29.5	1.5	2-3-4	35	
		SANDY SILT, gray and brown, moist to wet, medium to stiff, clayey to 31.0 ft		SPT-18	29.5 - 31.0	0.8	2-5-4	25	
318.0'	33.0'			ST-3	31.0 - 33.0	2.0		34	
		POORLY GRADED SAND with Silt, yellowish brown and gray, moist to wet, loose to medium dense		SPT-19	33.0 - 34.5	1.1	8-11-10	17	
				SPT-20	34.5 - 36.0	1.2	4-4-3	19	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-21	36.0 - 37.5	1.2	4-1-4	21	
312.1'	38.9'			ST-4	38.0 - 38.9	0.9		15	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312209.67, E 1114305.60 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-112** Total Depth 71.0 ft
Location	McCracken County, Kentucky	Surface Elevation	381.8 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/23/10 Completed 2/24/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	44.5 ft Date/Time 2/24/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
381.8'	0.0'	Top of Hole							
380.3'	1.5'	Fill: TOPSOIL		SPT-1	0.0 - 1.5	1.0	1-2-3	26	Boring advanced with 4.25" hollow stem auger.
		Fill: LEAN CLAY, light brown, moist, very stiff, silty, organics		SPT-2	2.5 - 4.0	0.8	7-7-10	22	
375.8'	6.0'			SPT-3	5.0 - 6.5	0.7	4-4-4	19	
		Fill: STACKED FLY ASH, gray and black, moist, very stiff, occasional powdered limestone pockets		SPT-4	7.5 - 9.0	1.3	10-13-13	32	
				ST-1	10.0 - 11.5	1.2		23	
				SPT-5	12.5 - 14.0	0.5	7-11-27	34	
				SPT-6	15.0 - 16.5	0.7	3-3-23	56	
				SPT-7	17.5 - 19.0	0.9	30-22-50+/0.3'	48	
				SPT-8	20.0 - 21.5	0.8	8-50+/0.3'	51	
				SPT-9	22.5 - 24.0	1.1	24-34-50+/0.3'	44	
				SPT-10	25.0 - 26.5	1.4	20-30-50+/0.4'	47	
				SPT-11	27.5 - 29.0	1.5	10-17-39	34	
				SPT-12	30.0 - 31.5	1.5	10-23-26	29	
348.8'	33.0'	Fill: LEAN CLAY, light brown and gray, moist, very stiff, silty		SPT-13	32.5 - 34.0	1.5	3-7-10	20	
345.3'	36.5'			SPT-14	35.0 - 36.5	1.2	6-11-14	21	
		Fill: SLUICED FLY ASH, gray and black, moist to wet, very soft to very stiff, occasional bottom ash		SPT-15	37.5 - 39.0	1.0	10-11-10	27	
				SPT-16	40.0 - 41.5	0.8	10-11-14	25	
				SPT-17	42.5 - 44.0	1.3	4-4-7	25	

Project No.	175559035	Location	N 312209.67, E 1114305.60 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-112
		Total Depth	71.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fill: SLUICED FLY ASH, gray and black, moist to wet, very soft to very stiff, occasional bottom ash *(Continued)*	SPT-18	45.0 - 46.5	1.0	4-4-5	35	
			SPT-19	47.5 - 49.0	1.1	5-3-5	45	
			SPT-20	50.0 - 51.5	1.3	2-2-2	41	
			SPT-21	52.5 - 54.0	0.7	2-3-7	35	
			SPT-22	55.0 - 56.5	1.0	1-4-4	42	
			SPT-23	57.5 - 59.0	0.9	5-3-6	37	
			SPT-24	60.0 - 61.5	1.5	5-3-5	28	
			SPT-25	62.5 - 64.0	1.5	0-0-1	46	
			SPT-26	65.0 - 66.5	1.5	0-0-1	46	
314.3'	67.5'							See "Piezometer Installation Detail" for backfill materials and amounts used.
		POORLY GRADED SAND with Silt, gray, wet, medium dense	SPT-27	67.5 - 69.0	1.0	4-6-11	23	
310.8'	71.0'		SPT-28	69.5 - 71.0	0.9	4-5-9	23	

No Refusal /
Bottom of Hole

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312261.99, E 1114359.00 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-113** Total Depth 86.5 ft
Location	McCracken County, Kentucky	Surface Elevation	403.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/12/10 Completed 2/13/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	70.0 ft Date/Time 2/13/10
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
403.6'	0.0'	Top of Hole						
403.1'	0.5'	Fill: TOPSOIL	SPT-1	0.0 - 1.5	0.8	1-2-2	23	Boring advanced with 4.25" hollow stem auger.
401.6'	2.0'	Fill: LEAN CLAY with Sand, light brown and gray, moist, soft, silty						
		Fill: STACKED FLY ASH, gray and black, moist, medium stiff to very stiff	SPT-2	5.0 - 6.5	1.1	4-4-4	65	
			SPT-3	10.0 - 11.5	1.2	2-3-4	46	
			SPT-4	15.0 - 16.5	1.0	9-7-6	66	
			SPT-5	20.0 - 21.5	0.9	14-41-43	52	
			SPT-6	25.0 - 26.5	1.5	7-6-7	48	
			SPT-7	30.0 - 31.5	1.0	26-13-11	59	
			SPT-8	35.0 - 36.5	1.0	11-32-50+/0.2'	32	
			SPT-9	40.0 - 41.5	1.3	17-49-50+/0.3'	46	

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 312261.99, E 1114359.00 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-113** Total Depth 86.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: STACKED FLY ASH, gray and black, moist, medium stiff to very stiff *(Continued)*		SPT-10	45.0 - 46.5	0.8	21-26-27	59	
				SPT-11	50.0 - 51.5	1.4	12-12-37	51	
348.6'	55.0'								
		Fill: SLUICED FLY ASH, gray and black, moist to wet, soft to very stiff		SPT-12	55.0 - 56.5	1.2	9-11-12	34	
				SPT-13	60.0 - 61.5	0.9	4-5-8	28	
				ST-1	65.0 - 67.0	1.3		38	
				ST-2	70.0 - 72.0	1.9		42	
				SPT-14	75.0 - 76.5	0.9	7-5-8	33	
				SPT-15	80.0 - 81.5	1.3	2-2-2	43	See "Piezometer Installation Detail" for backfill materials and amounts used.
317.4'	86.2'			SPT-16	85.0 - 86.5	1.5	1-1-2	36	
317.1'	86.5'	POORLY GRADED SAND with Silt, gray, wet, very loose							
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Stantec

Project No.	175559035	Location	N 312043.43, E 1114723.51 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-114** Total Depth 38.6 ft
Location	McCracken County, Kentucky	Surface Elevation	349.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/15/10 Completed 1/17/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	15.5 ft Date/Time 1/17/10
Logged By	B. Bline	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
349.6'	0.0'	Top of Hole							
348.0'	1.6'	Fill: LEAN CLAY, light brown and gray, moist, stiff, organics		SPT-1	0.0 - 1.5	1.2	2-5-9	31	Boring advanced with 4.25" hollow stem auger.
		Fill: SLUICED FLY ASH, light gray to gray, moist, soft to very stiff		SPT-2	1.5 - 3.0	1.4	9-11-10	26	
				SPT-3	3.0 - 4.5	1.5	1-2-3	39	Use of safety hammer starting at 6.5 ft.
				ST-1	4.5 - 6.1	1.4		37	
				SPT-4	6.5 - 8.0	1.3	4-3-3	41	
				SPT-5	8.0 - 9.5	1.2	4-3-3	36	
				ST-2	9.5 - 10.3	0.8		30	
				SPT-6	11.5 - 13.0	1.3	15-11-13	14	
				SPT-7	13.0 - 14.5	1.4	13-11-10	14	
				SPT-8	14.5 - 16.0	1.5	18-15-7	23	
332.1'	17.5'			SPT-9	16.0 - 17.5	1.5	2-1-2	48	
		Fill: SLUICED BOTTOM ASH, dark gray to black, moist to wet, medium dense		SPT-10	17.5 - 19.0	1.5	15-13-15	19	
				SPT-11	19.0 - 20.5	1.3	13-9-9	20	
327.6'	22.0'			SPT-12	20.5 - 22.0	1.5	4-7-9	30	
		Fill: SLUICED FLY ASH, dark gray, wet, soft to medium stiff		SPT-13	22.0 - 23.5	1.5	3-3-2	40	
324.7'	24.9'			SPT-14	23.5 - 25.0	1.5	2-1-1	25	
		SILT, light gray, moist, very stiff		SPT-15	25.0 - 26.5	0.4	7-13-16	22	
				SPT-16	26.5 - 28.0	1.2	9-14-12	21	
320.1'	29.5'			ST-3	28.0 - 29.5	1.5		21	
		POORLY GRADED SAND with Silt, light gray and yellowish brown, wet, medium dense to dense		SPT-17	30.0 - 31.5	1.5	8-13-21	19	
316.6'	33.0'			SPT-18	31.5 - 33.0	1.5	14-9-12	15	
		LEAN CLAY with Sand, reddish brown and gray, moist, very stiff, silty		ST-4	33.0 - 34.0	0.8		17	
				SPT-19	34.0 - 35.5	1.5	7-13-15	21	See "Piezometer Installation Detail" for backfill materials and amounts used.
				SPT-20	35.5 - 37.0	1.0	12-25-17	23	
311.0'	38.6'			SPT-21	37.0 - 38.5	1.1	4-9-19	22	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312148.78, E 1114670.38 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-115** Total Depth 60.0 ft
Location	McCracken County, Kentucky	Surface Elevation	388.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/23/10 Completed 2/23/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	N/A Date/Time N/A
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
388.2'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-116							Boring advanced with 4.25" hollow stem auger.

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312148.78, E 1114670.38 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-115
		Total Depth	60.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		OVERBURDEN, see boring log STN-116 *(Continued)*							See "Piezometer Installation Detail" for backfill materials and amounts used.
328.2'	60.0'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312151.06, E 1114675.00 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-116** Total Depth 77.0 ft
Location	McCracken County, Kentucky	Surface Elevation	388.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/22/10 Completed 2/23/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	12.5 ft Date/Time 2/22/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
388.2'	0.0'	Top of Hole							
387.7'	0.5'	Fill: TOPSOIL		SPT-1	0.0 - 1.5	1.0	1-2-5	25	Boring advanced with 4.25" hollow stem auger.
386.2'	2.0'	Fill: LEAN CLAY, light brown and gray, moist, medium stiff, silty, organics		SPT-2	2.5 - 4.0	0.4	5-4-8	29	
		Fill: STACKED FLY ASH, gray and black, moist to wet, stiff to very stiff, occasional powdered limestone pockets		ST-1	5.0 - 7.0	1.8		24	
				SPT-3	7.5 - 9.0	1.5	7-7-9	31	
				ST-2	10.0 - 10.5	0.0		--	
				SPT-4	12.5 - 14.0	1.5	4-4-5	43	
				ST-3	15.0 - 17.0	2.0		43	
				SPT-5	17.5 - 19.0	1.5	4-4-8	41	
				SPT-6	20.0 - 21.5	1.5	3-4-8	42	
				SPT-7	22.5 - 24.0	1.5	3-3-7	45	
				SPT-8	25.0 - 26.5	1.1	6-20-21	48	
				SPT-9	27.5 - 29.0	1.2	4-25-44	44	
				SPT-10	30.0 - 31.5	1.5	9-10-9	66	
				SPT-11	32.5 - 34.0	0.8	7-27-38	31	
352.2'	36.0'			SPT-12	35.0 - 36.5	1.1	2-3-8	25	
		Fill: LEAN CLAY, light brown and gray, moist, very stiff, silty							
346.7'	41.5'			SPT-13	40.0 - 41.5	1.2	5-9-16	21	
				SPT-14	42.5 - 44.0	0.8	5-7-9	30	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 312151.06, E 1114675.00 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-116** Total Depth 77.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fill: SLUICED FLY ASH, gray and black, moist to wet, medium stiff to very stiff, bottom ash intermixed throughout *(Continued)*	SPT-15	45.0 - 46.5	1.4	4-5-7	21	
			SPT-16	47.5 - 49.0	0.8	5-7-6	5	
			SPT-17	50.0 - 51.5	1.1	5-2-3	24	
			SPT-18	52.5 - 54.0	0.9	7-11-15	24	
			SPT-19	55.0 - 56.5	0.8	7-11-9	17	
			SPT-20	57.5 - 59.0	1.1	11-15-10	21	
			SPT-21	60.0 - 61.5	1.5	7-9-10	22	
325.7'	62.5'							
		SILT, light brown and gray, moist, very stiff, occasional clay pockets	SPT-22	62.5 - 64.0	1.1	6-12-14	--	
			ST-4	65.0 - 65.3	0.3		--	
			SPT-23	65.3 - 66.8	0.9	33-50+/0.4'	22	
			SPT-24	67.5 - 69.0	1.0	10-22-27	17	
316.7'	71.5'		SPT-25	70.0 - 71.5	0.9	19-29-23	18	
		SANDY SILT, yellowish brown, moist, very stiff	SPT-26	72.5 - 74.0	1.0	6-9-10	17	See "Piezometer Installation Detail" for backfill materials and amounts used.
			ST-5	75.0 - 75.5	0.0		--	
311.2'	77.0'		SPT-27	75.5 - 77.0	1.3	5-13-15	15	
		No Refusal / Bottom of Hole						

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 312849.17, E 1115060.52 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-117** Total Depth 37.0 ft
Location	McCracken County, Kentucky	Surface Elevation	348.1 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/1/10 Completed 2/1/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	15.5 ft Date/Time 2/1/10
Logged By	B. Bline	Automatic Hammer ☐	Safety Hammer ☒ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
348.1'	0.0'	Top of Hole						
		OVERBURDEN, see boring log STN-118						Boring advanced with 4.25" hollow stem auger.
			ST-1	6.0 - 8.0	2.0		29	Bulk sample obtained from 6.0 to 8.0 ft.
			ST-2	20.0 - 22.0	2.0		22	
			ST-3	22.0 - 24.0	2.0		25	
			ST-4	24.0 - 26.0	2.0		--	
311.1'	37.0'							See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole						

SUBSURFACE LOG

Stantec

Project No.	175559035	Location	N 312843.34, E 1115059.61 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-118** Total Depth 65.3 ft
Location	McCracken County, Kentucky	Surface Elevation	348.2 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/27/10 Completed 1/28/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	11.0 ft Date/Time 1/27/10
Logged By	D. Chapman/J. Curtsinger	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
348.2'	0.0'	Top of Hole							
346.7'	1.5'	Fill: LEAN CLAY, brown, moist, very stiff, silty		SPT-1	0.0 - 1.5	1.5	2-11-14	21	Boring advanced with 4.25" hollow stem auger.
337.7'	10.5'	Fill: SLUICED FLY ASH, gray, moist, soft to very stiff, occasional bottom ash		SPT-2	1.5 - 3.0	1.3	10-9-12	30	
				SPT-3	3.0 - 4.5	1.5	4-2-4	33	
				SPT-4	4.5 - 6.0	1.0	3-7-5	25	
				SPT-5	6.0 - 7.5	1.4	3-5-3	19	
				SPT-6	7.5 - 9.0	1.2	3-1-2	29	
				SPT-7	9.0 - 10.5	1.3	5-5-5	24	
327.2'	21.0'	Fill: SLUICED BOTTOM ASH, black, moist to wet, medium dense to dense		SPT-8	10.5 - 12.0	1.5	4-6-10	25	
				SPT-9	12.0 - 13.5	1.1	6-8-9	21	
				SPT-10	13.5 - 15.0	1.2	4-5-6	23	
				ST-1	15.0 - 16.5	1.5		23	
				SPT-11	16.5 - 18.0	1.5	17-17-15	16	
				SPT-12	18.0 - 19.5	1.5	13-17-11	10	
				SPT-13	19.5 - 21.0	1.0	9-6-4	14	
318.7'	29.5'	LEAN CLAY, light gray, moist to wet, very soft to medium stiff, silty		SPT-14	21.0 - 22.5	0.7	2-1-1	20	
				SPT-15	22.5 - 24.0	1.2	2-3-2	25	
				SPT-16	24.0 - 25.5	0.0	1-0-0	--	
				ST-2	25.5 - 27.5	2.0		20	
				ST-3	27.5 - 29.5	2.0		19	
305.2'	43.0'	SILTY SAND, yellowish brown and light gray, wet, loose to medium dense, occasional clay pockets		SPT-17	29.5 - 31.0	1.4	9-11-6	18	
				SPT-18	31.0 - 32.5	0.9	3-4-4	20	
				SPT-19	32.5 - 34.0	1.1	9-7-7	18	
				SPT-20	34.0 - 35.5	1.5	5-5-5	17	
		-Clayey from 35.5 to 38.5 ft.		SPT-21	35.5 - 37.0	1.2	9-11-13	18	Environmental drilling procedures started at 37.0 ft.
				SPT-22	40.0 - 41.5	1.5	7-7-5	--	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 312843.34, E 1115059.61 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-118** Total Depth 65.3 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		WELL GRADED GRAVEL with Silt and Sand, yellowish brown and gray, wet, dense to very dense *(Continued)*		SPT-23	45.0 - 46.5	1.3	18-23-17	--	
				SPT-24	50.0 - 51.5	1.2	24-30-38	--	
				SPT-25	55.0 - 55.4	0.4	50+/0.4	--	
				SPT-26	60.0 - 61.5	1.2	13-22-32	--	Boring backfilled with bentonite grout from 0.0 to 65.3 ft.
282.9'	65.3'			SPT-27	65.0 - 65.3	0.3	50+/0.3	--	

No Refusal /
Bottom of Hole

Environmental water sample collected by TVA following drilling operations.

SUBSURFACE LOG

Stantec

Project No.	175559035	Location	N 312857.74, E 1114949.90 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-119**	Total Depth	68.5 ft
Location	McCracken County, Kentucky	Surface Elevation	380.9 ft. (NGVD29)		
Project Type	Geotechnical Exploration	Date Started	2/22/10	Completed	2/23/10
Supervisor	C. Millhollin Driller S. Bradford	Depth to Water	34.5 ft	Date/Time	2/23/10
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐	Other ☐	

Lithology: Elevation	Lithology: Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
380.9'	0.0'	Top of Hole							
380.4'	0.5'	Fill: TOPSOIL		SPT-1	0.0 - 1.5	1.2	1-2-3	23	Boring advanced with 4.25" hollow stem auger.
378.9'	2.0'	Fill: LEAN CLAY, light brown and gray, moist, medium stiff, silty, organics		SPT-2	2.5 - 4.0	1.0	14-50+/0.5'	20	
		Fill: STACKED FLY ASH, gray and black, moist, stiff to very stiff, occasional powdered limestone pockets		SPT-3	5.0 - 6.5	1.5	4-4-6	44	
				SPT-4	7.5 - 9.0	1.0	24-50+/0.5'	53	
				SPT-5	10.0 - 11.5	1.5	7-6-14	39	
				SPT-6	12.5 - 14.0	1.0	7-18-21	41	
				SPT-7	15.0 - 16.5	1.5	7-5-8	44	
				ST-1	16.5 - 18.5	1.0		29	
				SPT-8	19.5 - 21.0	1.5	4-5-9	46	
				SPT-9	22.0 - 23.5	1.3	8-10-13	40	
				SPT-10	24.5 - 26.0	1.5	17-17-18	40	
				SPT-11	27.0 - 28.5	1.5	9-19-20	52	
				SPT-12	29.5 - 31.0	1.4	19-22-16	56	
348.1'	32.8'	Fill: LEAN CLAY, light brown and gray, moist, very stiff, silty		SPT-13	32.0 - 33.5	1.3	5-7-12	23	
346.4'	34.5'	Fill: SLUICED FLY ASH, gray to black, moist to wet, stiff to very stiff		SPT-14	34.5 - 36.0	1.5	7-17-16	19	
				SPT-15	37.0 - 38.5	1.5	4-3-7	26	
				SPT-16	39.5 - 41.0	1.5	2-3-5	32	
				SPT-17	42.0 - 43.5	1.2	2-2-7	41	

SUBSURFACE LOG

Project No.	175559035	Location	N 312857.74, E 1114949.90 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-119
Total Depth	68.5 ft		

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fill: SLUICED FLY ASH, gray to black, moist to wet, stiff to very stiff *(Continued)*		SPT-18	44.5 - 46.0	1.1	7-4-6	27	
				SPT-19	47.0 - 48.5	1.3	6-9-15	27	
		-Bottom ash and powdered limestone pockets intermixed from 49.0 to 58.0 ft.		SPT-20	49.5 - 51.0	1.5	9-12-15	19	
				SPT-21	52.0 - 53.5	1.5	12-15-6	16	
				SPT-22	54.5 - 56.0	1.5	5-6-7	23	
322.9'	58.0'			SPT-23	57.0 - 58.5	1.5	4-3-4	23	
		LEAN CLAY, light gray to light brown and gray, moist, stiff, silty		SPT-24	59.5 - 61.0	1.0	2-3-5	20	
				SPT-25	62.0 - 63.5	1.0	3-5-8	20	
				ST-2	64.5 - 66.5	1.8		20	See "Piezometer Installation Detail" for backfill materials and amounts used.
312.4'	68.5'			ST-3	66.5 - 68.5	1.2		23	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 312862.75, E 1114950.57 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-120** Total Depth 59.7 ft
Location	McCracken County, Kentucky	Surface Elevation	380.8 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/23/10 Completed 2/23/10
Supervisor	C. Millhollin Driller S. Bradford	Depth to Water	N/A Date/Time N/A
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
380.8'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-119							Boring advanced with 4.25" hollow stem auger.

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 312862.75, E 1114950.57 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-120** Total Depth 59.7 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
321.1'	59.7'	OVERBURDEN, see boring log STN-119 *(Continued)*							See "Piezometer Installation Detail" for backfill materials and amounts used.
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 312853.82, E 1114867.54 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-121** Total Depth 86.5 ft
Location	McCracken County, Kentucky	Surface Elevation	405.6 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/16/10 Completed 2/16/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	10.0 ft Date/Time 2/16/10
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
405.6'	0.0'	Top of Hole						
405.1'	0.5'	Fill: TOPSOIL	SPT-1	0.0 - 1.5	1.1	2-4-4	20	Boring advanced with 4.25" hollow stem auger.
403.6'	2.0'	Fill: LEAN CLAY, light brown and gray, moist, stiff, silty						
		Fill: STACKED FLY ASH, dark gray and black, moist to wet, stiff to very stiff, occasional powdered limestone pockets	SPT-2	5.0 - 6.5	0.9	5-4-5	35	
			SPT-3	10.0 - 11.5	0.9	3-4-4	41	
			SPT-4	15.0 - 16.5	1.5	8-9-11	66	
			SPT-5	20.0 - 21.5	1.0	7-28-14	45	
			SPT-6	25.0 - 26.5	0.9	11-7-6	39	
			SPT-7	30.0 - 31.5	0.8	34-50+/0.3'	44	
			SPT-8	35.0 - 36.5	0.9	15-19-21	33	
			SPT-9	40.0 - 41.5	1.2	3-3-16	46	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No. 175559035 | Location N 312853.82, E 1114867.54 (NAD27)

Project Name SHF Consolidated Waste Dry Stack | Boring No. **STN-121** | Total Depth 86.5 ft

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fill: STACKED FLY ASH, dark gray and black, moist to wet, stiff to very stiff, occasional powdered limestone pockets *(Continued)*	SPT-10	45.0 - 46.5	1.5	10-11-13	59	
			SPT-11	50.0 - 51.5	1.0	25-29-38	52	
			SPT-12	55.0 - 56.5	1.2	12-19-27	48	
345.6'	60.0'							
		Fill: LEAN CLAY, light brown and gray, moist, very stiff, silty	SPT-13	60.0 - 61.5	1.0	7-8-13	20	
343.6'	62.0'							
		Fill: SLUICED FLY ASH, dark gray and black, moist to wet, stiff to very stiff	SPT-14	65.0 - 66.5	1.3	5-7-8	36	
			ST-1	70.0 - 72.0	0.0		--	
			SPT-15	72.0 - 73.5	0.8	5-7-9	27	
			ST-2	75.0 - 77.0	0.0		--	
			SPT-16	80.0 - 81.5	0.7	5-9-6	35	
323.6'	82.0'							
		LEAN CLAY, light brown and gray, moist, stiff, silty						See "Piezometer Installation Detail" for backfill materials and amounts used.
319.1'	86.5'		SPT-17	85.0 - 86.5	0.9	8-6-8	18	
		No Refusal / Bottom of Hole						

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 313845.00, E 1114860.16 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-122** Total Depth 48.5 ft
Location	McCracken County, Kentucky	Surface Elevation	360.0 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/12/10 Completed 1/12/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	N/A Date/Time N/A
Logged By	B. Bline	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core: Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
360.0'	0.0'	Top of Hole						
358.5'	1.5'	Fill: LEAN CLAY, brown, moist, stiff, silty	SPT-1	0.0 - 1.5	1.5	15-4-8	28	Boring advanced with 4.25" hollow stem auger.
		Fill: STACKED FLY ASH, gray to dark gray, moist, medium stiff to very stiff, occasional bottom ash	SPT-2	1.5 - 3.0	1.5	8-22-32	47	
			SPT-3	3.0 - 4.5	1.5	25-22-18	71	WOH = Weight of Hammer
			ST-1	4.5 - 5.0	0.5		47	
			SPT-4	5.0 - 6.5	1.5	20-21-23	42	
			SPT-5	6.5 - 8.0	0.6	21-22-13	61	
			SPT-6	8.0 - 9.5	1.5	8-9-12	109	
			SPT-7	9.5 - 11.0	1.5	5-6-5	86	
			SPT-8	11.0 - 12.5	1.5	3-3-3	101	
			SPT-9	12.5 - 14.0	1.5	2-3-5	110	
345.4'	14.6'		SPT-10	14.0 - 15.5	1.5	10-10-14	65	
344.9'	15.1'	Fill: LEAN CLAY, brown, moist, very stiff	SPT-11	15.5 - 17.0	1.5	6-12-12	66	
		Fill: SLUICED FLY ASH, gray to dark gray, moist to wet, very soft to very stiff, occasional bottom ash	SPT-12	17.0 - 18.5	1.5	7-6-9	39	
			SPT-13	18.5 - 20.0	1.5	3-3-3	45	
			ST-2	20.0 - 22.0	1.8		38	
			SPT-14	22.0 - 23.5	1.5	2-1-1	43	
			SPT-15	23.5 - 25.0	1.5	1-2-7	43	
			SPT-16	25.0 - 26.5	1.5	5-2-2	33	
			SPT-17	26.5 - 28.0	1.5	1-1-3	44	
			SPT-18	28.0 - 29.5	1.5	2-1-3	28	
			SPT-19	29.5 - 31.0	1.5	WOH	29	
			SPT-20	31.0 - 32.5	1.5	1-1-2	34	
			SPT-21	32.5 - 34.0	1.5	2-2-3	36	
			ST-3	34.0 - 36.5	2.0		40	
			SPT-22	36.5 - 38.0	1.5	3-2-4	33	
			SPT-23	38.0 - 39.5	1.5	3-2-5	35	
			SPT-24	39.5 - 41.0	1.5	0-1-2	25	
			SPT-25	41.0 - 42.5	1.5	3-3-2	35	
			SPT-26	42.5 - 44.0	1.5	2-2-2	33	

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SUBSURFACE LOG

Project No.	175559035	Location	N 313845.00, E 1114860.16 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-122**	Total Depth	48.5 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
				SPT-27	44.0 - 45.5	1.5	WOH	35	See "Piezometer Installation Detail" for backfill materials and amounts used.
314.2'	45.8'								
		LEAN CLAY, gray, moist to wet, very soft, silty, orgaincs		SPT-28	45.5 - 47.0	1.5	WOH	31	
				SPT-29	47.0 - 48.5	0.8	WOH	28	
311.5'	48.5'								
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 313861.58, E 1114760.17 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-123** Total Depth 75.5 ft
Location	McCracken County, Kentucky	Surface Elevation	386.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/12/10 Completed 2/13/10
Supervisor	C. Millhollin Driller S. Bradford	Depth to Water	56.5 ft Date/Time 2/12/10
Logged By	C. Millhollin	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
386.3'	0.0'	Top of Hole							
385.8'	0.5'	Fill: TOPSOIL		SPT-1	0.0 - 1.5	1.1	2-2-2	26	Boring advanced with 4.25" hollow stem auger.
383.2'	3.1'	Fill: LEAN CLAY, light brown and gray, moist, soft, silty		SPT-2	2.5 - 4.0	1.5	3-5-7	32	WOH = Weight of Hammer
		Fill: STACKED FLY ASH, dark gray and black, moist, medium stiff to very stiff, occasional powdered limestone pockets		SPT-3	5.0 - 6.5	1.4	23-27-32	35	
				SPT-4	7.5 - 9.0	0.9	4-5-8	36	
				SPT-5	10.0 - 11.5	1.5	9-10-11	39	Bulk sample obtained from 10.0 to 12.0 ft.
				SPT-6	12.5 - 14.0	1.4	6-5-6	45	
				SPT-7	15.0 - 16.5	1.5	8-9-8	51	
				SPT-8	17.5 - 19.0	1.2	5-8-6	57	
				SPT-9	20.0 - 21.5	1.5	5-6-7	66	
				ST-1	22.5 - 24.5	1.5		42	
				SPT-10	25.5 - 27.0	1.5	1-2-4	42	
				SPT-11	28.0 - 29.5	0.7	37-50+/0.2'	49	
				SPT-12	30.5 - 32.0	1.5	28-38-50	74	
				SPT-13	33.5 - 35.0	1.5	8-15-42	83	
				SPT-14	36.0 - 37.5	1.5	9-15-21	81	
				SPT-15	38.5 - 40.0	1.4	10-11-8	85	
				SPT-16	41.0 - 42.5	1.5	4-5-8	86	

Project No.	175559035	Location	N 313861.58, E 1114760.17 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-123** Total Depth 75.5 ft

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
340.3'	46.0'			SPT-17	43.5 - 45.0	1.5	17-21-18	43	
		Fill: SLUICED FLY ASH, dark gray and black, moist to wet, very soft to very stiff		SPT-18	46.0 - 47.5	1.3	8-10-14	36	
				SPT-19	48.5 - 50.0	1.5	3-2-3	45	
				ST-2	51.0 - 53.0	2.0		50	
				SPT-20	54.0 - 55.5	1.5	3-5-6	43	
				SPT-21	56.5 - 58.0	1.5	2-2-2	48	
				SPT-22	59.0 - 60.5	1.5	WOH	40	
				SPT-23	61.5 - 63.0	1.5	1-1-2	38	
				SPT-24	64.0 - 65.5	1.5	3-12-14	41	
				SPT-25	66.5 - 68.0	1.5	4-4-5	39	
				SPT-26	69.0 - 70.5	1.2	WOH	39	
				SPT-27	71.5 - 73.0	1.5	WOH	43	See "Piezometer Installation Detail" for backfill materials and amounts used.
311.0'	75.4'			SPT-28	74.0 - 75.5	1.5	WOH	33	
310.8'	75.5'	LEAN CLAY, light brown, wet, soft							
		No Refusal / Bottom of Hole							

Project No.	175559035	Location	N 313889.25, E 1114655.68 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-124** Total Depth 105.2 ft
Location	McCracken County, Kentucky	Surface Elevation	413.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/15/10 Completed 2/16/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	80.0 ft Date/Time 2/15/10
Logged By	D. Chapman	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample #	RQD	Depth Run	Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
413.9'	0.0'	Top of Hole							
413.4'	0.5'	Fill: LEAN CLAY with Sand, brown, moist, soft, organics	SPT-1		0.0 - 1.5	1.4	2-2-9	45	Boring advanced with 4.25" hollow stem auger. WOH = Weight of Hammer
		Fill: STACKED FLY ASH, dark gray and black, moist, medium stiff to very stiff, occasional powdered limestone pockets	SPT-2		5.0 - 6.5	1.5	7-7-16	46	
			SPT-3		10.0 - 11.5	1.3	3-5-5	43	
			SPT-4		15.0 - 16.5	1.5	3-2-3	41	
			SPT-5		20.0 - 21.5	1.5	8-49-36	55	
			SPT-6		25.0 - 26.5	1.5	7-16-48	49	
			SPT-7		30.0 - 31.5	0.3	50+/0.3'	35	
			SPT-8		35.0 - 36.5	0.8	10-14-16	27	
			SPT-9		40.0 - 41.5	0.4	50+/0.4'	44	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 313889.25, E 1114655.68 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-124** Total Depth 105.2 ft

Lithology Elevation	Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
		Fill: STACKED FLY ASH, dark gray and black, moist, medium stiff to very stiff, occasional powdered limestone pockets *(Continued)*	SPT-10	45.0 - 46.5	0.4	50+/0.4'	37	
			SPT-11	50.0 - 51.5	0.4	50+/0.4'	42	
			SPT-12	55.0 - 56.5	1.1	18-29-50+/0.2'	57	
			SPT-13	60.0 - 61.5	0.3	50+/0.3'	41	
			SPT-14	65.0 - 66.5	1.5	22-15-25	75	
343.9'	70.0'	Fill: LEAN CLAY, olive brown, moist, soft, silty	SPT-15	70.0 - 71.5	0.6	2-2-2	23	
341.9'	72.0'	Fill: SLUICED FLY ASH, dark gray, moist to wet, very soft to stiff						
			SPT-16	75.0 - 76.5	1.1	3-7-6	35	
			SPT-17	80.0 - 81.5	0.9	WOH	48	
			SPT-18	85.0 - 86.5	1.3	WOH	44	
			SPT-19	90.0 - 91.5	1.5	1-4-6	46	

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 313889.25, E 1114655.68 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-124** Total Depth 105.2 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: SLUICED FLY ASH, dark gray, moist to wet, very soft to stiff *(Continued)*		SPT-20	95.0 - 96.5	1.5	3-3-2	28	
				SPT-21	100.0 - 101.5	1.5	1-1-2	42	
310.9'	103.0'								See "Piezometer Installation Detail" for backfill materials and amounts used.
308.7'	105.2'	POORLY GRADED SAND with Silt and Gravel, olive brown, wet, dense							

No Refusal /
Bottom of Hole

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

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Project No.	175559035	Location	N 313973.57, E 1114166.63 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-125** Total Depth 133.0 ft
Location	McCracken County, Kentucky	Surface Elevation	444.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/12/10 Completed 1/12/10
Supervisor	N. Puckett Driller M.Wethington	Depth to Water	115.0 ft Date/Time 1/12/10
Logged By	N. Puckett	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
444.5'	0.0'	Top of Hole							
444.3'	0.2'	TOPSOIL		SPT-1	0.0 - 1.5	1.3	5-4-5	18	Boring advanced with 4.25" hollow stem auger.
442.5'	2.0'	Fill: LEAN CLAY, brown and gray, moist, stiff, silty		SPT-2	1.5 - 3.0	1.4	7-8-9	14	
		Fill: STACKED FLY ASH, gray and black, moist, very stiff							WOH = Weight of Hammer
				SPT-3	10.0 - 11.5	1.4	12-10-17	41	
				SPT-4	20.0 - 21.5	0.9	21-50+/0.4'	31	
				SPT-5	30.0 - 31.5	0.9	41-50+/0.4'	38	
				SPT-6	40.0 - 41.5	1.2	16-22-50+/0.2'	20	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 313973.57, E 1114166.63 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-125** Total Depth 133.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
		Fill: STACKED FLY ASH, gray and black, moist, very stiff *(Continued)*							
				SPT-7	50.0 - 51.5	1.4	21-36-50+/0.4'	33	
				SPT-8	60.0 - 61.5	0.9	22-50+/0.4'	31	
				SPT-9	70.0 - 71.5	1.2	13-27-50+/0.2'	27	
				SPT-10	80.0 - 81.5	1.5	16-29-38	39	
				SPT-11	85.0 - 86.5	0.7	48-50+/0.2'	35	
354.5'	90.0'	Fill: SLUICED FLY ASH, dark gray and black, moist to wet, very soft to very stiff		SPT-12	90.0 - 91.5	1.5	10-13-13	35	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

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SUBSURFACE LOG

Project No.	175559035	Location	N 313973.57, E 1114166.63 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-125
Total Depth	133.0 ft		

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: SLUICED FLY ASH, dark gray and black, moist to wet, very soft to very stiff *(Continued)*		ST-1	95.0 - 97.0	2.0		21	
				ST-2	105.0 - 107.0	2.0		25	
				SPT-13	115.0 - 116.5	1.1	WOH	47	
324.5'	120.0'								
		SILTY SAND, light gray, moist to wet, medium dense		SPT-14	120.0 - 121.5	1.5	8-8-7	203	
		-Wood intermixed from from 120.0 to 126.0 ft.		SPT-15	125.0 - 126.5	1.5	9-14-15	19	
314.5'	130.0'								See "Piezometer Installation Detail" for backfill materials and amounts used.
		POORLY GRADED SAND with Silt, light gray and yellowish brown, wet, dense		SPT-16	130.0 - 131.5	1.4	21-15-15	17	
311.5'	133.0'			SPT-17	131.5 - 133.0	1.4	13-17-14	15	
		No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 313245.28, E 1114516.15 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-126** Total Depth 131.0 ft
Location	McCracken County, Kentucky	Surface Elevation	441.9 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/13/10 Completed 1/13/10
Supervisor	N. Puckett Driller M.Wethington	Depth to Water	120.0 ft Date/Time 1/13/10
Logged By	N. Puckett	Automatic Hammer ☒ Safety Hammer ☐ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
441.9'	0.0'	Top of Hole						
441.7'	0.2'	TOPSOIL	SPT-1	0.0 - 1.5	1.5	6-6-8	19	Boring advanced with 4.25" hollow stem auger.
440.0'	1.9'	Fill: LEAN CLAY, brown and gray, moist, stiff	SPT-2	1.5 - 3.0	1.5	9-14-18	40	
		Fill: STACKED FLY ASH, black and gray, moist to dry, very stiff						
			SPT-3	10.0 - 11.5	1.5	27-19-20	33	
			SPT-4	20.0 - 21.5	0.9	15-50+/0.4'	29	
			SPT-5	30.0 - 31.5	0.3	50+/0.3'	12	
			SPT-6	40.0 - 41.5	0.9	21-50+/0.4'	23	

Project No.	175559035	Location	N 313245.28, E 1114516.15 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-126**	Total Depth	131.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: STACKED FLY ASH, black and gray, moist to dry, very stiff *(Continued)*							
				SPT-7	50.0 - 51.5	0.5	50+/0.5'	10	
				SPT-8	60.0 - 61.5	1.4	6-8-8	15	
				SPT-9	70.0 - 71.5	1.0	20-50+/0.5'	48	
				SPT-10	80.0 - 81.5	0.5	50+/0.3'	24	
				SPT-11	85.0 - 86.5	0.4	50+/0.4'	15	
				SPT-12	90.0 - 91.5	0.3	50+/0.3'	18	

Project No.	175559035	Location	N 313245.28, E 1114516.15 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-126** Total Depth 131.0 ft

Lithology Elevation	Depth	Description	Overburden Rock Core	Sample # RQD	Depth Run	Rec. Ft. Rec. Ft.	Blows Rec. %	Mois.Cont. % Run Depth	Remarks
341.9'	100.0'	Fill: STACKED FLY ASH, black and gray, moist to dry, very stiff *(Continued)*							
		Fill: SLUICED FLY ASH, gray and black, moist to wet, stiff		SPT-13	100.0 - 101.5	1.3	4-5-8	22	
				ST-1	105.0 - 107.0	2.0		31	
				ST-2	110.0 - 112.0	2.0		41	
				ST-3	120.0 - 122.0	2.0		28	
312.4'	129.5'			ST-4	128.0 - 129.5	1.5		33	See "Piezometer Installation Detail" for backfill materials and amounts used.
310.9'	131.0'	POORLY GRADED SAND with Silt and Gravel, yellowish brown, wet, very dense		SPT-14	129.5 - 131.0	1.3	12-25-25	13	

No Refusal /
Bottom of Hole

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SUBSURFACE LOG

Project No.	175559035	Location	N 312463.74, E 1114532.22 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-127** Total Depth 130.0 ft
Location	McCracken County, Kentucky	Surface Elevation	441.4 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/15/10 Completed 1/17/10
Supervisor	B. Bline Driller M.Wethington	Depth to Water	N/A Date/Time N/A
Logged By	B. Bline/S. Lange	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
441.4'	0.0'	Top of Hole						
439.9'	1.5'	Fill: LEAN CLAY, brown and gray, moist, stiff	SPT-1	0.0 - 1.5	1.5	5-5-8	17	Boring advanced with 4.25" hollow stem auger.
		Fill: STACKED FLY ASH, light gray to dark gray, moist, stiff to very stiff						
			SPT-2	10.0 - 11.5	1.4	8-46-38	41	
			SPT-3	20.0 - 21.5	1.5	5-8-6	41	
			SPT-4	30.0 - 31.5	1.5	22-32-40	25	
			SPT-5	40.0 - 41.5	0.9	27-50+/0.4'	47	

Project No.	175559035	Location	N 312463.74, E 1114532.22 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	STN-127
		Total Depth	130.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
		Fill: STACKED FLY ASH, light gray to dark gray, moist, stiff to very stiff *(Continued)*							
				SPT-6	50.0 - 51.5	0.3	50+/0.3'	39	
				SPT-7	60.0 - 61.5	0.9	25-50+/0.4'	22	
				SPT-8	70.0 - 71.5	1.5	14-24-23	25	
				SPT-9	80.0 - 81.5	1.5	23-19-16	35	
				SPT-10	90.0 - 91.5	1.5	21-23-19	43	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 312463.74, E 1114532.22 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-127** Total Depth 130.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
341.4'	100.0'	Fill: STACKED FLY ASH, light gray to dark gray, moist, stiff to very stiff *(Continued)*							
		Fill: SLUICED FLY ASH, dark gray, moist to wet, very stiff		ST-1	100.0 - 102.0	1.7		17	
				ST-2	110.0 - 112.0	2.0		21	
321.4'	120.0'	SILT, light gray, moist, very stiff		SPT-11	120.0 - 121.5	1.5	16-17-28	14	
313.4'	128.0'	SILTY SAND, light brown and gray, wet, dense, occasional clay pockets		SPT-12	128.5 - 130.0	1.5	8-17-21	23	See "Piezometer Installation Detail" for backfill materials and amounts.
311.4'	130.0'	No Refusal / Bottom of Hole							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

SUBSURFACE LOG

Project No.	175559035	Location	N 315914.33, E 1115215.99 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-128** Total Depth 58.0 ft
Location	McCracken County, Kentucky	Surface Elevation	348.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/13/10 Completed 1/13/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	5.5 ft Date/Time 1/13/10
Logged By	B. Bline	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
348.5'	0.0'	Top of Hole							
		Fill: FLY ASH, gray to dark gray, moist to wet, very soft to medium stiff, occasional bottom ash		SPT-1	0.0 - 1.5	1.2	3-3-2	14	Boring advanced with 4.25" hollow stem auger.
				SPT-2	2.5 - 4.0	1.1	2-2-2	16	WOH = Weight of Hammer
				SPT-3	5.0 - 6.5	1.5	WOH	47	
				SPT-4	7.5 - 9.0	1.3	WOH	51	
				SPT-5	10.0 - 11.5	1.5	0-1-1	47	
				SPT-6	12.5 - 14.0	1.5	0-0-1	36	
				SPT-7	15.0 - 16.5	1.5	1-1-0	31	
				SPT-8	17.5 - 19.0	1.5	0-1-1	30	
				SPT-9	20.0 - 21.5	1.5	1-1-1	38	
				SPT-10	22.5 - 24.0	1.5	1-0-1	31	
				SPT-11	25.0 - 26.5	1.5	WOH	30	
				SPT-12	27.5 - 29.0	1.5	WOH	41	
				SPT-13	30.0 - 31.5	1.2	WOH	35	
				SPT-14	32.5 - 34.0	1.5	WOH	39	
				SPT-15	35.0 - 36.5	1.5	WOH	37	
310.1'	38.4'			SPT-16	37.5 - 39.0	1.5	0-2-3	30	
		LEAN CLAY with Sand, light brown and gray, moist to wet, medium stiff to stiff		SPT-17	40.0 - 41.5	1.5	4-5-6	22	
		-Sandy below 42.8 ft.		SPT-18	42.5 - 44.0	1.5	3-4-3	22	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 315914.33, E 1115215.99 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-128**	Total Depth	58.0 ft

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
302.0'	46.5'			SPT-19	45.0 - 46.5	1.3	4-6-6	22	
		SILTY SAND, reddish brown to gray, wet, loose to very dense		SPT-20	47.5 - 49.0	1.5	3-6-7	26	
				SPT-21	50.0 - 51.5	1.5	3-3-3	27	
				SPT-22	52.5 - 54.0	1.5	4-9-5	43	
				SPT-23	55.0 - 56.5	1.1	12-10-13	20	See "Piezometer Installation Detail" for backfill materials and amounts.
290.5'	58.0'			SPT-24	56.5 - 58.0	1.1	10-25-29	14	
		No Refusal / Bottom of Hole							

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 315910.33, E 1115215.99 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-128A** Total Depth 45.0 ft
Location	McCracken County, Kentucky	Surface Elevation	348.5 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	2/2/10 Completed 2/2/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	N/A Date/Time N/A
Logged By	B. Bline	Automatic Hammer ☐ Safety Hammer ☒ Other ☐	

Lithology Elevation	Lithology Depth	Description	Overburden / Rock Core	Sample # / RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
348.5'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-128							Boring advanced with 4.25" hollow stem auger.
				ST-1	10.0 - 12.0	2.0		45	
				ST-2	20.0 - 22.0	2.0		44	
									Boring backfilled with bentonite grout from 0.0 to 45.0 ft.
303.5'	45.0'								
		No Refusal / Bottom of Hole Offset 4 ft south of STN-128.							

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 4/19/10

4/19/10

Project No.	175559035	Location	N 315906.33, E 1115215.99 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-128B**	Total Depth	42.0 ft
Location	McCracken County, Kentucky	Surface Elevation	348.5 ft. (NGVD29)		
Project Type	Geotechnical Exploration	Date Started	2/2/10	Completed	2/2/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	N/A	Date/Time	N/A
Logged By	B. Bline	Automatic Hammer ☐	Safety Hammer ☒	Other ☐	

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
348.5'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-128							Boring advanced with 4.25" hollow stem auger.
				ST-1	39.0 - 41.0	2.0		23	Boring backfilled with bentonite grout from 0.0 to 42.0 ft.
306.5'	42.0'			ST-2	41.0 - 42.0	1.0		21	

No Refusal /
Bottom of Hole
Offset 8 ft south of STN-128.

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 315283.90, E 1116404.12 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-129** Total Depth 58.0 ft
Location	McCracken County, Kentucky	Surface Elevation	349.3 ft. (NGVD29)
Project Type	Geotechnical Exploration	Date Started	1/14/10 Completed 1/14/10
Supervisor	B. Bline Driller S. Bradford	Depth to Water	7.0 ft Date/Time 1/14/10
Logged By	B. Bline	Automatic Hammer ☒	Safety Hammer ☐ Other ☐

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
349.3'	0.0'	Top of Hole							
		Fill: FLY ASH, gray to dark gray, moist to wet, very soft to medium stiff		SPT-1	0.0 - 1.5	1.2	3-2-3	51	Boring advanced with 4.25" hollow stem auger.
				SPT-2	2.5 - 4.0	1.5	3-3-3	38	WOH = Weight of Hammer
				SPT-3	5.0 - 6.5	1.5	1-1-1	50	
				SPT-4	7.5 - 9.0	1.5	0-0-1	44	
				SPT-5	10.0 - 11.5	1.5	WOH	50	
				SPT-6	12.5 - 14.0	1.5	1-1-2	35	
				SPT-7	15.0 - 16.5	1.5	1-1-0	38	
				SPT-8	17.5 - 19.0	1.5	1-1-1	38	
				SPT-9	20.0 - 21.5	1.5	0-1-0	33	
				SPT-10	22.5 - 24.0	1.5	1-2-1	30	
				SPT-11	25.0 - 26.5	1.5	6-5-3	31	
				SPT-12	27.5 - 29.0	1.5	WOH	34	
				SPT-13	30.0 - 31.5	1.5	WOH	34	
				SPT-14	32.5 - 34.0	1.5	WOH	38	
				SPT-15	35.0 - 36.5	1.5	WOH	36	
				SPT-16	37.5 - 39.0	1.5	WOH	38	
				SPT-17	40.0 - 41.5	1.5	WOH	40	
				SPT-18	42.5 - 44.0	1.5	WOH	39	

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Project No.	175559035	Location	N 315283.90, E 1116404.12 (NAD27)
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-129** Total Depth 58.0 ft

Lithology Elevation	Lithology Depth	Description	Overburden Sample # / Rock Core RQD	Depth / Run	Rec. Ft. / Rec. Ft.	Blows / Rec. %	Mois.Cont. % / Run Depth	Remarks
301.8'	47.5'	Fill: FLY ASH, gray to dark gray, moist to wet, very soft to medium stiff *(Continued)*	SPT-19	45.0 - 46.5	1.5	WOH	34	
		LEAN CLAY with Sand, light brown and gray, moist to wet, very soft to stiff, silty	SPT-20	47.5 - 49.0	1.5	WOH	30	
			SPT-21	50.0 - 51.5	1.5	0-2-4	29	
			SPT-22	52.5 - 54.0	1.5	3-2-2	30	See "Piezometer Installation Detail" for backfill materials and amounts used.
293.3'	56.0'		SPT-23	55.0 - 56.5	1.5	3-4-5	30	
291.3'	58.0'	POORLY GRADED SAND with Silt, light gray to yellowish brown, wet, loose	SPT-24	56.5 - 58.0	0.8	6-3-6	30	

No Refusal /
Bottom of Hole

Project No.	175559035	Location	N 315275.92, E 1116404.53 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-129A**	Total Depth	54.0 ft
Location	McCracken County, Kentucky	Surface Elevation	349.3 ft. (NGVD29)		
Project Type	Geotechnical Exploration	Date Started	2/2/10	Completed	2/2/10
Supervisor	D. Chapman Driller M. Wethington	Depth to Water	N/A	Date/Time	N/A
Logged By	D. Chapman	Automatic Hammer ☒	Safety Hammer ☐	Other ☐	

Lithology			Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	
Elevation	Depth	Description	Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	Remarks
349.3'	0.0'	Top of Hole							
		OVERBURDEN, see boring log STN-129							Boring advanced with 4.25" hollow stem auger.
				ST-1	10.0 - 12.0	1.1		40	
				ST-2	20.0 - 22.0	1.5		39	

Stantec

SUBSURFACE LOG

Project No.	175559035	Location	N 315275.92, E 1116404.53 (NAD27)		
Project Name	SHF Consolidated Waste Dry Stack	Boring No.	**STN-129A**	Total Depth	54.0 ft

Lithology		Description	Overburden	Sample #	Depth	Rec. Ft.	Blows	Mois.Cont. %	Remarks
Elevation	Depth		Rock Core	RQD	Run	Rec. Ft.	Rec. %	Run Depth	
		OVERBURDEN, see boring log STN-129 *(Continued)*							
				ST-3	50.0 - 52.0	1.3		29	Boring backfilled with bentonite grout from 0.0 to 54.0 ft.
295.3'	54.0'			ST-4	52.0 - 54.0	2.0		33	

No Refusal /
Bottom of Hole

Offset 4 ft south of STN-129.

FMSM_LEGACY 175559035 BORINGS.GPJ FMSM.GDT 5/26/10

Appendix B

Piezometer and Inclinometer Installation Details and Readings

SHAWNEE FOSSIL PLANT
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
Piezometer Readings

		ASH POND 1 & 2																			
		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring	
		STN-1		**STN-3**		**STN-6**		**STN-8**		**STN-8P**		**STN-11**		**STN-12**		**STN-13**		**STN-16**		**STN-17**	
		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.	
		326.9		**351.2**		**328.6**		**351.9**		**351.9**		**327.3**		**351.0**		**350.8**		**328.5**		**350.3**	
Date	**Ohio River Elevation***	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
29-Oct-09	308.3	17.5	309.4	32.1	319.1	19.4	309.2	42.1	309.8	Not Installed		Not Installed		Not Installed		Not Installed		Not Installed		Not Installed	
30-Nov-09	300.4	16.5	310.4	31.4	319.8	19.8	308.8	42.5	309.4												
21-Dec-09	314.8	12.1	314.8	27.5	323.7	13.8	314.8	36.6	315.3												
26-Jan-09	321.4	8.0	318.9	28.1	323.1	12.8	315.8	35.3	316.6												
26-Feb-10	308.3	11.7	315.2	29.4	321.8	19.0	309.6	41.8	310.1	22.9	329.0	13.9	313.4	37.4	313.6	7.1	343.7	15.8	312.7	31.6	318.7
23-Mar-10	321.4	6.5	320.4	25.5	325.7	8.9	319.7	31.8	320.1	22.7	329.2	7.0	320.3	29.9	321.1	6.6	344.2	9.5	319.0	30.7	319.6
29-Apr-10	306.0	12.2	314.7	30.3	320.9	19.9	308.7	22.6	329.3	22.6	329.3	15.1	312.2	37.9	313.1	6.5	344.3	16.5	312.0	37.8	312.5
27-May-10	317.4	7.8	319.1	25.6	325.6	10.7	317.9	33.5	318.4	22.6	329.3	7.5	319.8	30.2	320.8	6.3	344.5	10.7	317.8	31.2	319.1

		ASH POND 1 & 2																			
		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring	
		STN-18		**STN-21**		**STN-22**		**STN-23**		**STN-25**		**STN-26**		**STN-27**		**STN-32P**		**STN-33**		**STN-35**	
		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.	
		350.4		**349.7**		**349.7**		**349.0**		**349.9**		**349.9**		**349.4**		**350.6**		**327.6**		**350.7**	
Date	**Ohio River Elevation***	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
29-Oct-09	308.3	Not Installed		Not Installed		Not Installed		Not Installed		Not Installed		Not Installed		Not Installed		Not Installed		19.0	308.6	41.8	308.9
30-Nov-09	300.4																	25.1	302.5	47.6	303.1
21-Dec-09	314.8																	14.3	313.3	37.1	313.6
26-Jan-09	321.4																	8.3	319.3	31.4	319.3
26-Feb-10	308.3	22.8	327.6	34.6	315.1	21.0	328.7	31.7	317.3	30.3	319.6	27.8	322.1	20.3	329.1	6.1	344.5	19.2	308.4	41.9	308.8
23-Mar-10	321.4	18.2	332.2	29.1	320.6	21.2	328.5	28.2	320.8	28.5	321.4	27.9	322.0	20.2	329.2	5.7	344.9	7.6	320.0	30.6	320.1
29-Apr-10	306.0	18.2	332.2	34.4	315.3	20.6	329.1	31.5	317.5	30.1	319.8	27.8	322.1	20.0	329.4	6.0	344.6	20.5	307.1	43.2	307.5
27-May-10	317.4	18.0	332.4	30.2	319.5	20.4	329.3	29.0	320.0	28.7	321.2	27.8	322.1	20.1	329.3	6.0	344.6	10.6	317.0	33.4	317.3

		ASH POND 1 & 2																			
		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring		Boring	
		STN-38		**STN-39A**		**STN-40**		**STN-43**		**STN-45**		**STN-48**		**STN-50**		**STN-50P**		**STN-53**		**STN-55**	
		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.		Surface Elev.	
		322.9		**350.5**		**350.7**		**327.4**		**350.8**		**326.6**		**350.6**		**350.6**		**326.0**		**350.2**	
Date	**Ohio River Elevation***	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
29-Oct-09	308.3	12.0	310.9	Not Installed		40.1	310.6	13.5	313.9	32.8	318.0	13.6	313.0	36.1	314.5	Not Installed		1.5	324.5	25.3	324.9
30-Nov-09	300.4	15.1	307.8			42.4	308.3	13.7	313.7	33.7	317.1	14.1	312.5	36.4	314.2			1.4	324.6	25.4	324.8
21-Dec-09	314.8	7.4	315.5			35.1	315.6	10.4	317.0	30.3	320.5	11.5	315.1	34.6	316.0			NA**	NA**	23.2	327.0
26-Jan-09	321.4	4.0	318.9			31.7	319.0	6.4	321.0	27.8	323.0	6.0	320.6	29.2	321.4			NA**	NA**	21.8	328.4
26-Feb-10	308.3	7.5	315.4	5.5	345.0	39.2	311.5	12.6	314.8	32.6	318.2	13.5	313.1	35.5	315.1	6.0	344.6	0.8	325.2	24.7	325.5
23-Mar-10	321.4	2.2	320.7	5.2	345.3	30	320.7	5.2	322.2	26.3	324.5	5.5	321.1	28.4	322.2	5.7	344.9	NA**	NA**	20.6	329.6
29-Apr-10	306.0	13.2	309.7	5.2	345.3	40.8	309.9	13.1	314.3	33.2	317.6	13.9	312.7	34.6	316.0	5.8	344.8	1.3	324.7	25.3	324.9
27-May-10	317.4	4	318.9	5.4	345.1	41.6	309.1	7.5	319.9	27.7	323.1	8.2	318.4	29.8	320.8	5.6	345.0	NA**	NA**	21.5	328.7

* The Ohio River elevations for each date reported were taken from US Army Corps of Engineers Gage 03611000 at Paducah, KY

** Water was overflowing from the riser pipe when the cap was removed. No readings at these locations could be obtained.

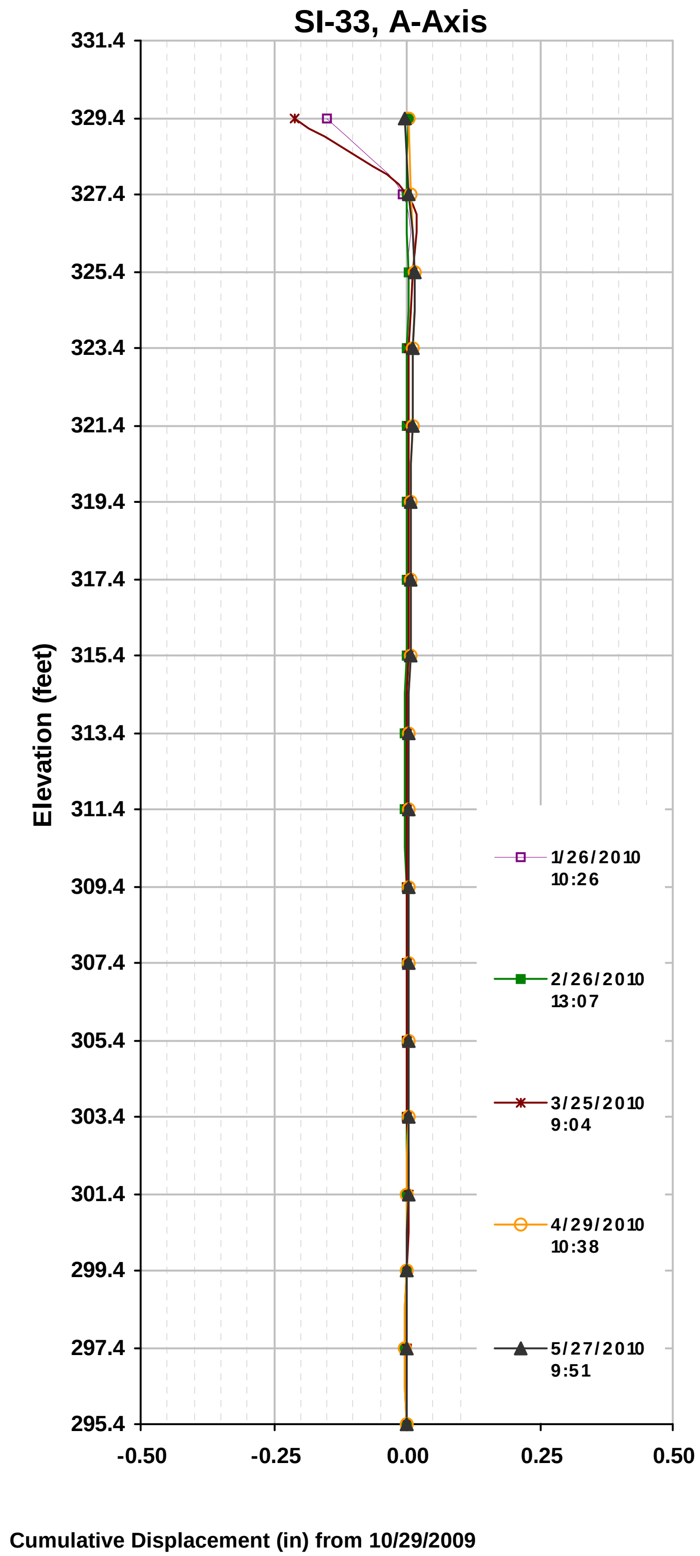
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
Piezometer Readings

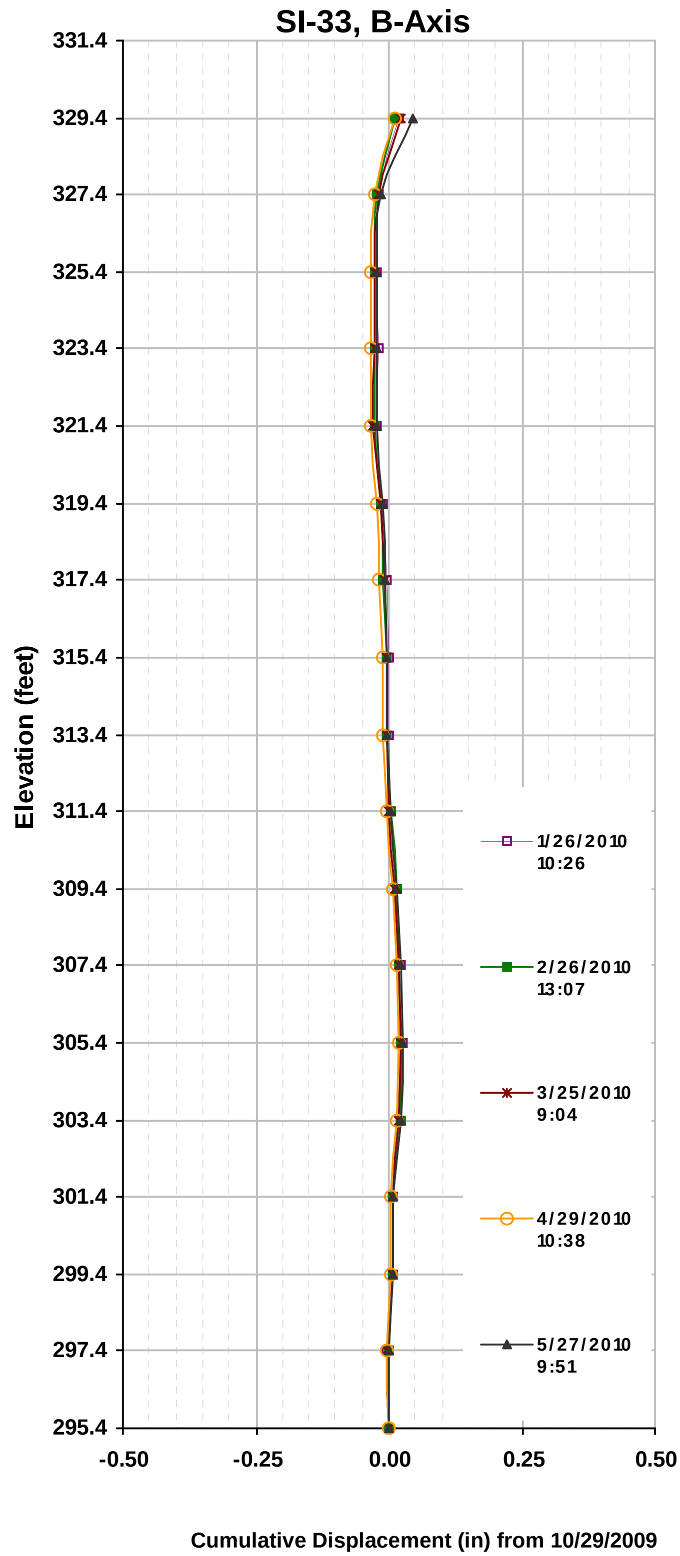
		Consolidated Waste Dry Stack																			
		Boring STN-101		Boring STN-102		Boring STN-103		Boring STN-104		Boring STN-105		Boring STN-106		Boring STN-107		Boring STN-108		Boring STN-109		Boring STN-110	
		Surface Elev. 345.6		Surface Elev. 375.9		Surface Elev. 375.9		Surface Elev. 411.3		Surface Elev. 347.7		Surface Elev. 375.3		Surface Elev. 408.1		Surface Elev. 350.3		Surface Elev. 386.0		Surface Elev. 385.9	
Date	**Ohio River Elevation***	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
26-Feb-10	308.3	19.8	325.8	48.8	327.1	56.2	319.7	83.9	327.4	23.9	323.8	49.2	326.1	88.8	319.3	29.6	320.7	61.3	324.7	62.0	323.9
23-Mar-10	321.4	19.5	326.1	48.9	327.0	53.7	322.2	84.0	327.3	23.0	324.7	49.0	326.3	86.3	321.8	28.5	321.8	61.5	324.5	62.5	323.4
29-Apr-10	306.0	20.1	325.5	45.1	330.8	54.1	321.8	81.7	329.6	23.7	324.0	48.5	326.8	86.7	321.4	30.0	320.3	61.2	324.8	62.2	323.7
27-May-10	317.4	18.8	326.8	44.8	331.1	50.4	325.5	81.4	329.9	22.6	325.1	48.2	327.1	84.5	323.6	28.5	321.8	60.4	325.6	61.1	324.8

		Consolidated Waste Dry Stack																			
		Boring STN-111		Boring STN-112		Boring STN-113		Boring STN-114		Boring STN-115		Boring STN-116		Boring STN-117		Boring STN-119		Boring STN-120		Boring STN-121	
		Surface Elev. 351.0		Surface Elev. 381.8		Surface Elev. 403.6		Surface Elev. 349.6		Surface Elev. 388.2		Surface Elev. 388.2		Surface Elev. 348.1		Surface Elev. 380.9		Surface Elev. 380.8		Surface Elev. 405.6	
Date	**Ohio River Elevation***	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
26-Feb-10	308.3	21.7	329.3	52.2	329.6	73.2	330.4	18.0	331.6	56.2	332.0	57.6	330.6	16.6	331.5	46.0	334.9	46.1	334.7	71.7	333.9
23-Mar-10	321.4	22.2	328.8	52.1	329.7	73.1	330.5	18.2	331.4	56.3	331.9	57.6	330.6	17.2	330.9	46.3	334.6	46.4	334.4	72.0	333.6
29-Apr-10	306.0	21.8	329.2	51.6	330.2	72.7	330.9	17.9	331.7	53.8	334.4	57.3	330.9	16.6	331.5	46.2	334.7	46.8	334.0	69.8	335.8
27-May-10	317.4	21.8	329.2	51.6	330.2	72.6	331.0	17.8	331.8	53.7	334.5	56.9	331.3	16.1	332.0	46.3	334.6	46.9	333.9	69.8	335.8

		Consolidated Waste Dry Stack															
		Boring STN-122		Boring STN-123		Boring STN-124		Boring STN-125		Boring STN-126		Boring STN-127		Boring STN-128		Boring STN-129	
		Surface Elev. 360.0		Surface Elev. 386.3		Surface Elev. 413.9		Surface Elev. 444.5		Surface Elev. 441.9		Surface Elev. 441.4		Surface Elev. 348.5		Surface Elev. 349.3	
Date	**Ohio River Elevation***	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation	Water Depth	Water Elevation
26-Feb-10	308.3	24.5	335.5	52.0	334.3	81.7	332.2	118.4	326.1	113.1	328.8	111.7	329.7	30.9	317.6	33.3	316.0
23-Mar-10	321.4	25.1	334.9	52.5	333.8	82.5	331.4	118.8	325.7	113.0	328.9	111.7	329.7	23.2	325.3	26.6	322.7
29-Apr-10	306.0	24.8	335.2	52.9	333.4	82.5	331.4	118.2	326.3	112.8	329.1	111.3	330.1	32.5	316.0	36.6	312.7
27-May-10	317.4	34.5	325.5	52.8	333.5	82.2	331.7	118.0	326.5	112.4	329.5	110.9	330.5	26.1	322.4	28.0	321.3

* The Ohio River elevations for each date reported were taken from US Army Corps of Engineers Gage 03611000 at Paducah, KY





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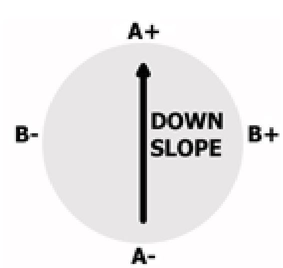
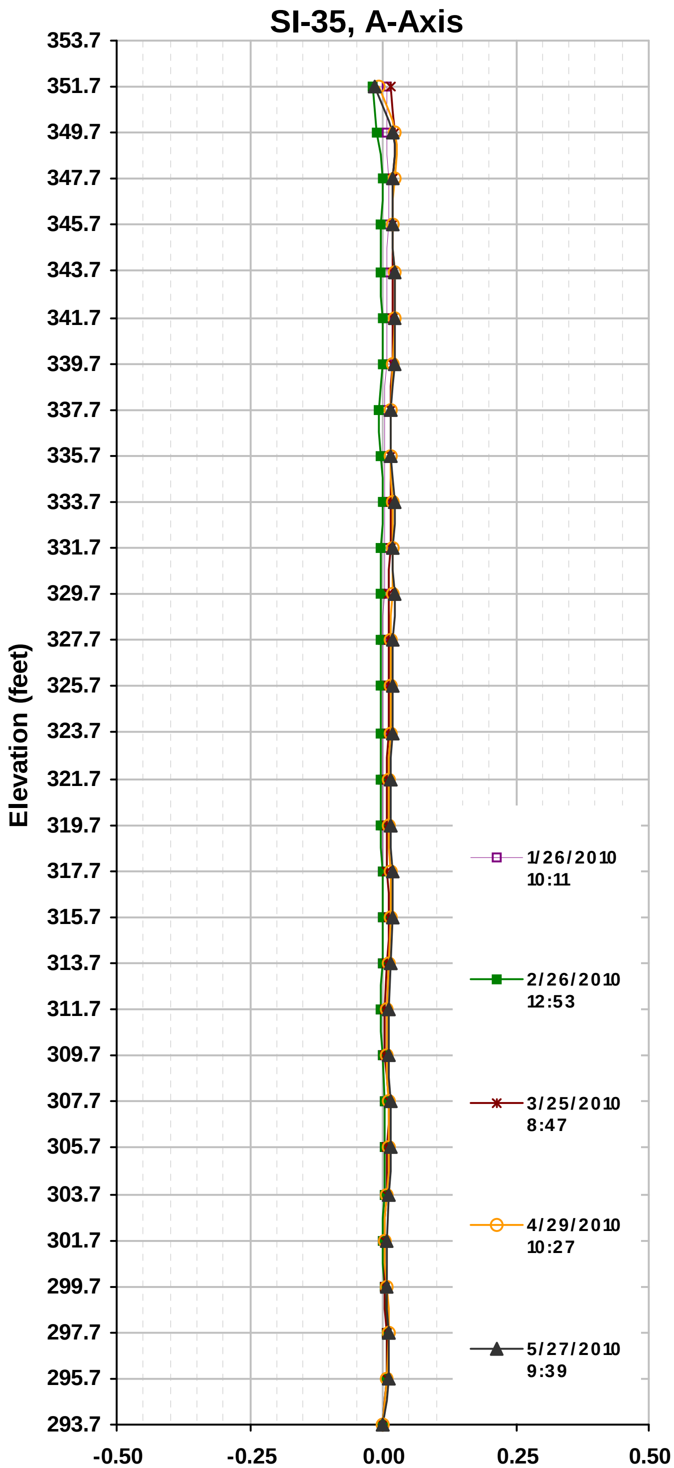
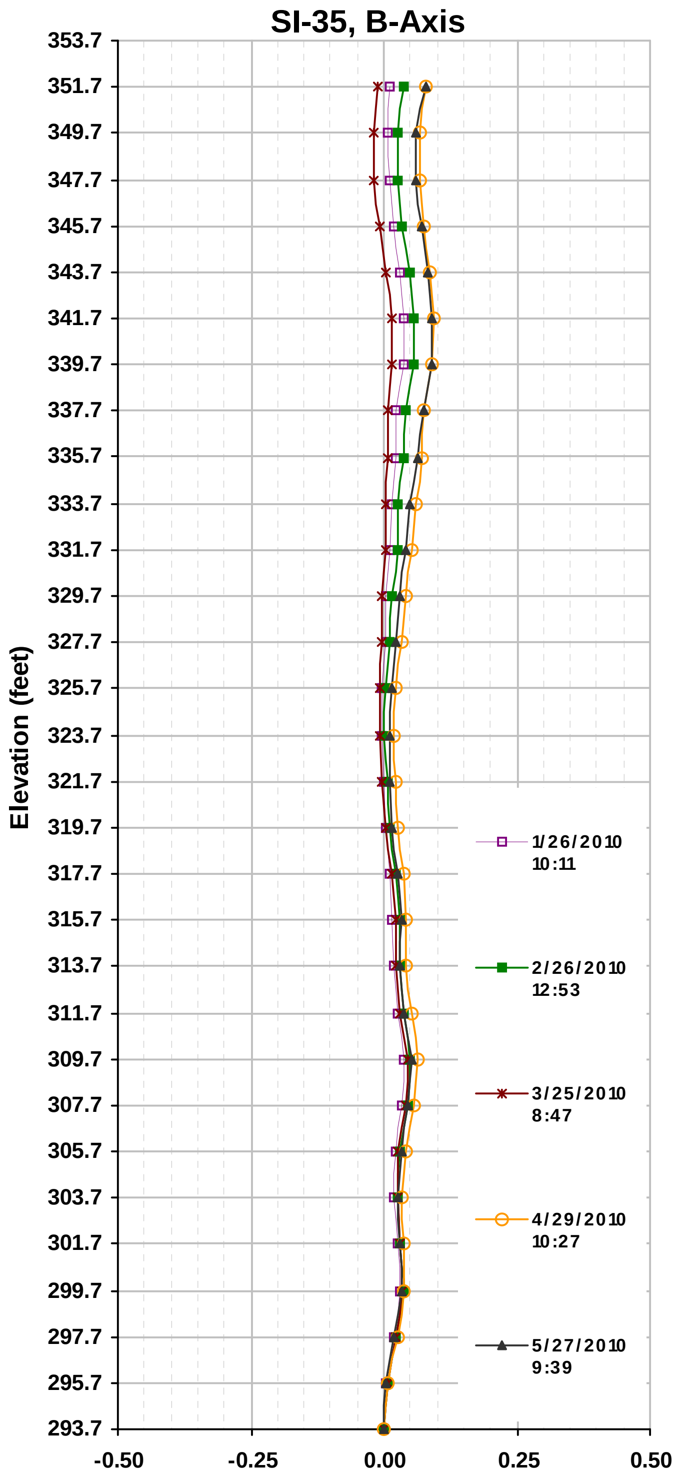


Shawnee Fossil Plant
Ash Pond 2
Paducah, KY
175559023
5/27/2010

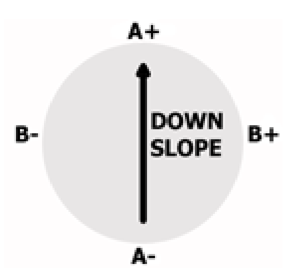


Cumulative Displacement (in) from 10/29/2009

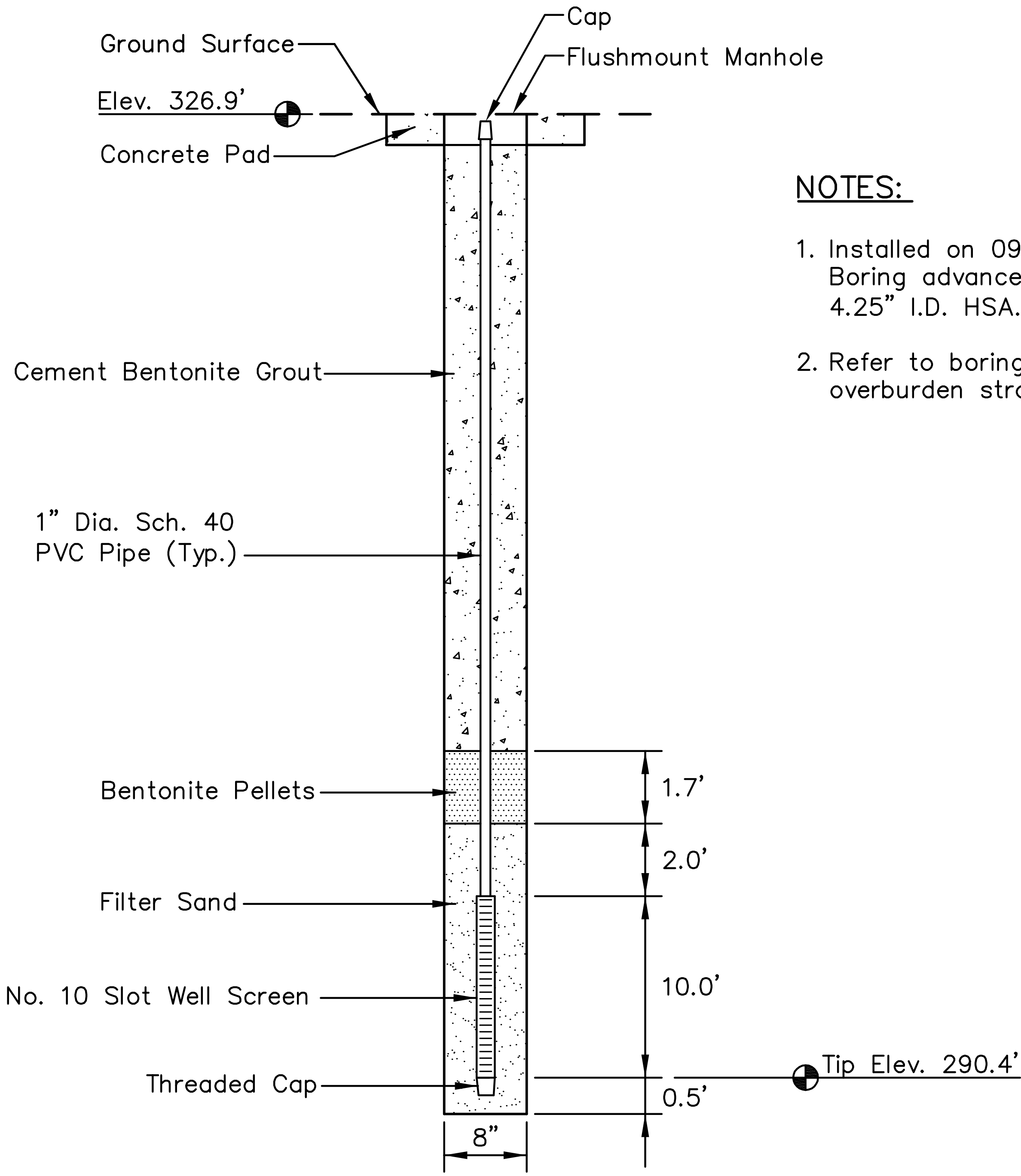


Cumulative Displacement (in) from 10/29/2009

Stantec



Shawnee Fossil Plant
Ash Pond 2
Paducah, KY
175559023
5/27/2010



NOTES:

1. Installed on 09/22/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 317,797.70
Easting: 1,112,894.71
Ground Elevation: 326.9'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-1
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

Stantec

Stantec Consulting Services Inc.
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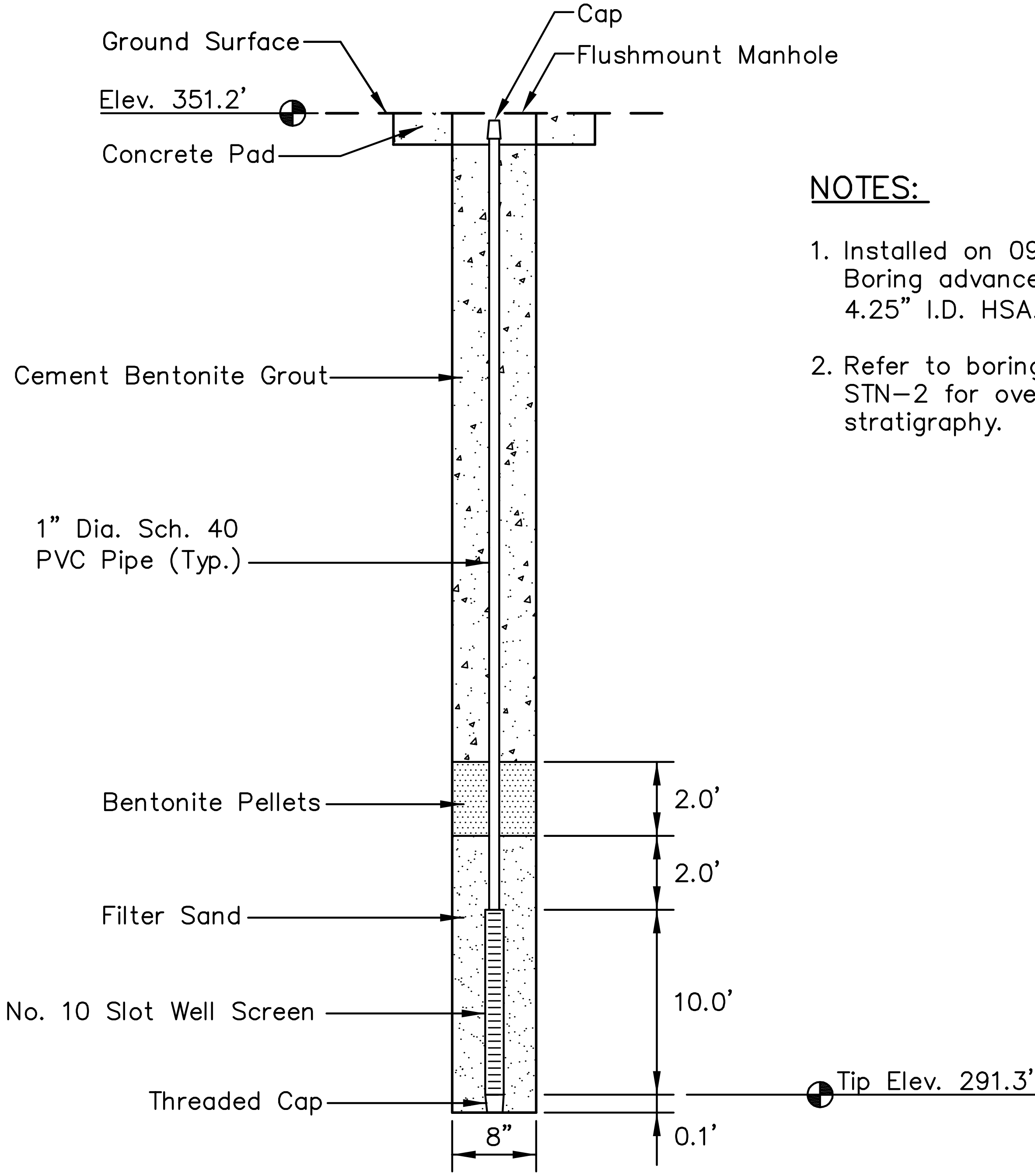
502-212-5000
www.stantec.com

DRAWN BY	SB	DATE	OCT., 2009	REVISED		SHEET
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	1 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/20/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN-2 for overburden stratigraphy.

LOCATION

Northing: 317,685.06
Easting: 1,112,908.87
Ground Elevation: 351.2'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-3
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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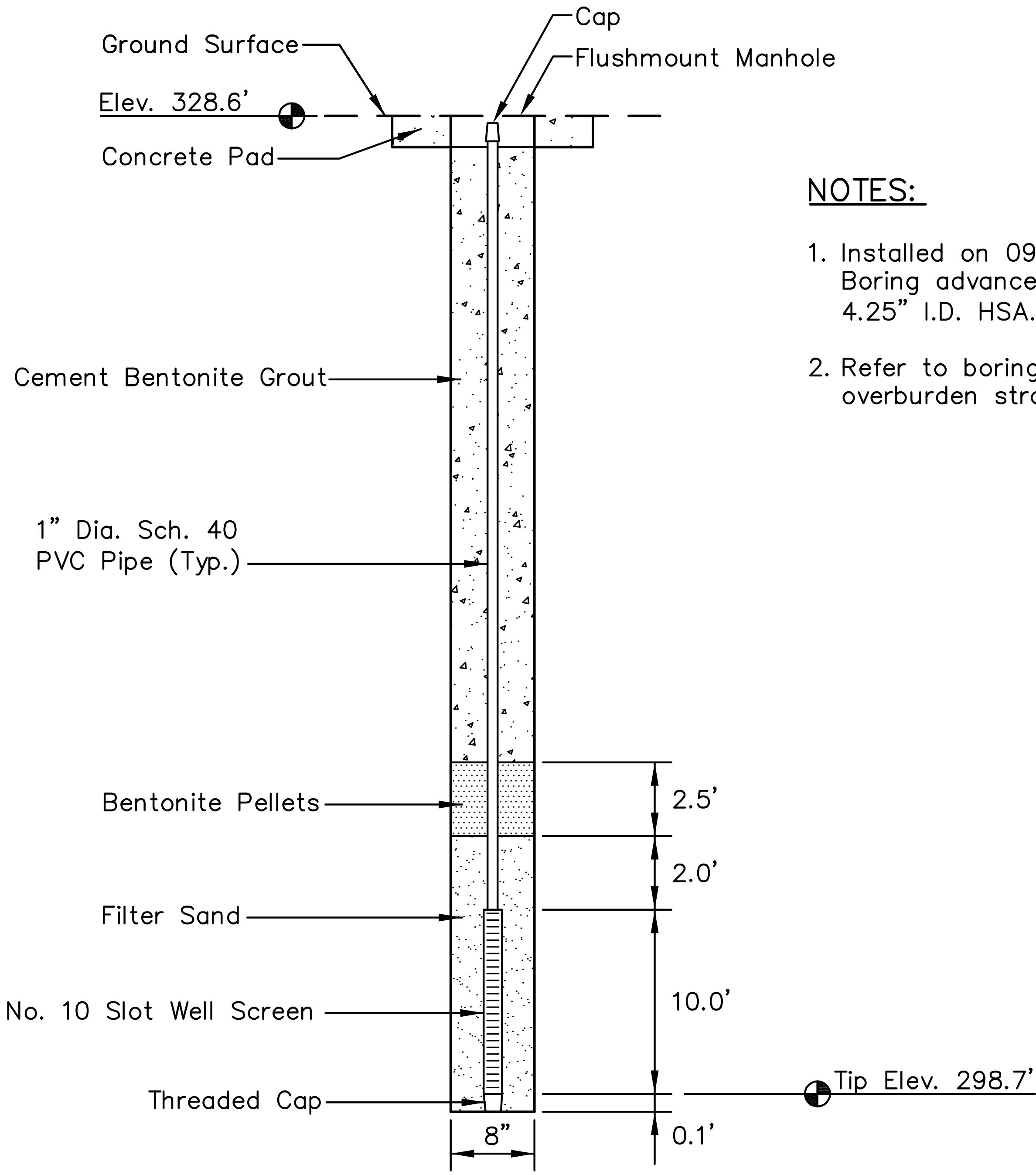
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	2 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/22/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 05/20/2010 USER: PETTY, RICHARD
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\PZ_DETAILS\59023PZ-STN-6.DWG

LOCATION

Northing: 316,969.98
Easting: 1,112,248.35
Ground Elevation: 328.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-6
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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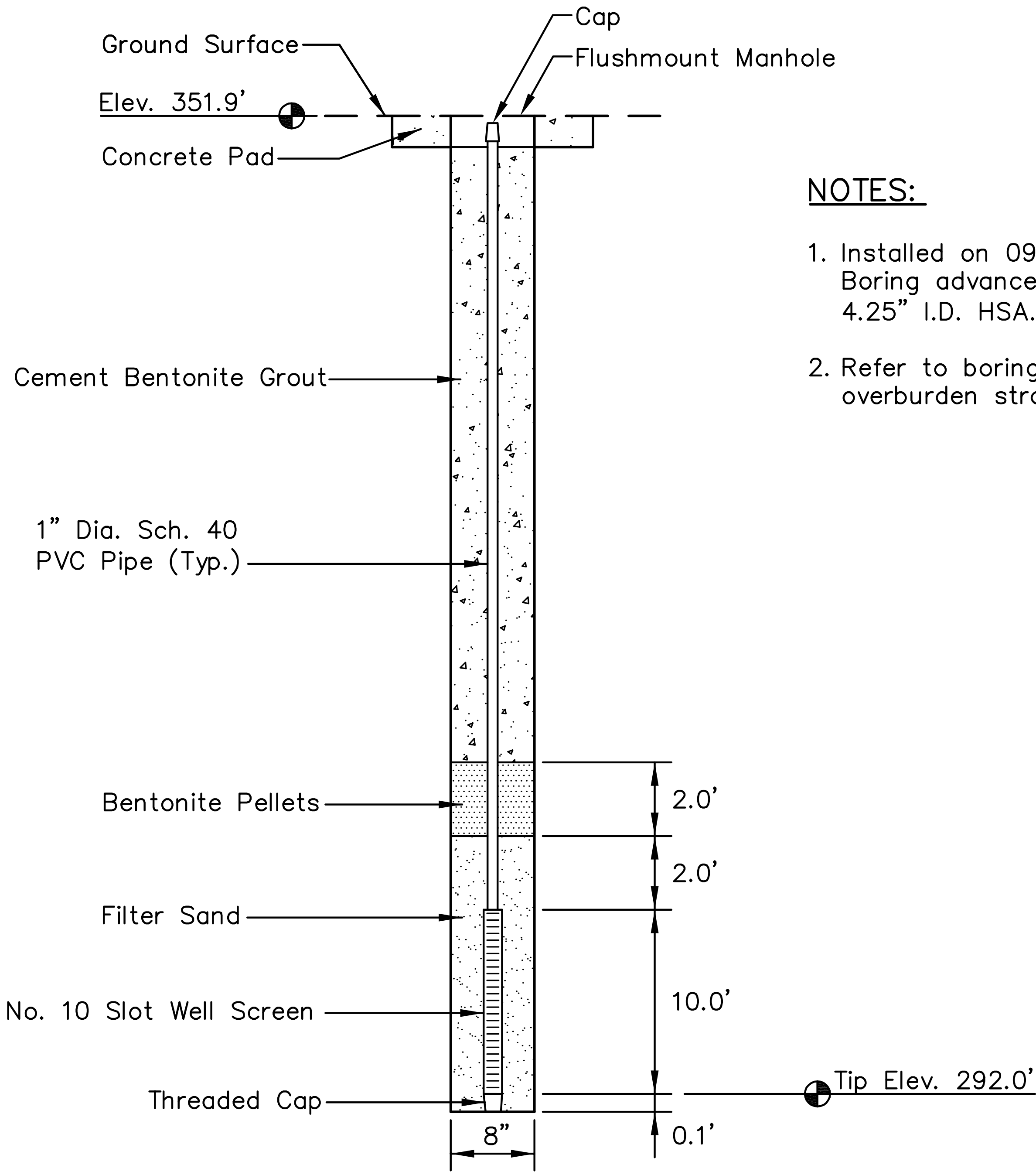
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	3 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/21/09. Boring advanced with 4.25" I.D. HSA.

2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 316,915.52
Easting: 1,112,335.31
Ground Elevation: 351.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-8
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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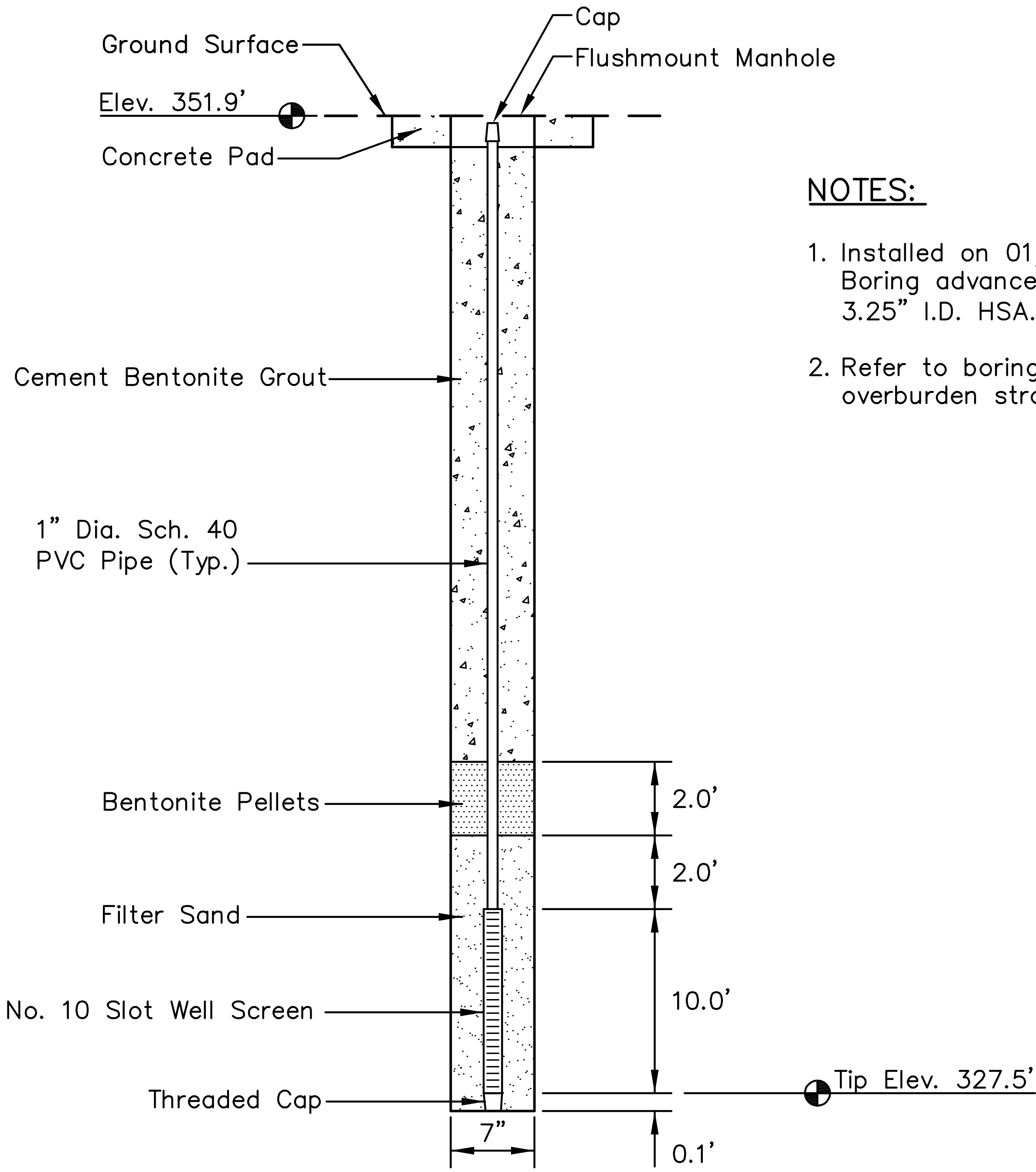
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	4 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/07/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/05/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\REV0_IFR\PZ_DETAILS\59023PZ-STN-8P.DWG

LOCATION

Northing: 316,924.83
Easting: 1,112,319.91
Ground Elevation: 351.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-8P
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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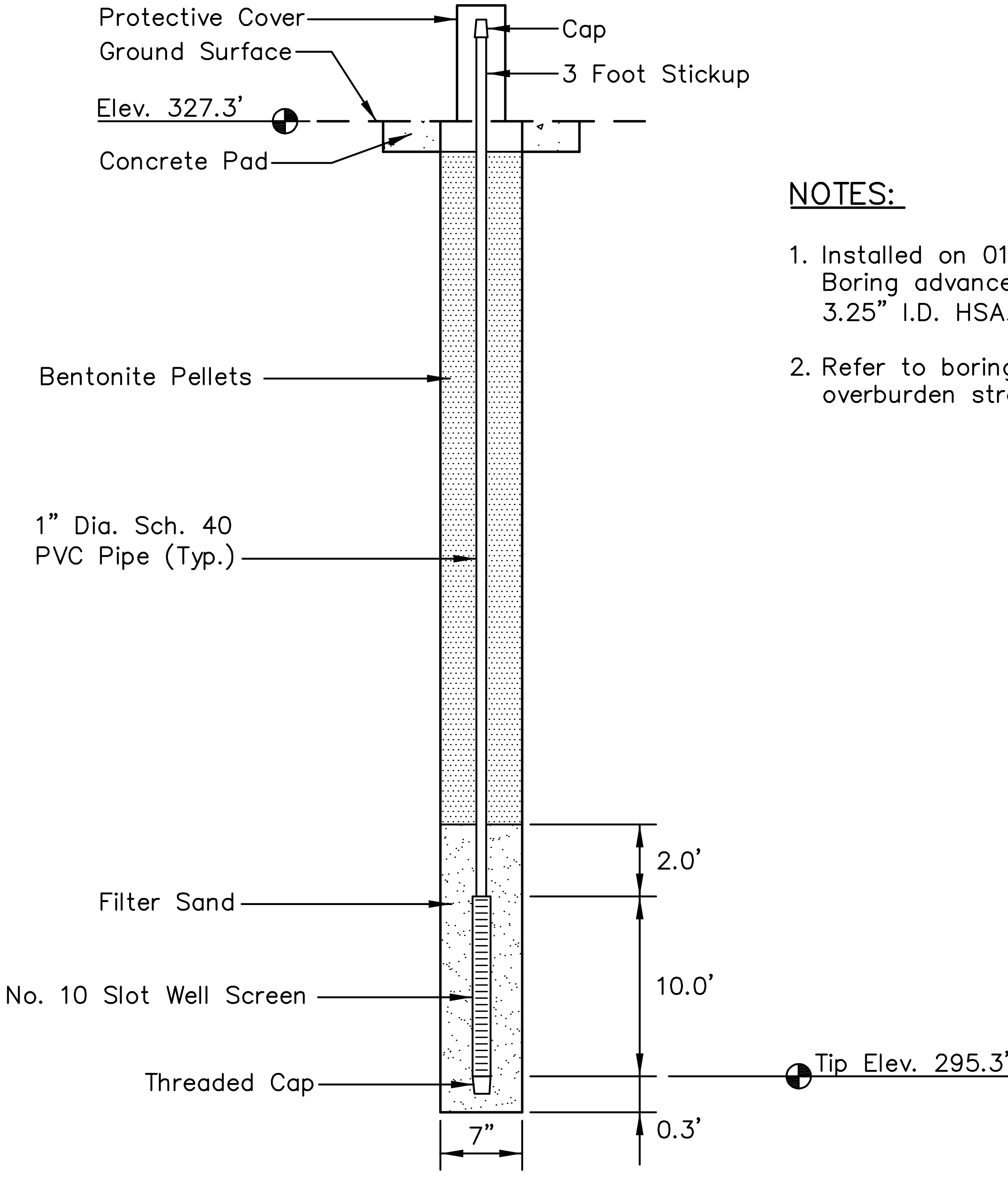
CHECKED BY NAB	SCALE NTS	2.		4.	



NOTES:

1. Installed on 01/31/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 315,974.74
Easting: 1,112,535.84
Ground Elevation: 327.3'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-11
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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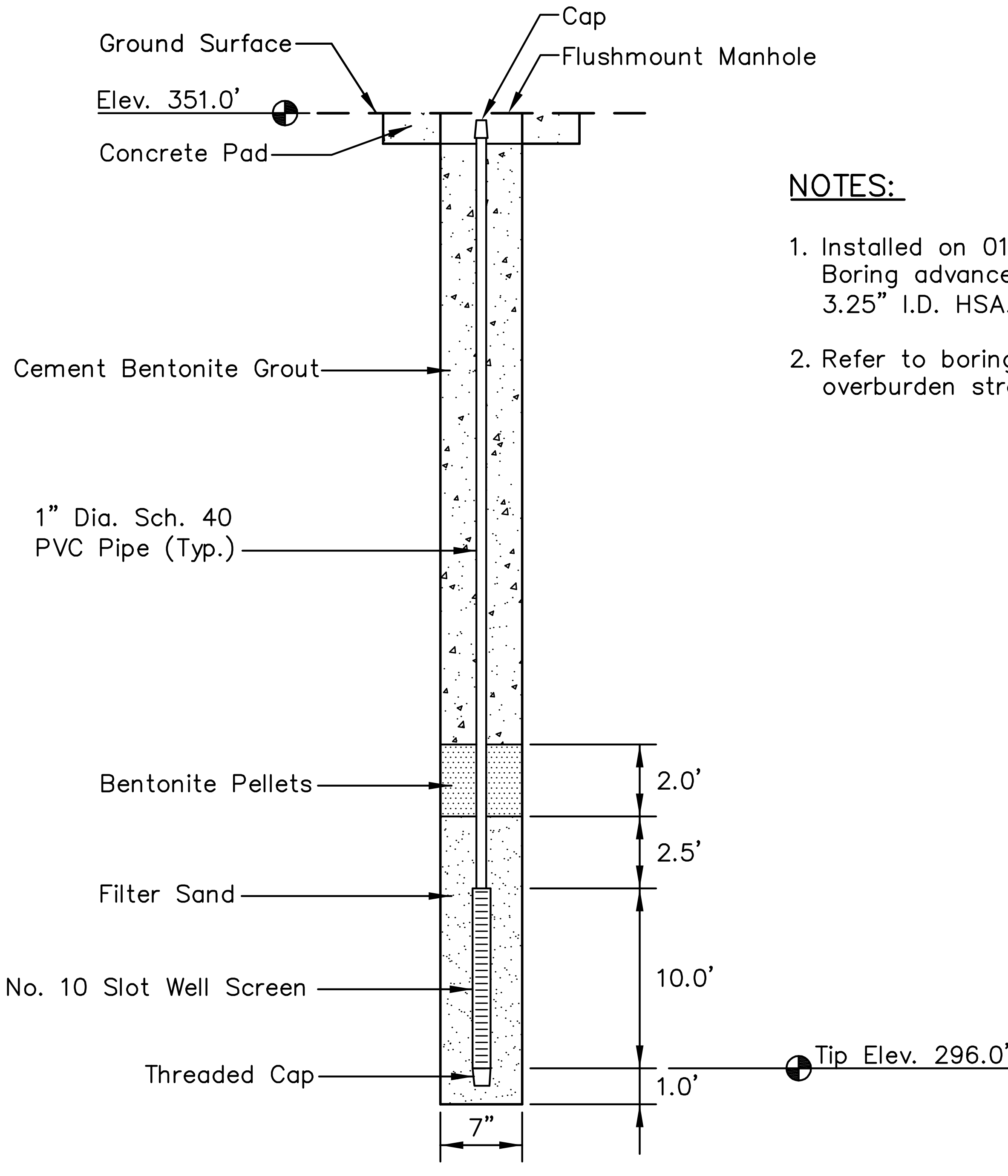
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	6 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/14/10. Boring advanced with 3.25" I.D. HSA.

2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 316,016.50
Easting: 1,112,610.36
Ground Elevation: 351.0'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-12
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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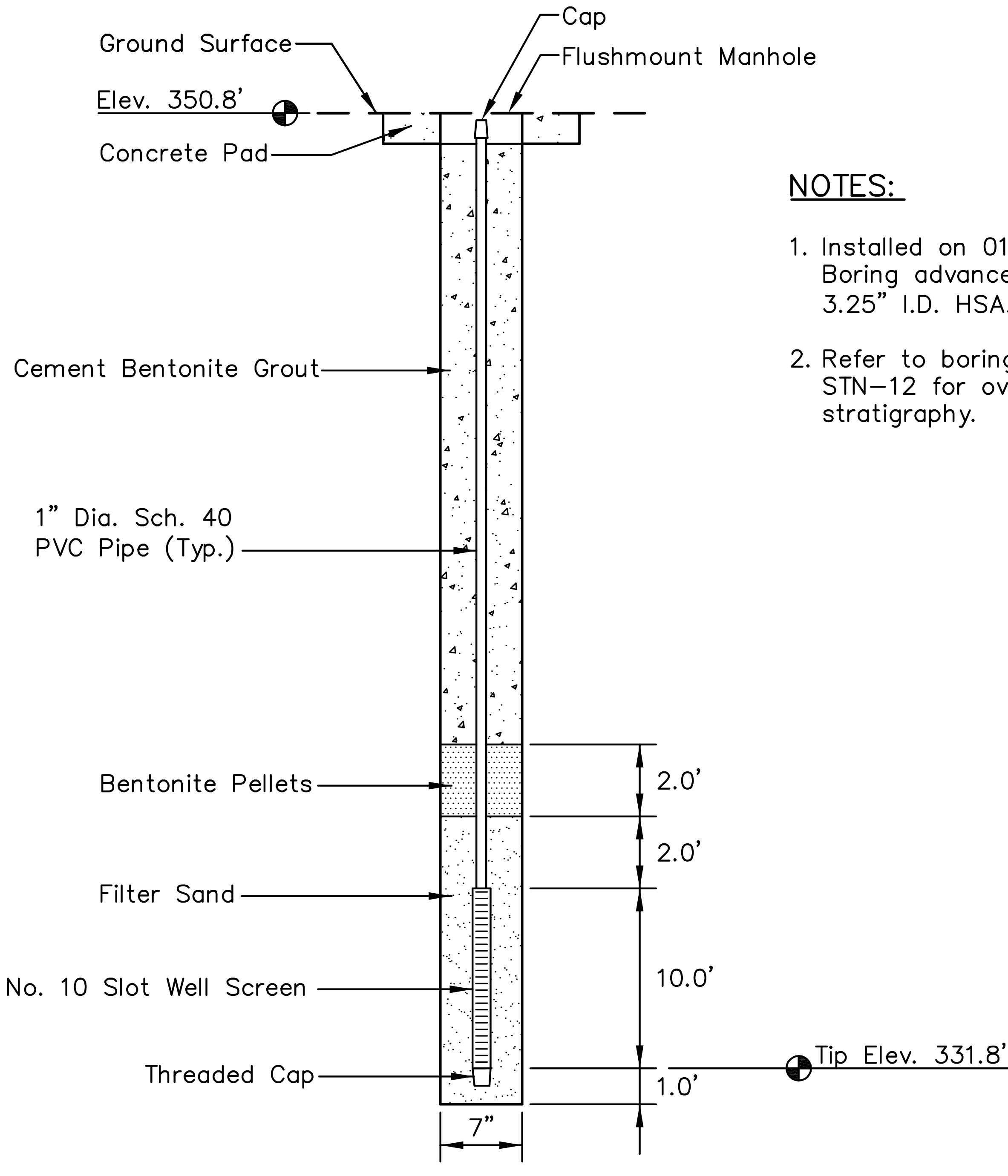
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	7 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/15/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log STN–12 for overburden stratigraphy.

LOCATION

Northing: 316,012.54
Easting: 1,112,611.83
Ground Elevation: 350.8'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-13
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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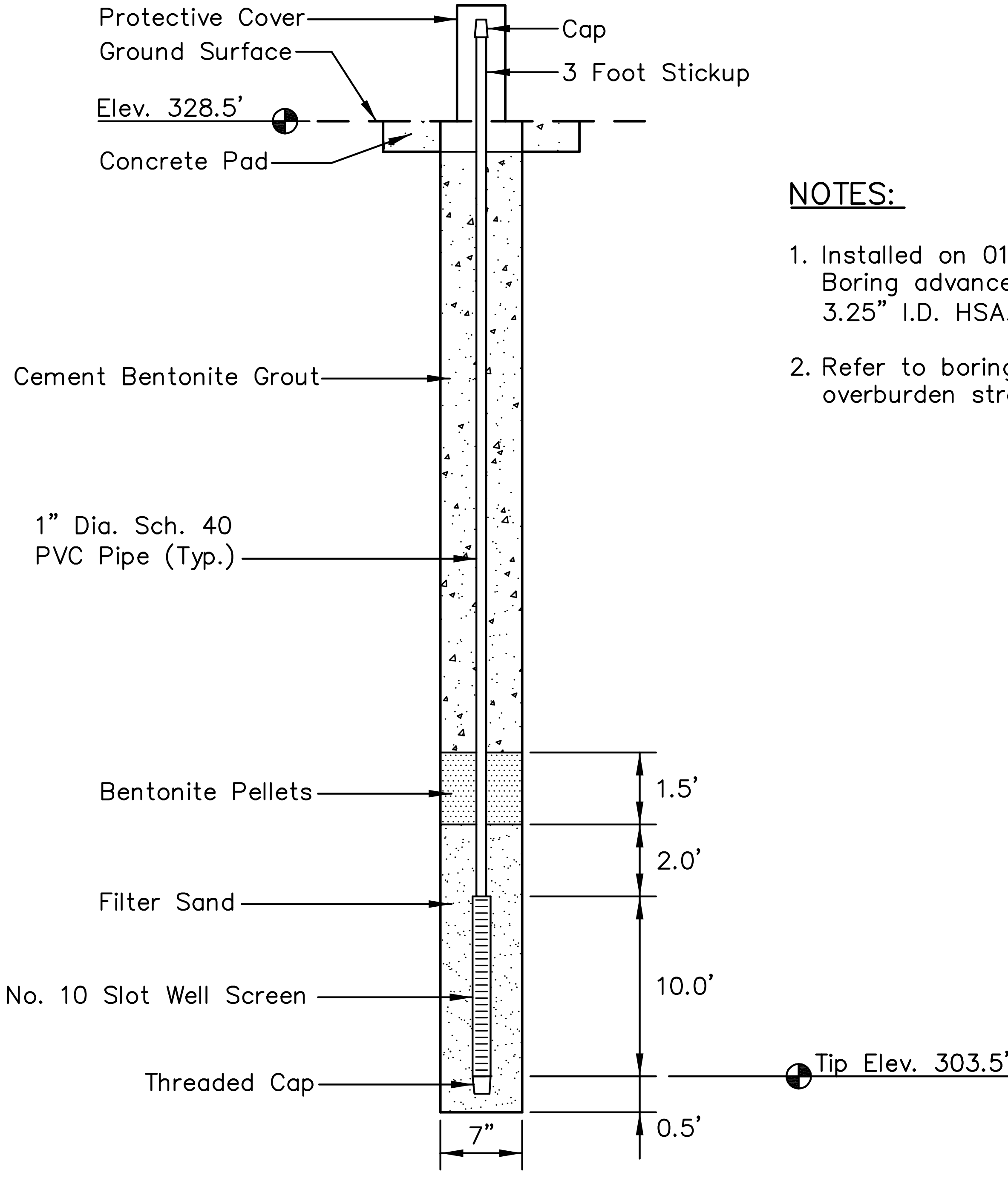
CHECKED BY JRC	PROJ. NO. 175559023	1.	3.	8 OF 32	
CHECKED BY NAB	SCALE NTS	2.	4.		



NOTES:

1. Installed on 01/28/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 315,098.19
Easting: 1,113,021.92
Ground Elevation: 328.5'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-16
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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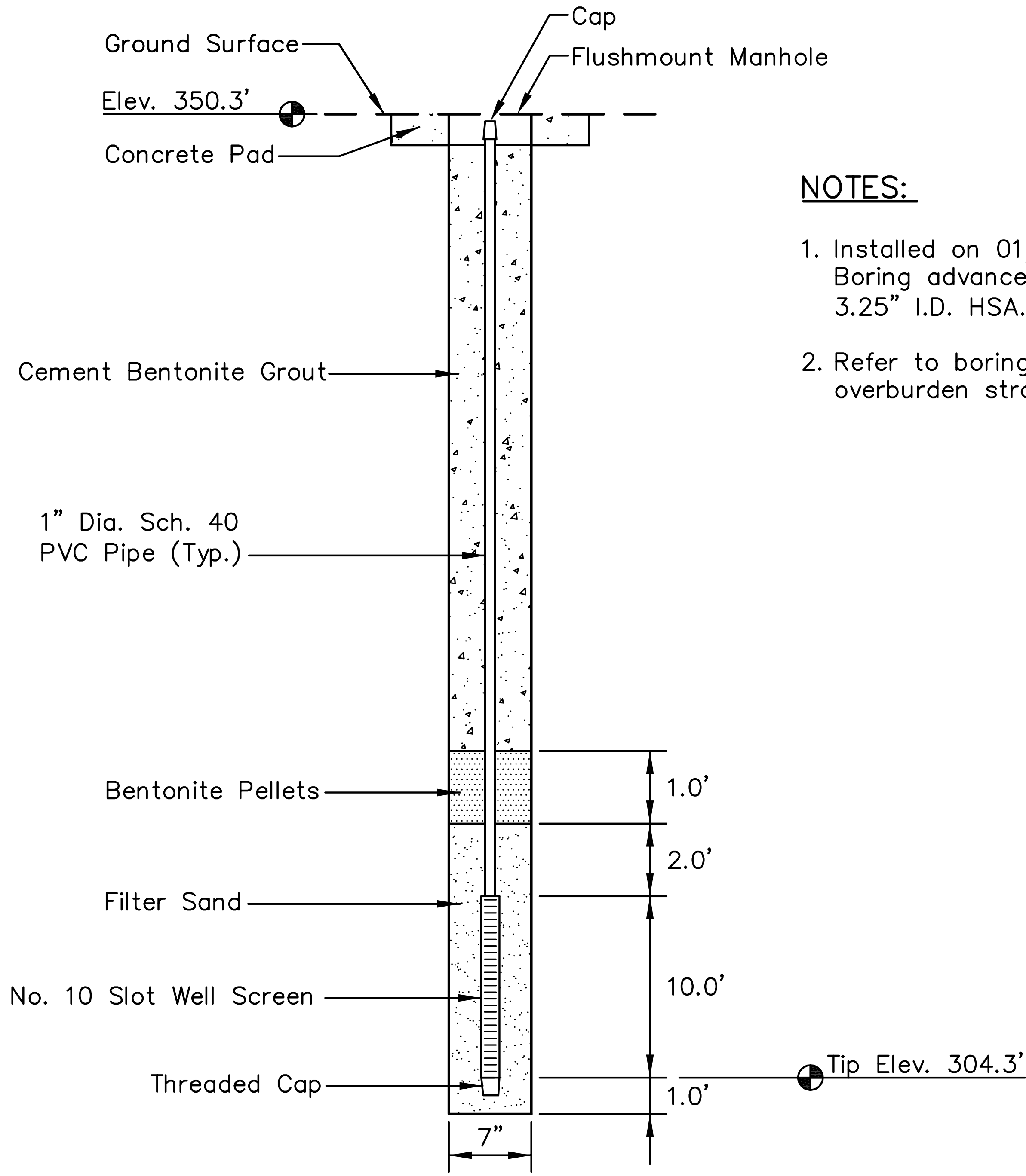
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	9 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/26/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 02/19/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\REV0_IFR\PZ_DETAILS\59023PZ-STN-17.DWG

LOCATION

Northing: 315,137.42
Easting: 1,113,091.63
Ground Elevation: 350.3'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-17
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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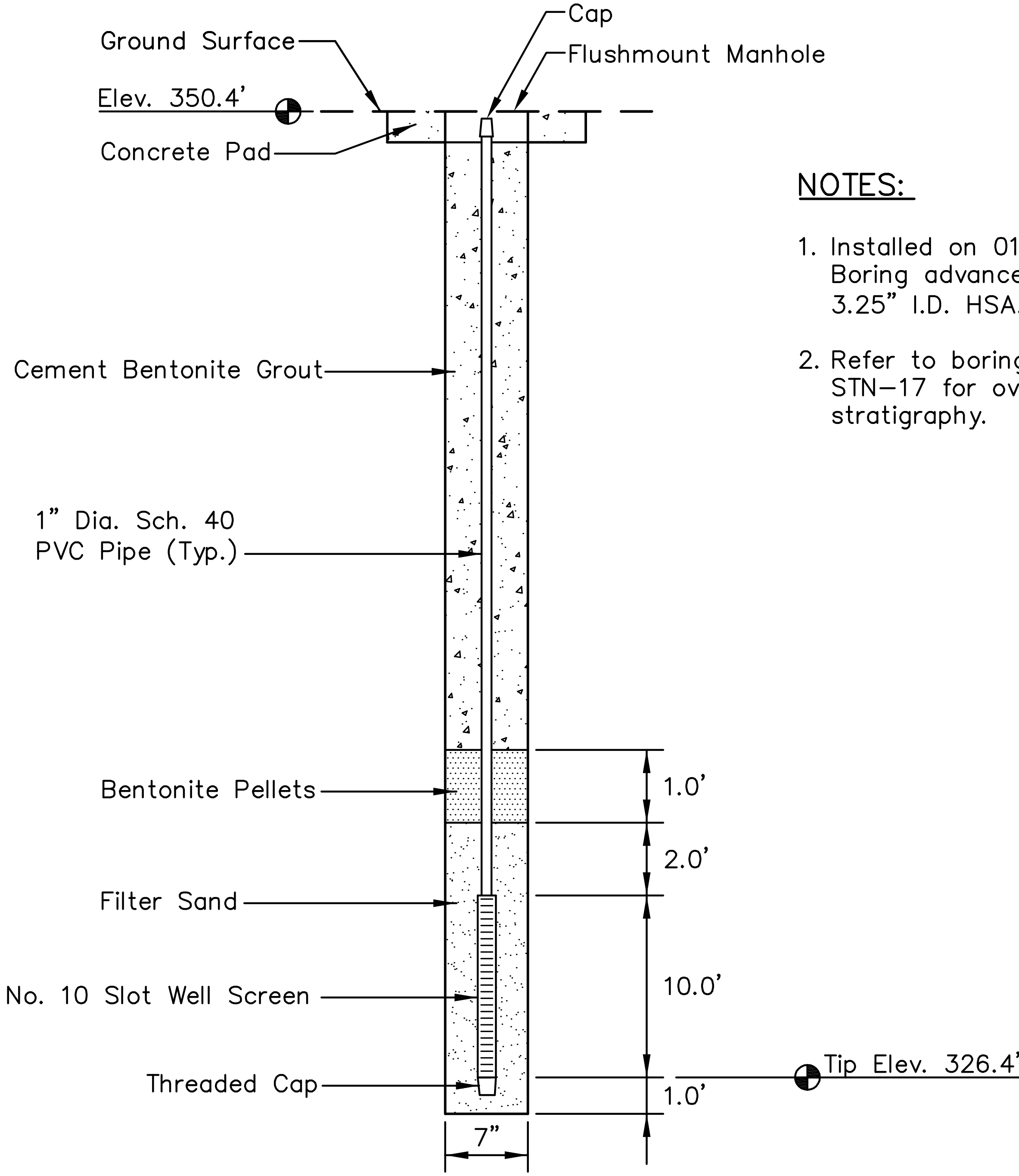
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	10 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/26/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log STN–17 for overburden stratigraphy.

LOCATION

Northing: 315,133.53
Easting: 1,113,093.60
Ground Elevation: 350.4'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-18
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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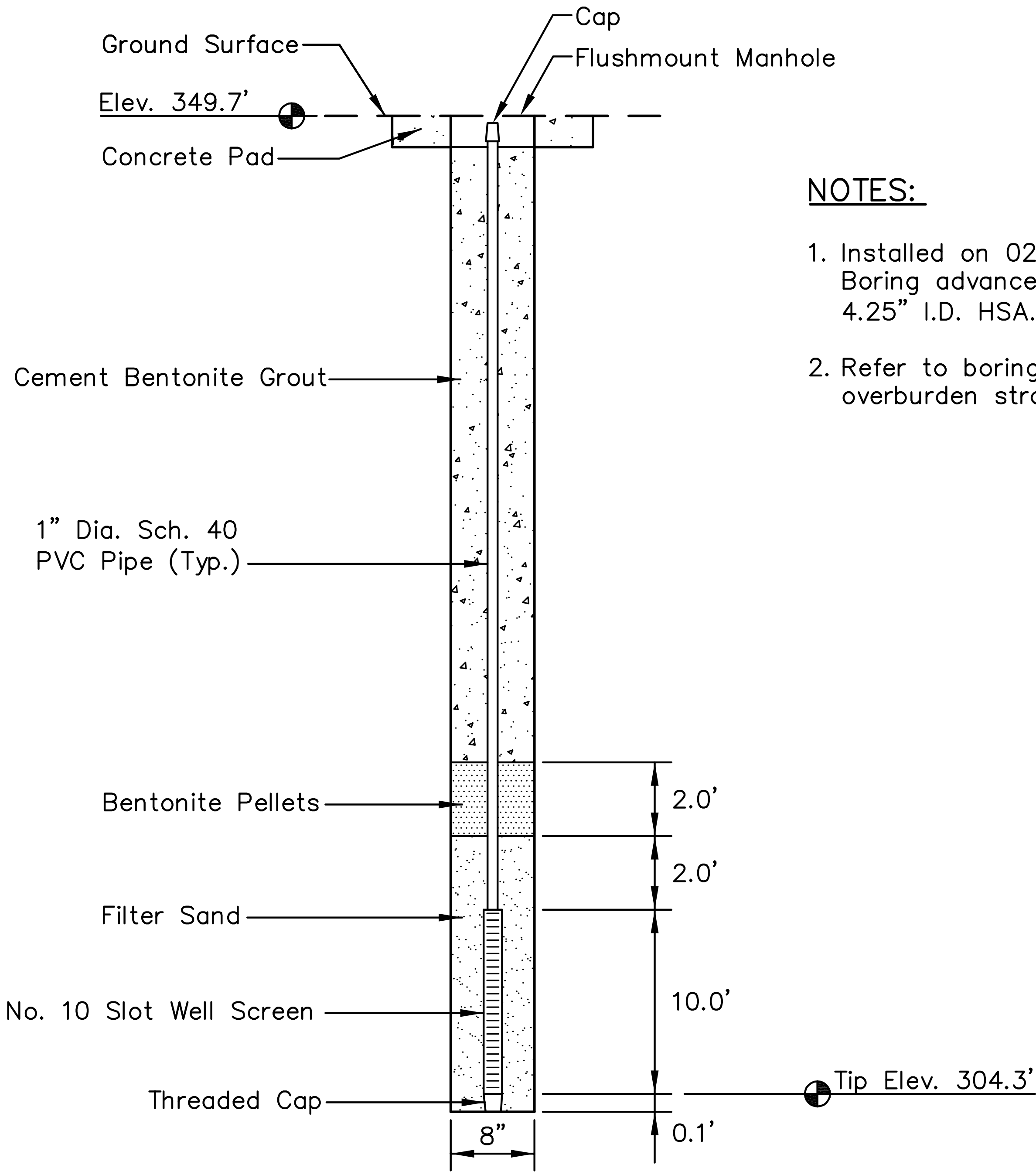
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	11 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/02/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,231.64
Easting: 1,113,471.65
Ground Elevation: 349.7'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-21
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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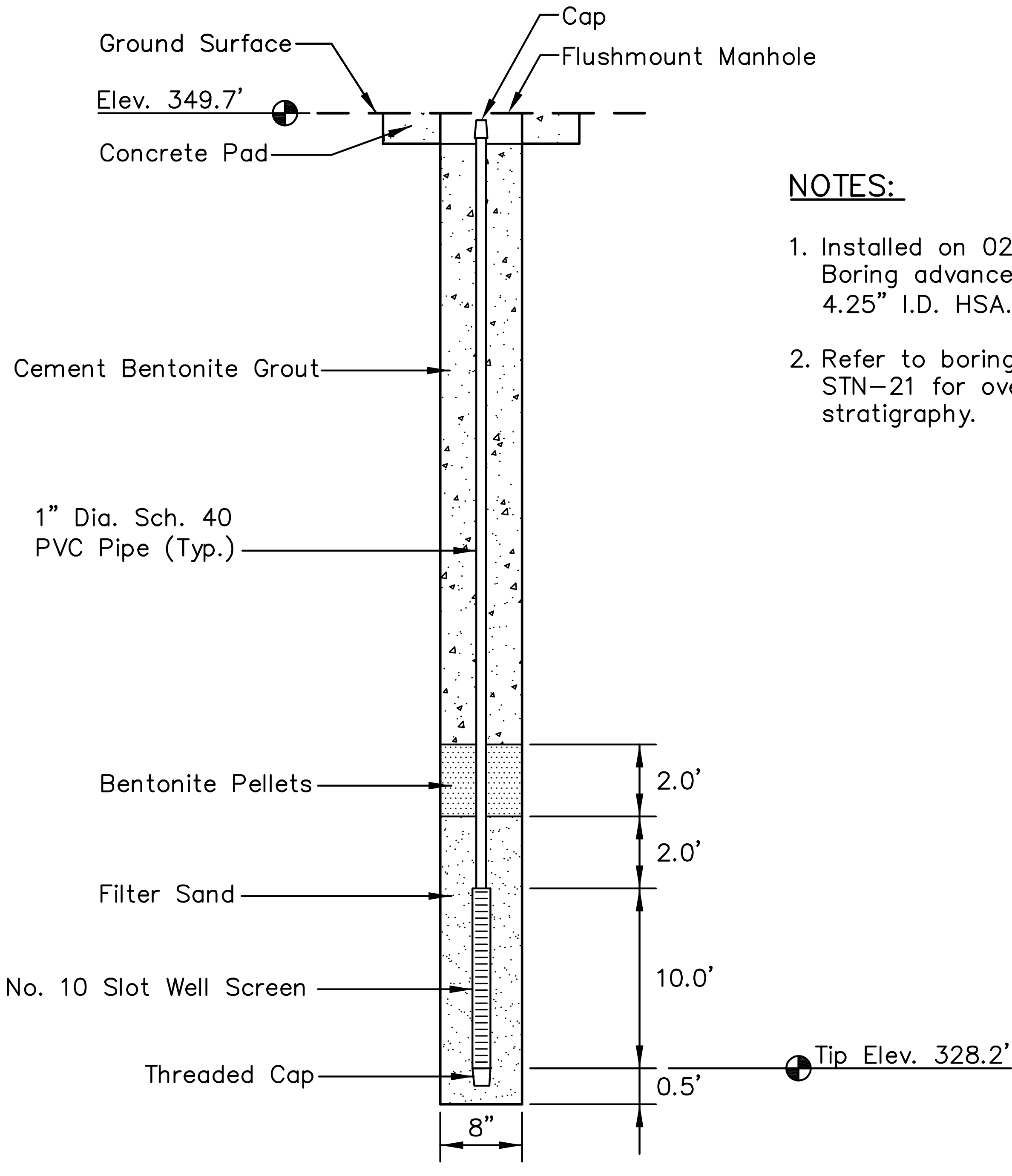
CHECKED BY JRC	PROJ. NO. 175559023	1.	3.	12 OF 32
CHECKED BY NAB	SCALE NTS	2.	4.	



NOTES:

1. Installed on 02/01/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN−21 for overburden stratigraphy.

LOCATION

Northing: 314,238.31
Easting: 1,113,470.52
Ground Elevation: 349.7'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-22
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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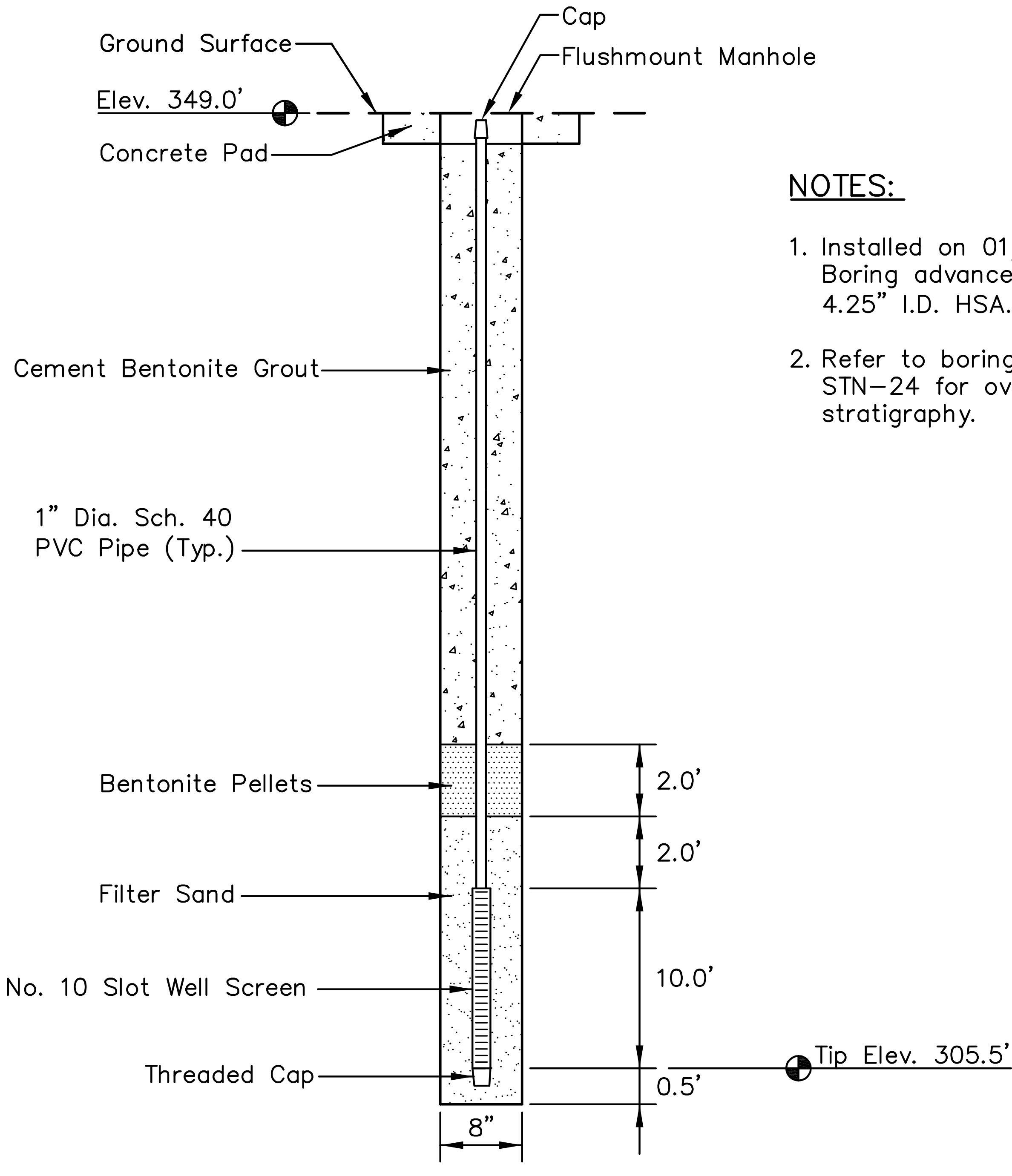
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	13 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/29/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN-24 for overburden stratigraphy.

LOCATION

Northing: 313,495.53
Easting: 1,113,645.65
Ground Elevation: 349.0'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-23
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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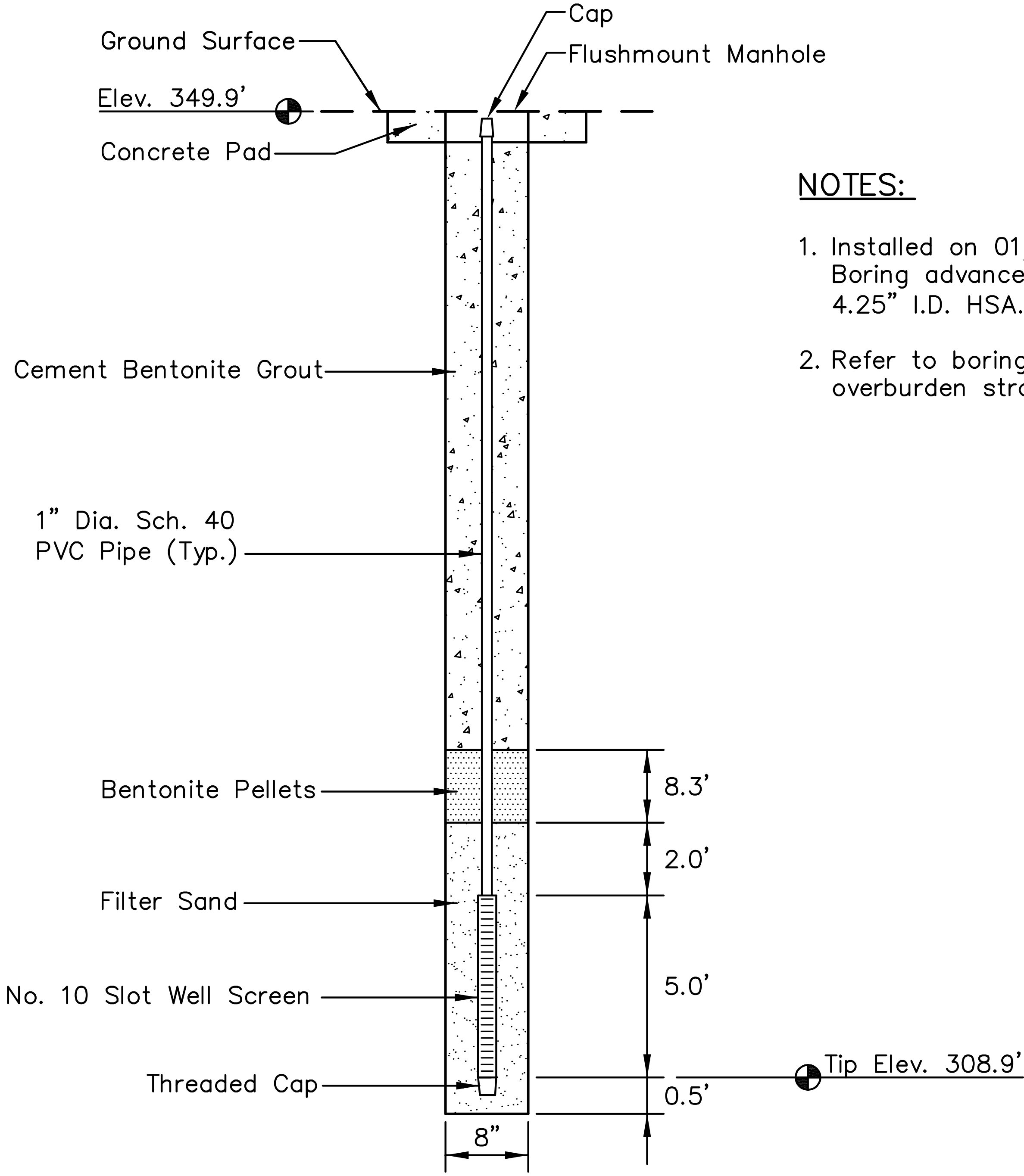
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	14 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/29/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,778.59
Easting: 1,113,804.66
Ground Elevation: 349.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-25
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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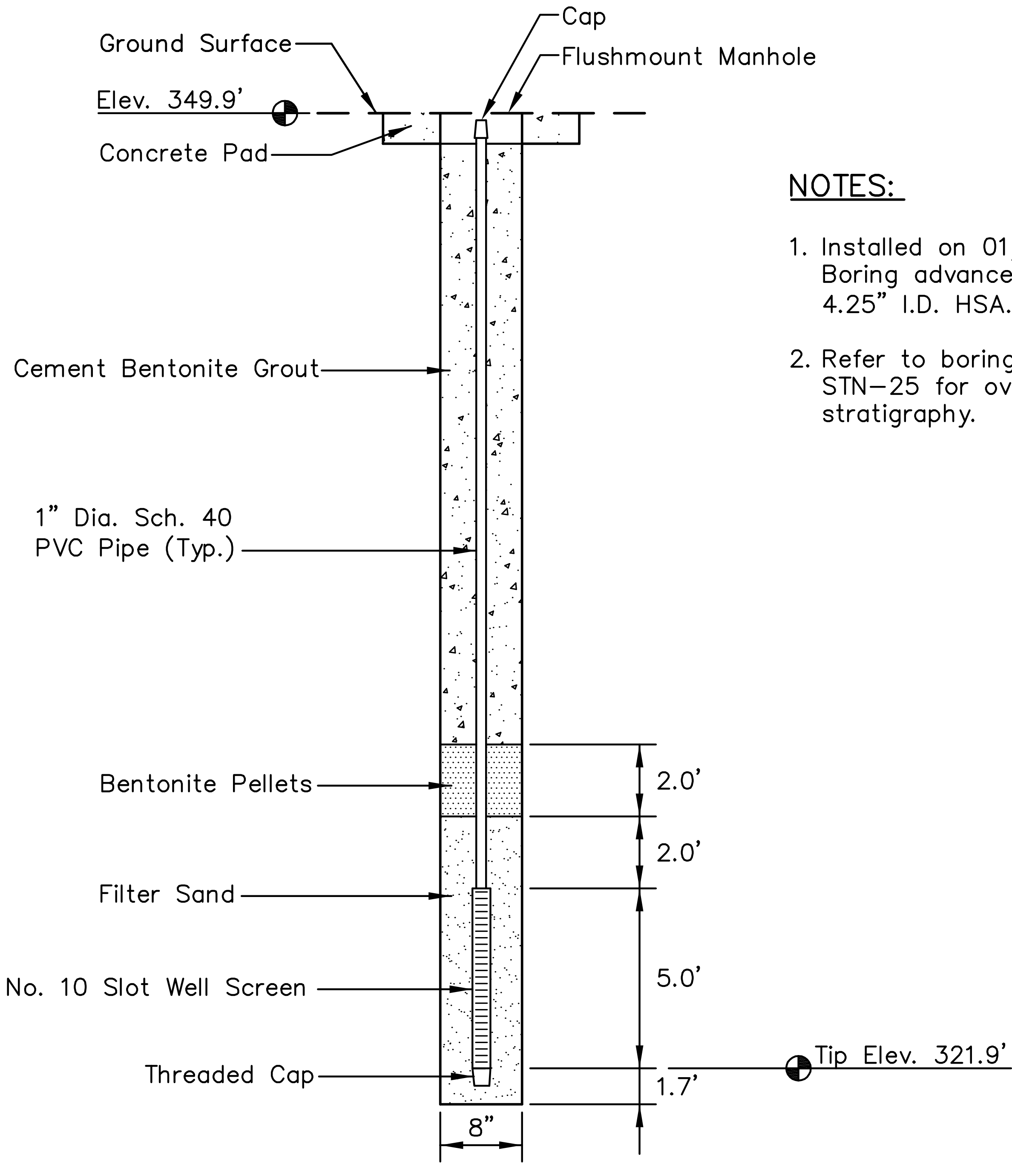
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	15 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/31/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN–25 for overburden stratigraphy.

LOCATION

Northing: 312,774.78
Easting: 1,113,806.04
Ground Elevation: 349.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-26
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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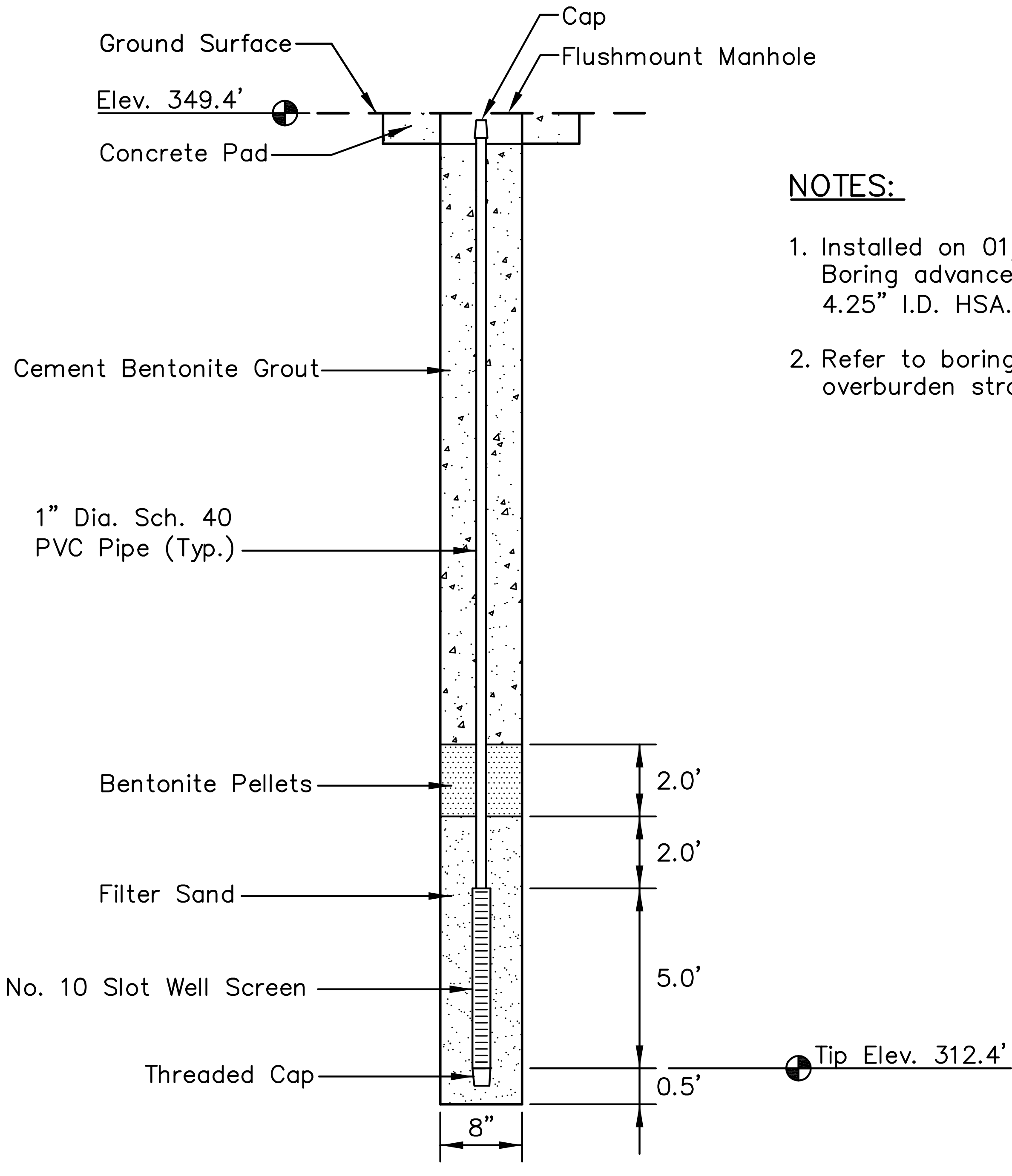
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	16 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/18/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,133.86
Easting: 1,114,170.06
Ground Elevation: 349.4'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-27
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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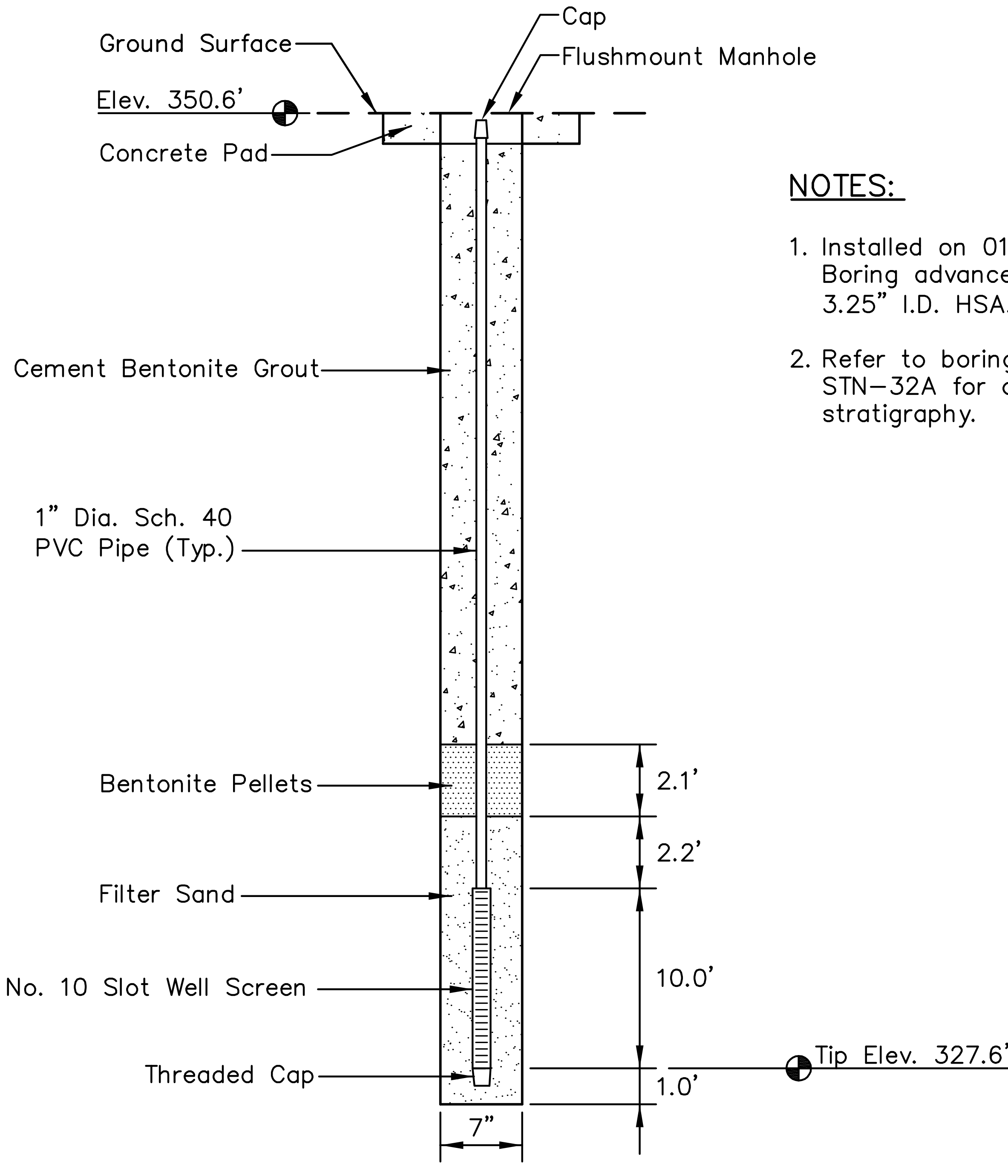
DRAWN BY	SB	DATE	FEB., 2010	REVISED		SHEET
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	17 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/06/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log STN-32A for overburden stratigraphy.

LOCATION

Northing: 314,461.18
Easting: 1,117,058.88
Ground Elevation: 350.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-32P
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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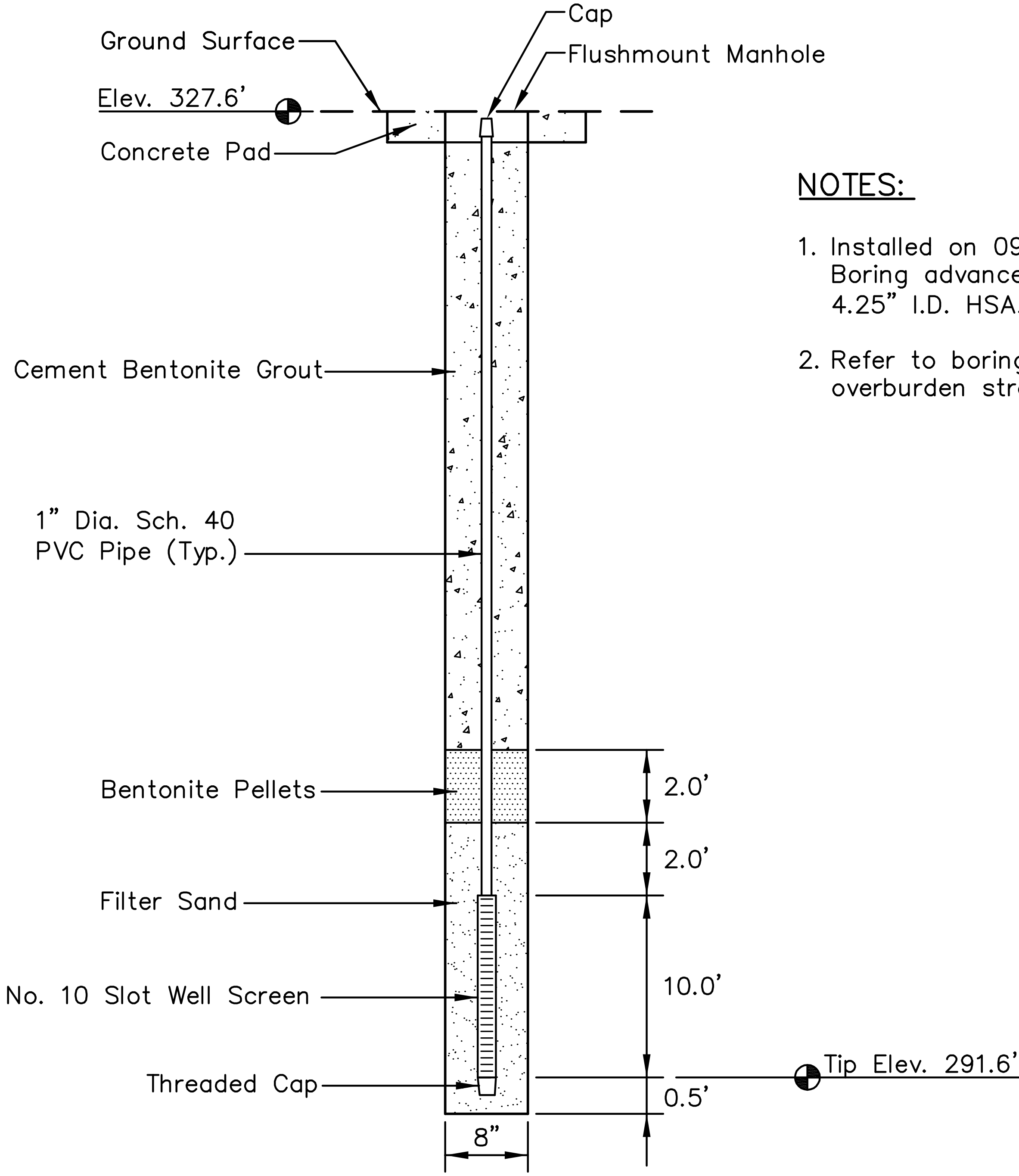
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	18 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/16/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,954.00
Easting: 1,117,204.67
Ground Elevation: 327.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-33
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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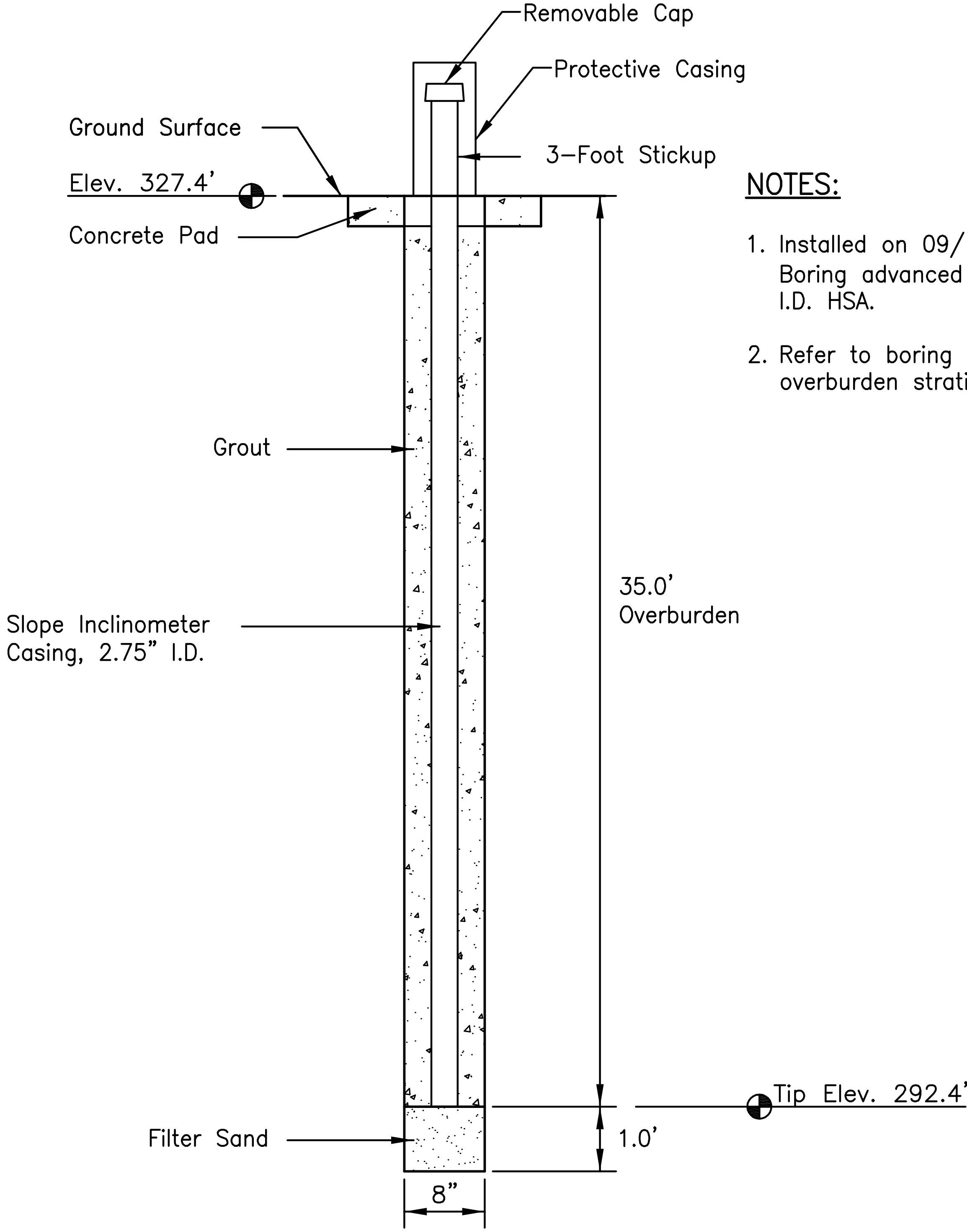
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	19 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/17/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,949.58
Easting: 1,117,204.80
Ground Elevation: 327.4'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services. Horizontal Datum: NAD 27 Vertical Datum: NGVD29

STN-33-SI
SLOPE INCLINOMETER DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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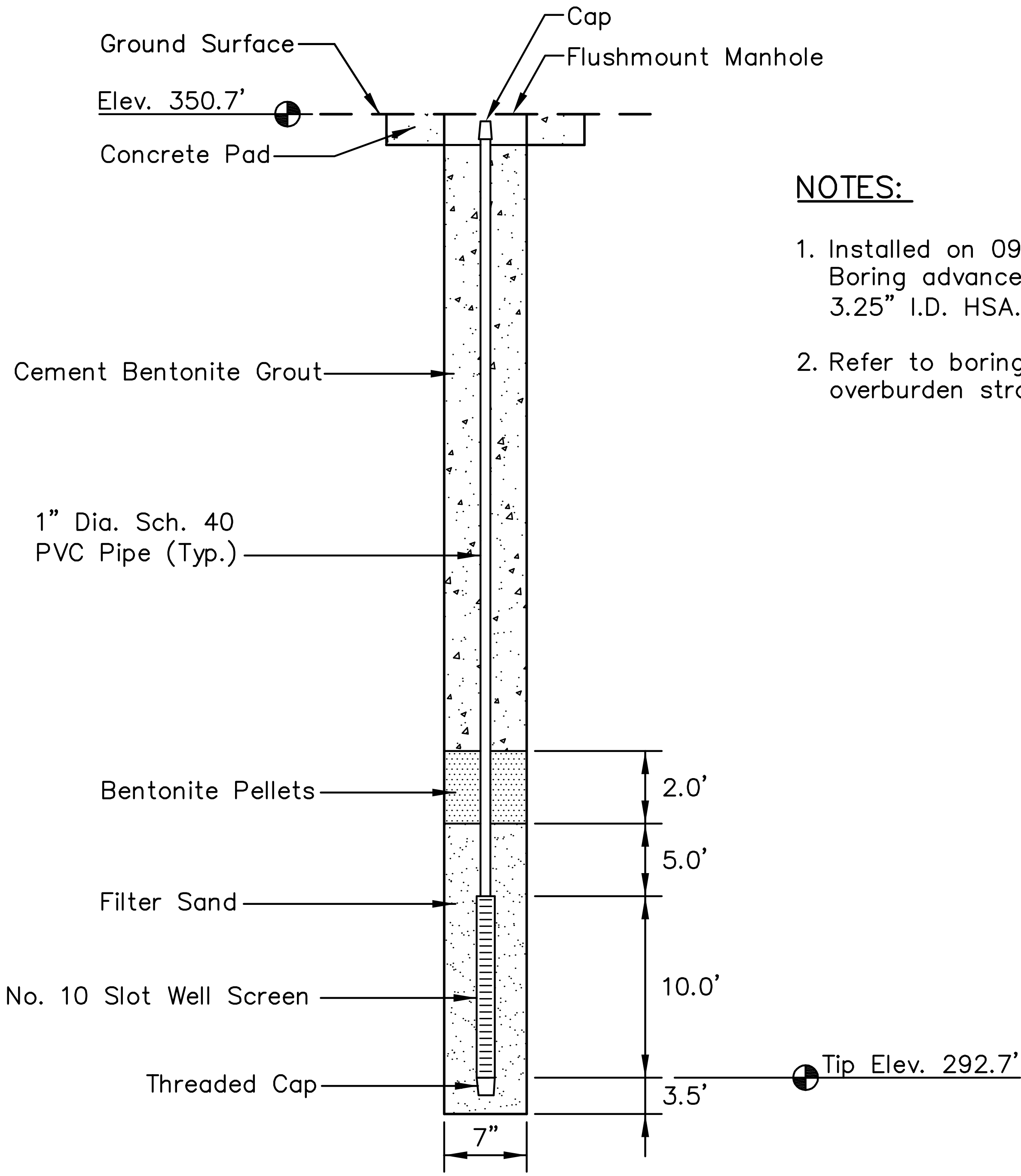
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.		20 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 09/11/09. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,938.34
Easting: 1,117,090.74
Ground Elevation: 350.7'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-35
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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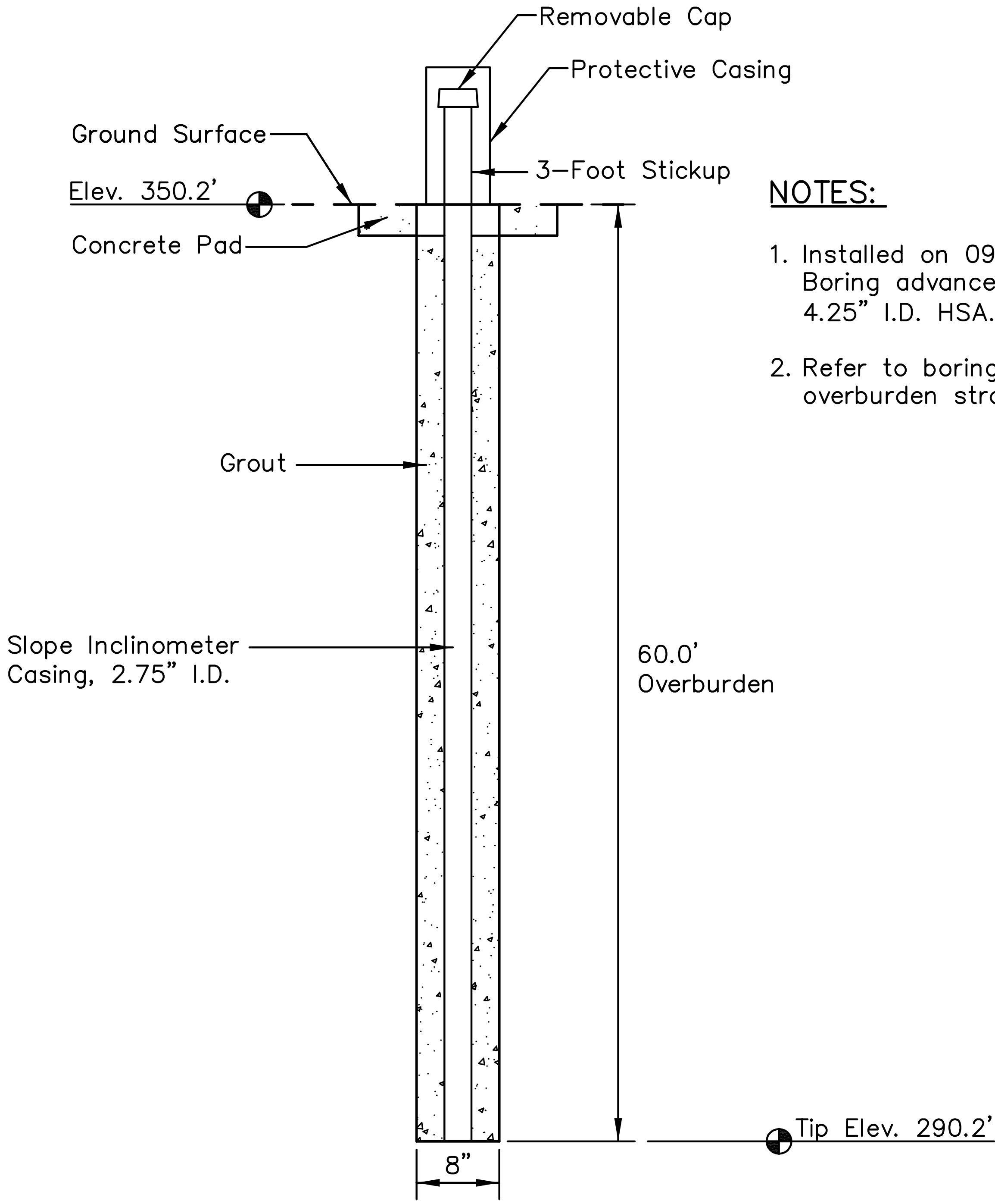
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.		21 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 09/16/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,947.72
Easting: 1,117,089.80
Ground Elevation: 350.2'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-35-SI
SLOPE INCLINOMETER DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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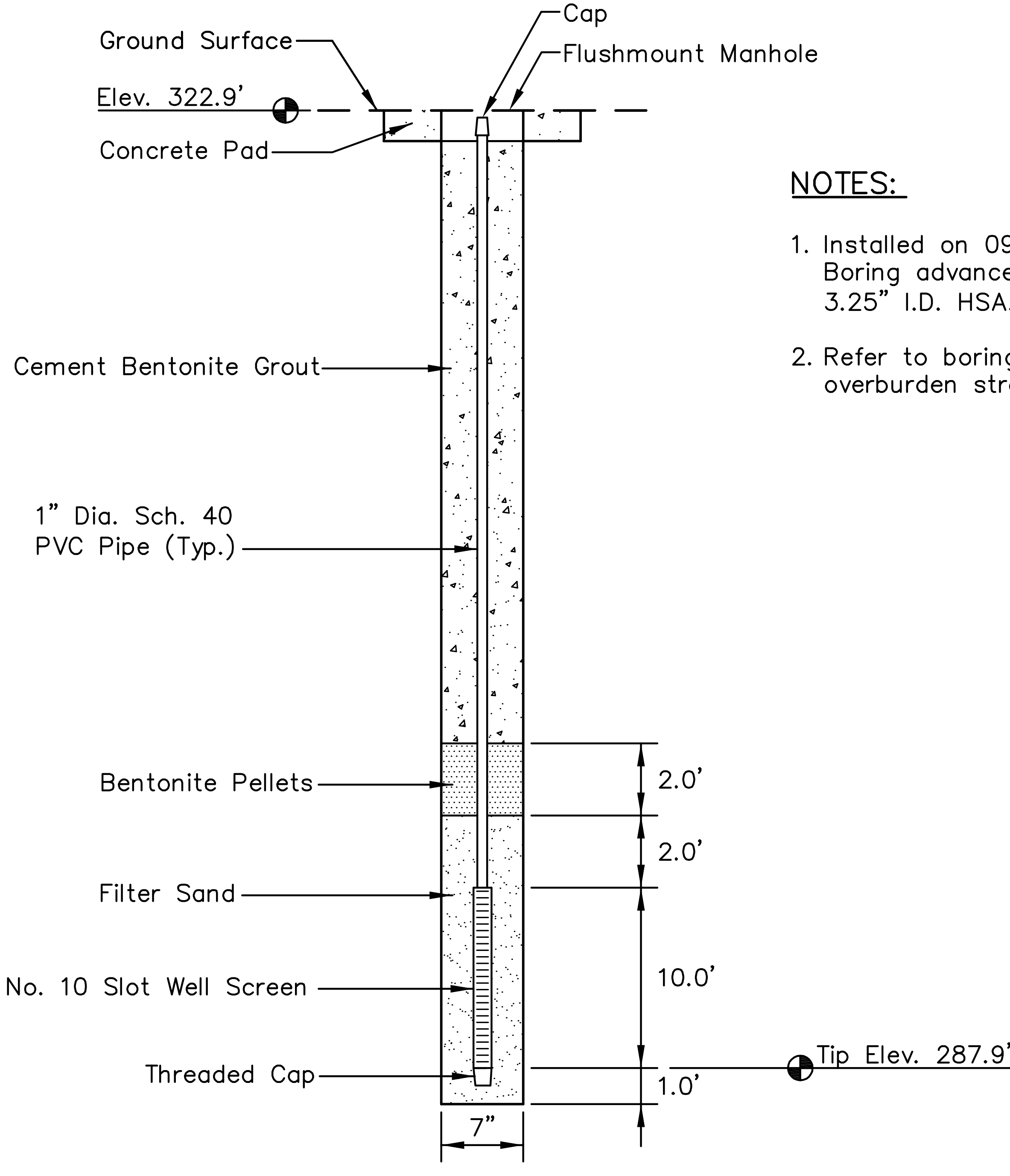
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	22 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/16/09. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 315,618.68
Easting: 1,116,395.32
Ground Elevation: 322.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-38
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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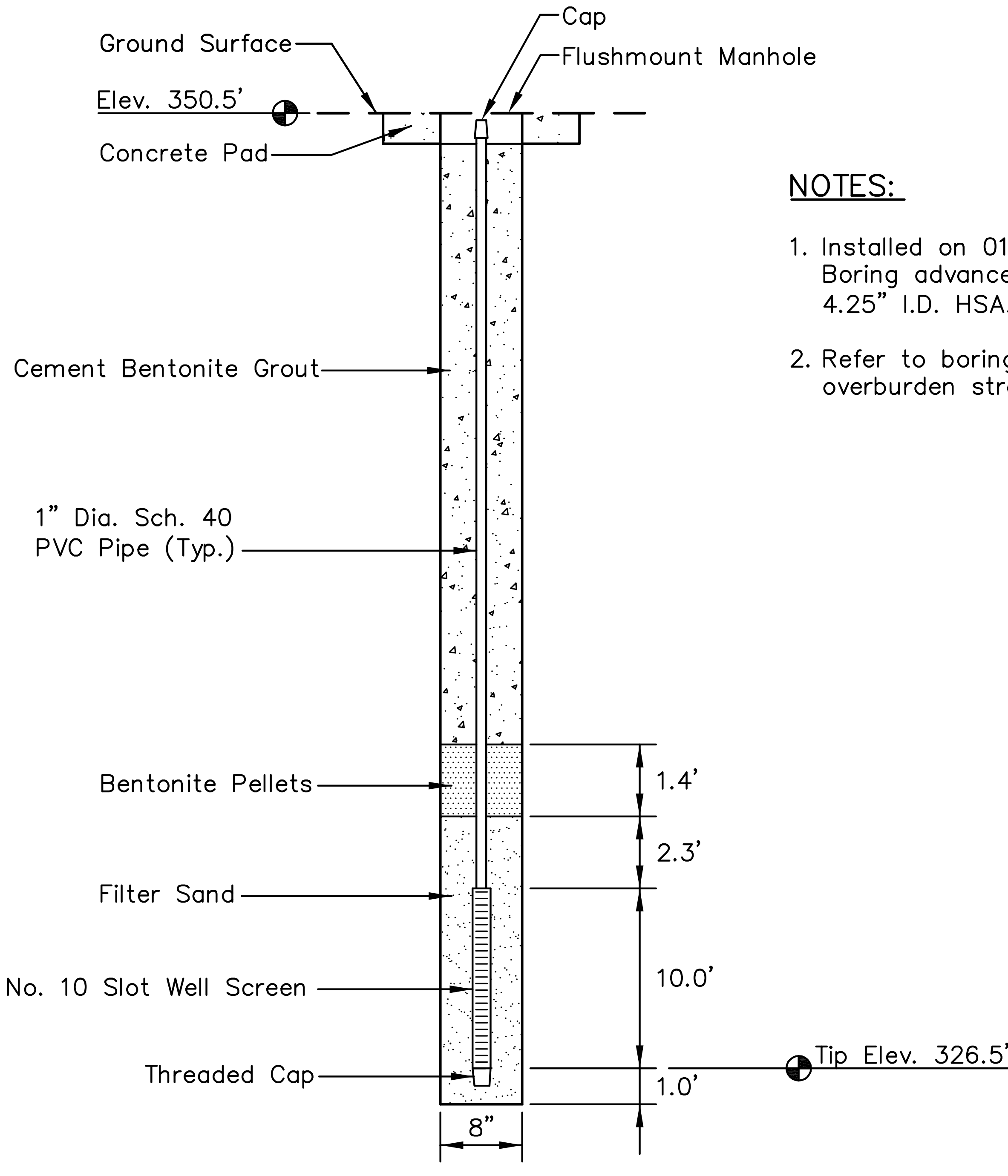
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	23 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/07/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 315,541.32
Easting: 1,116,337.61
Ground Elevation: 350.5'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-39A
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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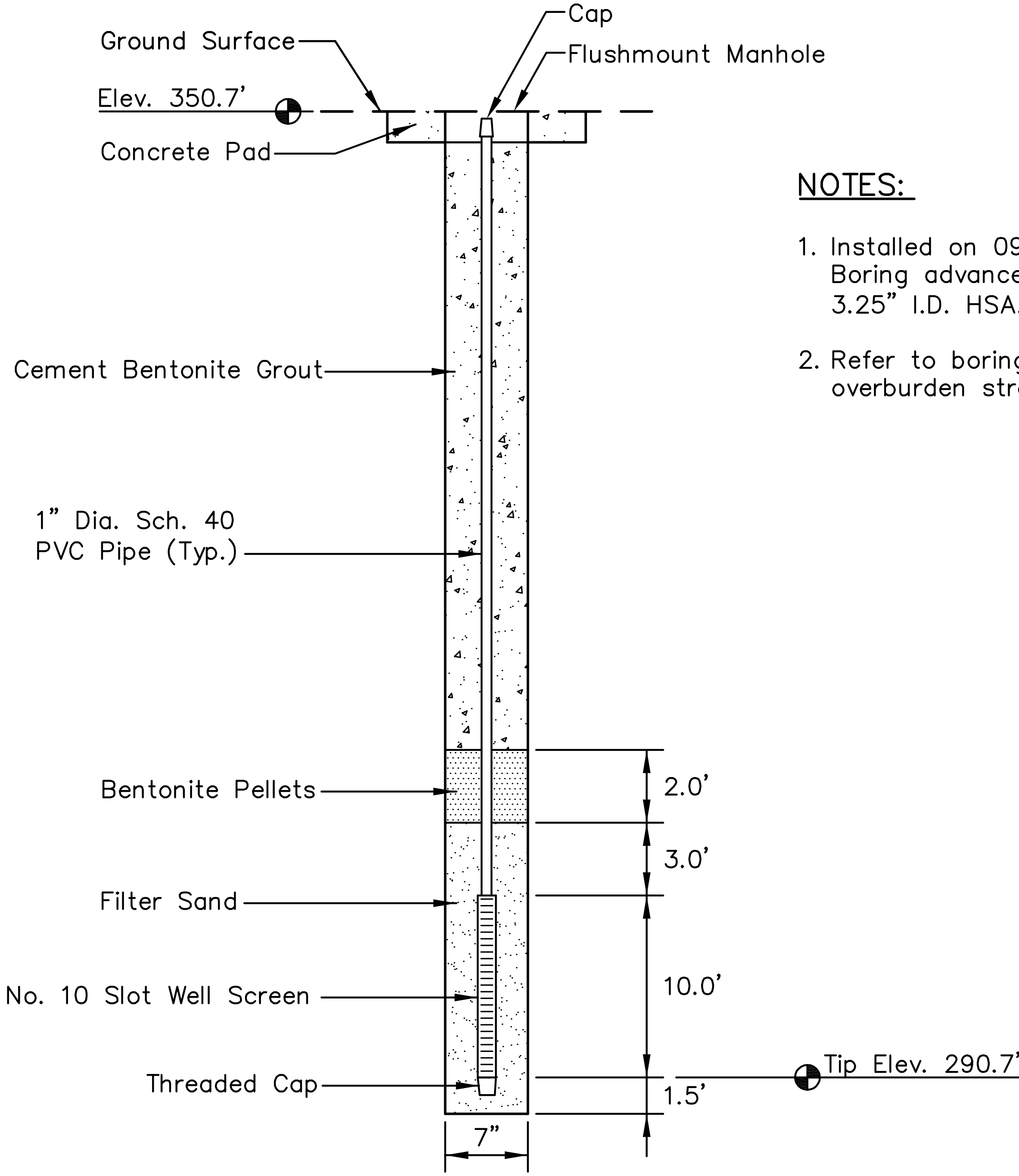
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	24 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/13/09. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 315,521.49
Easting: 1,116,330.97
Ground Elevation: 350.7'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-40
PIEZOMETER INSTALLATION DETAIL
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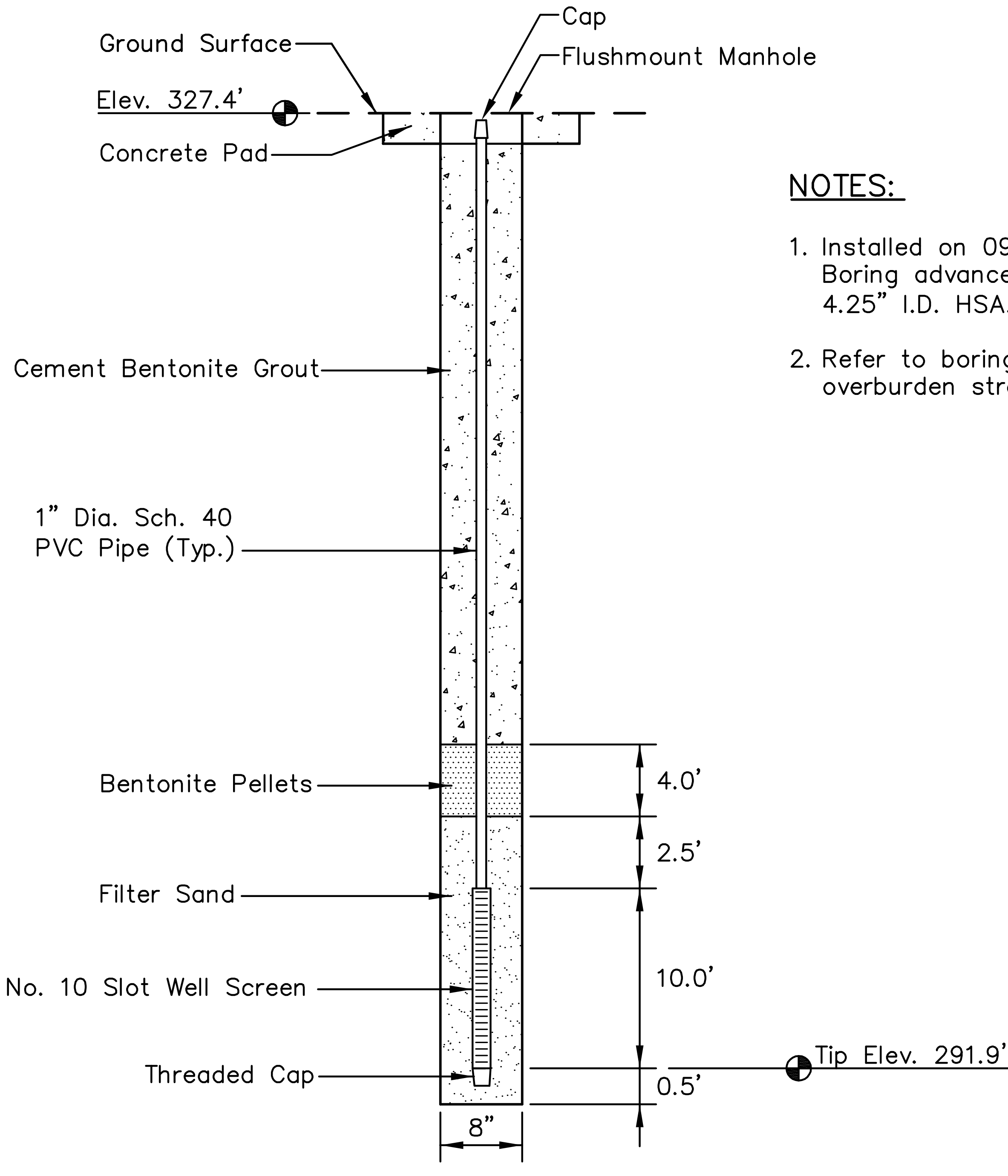
DRAWN BY	SB	DATE	OCT., 2009			
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	25 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/18/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 02/19/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\REV0_IFR\PZ_DETAILS\59023PZ-STN-43.DWG

LOCATION

Northing: 316,162.64
Easting: 1,115,545.71
Ground Elevation: 327.4'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-43
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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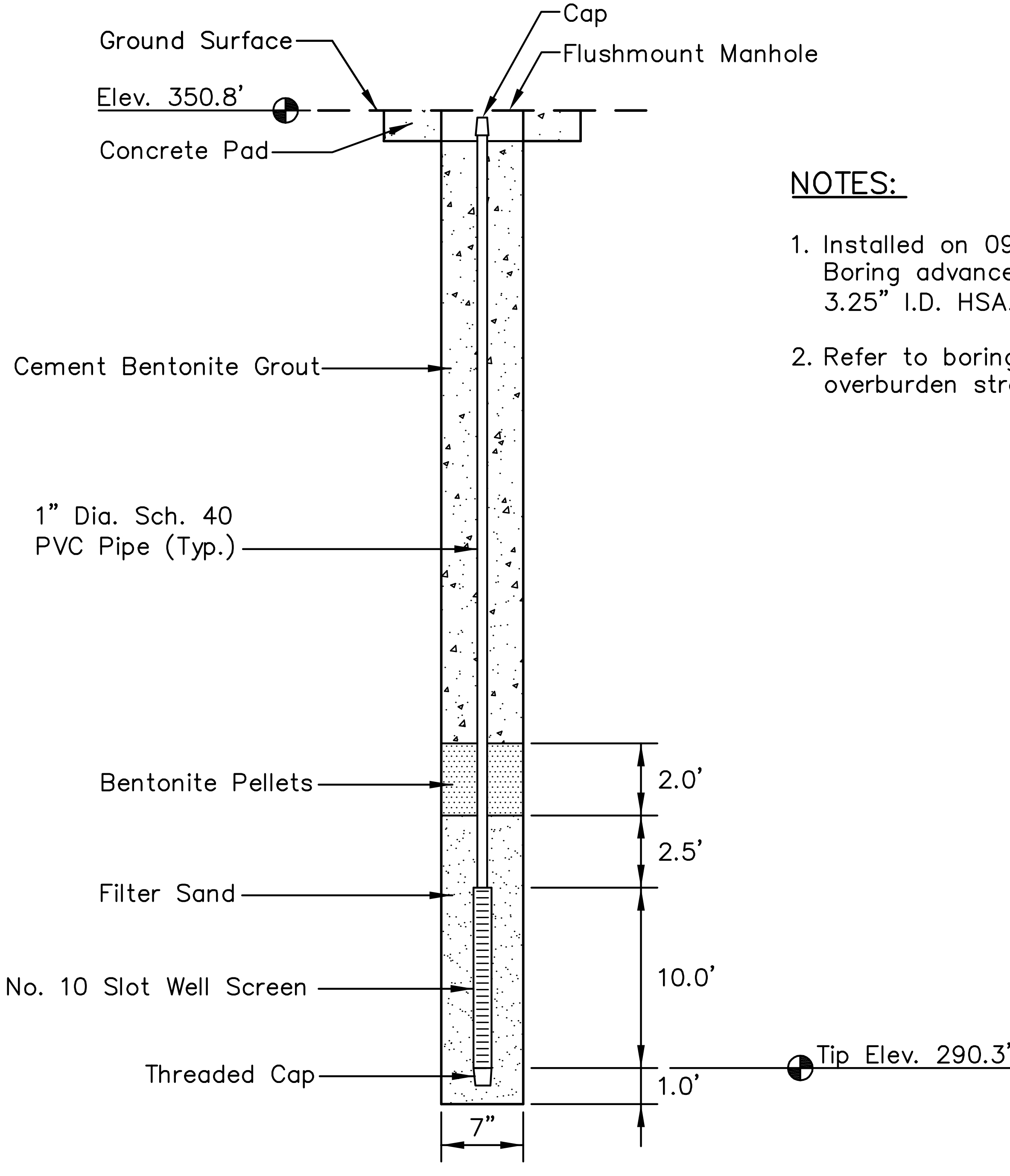
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	26 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/15/09. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 316,070.97
Easting: 1,115,485.44
Ground Elevation: 350.8'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-45
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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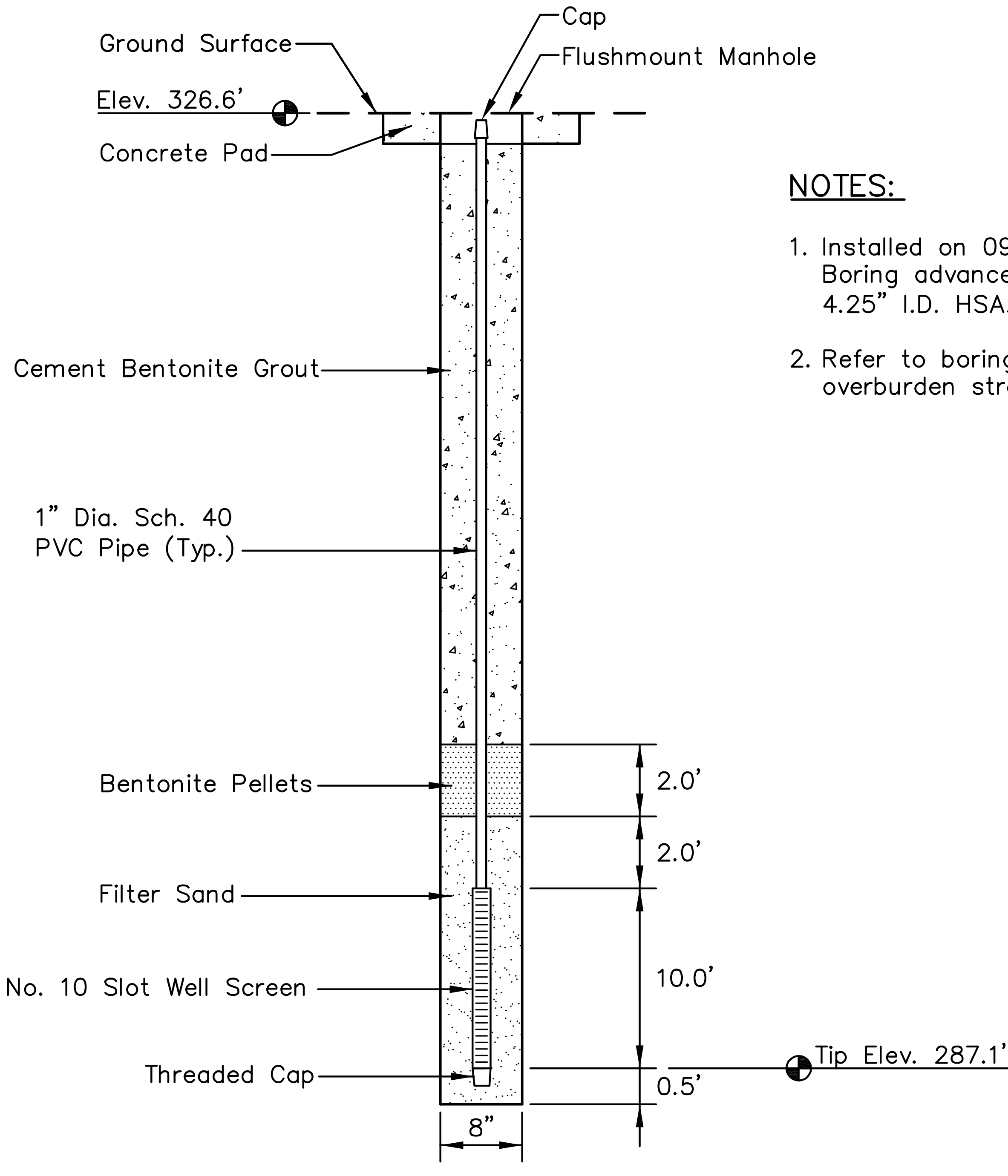
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	27 OF 32	
CHECKED BY	NAB	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 09/19/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 316,712.60
Easting: 1,114,710.52
Ground Elevation: 326.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-48
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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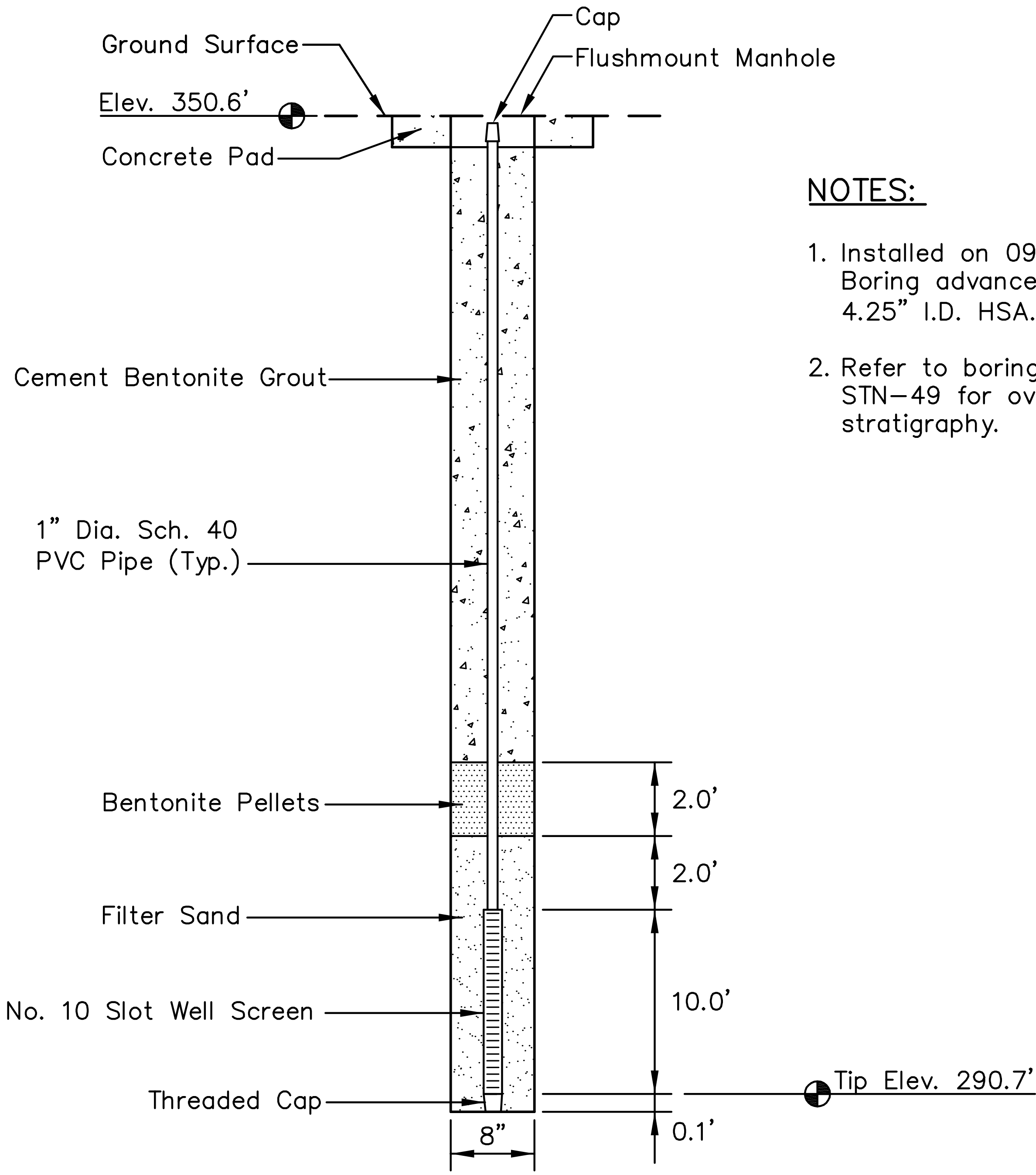
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	28 OF 32	
CHECKED BY	NAB	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 09/18/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN–49 for overburden stratigraphy.

LOCATION

Northing: 316,615.65
Easting: 1,114,648.22
Ground Elevation: 350.6'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-50
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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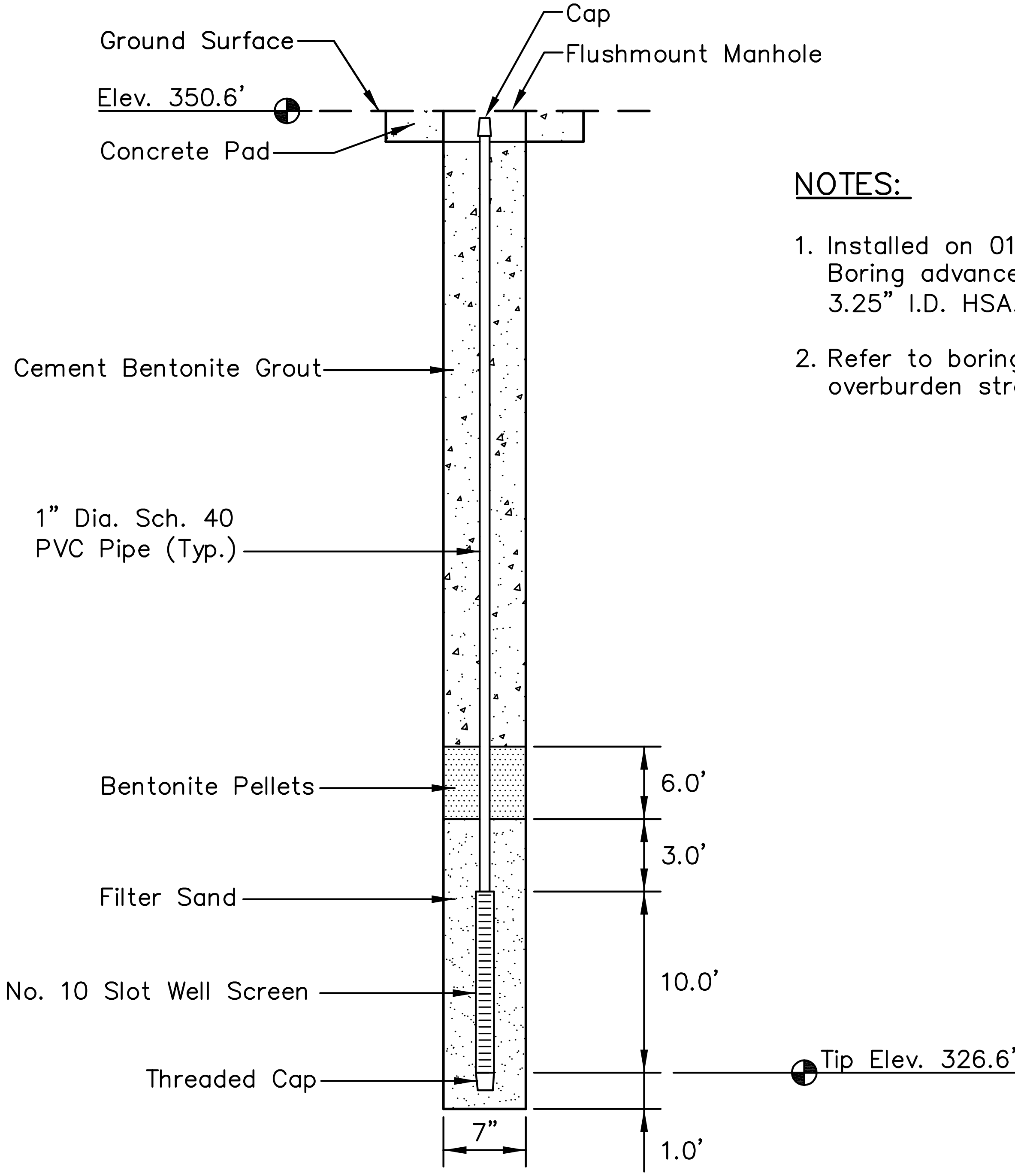
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	29 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/12/10. Boring advanced with 3.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 02/24/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\REV0_IFR\PZ_DETAILS\59023PZ-STN-50P.DWG

LOCATION

Northing: 316,630.15
Easting: 1,114,657.10
Ground Elevation: 350.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-50P
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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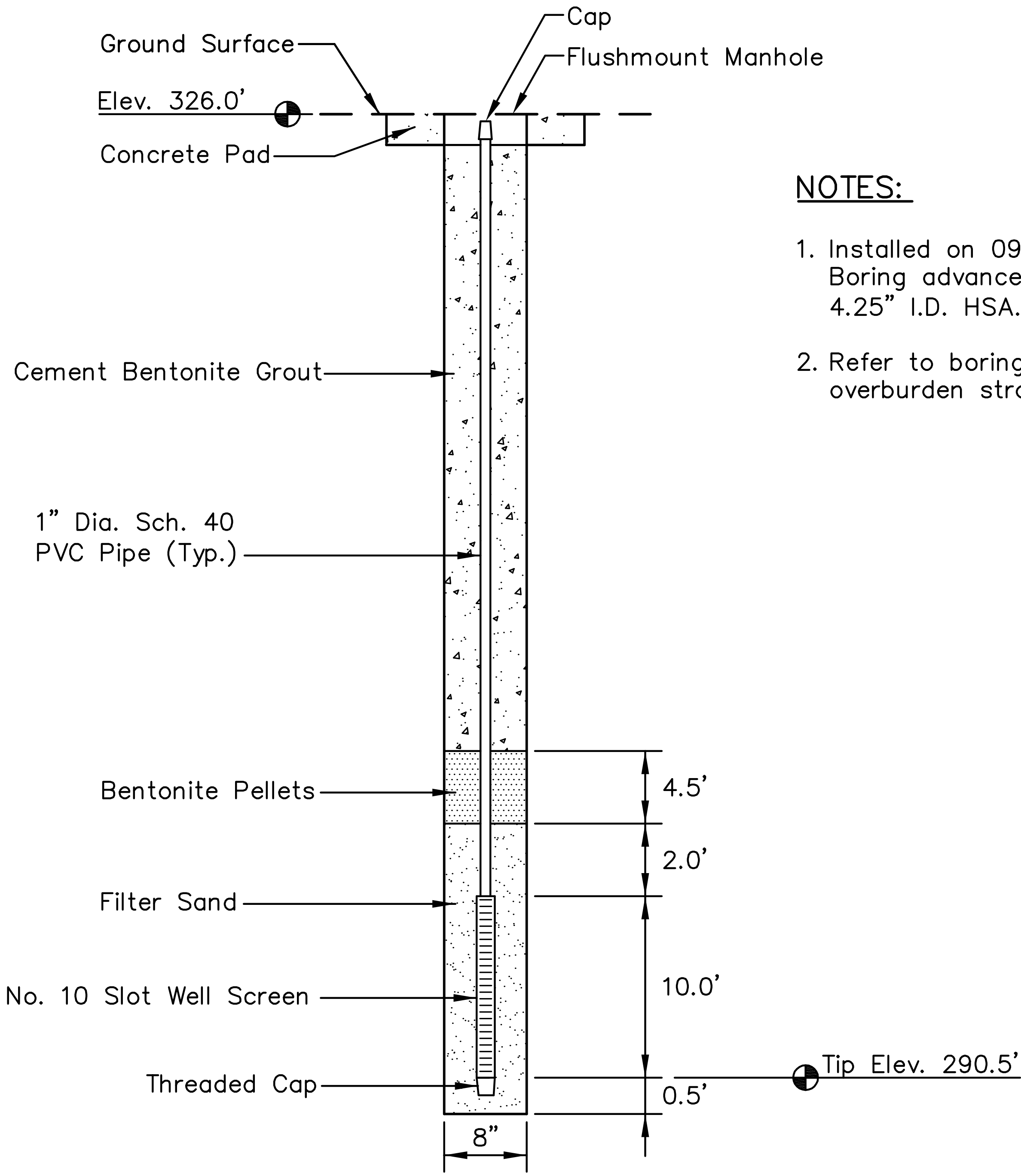
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	30 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 09/21/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 317,251.66
Easting: 1,113,870.22
Ground Elevation: 326.0'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-53
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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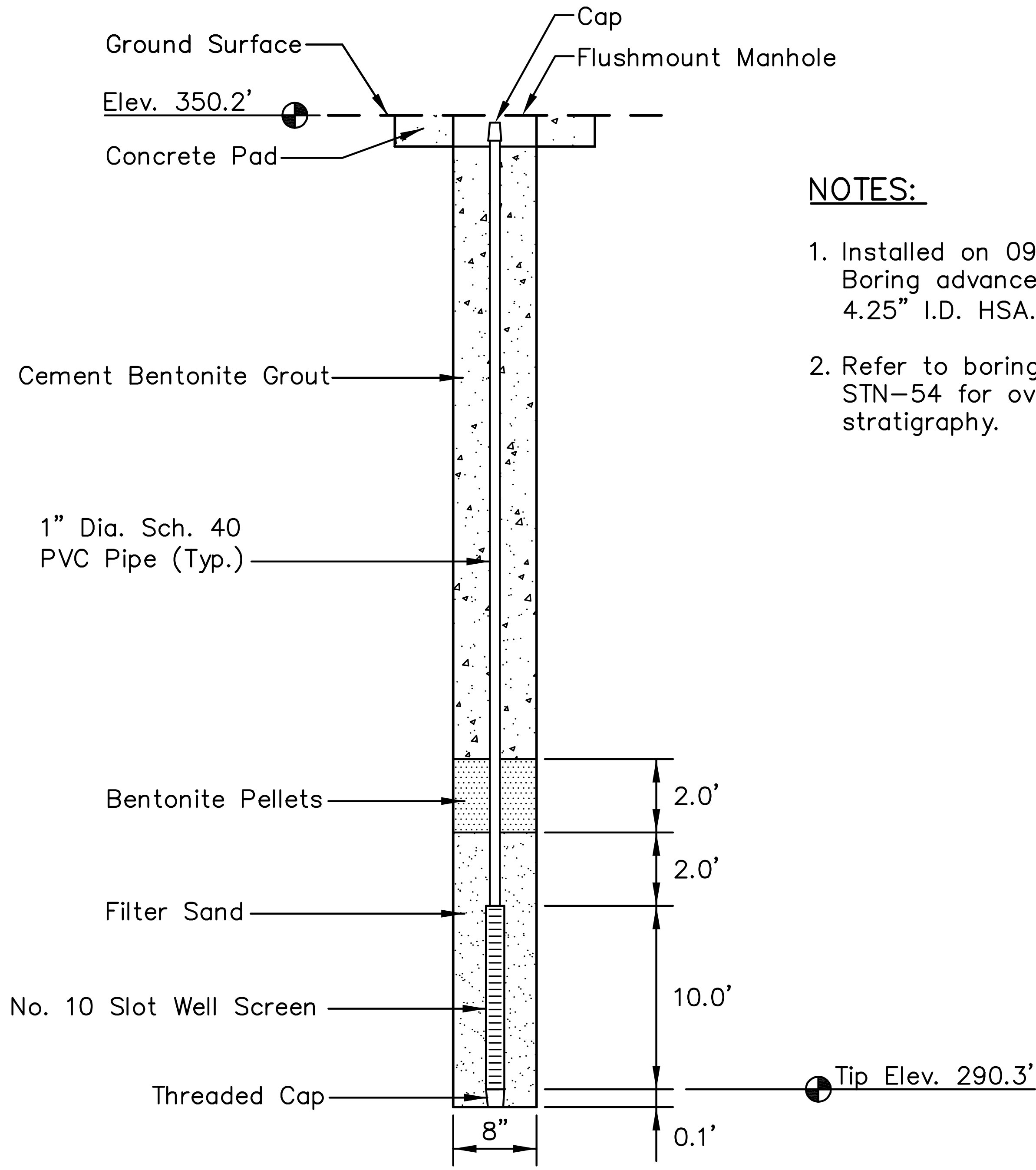
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	31 OF 32	
CHECKED BY	NAB	SCALE	NTS	2.	4.		



NOTES:

1. Installed on 09/19/09. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN-54 for overburden stratigraphy.

LOCATION

Northing: 317,161.11
Easting: 1,113,811.71
Ground Elevation: 350.2'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-55
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
ASH POND 1 & 2

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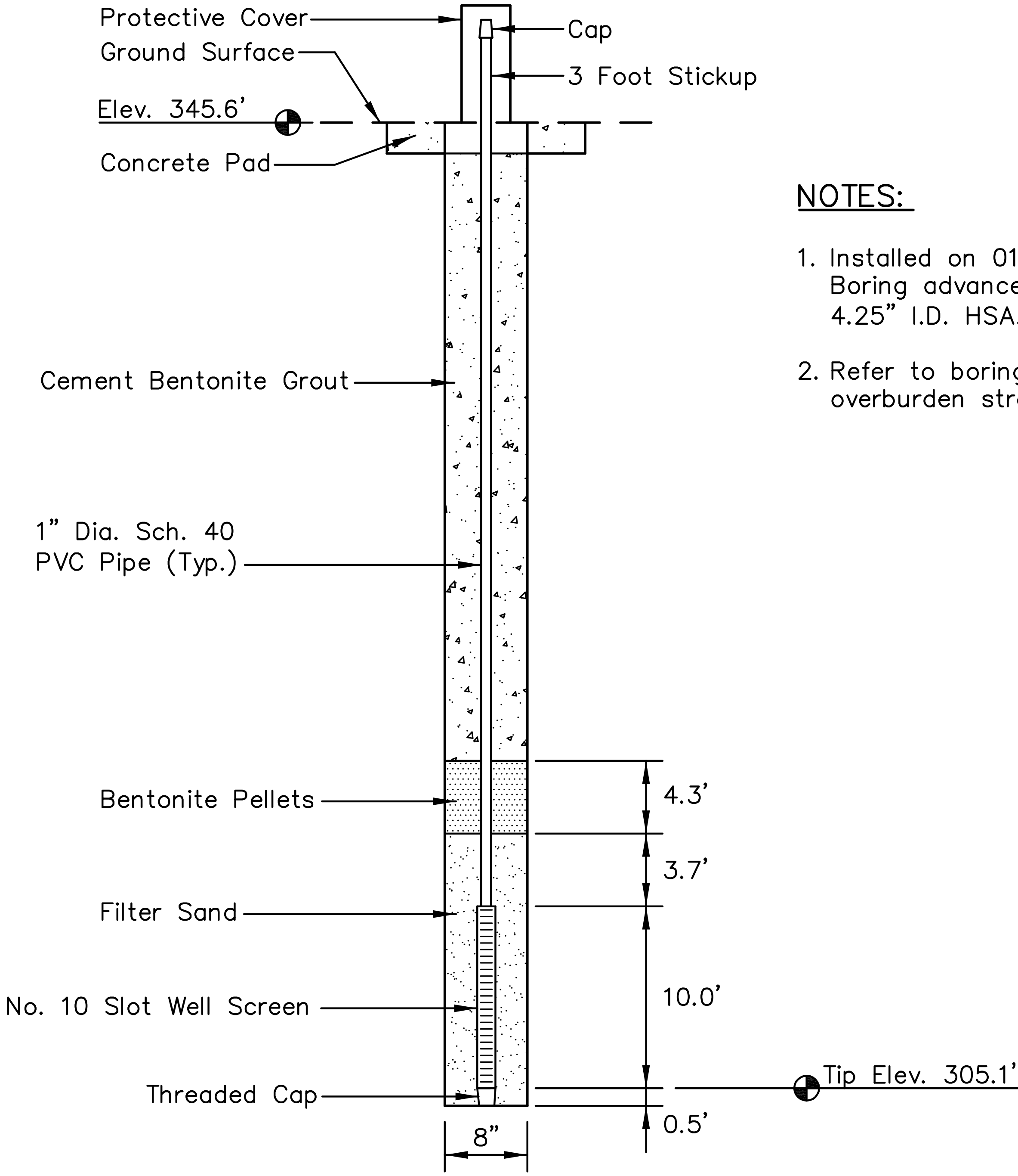
CHECKED BY	JRC	PROJ. NO.	175559023	1.	3.	32 OF 32
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/25/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,239.59
Easting: 1,113,599.85
Ground Elevation: 345.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-101
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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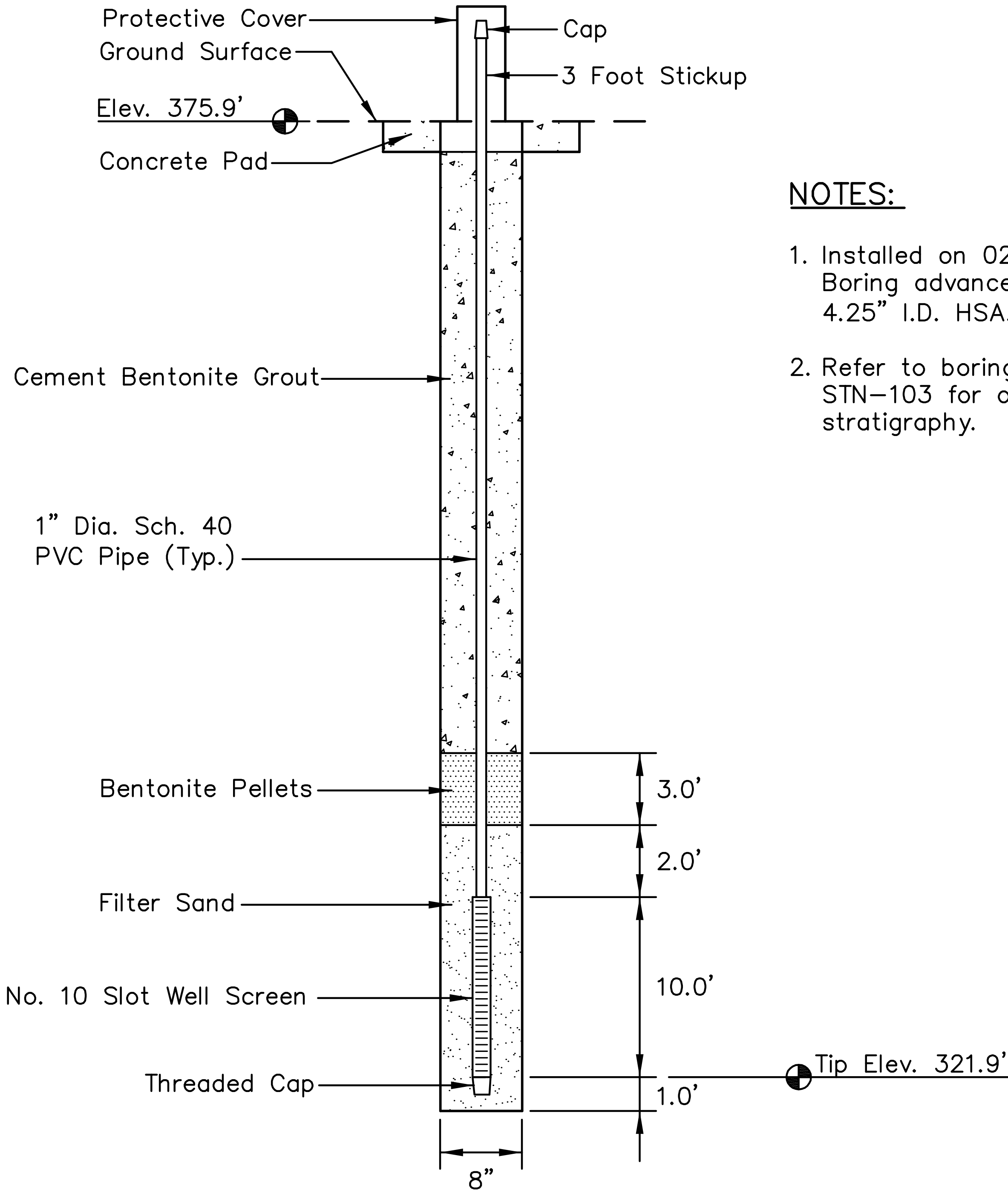
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	1 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/10/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN-103 for overburden stratigraphy.

LOCATION

Northing: 314,242.14
Easting: 1,113,701.41
Ground Elevation: 375.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-102
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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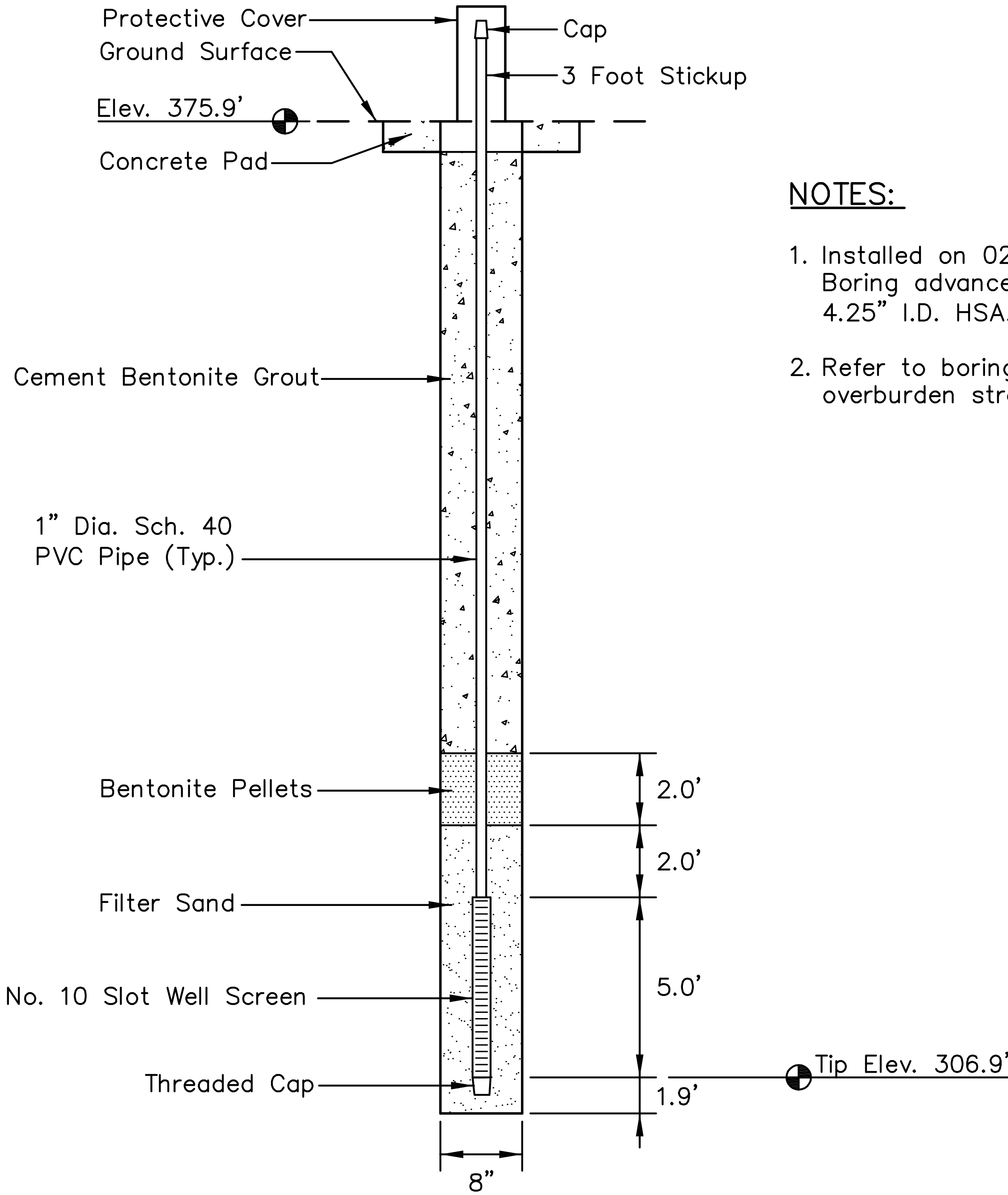
CHECKED BY	JRC	PROJ. NO.	175559035	1.		3.	2 OF 28
CHECKED BY	NAB	SCALE	NTS	2.		4.	



NOTES:

1. Installed on 02/09/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 314,237.20
Easting: 1,113,701.82
Ground Elevation: 375.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-103
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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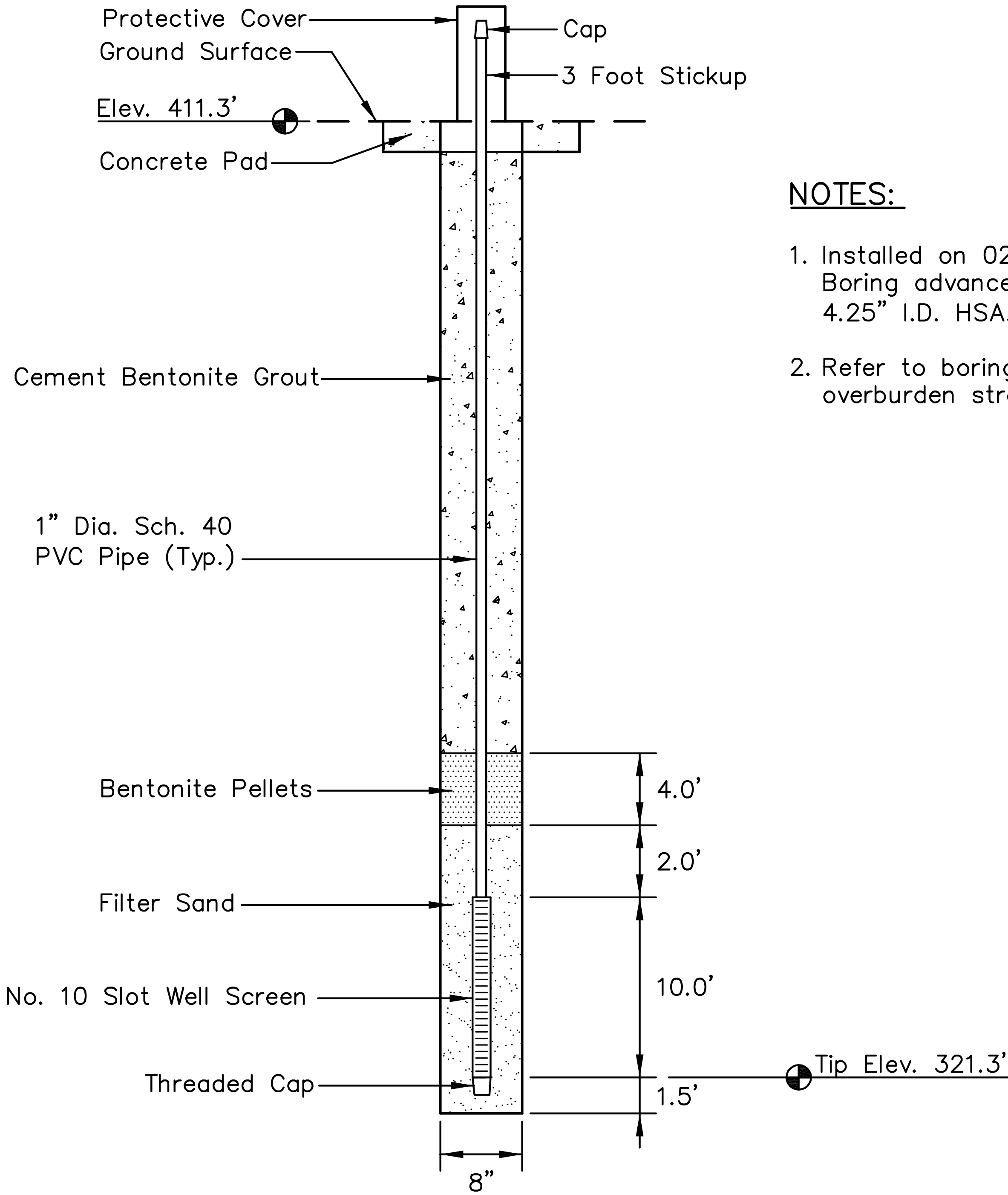
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	3 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/11/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-104.DWG

LOCATION

Northing: 314,242.09
Easting: 1,113,825.68
Ground Elevation: 411.3'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-104
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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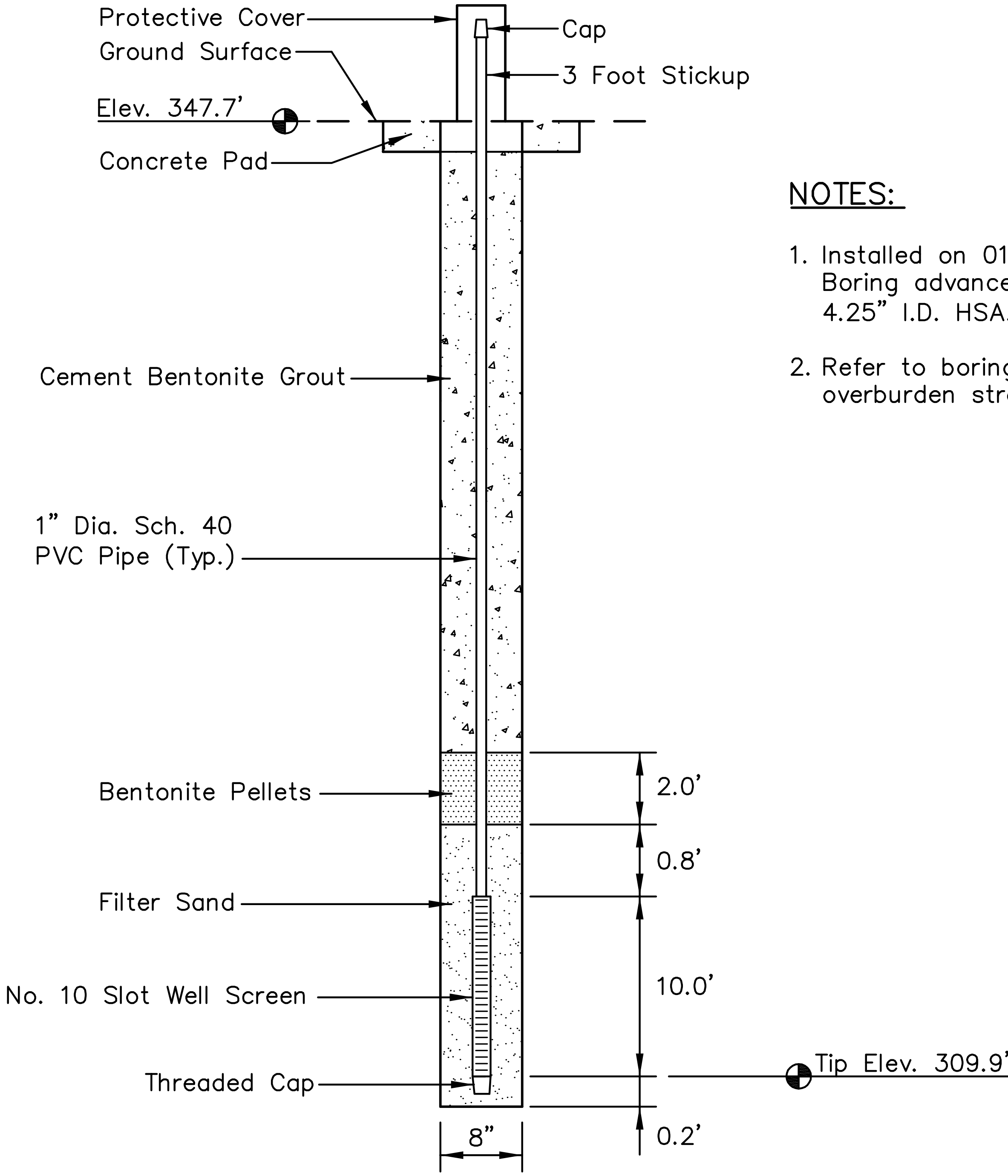
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	4 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/29/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/04/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-105.DWG

LOCATION

Northing: 313,503.36
Easting: 1,113,698.42
Ground Elevation: 347.7'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-105
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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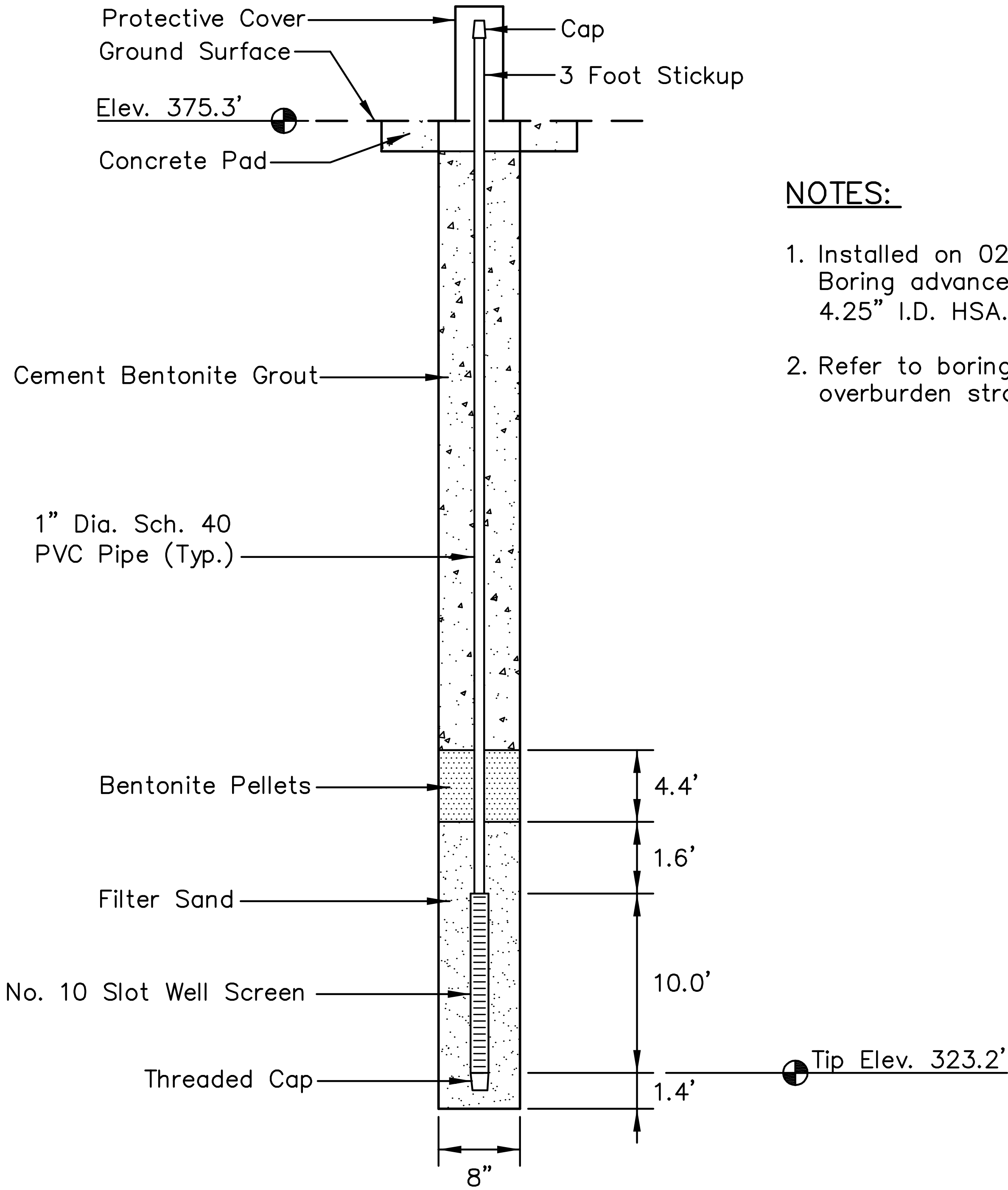
CHECKED BY	JRC	PROJ. NO.	175559035	1.		3.	5 OF 28
CHECKED BY	NAB	SCALE	NTS	2.		4.	



NOTES:

1. Installed on 02/24/10. Boring advanced with 4.25" I.D. HSA.

2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 313,516.57
Easting: 1,113,784.54
Ground Elevation: 375.3'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-106
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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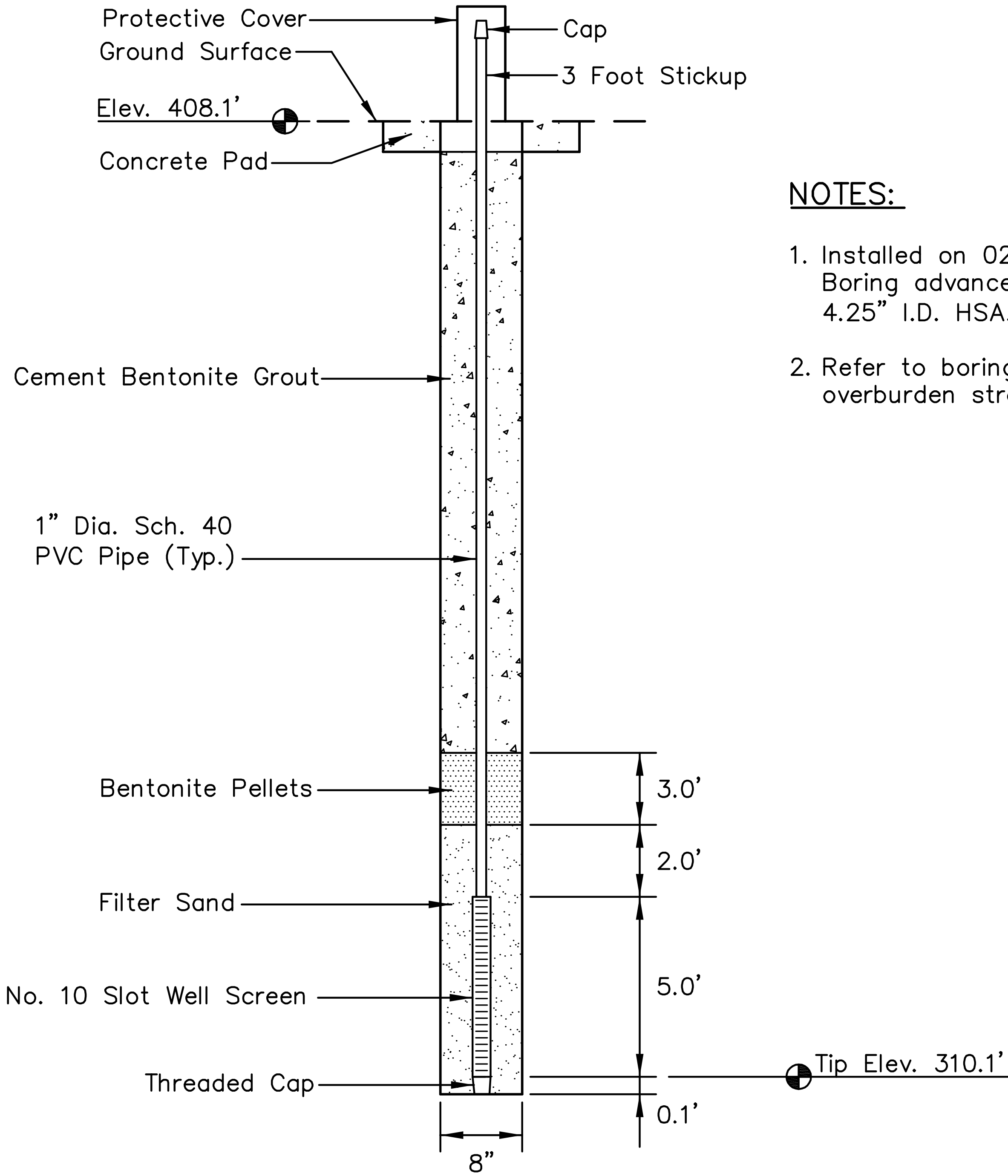
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	6 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/12/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-107.DWG

LOCATION

Northing: 313,531.32
Easting: 1,113,908.57
Ground Elevation: 408.1'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-107
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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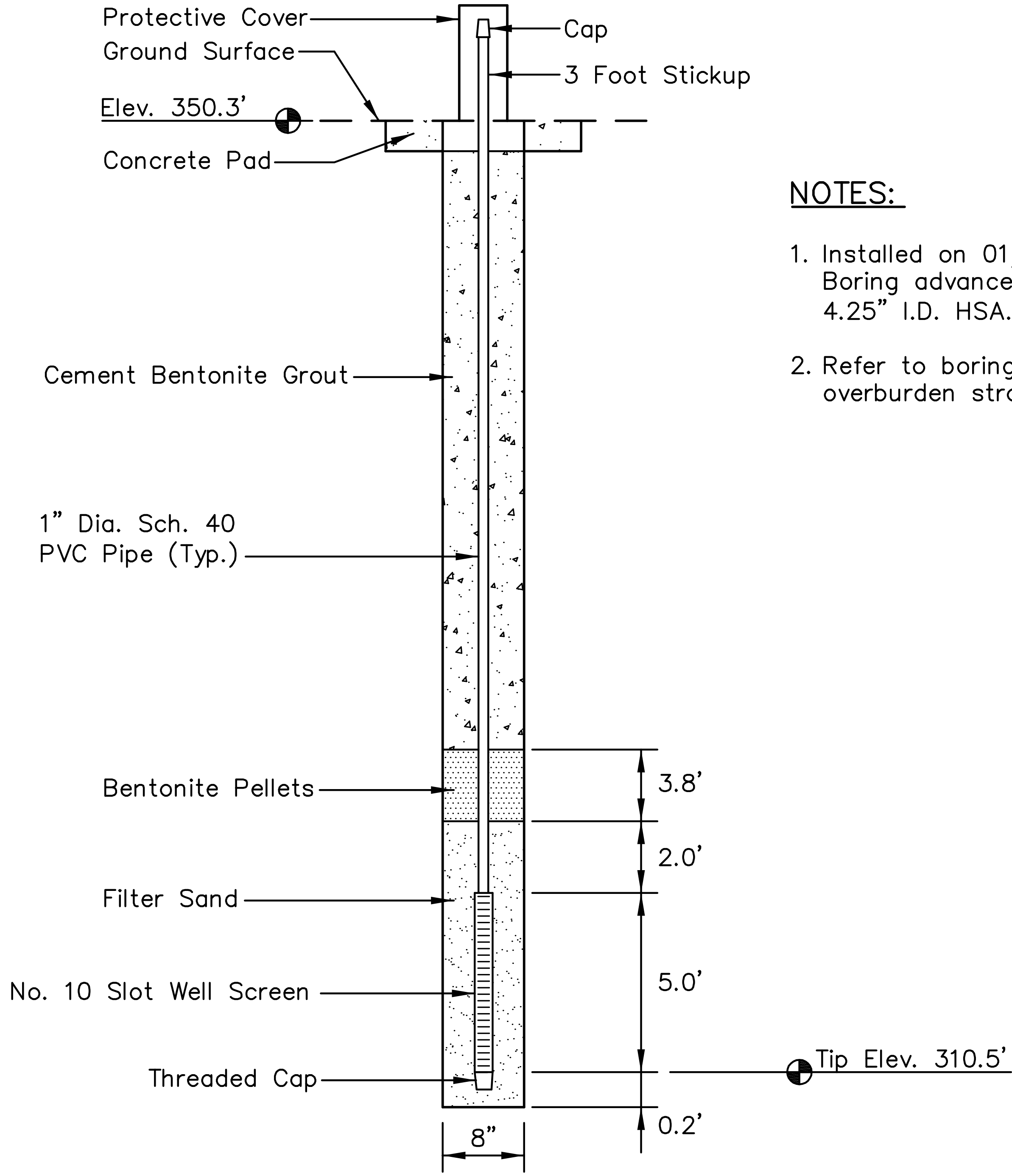
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/31/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,796.11
Easting: 1,113,871.67
Ground Elevation: 350.3'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-108
PIEZOMETER INSTALLATION DETAIL
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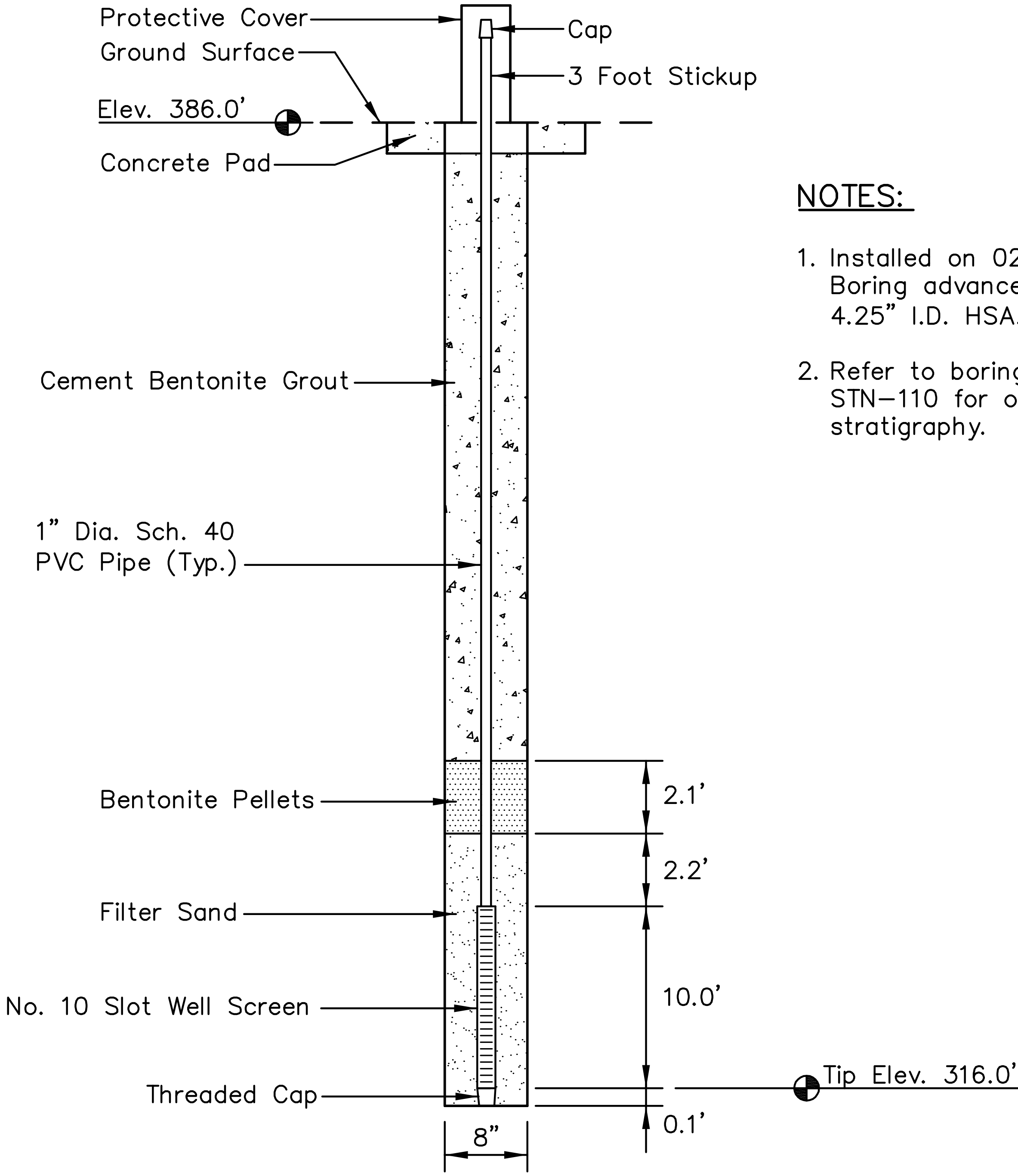

NOTES:

1. Installed on 02/24/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN-110 for overburden stratigraphy.

LOCATION

Northing: 312,824.38
Easting: 1,113,978.97
Ground Elevation: 386.0'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-109
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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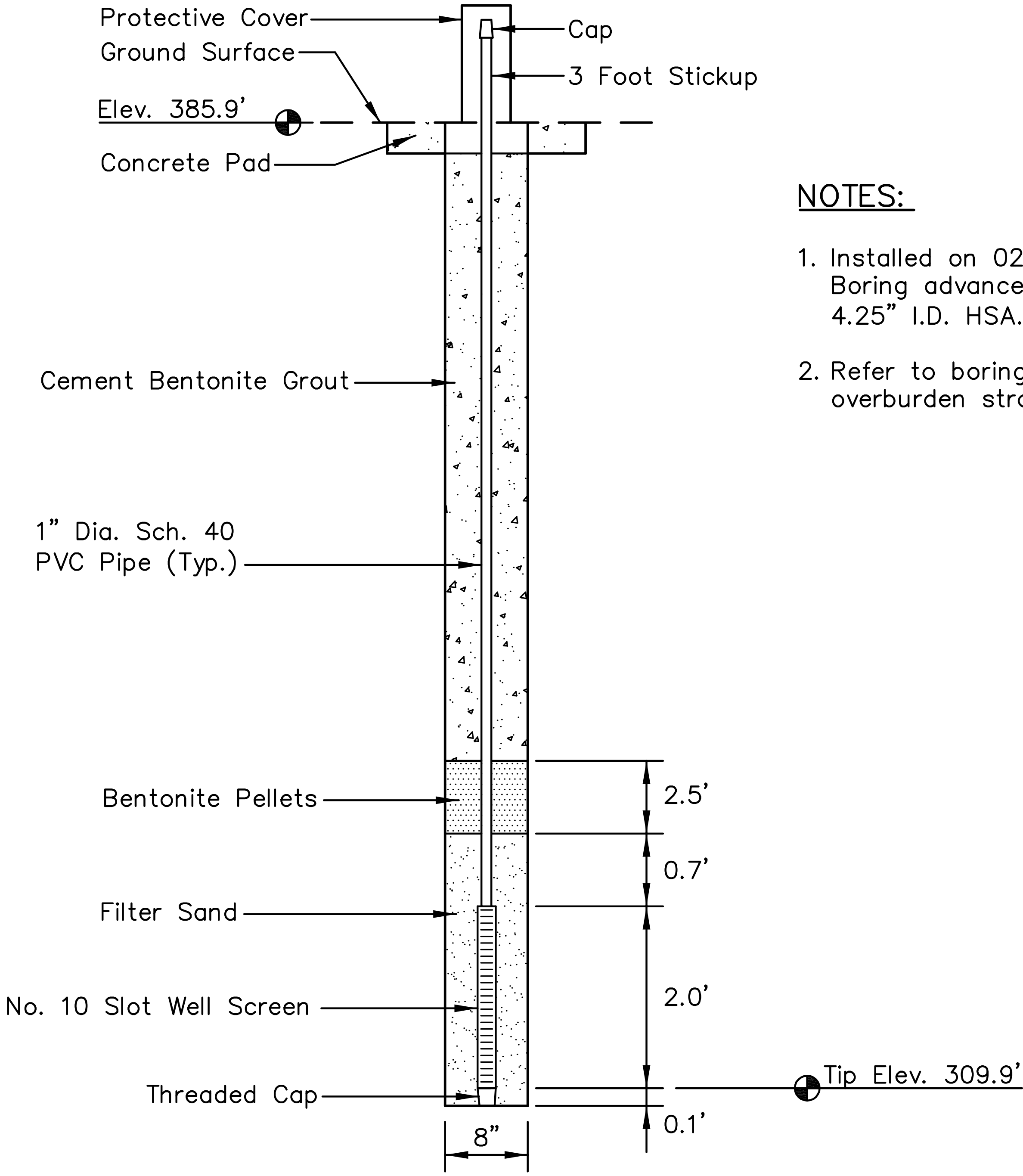
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/23/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/02/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-110.DWG

LOCATION

Northing: 312,829.42
Easting: 1,113,977.17
Ground Elevation: 385.9'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-110
PIEZOMETER INSTALLATION DETAIL
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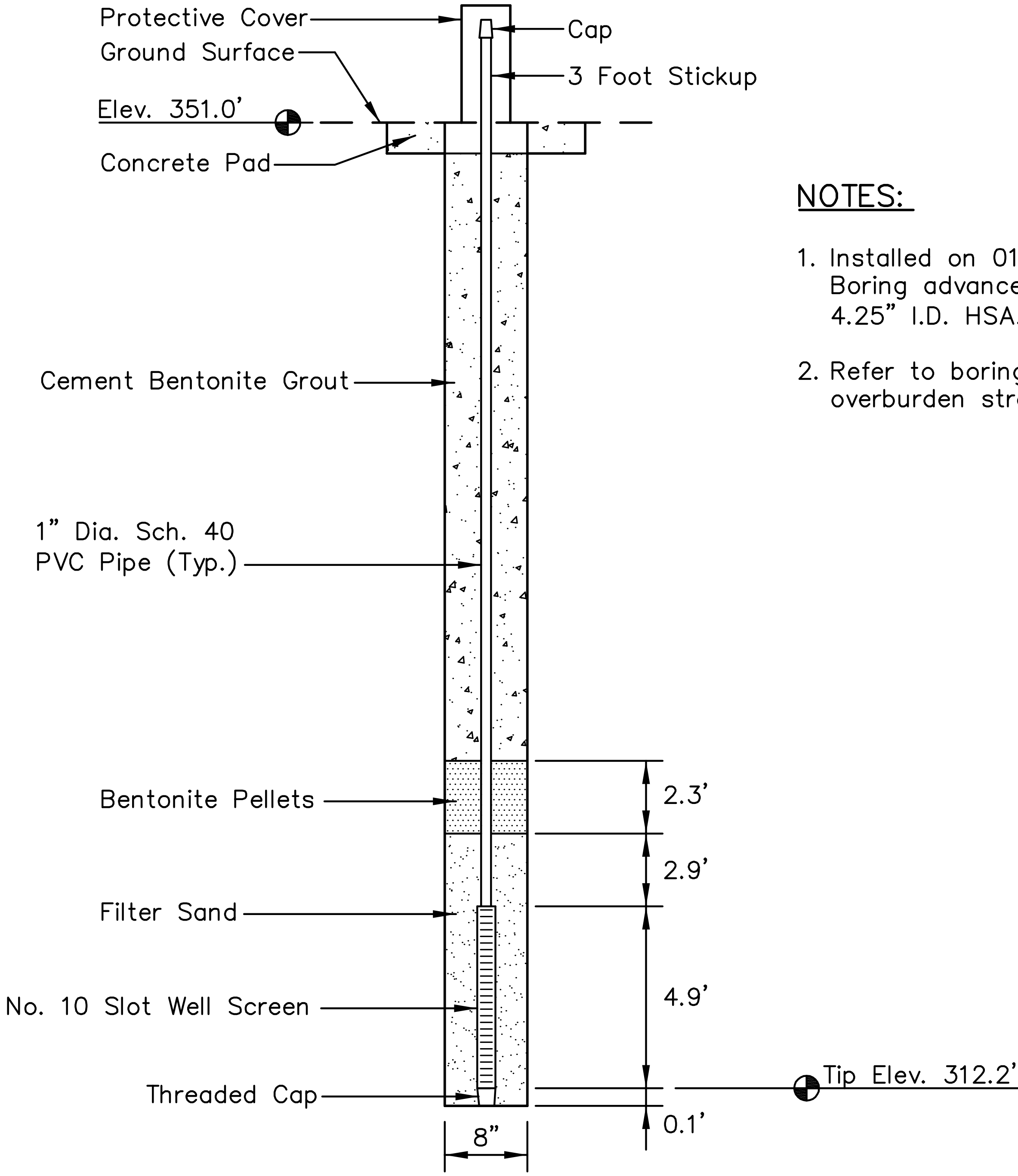

NOTES:

1. Installed on 01/18/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/04/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-111.DWG

LOCATION

Northing: 312,163.61
Easting: 1,114,222.26
Ground Elevation: 351.0'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-111
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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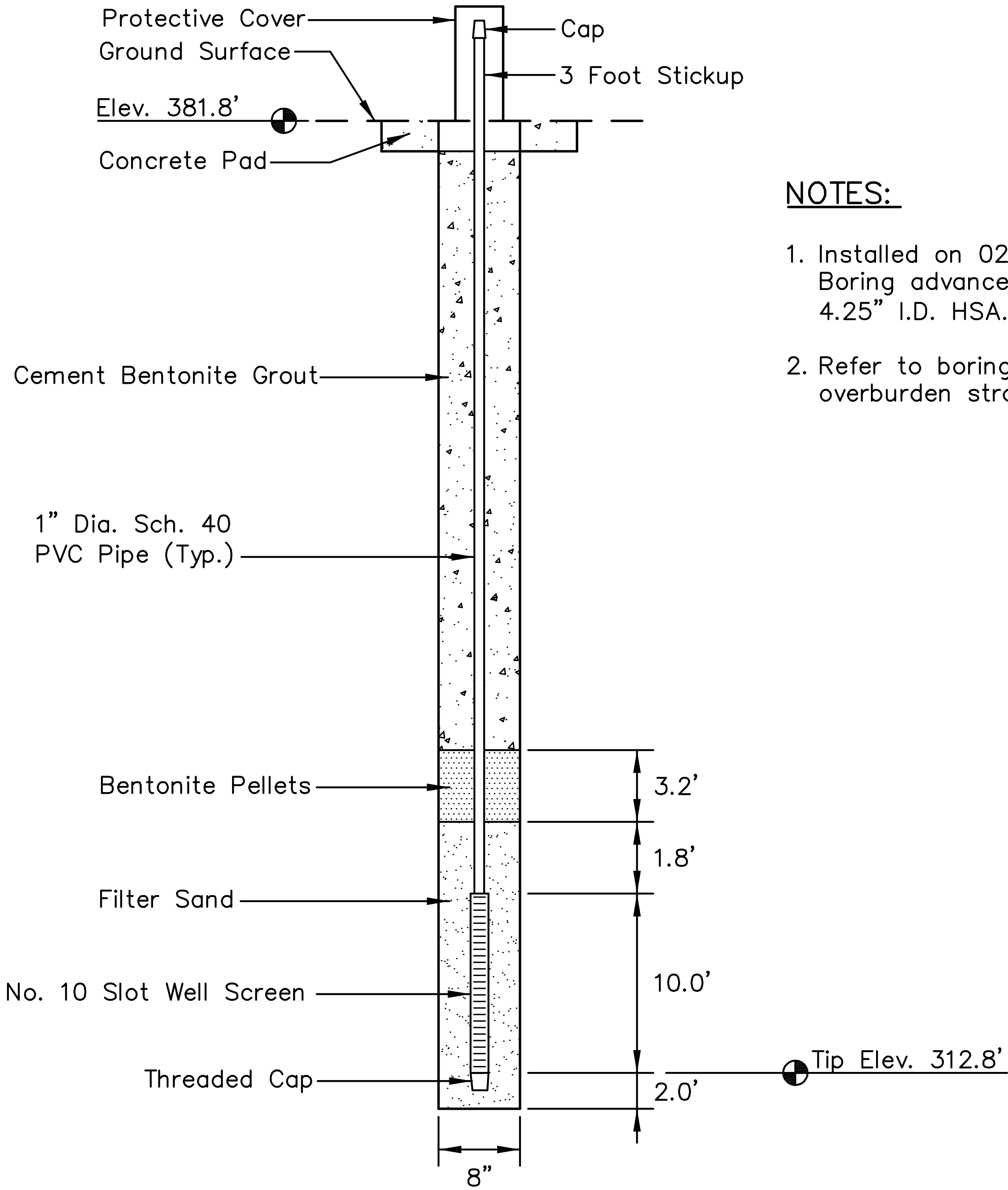
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	11 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/24/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/04/2010 USER: PETTY, RICHARD
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-112.DWG

LOCATION

Northing: 312,209.67
Easting: 1,114,305.60
Ground Elevation: 381.8'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-112
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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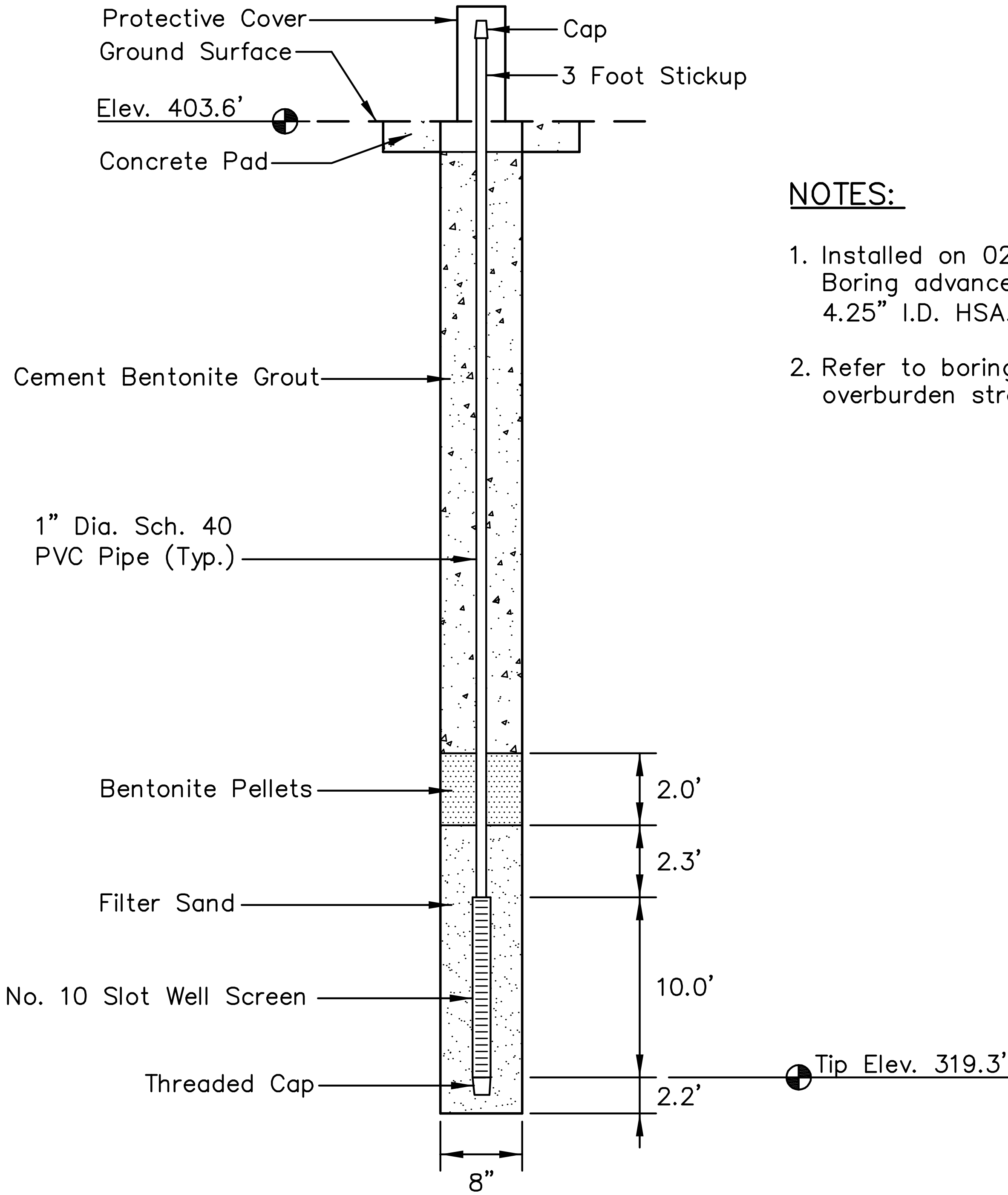

NOTES:

1. Installed on 02/13/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,261.99
Easting: 1,114,359.00
Ground Elevation: 403.6'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-113
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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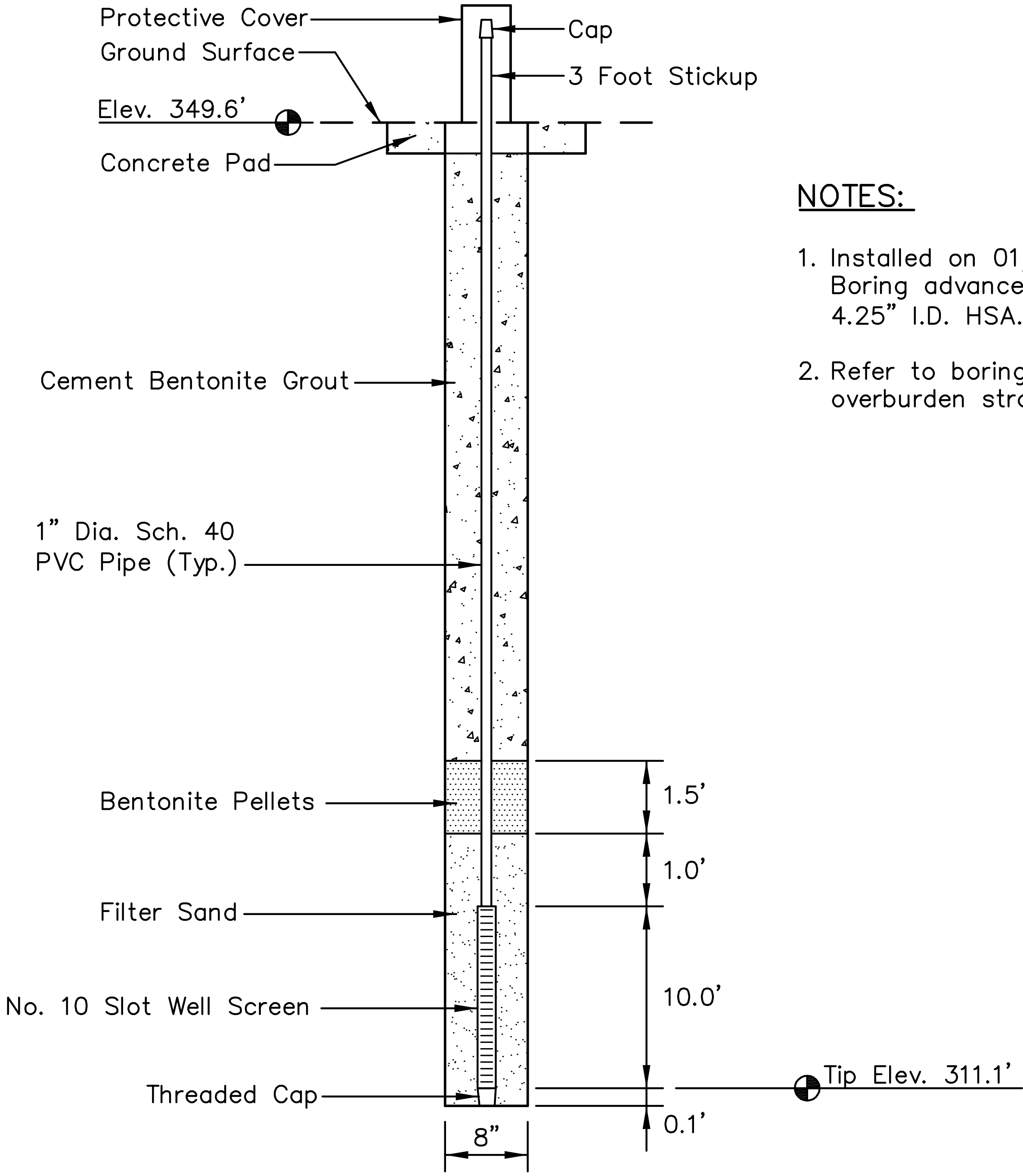

NOTES:

1. Installed on 01/17/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,043.43
Easting: 1,114,723.51
Ground Elevation: 349.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-114
PIEZOMETER INSTALLATION DETAIL
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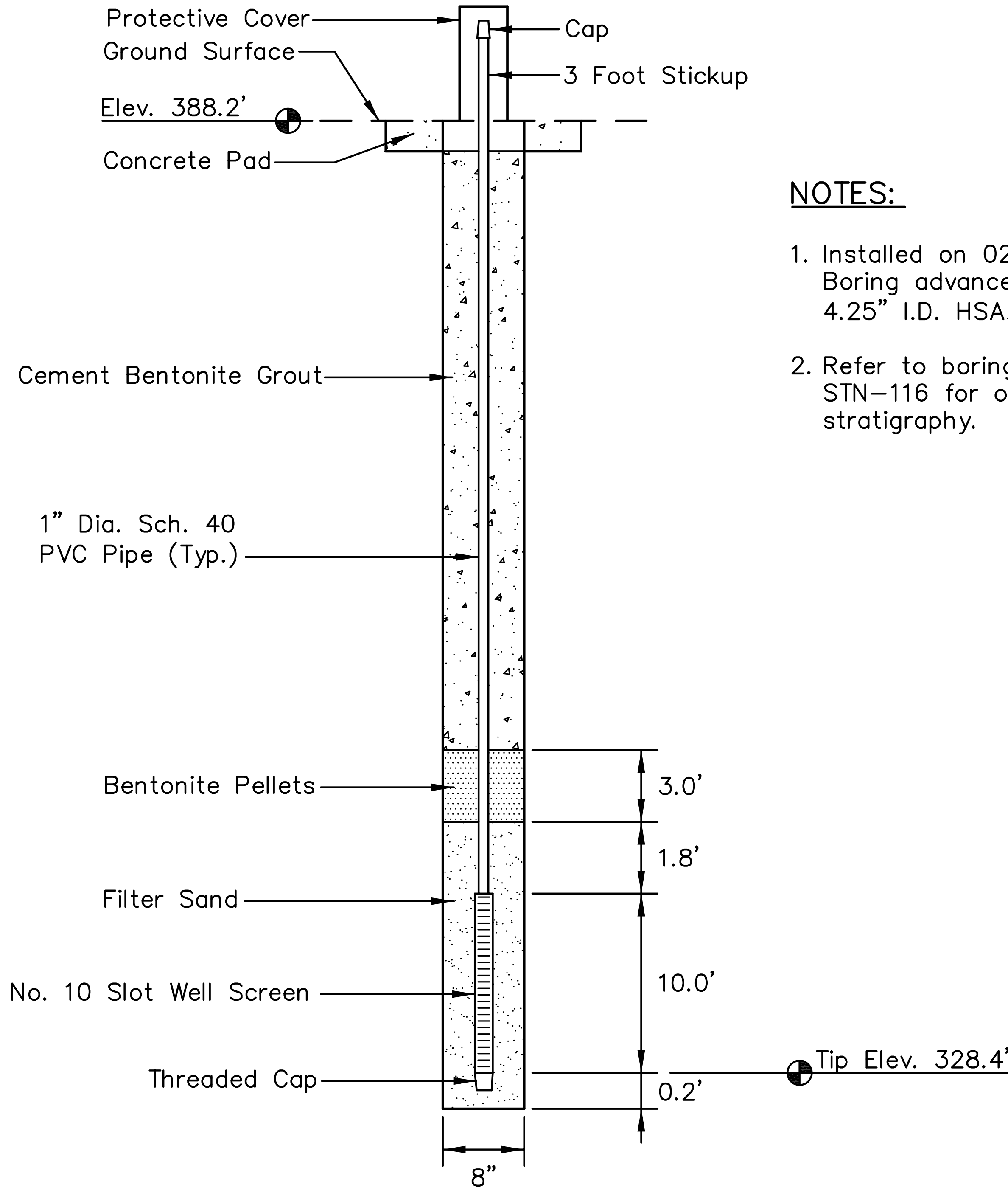

NOTES:

1. Installed on 02/23/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN-116 for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-115.DWG

LOCATION

Northing: 312,148.78
Easting: 1,114,670.38
Ground Elevation: 388.2'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-115
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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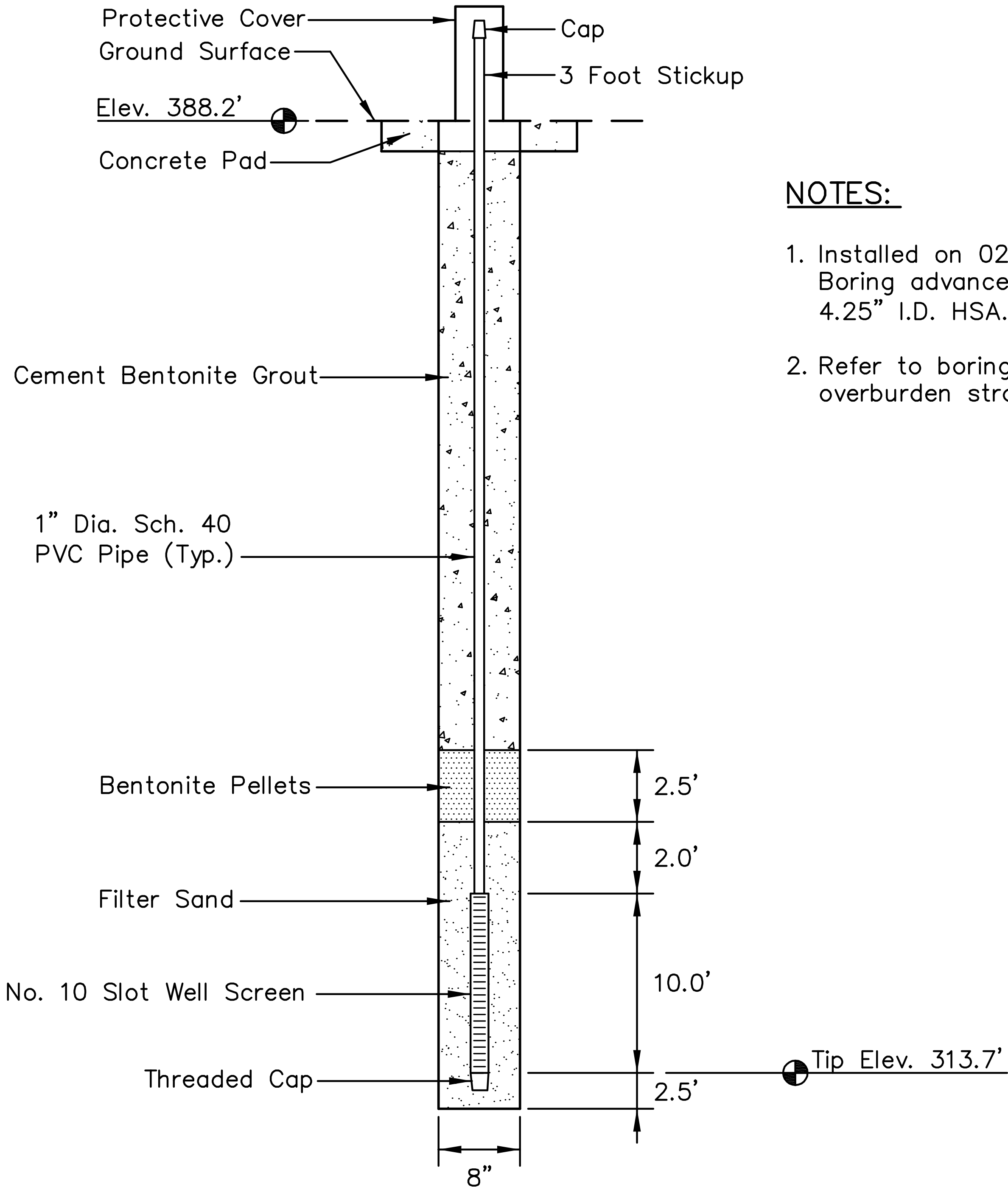

NOTES:

1. Installed on 02/23/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,151.06
Easting: 1,114,675.00
Ground Elevation: 388.2'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-116
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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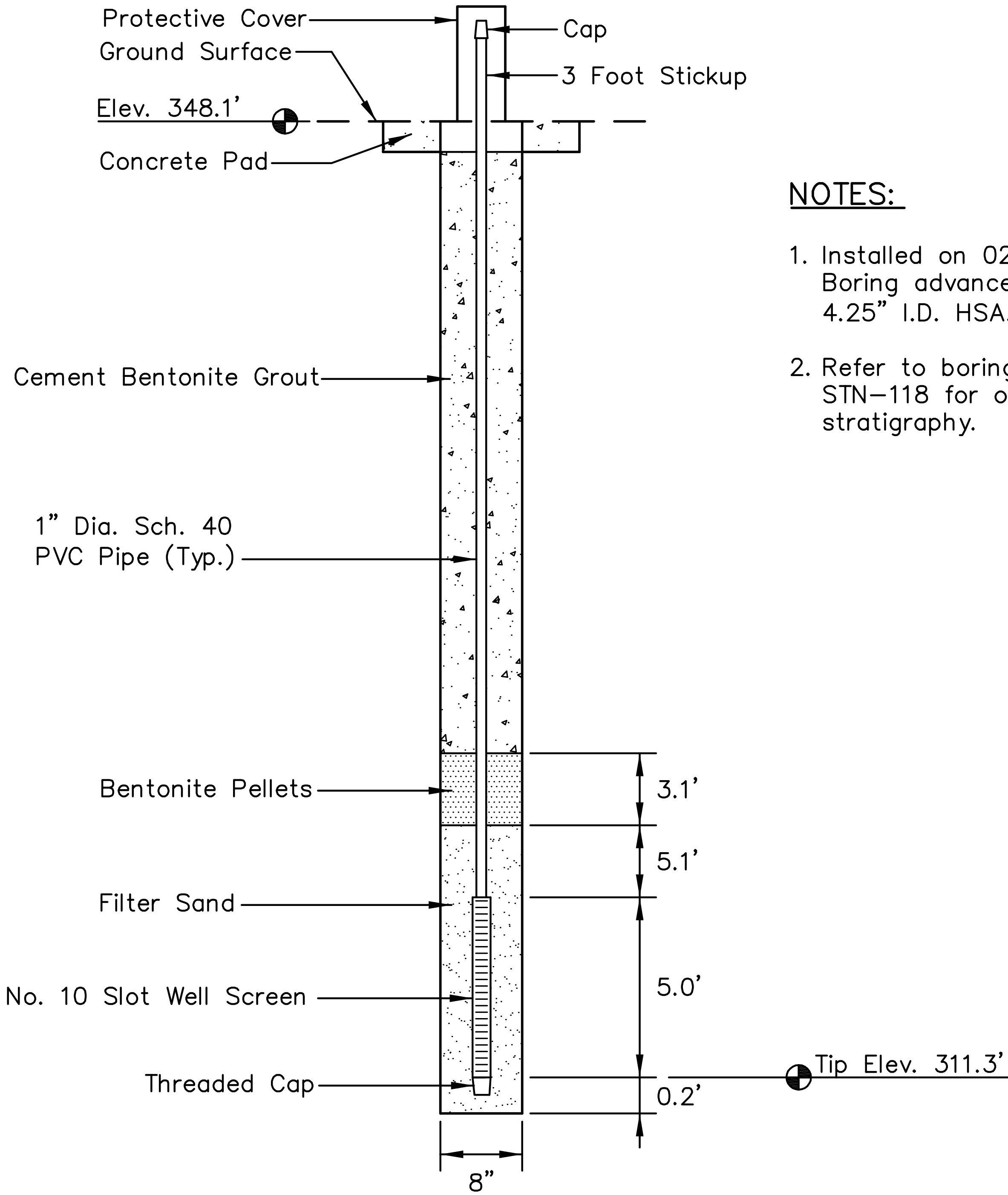
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/01/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log STN–118 for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-117.DWG

LOCATION

Northing: 312,849.17
Easting: 1,115,060.52
Ground Elevation: 348.1'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-117
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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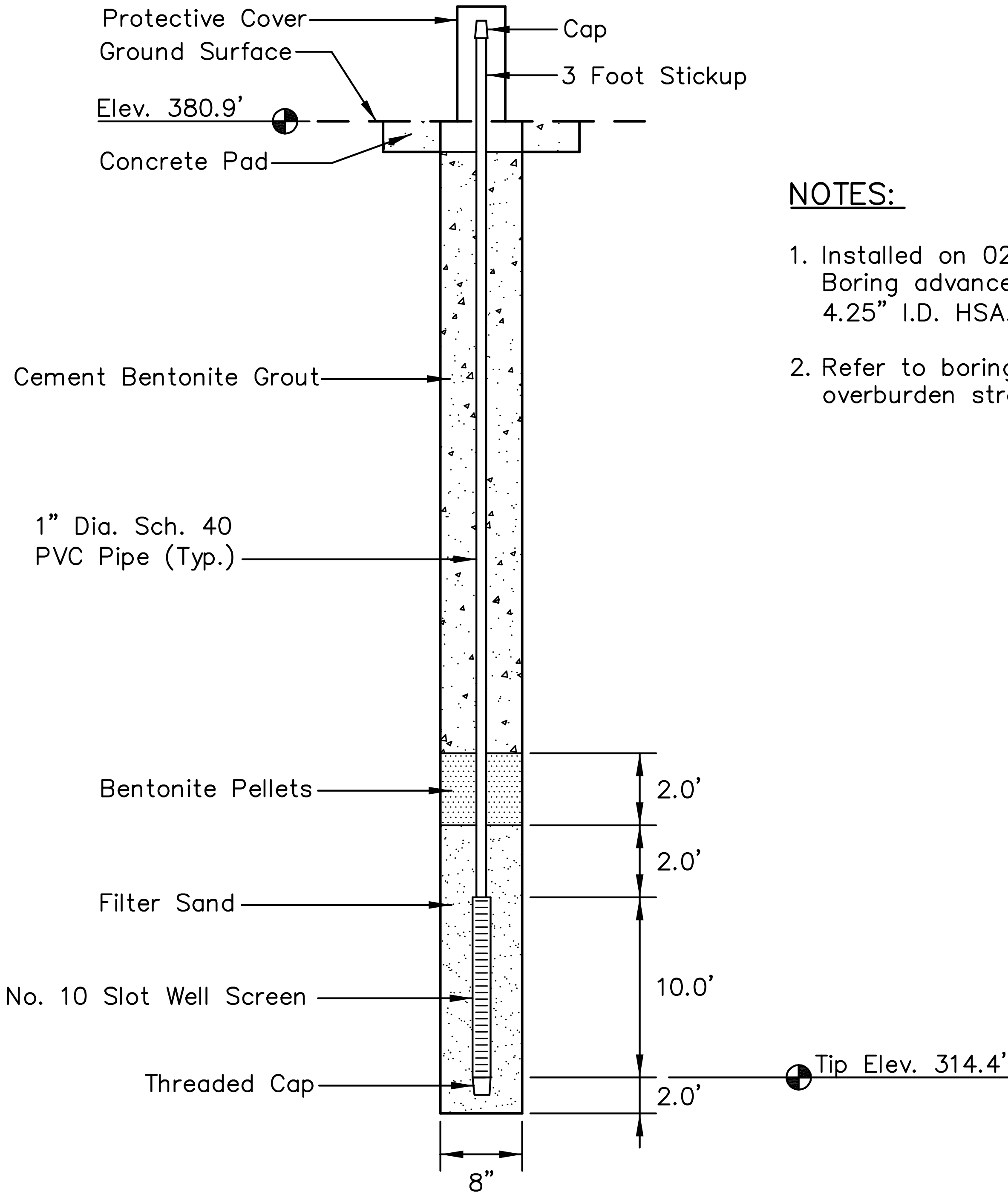
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 02/23/10. Boring advanced with 4.25" I.D. HSA.

2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-119.DWG

LOCATION

Northing: 312,857.74
Easting: 1,114,949.90
Ground Elevation: 380.9'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-119
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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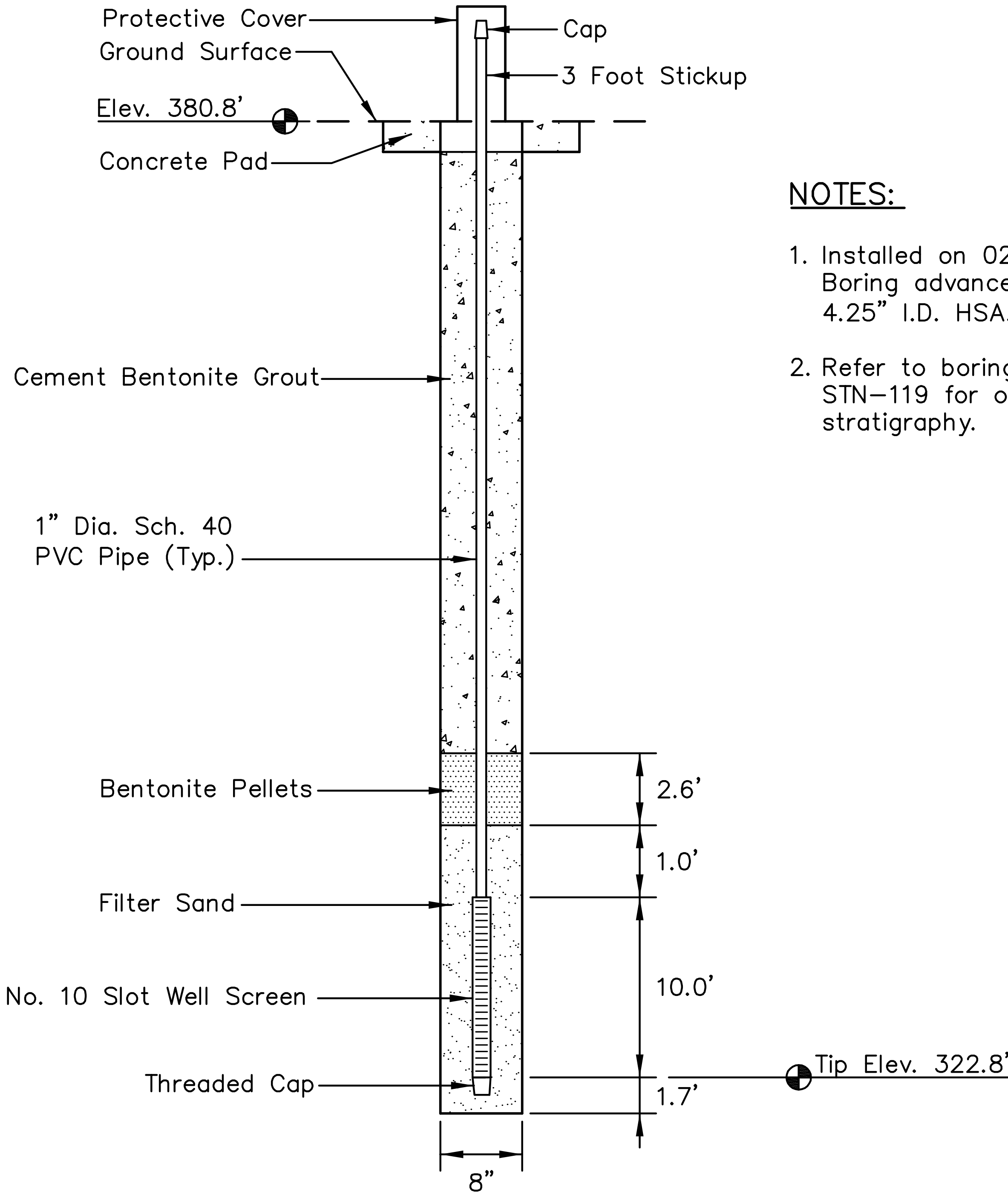

NOTES:

1. Installed on 02/23/10. Boring advanced with 4.25" I.D. HSA.

2. Refer to boring log STN–119 for overburden stratigraphy.

LOCATION

Northing: 312,862.75
Easting: 1,114,950.57
Ground Elevation: 380.8'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-120
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
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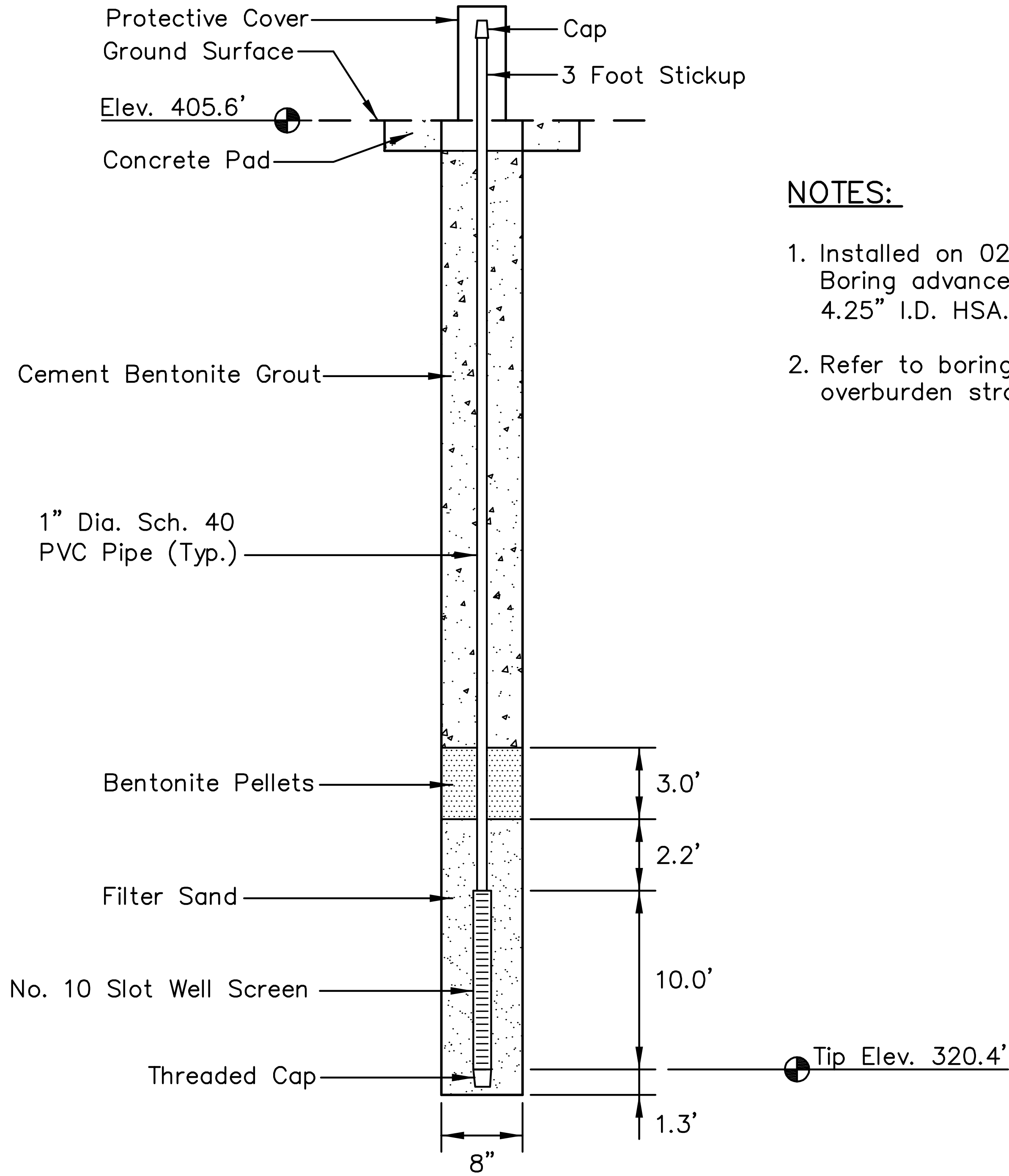

NOTES:

1. Installed on 02/16/10. Boring advanced with 4.25" I.D. HSA.

2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,853.82
Easting: 1,114,867.54
Ground Elevation: 405.6'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-121
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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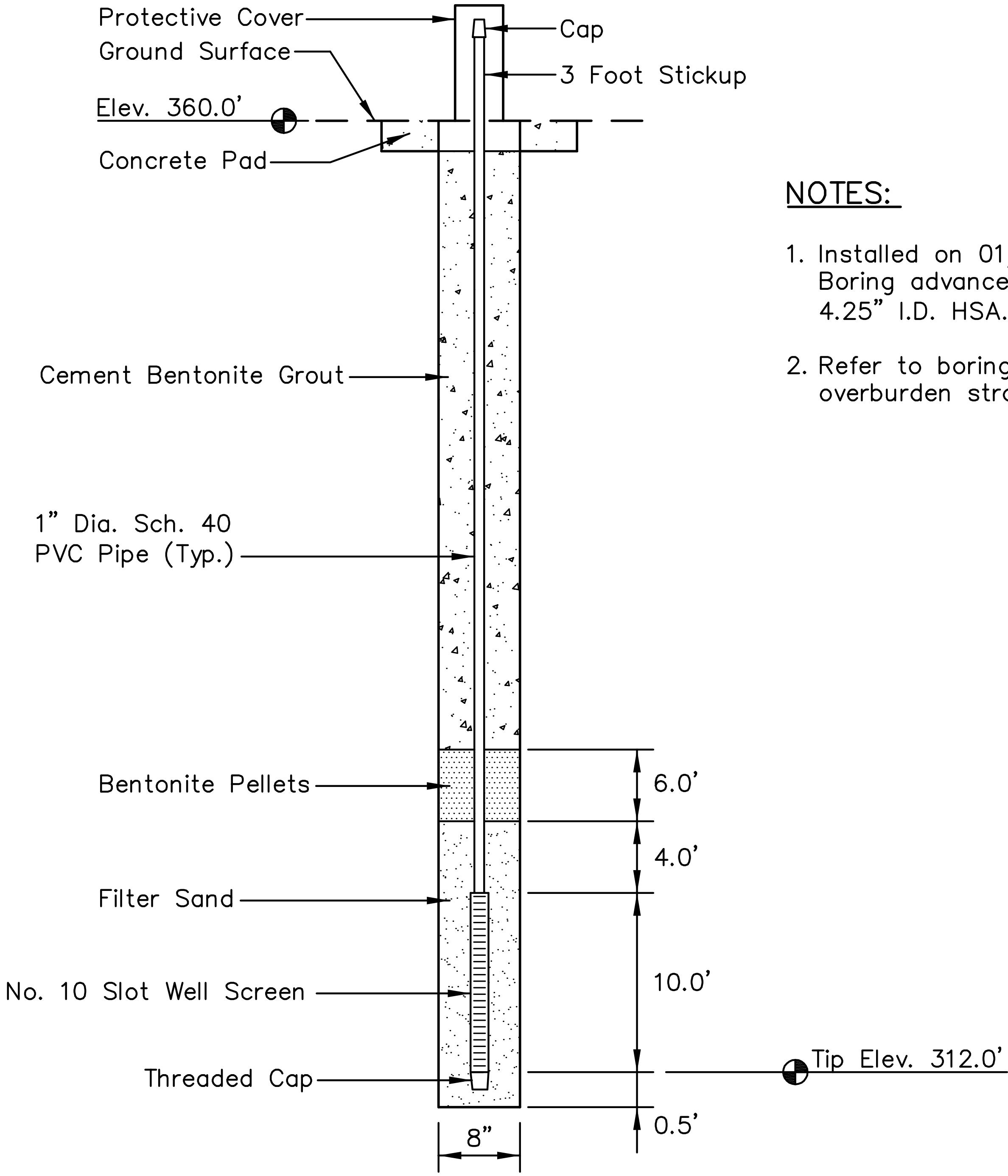
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/12/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 313,845.00
Easting: 1,114,860.16
Ground Elevation: 360.0'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-122
PIEZOMETER INSTALLATION DETAIL
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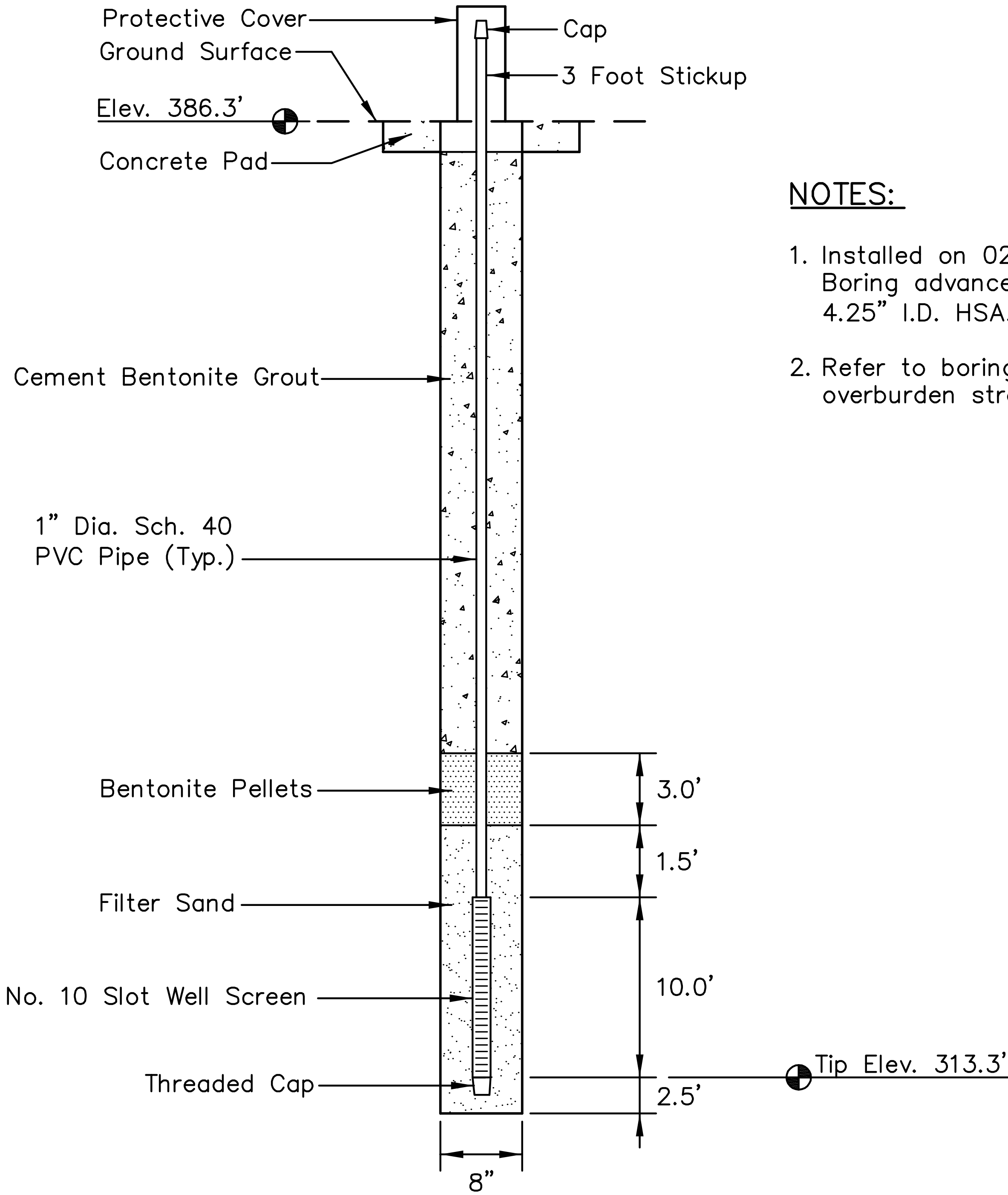
CHECKED BY	NAB	SCALE	NTS	2.	4.	

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-122.DWG



NOTES:

1. Installed on 02/13/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 313,861.58
Easting: 1,114,760.17
Ground Elevation: 386.3'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-123
PIEZOMETER INSTALLATION DETAIL
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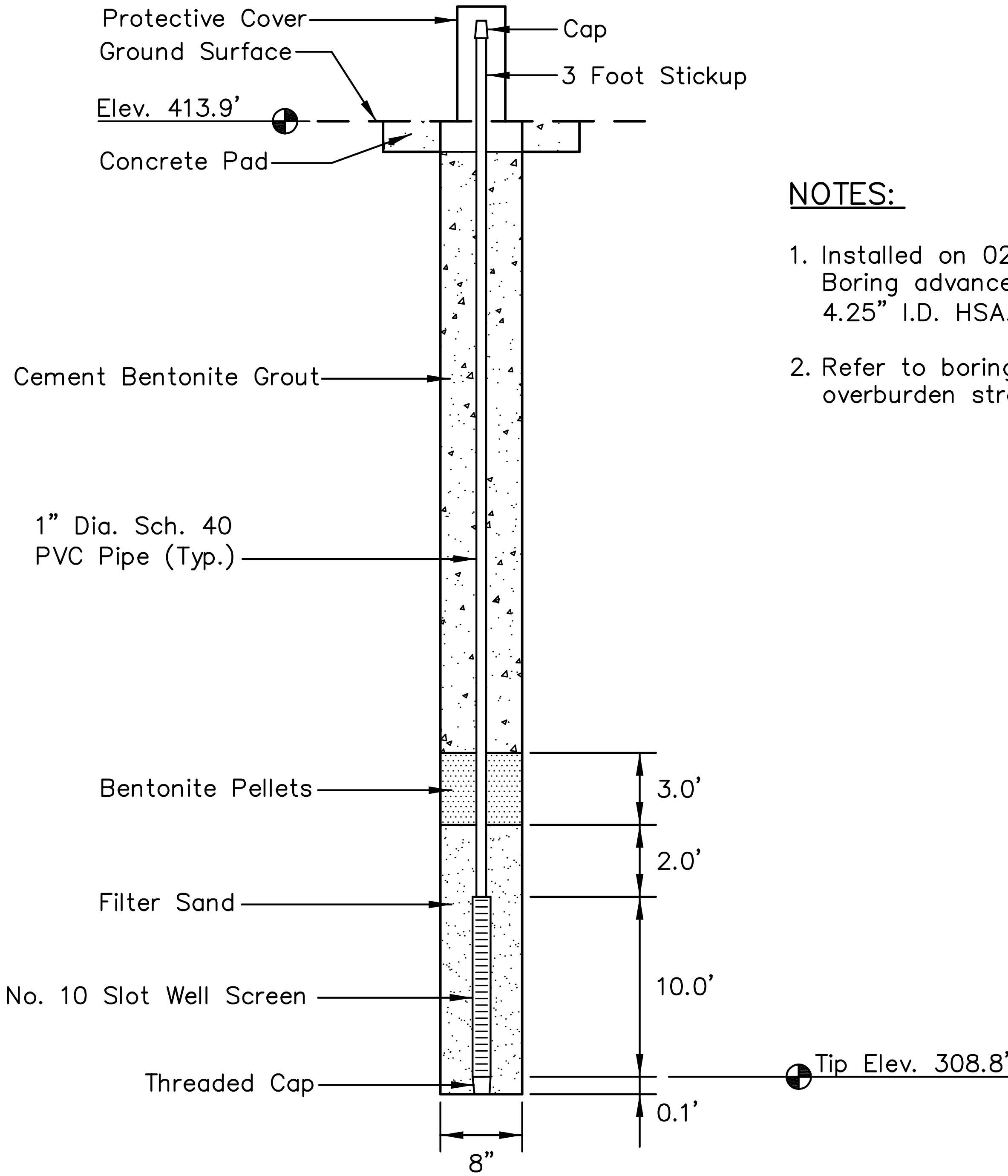

NOTES:

1. Installed on 02/15/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-124.DWG

LOCATION

Northing: 313,889.25
Easting: 1,114,655.68
Ground Elevation: 413.9'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-124
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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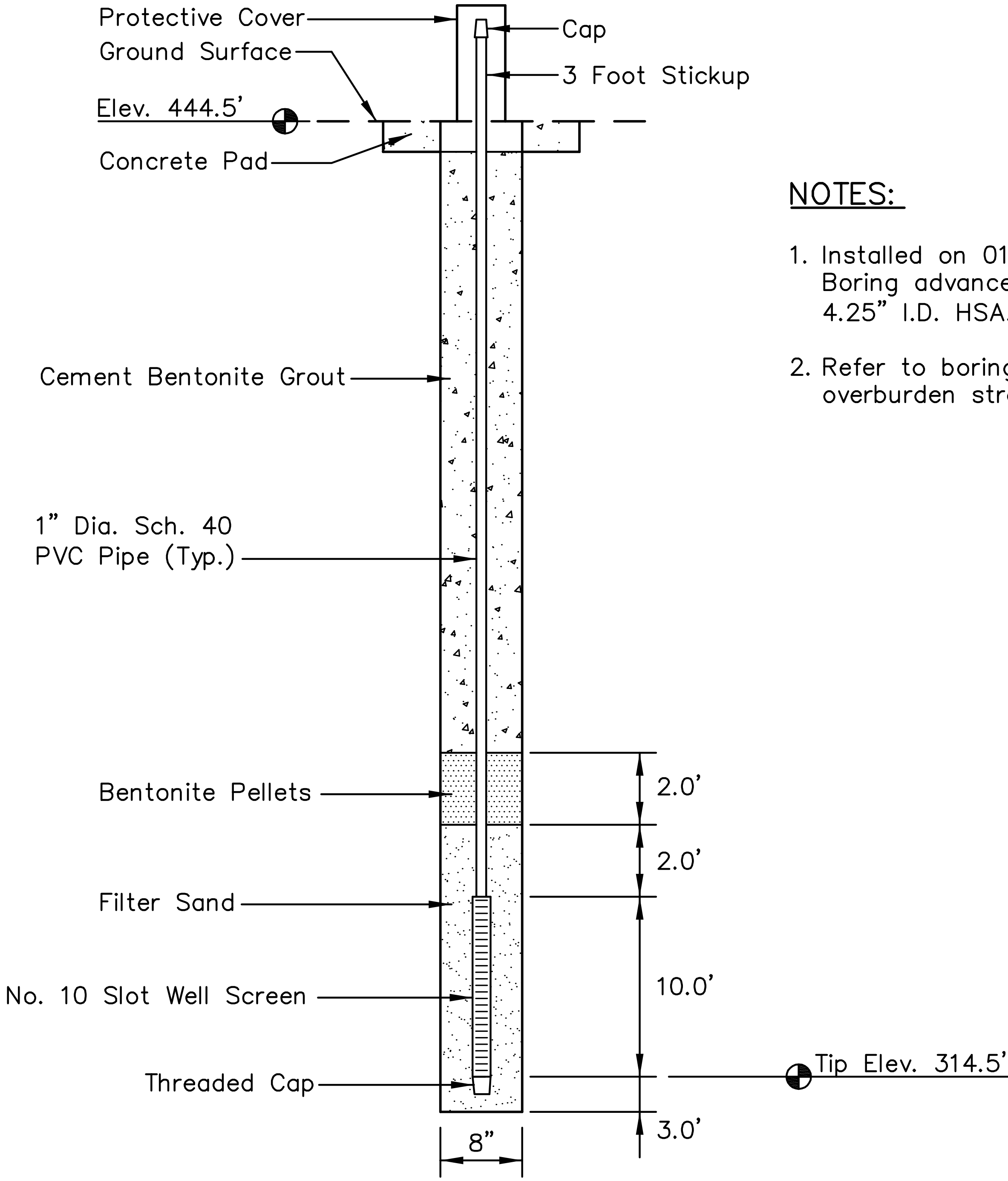
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/12/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 313,973.57
Easting: 1,114,166.63
Ground Elevation: 444.5'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-125
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
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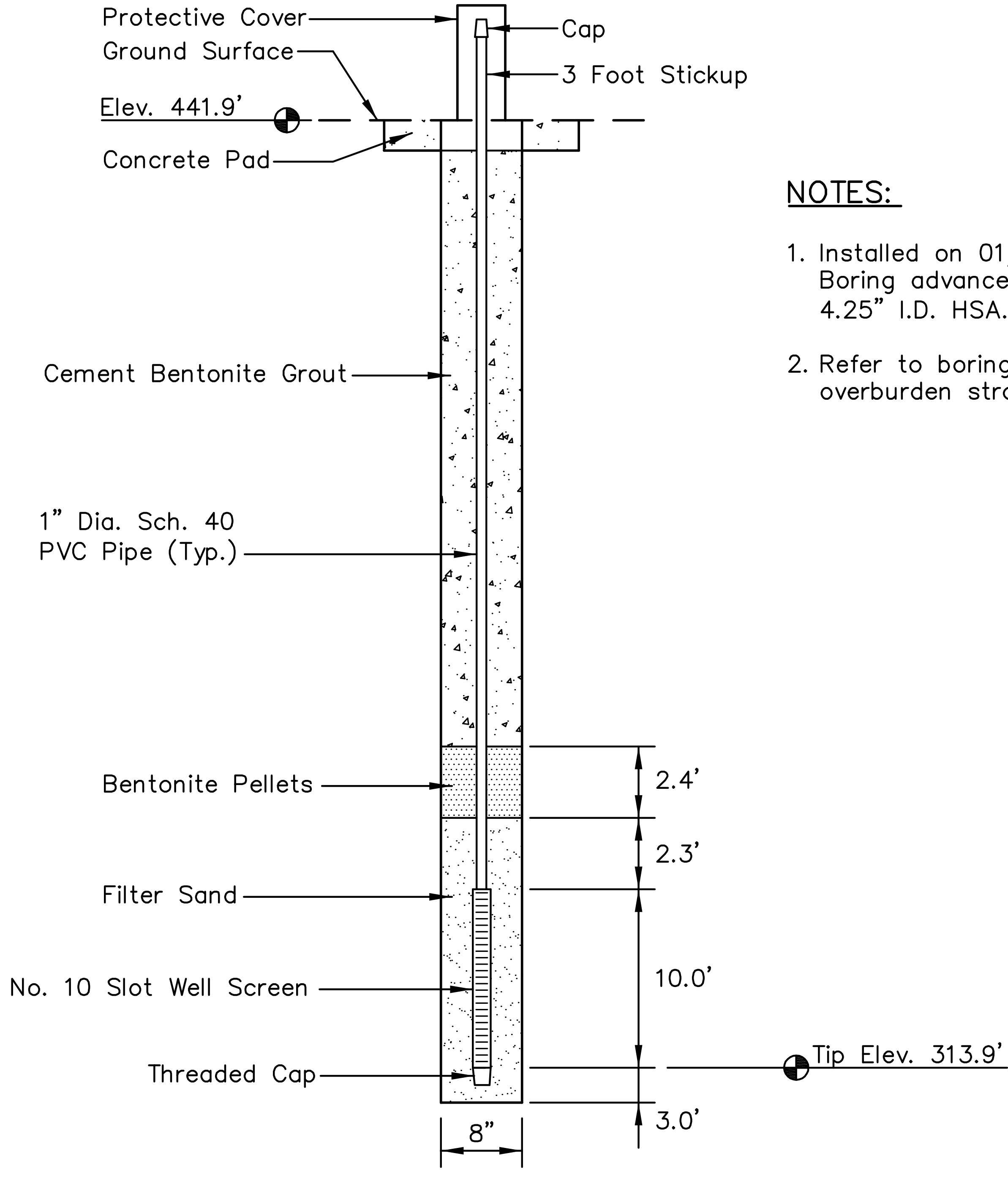
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	24 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/14/10. Boring advanced with 4.25" I.D. HSA.

2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 313,245.28
Easting: 1,114,516.15
Ground Elevation: 441.9'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

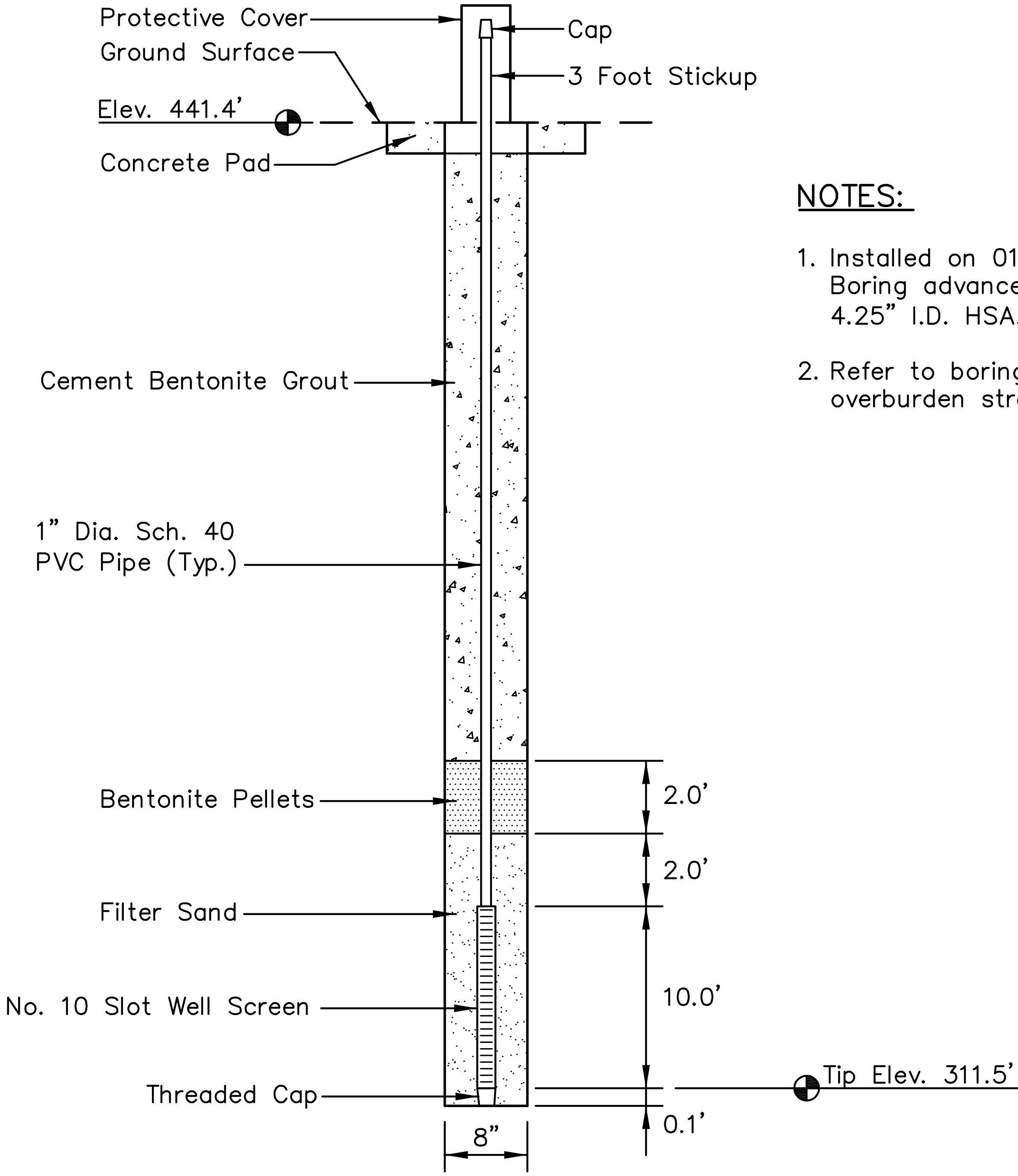
STN-126
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

Stantec

Stantec Consulting Services Inc.
1901 Nelson Miller Parkway
Louisville, Kentucky
40223-2177
502-212-5000

www.stantec.com

DRAWN BY	SB	DATE	FEB., 2010	REVISED		SHEET
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	25 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/17/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 312,463.74
Easting: 1,114,532.22
Ground Elevation: 441.4'

Locations provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-127
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

Stantec

Stantec Consulting Services Inc.
1901 Nelson Miller Parkway
Louisville, Kentucky
40223-2177
502-212-5000
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DRAWN BY	SB	DATE	FEB., 2010	REVISED			SHEET
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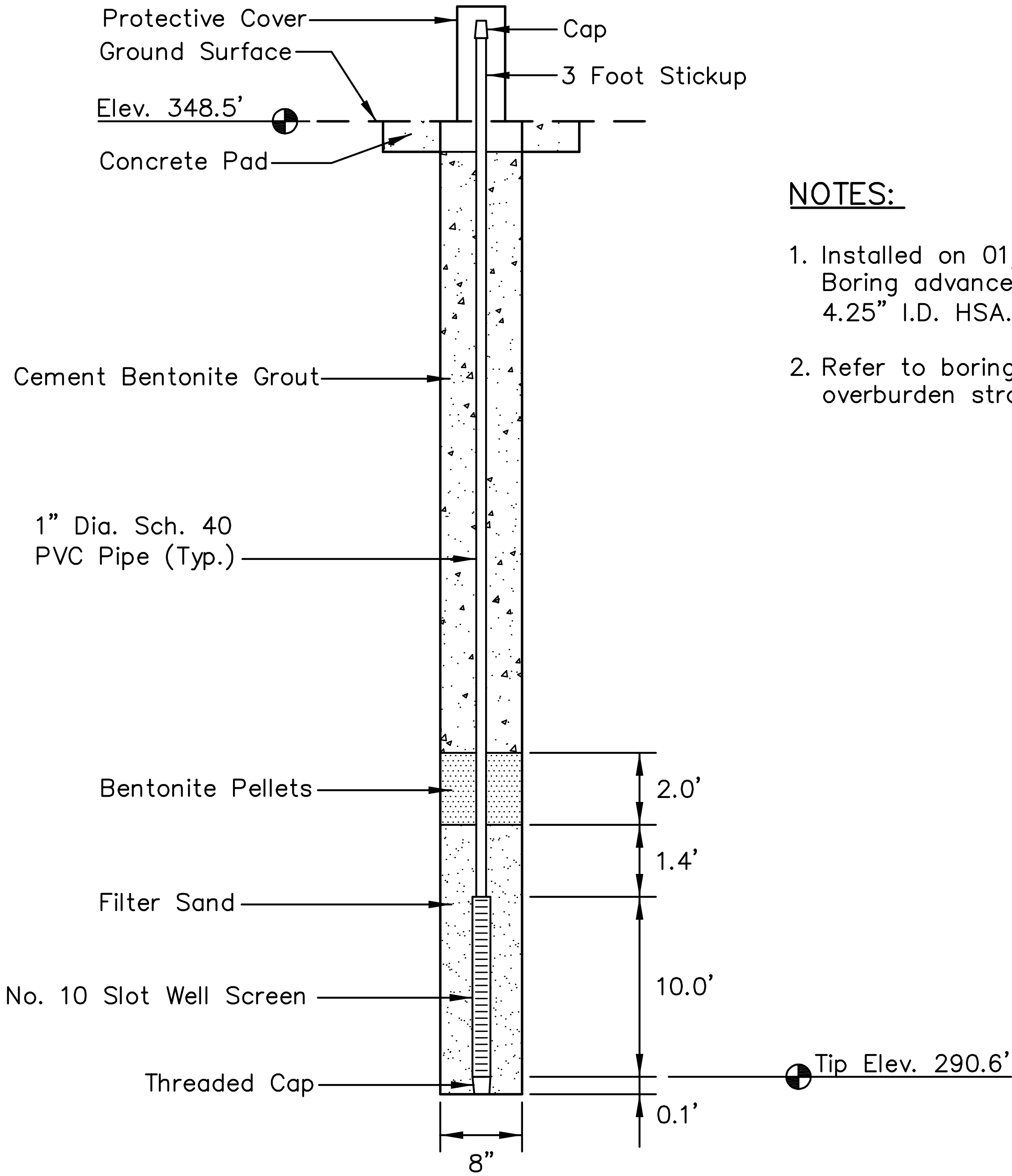
CHECKED BY	NAB	SCALE	NTS	2.		4.	



NOTES:

1. Installed on 01/13/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

PLOT DATE: 03/01/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559035\GEOTECHNICAL\DRAWING\PZ_DETAILS\59035PZ-STN-128.DWG

LOCATION

Northing: 315,914.33
Easting: 1,115,215.99
Ground Elevation: 348.5'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-128
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

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1901 Nelson Miller Parkway
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40223-2177
502-212-5000
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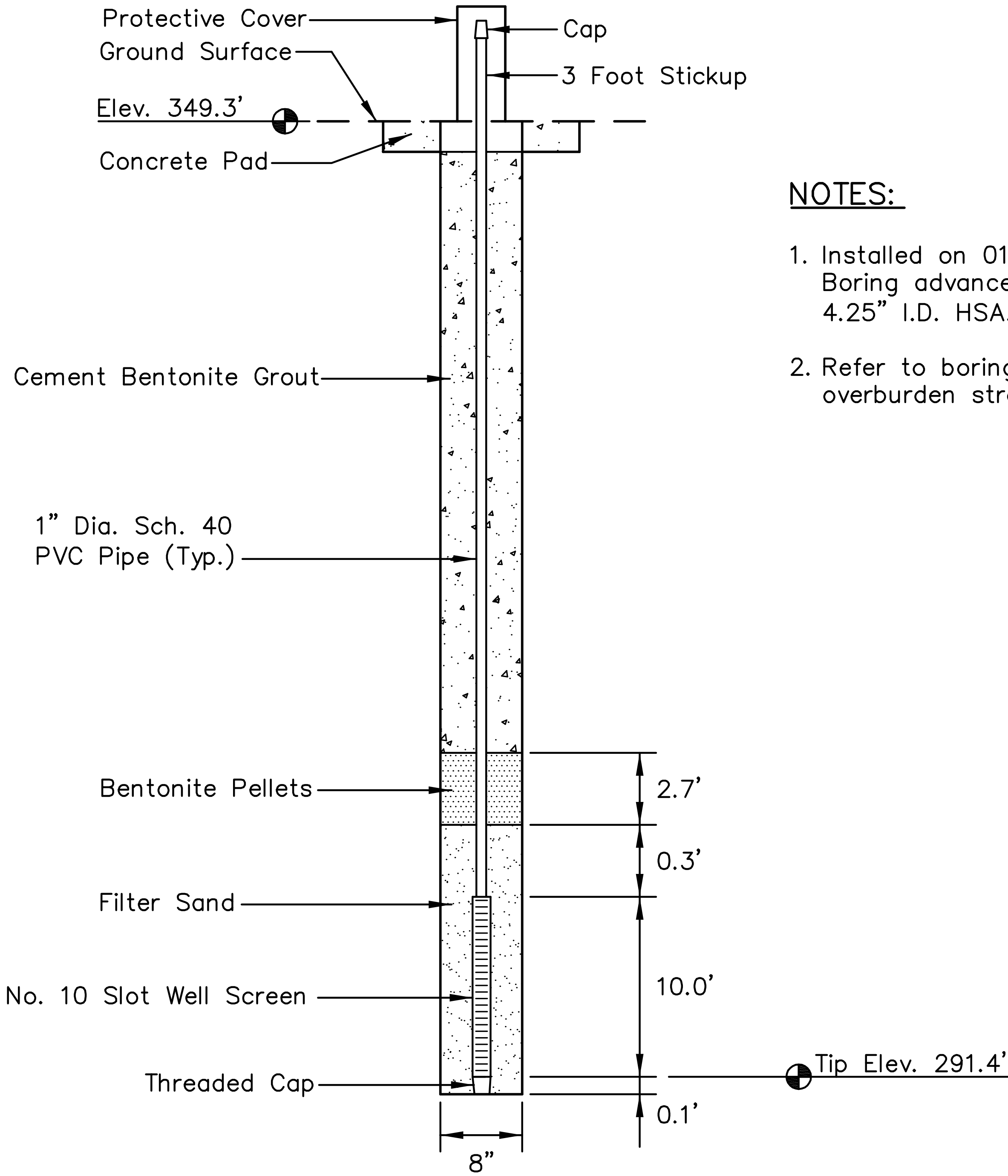
DRAWN BY	SB	DATE	FEB., 2010	REVISED		SHEET
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	27 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	



NOTES:

1. Installed on 01/14/10. Boring advanced with 4.25" I.D. HSA.
2. Refer to boring log for overburden stratigraphy.

LOCATION

Northing: 315,283.90
Easting: 1,116,404.12
Ground Elevation: 349.3'

Locations provided by TVA,
Power Systems Operations,
Surveying and Project Services.
Horizontal Datum: NAD 27
Vertical Datum: NGVD29

STN-129
PIEZOMETER INSTALLATION DETAIL
SHAWNEE FOSSIL PLANT
CONSOLIDATED WASTE DRY STACK

Stantec

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40223-2177
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DRAWN BY	SB	DATE	FEB., 2010	REVISED		SHEET
CHECKED BY	JRC	PROJ. NO.	175559035	1.	3.	28 OF 28
CHECKED BY	NAB	SCALE	NTS	2.	4.	

Appendix C

Laboratory Test Results

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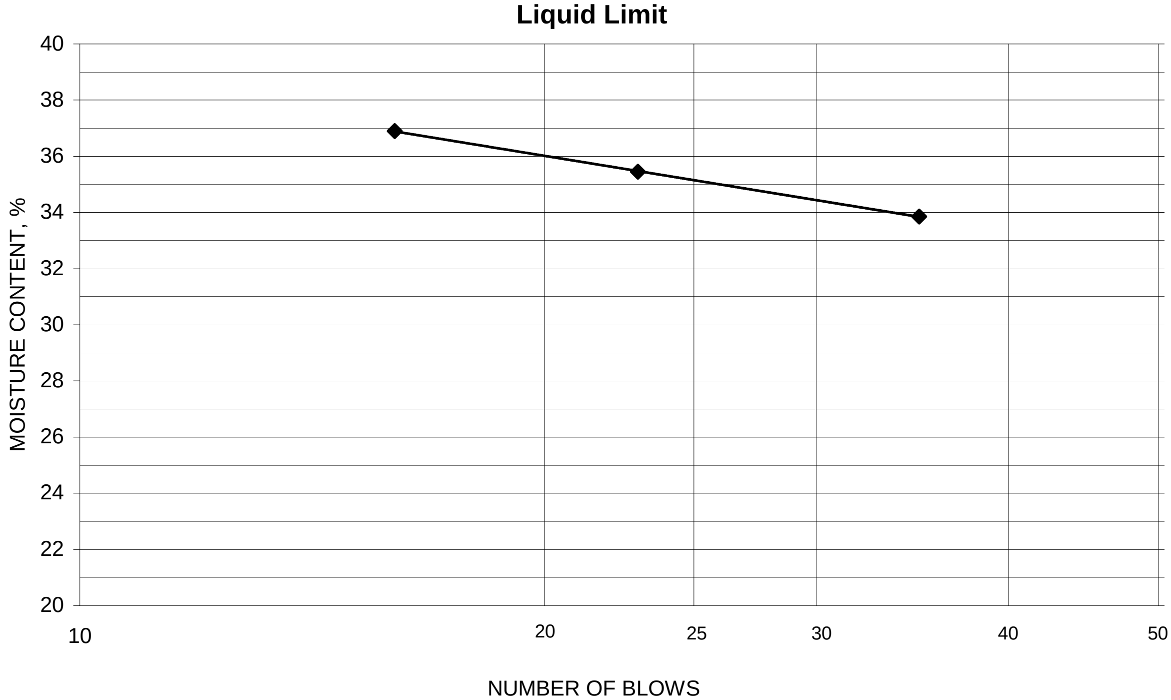
ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-1, 15.0'-16.5'	Lab ID	11
Tested By	KDK Test Method ASTM D 4318 Method A	% + No. 40	9
Test Date	10-08-2009 Prepared Dry	Date Received	10-01-2009

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
14.73	12.11	4.37	35	33.9	
14.76	12.03	4.33	23	35.5	
15.09	12.19	4.33	16	36.9	35

Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
12.04	10.84	4.35	18.5	19	16
11.73	10.54	4.31	19.1		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-2, 41.0'-42.5'	Lab ID	54
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 26.2

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	98.9
No. 200	0.075	94.3
	0.02	69.2
	0.005	37.9
	0.002	30.0
estimated	0.001	27.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	1.1
Medium Sand	1.1	---
Fine Sand	4.6	4.6
Silt	56.4	64.3
Clay	37.9	30.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 37

Plastic Limit: 18

Plasticity Index: 19

Activity Index: 0.63

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-6 (18)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-2, 41.0'-42.5'	Lab ID	54

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KDK
Test Date: 10-07-2009
Date Received 10-01-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.71

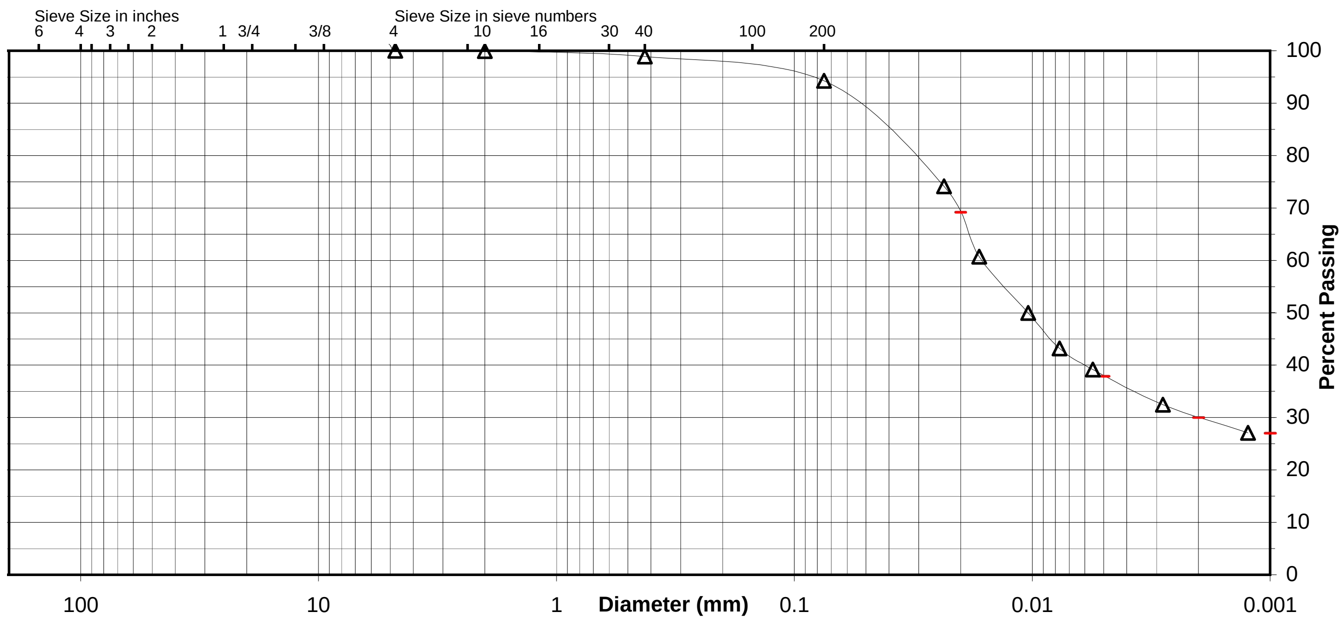
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.9
No. 200	94.3
0.02 mm	69.2
0.005 mm	37.9
0.002 mm	30.0
0.001 mm	27.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	1.1	4.6	56.4	37.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	1.1	4.6	64.3	30.0



Comments

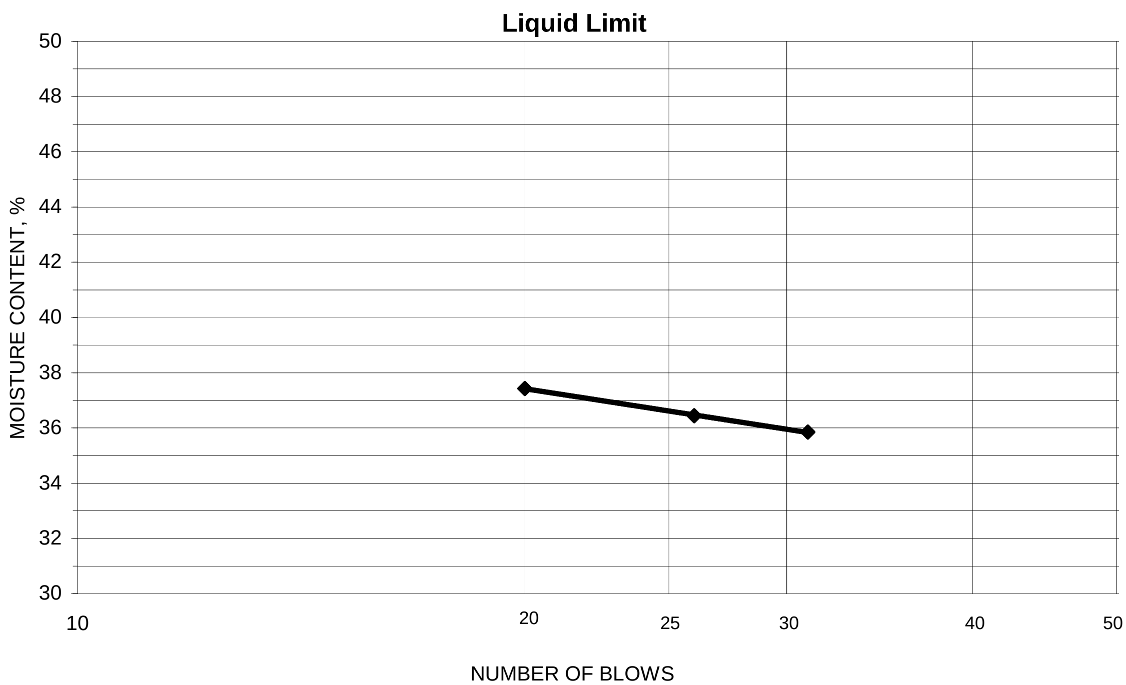
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-2, 41.0'-42.5'	Lab ID	54
		% + No. 40	1
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
14.76	12.01	4.34	31	35.9	37
15.75	12.70	4.33	26	36.4	
14.64	11.84	4.36	20	37.4	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
11.58	10.47	4.30	18.0	18	19
12.25	11.06	4.36	17.8		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-4, 16.5'-18.0'
Lab ID: 78

County: McCracken
Date Received: 10-1-09
Sample Type: SPT
Date Reported: 10-14-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 30.4

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.4
No. 200	0.075	94.3
	0.02	68.2
	0.005	45.5
	0.002	35.9
estimated	0.001	32.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.6
Medium Sand	0.6	---
Fine Sand	5.1	5.1
Silt	48.8	58.4
Clay	45.5	35.9

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 40
Plastic Limit: 20
Plasticity Index: 20
Activity Index: 0.56

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-6 (20)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-4, 16.5'-18.0'
Lab ID: 78

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: KDK
Test Date: 10-07-2009
Date Received 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

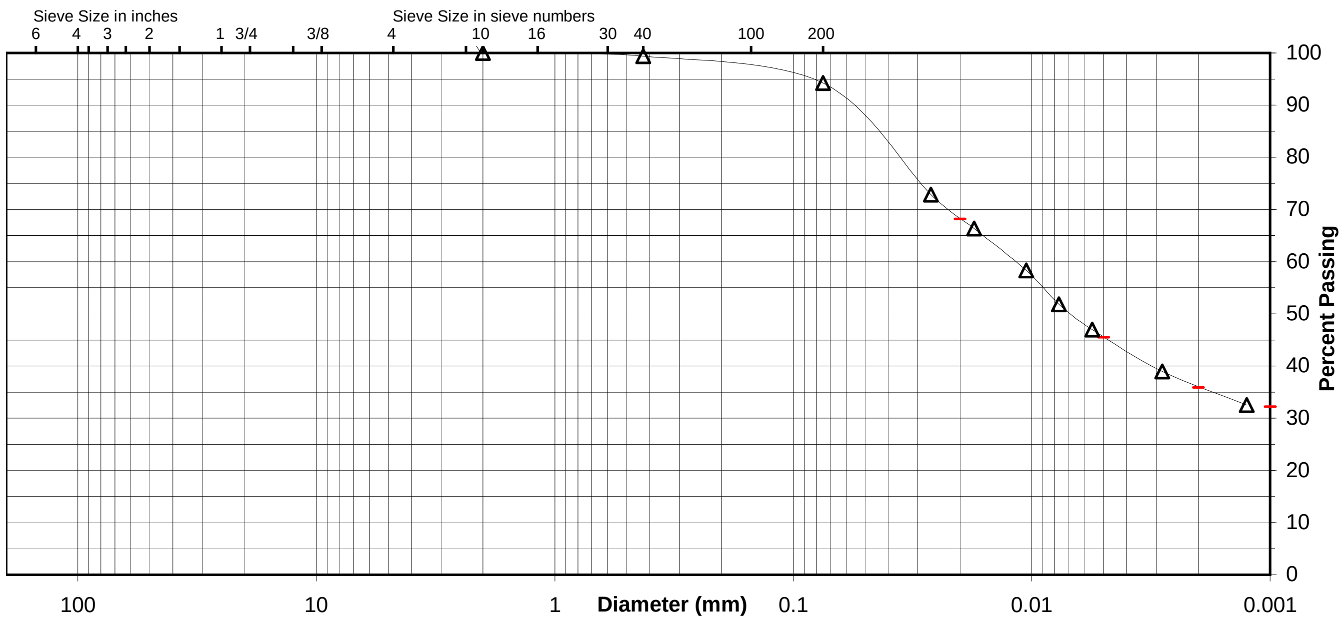
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.4
No. 200	94.3
0.02 mm	68.2
0.005 mm	45.5
0.002 mm	35.9
0.001 mm	32.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.6	5.1	48.8	45.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.6	5.1	58.4	35.9



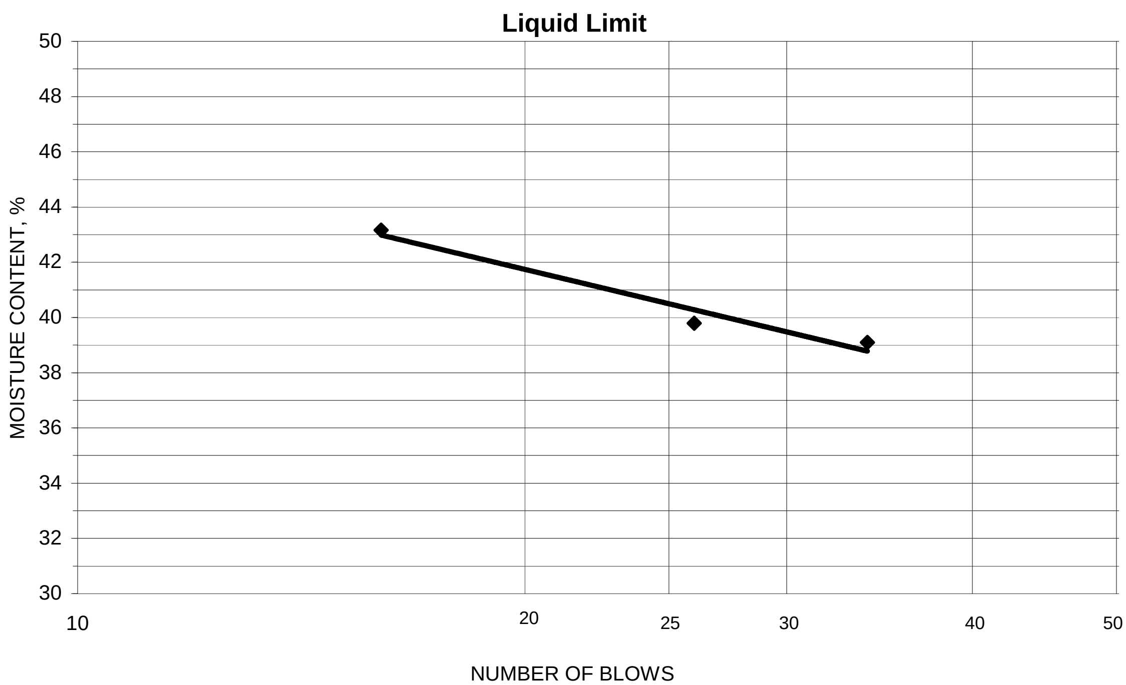
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-4, 16.5'-18.0'	Lab ID	78
		% + No. 40	1
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
11.74	9.66	4.34	34	39.1	40
9.60	8.10	4.33	26	39.8	
10.41	8.58	4.34	16	43.2	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
12.13	10.85	4.31	19.6	20	20
11.11	10.00	4.36	19.7		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-6, 24.0'-25.5'	Lab ID	822
County	McCracken	Date Received	10-6-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 17.1

Particle Size Analysis
Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	72.1
No. 4	4.75	60.6
No. 10	2	51.0
No. 40	0.425	40.8
No. 200	0.075	5.2
	0.02	3.1
	0.005	3.1
	0.002	2.5
estimated	0.001	2.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	39.4	49.0
Coarse Sand	9.6	10.2
Medium Sand	10.2	---
Fine Sand	35.6	35.6
Silt	2.1	2.7
Clay	3.1	2.5

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship
Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.72

Classification
Unified Group Symbol: SP-SM
Group Name: Poorly graded sand with silt and gravel

AASHTO Classification: A-1-b (1)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-6, 24.0'-25.5'	Lab ID	822

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: JMB
Test Date: 10-07-2009
Date Received 10-06-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	72.1
No. 4	60.6
No. 10	51.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.72

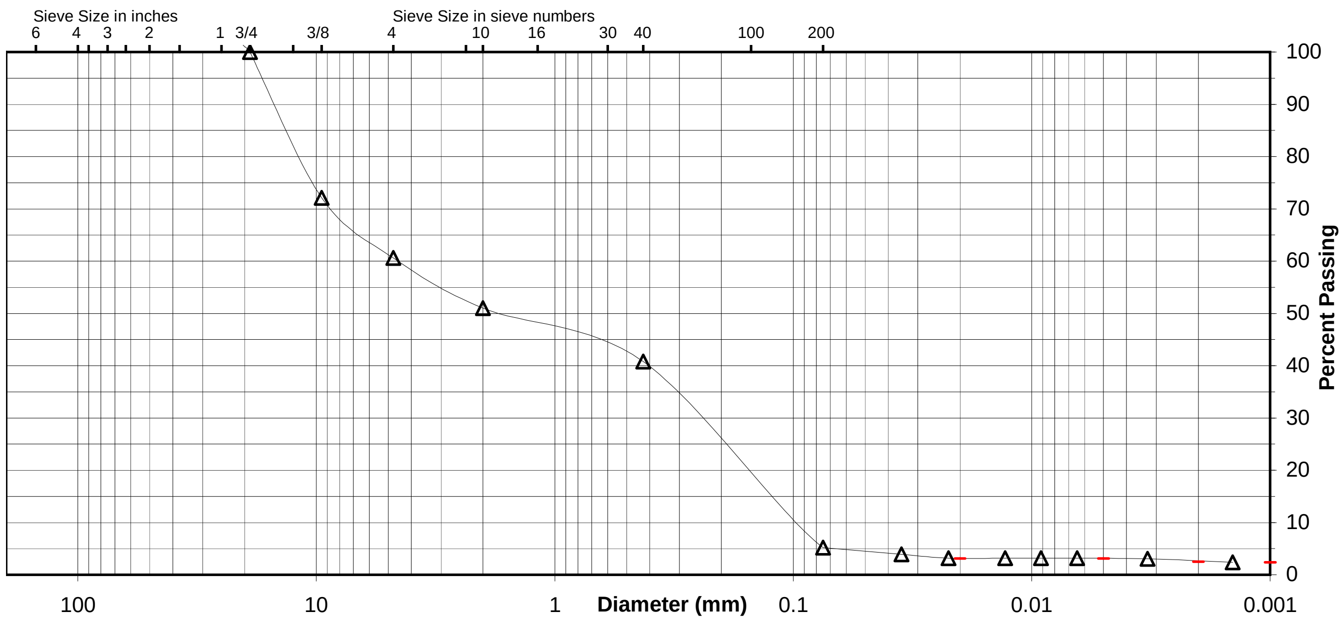
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	40.8
No. 200	5.2
0.02 mm	3.1
0.005 mm	3.1
0.002 mm	2.5
0.001 mm	2.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	39.4	9.6	10.2	35.6	2.1	3.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	49.0	10.2	35.6	2.7	2.5



Comments

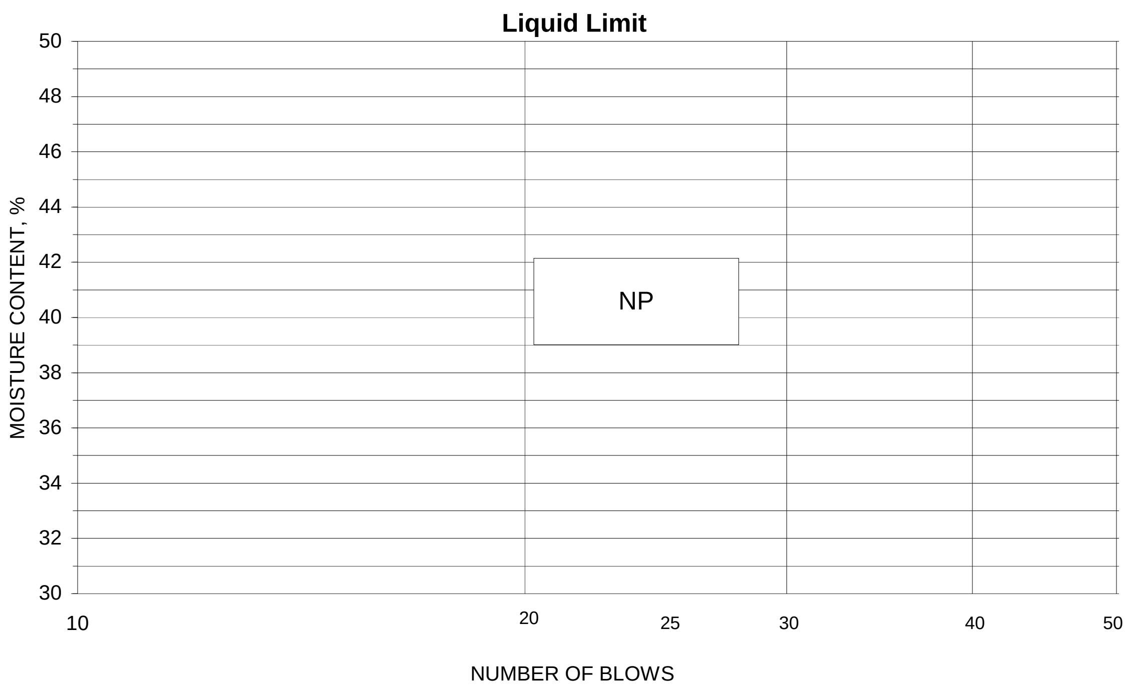
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-6, 24.0'-25.5'	Lab ID	822
		% + No. 40	59
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-06-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-8, 6.5'-8.0'	Lab ID	134
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-16-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 16.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	93.1
No. 4	4.75	90.4
No. 10	2	86.0
No. 40	0.425	82.5
No. 200	0.075	72.4
	0.02	45.7
	0.005	23.6
	0.002	19.4
estimated	0.001	17.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	9.6	14.0
Coarse Sand	4.4	3.5
Medium Sand	3.5	---
Fine Sand	10.1	10.1
Silt	48.8	53.0
Clay	23.6	19.4

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 33

Plastic Limit: 15

Plasticity Index: 18

Activity Index: 0.95

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (11)

Comments:

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-8, 6.5'-8.0'	Lab ID	134

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: KDK
Test Date: 10-07-2009
Date Received 10-01-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	93.1
No. 4	90.4
No. 10	86.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.69

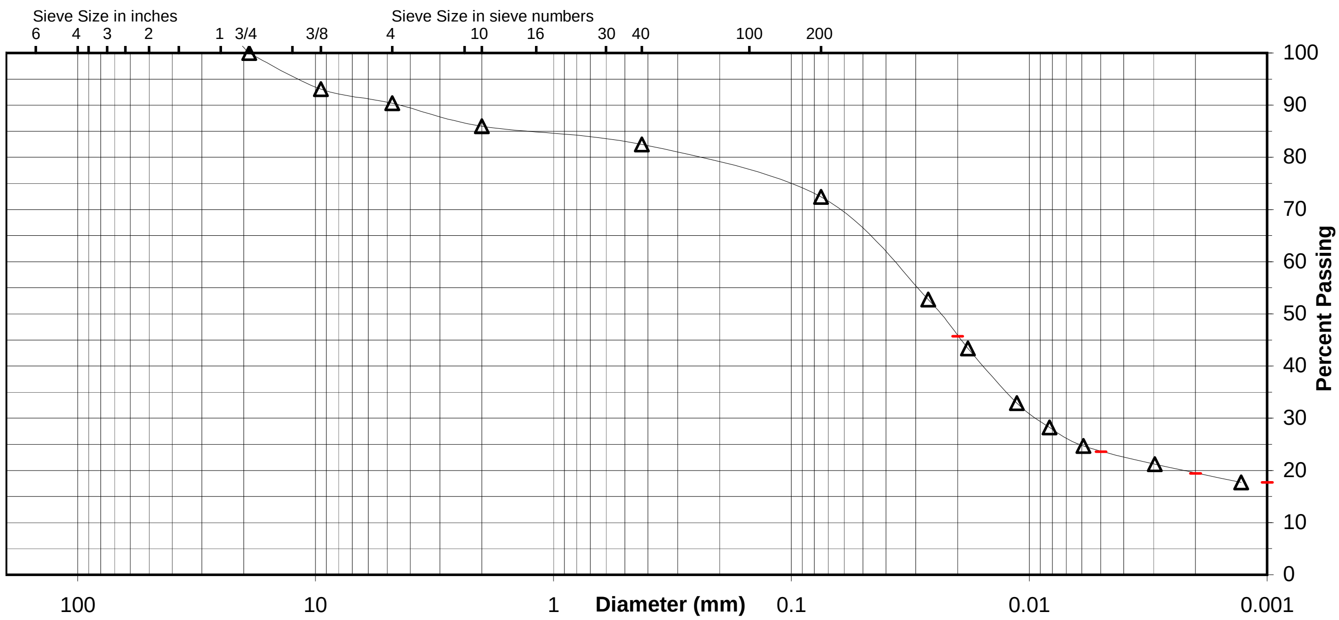
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	82.5
No. 200	72.4
0.02 mm	45.7
0.005 mm	23.6
0.002 mm	19.4
0.001 mm	17.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	9.6	4.4	3.5	10.1	48.8	23.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	14.0	3.5	10.1	53.0	19.4



Comments

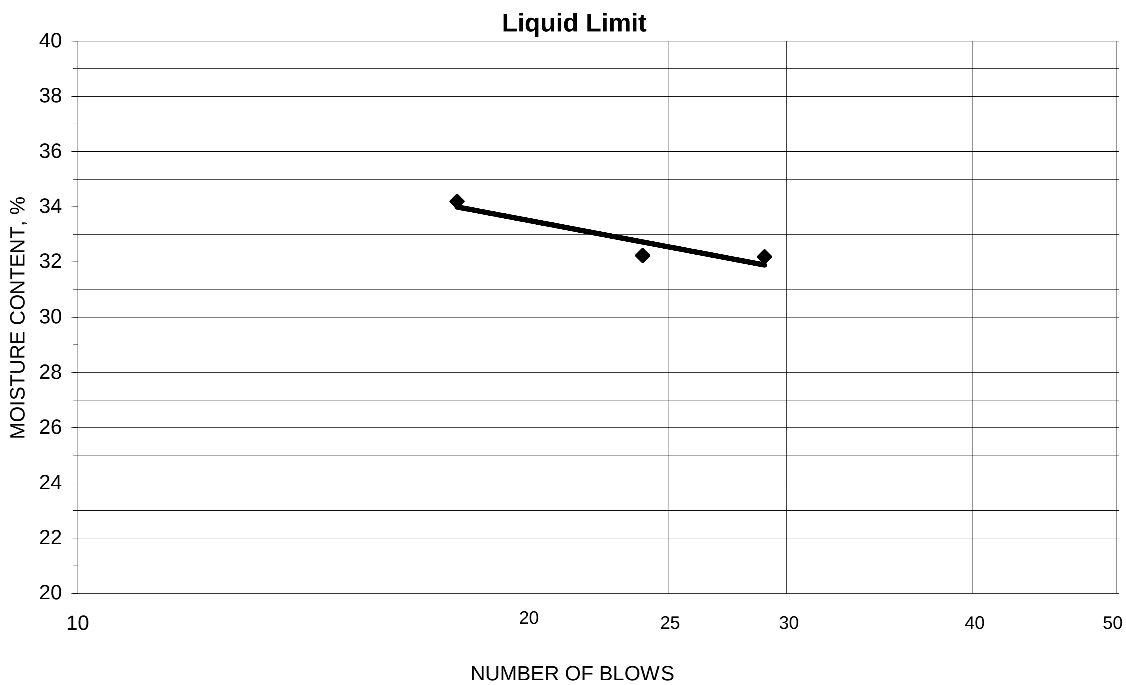
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-8, 6.5'-8.0'	Lab ID	134
		% + No. 40	18
Tested By	KDK	Test Method: ASTM D 4318 Method A	Date Received: 10-01-2009
Test Date	10-08-2009	Prepared: Dry	

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
15.49	12.77	4.32	29	32.2	33
15.98	13.15	4.37	24	32.2	
14.76	12.10	4.32	18	34.2	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.53	9.75	4.31	14.3	15	18
10.66	9.85	4.33	14.7		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-14, 17.0'-18.5'	Lab ID	991
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 22.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	100.0
No. 40	0.425	99.1
No. 200	0.075	91.4
	0.02	70.0
	0.005	40.6
	0.002	31.8
estimated	0.001	28.6

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.9
Medium Sand	0.9	---
Fine Sand	7.7	7.7
Silt	50.8	59.6
Clay	40.6	31.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 42

Plastic Limit: 15

Plasticity Index: 27

Activity Index: 0.84

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-7-6 (25)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - Shawnee Ash Ponds 1 and 2
Project Number: 175559023
Source: STN-14, 17.0'-18.5'
Lab ID: 991

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RHB
Test Date: 03-01-2010
Date Received: 02-17-2010

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

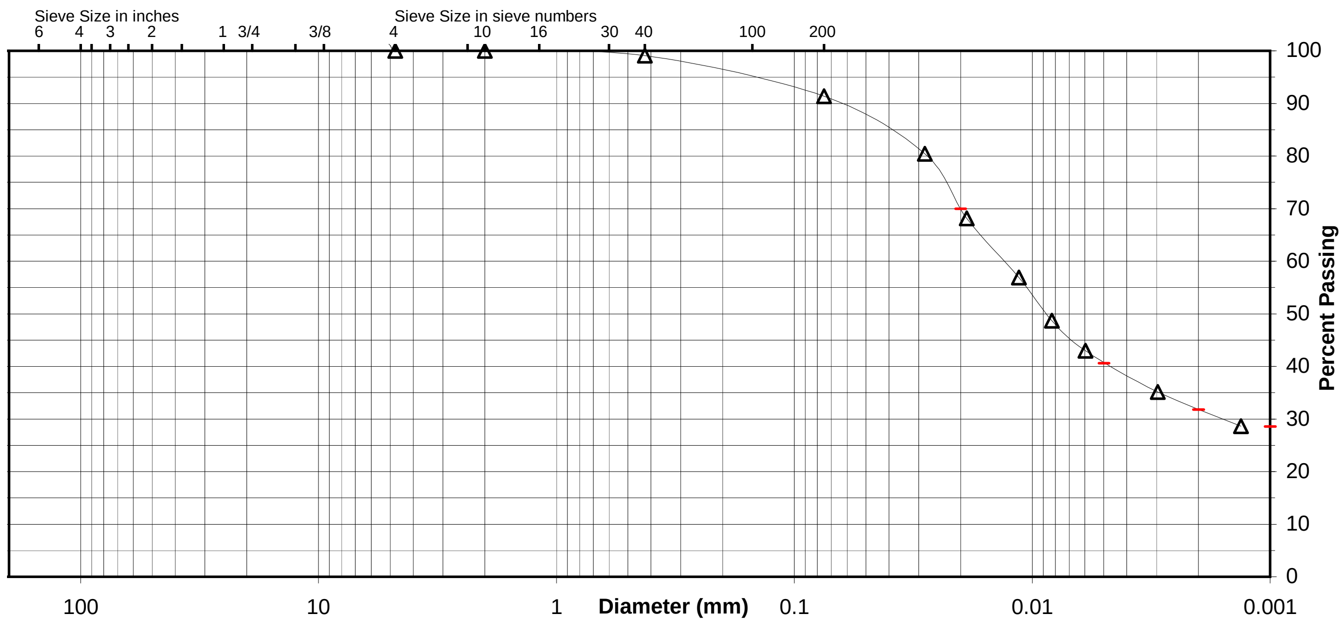
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.1
No. 200	91.4
0.02 mm	70.0
0.005 mm	40.6
0.002 mm	31.8
0.001 mm	28.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.9	7.7	50.8	40.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.9	7.7	59.6	31.8



Comments

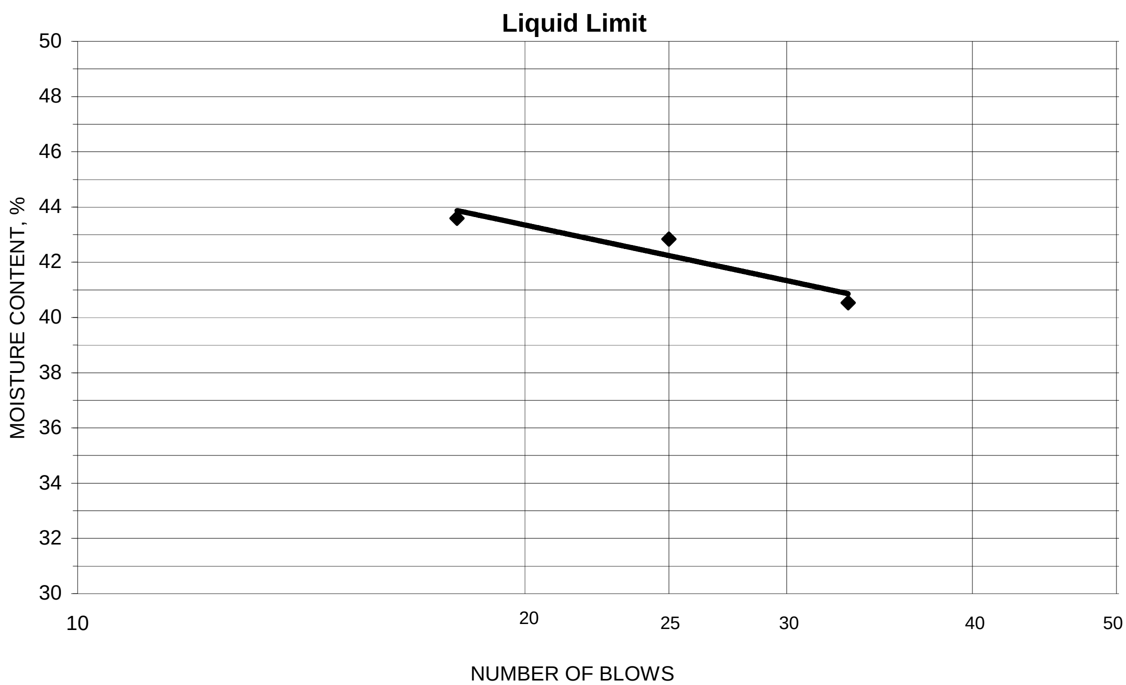
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-14, 17.0'-18.5'	Lab ID	991
		% + No. 40	1
Tested By	AR	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	03-11-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
34.52	30.43	20.34	33	40.5	
33.18	28.42	17.31	25	42.8	
37.04	32.07	20.67	18	43.6	42



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
26.73	25.54	17.38	14.6	15	27
30.38	29.26	21.66	14.7		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-17, 18.0'-19.5'	Lab ID	1047
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 20.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	100.0
No. 10	2	99.8
No. 40	0.425	96.3
No. 200	0.075	87.0
	0.02	70.2
	0.005	49.2
	0.002	37.8
estimated	0.001	34.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.2
Coarse Sand	0.2	3.5
Medium Sand	3.5	---
Fine Sand	9.3	9.3
Silt	37.8	49.2
Clay	49.2	37.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 40

Plastic Limit: 20

Plasticity Index: 20

Activity Index: 0.53

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-6 (18)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-17, 18.0'-19.5'	Lab ID	1047

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded and Angular
Particle Hardness: Hard and Durable

Tested By: CLH
Test Date: 02-24-2010
Date Received 02-17-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	100.0
No. 10	99.8

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

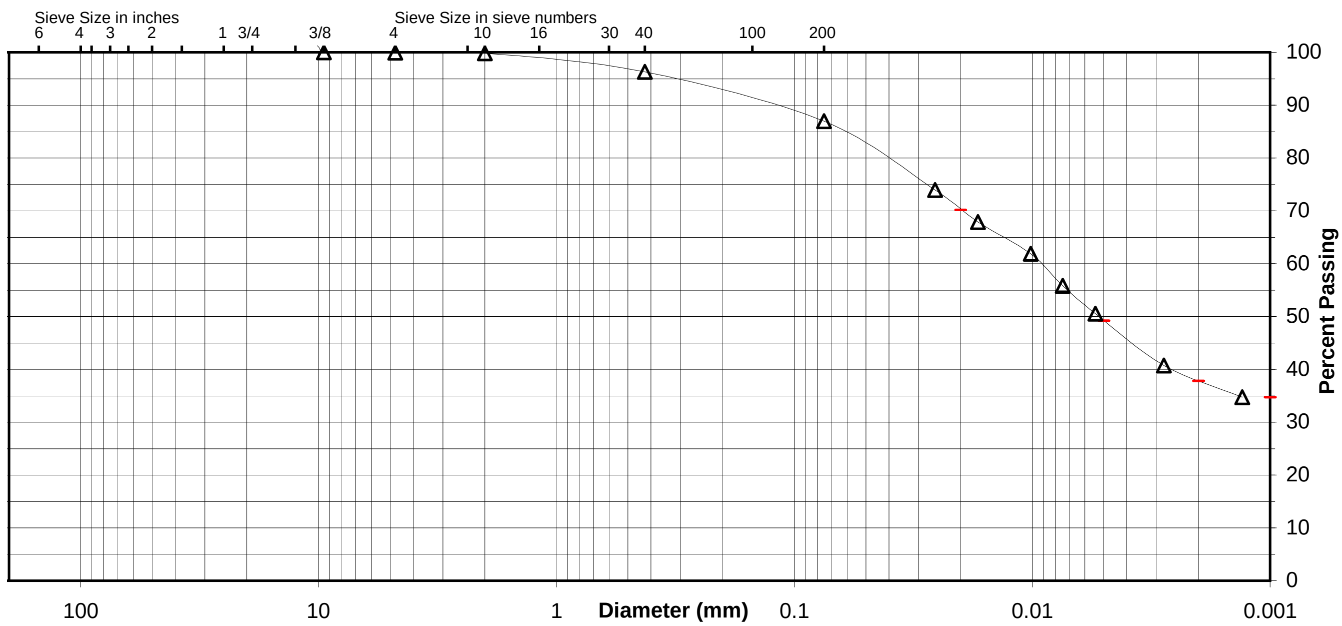
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	96.3
No. 200	87.0
0.02 mm	70.2
0.005 mm	49.2
0.002 mm	37.8
0.001 mm	34.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.2	3.5	9.3	37.8	49.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.2	3.5	9.3	49.2	37.8



Comments

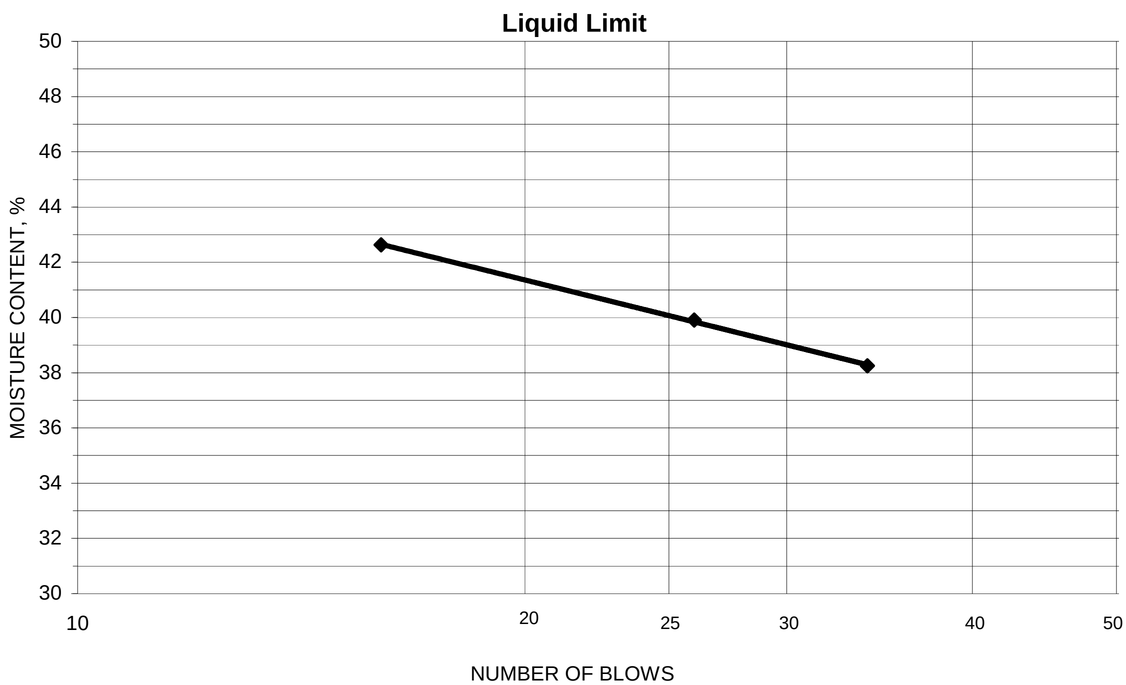
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-17, 18.0'-19.5'	Lab ID	1047
		% + No. 40	4
Tested By	JMB Test Method ASTM D 4318 Method A	Date Received	02-17-2010
Test Date	02-25-2010 Prepared Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
13.10	10.66	4.28	34	38.2	40
13.37	10.80	4.36	26	39.9	
12.26	9.89	4.33	16	42.6	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.46	9.44	4.31	19.9	20	20
10.29	9.30	4.32	19.9		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-20, 7.5'-9.0'	Lab ID	1081
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 12.7

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.4
No. 10	2	98.2
No. 40	0.425	96.3
No. 200	0.075	84.6
	0.02	55.5
	0.005	25.4
	0.002	21.6
estimated	0.001	21.1

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.6	1.8
Coarse Sand	1.2	1.9
Medium Sand	1.9	---
Fine Sand	11.7	11.7
Silt	59.2	63.0
Clay	25.4	21.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 32

Plastic Limit: 16

Plasticity Index: 16

Activity Index: 0.73

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (12)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - Shawnee Ash Ponds 1 and 2
Project Number: 175559023
Source: STN-20, 7.5'-9.0'
Lab ID: 1081

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded and Angular
Particle Hardness: Hard and Durable

Tested By: CLH
Test Date: 02-24-2010
Date Received: 02-17-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.4
No. 10	98.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

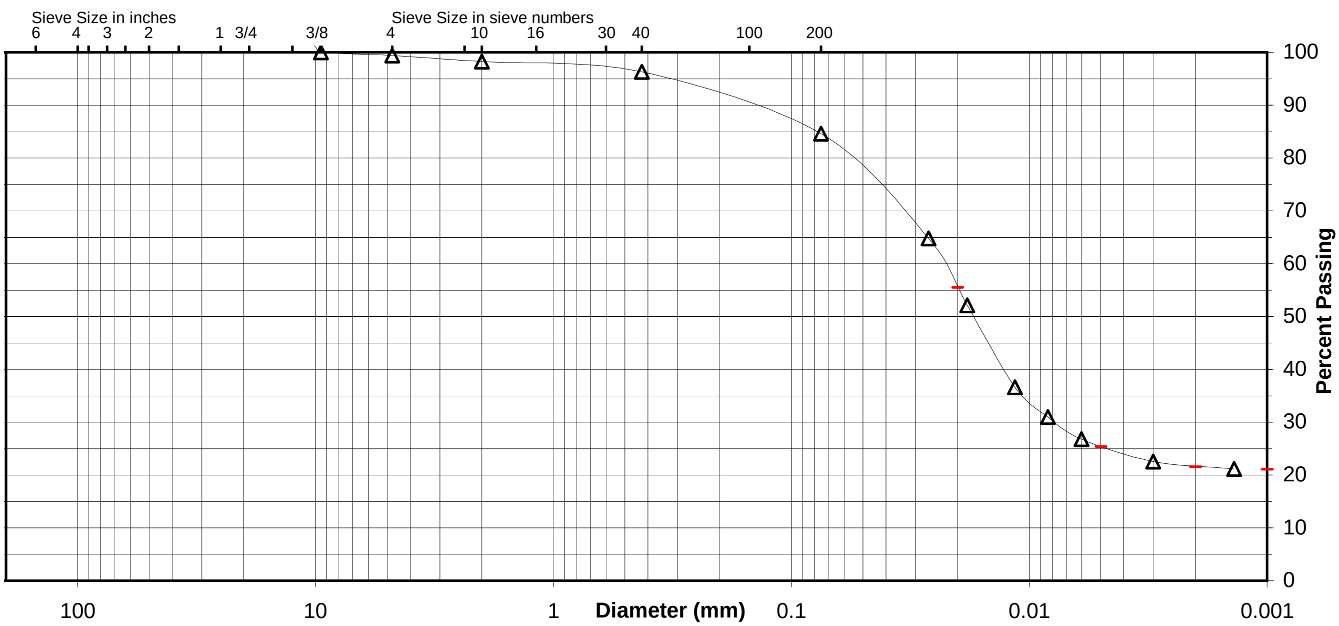
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	96.3
No. 200	84.6
0.02 mm	55.5
0.005 mm	25.4
0.002 mm	21.6
0.001 mm	21.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.6	1.2	1.9	11.7	59.2	25.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.8	1.9	11.7	63.0	21.6



Comments

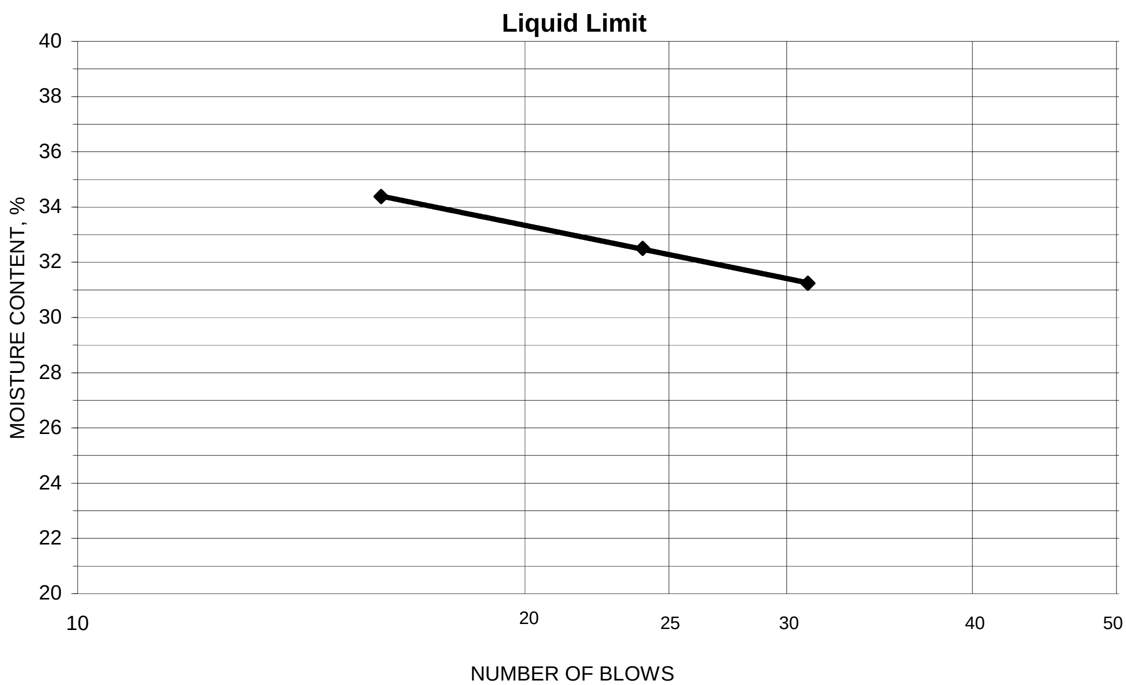
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-20, 7.5'-9.0'	Lab ID	1081
		% + No. 40	4
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	02-25-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
12.52	10.58	4.37	31	31.2	
13.38	11.17	4.37	24	32.5	
12.45	10.38	4.36	16	34.4	32



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.61	9.74	4.34	16.1	16	16
10.17	9.39	4.33	15.4		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-21, 4.5'-6.0'	Lab ID	1104
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 22.4

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.9
No. 4	4.75	91.9
No. 10	2	82.2
No. 40	0.425	69.4
No. 200	0.075	56.7
	0.02	34.2
	0.005	18.4
	0.002	14.1
estimated	0.001	13.3

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	8.1	17.8
Coarse Sand	9.7	12.8
Medium Sand	12.8	---
Fine Sand	12.7	12.7
Silt	38.3	42.6
Clay	18.4	14.1

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 30

Plastic Limit: 18

Plasticity Index: 12

Activity Index: 0.86

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.67

Classification

Unified Group Symbol: CL

Group Name: Sandy lean clay

AASHTO Classification: A-6 (4)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-21, 4.5'-6.0'	Lab ID	1104

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: RHB
Test Date: 03-07-2010
Date Received 02-17-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.9
No. 4	91.9
No. 10	82.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

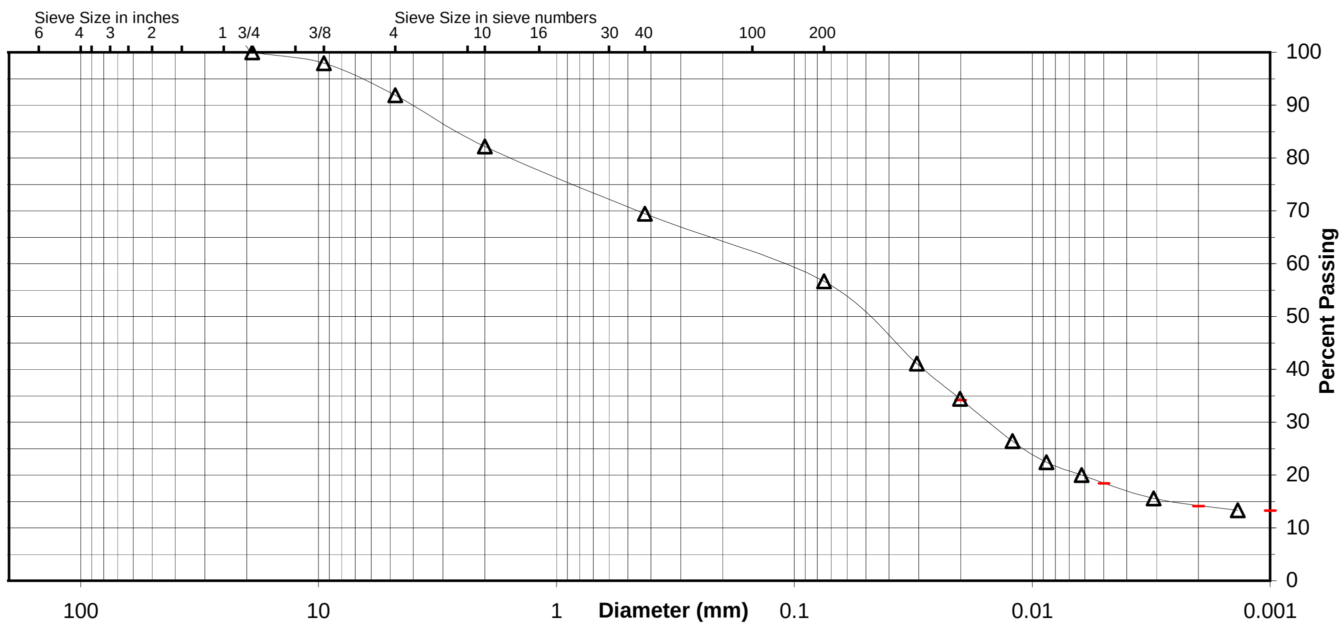
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	69.4
No. 200	56.7
0.02 mm	34.2
0.005 mm	18.4
0.002 mm	14.1
0.001 mm	13.3

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	8.1	9.7	12.8	12.7	38.3	18.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	17.8	12.8	12.7	42.6	14.1



Comments

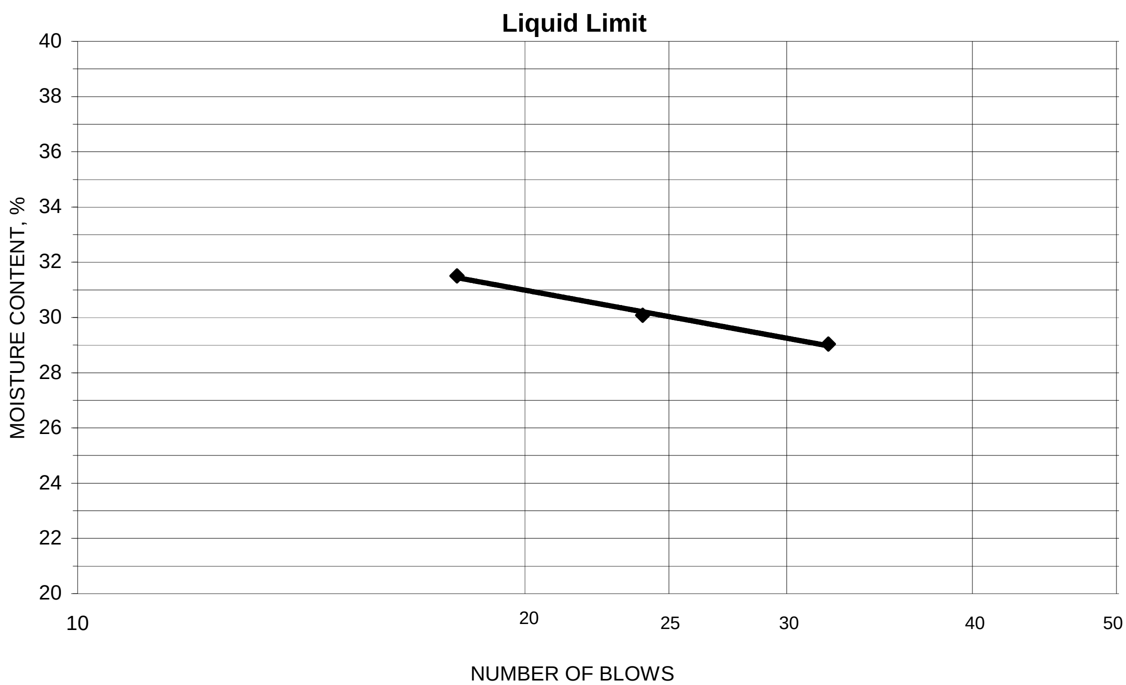
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-21, 4.5'-6.0'	Lab ID	1104
		% + No. 40	31
Tested By	AR	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	03-09-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
37.19	33.47	20.66	32	29.0	30
39.19	34.91	20.68	24	30.1	
38.90	34.76	21.62	18	31.5	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
25.38	24.13	17.34	18.4	18	12
25.97	24.63	17.31	18.3		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-21, 31.5'-33.0'	Lab ID	1118
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.0

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.9
No. 10	2	98.6
No. 40	0.425	95.9
No. 200	0.075	87.2
	0.02	63.2
	0.005	26.2
	0.002	20.0
estimated	0.001	18.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	1.4
Coarse Sand	1.3	2.7
Medium Sand	2.7	---
Fine Sand	8.7	8.7
Silt	61.0	67.2
Clay	26.2	20.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 29

Plastic Limit: 17

Plasticity Index: 12

Activity Index: 0.60

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-6 (9)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - Shawnee Ash Ponds 1 and 2
Project Number: 175559023
Source: STN-21, 31.5'-33.0'
Lab ID: 1118

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Soft

Tested By: AR
Test Date: 03-02-2010
Date Received 02-17-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	98.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.68

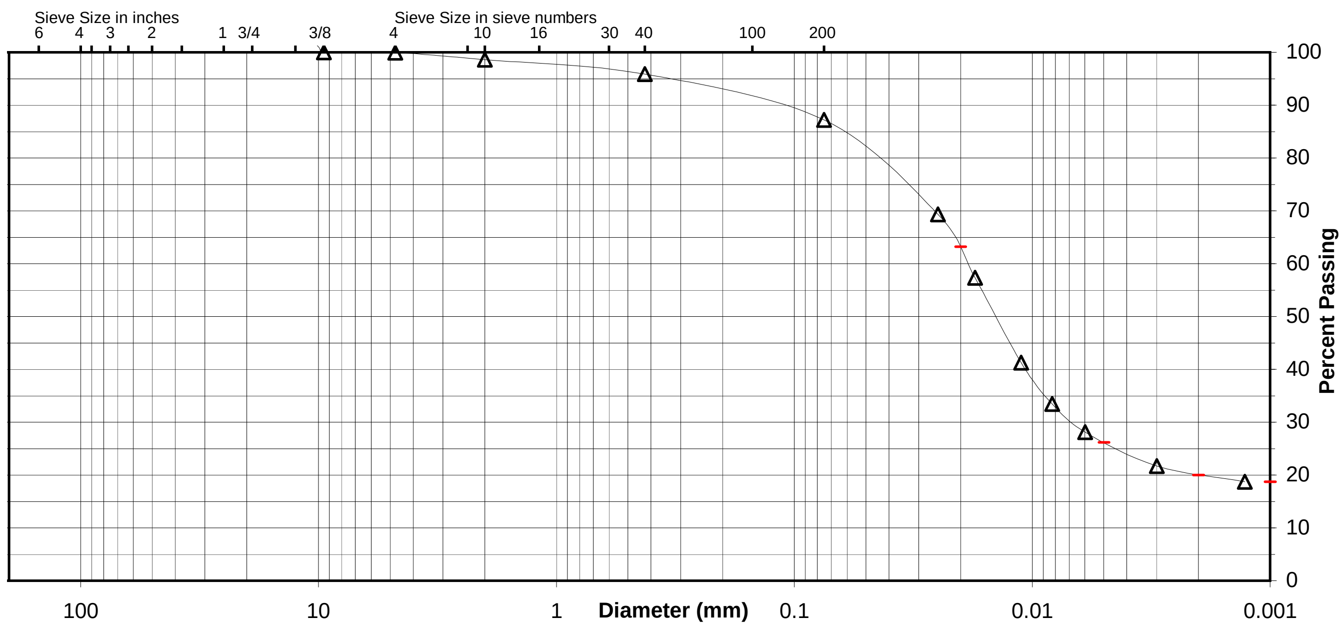
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	95.9
No. 200	87.2
0.02 mm	63.2
0.005 mm	26.2
0.002 mm	20.0
0.001 mm	18.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.1	1.3	2.7	8.7	61.0	26.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.4	2.7	8.7	67.2	20.0



Comments

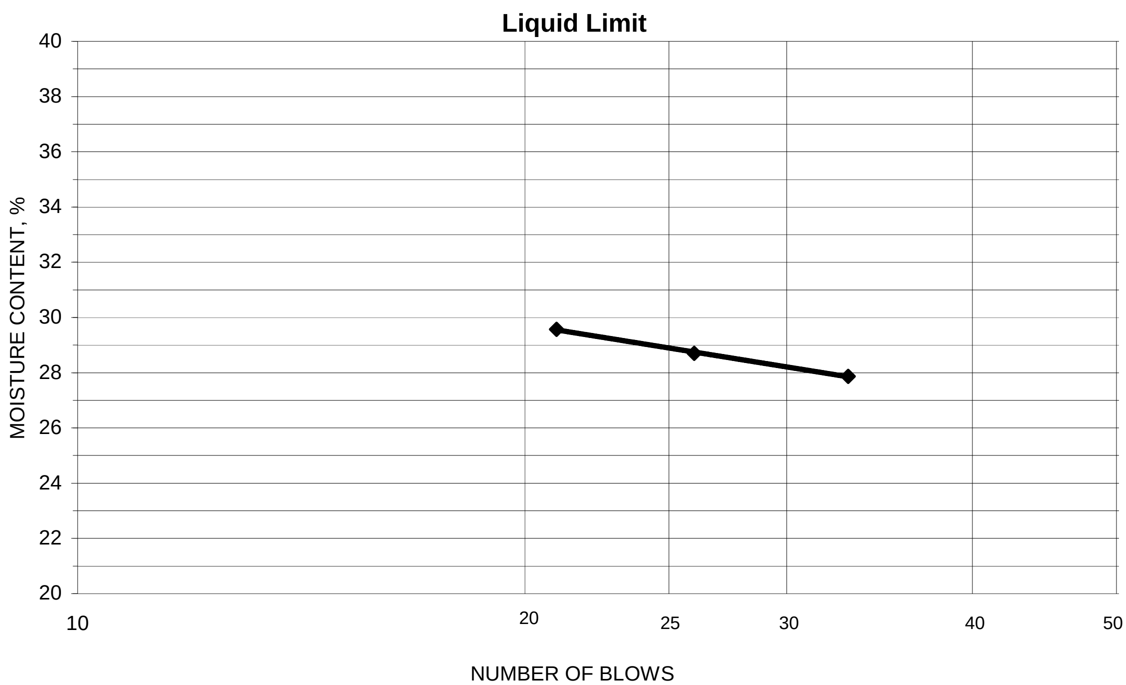
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-21, 31.5'-33.0'	Lab ID	1118
		% + No. 40	4
Tested By	AR	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	03-11-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
41.10	36.76	21.64	26	28.7	
35.14	31.26	17.34	33	27.9	
36.29	32.67	20.43	21	29.6	29



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
29.76	28.42	20.68	17.3	17	12
29.17	28.16	22.19	16.9		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-25, 21.5'-23.0'	Lab ID	1166
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 42.9

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	98.9
No. 10	2	97.3
No. 40	0.425	94.5
No. 200	0.075	85.3
	0.02	33.2
	0.005	2.4
	0.002	0.8
estimated	0.001	0.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.1	2.7
Coarse Sand	1.6	2.8
Medium Sand	2.8	---
Fine Sand	9.2	9.2
Silt	82.9	84.5
Clay	2.4	0.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.44

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-25, 21.5'-23.0'	Lab ID	1166

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: CLH
Test Date: 02-26-2010
Date Received 02-17-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	98.9
No. 10	97.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.44

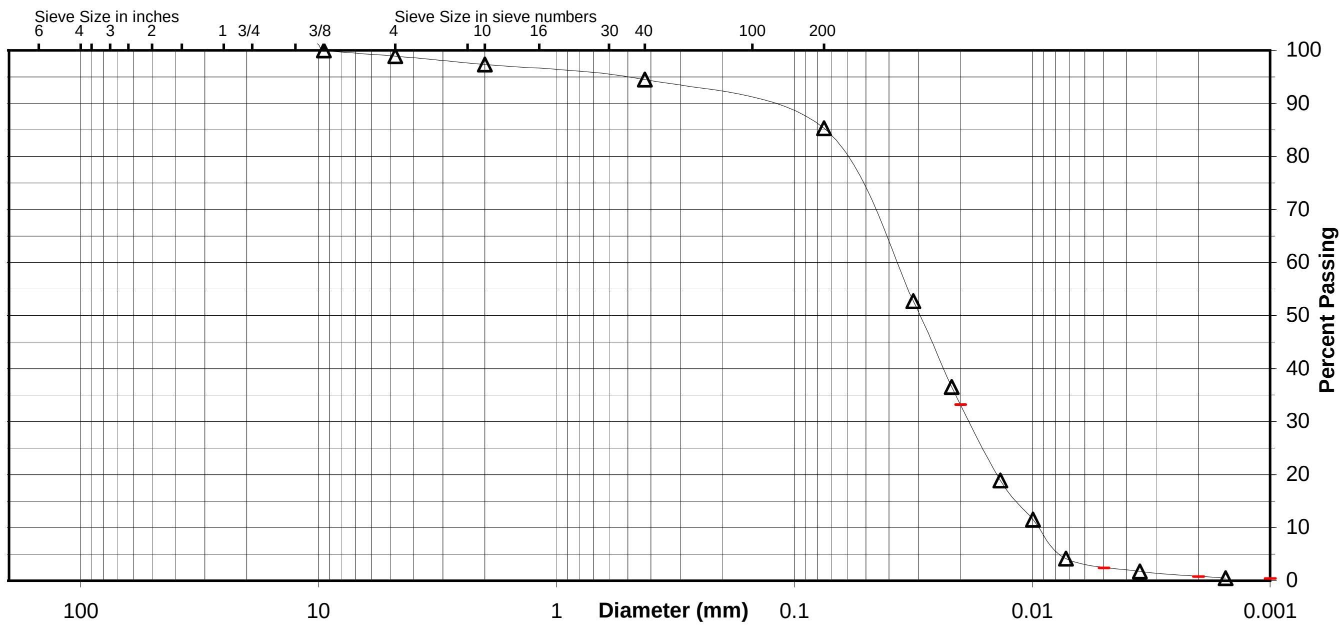
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	94.5
No. 200	85.3
0.02 mm	33.2
0.005 mm	2.4
0.002 mm	0.8
0.001 mm	0.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.1	1.6	2.8	9.2	82.9	2.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	2.7	2.8	9.2	84.5	0.8



Comments

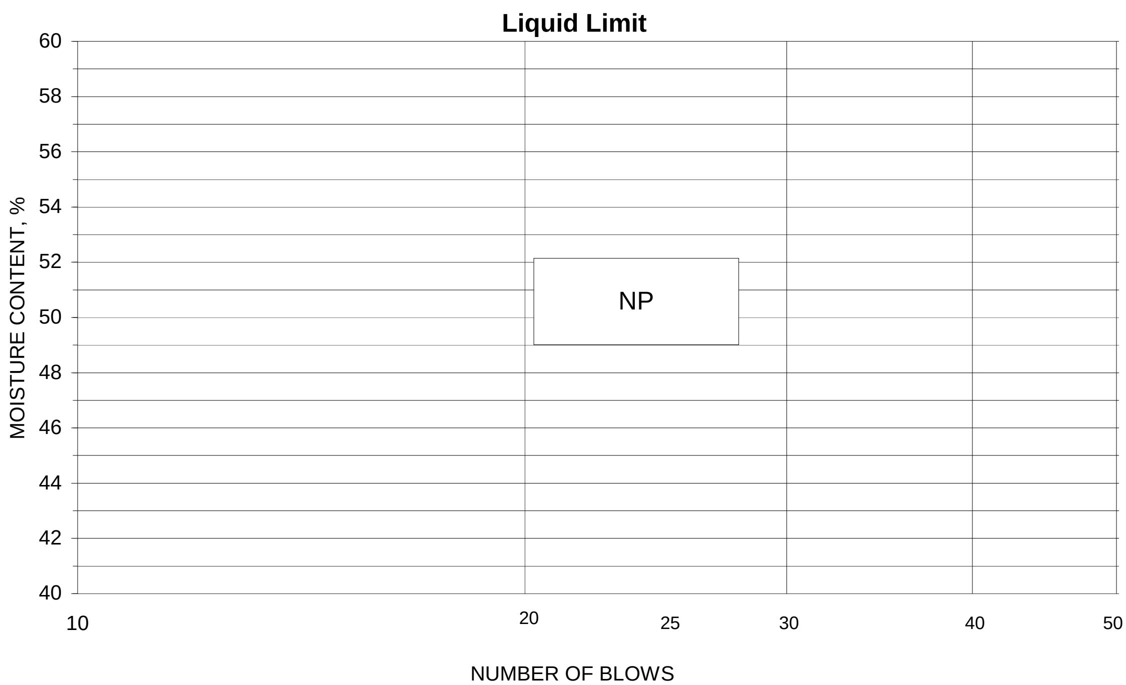
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-25, 21.5'-23.0'	Lab ID	1166
		% + No. 40	5
Tested By	CLH	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	02-26-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-25, 35.5'-37.0'	Lab ID	1174
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 10.0

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	73.3
No. 4	4.75	53.6
No. 10	2	35.3
No. 40	0.425	19.2
No. 200	0.075	7.5
	0.02	4.2
	0.005	3.6
	0.002	2.6
estimated	0.001	2.1

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	46.4	64.7
Coarse Sand	18.3	16.1
Medium Sand	16.1	---
Fine Sand	11.7	11.7
Silt	3.9	4.9
Clay	3.6	2.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 19

Plastic Limit: 18

Plasticity Index: 1

Activity Index: 0.33

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: GW-GM

Group Name: Well-graded gravel with silt and sand

AASHTO Classification: A-1-a (0)

Comments:

Stantec

Particle-Size Analysis of Soils

ASTM D 422

Project Name: TVA - Shawnee Ash Ponds 1 and 2

Project Number: 175559023

Source: STN-25, 35.5'-37.0'

Lab ID: 1174

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422

Prepared using: ASTM D 421

Particle Shape: Rounded and Angular

Particle Hardness: Hard and Durable

Tested By: RHB

Test Date: 03-01-2010

Date Received 02-17-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	73.3
No. 4	53.6
No. 10	35.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

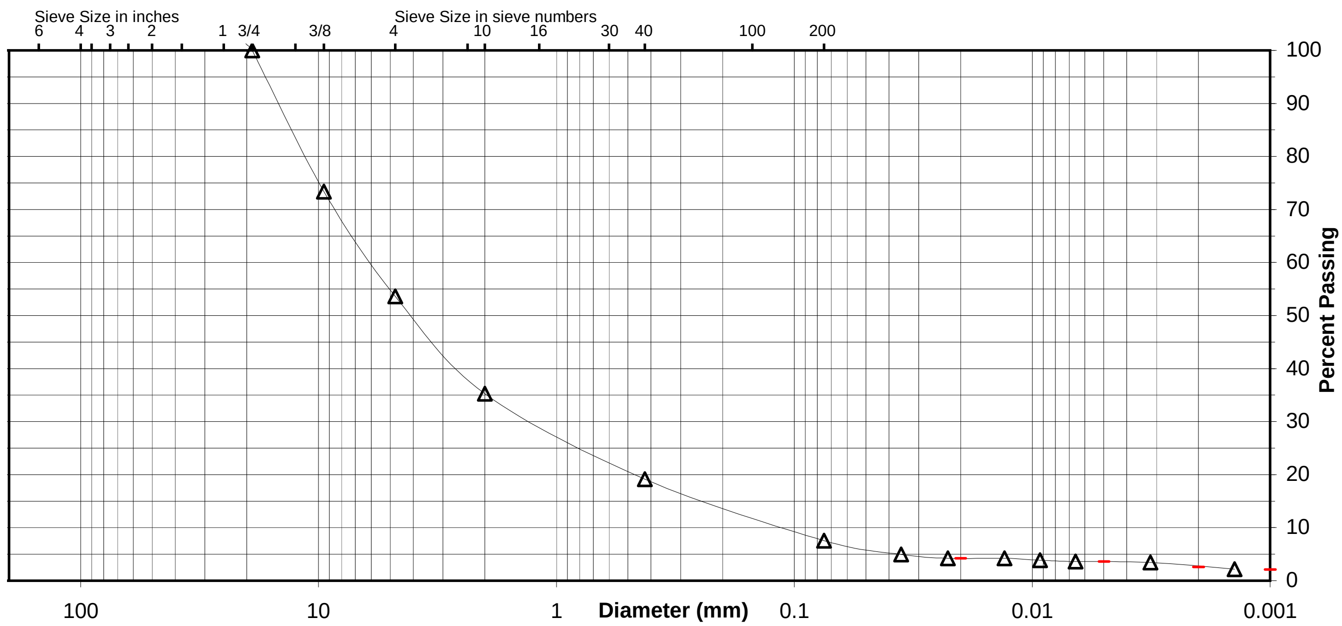
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	19.2
No. 200	7.5
0.02 mm	4.2
0.005 mm	3.6
0.002 mm	2.6
0.001 mm	2.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	46.4	18.3	16.1	11.7	3.9	3.6

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	64.7	16.1	11.7	4.9	2.6



Comments

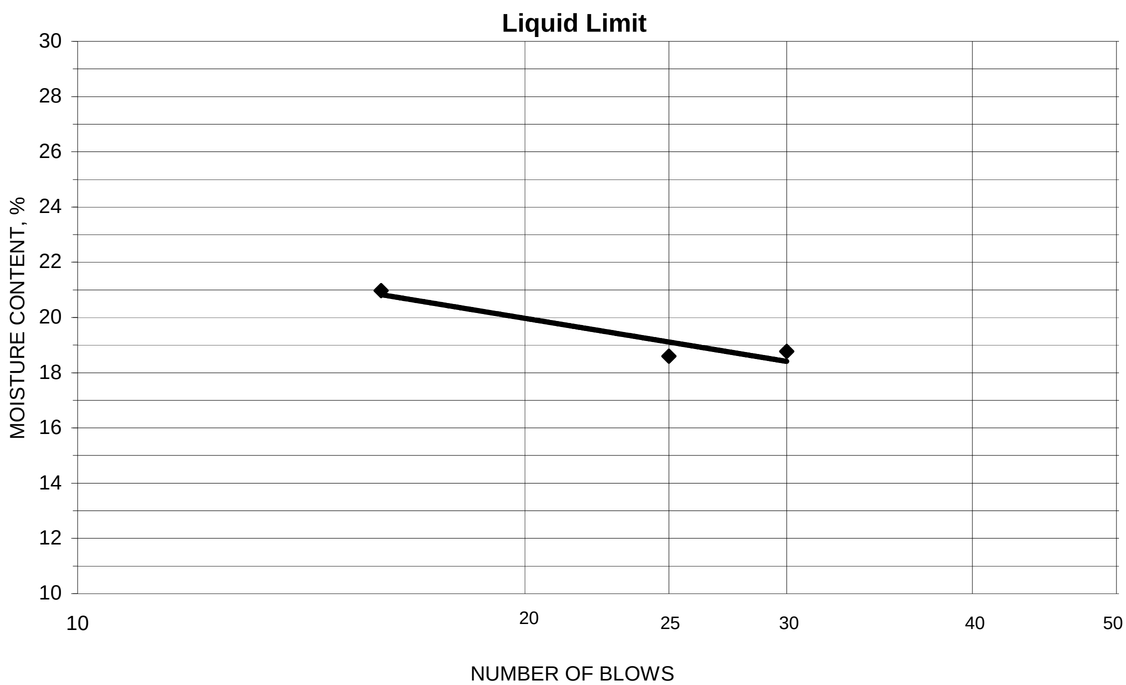
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-25, 35.5'-37.0'	Lab ID	1174
		% + No. 40	81
Tested By	AR	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	03-09-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
27.24	25.52	17.32	16	21.0	19
27.61	25.99	17.36	30	18.8	
29.90	27.93	17.34	25	18.6	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
20.59	20.10	17.35	17.8	18	1
27.03	26.26	22.12	18.6		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-31, 13.5'-15.0'	Lab ID	169
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 18.3

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size Sieve Size	Particle Size (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	90.1
No. 4	4.75	80.2
No. 10	2	72.6
No. 40	0.425	48.1
No. 200	0.075	2.5
	0.02	1.0
	0.005	0.8
	0.002	0.6
estimated	0.001	0.6

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	19.8	27.4
Coarse Sand	7.6	24.5
Medium Sand	24.5	---
Fine Sand	45.6	45.6
Silt	1.7	1.9
Clay	0.8	0.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SP

Group Name: Poorly graded sand with gravel

AASHTO Classification: A-1-b (1)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-31, 13.5'-15.0'	Lab ID	169

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: TKR
Test Date: 10-07-2009
Date Received: 10-01-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	90.1
No. 4	80.2
No. 10	72.6

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

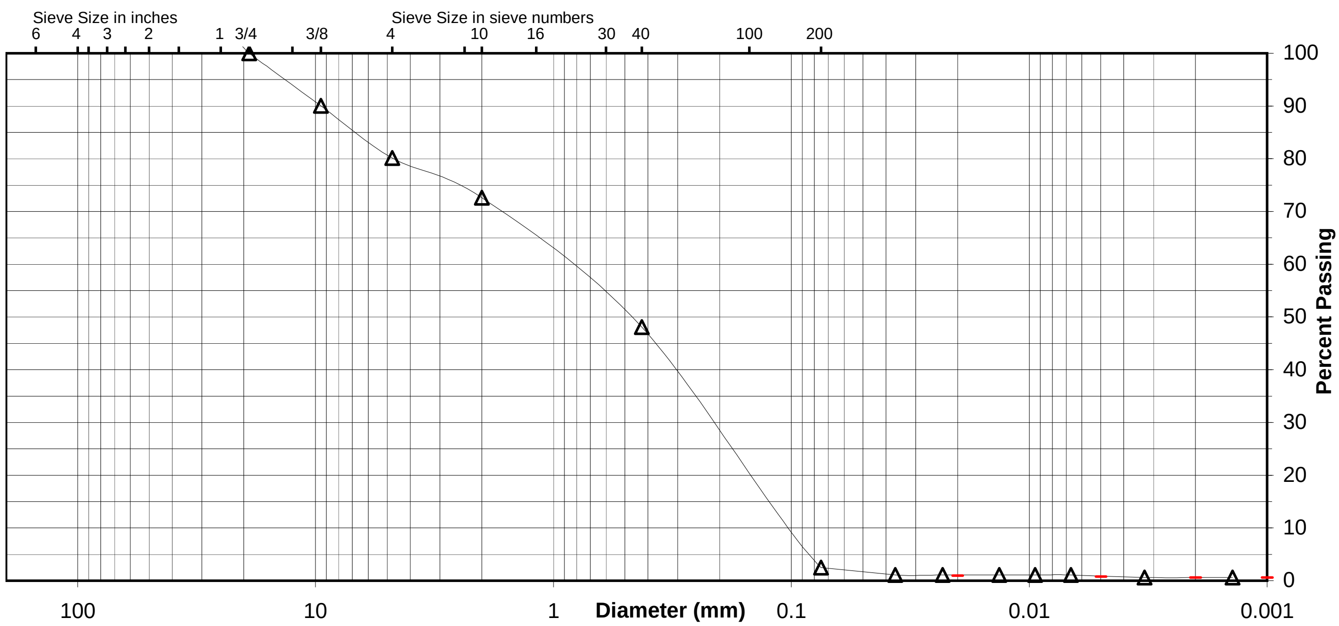
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	48.1
No. 200	2.5
0.02 mm	1.0
0.005 mm	0.8
0.002 mm	0.6
0.001 mm	0.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	19.8	7.6	24.5	45.6	1.7	0.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	27.4	24.5	45.6	1.9	0.6



Comments

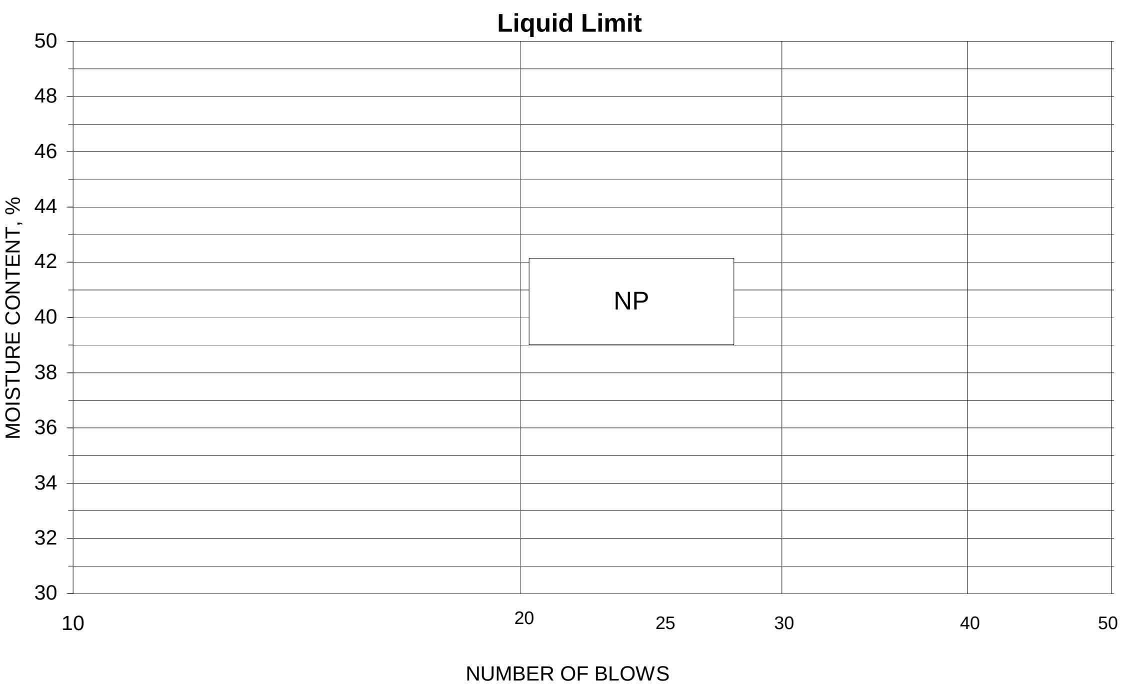
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-31, 13.5'-15.0'	Lab ID	169
		% + No. 40	52
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-32, 27.0'-28.5'
Lab ID: 202

County: McCracken
Date Received: 10-1-09
Sample Type: SPT
Date Reported: 10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 18.8

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	98.4
No. 40	0.425	90.8
No. 200	0.075	60.6
	0.02	42.3
	0.005	25.8
	0.002	20.0
estimated	0.001	16.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	1.6
Coarse Sand	1.6	7.6
Medium Sand	7.6	---
Fine Sand	30.2	30.2
Silt	34.8	40.6
Clay	25.8	20.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 28
Plastic Limit: 15
Plasticity Index: 13
Activity Index: 0.65

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Sandy lean clay

AASHTO Classification: A-6 (5)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Stantec

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-32, 27.0'-28.5'	Lab ID	202

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded and Angular
Particle Hardness: Hard and Durable

Tested By: KDK
Test Date: 10-09-2009
Date Received 10-01-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	98.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

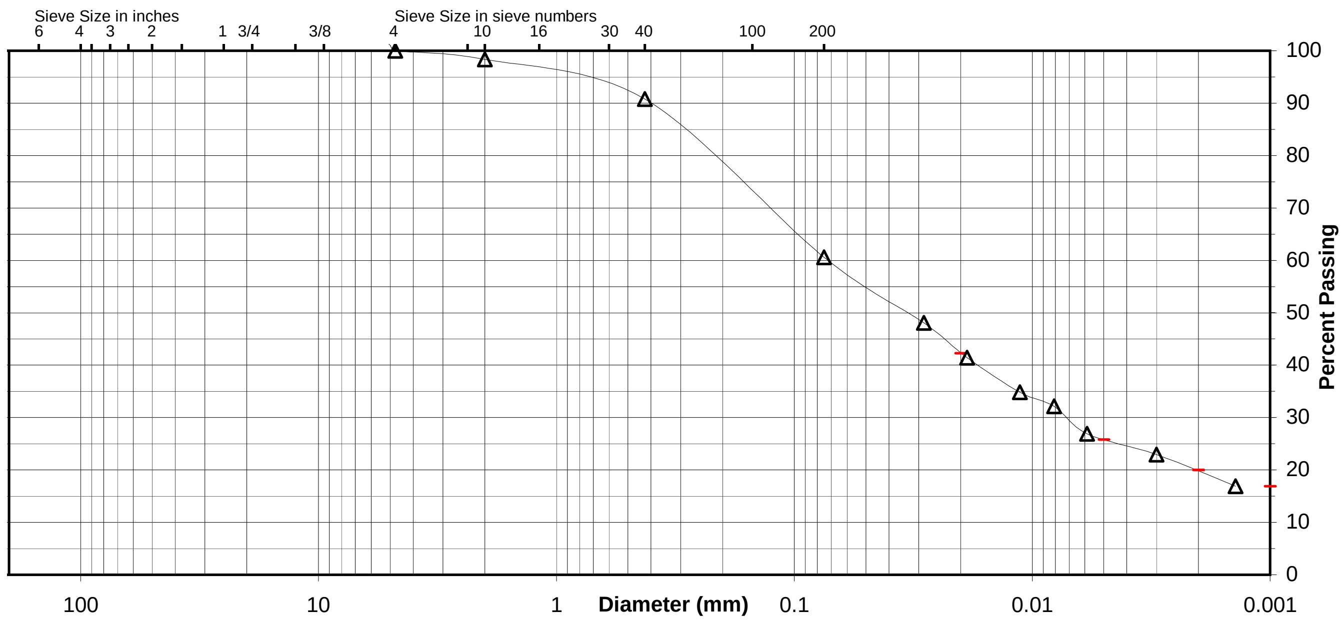
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	90.8
No. 200	60.6
0.02 mm	42.3
0.005 mm	25.8
0.002 mm	20.0
0.001 mm	16.9

Particle Size Distribution

	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
ASTM	0.0	0.0	1.6	7.6	30.2	34.8	25.8

	Gravel	Coarse Sand	Fine Sand	Silt	Clay
AASHTO	1.6	7.6	30.2	40.6	20.0



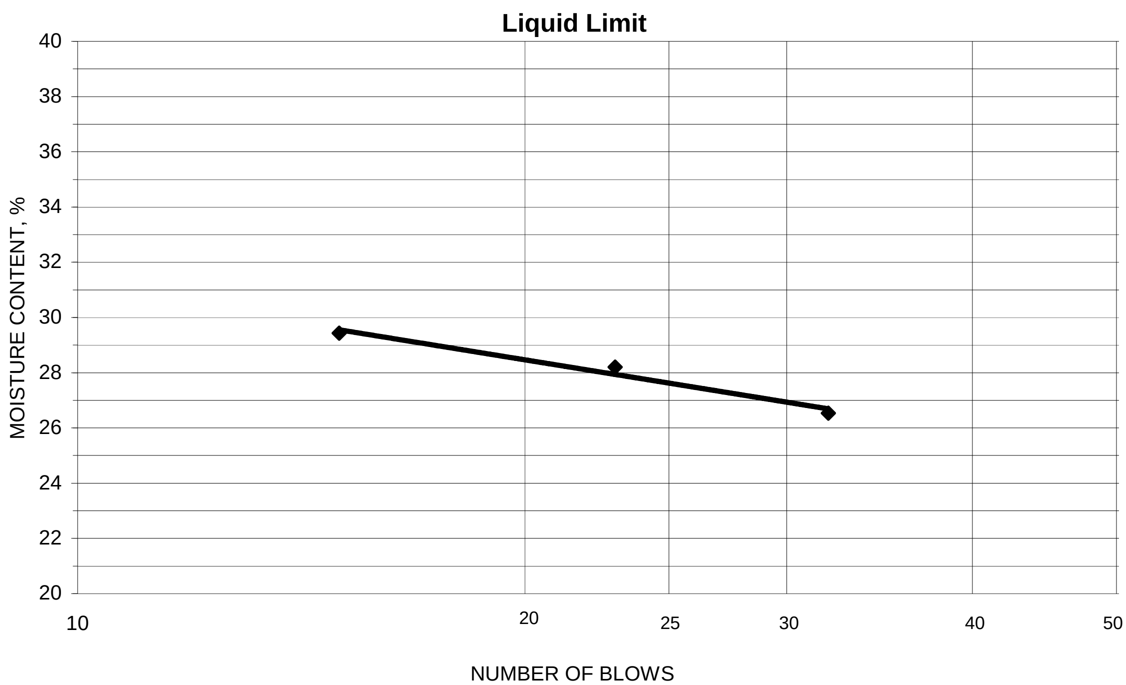
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-32, 27.0'-28.5'	Lab ID	202
		% + No. 40	9
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-14-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
11.71	10.16	4.32	32	26.5	
11.40	9.86	4.40	23	28.2	
13.33	11.29	4.36	15	29.4	28



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.06	9.33	4.35	14.7	15	13
9.36	8.73	4.35	14.4		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-32, 47.5'-49.0'	Lab ID	212
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 22.1

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	98.4
No. 40	0.425	86.5
No. 200	0.075	75.5
	0.02	65.3
	0.005	39.4
	0.002	30.0
estimated	0.001	26.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	1.6
Coarse Sand	1.6	11.9
Medium Sand	11.9	---
Fine Sand	11.0	11.0
Silt	36.1	45.5
Clay	39.4	30.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 40

Plastic Limit: 18

Plasticity Index: 22

Activity Index: 0.73

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (16)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-32, 47.5'-49.0'	Lab ID	212

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: KDK
Test Date: 10-08-2009
Date Received 10-01-2009

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	98.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.69

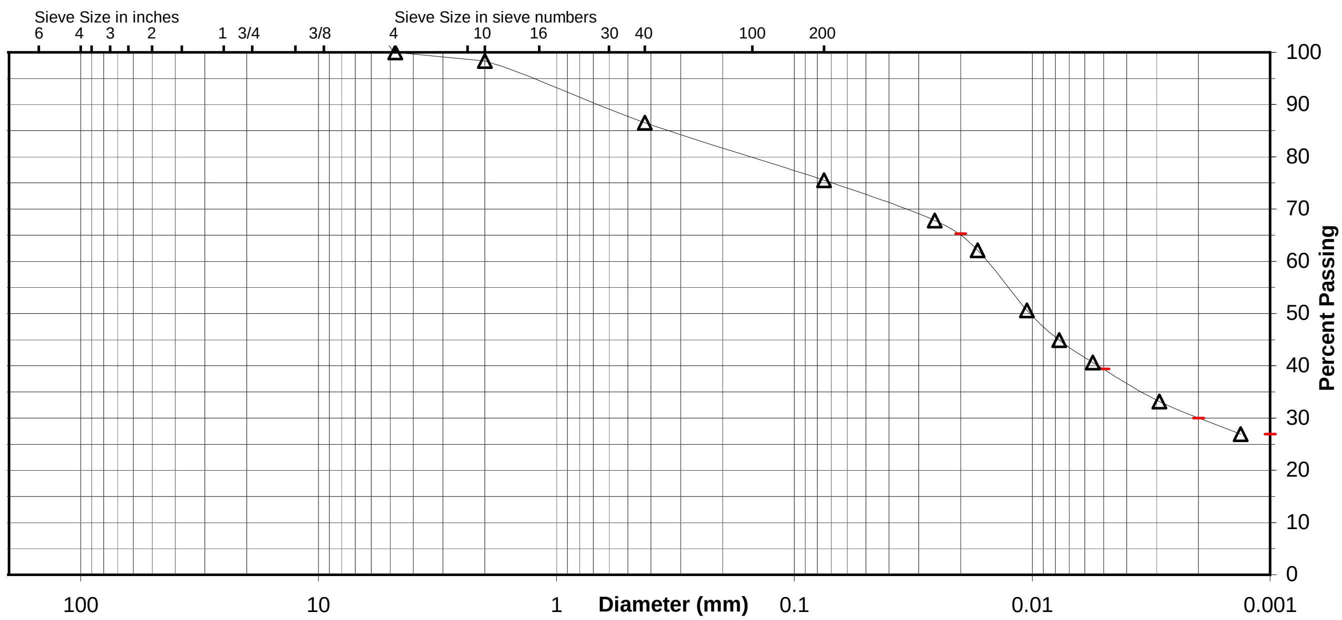
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	86.5
No. 200	75.5
0.02 mm	65.3
0.005 mm	39.4
0.002 mm	30.0
0.001 mm	26.9

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	1.6	11.9	11.0	36.1	39.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.6	11.9	11.0	45.5	30.0



Comments

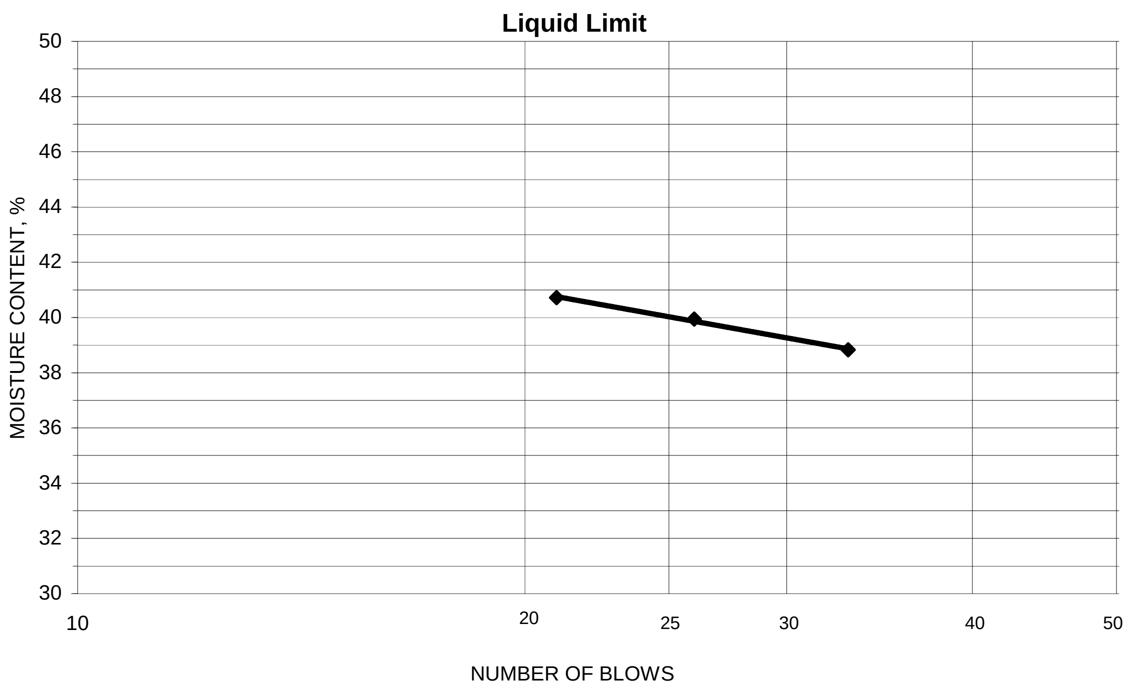
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-32, 47.5'-49.0'	Lab ID	212
		% + No. 40	13
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-09-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
14.06	11.35	4.37	33	38.8	40
14.22	11.40	4.34	26	39.9	
13.82	11.08	4.35	21	40.7	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
11.39	10.34	4.31	17.4	18	22
11.56	10.48	4.36	17.6		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	TVA - Shawnee Ash Ponds 1 and 2	Project Number	175559023
Source	STN-32A, 17.5'-19.0'	Lab ID	1205
County	McCracken	Date Received	2-17-10
Sample Type	SPT	Date Reported	3-23-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 23.9

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	98.7
No. 4	4.75	98.1
No. 10	2	96.5
No. 40	0.425	92.9
No. 200	0.075	87.1
	0.02	65.6
	0.005	40.8
	0.002	30.5
estimated	0.001	26.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	1.9	3.5
Coarse Sand	1.6	3.6
Medium Sand	3.6	---
Fine Sand	5.8	5.8
Silt	46.3	56.6
Clay	40.8	30.5

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 41

Plastic Limit: 19

Plasticity Index: 22

Activity Index: 0.73

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-7-6 (19)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name: TVA - Shawnee Ash Ponds 1 and 2
Project Number: 175559023
Source: STN-32A, 17.5'-19.0'
Lab ID: 1205

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Weathered and Friable

Tested By: RHB
Test Date: 03-01-2010
Date Received 02-17-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	98.7
No. 4	98.1
No. 10	96.5

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

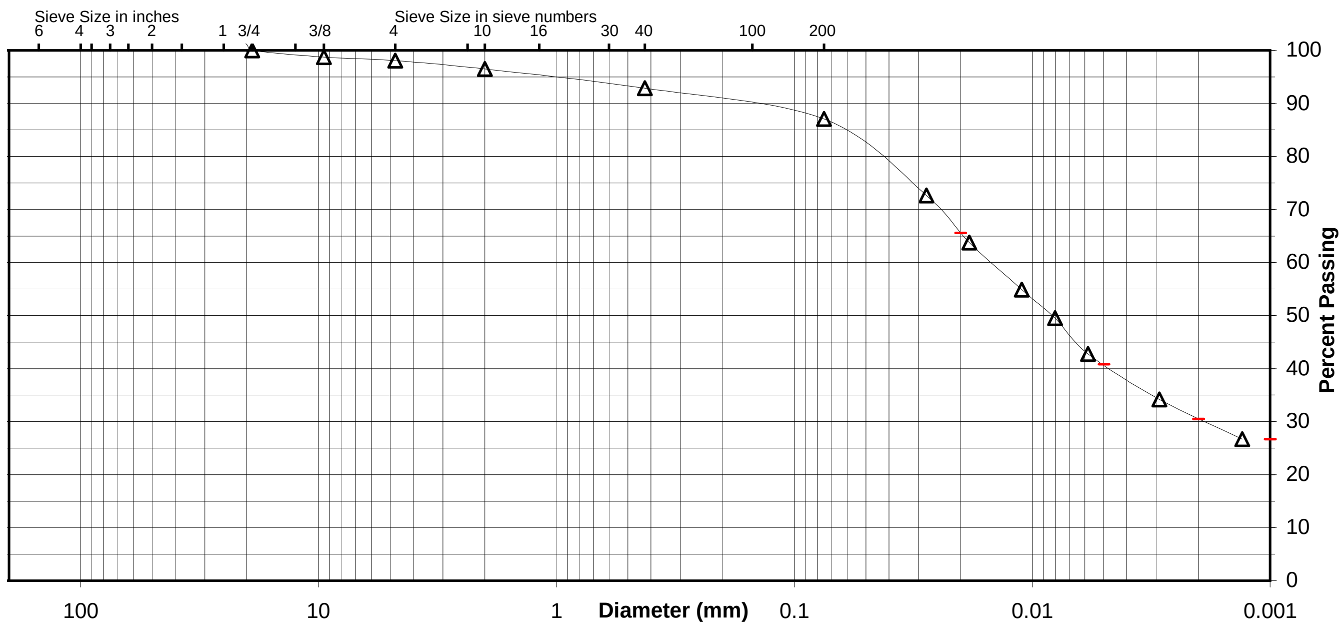
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	92.9
No. 200	87.1
0.02 mm	65.6
0.005 mm	40.8
0.002 mm	30.5
0.001 mm	26.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.9	1.6	3.6	5.8	46.3	40.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	3.5	3.6	5.8	56.6	30.5



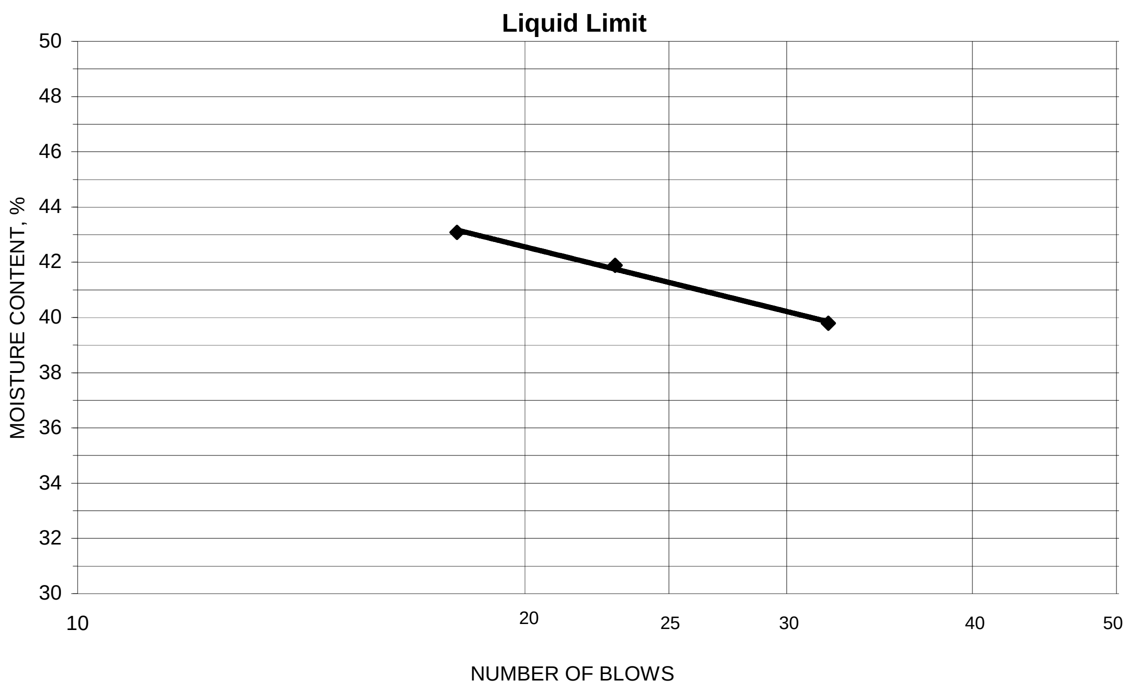
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	TVA - Shawnee Ash Ponds 1 and 2	Project No.	175559023
Source	STN-32A, 17.5'-19.0'	Lab ID	1205
		% + No. 40	7
Tested By	AR	Test Method	ASTM D 4318 Method A
Date Received	02-17-2010		
Test Date	03-09-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
30.98	26.95	17.33	23	41.9	41
37.04	32.46	21.83	18	43.1	
34.36	29.53	17.39	32	39.8	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
27.88	26.67	20.45	19.5	19	22
28.03	26.77	20.13	19.0		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-33, 18.0'-19.5'	Lab ID	230
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-16-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 24.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	96.7
No. 200	0.075	88.9
	0.02	73.4
	0.005	46.8
	0.002	36.2
estimated	0.001	32.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	3.3
Medium Sand	3.3	---
Fine Sand	7.8	7.8
Silt	42.1	52.7
Clay	46.8	36.2

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 46

Plastic Limit: 22

Plasticity Index: 24

Activity Index: 0.67

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-7-6 (23)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-33, 18.0'-19.5'
Lab ID: 230

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: CLH
Test Date: 10-14-2009
Date Received: 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.71

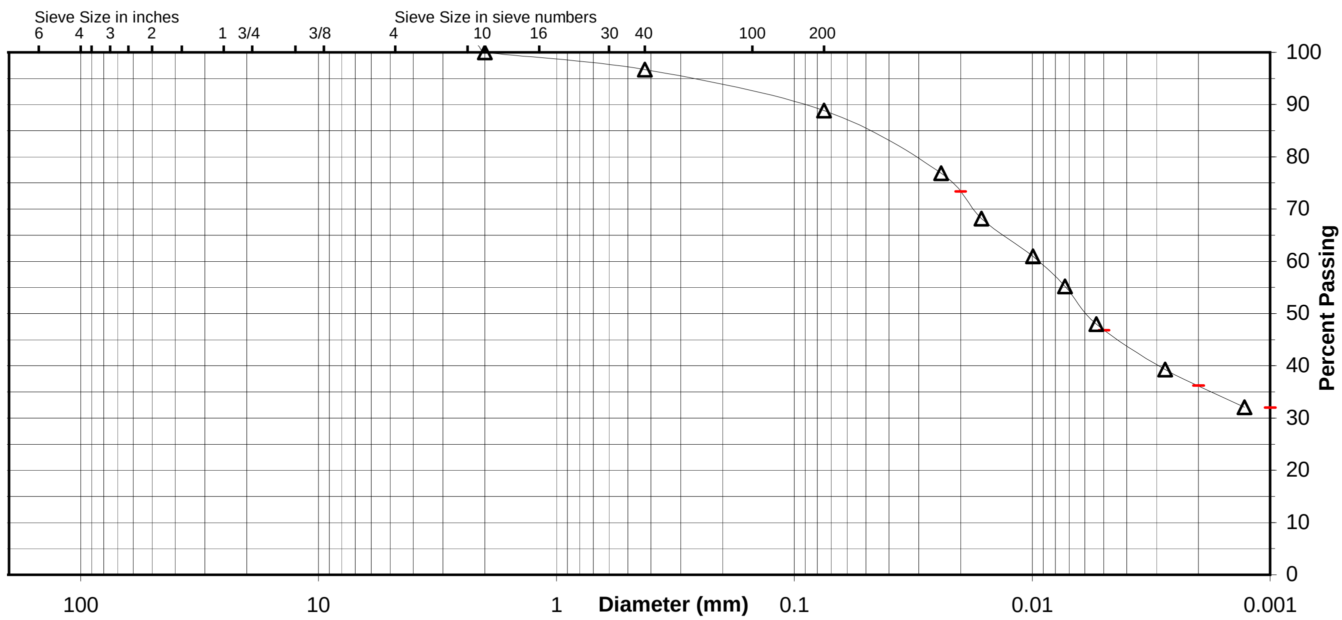
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	96.7
No. 200	88.9
0.02 mm	73.4
0.005 mm	46.8
0.002 mm	36.2
0.001 mm	32.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	3.3	7.8	42.1	46.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	3.3	7.8	52.7	36.2



Comments

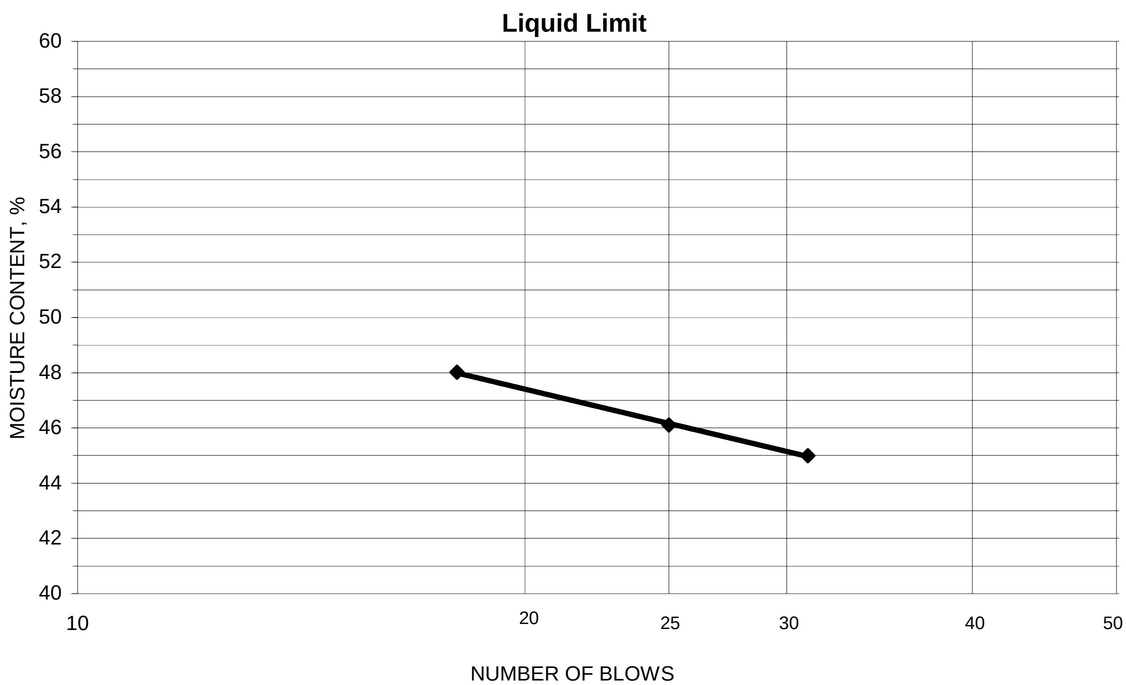
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-33, 18.0'-19.5'	Lab ID	230
		% + No. 40	3
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-14-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
14.75	11.51	4.31	31	45.0	46
14.09	11.01	4.33	25	46.1	
13.24	10.34	4.30	18	48.0	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
11.29	10.05	4.34	21.7	22	24
8.59	7.82	4.35	22.2		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-35, 15.0'-16.5'
Lab ID: 254

County: McCracken
Date Received: 10-1-09
Sample Type: SPT
Date Reported: 10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 16.7

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	90.1
No. 4	4.75	76.4
No. 10	2	58.3
No. 40	0.425	36.2
No. 200	0.075	15.6
	0.02	4.6
	0.005	2.2
	0.002	1.1
estimated	0.001	0.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	23.6	41.7
Coarse Sand	18.1	22.1
Medium Sand	22.1	---
Fine Sand	20.6	20.6
Silt	13.4	14.5
Clay	2.2	1.1

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.72

Classification

Unified Group Symbol: SM
Group Name: Silty sand with gravel

AASHTO Classification: A-1-b (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Stantec

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-35, 15.0'-16.5'	Lab ID	254

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Weathered and Friable

Tested By: JMB
Test Date: 10-08-2009
Date Received 10-01-2009

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	90.1
No. 4	76.4
No. 10	58.3

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.72

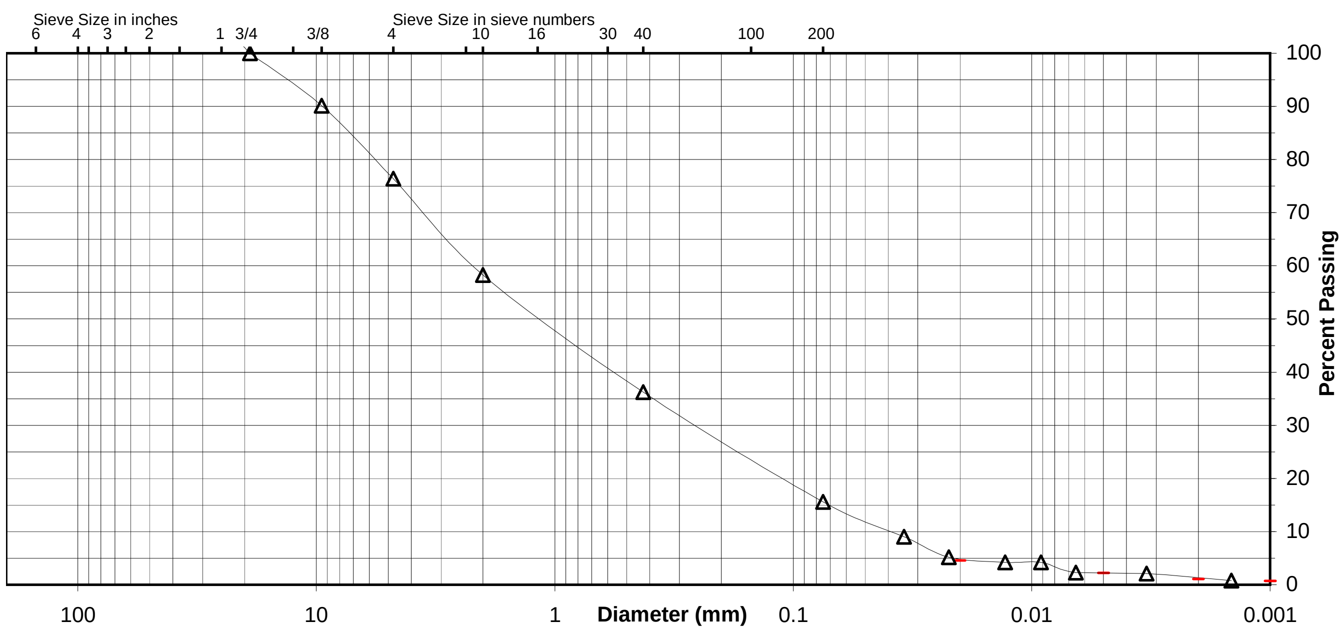
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	36.2
No. 200	15.6
0.02 mm	4.6
0.005 mm	2.2
0.002 mm	1.1
0.001 mm	0.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	23.6	18.1	22.1	20.6	13.4	2.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	41.7	22.1	20.6	14.5	1.1



Comments

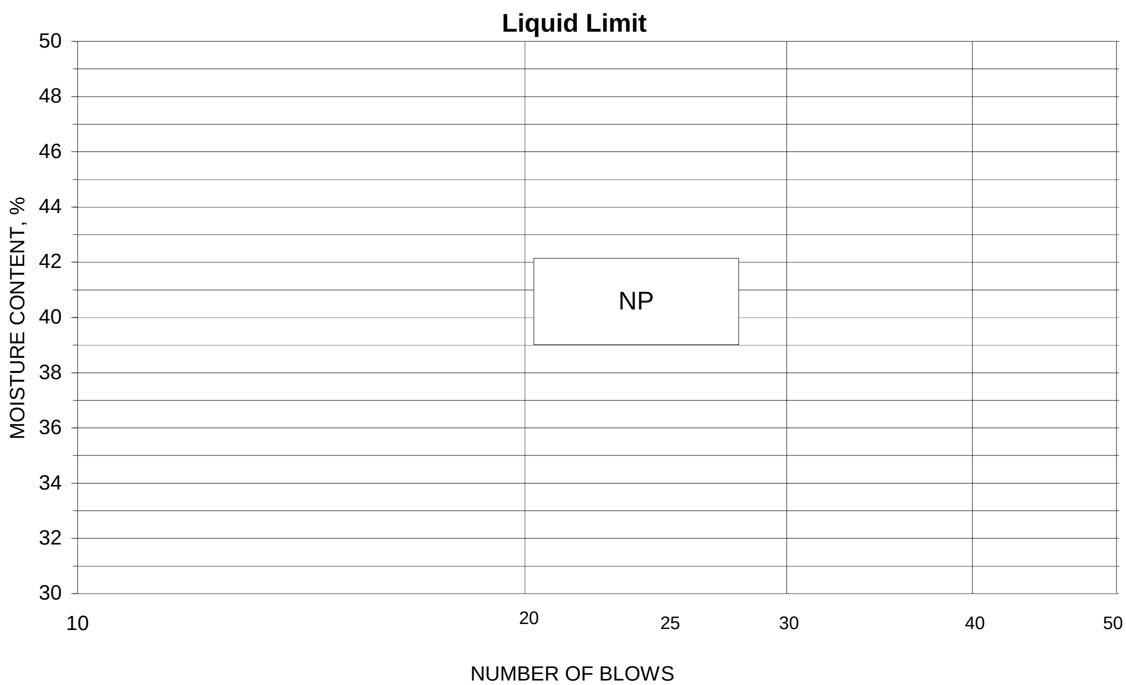
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-35, 15.0'-16.5'	Lab ID	254
		% + No. 40	64
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-09-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-36, 28.5'-30.0'	Lab ID	296
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 13.9

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	100.0
1"	25	90.8
3/4"	19	86.0
3/8"	9.5	77.2
No. 4	4.75	59.3
No. 10	2	43.7
No. 40	0.425	23.0
No. 200	0.075	4.5
	0.02	2.3
	0.005	2.3
	0.002	1.6
estimated	0.001	1.2

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	40.7	56.3
Coarse Sand	15.6	20.7
Medium Sand	20.7	---
Fine Sand	18.5	18.5
Silt	2.2	2.9
Clay	2.3	1.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SP

Group Name: Poorly graded sand with gravel

AASHTO Classification: A-1-a (1)

Comments:

Particle-Size Analysis of Soils

ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-36, 28.5'-30.0'	Lab ID	296

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded and Angular
Particle Hardness: Hard and Durable

Tested By: JMB
Test Date: 10-09-2009
Date Received 10-01-2009

Maximum Particle size: 1 1/2" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	100.0
1"	90.8
3/4"	86.0
3/8"	77.2
No. 4	59.3
No. 10	43.7

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

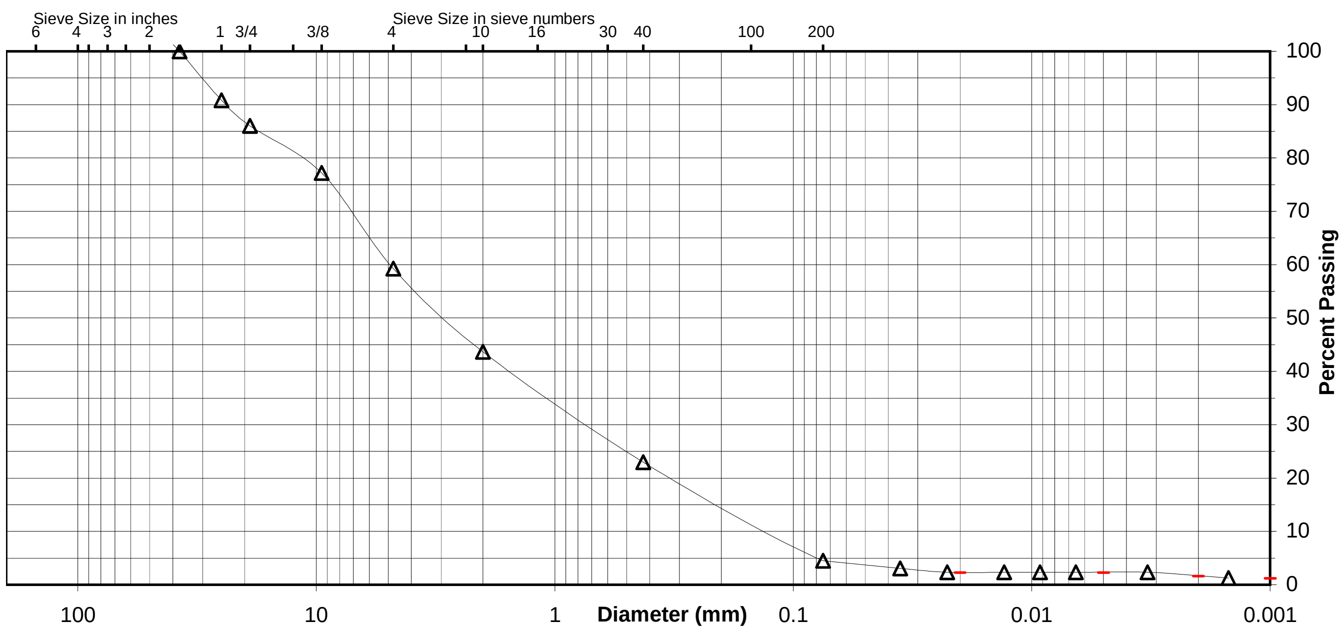
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	23.0
No. 200	4.5
0.02 mm	2.3
0.005 mm	2.3
0.002 mm	1.6
0.001 mm	1.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	14.0	26.7	15.6	20.7	18.5	2.2	2.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	56.3	20.7	18.5	2.9	1.6



Comments

Reviewed By RHB

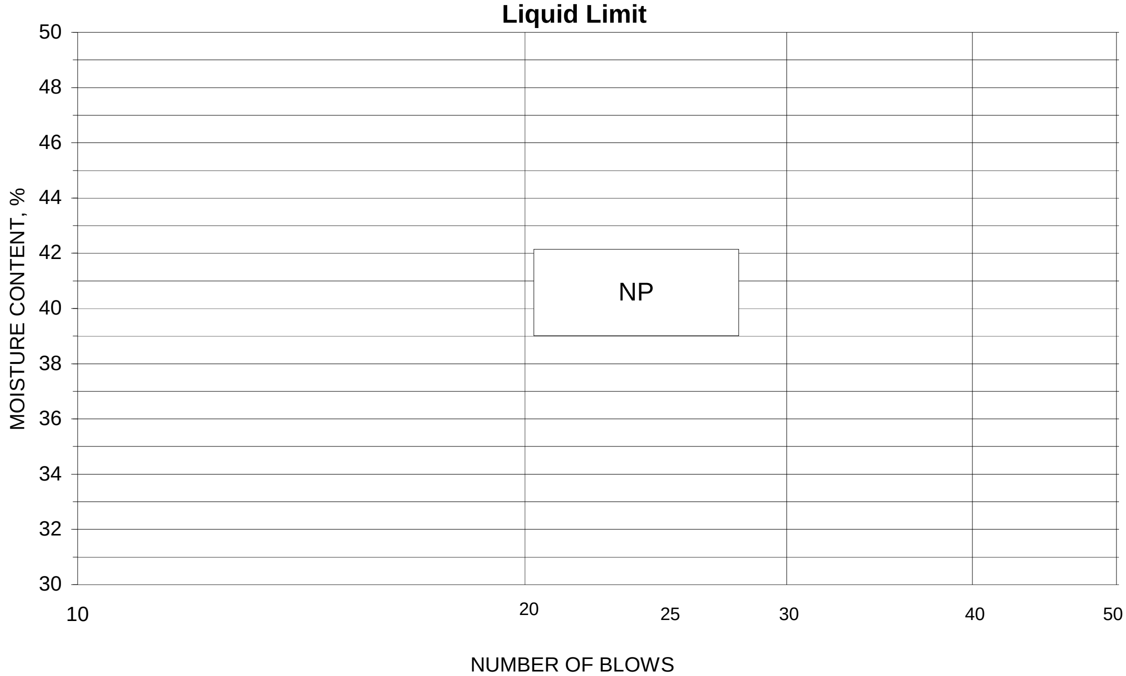
Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-36, 28.5'-30.0'	Lab ID	296
		% + No. 40	77
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-10-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit

Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-42, 32.5'-34.0'
Lab ID: 437

County: McCracken
Date Received: 10-1-09
Sample Type: SPT
Date Reported: 10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 25.1

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.4
No. 200	0.075	95.8
	0.02	81.7
	0.005	52.0
	0.002	40.4
estimated	0.001	35.3

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.6
Medium Sand	0.6	---
Fine Sand	3.6	3.6
Silt	43.8	55.4
Clay	52.0	40.4

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 45
Plastic Limit: 21
Plasticity Index: 24
Activity Index: 0.60

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-7-6 (25)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Source: STN-42, 32.5'-34.0'

Project Number: 175559023
Lab ID: 437

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JMB
Test Date: 10-08-2009
Date Received: 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.71

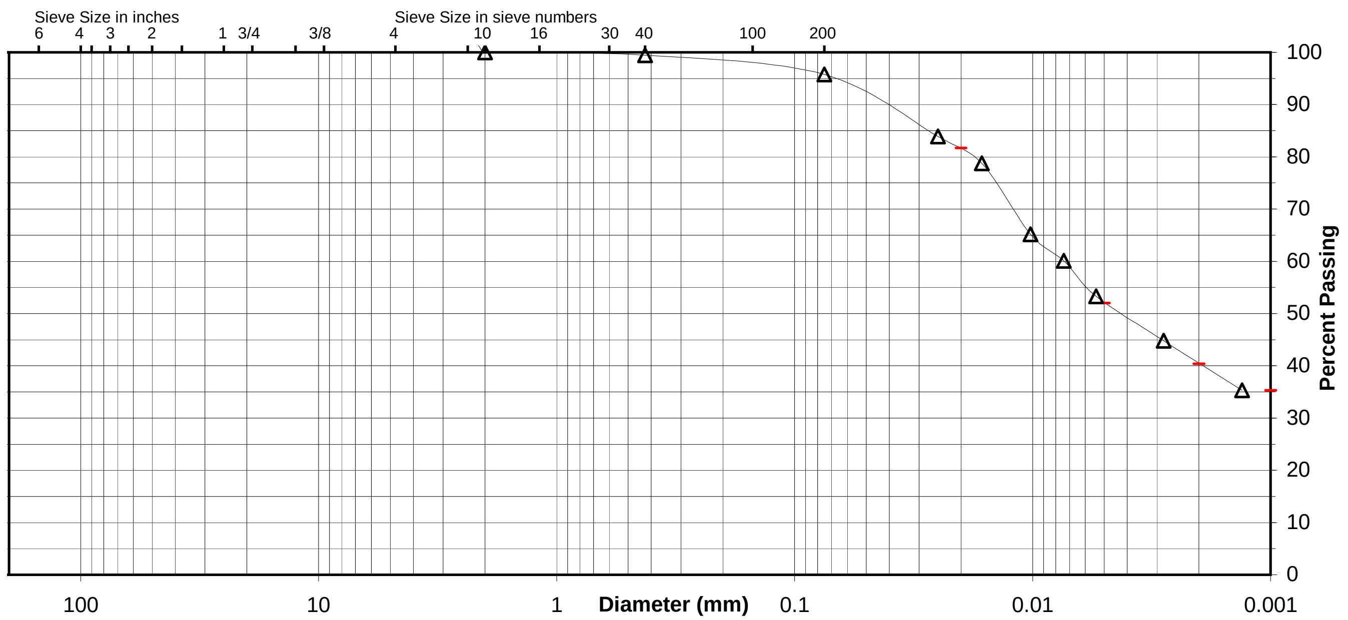
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	99.4
No. 200	95.8
0.02 mm	81.7
0.005 mm	52.0
0.002 mm	40.4
0.001 mm	35.3

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.6	3.6	43.8	52.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.6	3.6	55.4	40.4



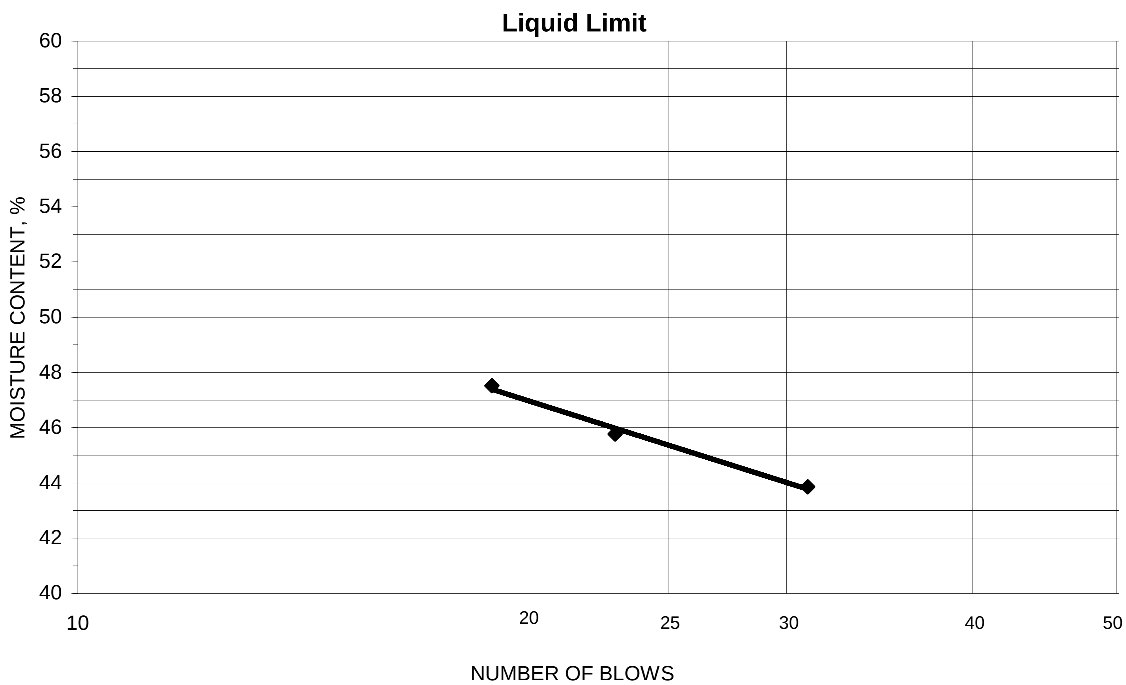
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-42, 32.5'-34.0'	Lab ID	437
		% + No. 40	1
Tested By	CLH	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-09-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
13.01	10.37	4.35	31	43.9	45
13.09	10.33	4.30	23	45.8	
13.53	10.56	4.31	19	47.5	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.48	9.42	4.37	21.0	21	24
10.58	9.50	4.32	20.8		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-43, 22.5'-24.0'	Lab ID	464
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-16-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 23.6

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.5
No. 200	0.075	43.0
	0.02	21.8
	0.005	15.5
	0.002	12.7
estimated	0.001	12.1

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.5
Medium Sand	0.5	---
Fine Sand	56.5	56.5
Silt	27.5	30.3
Clay	15.5	12.7

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SM

Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-43, 22.5'-24.0'	Lab ID	464

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JMB
Test Date: 10-09-2009
Date Received 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

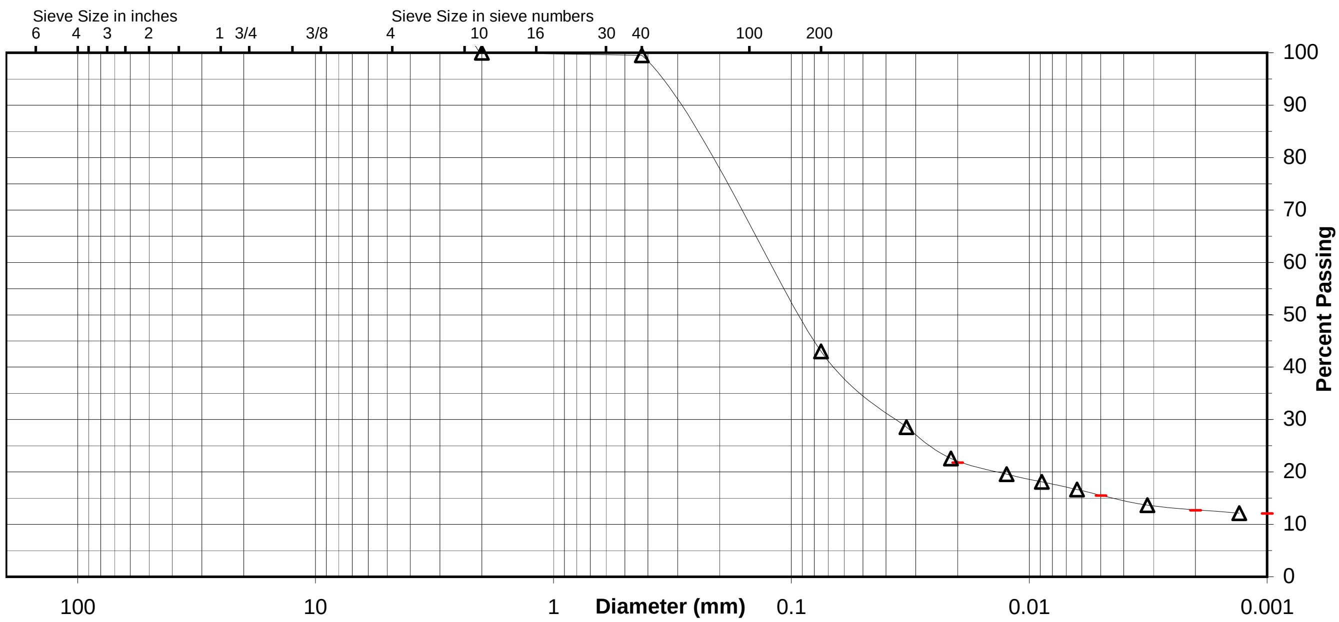
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.5
No. 200	43.0
0.02 mm	21.8
0.005 mm	15.5
0.002 mm	12.7
0.001 mm	12.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.5	56.5	27.5	15.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.5	56.5	30.3	12.7



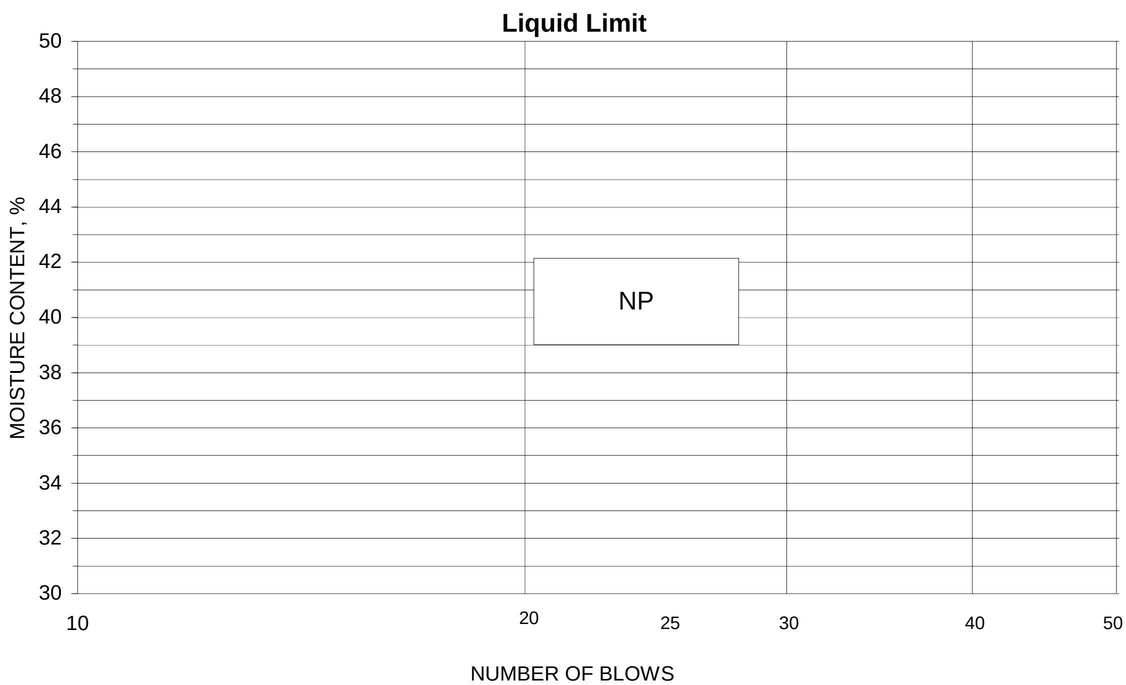
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-43, 22.5'-24.0'	Lab ID	464
		% + No. 40	1
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-12-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-46, 3.0'-4.5'
Lab ID: 513
County: McCracken
Date Received: 10-1-09
Sample Type: SPT
Date Reported: 10-14-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 16.2

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.9
No. 10	2	99.9
No. 40	0.425	98.5
No. 200	0.075	88.0
	0.02	63.6
	0.005	43.3
	0.002	34.0
estimated	0.001	29.1

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.1	0.1
Coarse Sand	0.0	1.4
Medium Sand	1.4	---
Fine Sand	10.5	10.5
Silt	44.7	54.0
Clay	43.3	34.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 38
Plastic Limit: 18
Plasticity Index: 20
Activity Index: 0.59

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL
Group Name: Lean clay
AASHTO Classification: A-6 (17)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-46, 3.0'-4.5'
Lab ID: 513

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JMB
Test Date: 10-07-2009
Date Received: 10-01-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.9
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

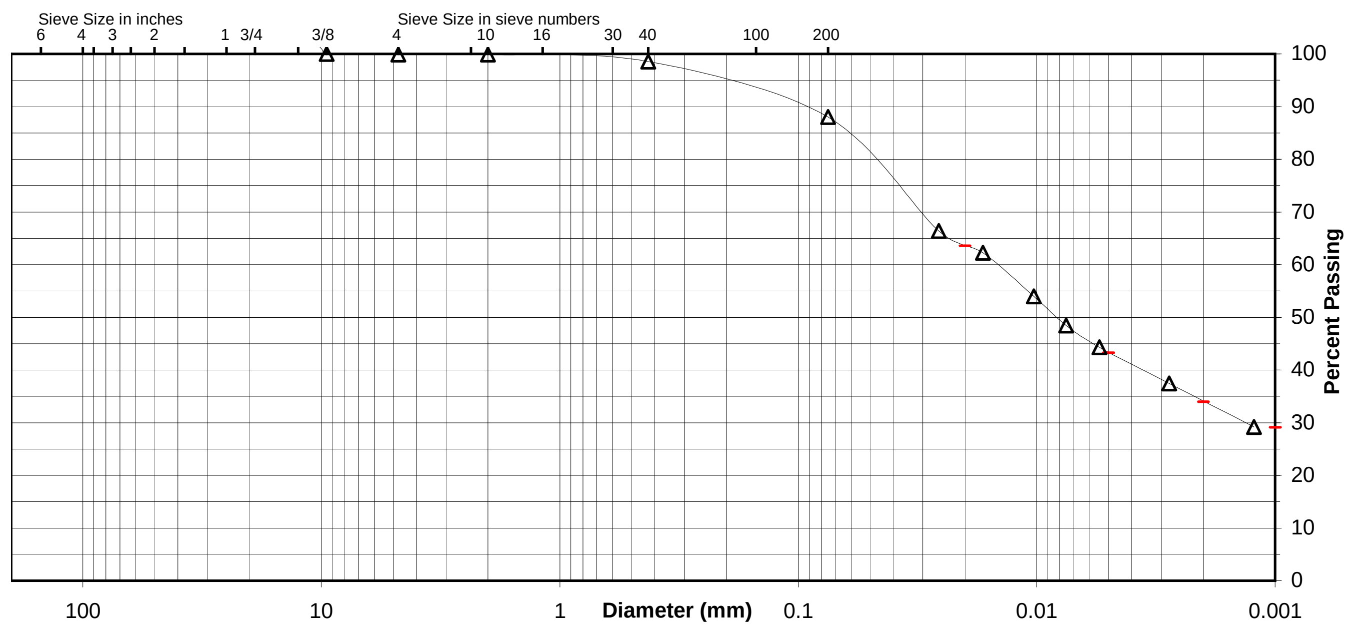
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.5
No. 200	88.0
0.02 mm	63.6
0.005 mm	43.3
0.002 mm	34.0
0.001 mm	29.1

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.1	0.0	1.4	10.5	44.7	43.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.1	1.4	10.5	54.0	34.0



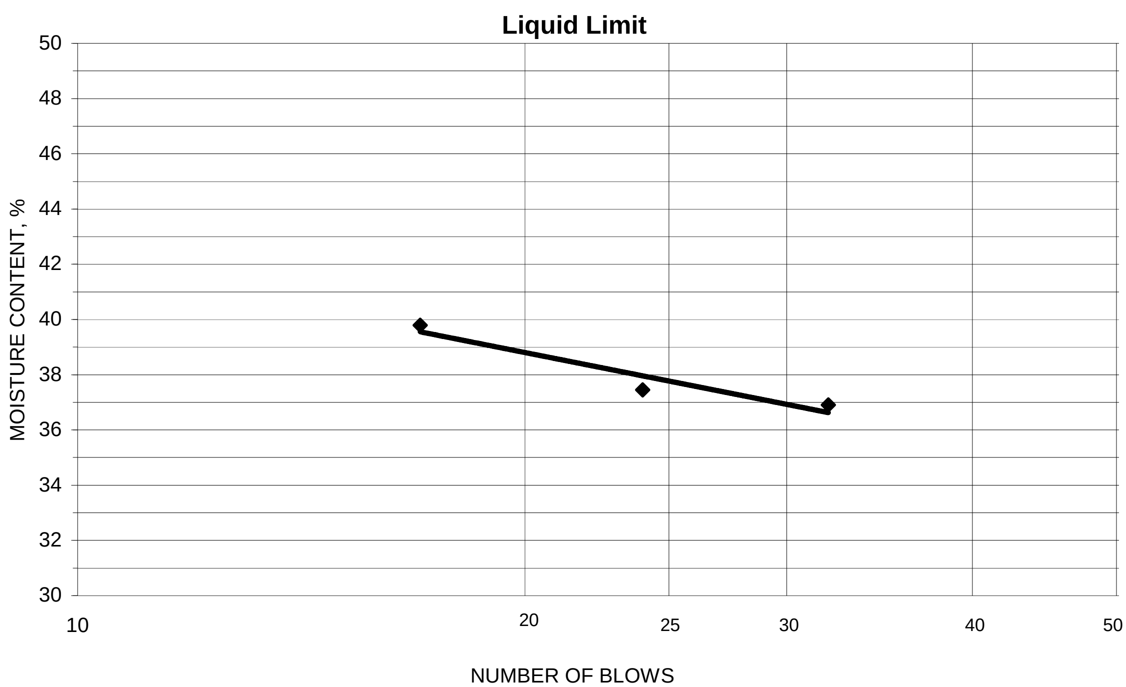
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-46, 3.0'-4.5'	Lab ID	513
		% + No. 40	1
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
15.59	12.56	4.35	32	36.9	
14.89	12.01	4.32	24	37.5	
14.86	11.88	4.39	17	39.8	38



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.43	9.52	4.39	17.7	18	20
9.42	8.65	4.34	17.9		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-47, 18.0'-19.5'	Lab ID	554
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-16-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 34.3

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.3
No. 10	2	96.9
No. 40	0.425	95.9
No. 200	0.075	78.6
	0.02	34.1
	0.005	7.5
	0.002	4.7
estimated	0.001	4.7

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.7	3.1
Coarse Sand	2.4	1.0
Medium Sand	1.0	---
Fine Sand	17.3	17.3
Silt	71.1	73.9
Clay	7.5	4.7

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.60

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Source: STN-47, 18.0'-19.5'

Project Number: 175559023
Lab ID: 554

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Weathered and Friable

Tested By: JMB
Test Date: 10-08-2009
Date Received: 10-01-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.3
No. 10	96.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.6

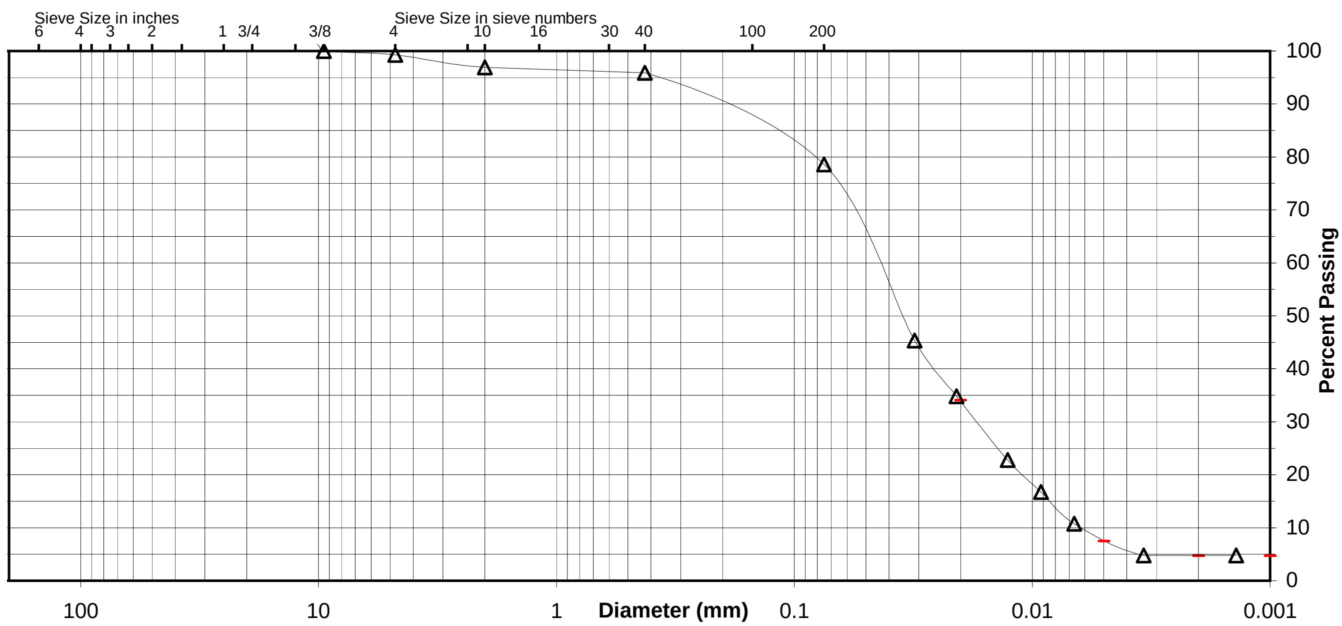
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	95.9
No. 200	78.6
0.02 mm	34.1
0.005 mm	7.5
0.002 mm	4.7
0.001 mm	4.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.7	2.4	1.0	17.3	71.1	7.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	3.1	1.0	17.3	73.9	4.7



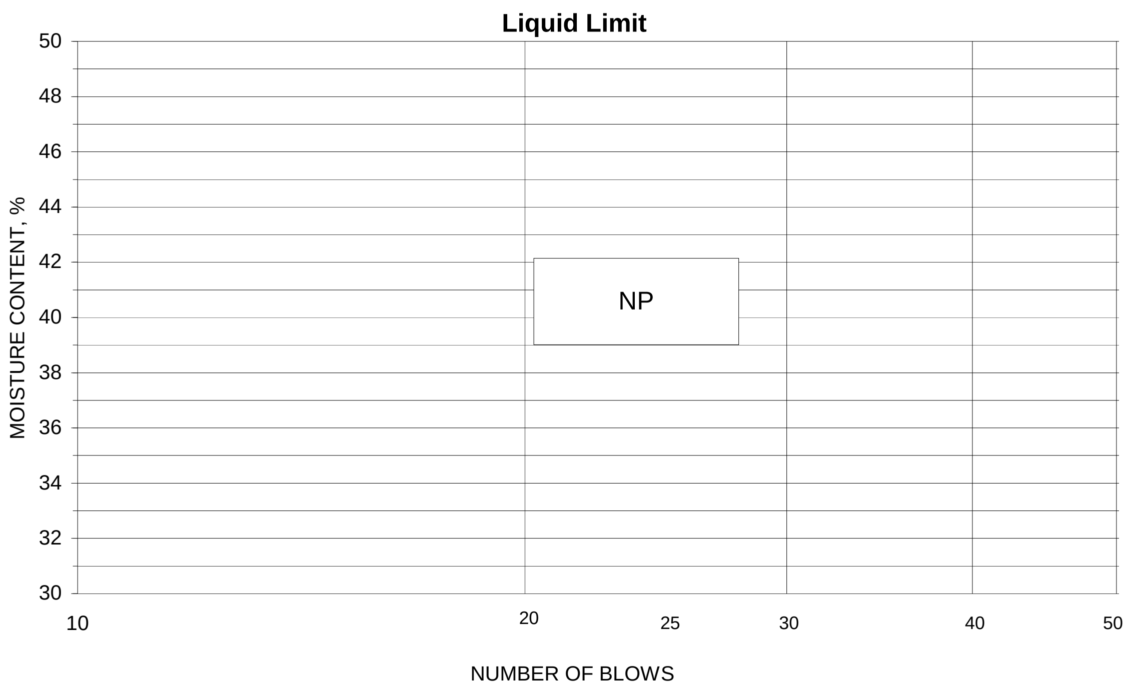
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-47, 18.0'-19.5'	Lab ID	554
		% + No. 40	4
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-09-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-49, 38.5'-40.0'	Lab ID	618
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 26.1

Particle Size Analysis
Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	98.7
No. 200	0.075	93.2
	0.02	85.3
	0.005	56.0
	0.002	42.5
estimated	0.001	35.5

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	0.0
Coarse Sand	0.0	1.3
Medium Sand	1.3	---
Fine Sand	5.5	5.5
Silt	37.2	50.7
Clay	56.0	42.5

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: 45
Plastic Limit: 20
Plasticity Index: 25
Activity Index: 0.60

Moisture-Density Relationship
Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification
Unified Group Symbol: CL
Group Name: Lean clay

AASHTO Classification: A-7-6 (25)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-49, 38.5'-40.0'	Lab ID	618

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JMB
Test Date: 10-08-2009
Date Received 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

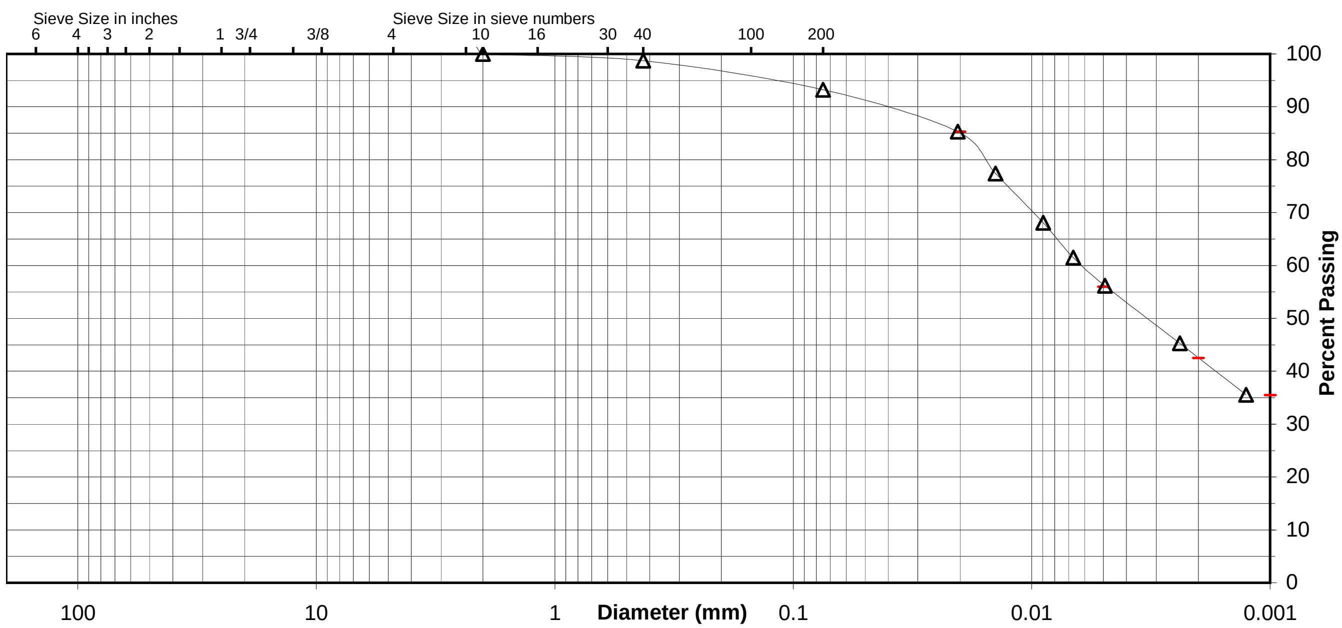
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	98.7
No. 200	93.2
0.02 mm	85.3
0.005 mm	56.0
0.002 mm	42.5
0.001 mm	35.5

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	1.3	5.5	37.2	56.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	1.3	5.5	50.7	42.5



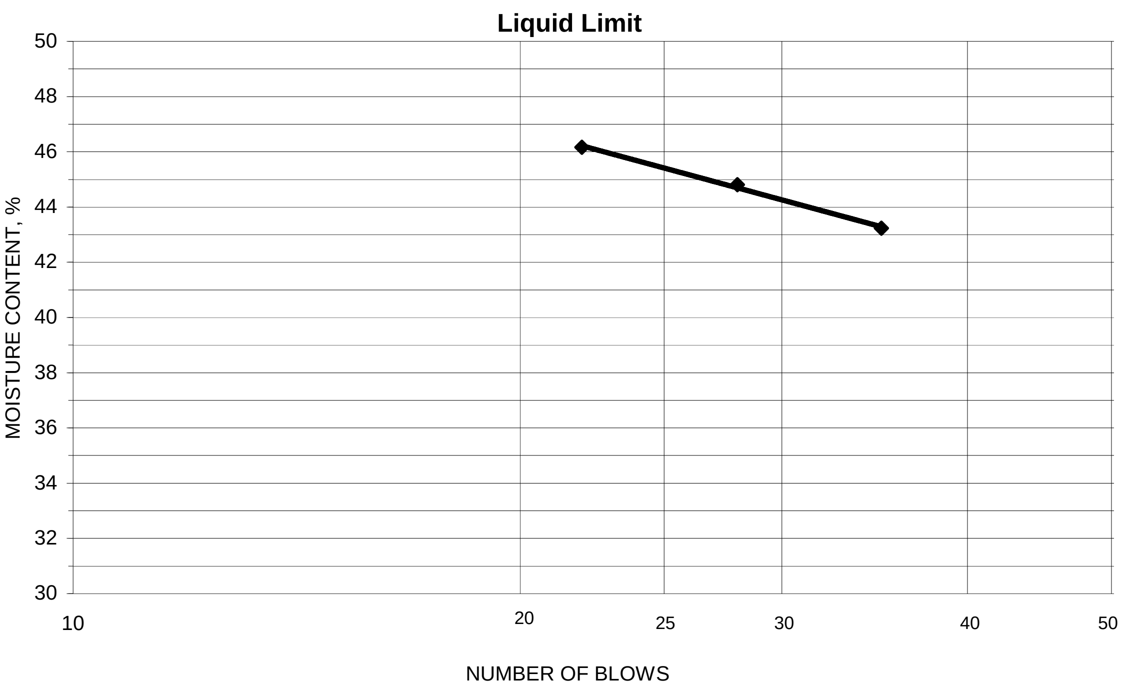
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-49, 38.5'-40.0'	Lab ID	618
		% + No. 40	1
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
14.80	11.64	4.33	35	43.2	
14.96	11.68	4.36	28	44.8	
13.87	10.86	4.34	22	46.2	45



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
11.26	10.13	4.32	19.4	20	25
8.63	7.92	4.35	19.9		

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-51, 10.5'-12.0'
Lab ID: 639
County: McCracken
Date Received: 10-1-09
Sample Type: SPT
Date Reported: 10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 25.3

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.9
No. 200	0.075	93.8
	0.02	66.3
	0.005	44.5
	0.002	33.5
estimated	0.001	29.7

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.1
Medium Sand	0.1	---
Fine Sand	6.1	6.1
Silt	49.3	60.3
Clay	44.5	33.5

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 40
Plastic Limit: 20
Plasticity Index: 20
Activity Index: 0.59

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL
Group Name: Lean clay
AASHTO Classification: A-6 (20)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-51, 10.5'-12.0'	Lab ID	639

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: KDK
Test Date: 10-07-2009
Date Received 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

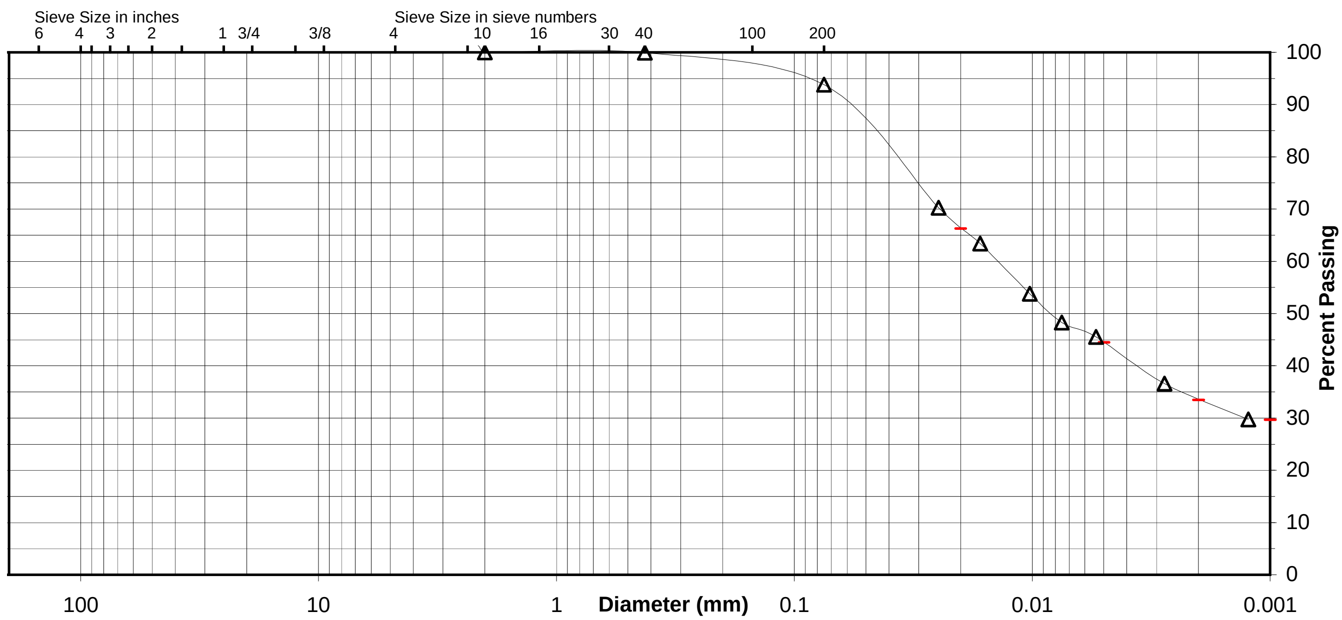
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.9
No. 200	93.8
0.02 mm	66.3
0.005 mm	44.5
0.002 mm	33.5
0.001 mm	29.7

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.1	6.1	49.3	44.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.1	6.1	60.3	33.5



Comments

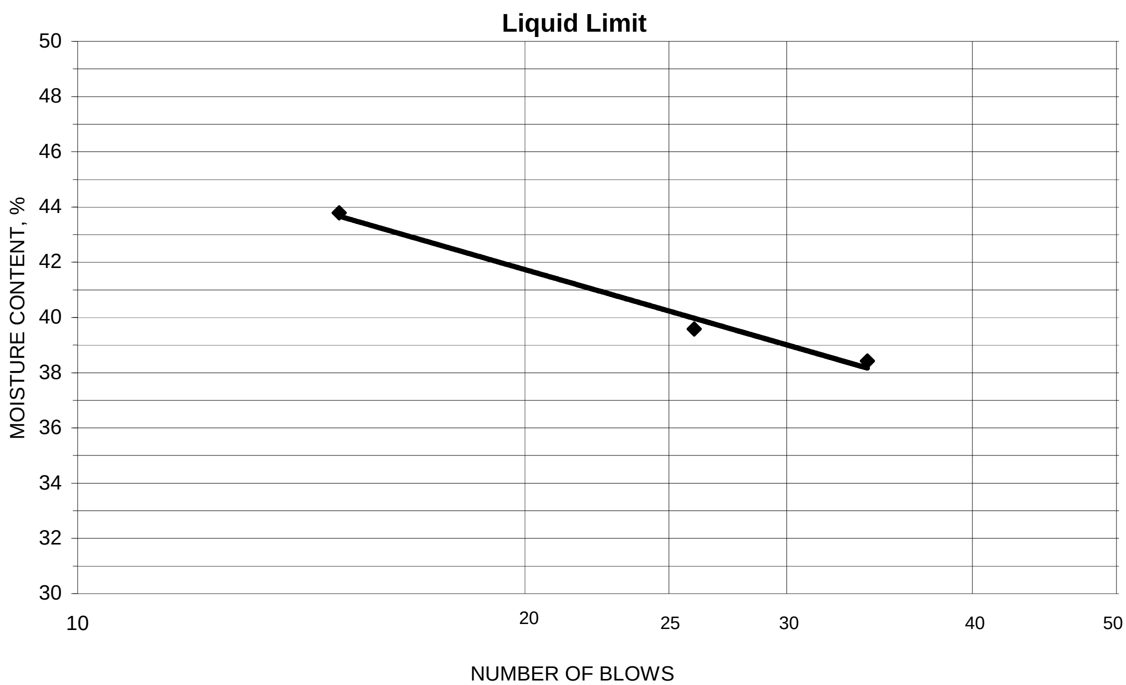
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-51, 10.5'-12.0'	Lab ID	639
		% + No. 40	0
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-08-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
10.30	8.64	4.32	34	38.4	40
10.43	8.70	4.33	26	39.6	
10.73	8.79	4.36	15	43.8	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.79	9.71	4.40	20.3	20	20
11.21	10.07	4.35	19.9		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-51, 25.5'-27.0'	Lab ID	649
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 11.2

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.7
No. 200	0.075	7.2
	0.02	1.9
	0.005	1.9
	0.002	1.9
estimated	0.001	1.9

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.3
Medium Sand	0.3	---
Fine Sand	92.5	92.5
Silt	5.3	5.3
Clay	1.9	1.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: SP-SM

Group Name: Poorly graded sand with silt

AASHTO Classification: A-3 (1)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project Number: 175559023
Source: STN-51, 25.5'-27.0'
Lab ID: 649

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: MWD
Test Date: 10-07-2009
Date Received: 10-01-2009

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

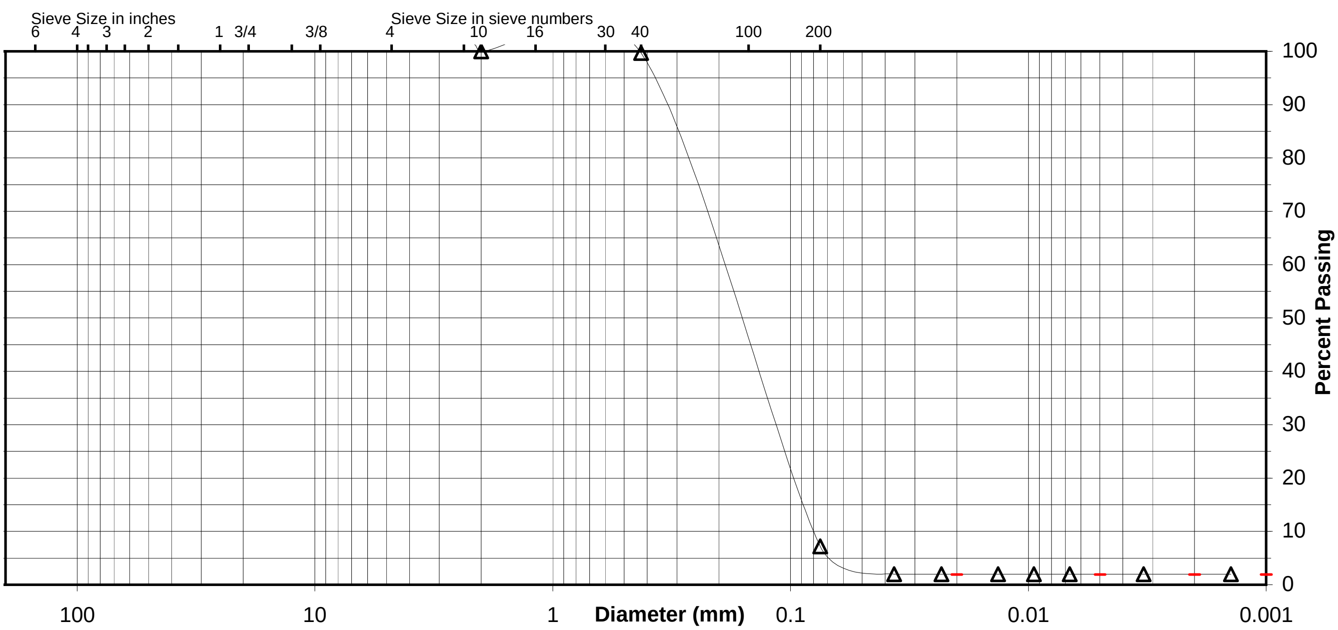
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.7
No. 200	7.2
0.02 mm	1.9
0.005 mm	1.9
0.002 mm	1.9
0.001 mm	1.9

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.3	92.5	5.3	1.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.3	92.5	5.3	1.9



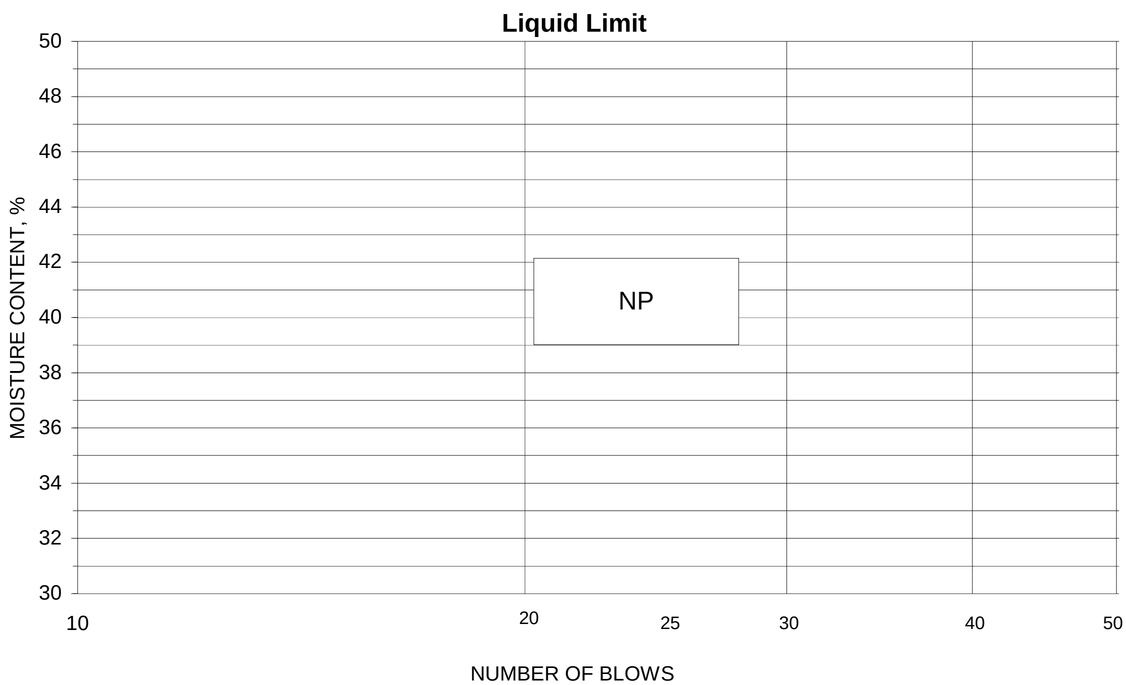
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-51, 25.5'-27.0'	Lab ID	649
		% + No. 40	0
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009	Test Date	10-08-2009
Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-52, 3.0'-4.5'	Lab ID	658
County	McCracken	Date Received	10-1-09
Sample Type	SPT	Date Reported	10-15-09

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 17.0

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	98.2
No. 10	2	97.2
No. 40	0.425	94.9
No. 200	0.075	79.7
	0.02	50.5
	0.005	25.3
	0.002	20.9
estimated	0.001	20.2

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	1.8	2.8
Coarse Sand	1.0	2.3
Medium Sand	2.3	---
Fine Sand	15.2	15.2
Silt	54.4	58.8
Clay	25.3	20.9

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 27

Plastic Limit: 14

Plasticity Index: 13

Activity Index: 0.62

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: CL

Group Name: Lean clay with sand

AASHTO Classification: A-6 (8)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project Number	175559023
Source	STN-52, 3.0'-4.5'	Lab ID	658

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: CLH
Test Date: 10-09-2009
Date Received 10-01-2009

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	98.2
No. 10	97.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.7

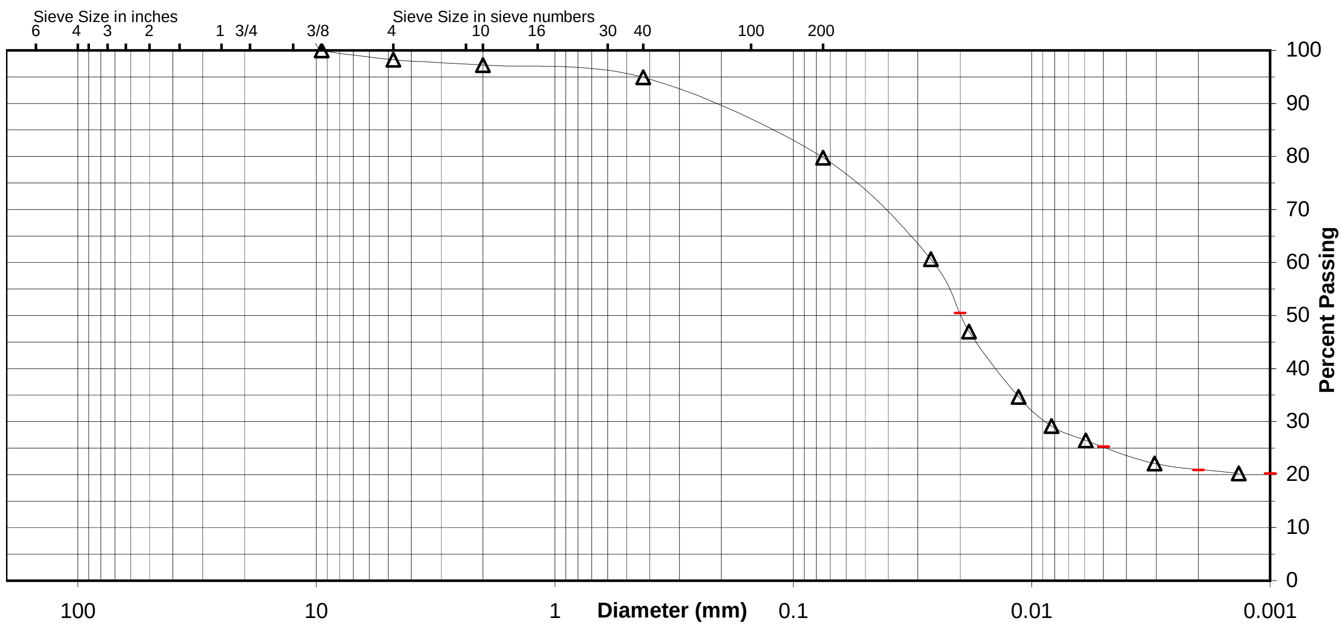
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	94.9
No. 200	79.7
0.02 mm	50.5
0.005 mm	25.3
0.002 mm	20.9
0.001 mm	20.2

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	1.8	1.0	2.3	15.2	54.4	25.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	2.8	2.3	15.2	58.8	20.9



Comments

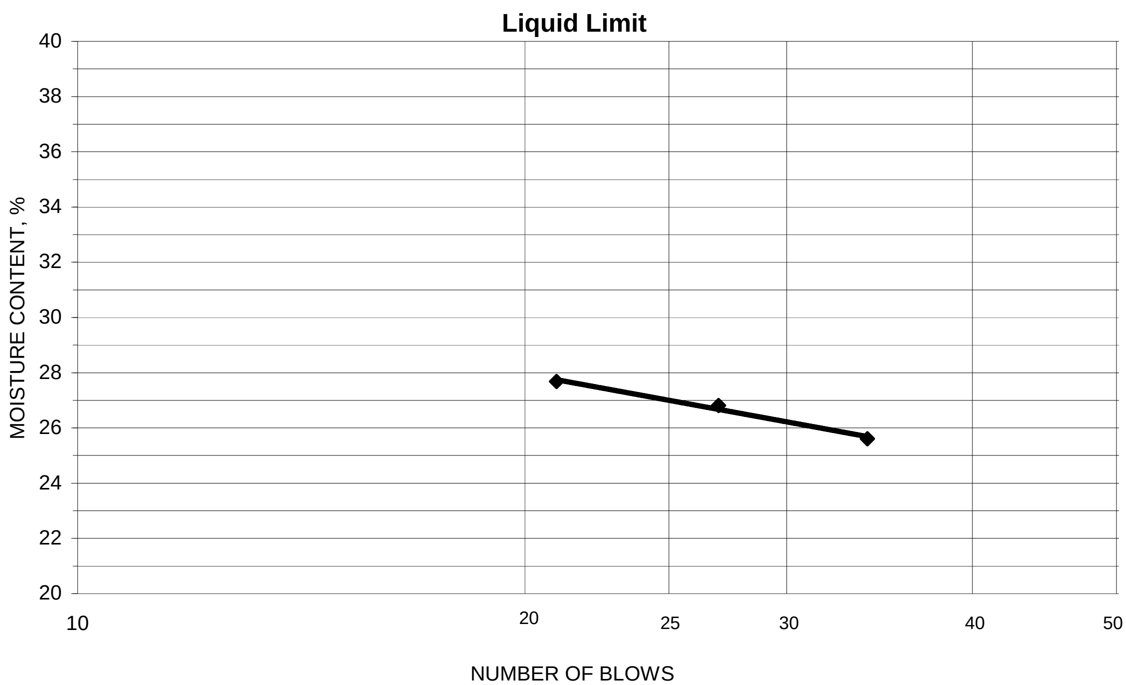
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-52, 3.0'-4.5'	Lab ID	658
		% + No. 40	5
Tested By	KDK	Test Method	ASTM D 4318 Method A
Date Received	10-01-2009		
Test Date	10-13-2009	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
17.12	14.51	4.32	34	25.6	27
17.09	14.39	4.32	27	26.8	
16.57	13.91	4.30	21	27.7	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
11.58	10.66	4.34	14.6	14	13
12.00	11.06	4.36	14.0		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Stantec

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-103, 47.5'-49.0'	Lab ID	332
County	McCracken	Date Received	3-4-10
Sample Type	SPT	Date Reported	3-31-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 46.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	99.9
No. 40	0.425	99.3
No. 200	0.075	90.9
	0.02	37.7
	0.005	4.1
	0.002	2.5
estimated	0.001	2.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.1
Coarse Sand	0.1	0.6
Medium Sand	0.6	---
Fine Sand	8.4	8.4
Silt	86.8	88.4
Clay	4.1	2.5

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.43

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-103, 47.5'-49.0'	Lab ID	332

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JF
Test Date: 03-24-2010
Date Received 03-04-2010

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	99.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.43

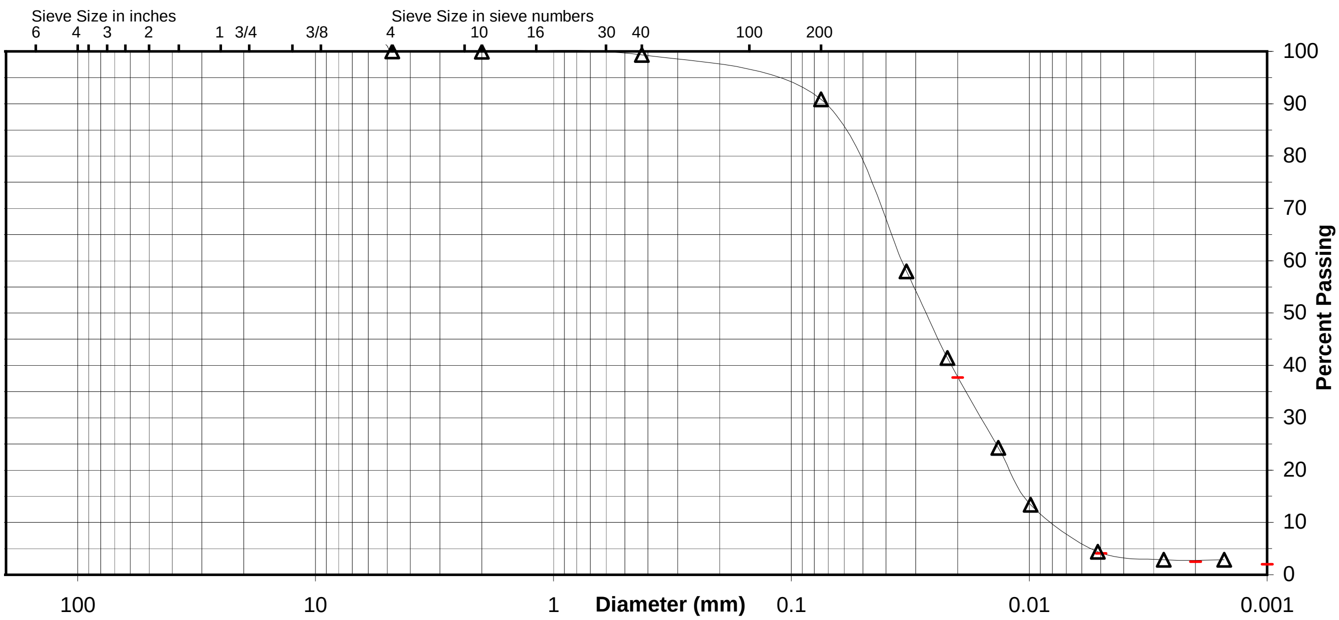
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.3
No. 200	90.9
0.02 mm	37.7
0.005 mm	4.1
0.002 mm	2.5
0.001 mm	2.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.1	0.6	8.4	86.8	4.1

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.1	0.6	8.4	88.4	2.5



Comments

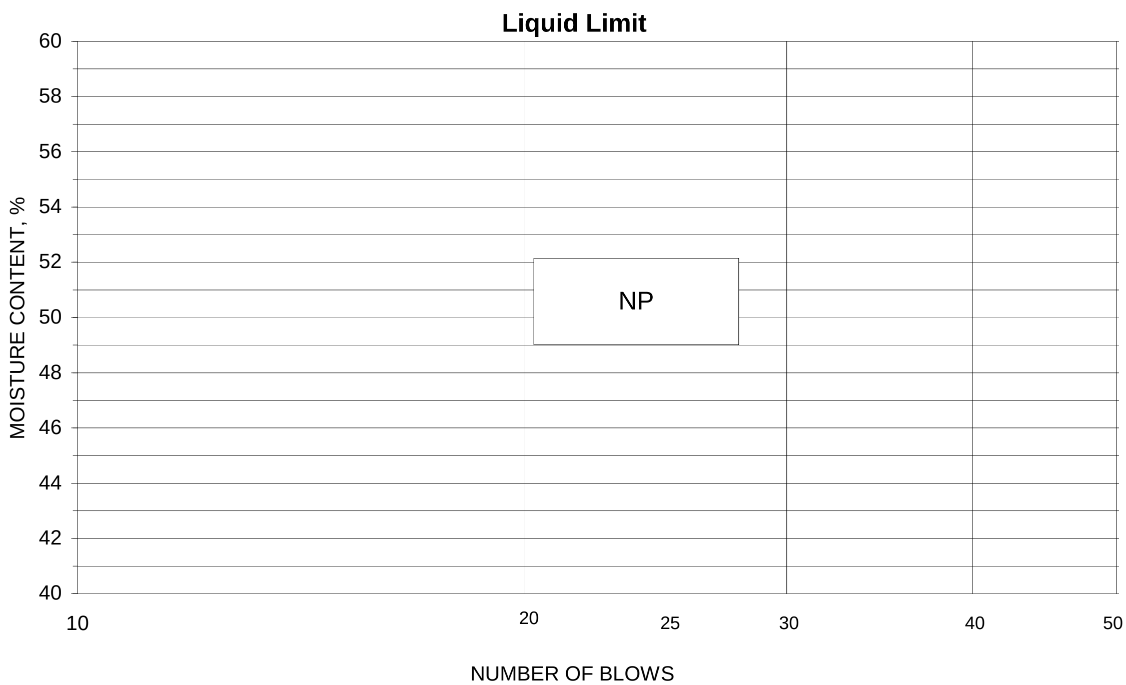
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-103, 47.5'-49.0'	Lab ID	332
		% + No. 40	1
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	03-04-2010		
Test Date	03-25-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: ______

Reviewed By ______

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-105, 24.5'-26.0'	Lab ID	83
County	McCracken	Date Received	3-3-10
Sample Type	SPT	Date Reported	3-30-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 21.9

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size Sieve Size	(mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	95.9
No. 10	2	80.9
No. 40	0.425	76.3
No. 200	0.075	63.5
	0.02	45.8
	0.005	20.8
	0.002	16.6
estimated	0.001	15.8

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	4.1	19.1
Coarse Sand	15.0	4.6
Medium Sand	4.6	---
Fine Sand	12.8	12.8
Silt	42.7	46.9
Clay	20.8	16.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 27

Plastic Limit: 17

Plasticity Index: 10

Activity Index: 0.59

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: CL

Group Name: Sandy lean clay

AASHTO Classification: A-4 (4)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-105, 24.5'-26.0'	Lab ID	83

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JMB
Test Date: 03-22-2010
Date Received 03-03-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	95.9
No. 10	80.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.71

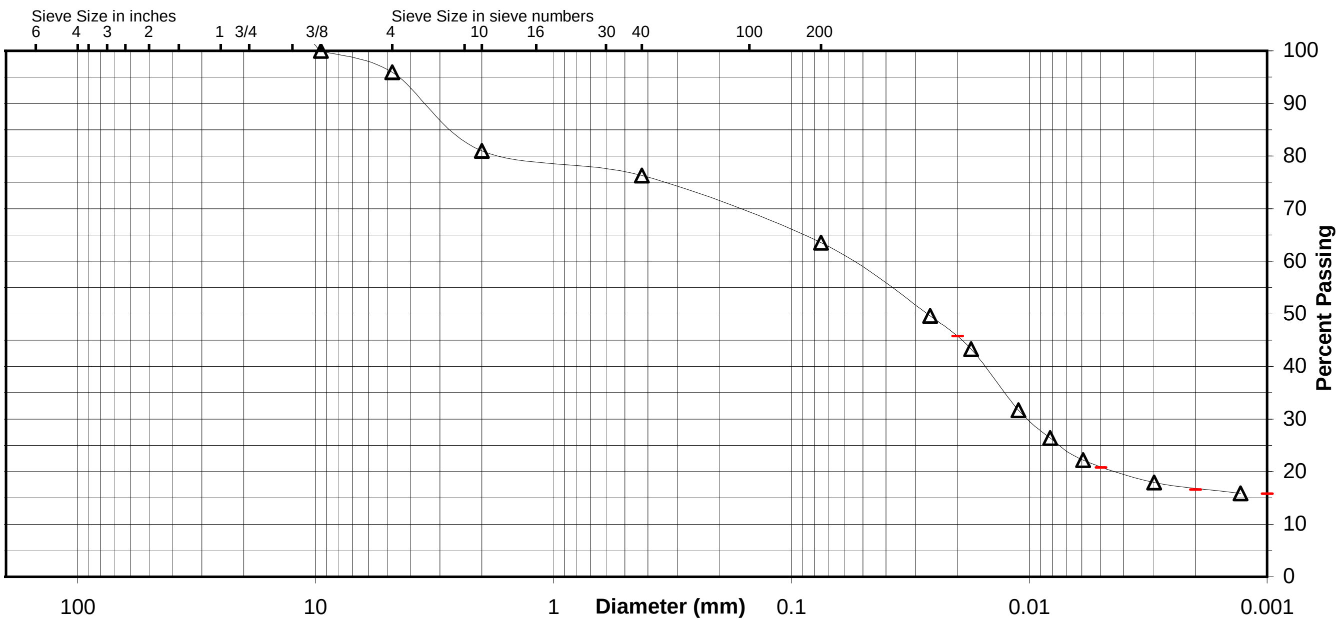
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	76.3
No. 200	63.5
0.02 mm	45.8
0.005 mm	20.8
0.002 mm	16.6
0.001 mm	15.8

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	4.1	15.0	4.6	12.8	42.7	20.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	19.1	4.6	12.8	46.9	16.6



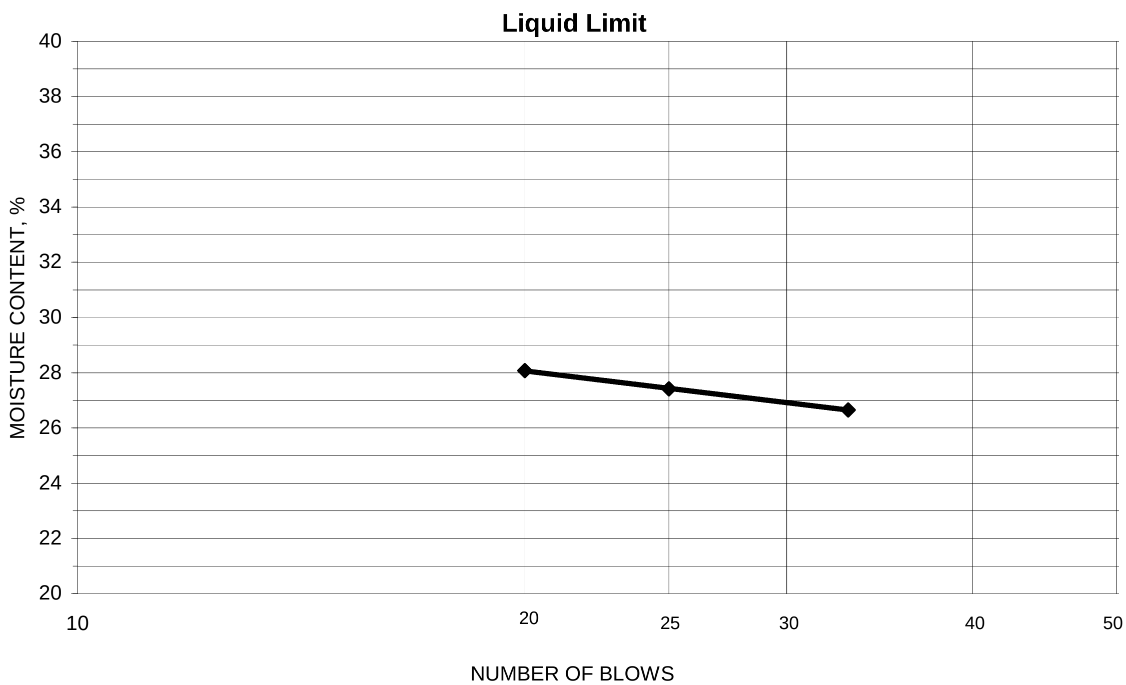
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-105, 24.5'-26.0'	Lab ID	83
		% + No. 40	24
Tested By	JMB/RHB	Test Method	ASTM D 4318 Method A
Date Received	03-03-2010		
Test Date	03-25-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
12.03	10.42	4.38	33	26.7	27
13.91	11.81	4.33	20	28.1	
14.73	12.49	4.32	25	27.4	



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
11.13	10.14	4.35	17.1	17	10
12.69	11.45	4.31	17.4		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Stantec

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-107, 30.0'-31.5'	Lab ID	383
County	McCracken	Date Received	3-4-10
Sample Type	SPT	Date Reported	3-31-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 41.5

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	99.7
No. 4	4.75	99.1
No. 10	2	98.2
No. 40	0.425	96.4
No. 200	0.075	87.2
	0.02	52.6
	0.005	11.9
	0.002	3.8
estimated	0.001	2.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.9	1.8
Coarse Sand	0.9	1.8
Medium Sand	1.8	---
Fine Sand	9.2	9.2
Silt	75.3	83.4
Clay	11.9	3.8

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.23

Classification

Unified Group Symbol: ML

Group Name: Silt

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-107, 30.0'-31.5'
Lab ID: 383

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JF
Test Date: 03-24-2010
Date Received: 03-04-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	99.7
No. 4	99.1
No. 10	98.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.23

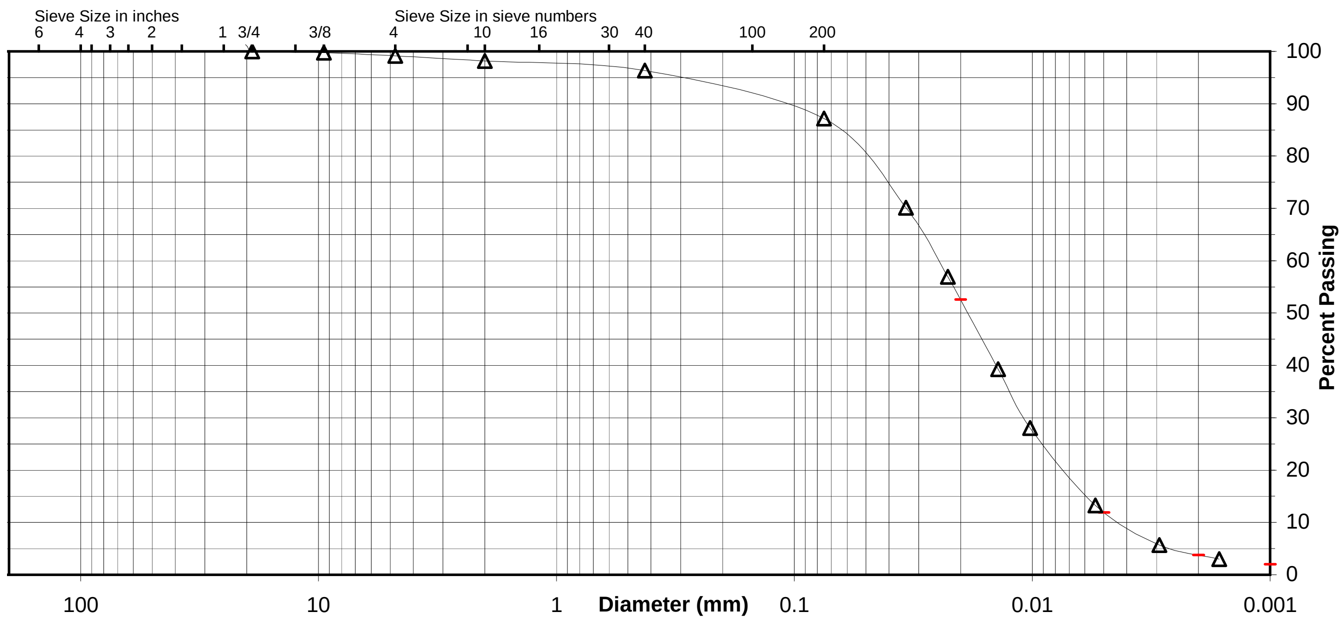
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	96.4
No. 200	87.2
0.02 mm	52.6
0.005 mm	11.9
0.002 mm	3.8
0.001 mm	2.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.9	0.9	1.8	9.2	75.3	11.9

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.8	1.8	9.2	83.4	3.8



Comments

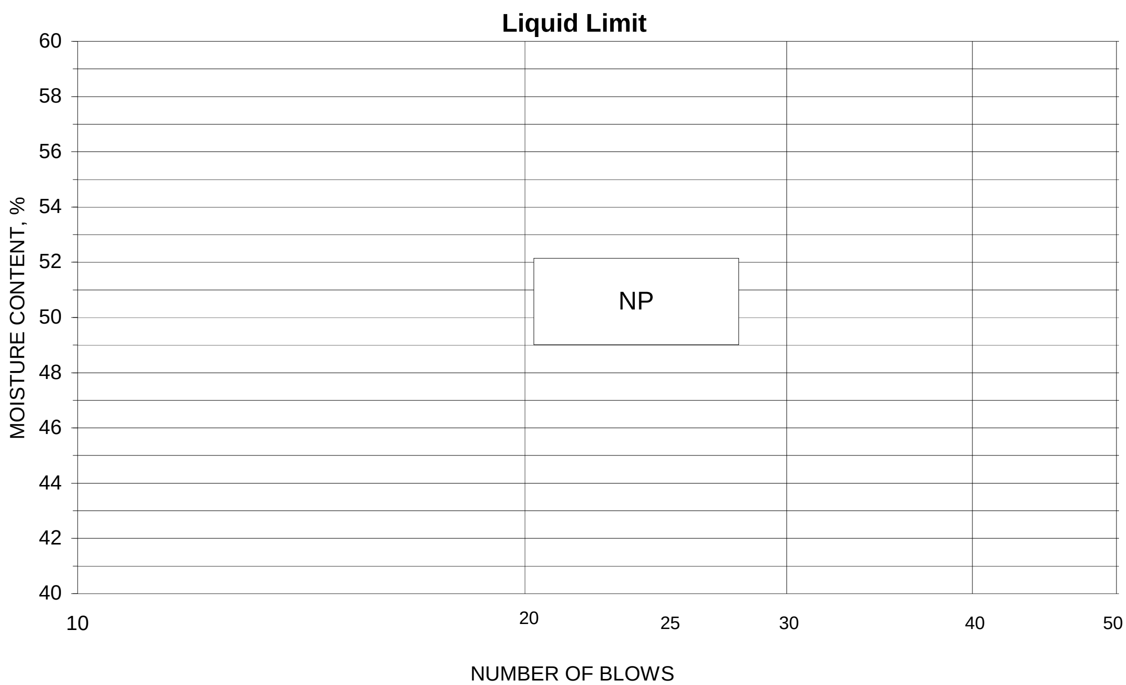
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-107, 30.0'-31.5'	Lab ID	383
		% + No. 40	4
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	03-04-2010		
Test Date	03-25-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-110, 72.5'-74.0' & 74.5'-76.0'
Lab ID: 422

County: McCracken
Date Received: 3-4-10
Sample Type: SPT Composite
Date Reported: 3-31-10

Test Results

Natural Moisture Content

Test Not Performed

Moisture Content (%): N/A

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	100.0
3/4"	19	94.5
3/8"	9.5	75.2
No. 4	4.75	56.4
No. 10	2	41.1
No. 40	0.425	25.1
No. 200	0.075	7.8
	0.02	5.2
	0.005	3.8
	0.002	3.0
estimated	0.001	3.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	43.6	58.9
Coarse Sand	15.3	16.0
Medium Sand	16.0	---
Fine Sand	17.3	17.3
Silt	4.0	4.8
Clay	3.8	3.0

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry

Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry

Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.70

Classification

Unified Group Symbol: SP-SM
Group Name: Poorly graded sand with silt and gravel

AASHTO Classification: A-1-a (1)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-110, 72.5'-74.0' & 74.5'-76.0'
Lab ID: 422

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Rounded
Particle Hardness: Hard and Durable

Tested By: Ford
Test Date: 03-25-2010
Date Received: 03-04-2010

Maximum Particle size: 1" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	100.0
3/4"	94.5
3/8"	75.2
No. 4	56.4
No. 10	41.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.7

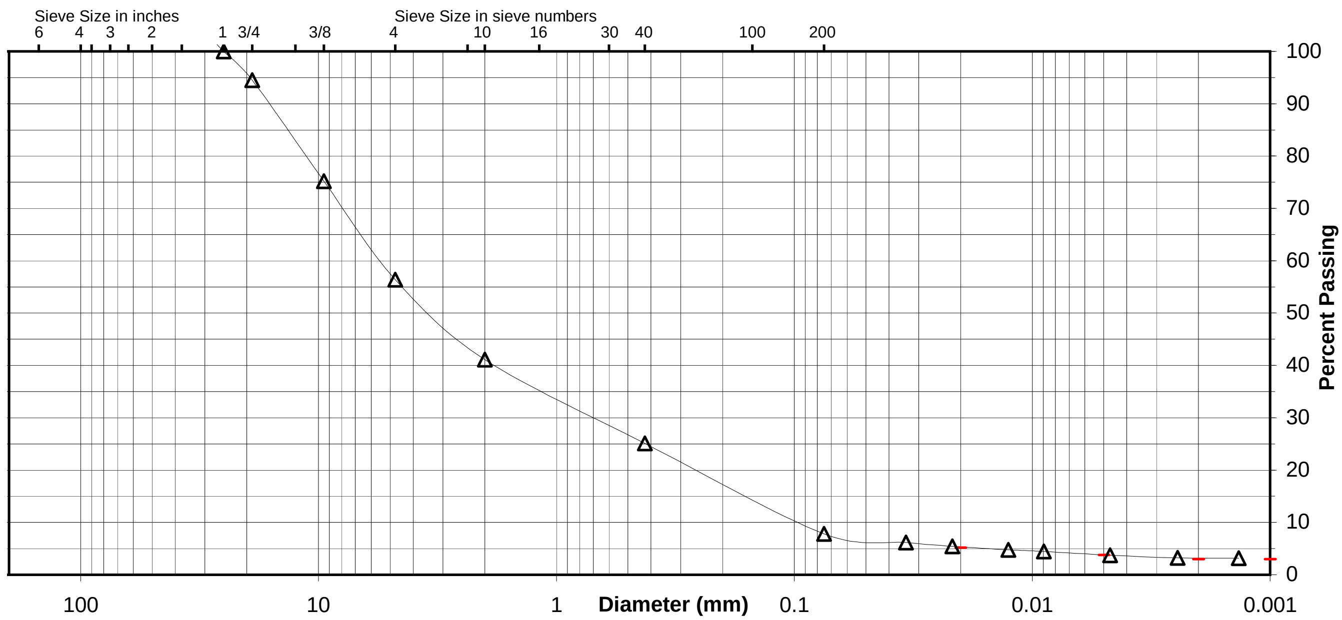
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	25.1
No. 200	7.8
0.02 mm	5.2
0.005 mm	3.8
0.002 mm	3.0
0.001 mm	3.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	5.5	38.1	15.3	16.0	17.3	4.0	3.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	58.9	16.0	17.3	4.8	3.0



Comments

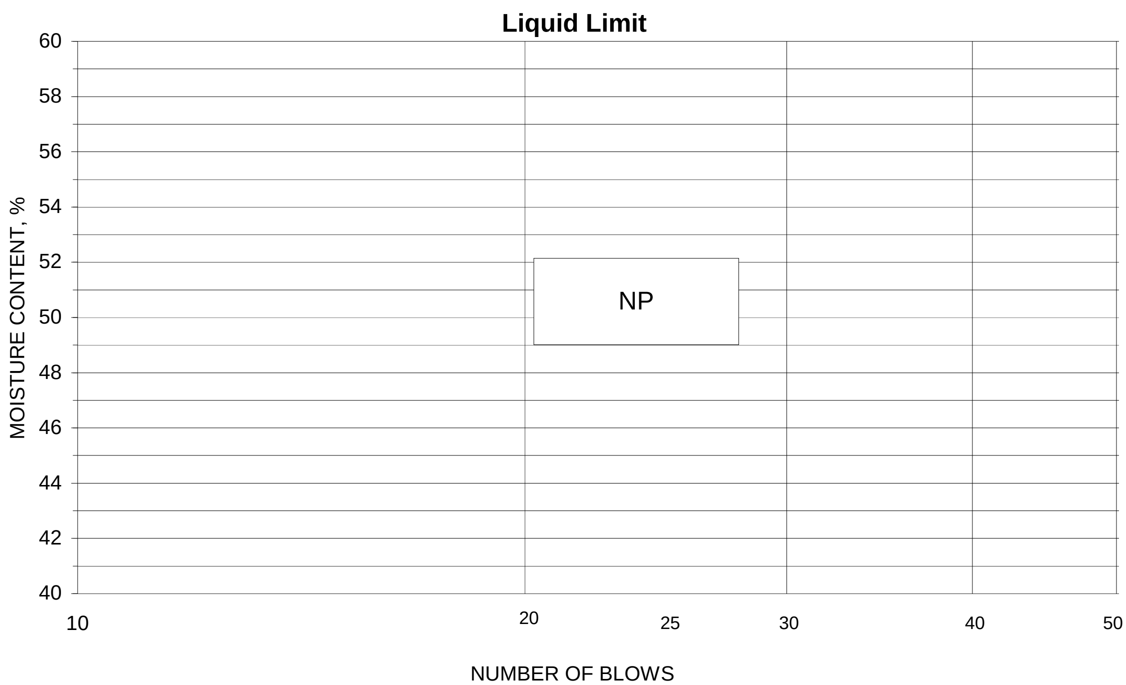
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-110, 72.5'-74.0' & 74.5'-76.0'	Lab ID	422
		% + No. 40	75
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	03-04-2010		
Test Date	03-26-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-116, 60.0'-61.5'	Lab ID	488
County	McCracken	Date Received	3-4-10
Sample Type	SPT	Date Reported	3-31-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 22.3

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	100.0
3/8"	9.5	97.4
No. 4	4.75	90.5
No. 10	2	78.1
No. 40	0.425	59.3
No. 200	0.075	31.5
	0.02	4.0
	0.005	1.3
	0.002	1.0
estimated	0.001	0.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	9.5	21.9
Coarse Sand	12.4	18.8
Medium Sand	18.8	---
Fine Sand	27.8	27.8
Silt	30.2	30.5
Clay	1.3	1.0

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.98

Classification

Unified Group Symbol: SM

Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-116, 60.0'-61.5'	Lab ID	488

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Soft

Tested By: Ford
Test Date: 03-25-2010
Date Received 03-04-2010

Maximum Particle size: 3/4" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	100.0
3/8"	97.4
No. 4	90.5
No. 10	78.1

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.98

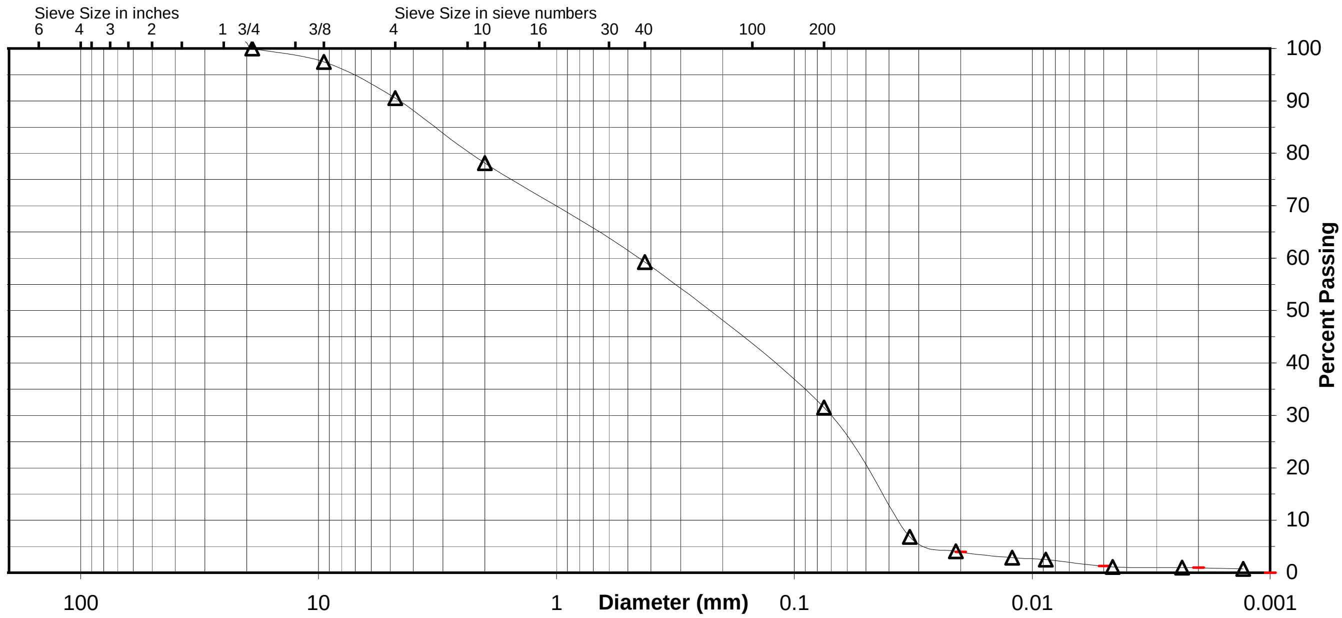
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	59.3
No. 200	31.5
0.02 mm	4.0
0.005 mm	1.3
0.002 mm	1.0
0.001 mm	0.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	9.5	12.4	18.8	27.8	30.2	1.3

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	21.9	18.8	27.8	30.5	1.0



Comments

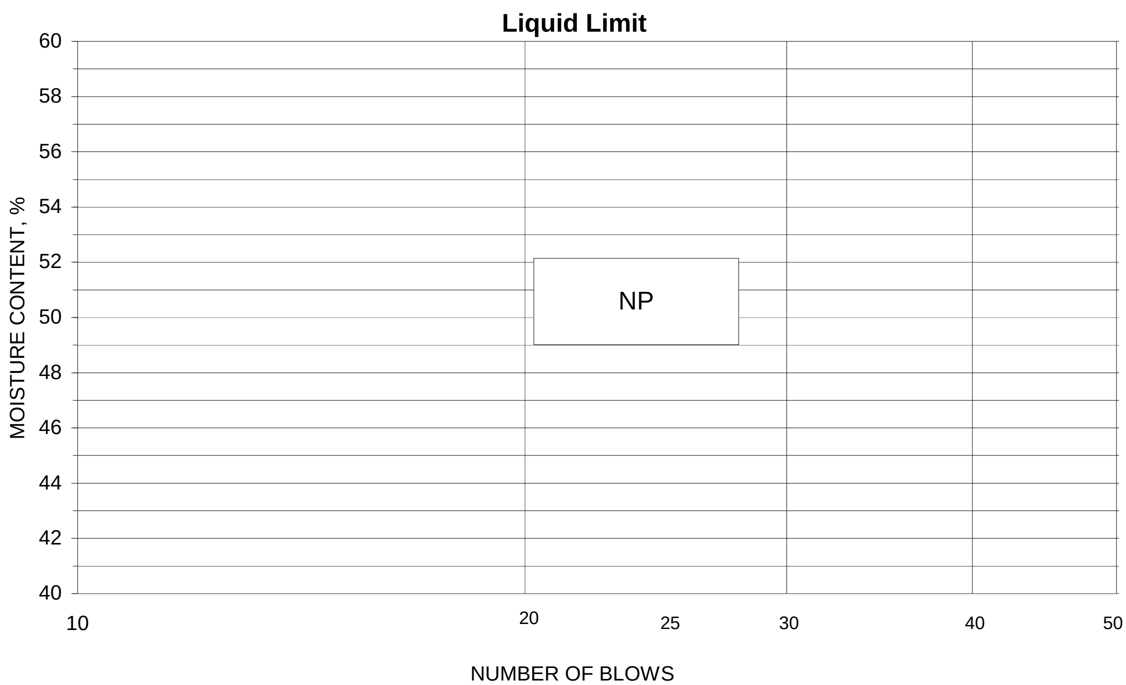
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-116, 60.0'-61.5'	Lab ID	488
		% + No. 40	41
Tested By	KWS	Test Method ASTM D 4318 Method A	Date Received 03-04-2010
Test Date	03-26-2010	Prepared Dry	

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks: ______________________

Reviewed By ______________

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-118, 29.5'-31.0'
Lab ID: 168

County: McCracken
Date Received: 3-3-10
Sample Type: SPT
Date Reported: 3-29-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 17.6

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	97.4
No. 200	0.075	27.1
	0.02	20.2
	0.005	14.2
	0.002	11.2
estimated	0.001	8.3

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	2.6
Medium Sand	2.6	---
Fine Sand	70.3	70.3
Silt	12.9	15.9
Clay	14.2	11.2

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.71

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-2-4 (0)

Comments:

Stantec

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-118, 29.5'-31.0'	Lab ID	168

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JMB
Test Date: 03-23-2010
Date Received 03-03-2010

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.71

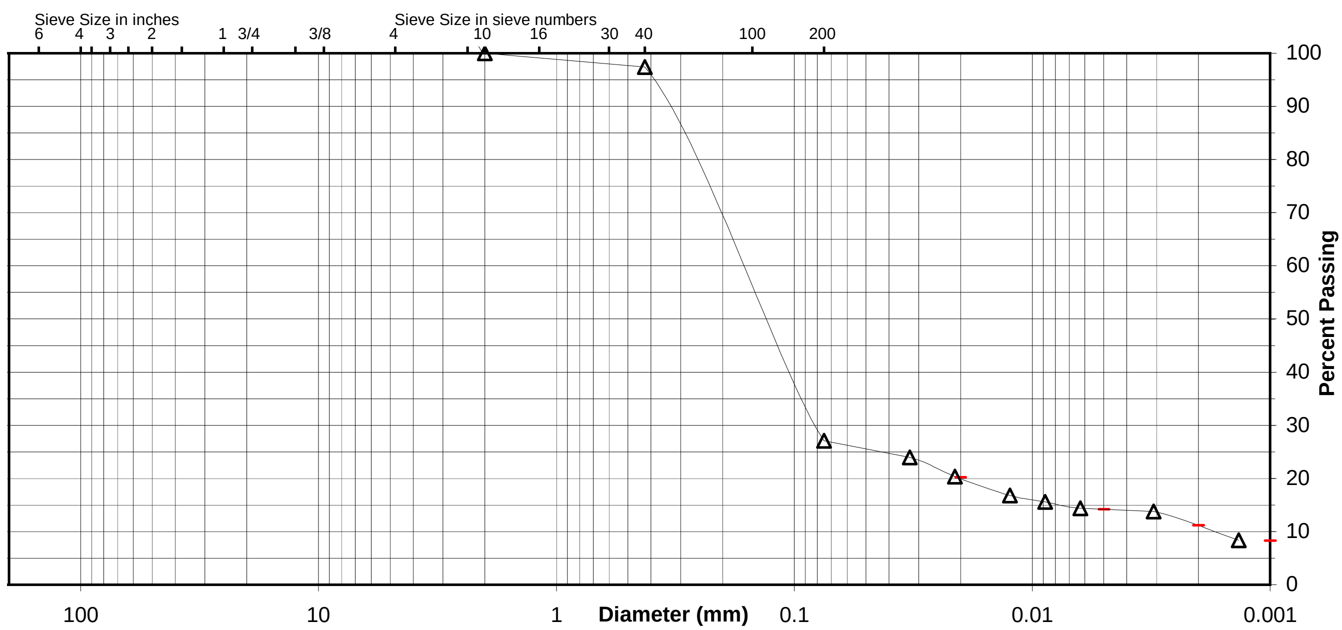
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	97.4
No. 200	27.1
0.02 mm	20.2
0.005 mm	14.2
0.002 mm	11.2
0.001 mm	8.3

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	2.6	70.3	12.9	14.2

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	2.6	70.3	15.9	11.2



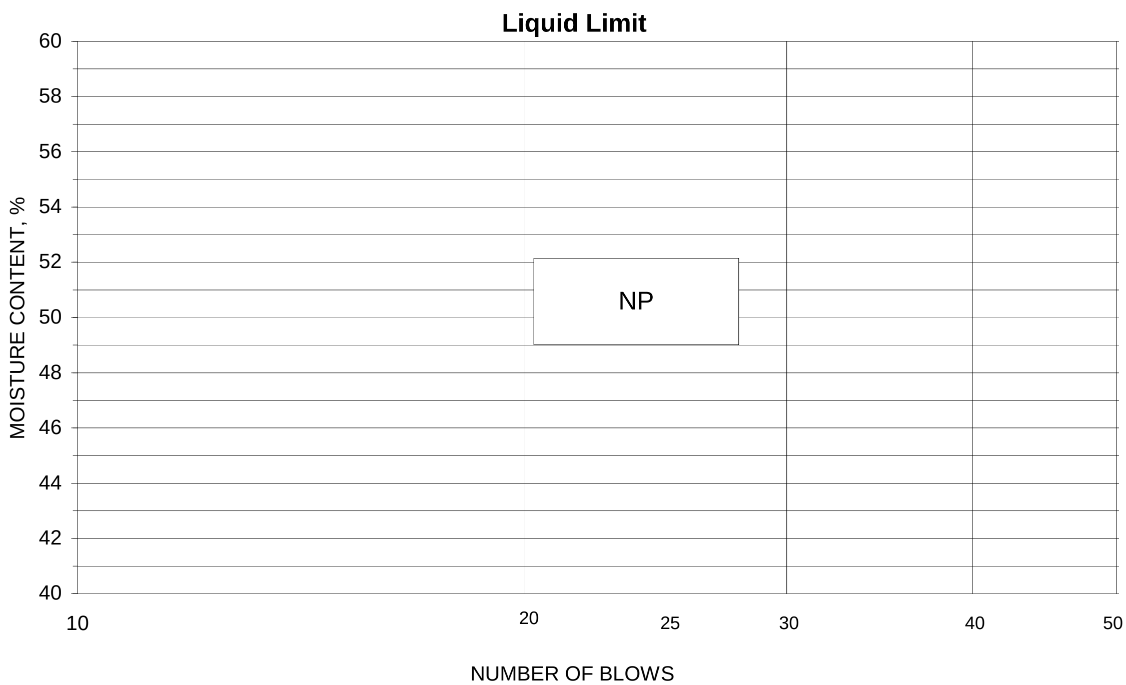
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-118, 29.5'-31.0'	Lab ID	168
		% + No. 40	3
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	03-03-2010		
Test Date	03-23-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-119, 62.0'-63.5'	Lab ID	518
County	McCracken	Date Received	3-4-10
Sample Type	SPT	Date Reported	3-31-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 19.8

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	98.2
No. 40	0.425	97.6
No. 200	0.075	85.6
	0.02	43.1
	0.005	19.5
	0.002	15.6
estimated	0.001	12.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.0	1.8
Coarse Sand	1.8	0.6
Medium Sand	0.6	---
Fine Sand	12.0	12.0
Silt	66.1	70.0
Clay	19.5	15.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: 26

Plastic Limit: 18

Plasticity Index: 8

Activity Index: 0.50

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.68

Classification

Unified Group Symbol: CL

Group Name: Lean clay

AASHTO Classification: A-4 (5)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-119, 62.0'-63.5'	Lab ID	518

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: Ford
Test Date: 03-26-2010
Date Received 03-04-2010

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	98.2

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.68

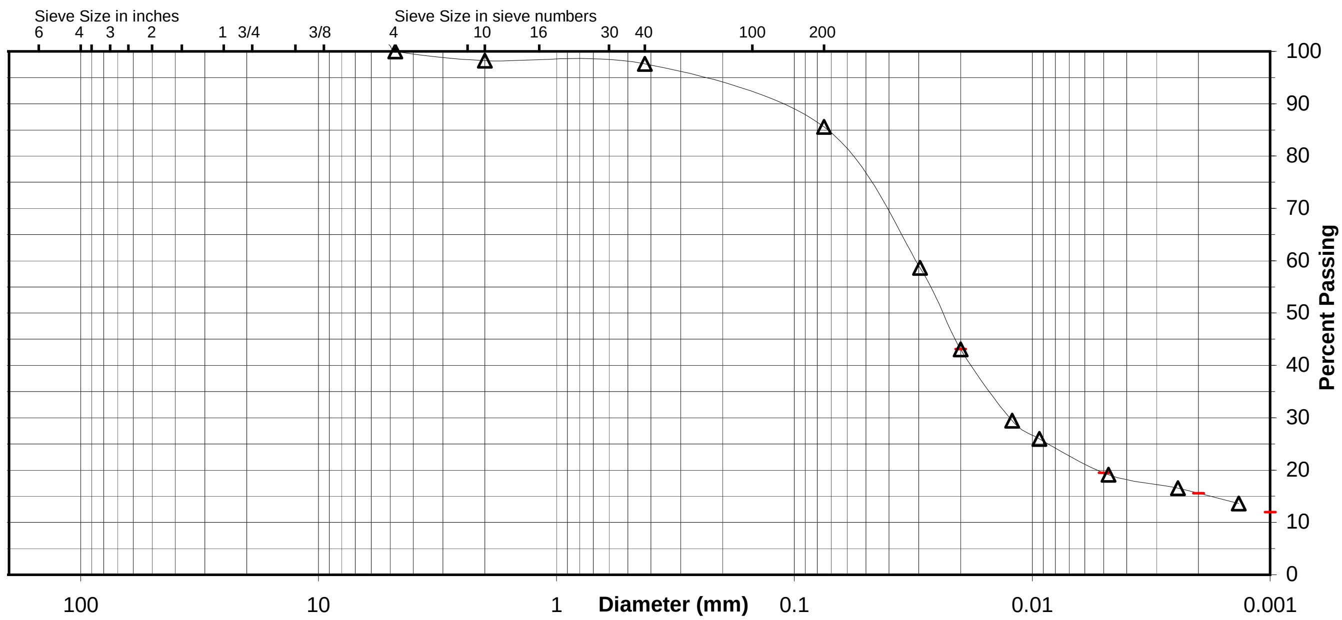
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	97.6
No. 200	85.6
0.02 mm	43.1
0.005 mm	19.5
0.002 mm	15.6
0.001 mm	12.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	1.8	0.6	12.0	66.1	19.5

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	1.8	0.6	12.0	70.0	15.6



Comments

Reviewed By

File: frm_175559035_sum_518 Sheet: Hydro-Report
Preparation Date: 1998
Revision Date: 1-2008

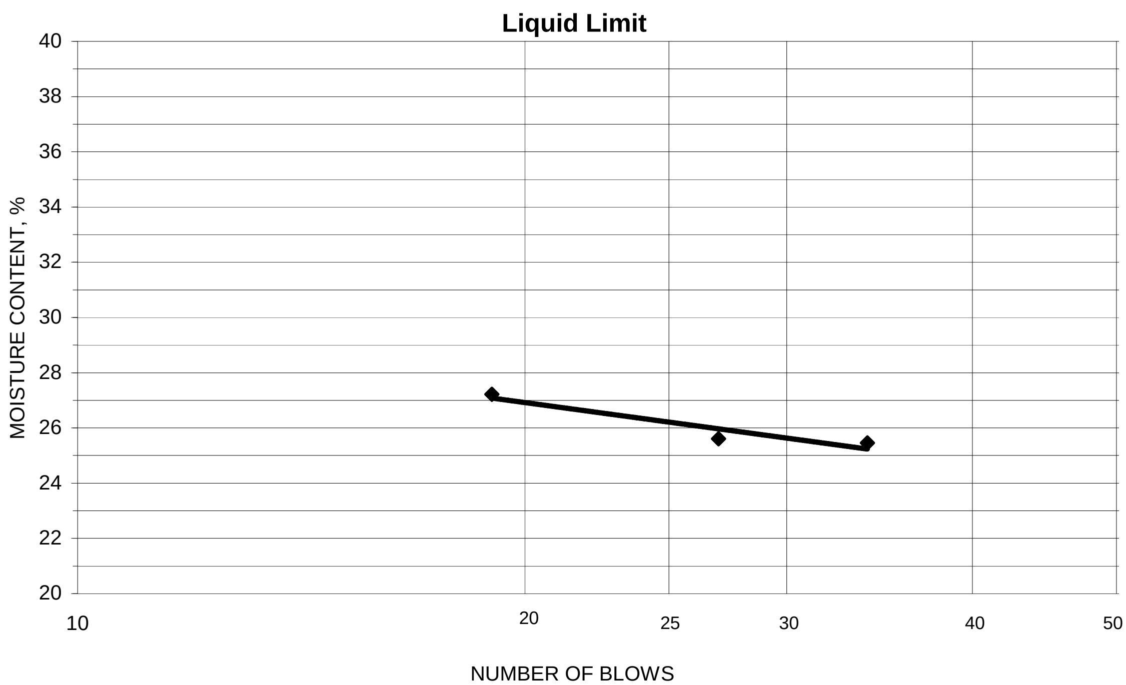
Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-119, 62.0'-63.5'	Lab ID	518
		% + No. 40	2
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	03-04-2010		
Test Date	03-29-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
20.20	18.38	11.23	34	25.5	
18.86	17.28	11.11	27	25.6	
20.84	18.79	11.26	19	27.2	26



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
17.63	16.60	10.97	18.3	18	8
17.89	16.83	11.09	18.5		

Remarks:

Reviewed By

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-123, 10.0'-11.5'	Lab ID	540
County	McCracken	Date Received	3-4-10
Sample Type	SPT	Date Reported	3-31-10

Test Results

Natural Moisture Content
Test Method: ASTM D 2216
Moisture Content (%): 38.7

Particle Size Analysis
Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	100.0
No. 4	4.75	99.1
No. 10	2	97.9
No. 40	0.425	88.8
No. 200	0.075	74.1
	0.02	40.8
	0.005	10.0
	0.002	4.2
estimated	0.001	1.0

Plus 3 in. material, not included: 0 (%)

	ASTM	AASHTO
Range	(%)	(%)
Gravel	0.9	2.1
Coarse Sand	1.2	9.1
Medium Sand	9.1	---
Fine Sand	14.7	14.7
Silt	64.1	69.9
Clay	10.0	4.2

Atterberg Limits
Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship
Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio
Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity
Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.26

Classification
Unified Group Symbol: ML
Group Name: Silt with sand
AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-123, 10.0'-11.5'	Lab ID	540

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Soft

Tested By: Ford
Test Date: 03-26-2010
Date Received 03-04-2010

Maximum Particle size: 3/8" Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	100.0
No. 4	99.1
No. 10	97.9

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.26

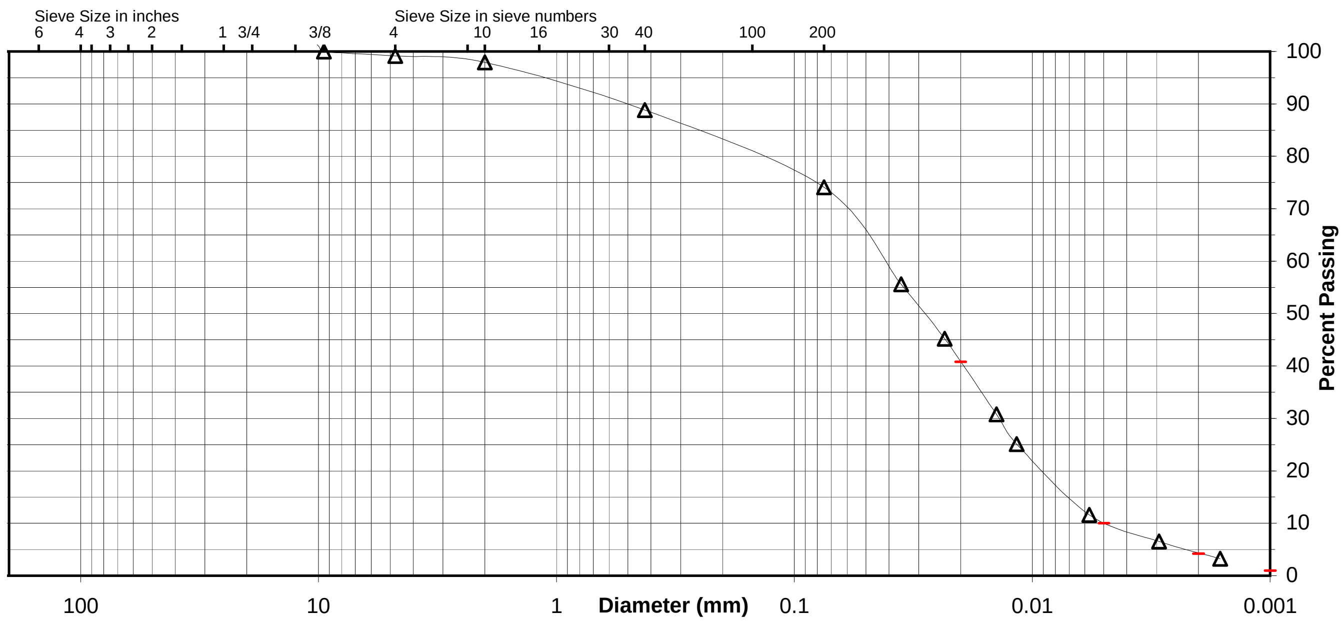
Dispersed using: Apparatus A - Mechanical, for 1 minute

Sieve Size	% Passing
No. 40	88.8
No. 200	74.1
0.02 mm	40.8
0.005 mm	10.0
0.002 mm	4.2
0.001 mm	1.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.9	1.2	9.1	14.7	64.1	10.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	2.1	9.1	14.7	69.9	4.2



Comments

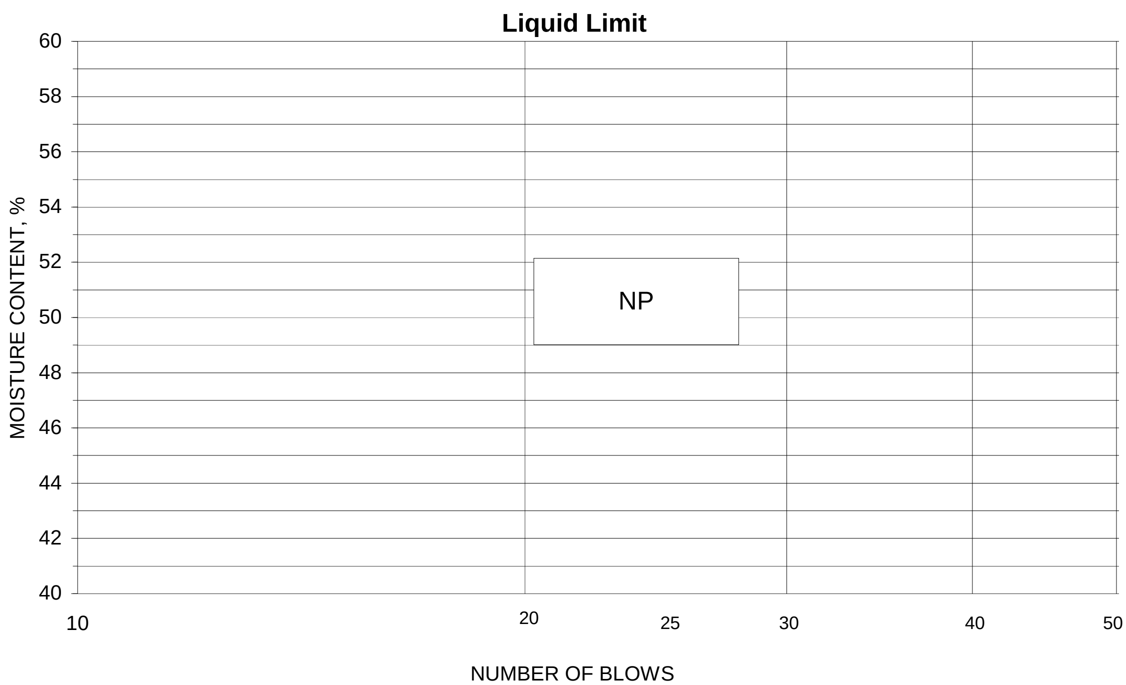
Reviewed By

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-123, 10.0'-11.5'	Lab ID	540
		% + No. 40	11
Tested By	KWS	Test Method	ASTM D 4318 Method A
Date Received	03-04-2010		
Test Date	03-26-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By

Stantec

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-128, 40.0'-41.5'
Lab ID: 282

County: McCracken
Date Received: 3-3-10
Sample Type: SPT
Date Reported: 3-30-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 21.5

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size Sieve Size	(mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	74.4
No. 40	0.425	73.1
No. 200	0.075	71.0
	0.02	48.8
	0.005	30.0
	0.002	25.6
estimated	0.001	24.6

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	25.6
Coarse Sand	25.6	1.3
Medium Sand	1.3	---
Fine Sand	2.1	2.1
Silt	41.0	45.4
Clay	30.0	25.6

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: 39
Plastic Limit: 16
Plasticity Index: 23
Activity Index: 0.88

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.69

Classification

Unified Group Symbol: CL
Group Name: Lean clay with sand

AASHTO Classification: A-6 (14)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-128, 40.0'-41.5'
Lab ID: 282

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JMB
Test Date: 03-22-2010
Date Received: 03-03-2010

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	74.4

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity: 2.69

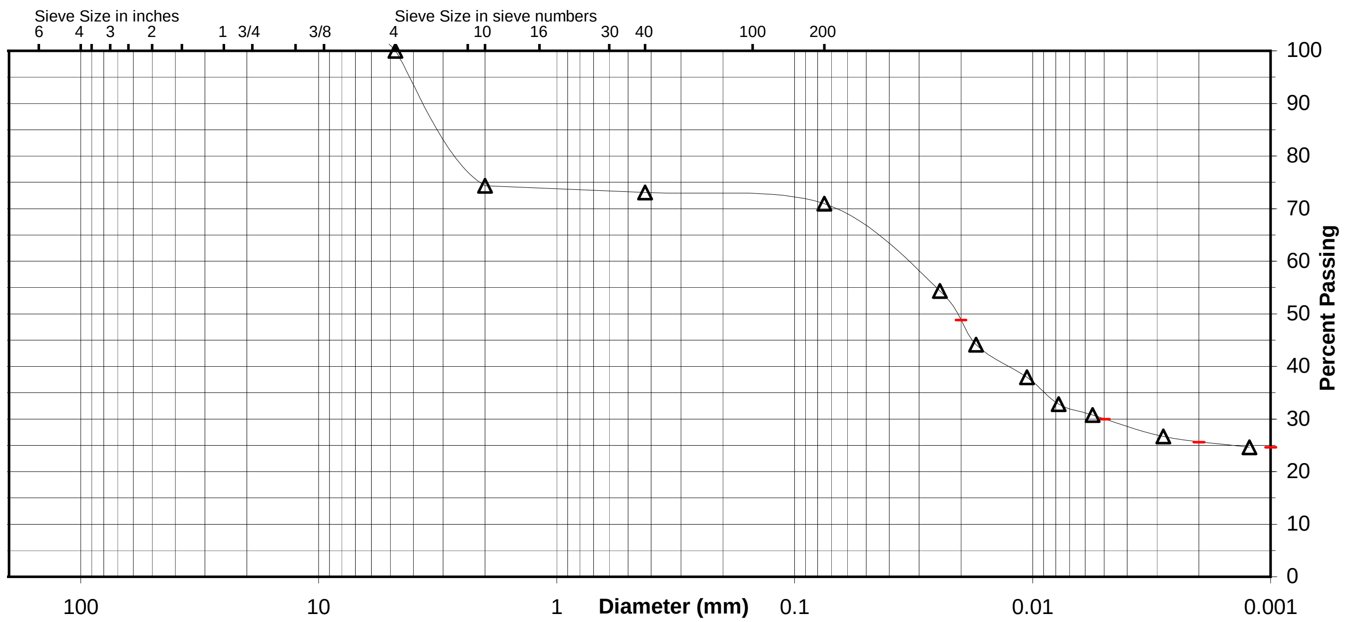
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	73.1
No. 200	71.0
0.02 mm	48.8
0.005 mm	30.0
0.002 mm	25.6
0.001 mm	24.6

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	25.6	1.3	2.1	41.0	30.0

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	25.6	1.3	2.1	45.4	25.6



Comments

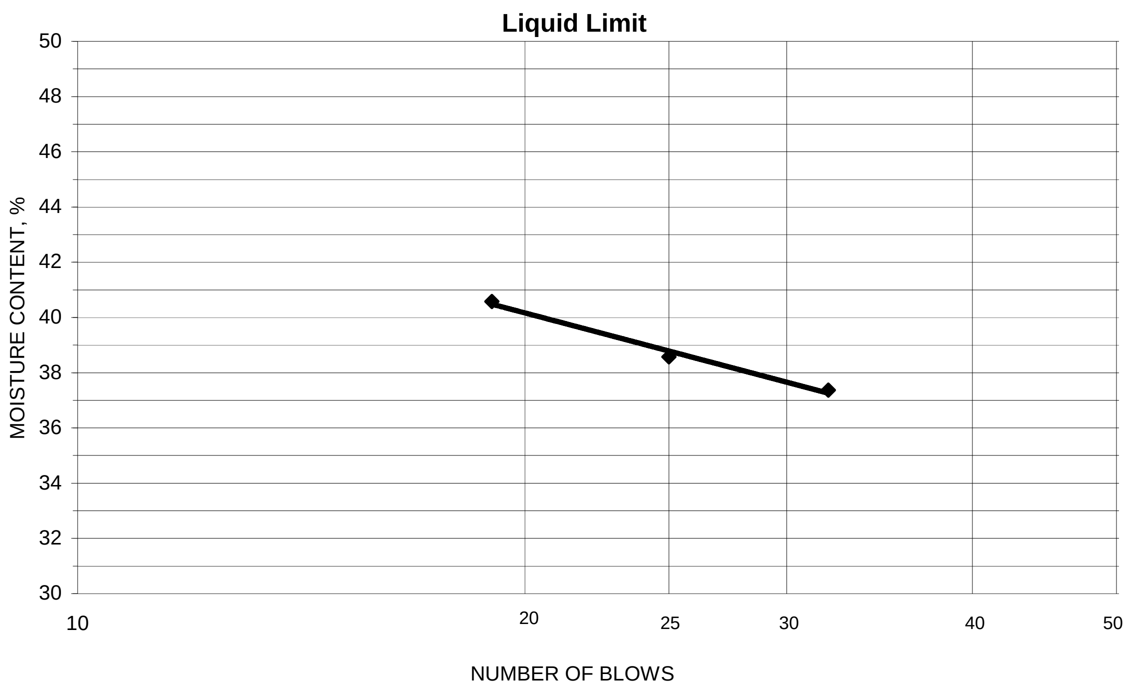
Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-128, 40.0'-41.5'	Lab ID	282
		% + No. 40	27

Tested By	RHB	Test Method	ASTM D 4318 Method A	Date Received	03-03-2010
Test Date	03-29-2010	Prepared	Dry		

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
13.54	11.04	4.35	32	37.4	
11.73	9.67	4.33	25	38.6	
13.49	10.84	4.31	19	40.6	39



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
10.92	10.02	4.32	15.8	16	23
10.75	9.89	4.37	15.6		

Remarks:

Reviewed By RHB

Summary of Soil Tests

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-128, 50.0'-51.5'
Lab ID: 286

County: McCracken
Date Received: 3-3-10
Sample Type: SPT
Date Reported: 3-29-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216
Moisture Content (%): 26.6

Particle Size Analysis

Preparation Method: ASTM D 421
Gradation Method: ASTM D 422
Hydrometer Method: ASTM D 422

Particle Size		%
Sieve Size	(mm)	Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	
No. 10	2	100.0
No. 40	0.425	99.8
No. 200	0.075	41.3
	0.02	26.6
	0.005	17.4
	0.002	13.8
estimated	0.001	13.4

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	0.0
Coarse Sand	0.0	0.2
Medium Sand	0.2	---
Fine Sand	58.5	58.5
Silt	23.9	27.5
Clay	17.4	13.8

Atterberg Limits

Test Method: ASTM D 4318 Method A
Prepared: Dry
Liquid Limit: ---
Plastic Limit: Non Plastic
Plasticity Index: ---
Activity Index: N/A

Moisture-Density Relationship

Test Not Performed
Maximum Dry Density (lb/ft^3): N/A
Maximum Dry Density (kg/m^3): N/A
Optimum Moisture Content (%): N/A
Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed
Bearing Ratio (%): N/A
Compacted Dry Density (lb/ft^3): N/A
Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854
Prepared: Dry
Particle Size: No. 10
Specific Gravity at 20° Celsius: 2.67

Classification

Unified Group Symbol: SM
Group Name: Silty sand

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-128, 50.0'-51.5'	Lab ID	286

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: N/A
Particle Hardness: N/A

Tested By: JMB
Test Date: 03-23-2010
Date Received 03-03-2010

Maximum Particle size: No. 10 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	
No. 10	100.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.67

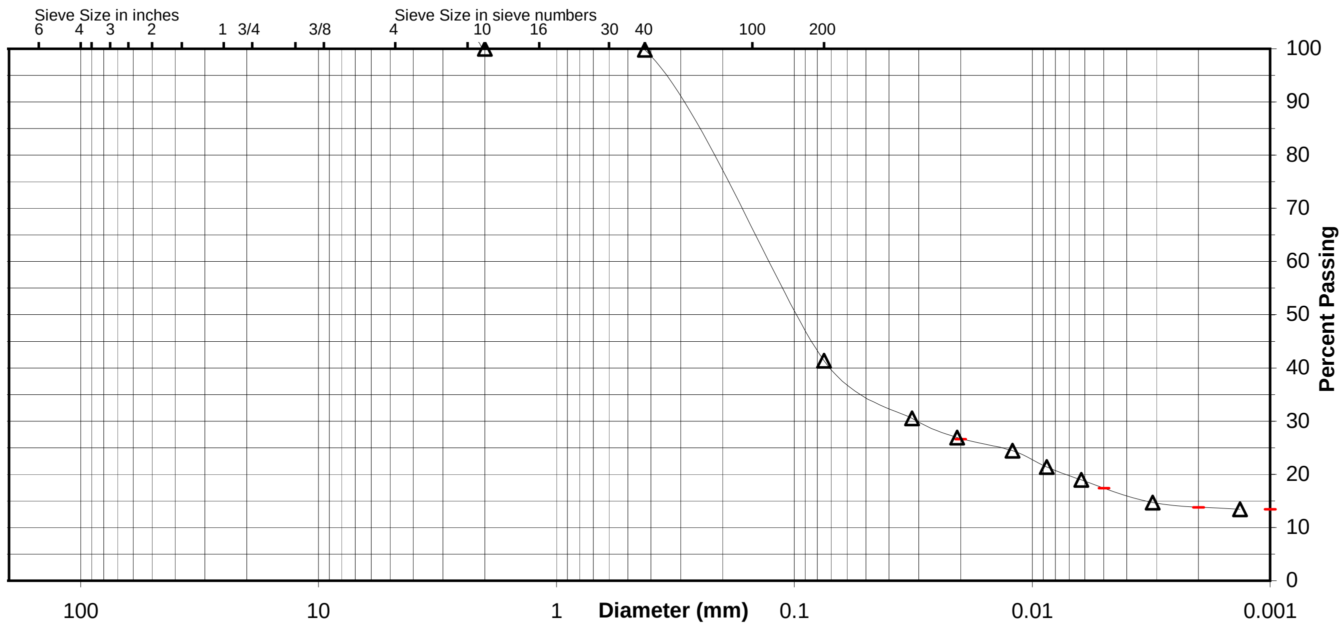
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	99.8
No. 200	41.3
0.02 mm	26.6
0.005 mm	17.4
0.002 mm	13.8
0.001 mm	13.4

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	0.0	0.2	58.5	23.9	17.4

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	0.0	0.2	58.5	27.5	13.8



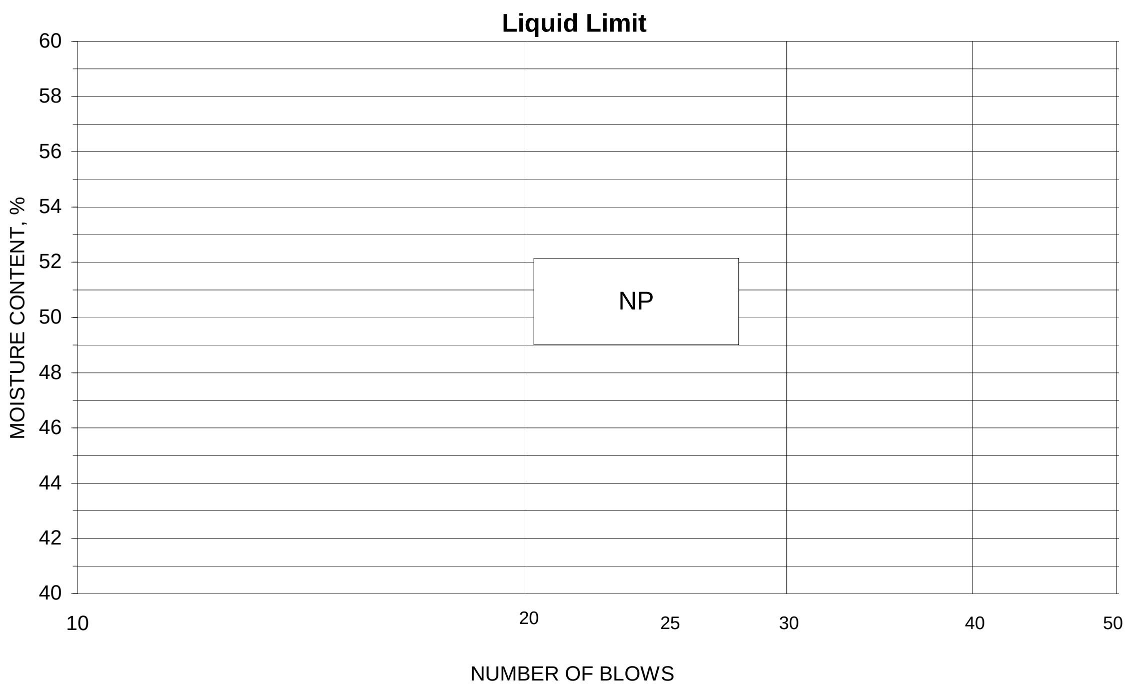
Comments

Reviewed By RHB

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-128, 50.0'-51.5'	Lab ID	286
		% + No. 40	0
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	03-03-2010		
Test Date	03-23-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index

Remarks:

Reviewed By RHB

Stantec

Summary of Soil Tests

Project Name	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project Number	175559035
Source	STN-129, 22.5'-24.0'	Lab ID	299
County	McCracken	Date Received	3-3-10
Sample Type	SPT	Date Reported	3-29-10

Test Results

Natural Moisture Content

Test Method: ASTM D 2216

Moisture Content (%): 30.2

Particle Size Analysis

Preparation Method: ASTM D 421

Gradation Method: ASTM D 422

Hydrometer Method: ASTM D 422

Particle Size: Sieve Size	Particle Size: (mm)	% Passing
3"	75	
2"	50	
1 1/2"	37.5	
1"	25	
3/4"	19	
3/8"	9.5	
No. 4	4.75	100.0
No. 10	2	96.0
No. 40	0.425	91.5
No. 200	0.075	79.2
	0.02	40.2
	0.005	10.8
	0.002	4.6
estimated	0.001	4.0

Plus 3 in. material, not included: 0 (%)

Range	ASTM (%)	AASHTO (%)
Gravel	0.0	4.0
Coarse Sand	4.0	4.5
Medium Sand	4.5	---
Fine Sand	12.3	12.3
Silt	68.4	74.6
Clay	10.8	4.6

Atterberg Limits

Test Method: ASTM D 4318 Method A

Prepared: Dry

Liquid Limit: ---

Plastic Limit: Non Plastic

Plasticity Index: ---

Activity Index: N/A

Moisture-Density Relationship

Test Not Performed

Maximum Dry Density (lb/ft^3): N/A

Maximum Dry Density (kg/m^3): N/A

Optimum Moisture Content (%): N/A

Over Size Correction %: N/A

California Bearing Ratio

Test Not Performed

Bearing Ratio (%): N/A

Compacted Dry Density (lb/ft^3): N/A

Compacted Moisture Content (%): N/A

Specific Gravity

Test Method: ASTM D 854

Prepared: Dry

Particle Size: No. 10

Specific Gravity at 20° Celsius: 2.42

Classification

Unified Group Symbol: ML

Group Name: Silt with sand

AASHTO Classification: A-4 (0)

Comments:

Particle-Size Analysis of Soils
ASTM D 422

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project Number: 175559035
Source: STN-129, 22.5'-24.0'
Lab ID: 299

Sieve analysis for the Portion Coarser than the No. 10 Sieve

Test Method: ASTM D 422
Prepared using: ASTM D 421

Particle Shape: Angular
Particle Hardness: Hard and Durable

Tested By: JMB
Test Date: 03-23-2010
Date Received 03-03-2010

Maximum Particle size: No. 4 Sieve

Sieve Size	% Passing
3"	
2"	
1 1/2"	
1"	
3/4"	
3/8"	
No. 4	100.0
No. 10	96.0

Analysis for the portion Finer than the No. 10 Sieve

Analysis Based on: Total Sample

Specific Gravity 2.42

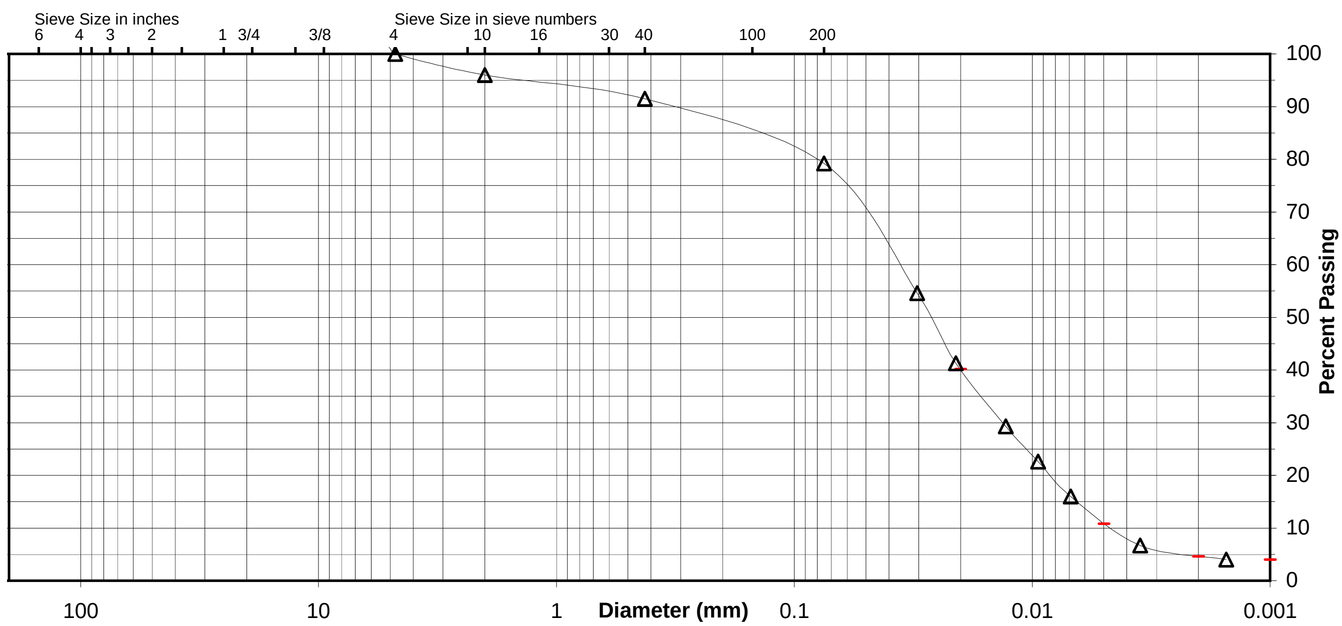
Dispersed using: Apparatus A - Mechanical, for 1 minute

No. 40	91.5
No. 200	79.2
0.02 mm	40.2
0.005 mm	10.8
0.002 mm	4.6
0.001 mm	4.0

Particle Size Distribution

ASTM	Coarse Gravel	Fine Gravel	C. Sand	Medium Sand	Fine Sand	Silt	Clay
	0.0	0.0	4.0	4.5	12.3	68.4	10.8

AASHTO	Gravel	Coarse Sand	Fine Sand	Silt	Clay
	4.0	4.5	12.3	74.6	4.6



Comments

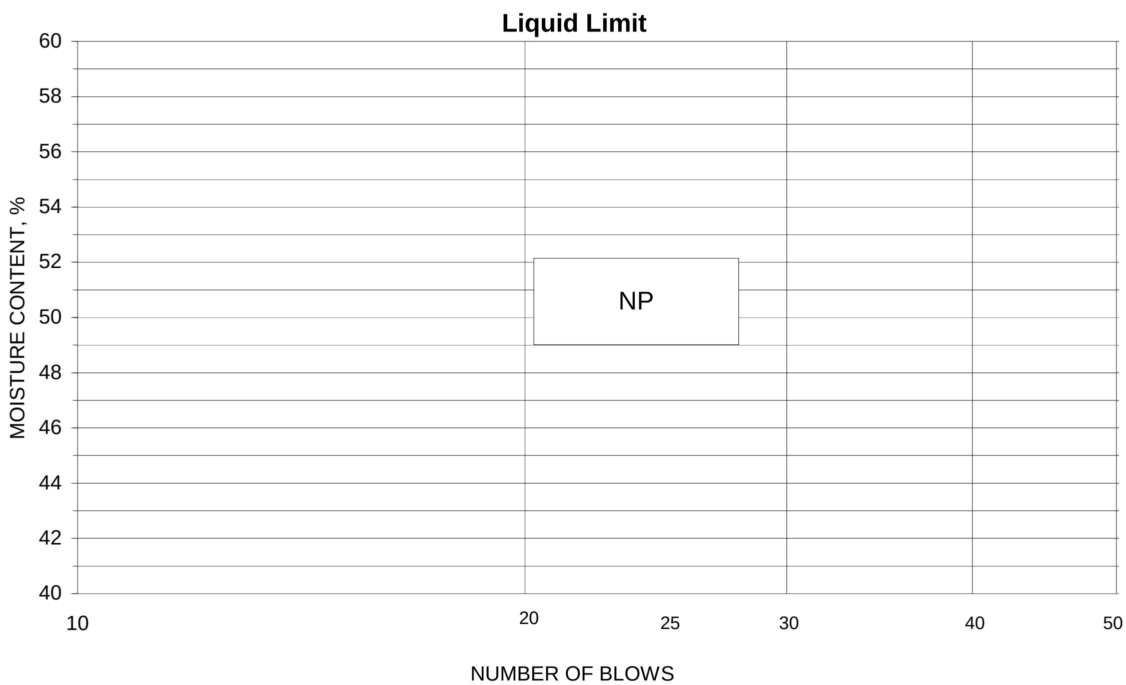
Reviewed By RHB

Stantec

ATTERBERG LIMITS

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Source	STN-129, 22.5'-24.0'	Lab ID	299
		% + No. 40	9
Tested By	JMB	Test Method	ASTM D 4318 Method A
Date Received	03-03-2010		
Test Date	03-23-2010	Prepared	Dry

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Number of Blows	Water Content (%)	Liquid Limit
					#VALUE!



PLASTIC LIMIT AND PLASTICITY INDEX

Wet Soil and Tare Mass (g)	Dry Soil and Tare Mass (g)	Tare Mass (g)	Water Content (%)	Plastic Limit	Plasticity Index
					#VALUE!

Remarks:

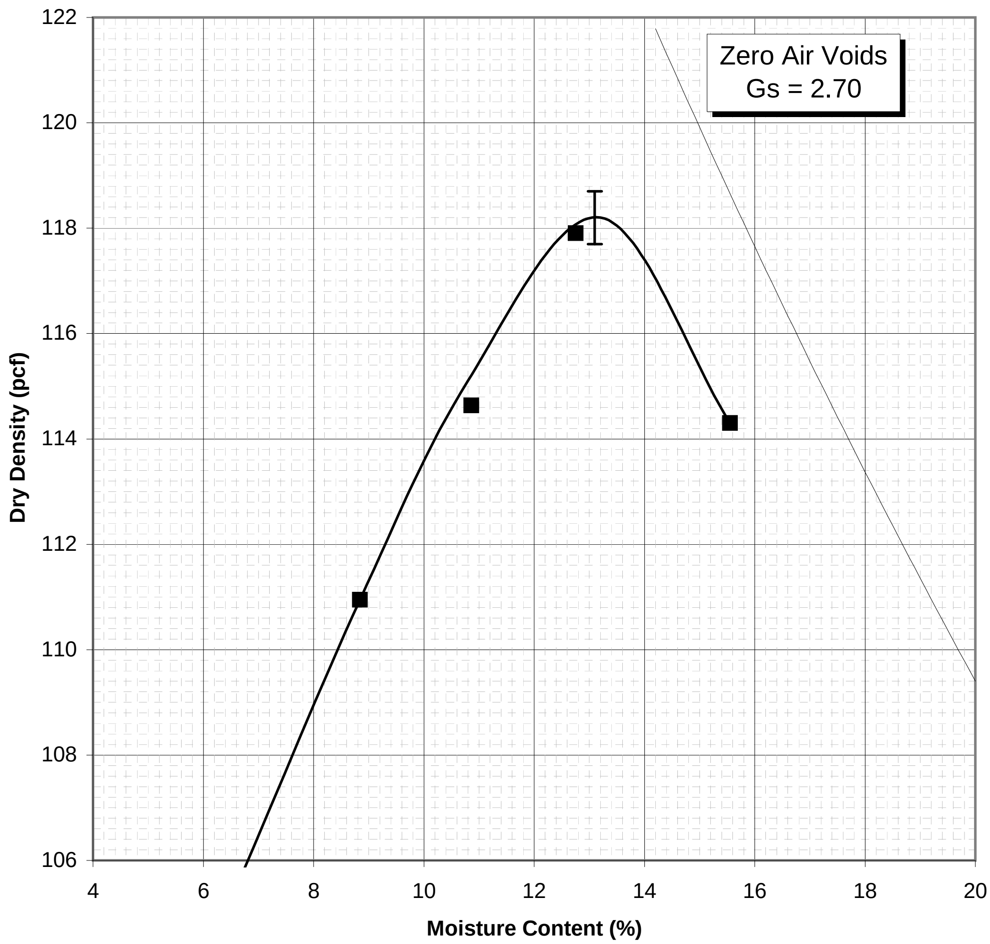
Reviewed By

Stantec

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2 | Project No.: 175559023
Source: STN-5 (1,2,3), 4.0'-8.0' | Sample No.: 824
Sample Description: Silty clay with sand (CL-ML), red
Visual Notes: | Test Method: ASTM D 698 - Method A
Prepared: Dry | Oversized Fraction: < 5 % | Rammer: Manual | Gs - Fines: Assumed

Mold Weight 4230 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5920	1690	201.20	190.50	29.10	6.6	105.6
6043	1813	270.70	251.30	31.90	8.8	110.9
6138	1908	233.90	214.10	31.80	10.9	114.6
6226	1996	283.80	255.30	31.90	12.8	117.9
6213	1983	306.00	269.30	33.30	15.6	114.3

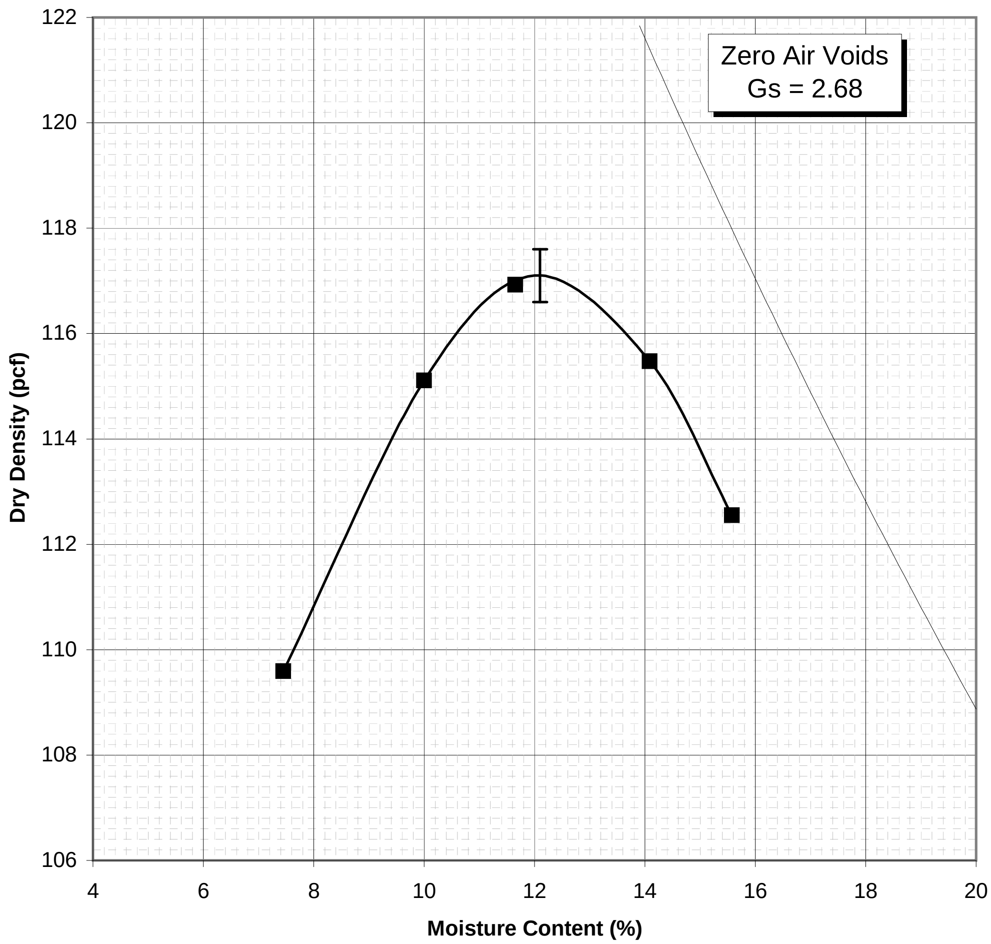


Maximum Dry Density 118.2 PCF
Optimum Moisture Content 13.1 %

Stantec Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-8P, 20.0'-24.5'
Sample No.: 1264
Sample Description: Lean clay (CL), brown, moist
Nmc: 14.9 %
Visual Notes: Very silty
Test Method: ASTM D 698 - Method A
Prepared: Dry
Oversized Fraction: < 5 %
Rammer: Manual
Gs - Fines: Estimated

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3807	1768	314.29	294.59	30.20	7.5	109.6
3940	1901	376.71	345.33	31.50	10.0	115.1
3999	1960	402.14	363.62	33.01	11.7	116.9
4017	1978	308.15	274.21	33.30	14.1	115.5
3992	1953	263.38	231.94	30.08	15.6	112.6

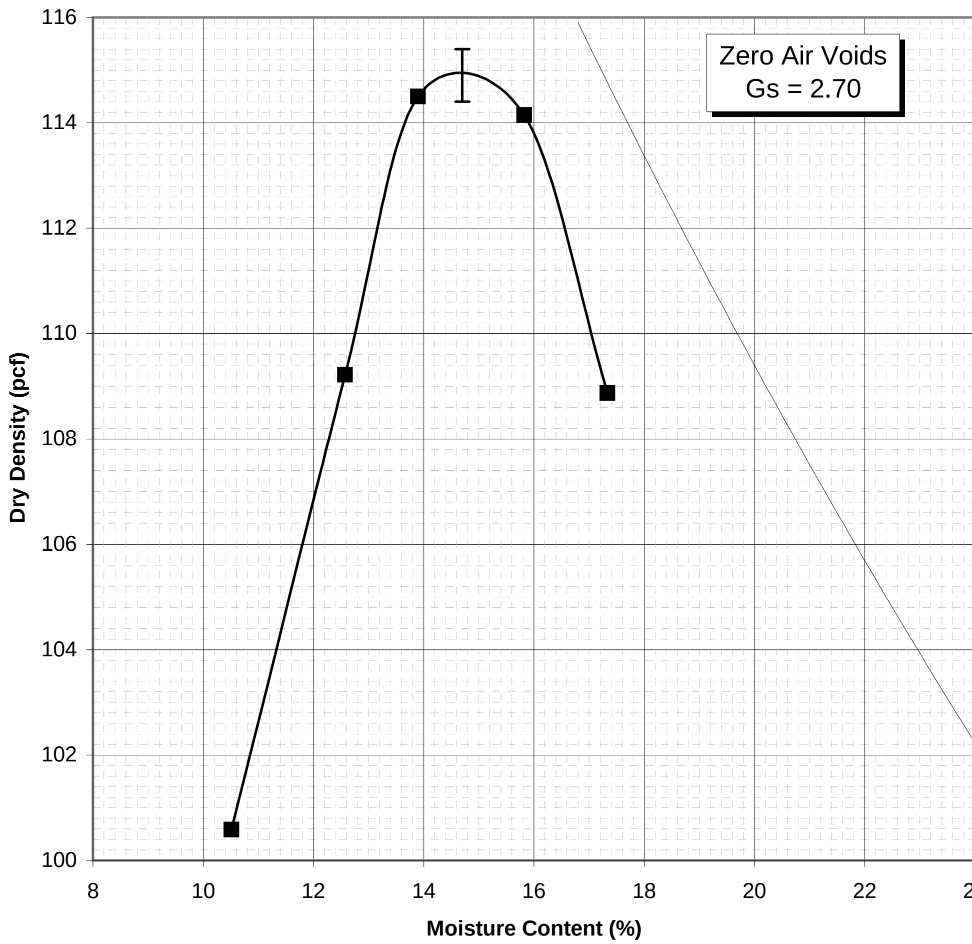


Maximum Dry Density 117.1 PCF
Optimum Moisture Content 12.1 %

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-12, 4.0'-6.0'
Sample No.: 1265
Sample Description: Lean clay (CL). Brown, moist
Nmc: 15.0 %
Visual Notes: Silty
Test Method: ASTM D 698 - Method A
Prepared: Dry Oversized Fraction: < 5 % Rammer: Manual
Gs - Fines: Assumed

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3708	1669	307.92	281.80	33.42	10.5	100.6
3885	1846	397.29	356.59	32.90	12.6	109.2
3997	1958	385.88	342.81	32.98	13.9	114.5
4024	1985	315.88	277.14	32.38	15.8	114.1
3957	1918	253.09	220.13	30.02	17.3	108.9

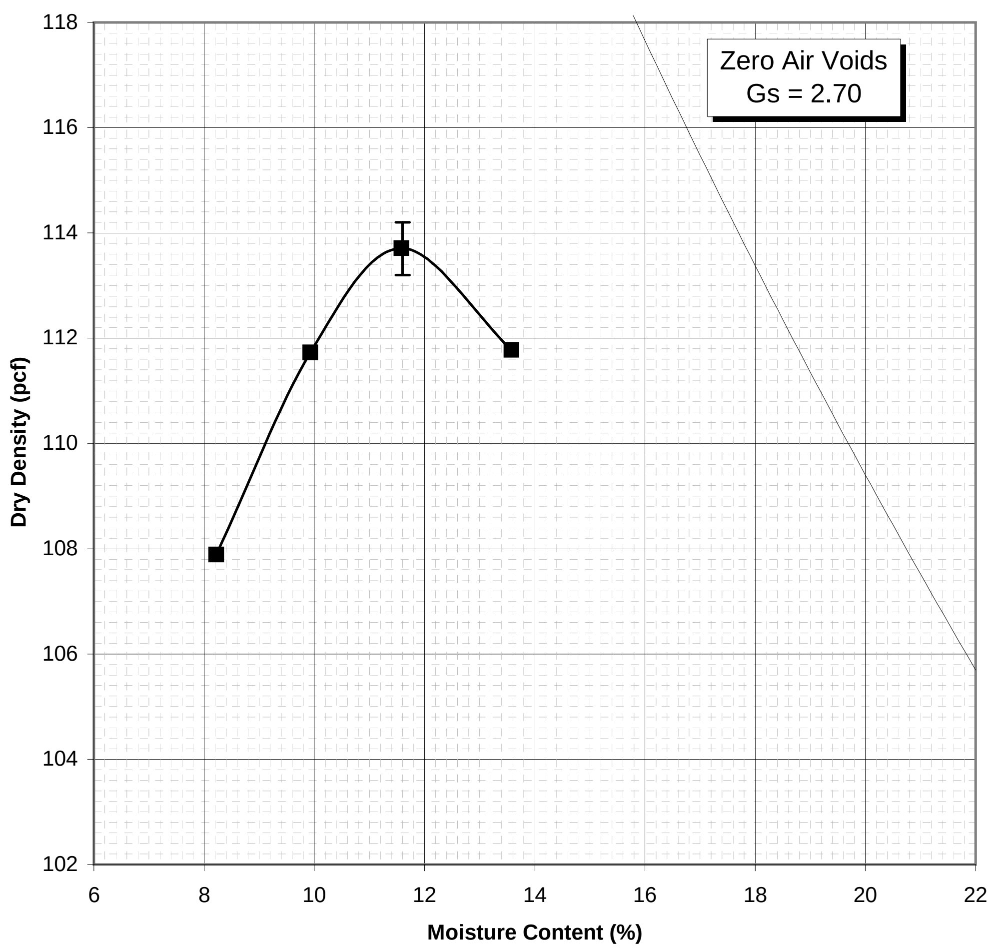


Maximum Dry Density 114.9 PCF
Optimum Moisture Content 14.7 %

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-13, 16.0'-20.0'
Sample No.: 1266
Sample Description: Silt (ML), gray, very moist to wet
Nmc: 29.4 %
Visual Notes: Bottom ash particles present
Test Method: ASTM D 698 - Method A
Prepared: Dry Oversized Fraction: < 5 % Rammer: Manual
Gs - Fines: Assumed

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3792	1753	220.35	206.08	32.53	8.2	107.9
3883	1844	224.89	207.47	32.03	9.9	111.7
3944	1905	232.47	211.69	32.28	11.6	113.7
3945	1906	237.41	212.80	31.53	13.6	111.8

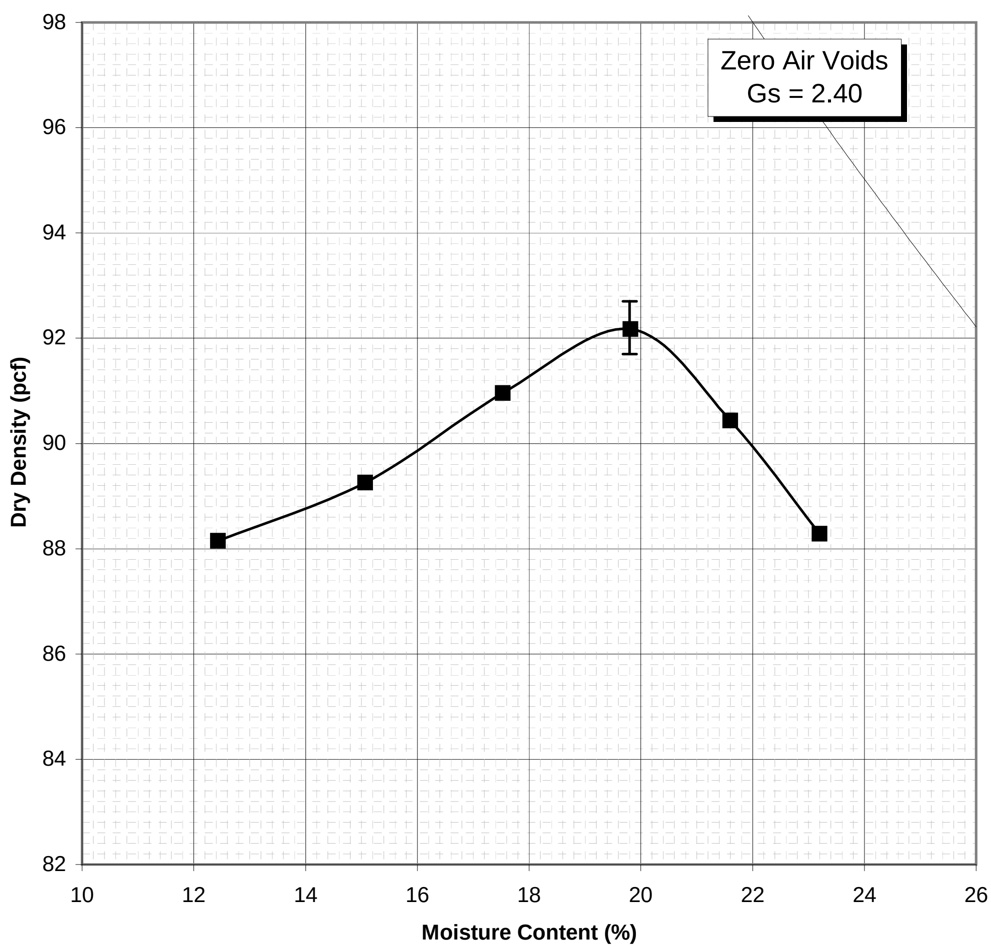


Maximum Dry Density 113.7 PCF
Optimum Moisture Content 11.6 %

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2 | Project No.: 175559023
Source: STN-23, 15.0'-18.0' | Sample No.: 1274
Sample Description: Silt (ML), gray, moist | Nmc: 23.4 %
Visual Notes: Ash | Test Method: ASTM D 698 - Method A
Prepared: Dry | Oversized Fraction: < 5 % | Rammer: Manual | Gs - Fines: Assumed

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3527	1488	261.18	235.56	29.53	12.4	88.1
3581	1542	216.91	192.24	28.54	15.1	89.3
3644	1605	277.62	240.82	30.90	17.5	91.0
3697	1658	225.13	192.74	29.26	19.8	92.2
3690	1651	275.33	231.81	30.33	21.6	90.4
3672	1633	250.21	208.86	30.63	23.2	88.3



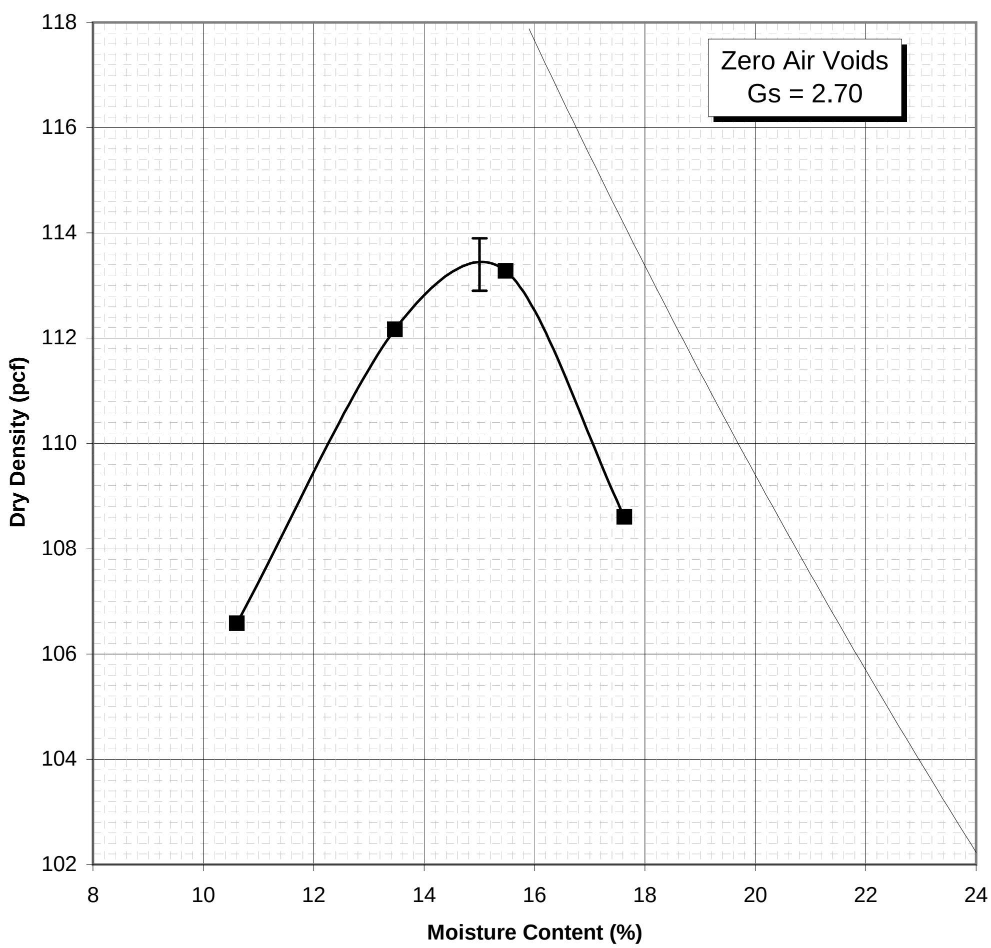
Maximum Dry Density 92.2 PCF
Optimum Moisture Content 19.8 %

Moisture-Density Data Sheet

Stantec

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-32P, 18.0'-20.0'
Sample No.: 1277
Sample Description: Lean clay (CL), strong brown, moist
Nmc: 23.0 %
Visual Notes:
Test Method: ASTM D 698 - Method A
Prepared: Dry
Oversized Fraction: < 5 %
Rammer: Manual
Gs - Fines: Assumed

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3809	1770	286.51	261.88	29.70	10.6	106.6
3950	1911	286.08	255.49	28.48	13.5	112.2
4003	1964	271.19	238.76	29.23	15.5	113.3
3957	1918	246.84	214.76	32.77	17.6	108.6



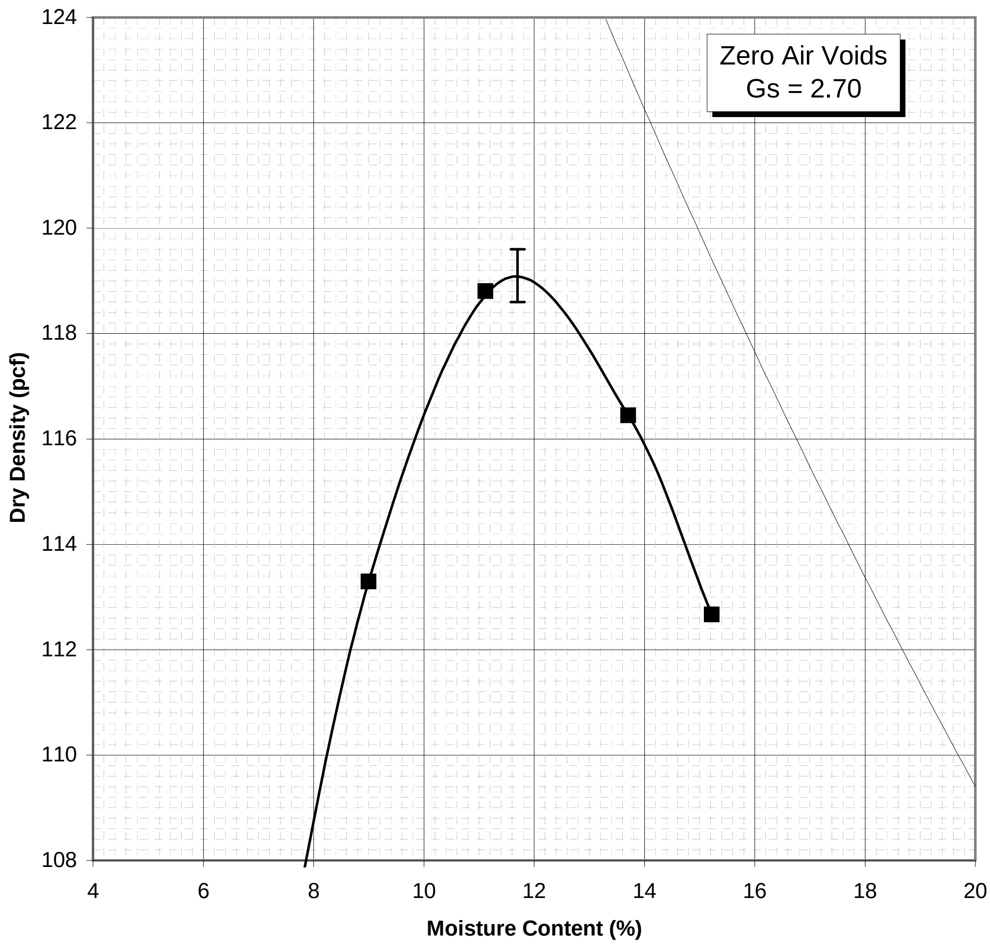
Maximum Dry Density 113.4 PCF
Optimum Moisture Content 15.0 %

Stantec

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2 | Project No.: 175559023
Source: STN-37, 8.0'-10.0' | Sample No.: 307
Sample Description: Silty clay (CL-ML), brown
Visual Notes: | Test Method: ASTM D 698 - Method A
Prepared: Dry | Oversized Fraction: < 5 % | Rammer: Manual | Gs - Fines: Assumed

Mold Weight 2038 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3892	1854	241.20	223.90	31.60	9.0	113.3
4020	1982	208.10	190.60	33.20	11.1	118.8
4026	1988	237.70	213.00	32.80	13.7	116.4
3987	1949	245.50	217.60	34.30	15.2	112.7
3698	1660	217.70	205.60	32.50	7.0	103.3

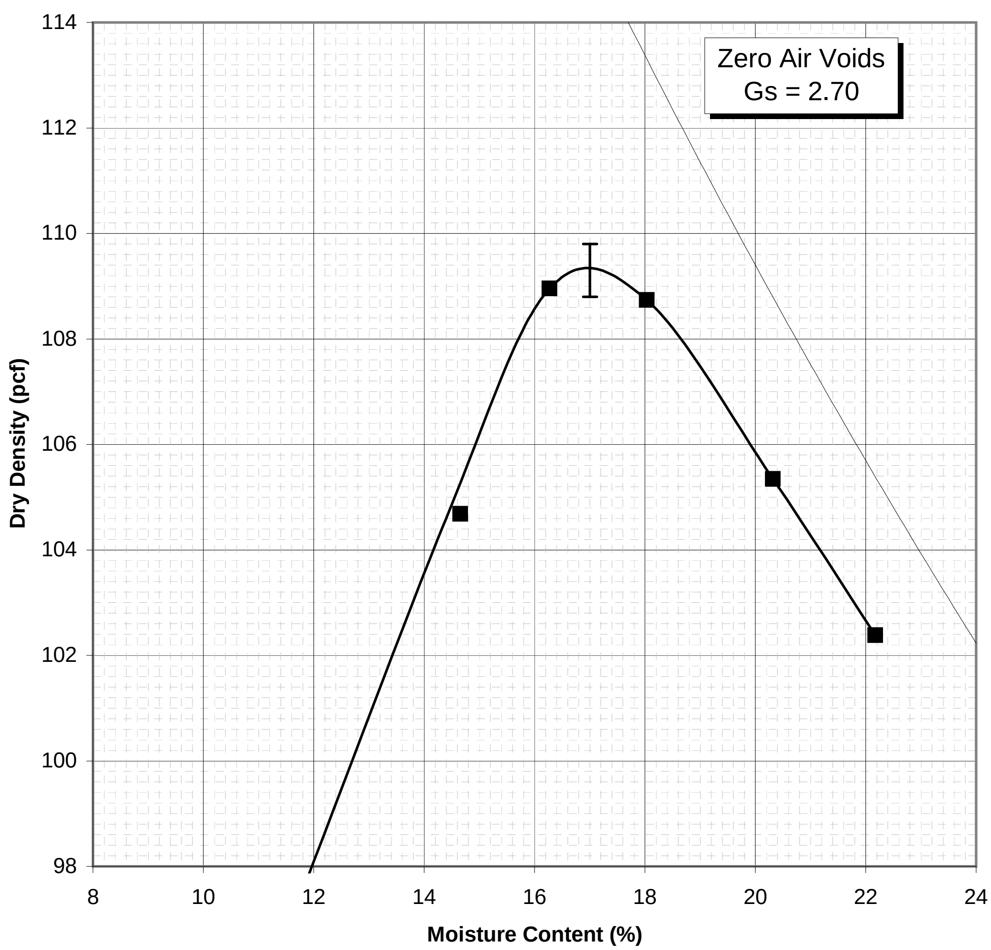


Maximum Dry Density 119.1 PCF
Optimum Moisture Content 11.7 %

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-50P, 16.0'-19.0'
Sample No.: 1279
Sample Description: Lean clay (CL), brown, moist
Nmc: 23.0 %
Visual Notes:
Test Method: ASTM D 698 - Method A
Prepared: Dry
Oversized Fraction: < 5 %
Rammer: Manual
Gs - Fines: Assumed

Mold Weight 2039 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
3667	1628	217.51	198.17	32.14	11.6	97.1
3841	1802	212.28	189.32	32.66	14.7	104.7
3942	1903	198.85	170.66	31.93	20.3	105.3
3917	1878	241.66	203.66	32.29	22.2	102.4
3941	1902	166.60	146.82	25.25	16.3	109.0
3966	1927	354.46	305.40	33.34	18.0	108.7

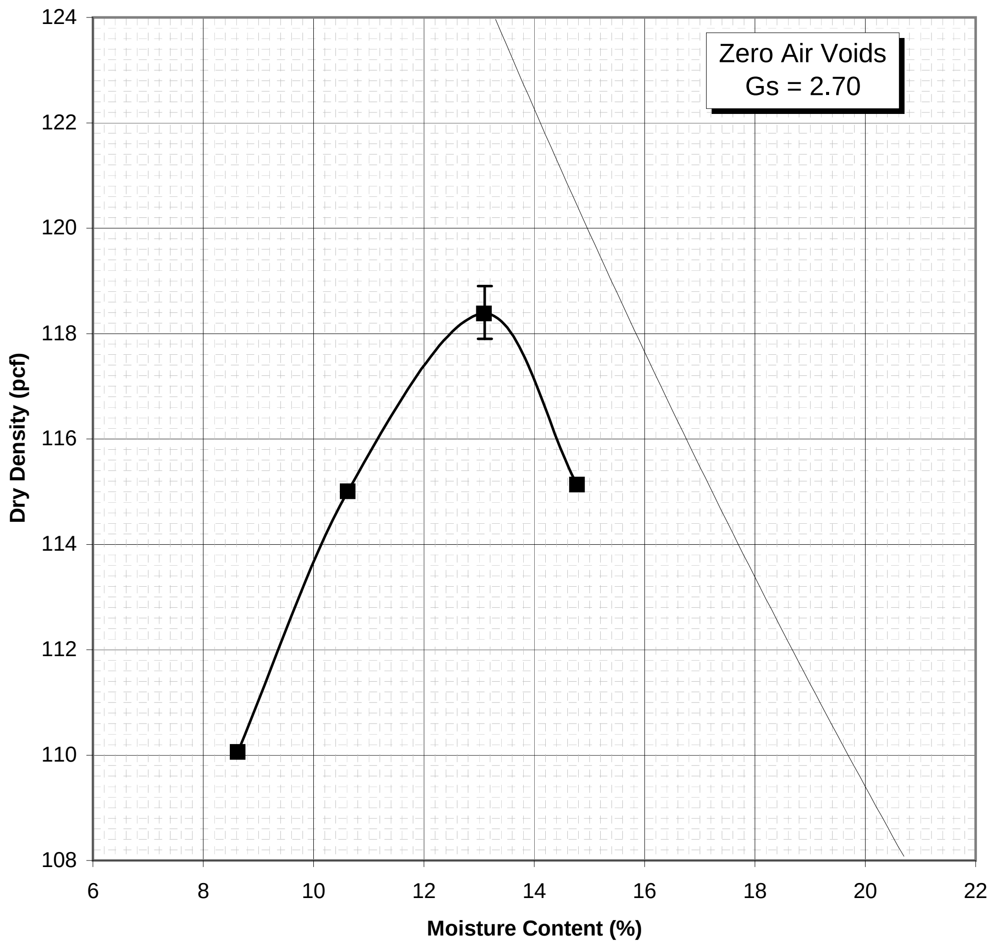


Maximum Dry Density 109.3 PCF
Optimum Moisture Content 17.0 %

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-52 (1,2,3), 4.0'-10.0'
Sample No.: 825
Sample Description: Silty clay with sand (CL-ML), gray/ tan
Visual Notes:
Test Method: ASTM D 698 - Method A
Prepared: Dry
Oversized Fraction: < 5 %
Rammer: Manual
Gs - Fines: Assumed

Mold Weight 4230 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
6025	1795	272.00	253.00	32.80	8.6	110.1
6140	1910	254.30	233.20	34.50	10.6	115.0
6240	2010	290.80	260.90	32.50	13.1	118.4
6214	1984	243.00	215.60	30.20	14.8	115.1

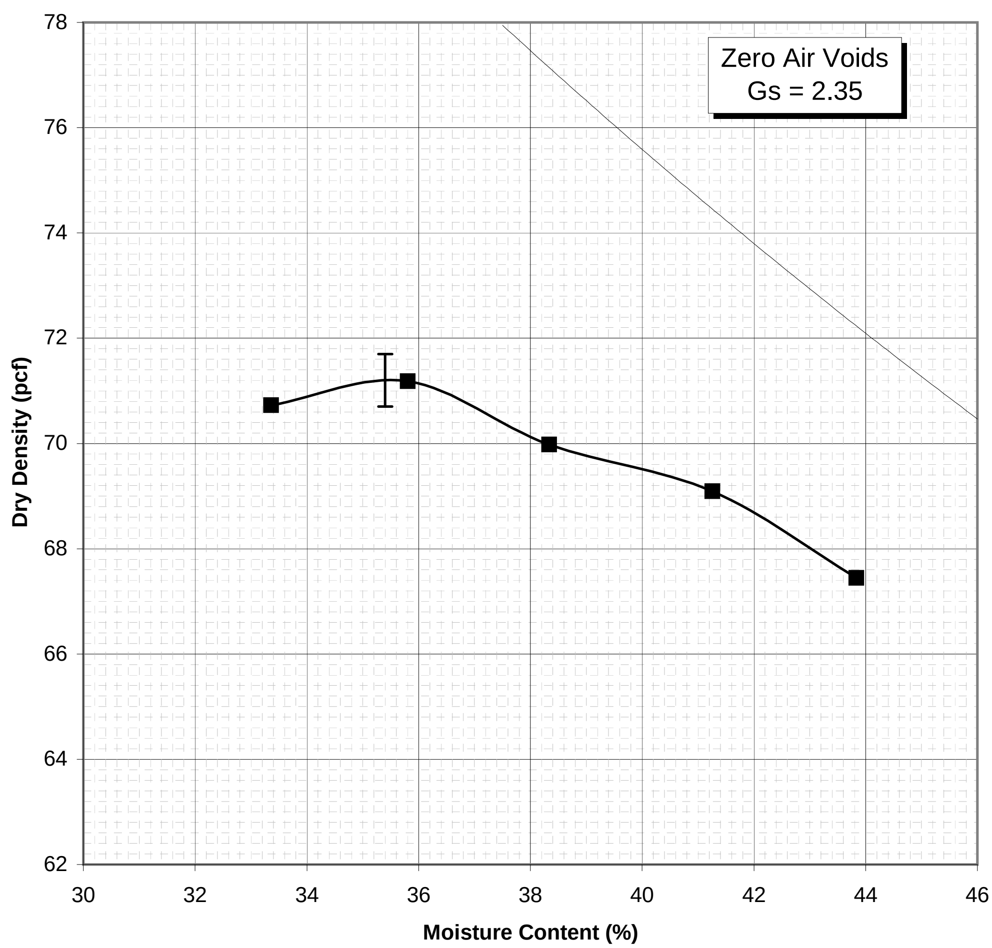


Maximum Dry Density 118.4 PCF
Optimum Moisture Content 13.1 %

Moisture-Density Data Sheet

Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack | Project No.: 175559035
Source: STN-109, 12.0'-25.0' | Sample No.: 589
Sample Description: Silt (ML), dark gray
Visual Notes: Fly ash dried at 60 degrees C | Test Method: ASTM D 698 - Method A
Prepared: Moist | Oversized Fraction: < 5 % | Rammer: Manual | Gs - Fines: Estimated

Mold Weight 4172.2 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5593	1420	448.78	354.41	71.55	33.4	70.7
5628	1456	480.02	372.68	72.89	35.8	71.2
5630	1458	537.35	409.33	75.38	38.3	70.0
5642	1470	414.14	314.40	72.66	41.3	69.1
5633	1461	345.55	262.81	74.05	43.8	67.4

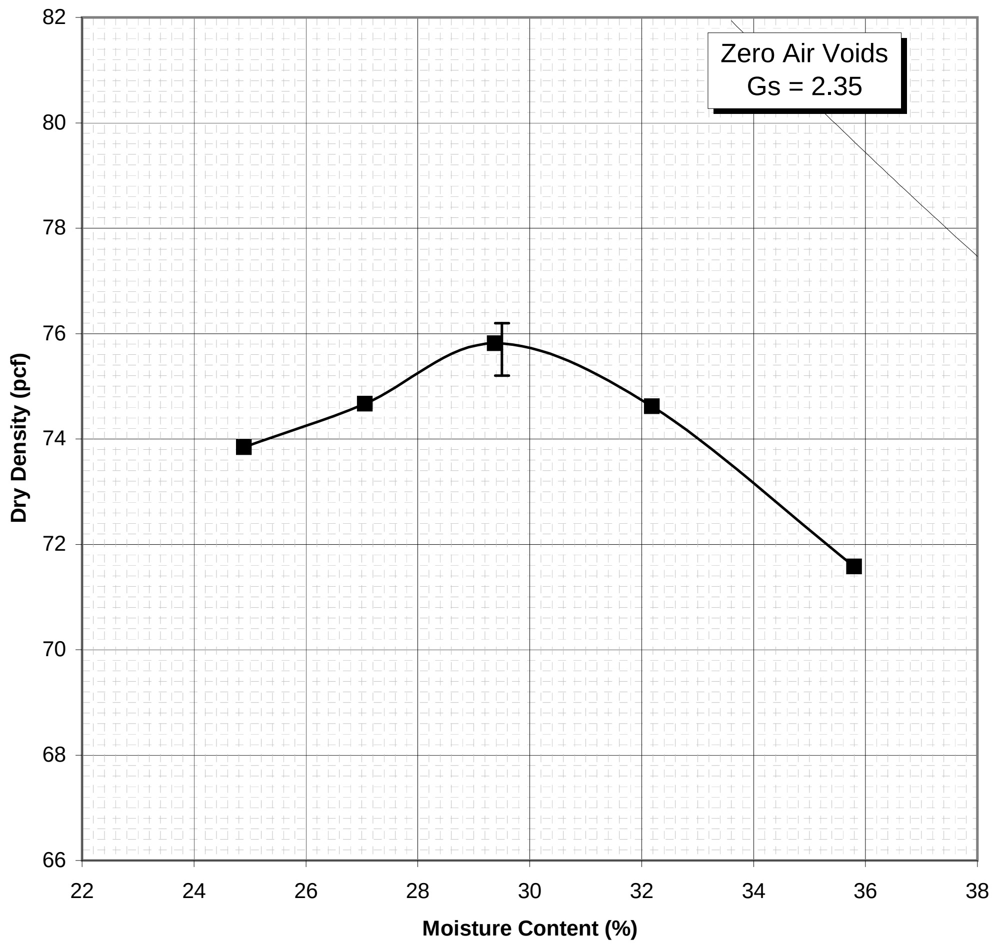


Maximum Dry Density 71.2 PCF
Optimum Moisture Content 35.4 %

Moisture-Density Data Sheet

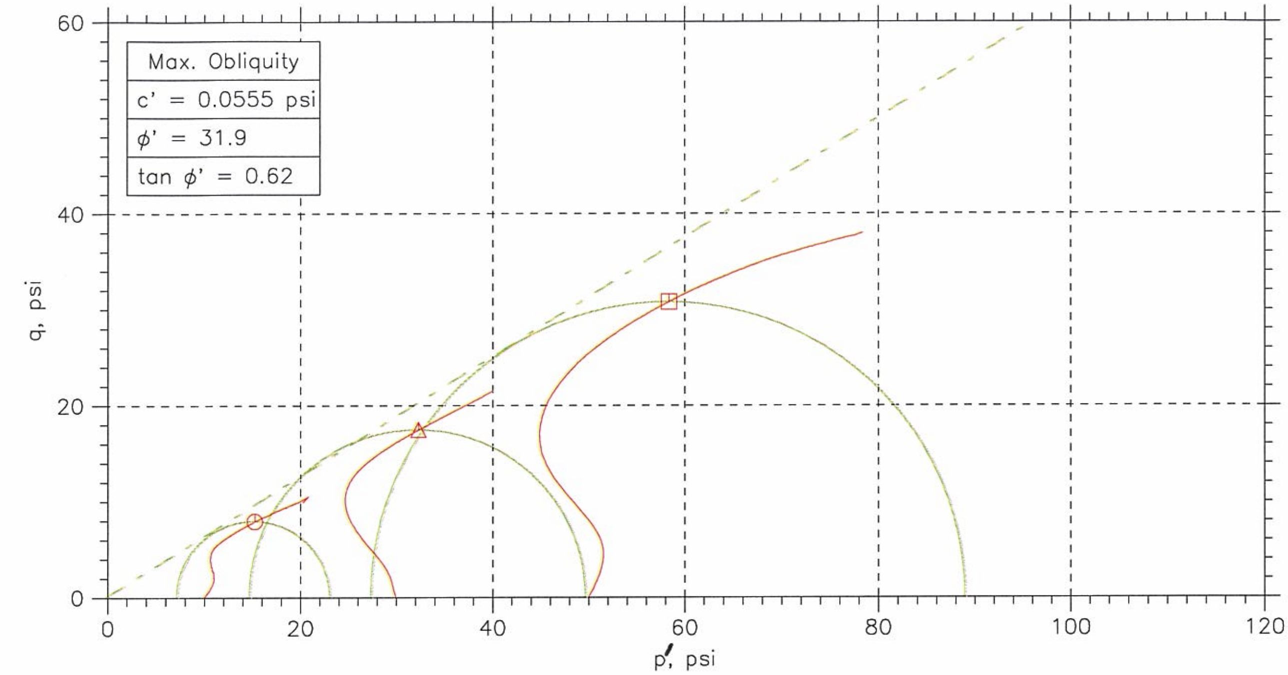
Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack | Project No.: 175559035
Source: STN-123, 10.0'-12.0' | Sample No.: 592
Sample Description: Silt (ML), dark gray
Visual Notes: Fly ash, dried at 60 degree Celcius for 4 days | Test Method: ASTM D 698 - Method A
Prepared: Moist | Oversized Fraction: < 5 % | Rammer: Manual | Gs - Fines: Estimated

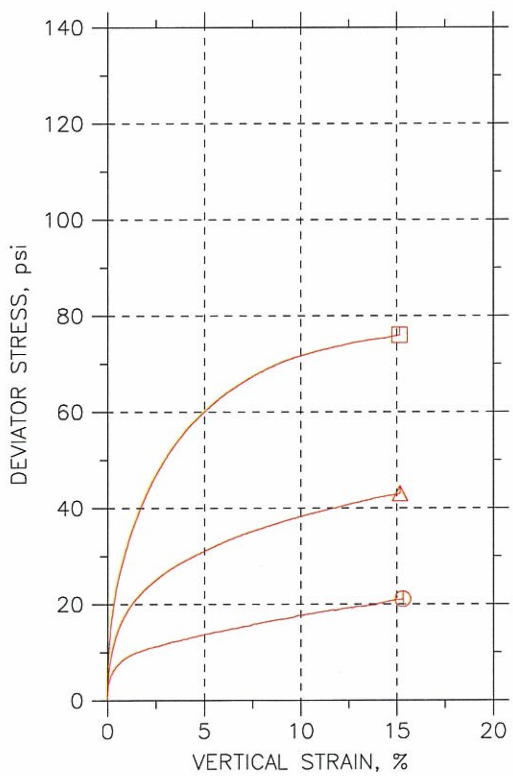
Mold Weight 4172.3 grams		Moisture Determination				
Wet Weight plus Mold (grams)	Wet Weight minus Mold (grams)	Wet Soil and Can Weight (grams)	Dry Soil and Can Weight (grams)	Can Weight (grams)	Water Content (%)	Dry Density (pcf)
5561	1389	364.58	307.50	78.18	24.9	73.8
5601	1429	358.35	298.09	75.38	27.1	74.7
5649	1477	320.75	264.12	71.36	29.4	75.8
5658	1485	294.70	241.61	76.65	32.2	74.6
5636	1464	244.39	199.31	73.39	35.8	71.6



Maximum Dry Density 75.7 PCF
Optimum Moisture Content 29.5 %

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		ST-3	ST-3	ST-3	
Test No.		2.1	2.2	2.3	
Depth		28.1-28.7'	28.7-29.3	29.3-29.9	
Initial	Diameter, in	1.41	2.85	2.824	
	Height, in	3.034	6.297	6.135	
	Water Content, %	24.3	26.8	20.2	
	Dry Density, pcf	100.7	96.94	108.6	
	Saturation, %	97.1	97.9	98.8	
	Void Ratio	0.674	0.739	0.552	
Before Shear	Water Content, %	25.9	26.0	21.3	
	Dry Density, pcf	99.16	98.96	106.9	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.7	0.703	0.576	
	Back Press., psi	72.87	107.1	74.15	
Ver. Eff. Cons. Stress, psi		9.98	29.91	49.96	
Shear Strength, psi		10.56	21.52	37.99	
Strain at Failure, %		15.3	15.2	15.2	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.95	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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Project: Shawnee Ash Ponds 1&2	
Location: ---	
Project No.: GTX-1504	
Boring No.: STN-3	
Sample Type: UD	
Description: Gray Lean clay with sand	
Remarks: 2054	

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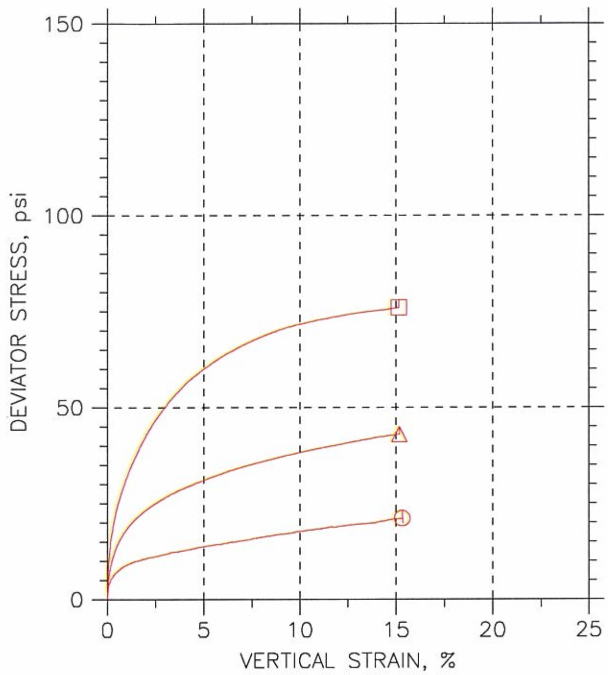
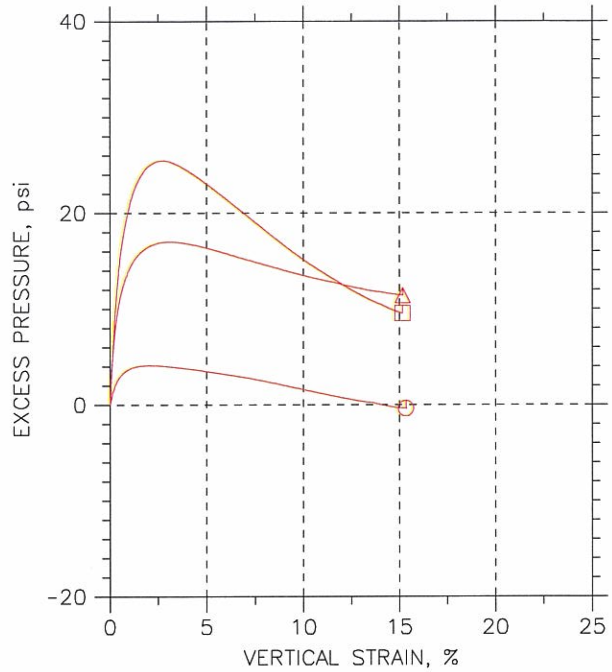
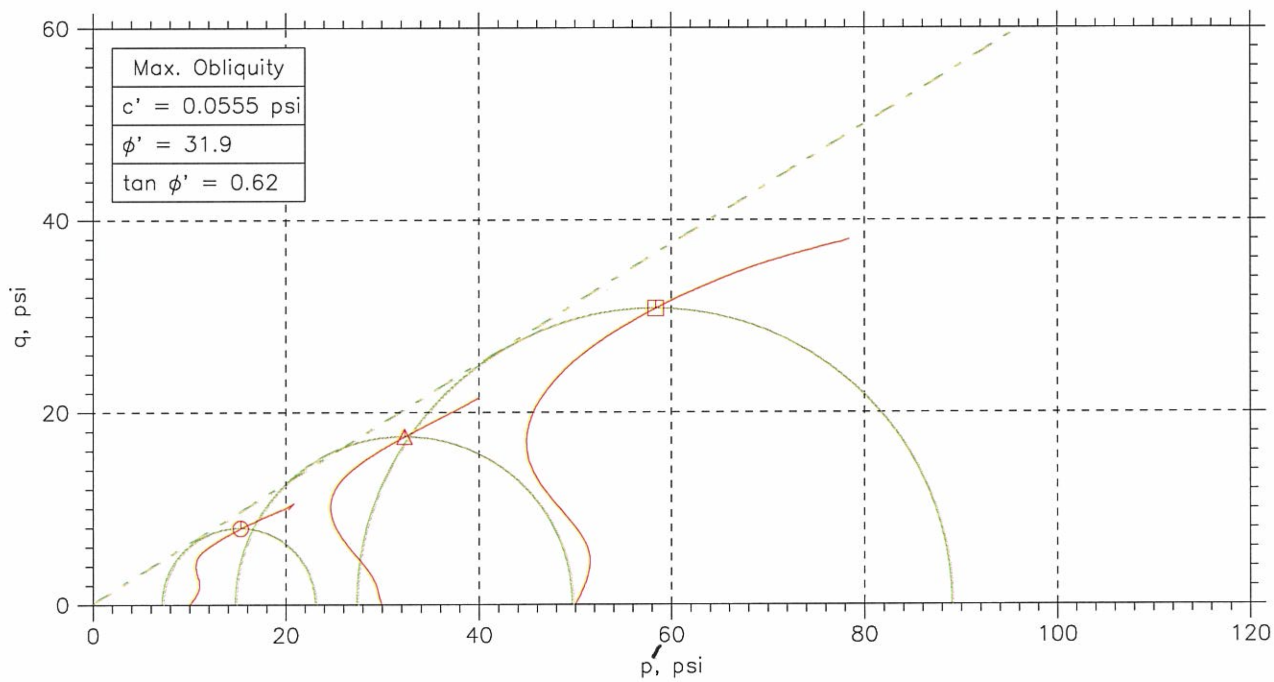
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	2.1	28.1-28.7'	MM	11/11/09	GT		1504-2.1.dat
△	ST-3	2.2	28.7-29.3	MM	10/27/09	GT		1504-2.2.dat
□	ST-3	2.3	29.3-29.9	MM	10/27/09	GT		1504-2.3.dat

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Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1504
Boring No.: STN-3	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: 2054		

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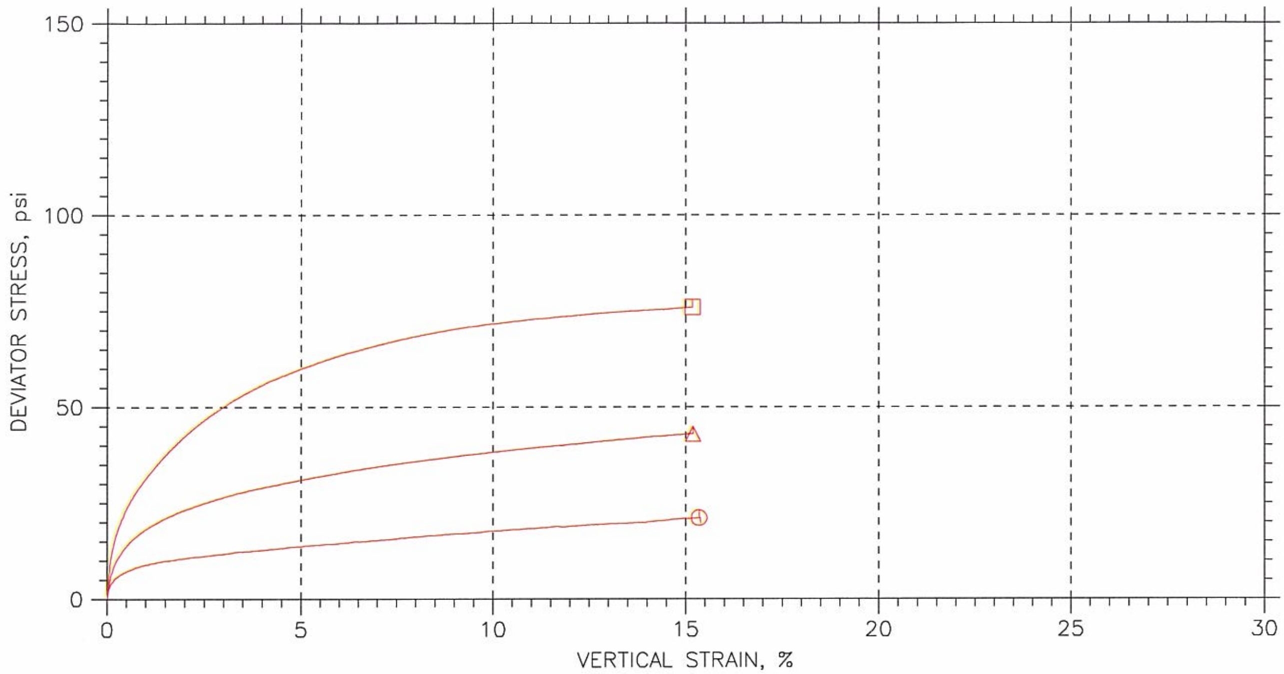
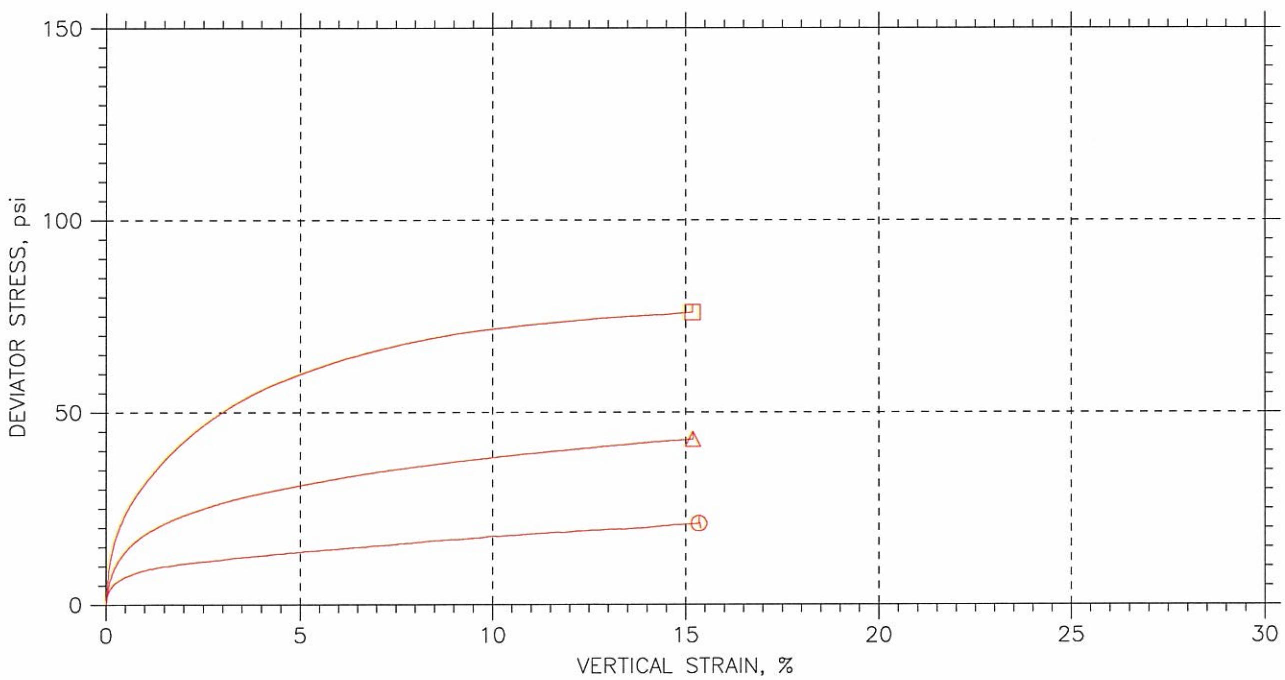
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	ST-3	2.1	28.1-28.7'	MM	11/11/09	GT		1504-2.1.dat
△	ST-3	2.2	28.7-29.3	MM	10/27/09	GT		1504-2.2.dat
⊡	ST-3	2.3	29.3-29.9	MM	10/27/09	GT		1504-2.3.dat

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Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1504
Boring No.: STN-3	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: 2054		

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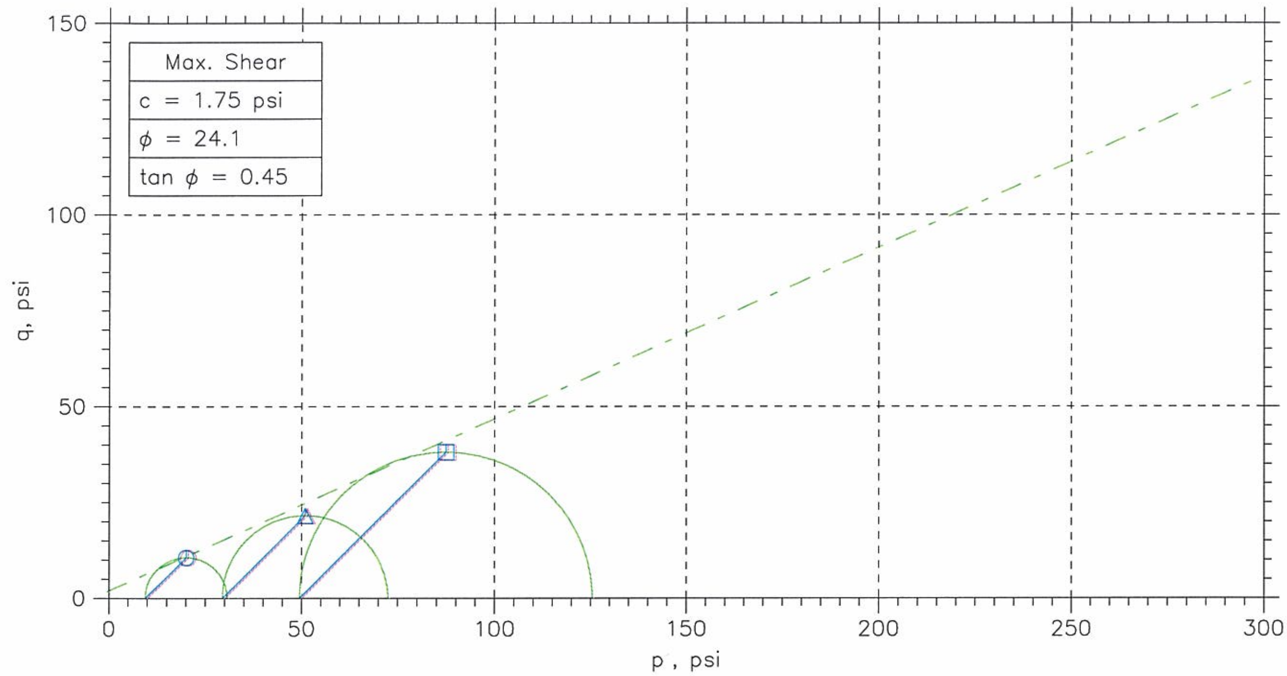
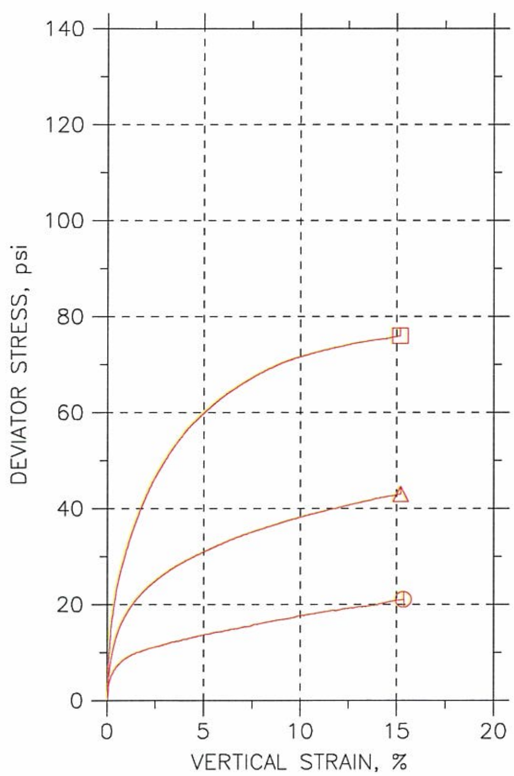
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	○	△	□	
	Sample No.	ST-3	ST-3	ST-3	
	Test No.	2.1	2.2	2.3	
	Depth	28.1-28.7'	28.7-29.3	29.3-29.9	
Initial	Diameter, in	1.41	2.85	2.824	
	Height, in	3.034	6.297	6.135	
	Water Content, %	24.3	26.8	20.2	
	Dry Density, pcf	100.7	96.94	108.6	
	Saturation, %	97.1	97.9	98.8	
	Void Ratio	0.674	0.739	0.552	
Before Shear	Water Content, %	25.9	26.0	21.3	
	Dry Density, pcf	99.16	98.96	106.9	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.7	0.703	0.576	
	Back Press., psi	72.87	107.1	74.15	
	Ver. Eff. Cons. Stress, psi	9.98	29.91	49.96	
	Shear Strength, psi	10.56	21.52	37.99	
	Strain at Failure, %	15.3	15.2	15.2	
	Strain Rate, %/min	0.016	0.016	0.016	
	B-Value	0.96	0.95	0.96	
	Estimated Specific Gravity	2.7	2.7	2.7	
	Liquid Limit	---	---	---	
	Plastic Limit	---	---	---	

Project: Shawnee Ash Ponds 1&2	
Location: ---	
Project No.: GTX-1504	
Boring No.: STN-3	
Sample Type: UD	
Description: Gray Lean clay with sand	
Remarks: 2054	

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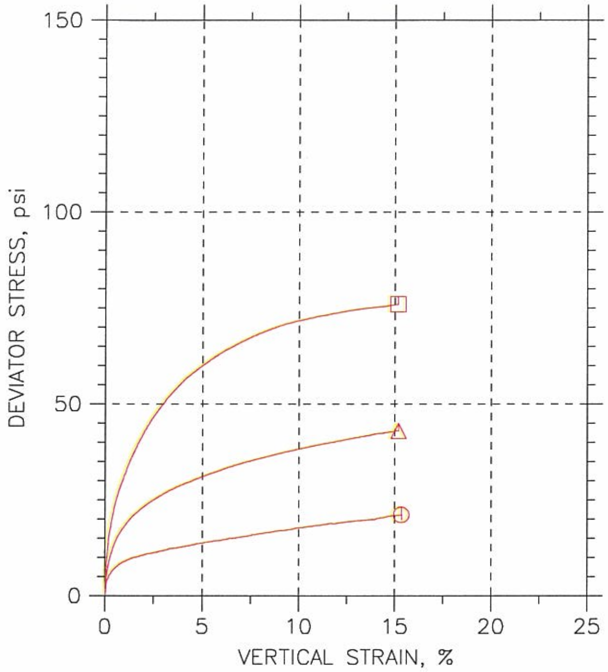
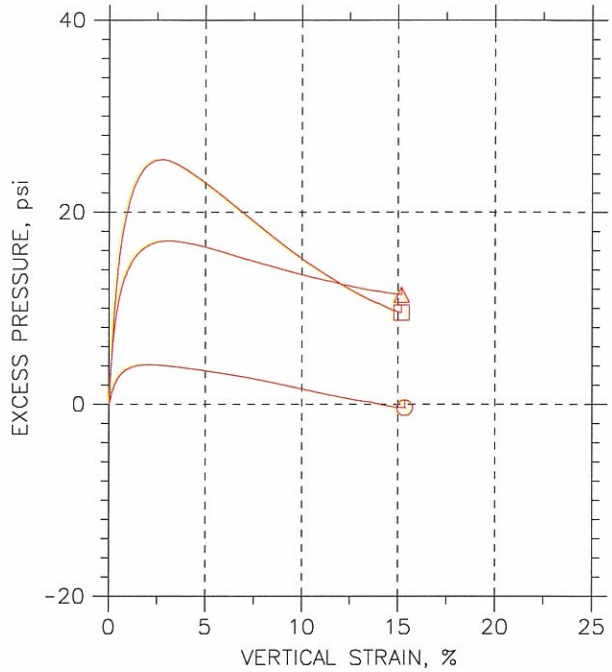
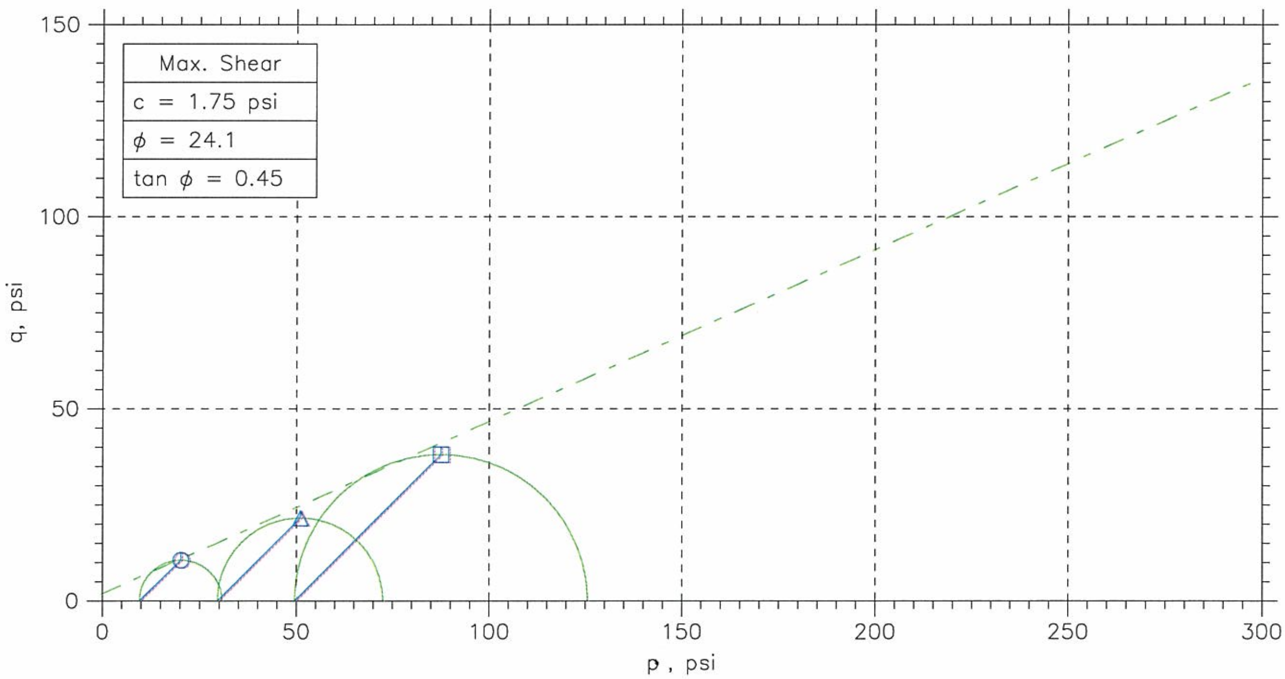
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	2.1	28.1-28.7'	MM	11/11/09	GT		1504-2.1.dat
△	ST-3	2.2	28.7-29.3	MM	10/27/09	GT		1504-2.2.dat
□	ST-3	2.3	29.3-29.9	MM	10/27/09	GT		1504-2.3.dat

Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1504
Boring No.: STN-3	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: 2054		

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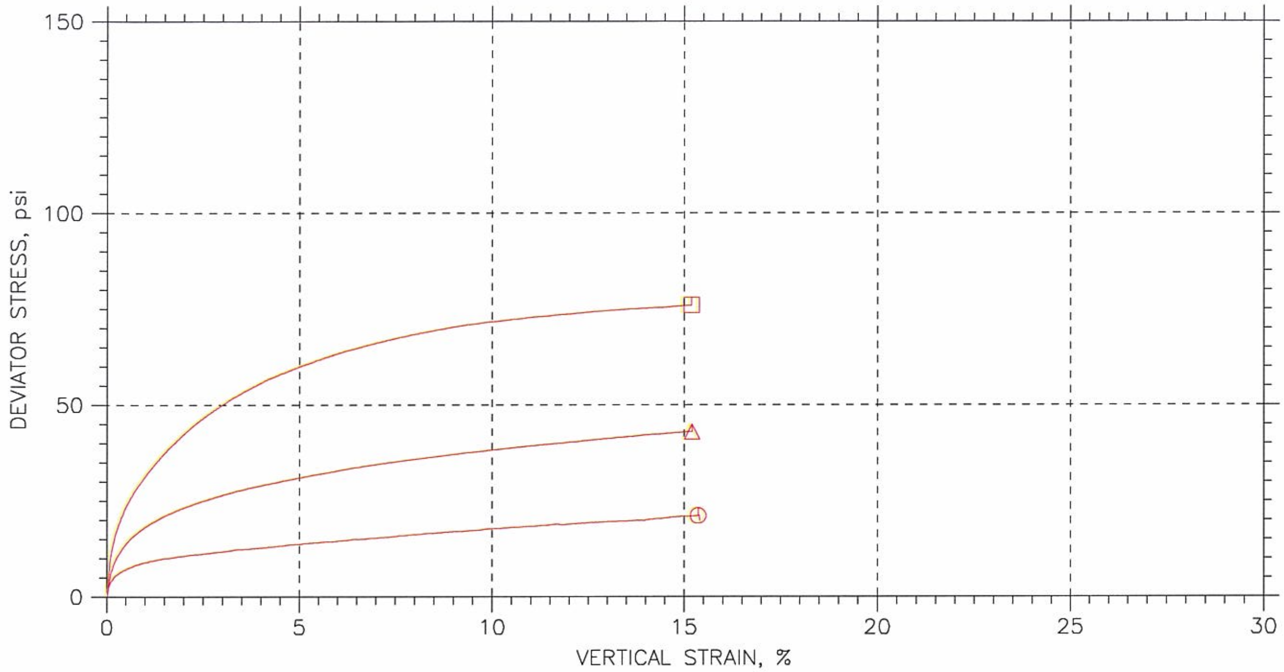
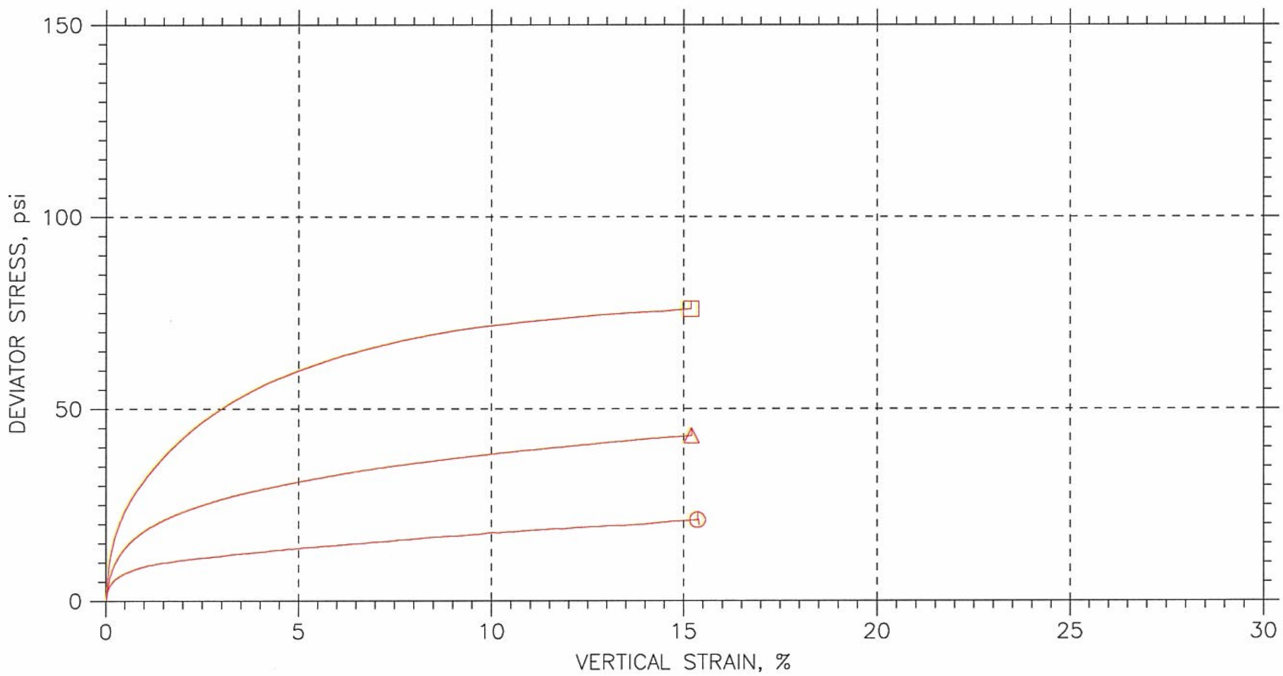
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	2.1	28.1-28.7'	MM	11/11/09	GT		1504-2.1.dat
△	ST-3	2.2	28.7-29.3	MM	10/27/09	GT		1504-2.2.dat
□	ST-3	2.3	29.3-29.9	MM	10/27/09	GT		1504-2.3.dat

Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1504
Boring No.: STN-3	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: 2054		

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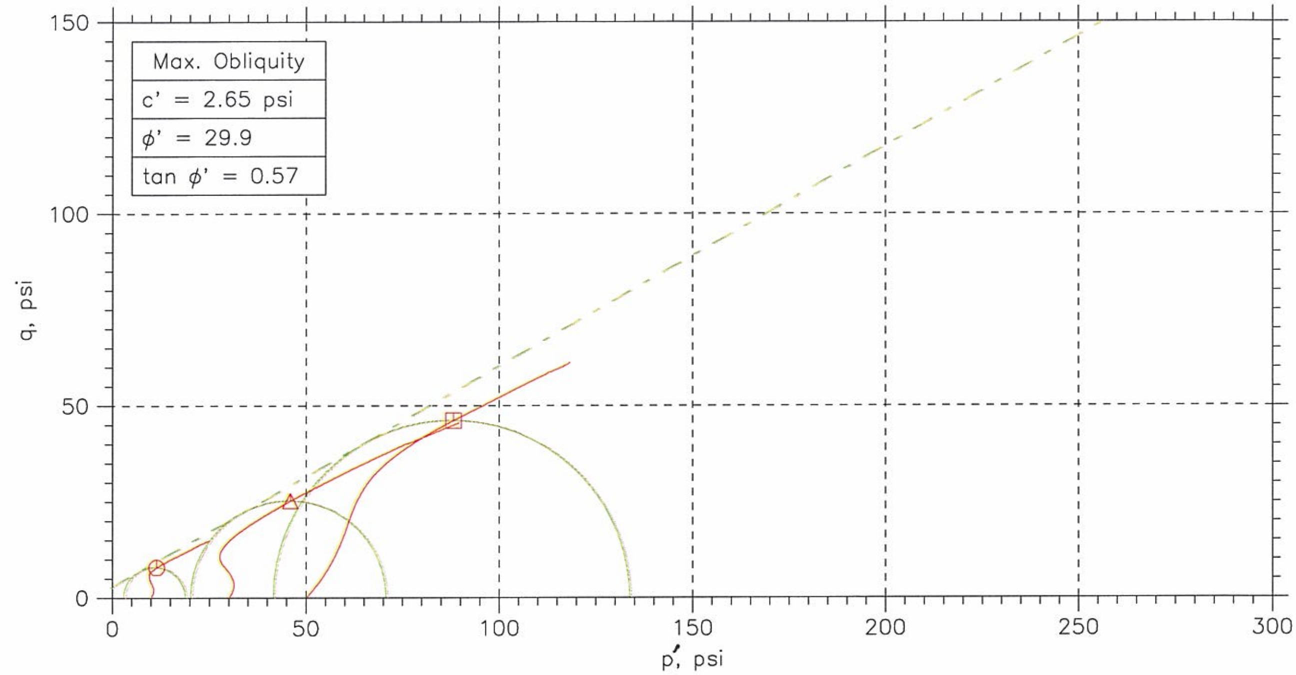
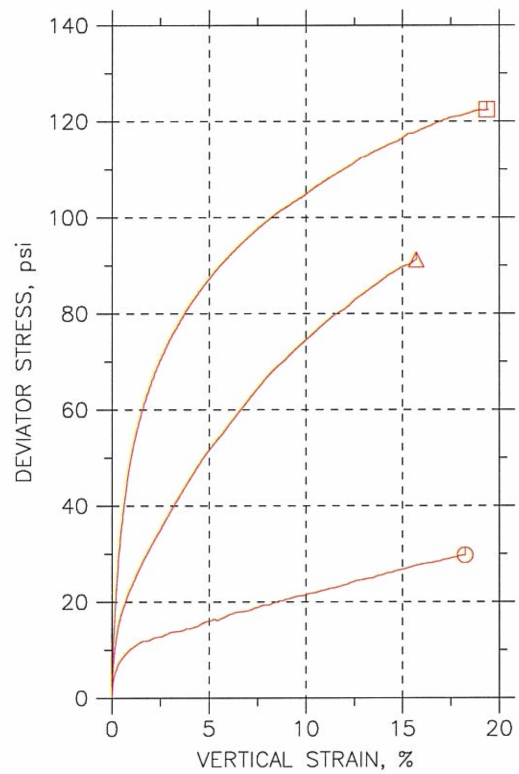
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		ST-1	ST-1	st-2	
Test No.		3.1	3.2	3.3	
Depth		5.2-5.8	5.8-6.4	10.4-11.0	
Initial	Diameter, in	2.794	2.848	1.431	
	Height, in	6.309	6.027	3.131	
	Water Content, %	14.3	15.6	14.6	
	Dry Density, pcf	112.9	112.7	110.8	
	Saturation, %	78.1	85.0	75.8	
	Void Ratio	0.493	0.495	0.521	
Before Shear	Water Content, %	16.5	16.6	15.3	
	Dry Density, pcf	116.6	116.4	119.4	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.445	0.449	0.412	
	Back Press., psi	140	116.3	101.1	
Ver. Eff. Cons. Stress, psi		9.973	29.98	49.98	
Shear Strength, psi		14.89	45.62	61.23	
Strain at Failure, %		18.2	15.7	19.3	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

GeoTesting express a subsidiary of Geocomp Corporation	Project: Shawnee Fossil Plant-AP12
	Location: ---
	Project No.: GTX-1504
	Boring No.: STN-8
	Sample Type: UD
	Description: Brown Sandy lean clay
	Remarks: System 1062

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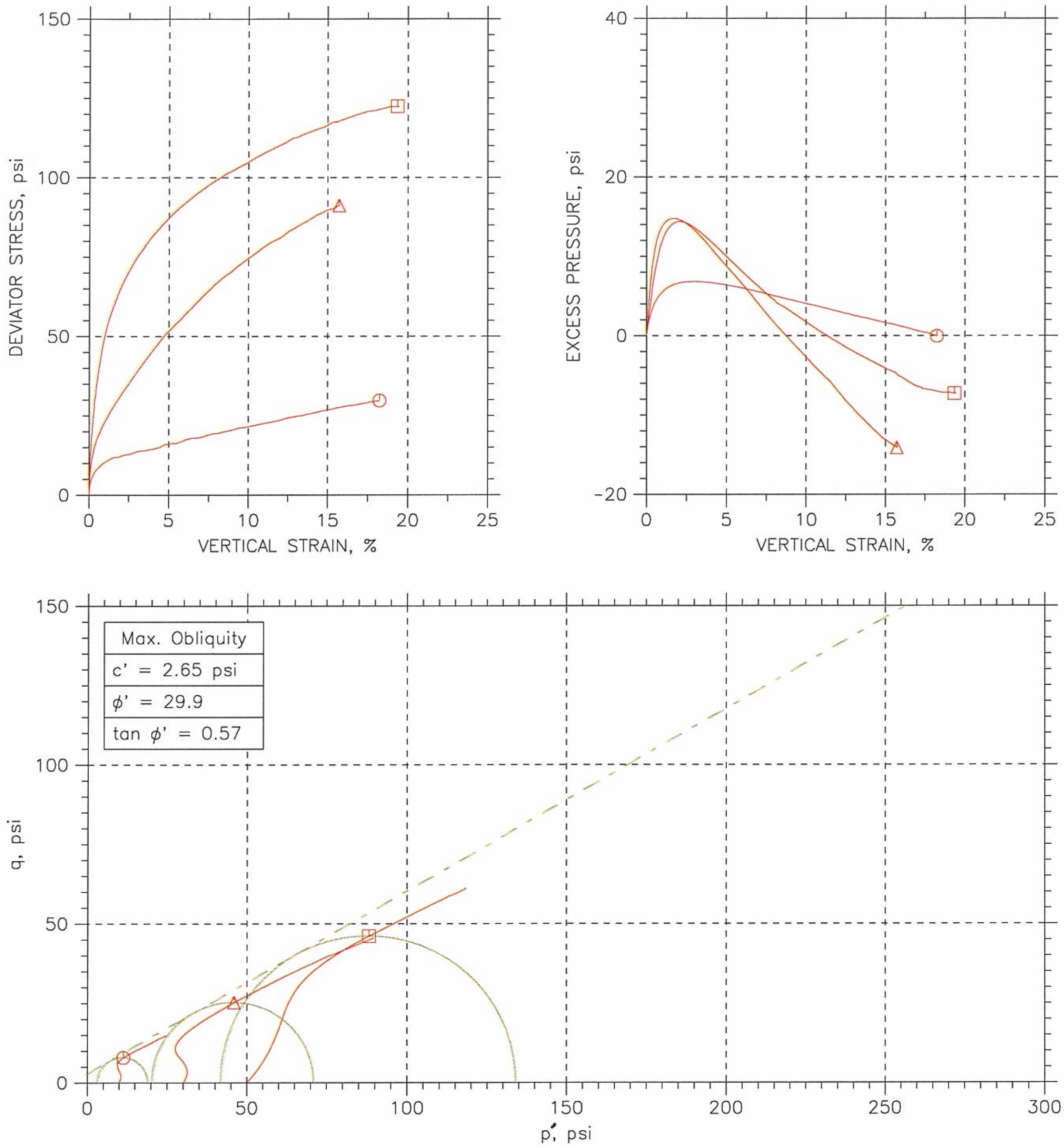
CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



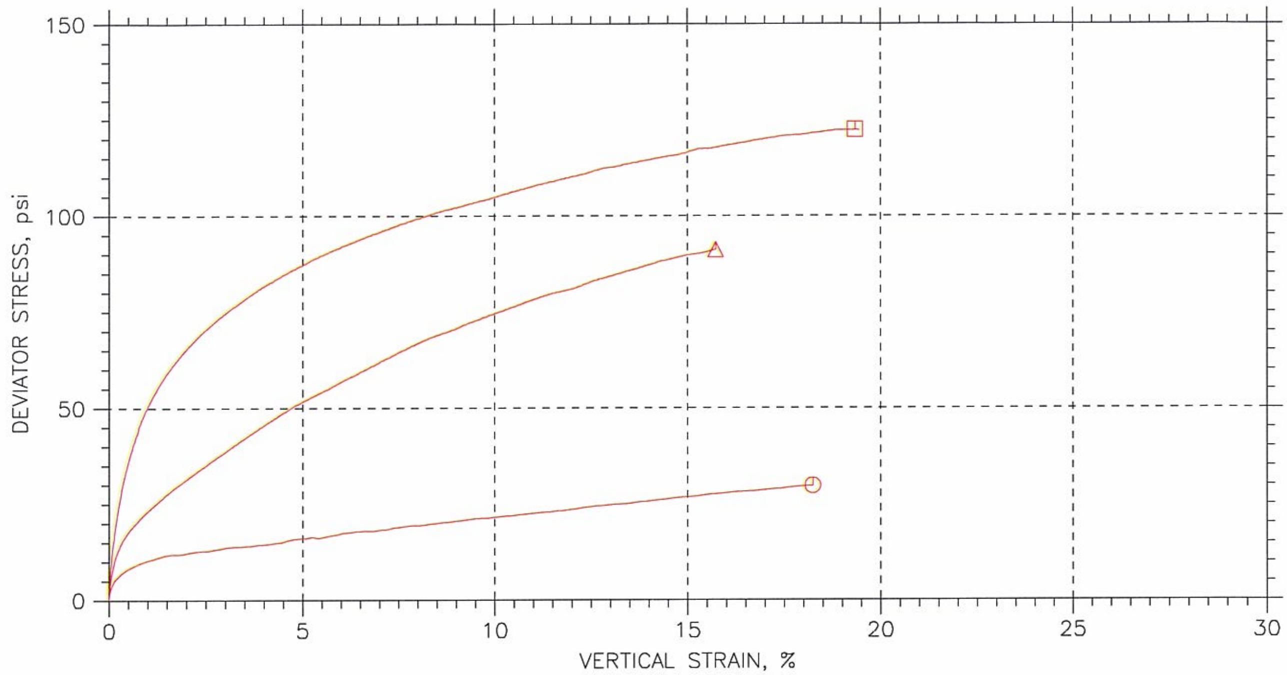
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-1	3.1	5.2-5.8	jm	10/27/09	mm		1504-3.1.dat
△	ST-1	3.2	5.8-6.4	jm	10/28/09	mm		1504-3.2.dat
□	st-2	3.3	10.4-11.0	JM	11/12/09	MM		1504-3.3.dat

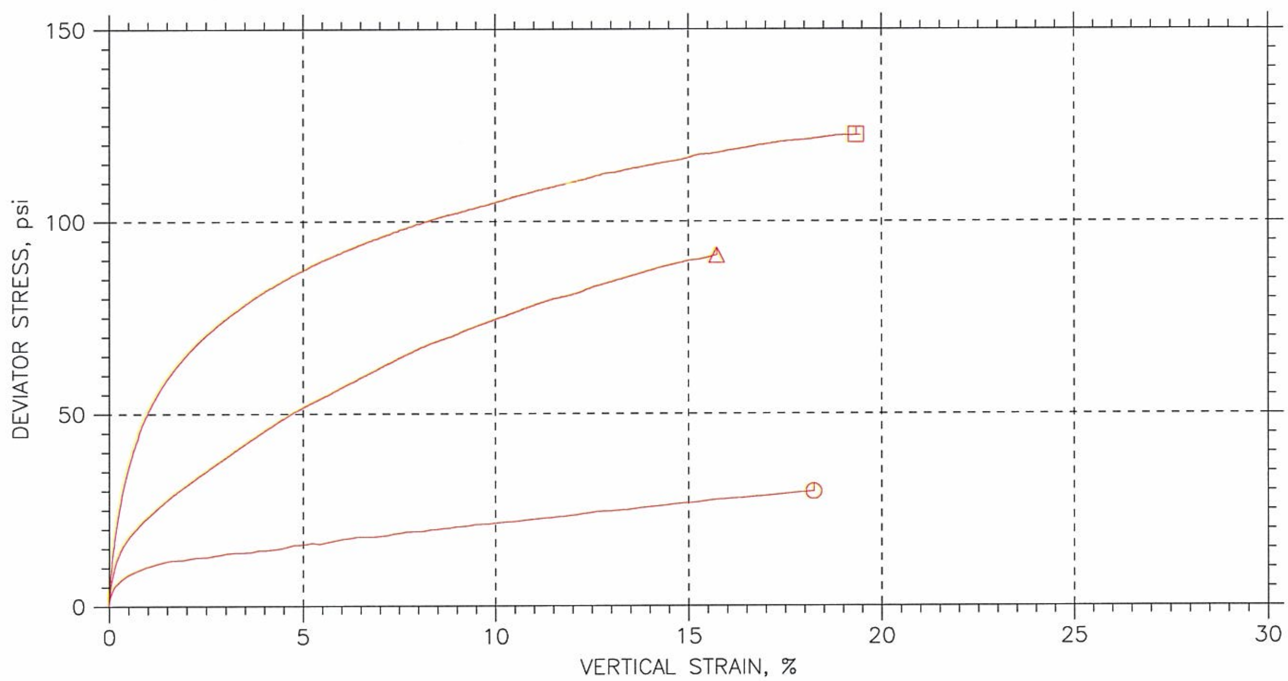
GeoTesting express
a subsidiary of Geocomp Corporation

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-8	Sample Type: UD	
Description: Brown Sandy lean clay		
Remarks: System 1062		

Fri, 20-NOV-2009 11:06:38

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-1	3.1	5.2-5.8	jm	10/27/09	mm		1504-3.1.dat
△	ST-1	3.2	5.8-6.4	jm	10/28/09	mm		1504-3.2.dat
□	st-2	3.3	10.4-11.0	JM	11/12/09	MM		1504-3.3.dat

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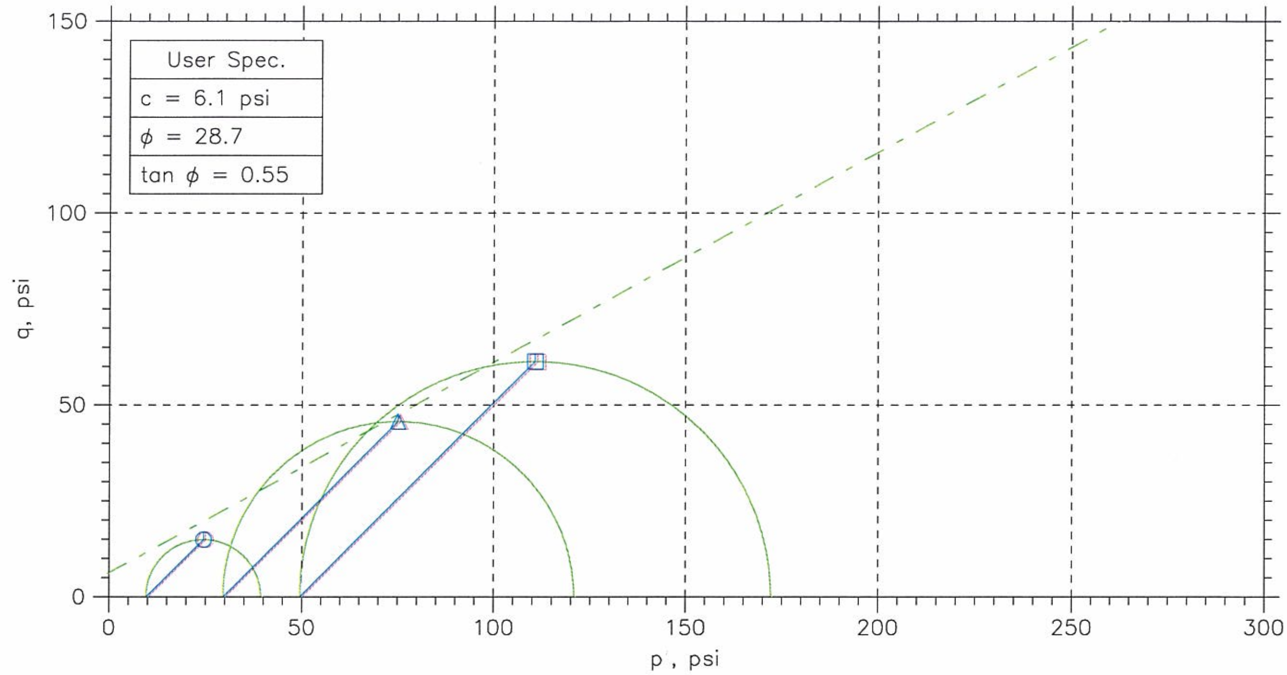
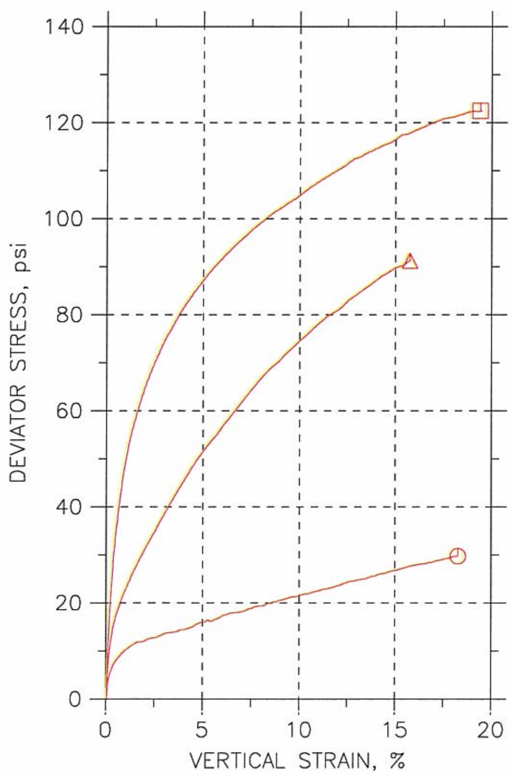
Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-8	Sample Type: UD	
Description: Brown Sandy lean clay		
Remarks: System 1062		

Fri, 20-NOV-2009 11:06:41

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



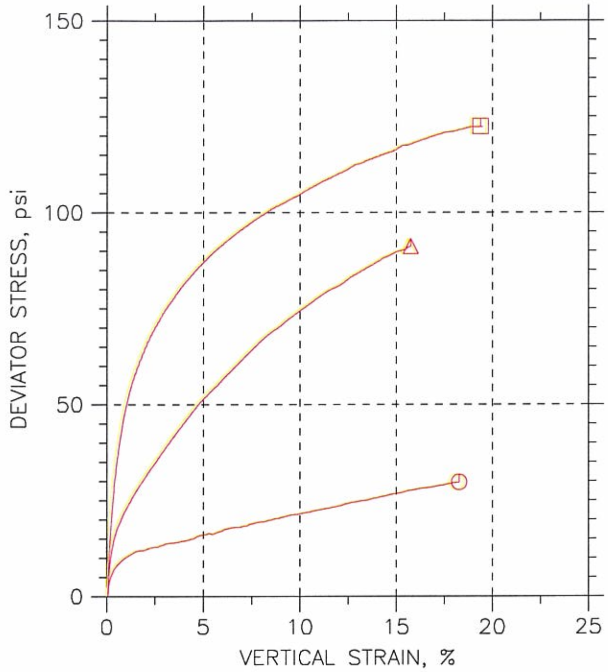


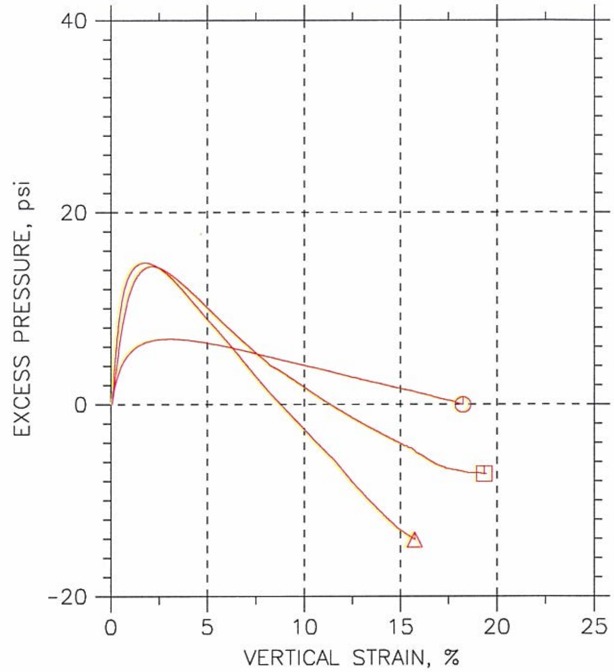
Symbol		○	△	□	
Sample No.		ST-1	ST-1	st-2	
Test No.		3.1	3.2	3.3	
Depth		5.2-5.8	5.8-6.4	10.4-11.0	
Initial	Diameter, in	2.794	2.848	1.431	
	Height, in	6.309	6.027	3.131	
	Water Content, %	14.3	15.6	14.6	
	Dry Density, pcf	112.9	112.7	110.8	
	Saturation, %	78.1	85.0	75.8	
	Void Ratio	0.493	0.495	0.521	
Before Shear	Water Content, %	16.5	16.6	15.3	
	Dry Density, pcf	116.6	116.4	119.4	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.445	0.449	0.412	
	Back Press., psi	140	116.3	101.1	
Ver. Eff. Cons. Stress, psi		9.973	29.98	49.98	
Shear Strength, psi		14.89	45.62	61.23	
Strain at Failure, %		18.2	15.7	19.3	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.95	0.96	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

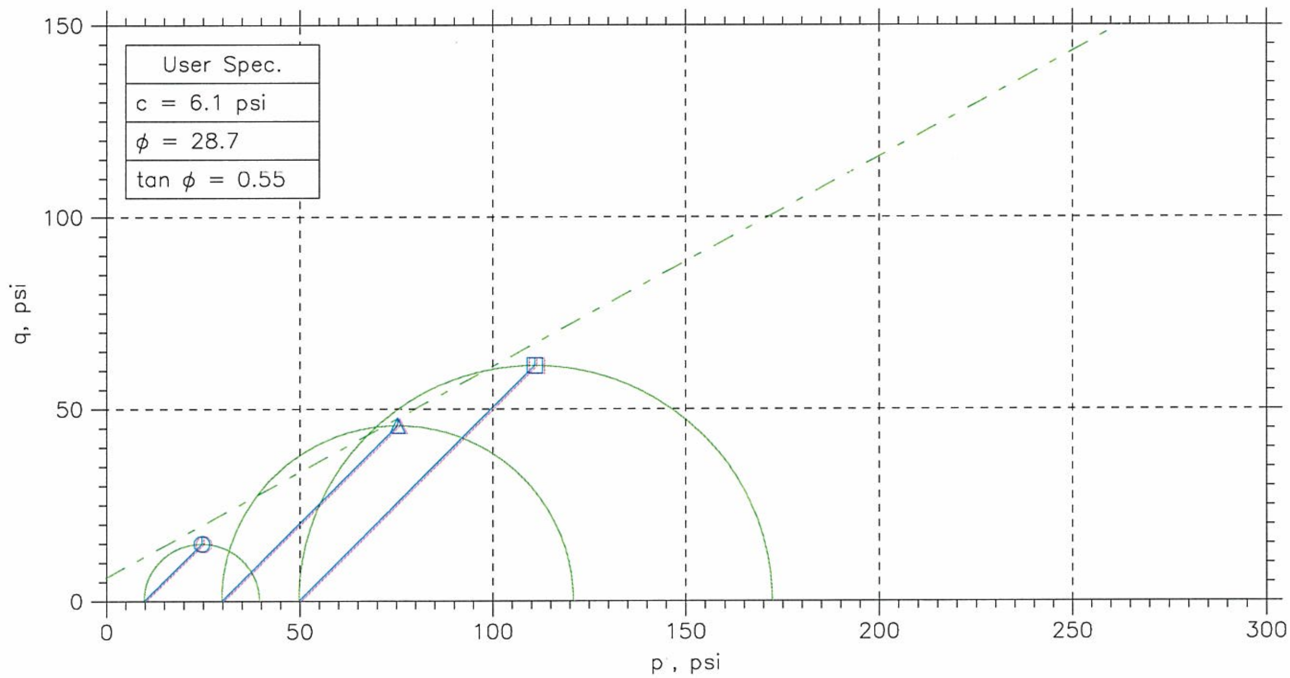
Project: Shawnee Fossil Plant-AP12
Location: ---
Project No.: GTX-1504
Boring No.: STN-8
Sample Type: UD
Description: Brown Sandy lean clay
Remarks: System 1062

Fri, 23-APR-2010 14:14:44

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





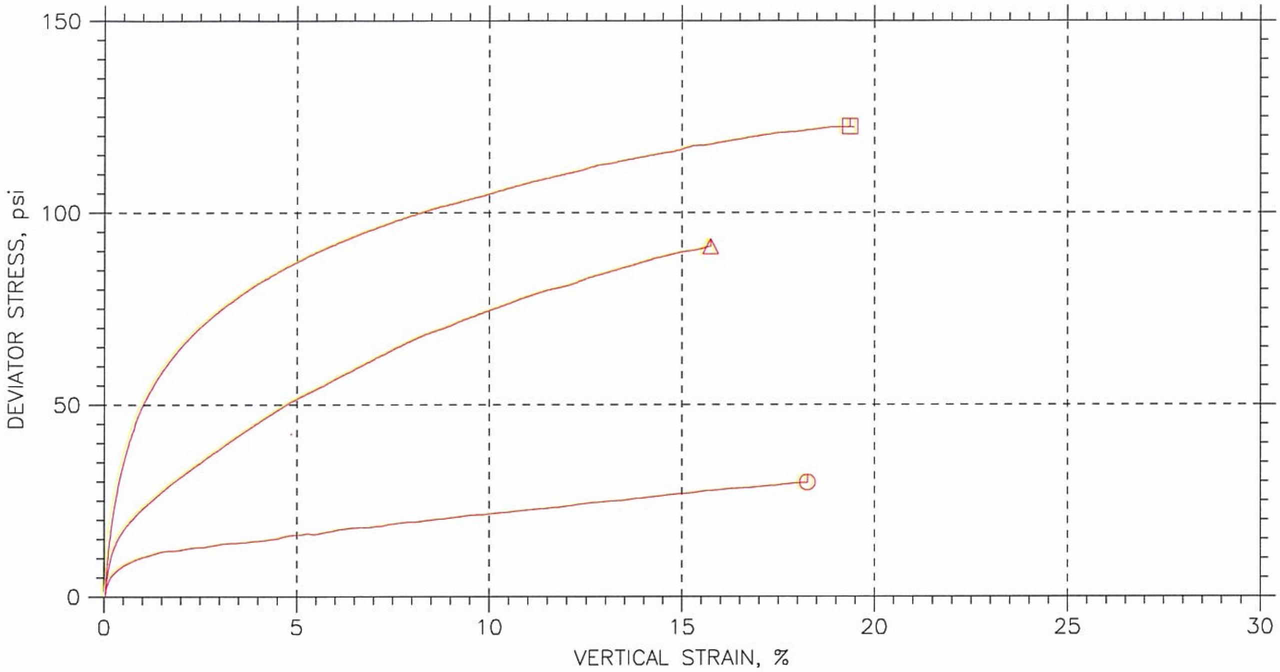


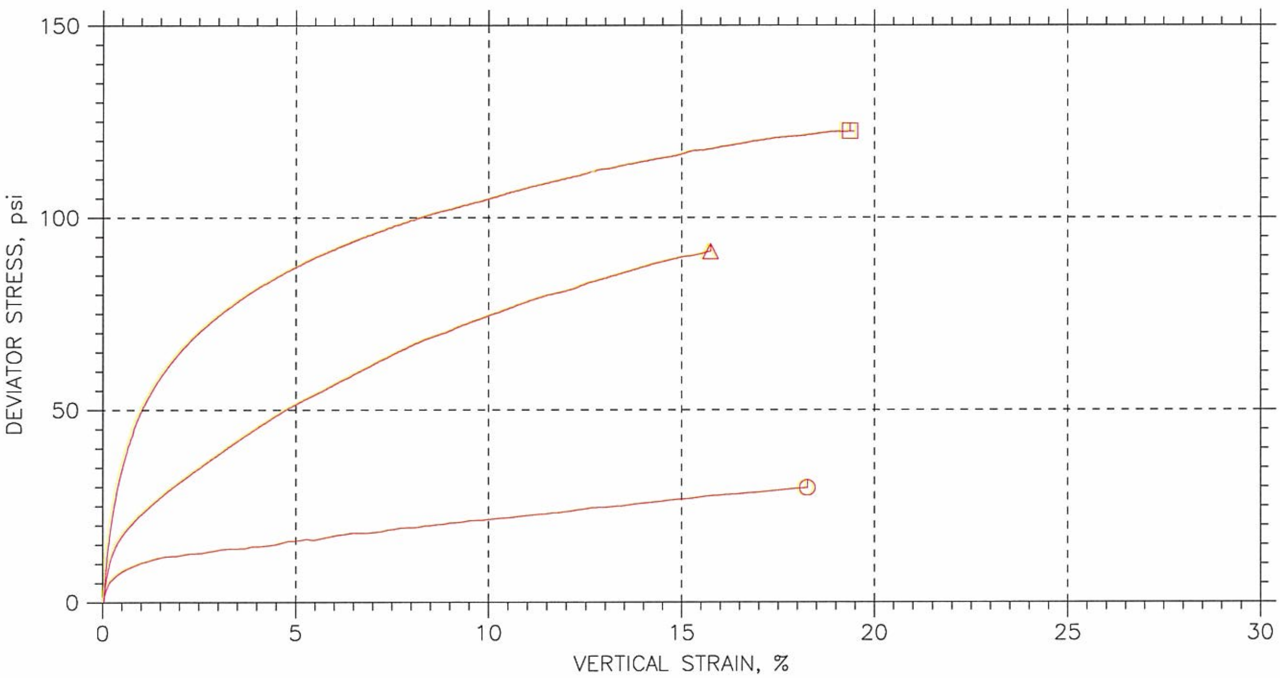
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	ST-1	3.1	5.2-5.8	jm	10/27/09	mm		1504-3.1.dat
△	ST-1	3.2	5.8-6.4	jm	10/28/09	mm		1504-3.2.dat
⊡	st-2	3.3	10.4-11.0	JM	11/12/09	MM		1504-3.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-8	Sample Type: UD	
Description: Brown Sandy lean clay		
Remarks: System 1062		

Fri, 23-APR-2010 14:14:45

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



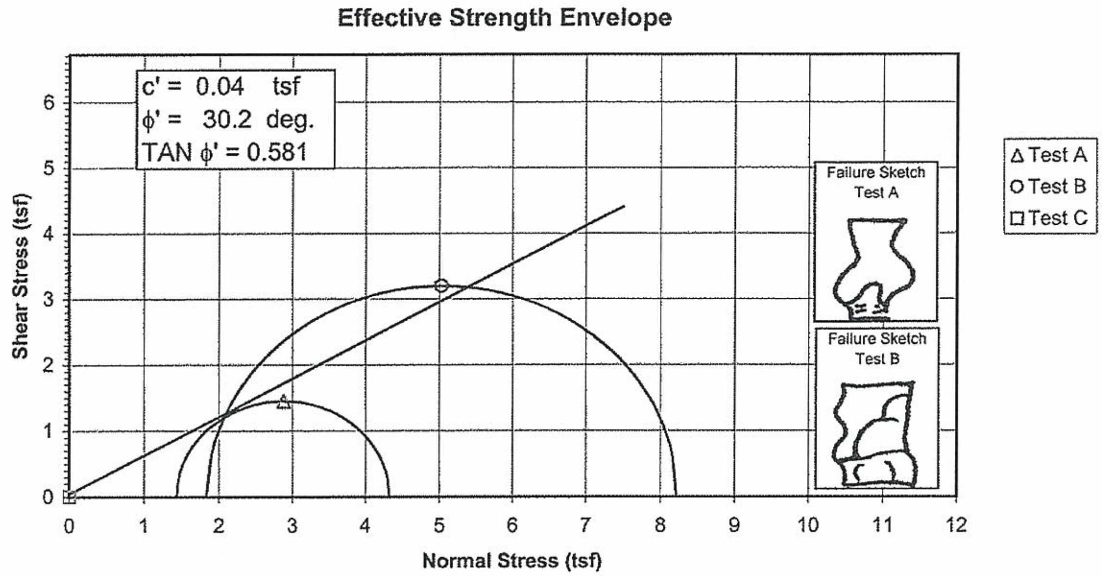


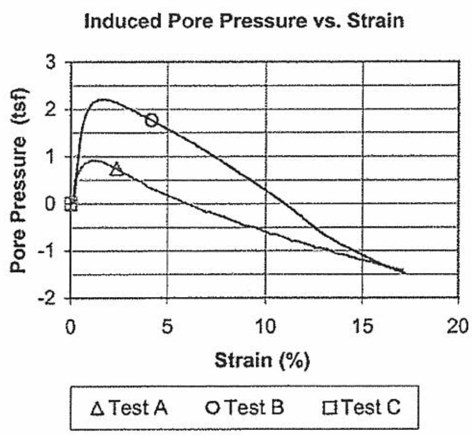
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-1	3.1	5.2-5.8	jm	10/27/09	mm		1504-3.1.dat
△	ST-1	3.2	5.8-6.4	jm	10/28/09	mm		1504-3.2.dat
□	st-2	3.3	10.4-11.0	JM	11/12/09	MM		1504-3.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-8	Sample Type: UD	
Description: Brown Sandy lean clay		
Remarks: System 1062		

Fri, 23-APR-2010 14:14:46

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C
Initial Data	Water content %	W_o	18.2	13.8	######
	Dry Density PCF	γ_{d_o}	110.8	113.8	######
	Saturation %	S_o	94.5	77.7	######
	Void Ratio	e_o	0.521	0.480	######
After Shear	Water content %	W_f	18.1	15.7	######
	Dry Density PCF	γ_{d_f}	113.3	118.4	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	0.488	0.424	######
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF @ failure		σ_3'f	1.44	1.84	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	2.91	6.39	0.00
Time to (σ1'-σ3')max min.		t_f	219.9	86.8	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.882	2.877	######
Initial Height, in.		H_o	6.002	5.993	######

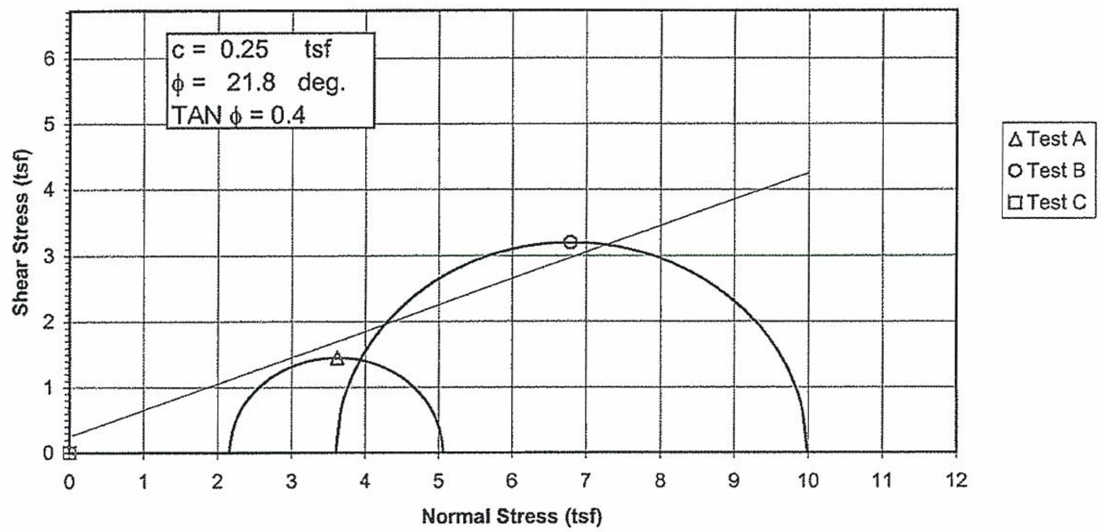
Controlled - Strain Test

Description of Specimens: Lean Clay (CL), brown, moist, firm

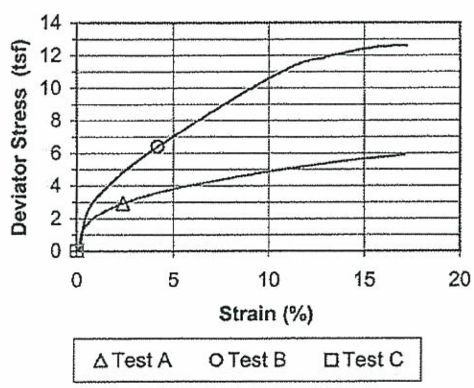
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.7	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
		Boring No.	STN-8P	Sample No.	6
		Depth Elev.	18.6'-19.1', 22.6'-23.1'		
		Laboratory	Stantec	Date	3-29-10
		TRIAXIAL COMPRESSION TEST REPORT			

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	18.2	13.8	######	
	Dry Density PCF	γ_{d_o}	110.8	113.8	######	
	Saturation %	S_o	94.5	77.7	######	
	Void Ratio	e_o	0.521	0.480	######	
After Shear	Water content %	W_f	18.1	15.7	######	
	Dry Density PCF	γ_{d_f}	113.3	118.4	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.488	0.424	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	2.91	6.39	0.00	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	219.9	86.8	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.882	2.877	######	
Initial Height, in.		H_o	6.002	5.993	######	

Controlled - Strain Test

Description of Specimens Lean Clay (CL), brown, moist, firm

			Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.7	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:						
			Boring No.	STN-8P	Sample No.	6
			Depth Elev.	18.6'-19.1', 22.6'-23.1'		
			Laboratory	Stantec	Date	3-29-10

TRIAXIAL COMPRESSION TEST REPORT

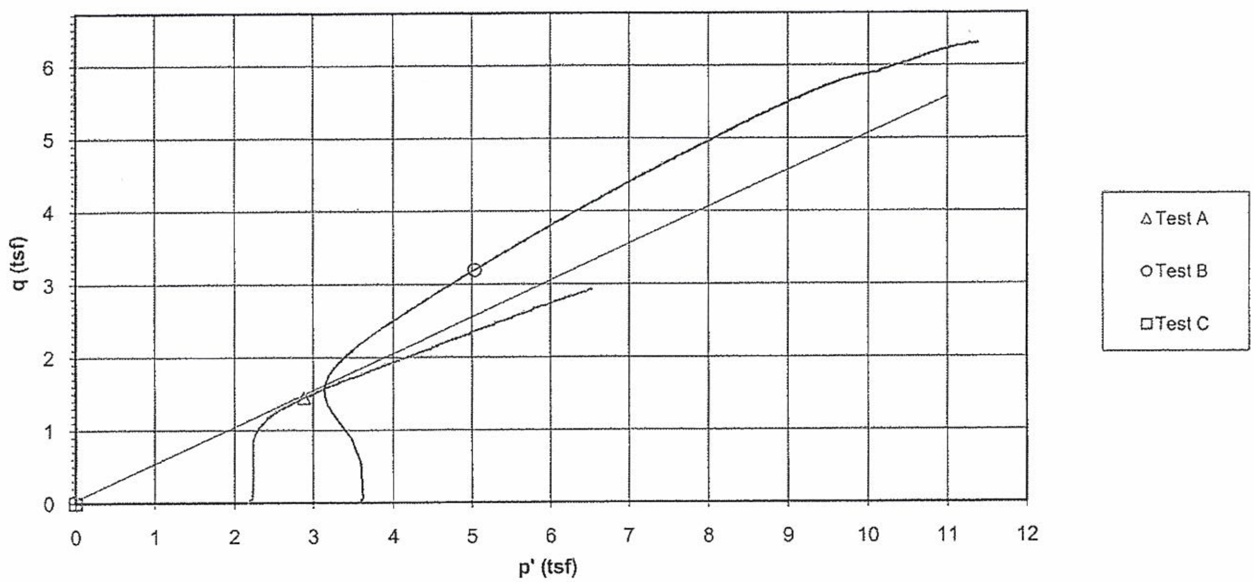
KB

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

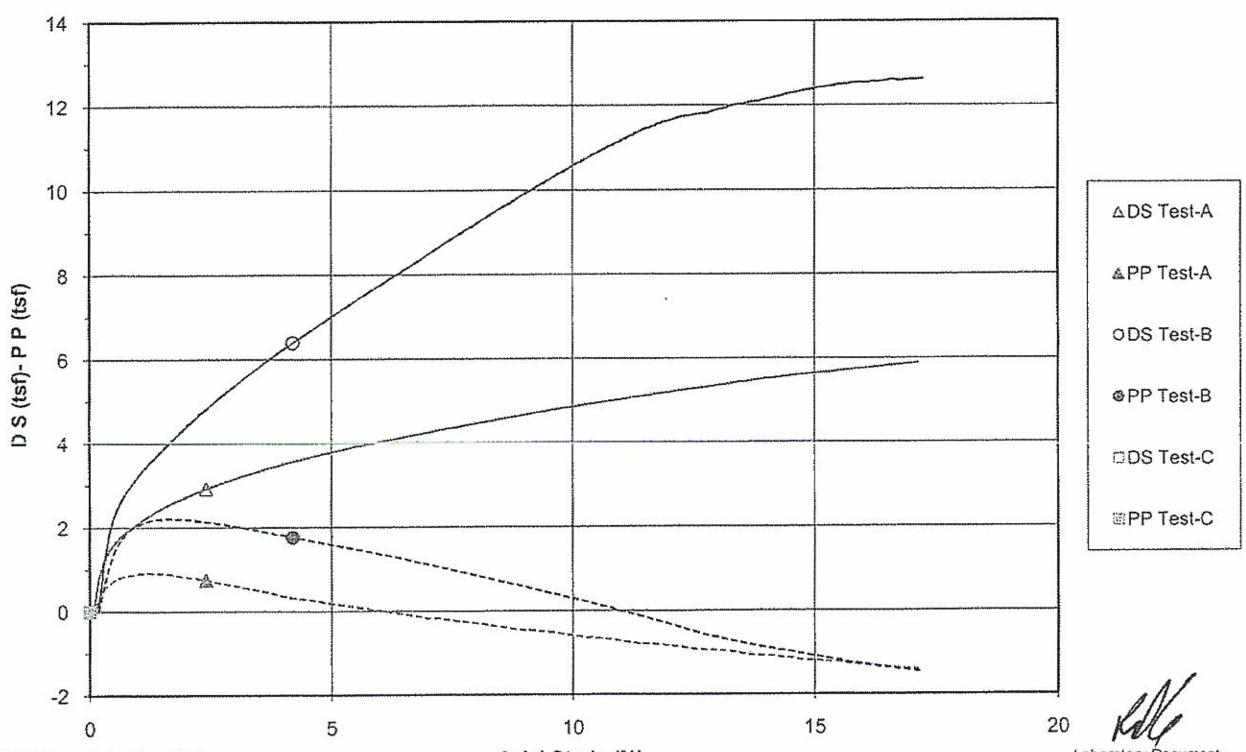
Project: Shawnee Fossil Plant (SHF) - Ash Ponds
Sample ID: STN-8P, 18.6'-19.1' & STN-8P, 22.6'-23.1'
Failure Criterion: Maximum Effective Principal Stress Ratio ϕ' = 30.2 deg.

Project No. 175559023
Test Number 6
c' = 0.04 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

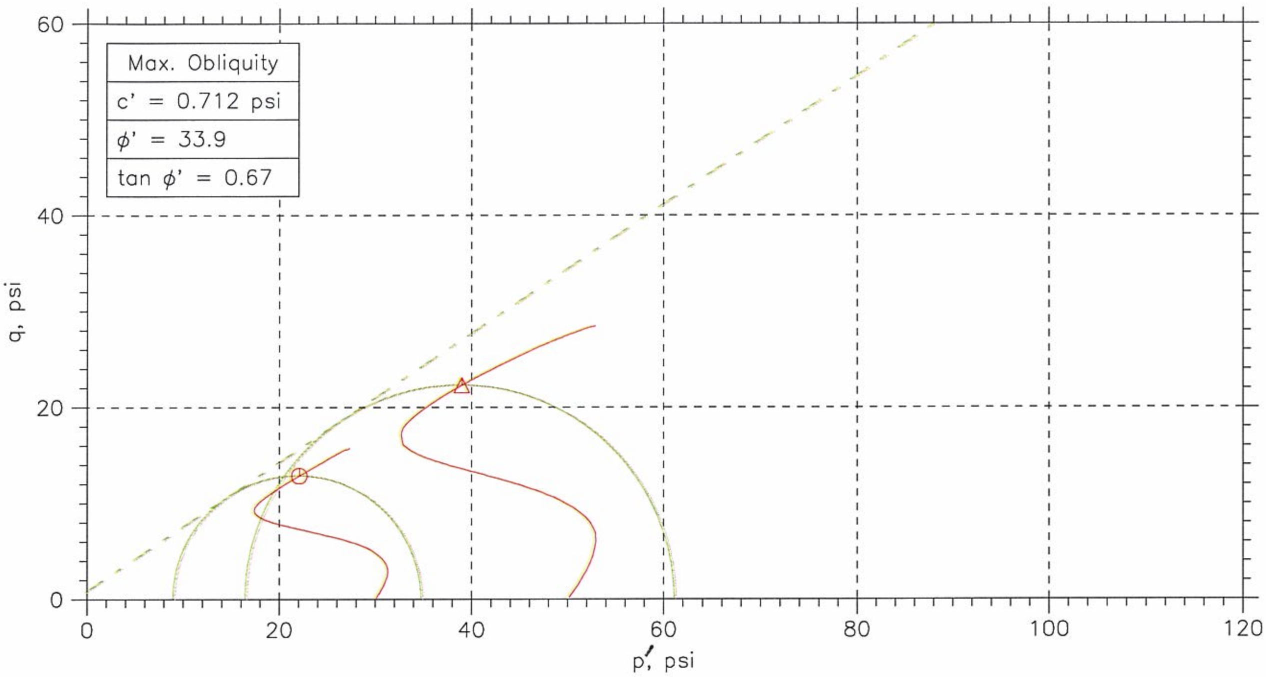


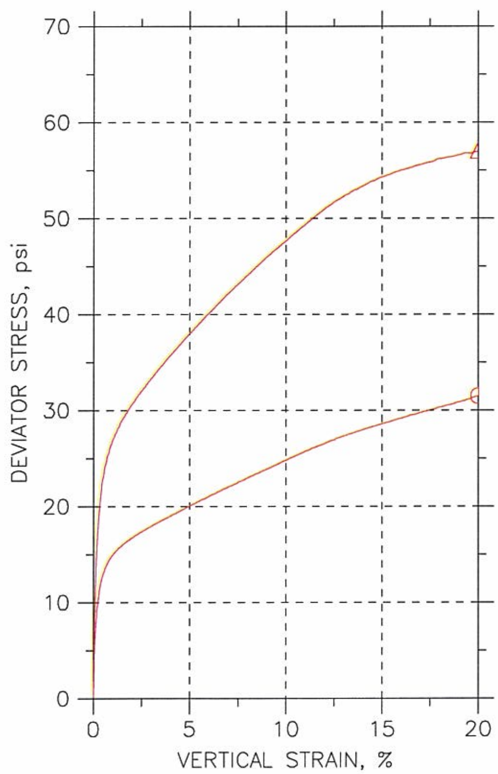
File: 175559023_cu_6.xls Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Symbol	○	△		
	Sample No.	837-A	837-B		
	Test No.	1.1	1.2		
	Depth	25.1-25.6	25.7-26.2		
Initial	Diameter, in	2.839	2.83		
	Height, in	5.959	5.961		
	Water Content, %	22.4	18.0		
	Dry Density, pcf	107.4	115.4		
	Saturation, %	106.2	105.6		
	Void Ratio	0.569	0.461		
Before Shear	Water Content, %	19.3	16.5		
	Dry Density, pcf	110.7	116.5		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.522	0.447		
	Back Press., psi	53.07	65.47		
	Ver. Eff. Cons. Stress, psi	29.97	49.92		
	Shear Strength, psi	15.76	28.51		
	Strain at Failure, %	20	20		
	Strain Rate, %/min	0.016	0.016		
	B-Value	0.95	0.95		
	Estimated Specific Gravity	2.7	2.7		
	Liquid Limit	---	---		
	Plastic Limit	---	---		

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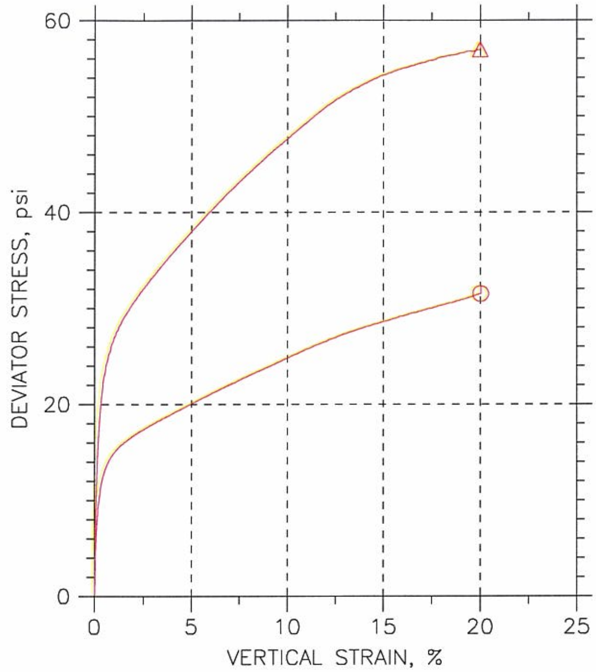
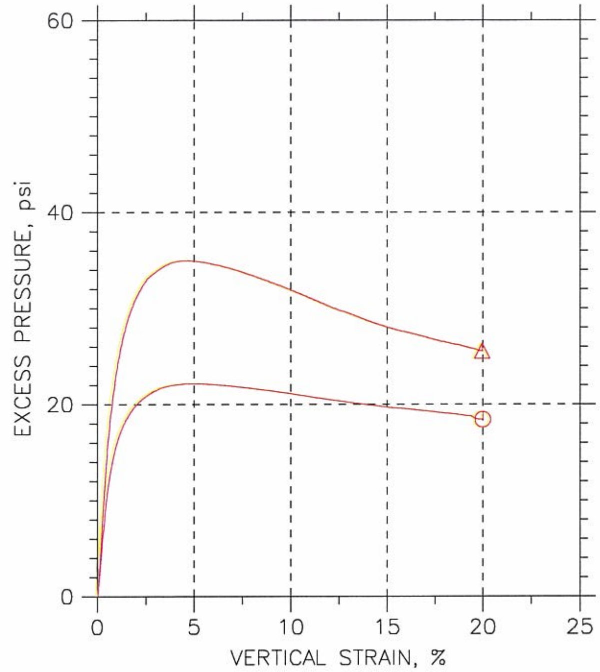
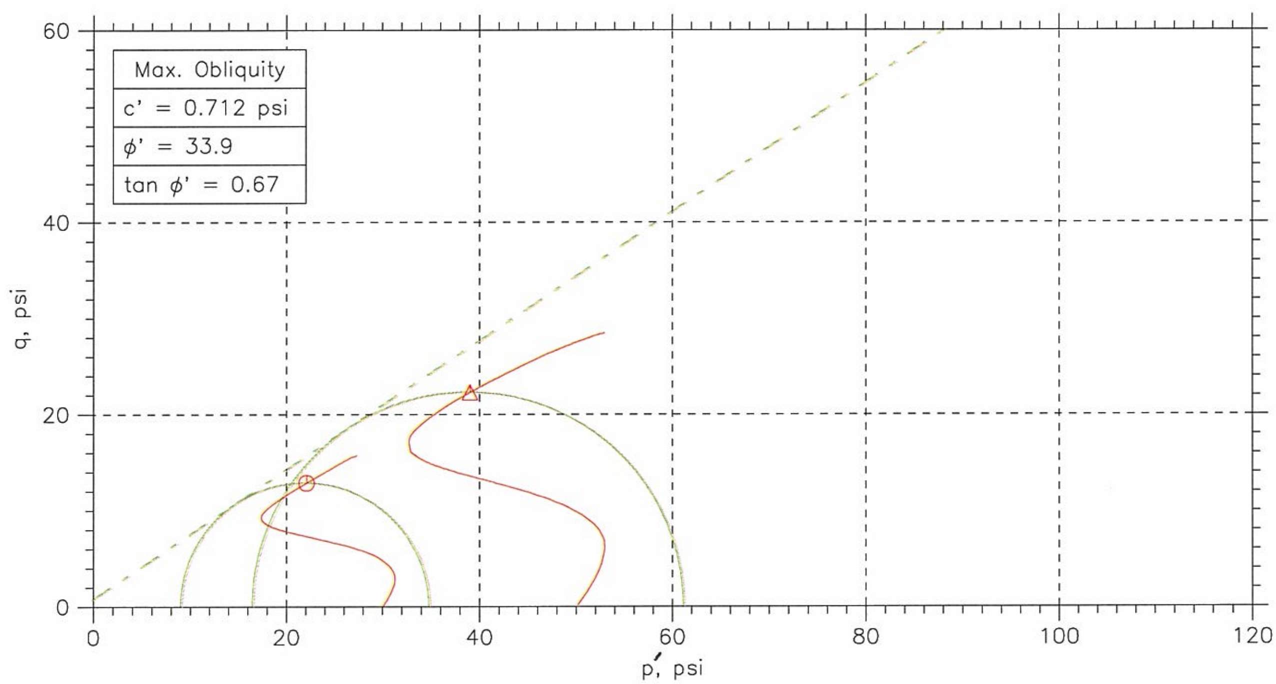
Project: Shawnee Ash Pond
Location:
Project No.: GTX-1547
Boring No.: STN-12
Sample Type: UD
Description: Light brown sandy clay
Remarks: 2054

Fri, 02-APR-2010 11:37:23

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
O	837-A	1.1	25.1-25.6	jm	3/25/10	mm		1547-1.1.dat
Δ	837-B	1.2	25.7-26.2	jm	3/22/10	mm		1547-1.2.dat

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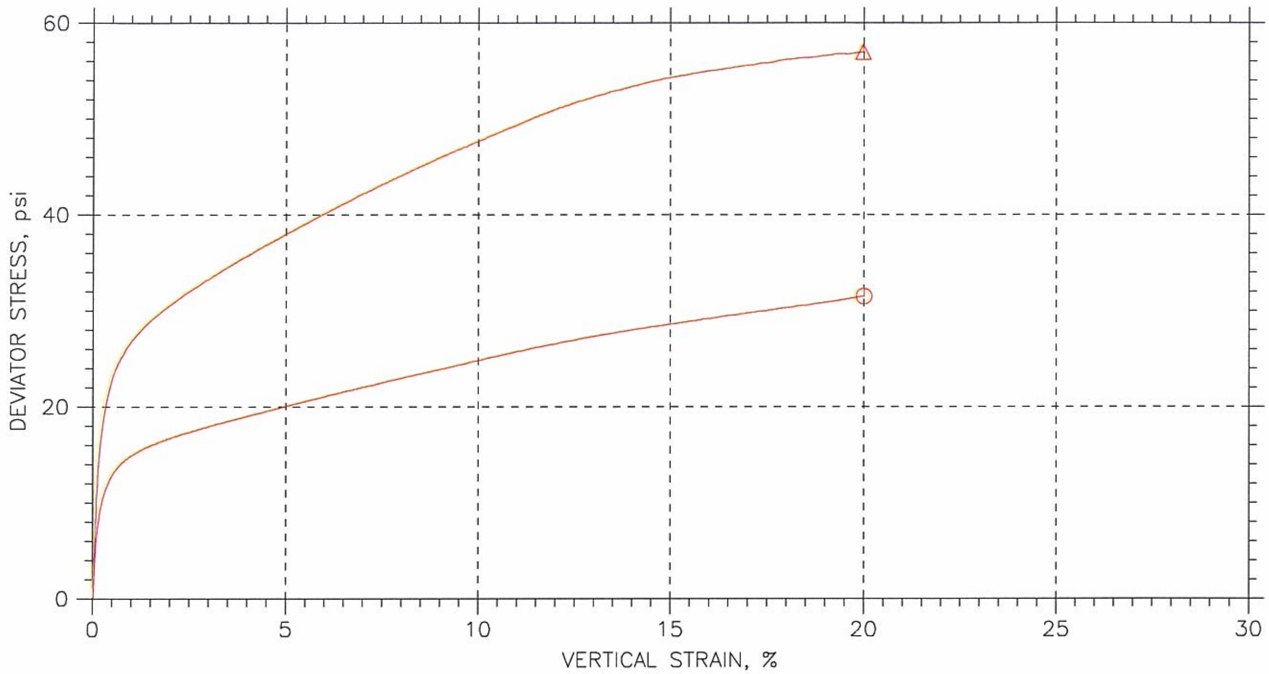
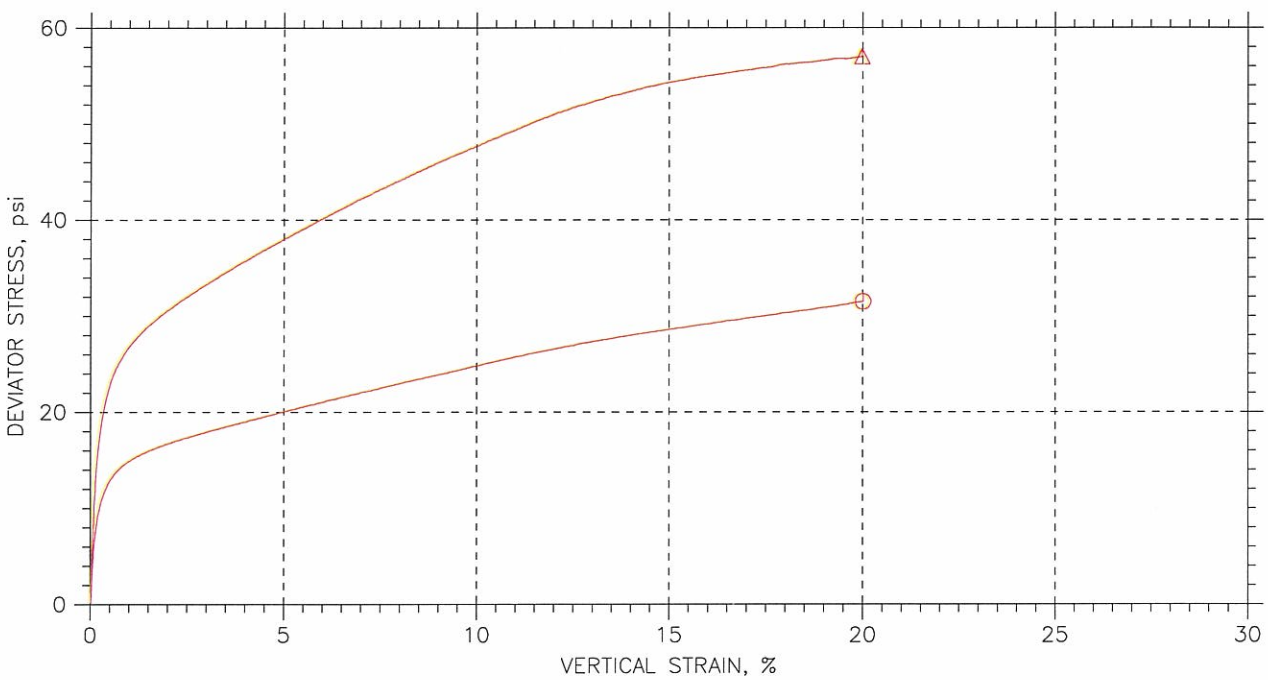
Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-12	Sample Type: UD	
Description: Light brown sandy clay		
Remarks: 2054		

Fri, 02-APR-2010 11:37:24

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	837-A	1.1	25.1-25.6	jm	3/25/10	mm		1547-1.1.dat
△	837-B	1.2	25.7-26.2	jm	3/22/10	mm		1547-1.2.dat

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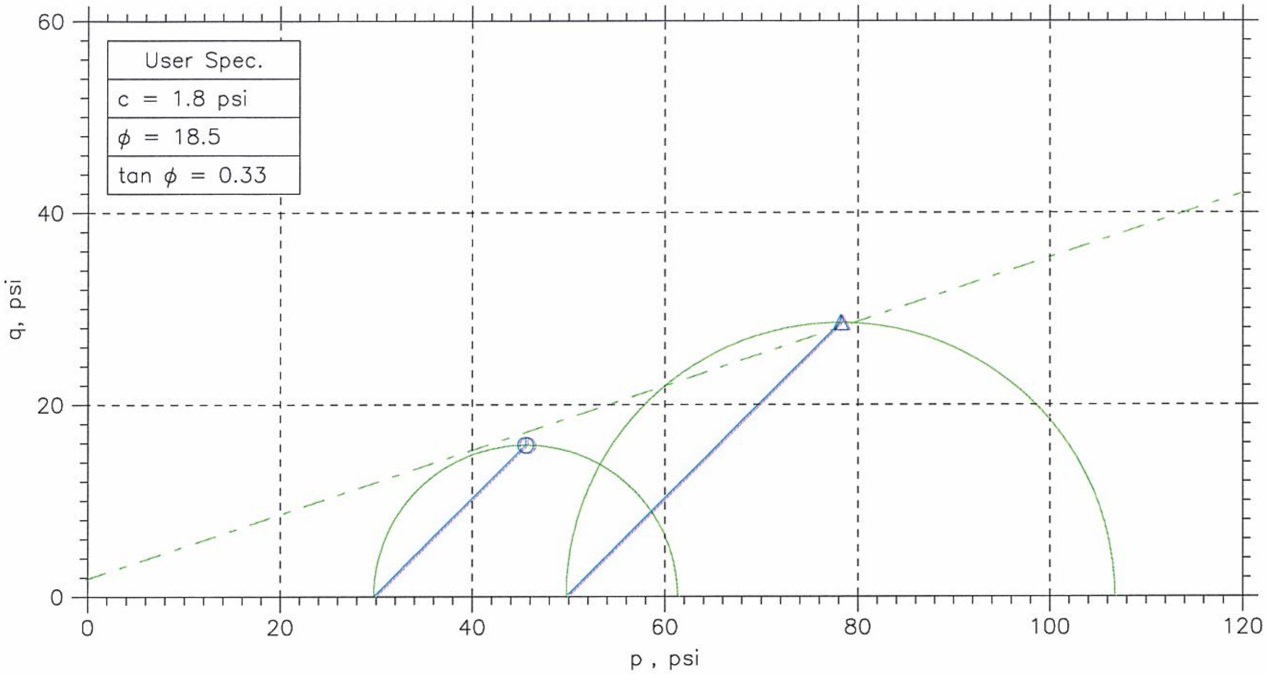
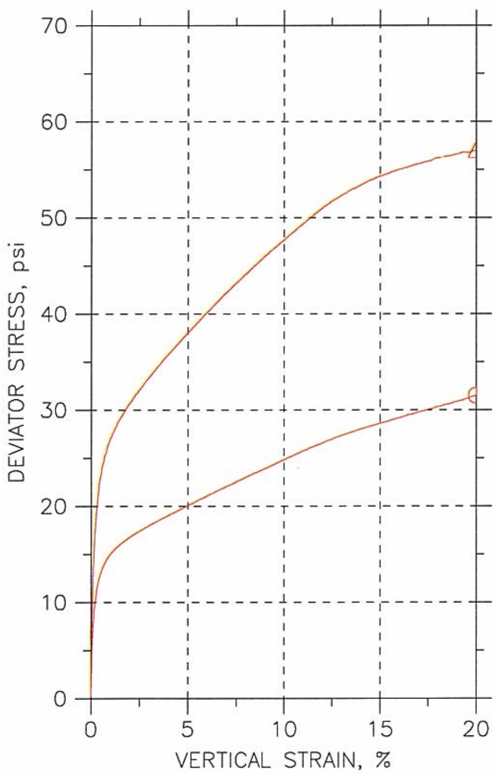
Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-12	Sample Type: UD	
Description: Light brown sandy clay		
Remarks: 2054		

Fri, 02-APR-2010 11:37:25

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



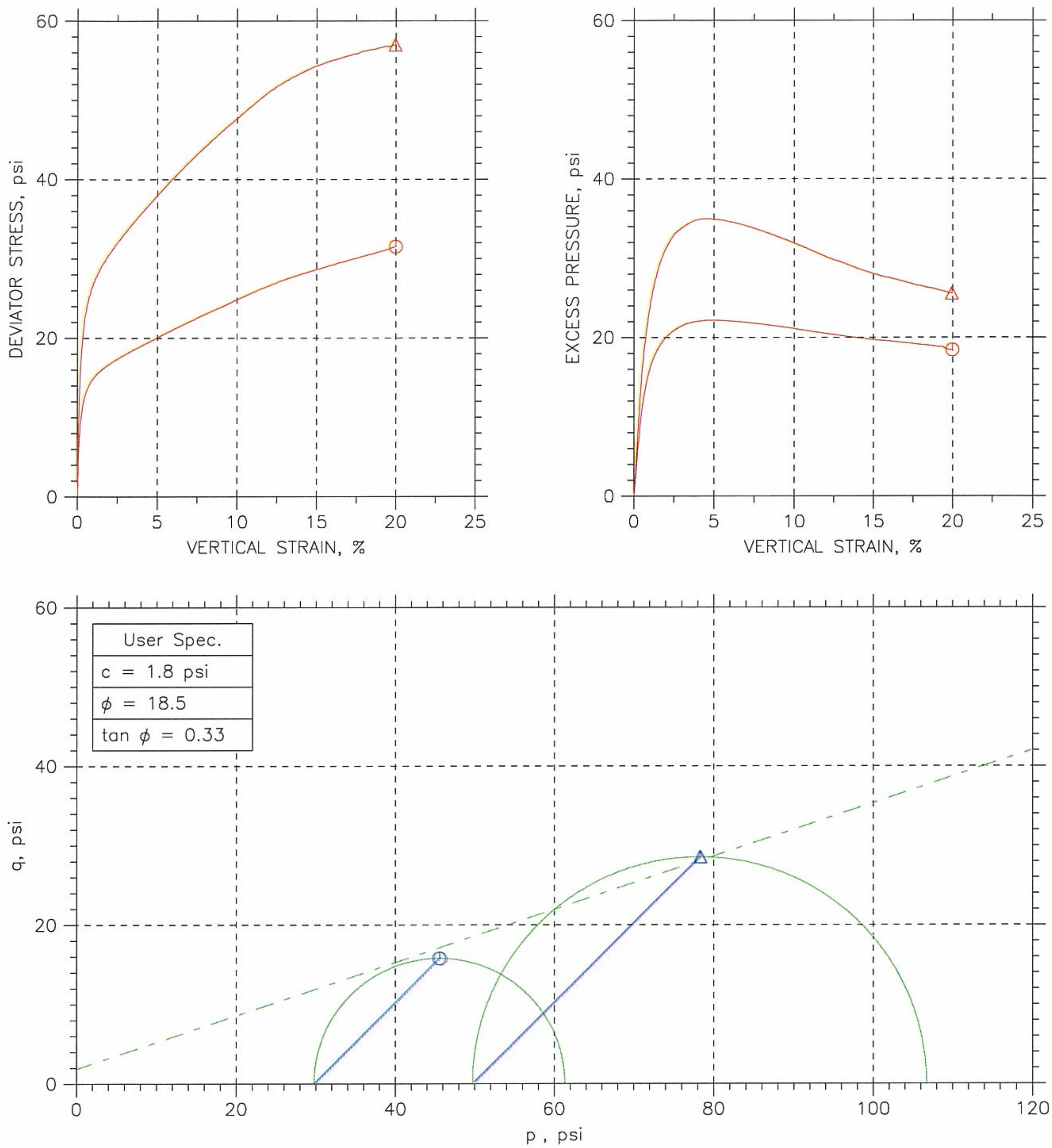


Symbol		⊙	△		
Sample No.		837-A	837-B		
Test No.		1.1	1.2		
Depth		25.1-25.6	25.7-26.2		
Initial	Diameter, in	2.839	2.83		
	Height, in	5.959	5.961		
	Water Content, %	22.4	18.0		
	Dry Density, pcf	107.4	115.4		
	Saturation, %	106.2	105.6		
	Void Ratio	0.569	0.461		
Before Shear	Water Content, %	19.3	16.5		
	Dry Density, pcf	110.7	116.5		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.522	0.447		
	Back Press., psi	53.07	65.47		
Ver. Eff. Cons. Stress, psi		29.97	49.92		
Shear Strength, psi		15.76	28.51		
Strain at Failure, %		20	20		
Strain Rate, %/min		0.016	0.016		
B-Value		0.95	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

Project: Shawnee Ash Pond
Location:
Project No.: GTX-1547
Boring No.: STN-12
Sample Type: UD
Description: Light brown sandy clay
Remarks: 2054

Fri, 23-APR-2010 09:21:25

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

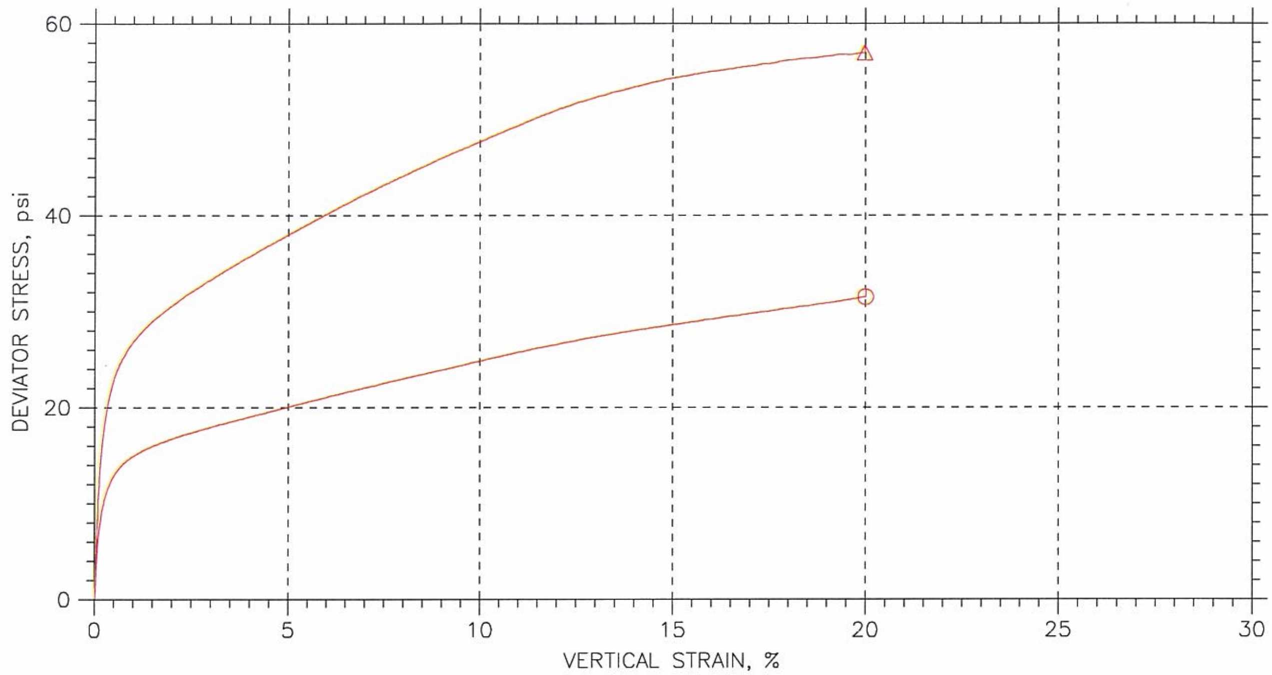


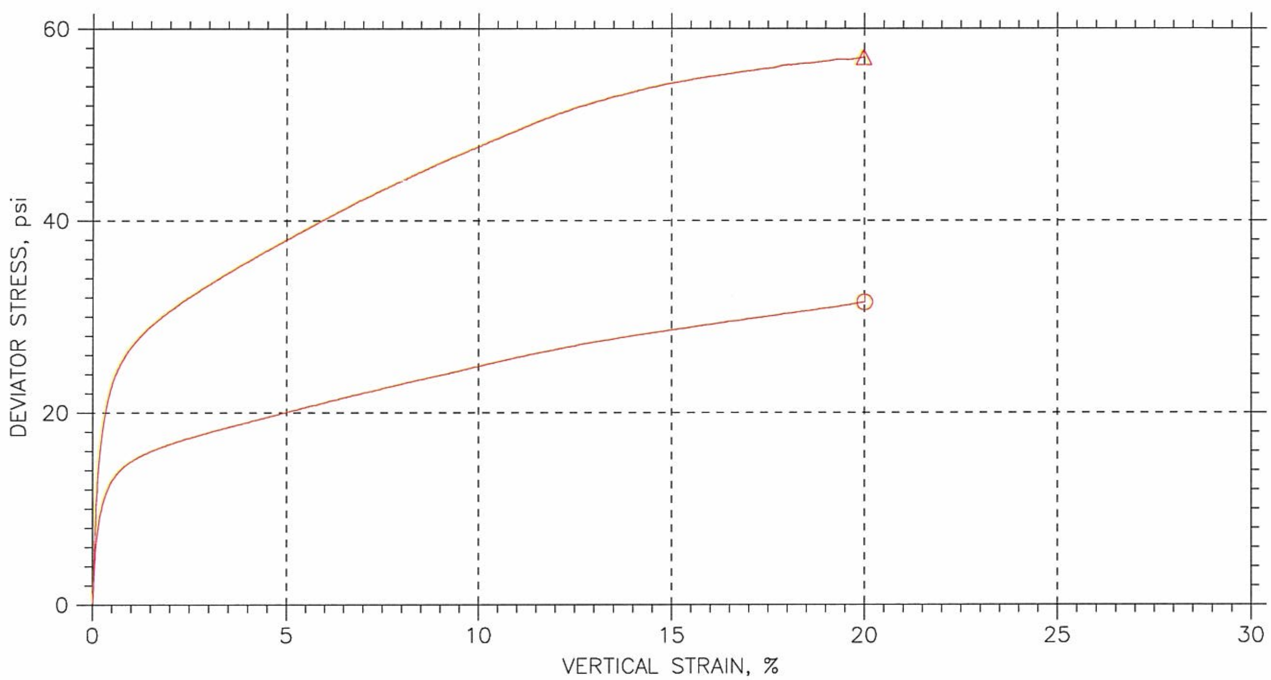
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	837-A	1.1	25.1-25.6	jm	3/25/10	mm		1547-1.1.dat
△	837-B	1.2	25.7-26.2	jm	3/22/10	mm		1547-1.2.dat

Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-12	Sample Type: UD	
Description: Light brown sandy clay		
Remarks: 2054		

Fri, 23-APR-2010 09:21:25

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





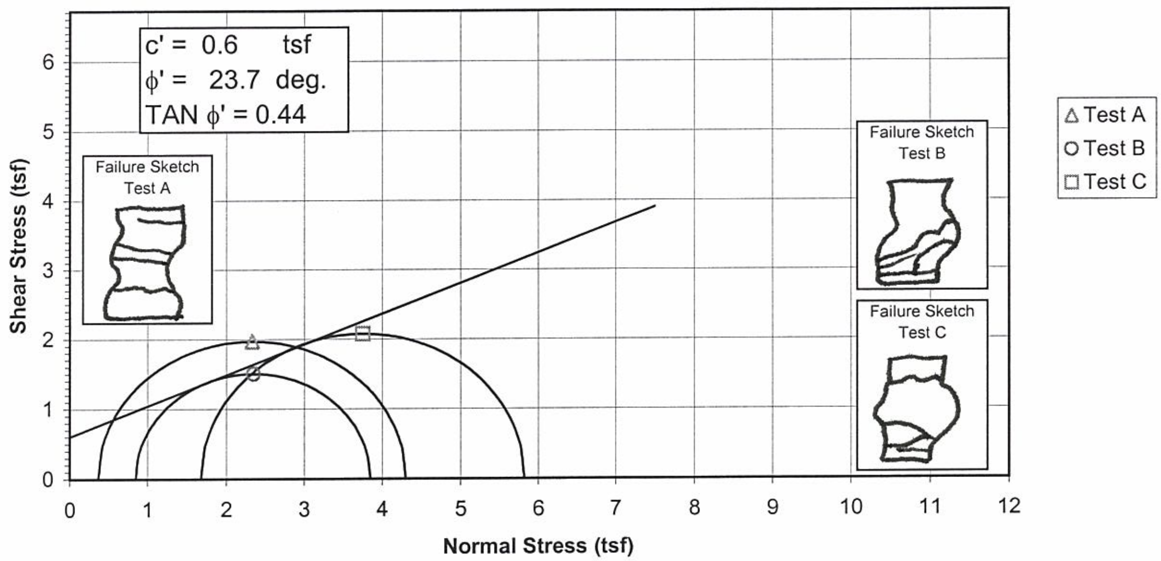
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	837-A	1.1	25.1-25.6	jm	3/25/10	mm		1547-1.1.dat
△	837-B	1.2	25.7-26.2	jm	3/22/10	mm		1547-1.2.dat

Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-12	Sample Type: UD	
Description: Light brown sandy clay		
Remarks: 2054		

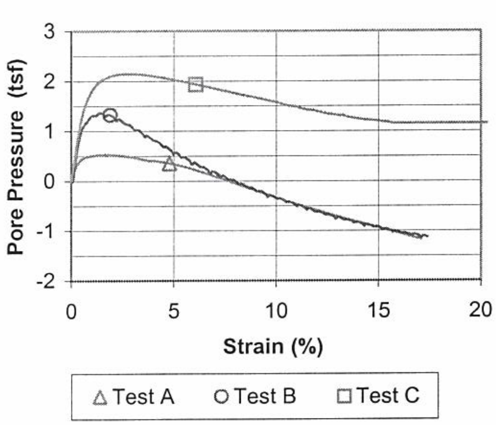
Fri, 23-APR-2010 09:21:26

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	13.2	15.7	15.7	
	Dry Density PCF	γ_{d_o}	119.5	114.2	114.3	
	Saturation %	S_o	88.4	90.5	90.9	
	Void Ratio	e_o	0.400	0.465	0.464	
After Shear	Water content %	W_f	14.1	15.8	14.8	
	Dry Density PCF	γ_{d_f}	121.3	117.5	119.9	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.379	0.424	0.396	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.37	0.85	1.68	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	3.93	3.01	4.15	
Time to (σ1'-σ3')max min.		t_f	43.4	40.3	625.6	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.877	2.876	2.882	
Initial Height, in.		H_o	5.988	6.018	5.976	

Controlled - Strain Test				
Description of Specimens	Lean Clay (CL), brown, moist, firm			
	Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.68	Project	Shawnee Fossil Plant (SHF) - Ash Ponds		
Remarks:	Boring No.	STN-15, STN-12		
			Sample No.	7
	Depth Elev.	4.6'-5.1', 4.6'-5.1', 5.2'-5.7'		
	Laboratory	Stantec	Date	3-29-10
	TRIAXIAL COMPRESSION TEST REPORT			

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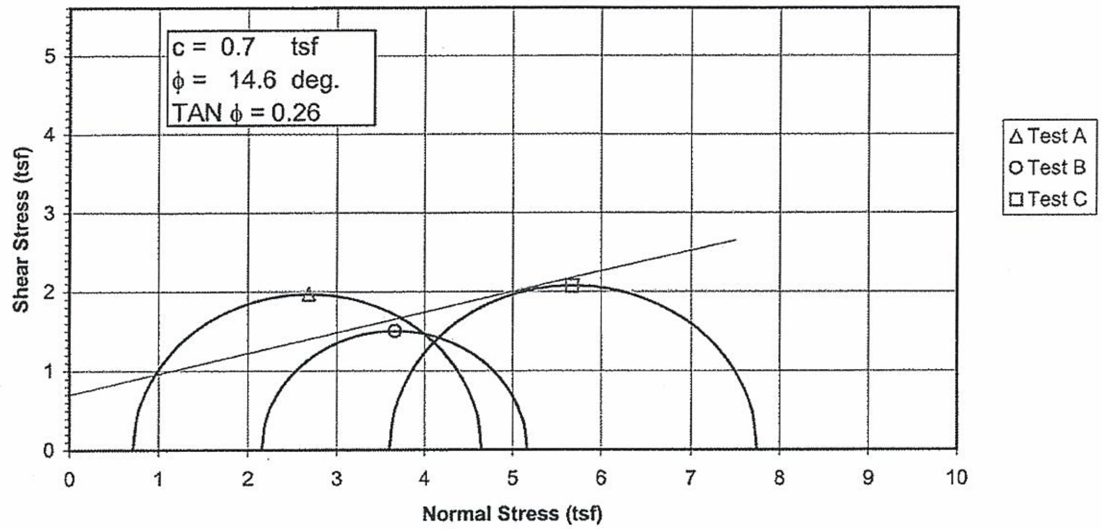
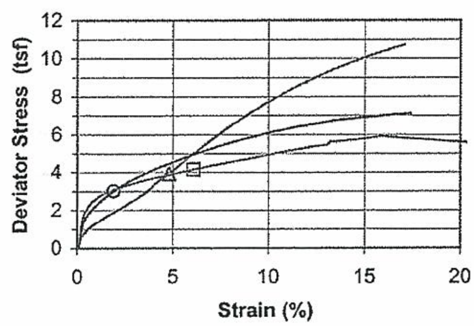
Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	13.2	15.7	15.7	
	Dry Density PCF	γ_{d_o}	119.5	114.2	114.3	
	Saturation %	S_o	88.4	90.5	90.9	
	Void Ratio	e_o	0.400	0.465	0.464	
After Shear	Water content %	W_f	14.1	15.8	14.8	
	Dry Density PCF	γ_{d_f}	121.3	117.5	119.9	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.379	0.424	0.396	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	3.93	3.01	4.15	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	43.4	40.3	625.6	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.877	2.876	2.882	
Initial Height, in.		H_o	5.988	6.018	5.976	

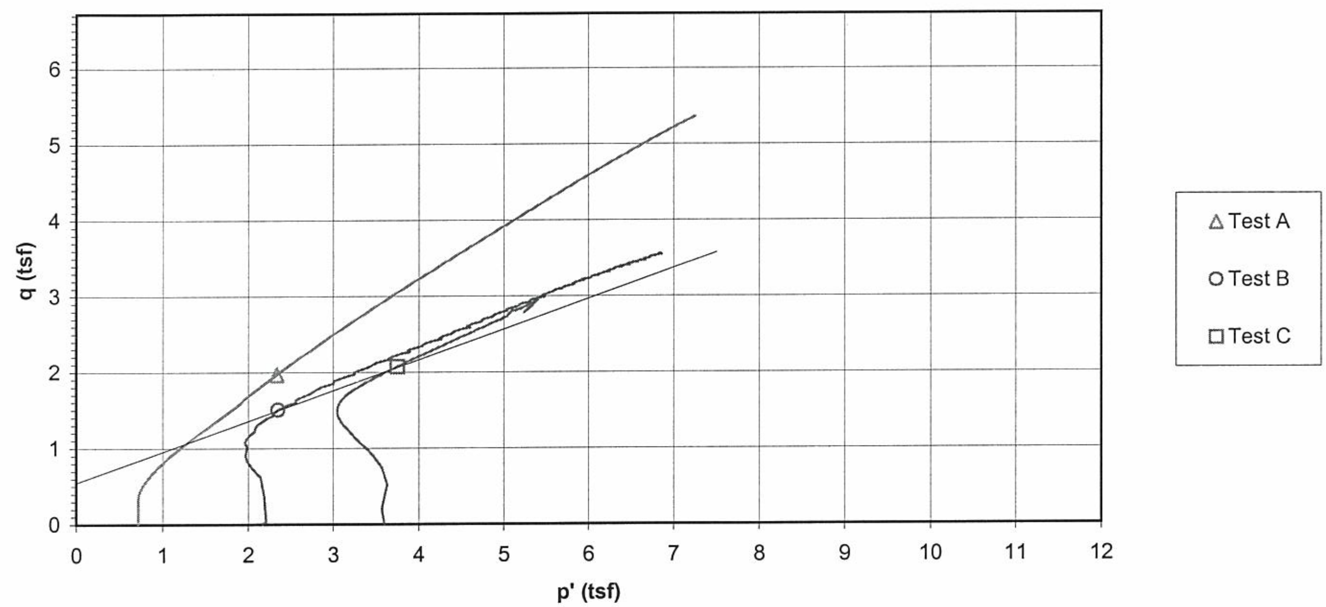
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), brown, moist, firm		
	Type of Specimen Undisturbed		Type of test $\bar{R}$
LL PL PI Gs 2.68	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:			
	Boring No.		Sample No. 7
	Depth Elev.	4.6'-5.1', 4.6'-5.1', 5.2'-5.7'	
	Laboratory	Stantec	Date 3-29-10
	TRIAXIAL COMPRESSION TEST REPORT		

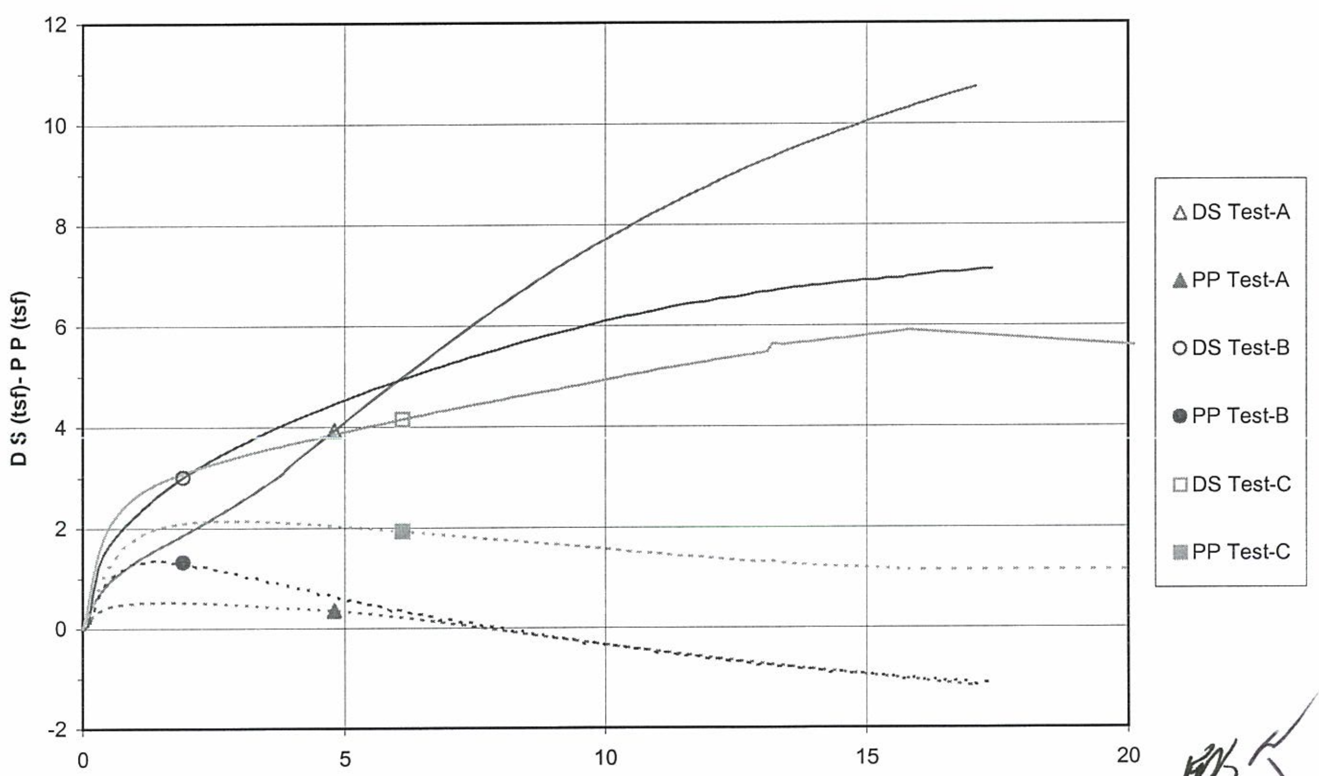
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-15, 4.6'-5.1' & STN-12, 4.6'-5.1' & STN-12, 5.2'-5.7'	Test Number	7
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 23.7 deg.	c' =	0.60 tsf

p' vs. q Plot

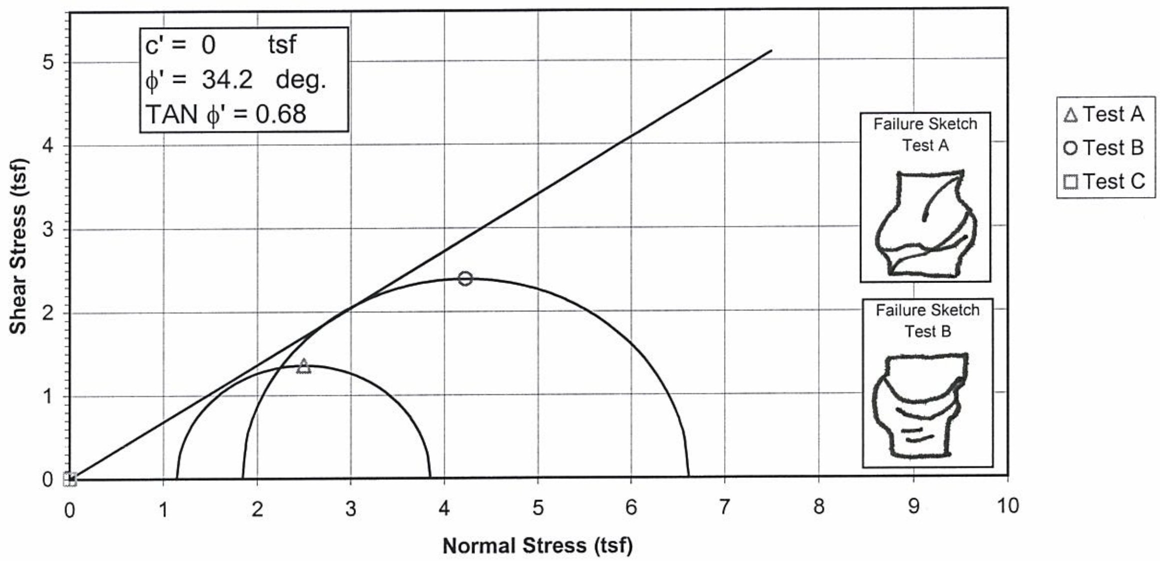


Deviator Stress and Induced Pore Pressure vs. Axial Strain

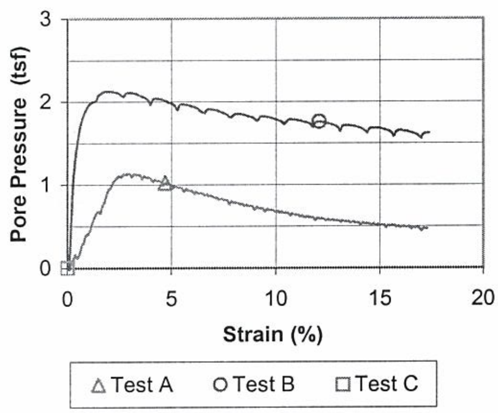


Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	21.9	19.0	######	
	Dry Density PCF	γ_{d_o}	105.2	110.1	######	
	Saturation %	S_o	98.8	97.1	######	
	Void Ratio	e_o	0.596	0.525	######	
After Shear	Water content %	W_f	21.2	16.5	######	
	Dry Density PCF	γ_{d_f}	106.9	116.2	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.572	0.445	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF @ failure		σ_3'f	1.14	1.84	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	2.71	4.77	0.00	
Time to (σ1'-σ3')max min.		t_f	162.0	86.1	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.876	2.888	######	
Initial Height, in.		H_o	5.989	6.007	######	

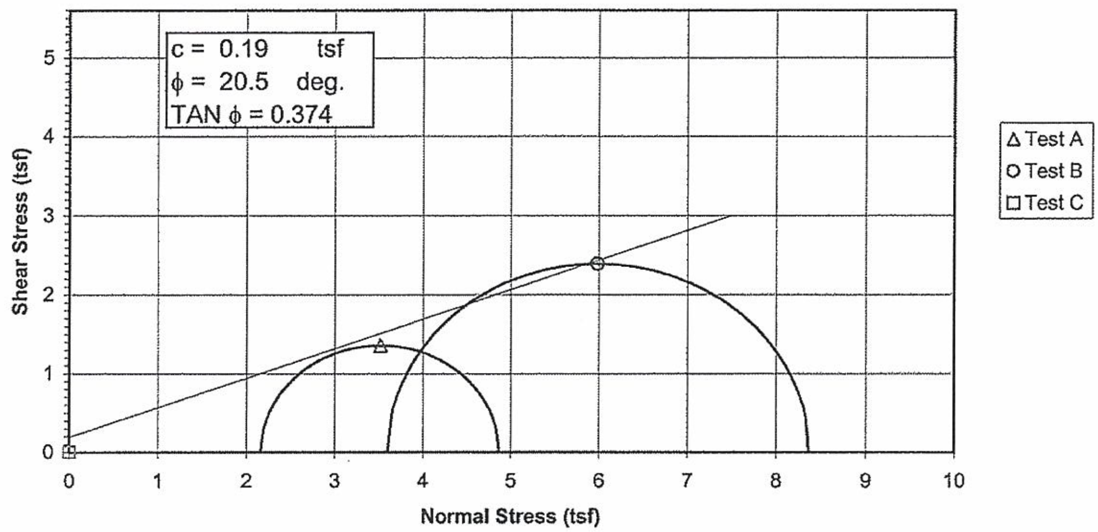
Controlled - Strain Test

Description of Specimens Lean Clay (CL), brown, moist, firm

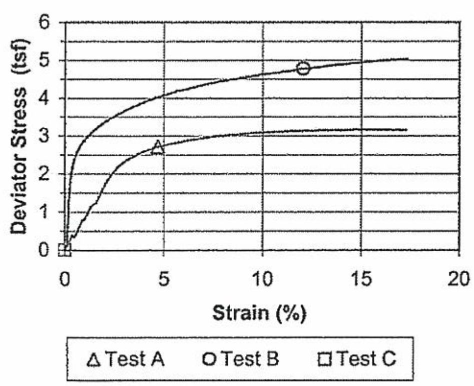
				Type of Specimen Undisturbed		Type of test $\overline{R}$
LL	PL	PI	Gs 2.69	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:						
				Boring No.	STN-17, STN-12	Sample No. 8
				Depth Elev.	16.1'-16.6', 16.4'-16.9'	
				Laboratory	Stantec	Date 3-29-10
				TRIAXIAL COMPRESSION TEST REPORT		

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	21.9	19.0	######	
	Dry Density PCF	γ_{d_o}	105.2	110.1	######	
	Saturation %	S_o	98.8	97.1	######	
	Void Ratio	e_o	0.596	0.525	######	
After Shear	Water content %	W_f	21.2	16.5	######	
	Dry Density PCF	γ_{d_f}	106.9	116.2	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.572	0.445	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	2.71	4.77	0.00	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	162.0	86.1	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.876	2.888	######	
Initial Height, in.		H_o	5.989	6.007	######	

Controlled - Strain Test					
Description of Specimens	Lean Clay (CL), brown, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.69	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
		Boring No.	STN-17, STN-12	Sample No.	8
		Depth Elev.	16.1'-16.6', 16.4'-16.9'		
		Laboratory	Stantec	Date	3-29-10
		TRIAXIAL COMPRESSION TEST REPORT			

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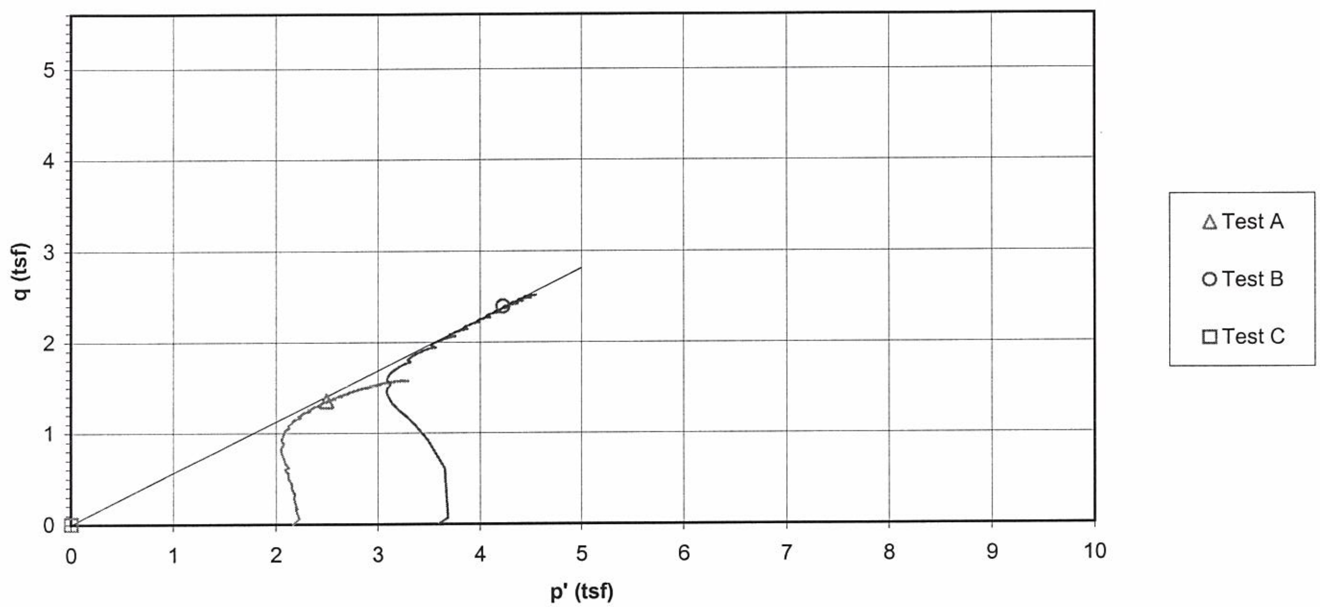
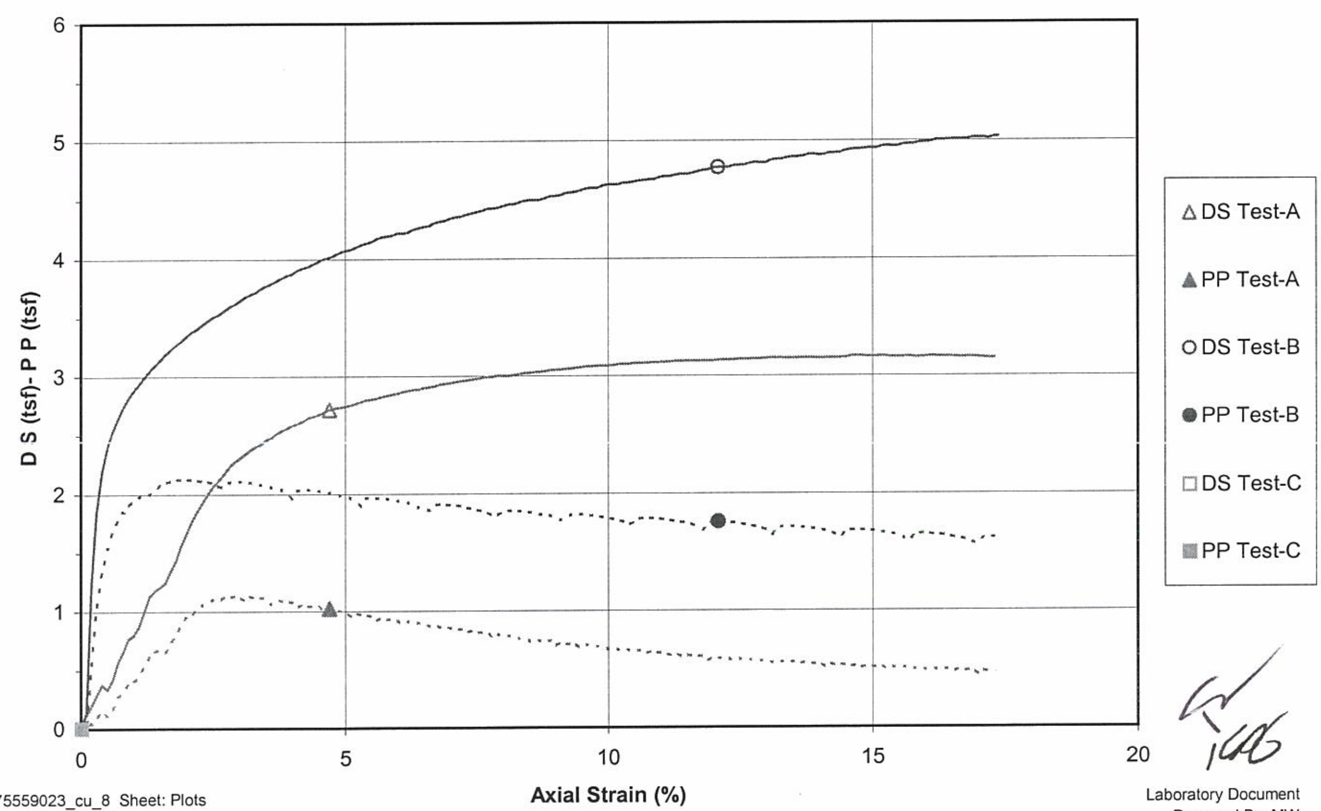
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-17, 16.1'-16.6' & STN-12, 16.4'-16.9'	Test Number	8
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 34.2 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

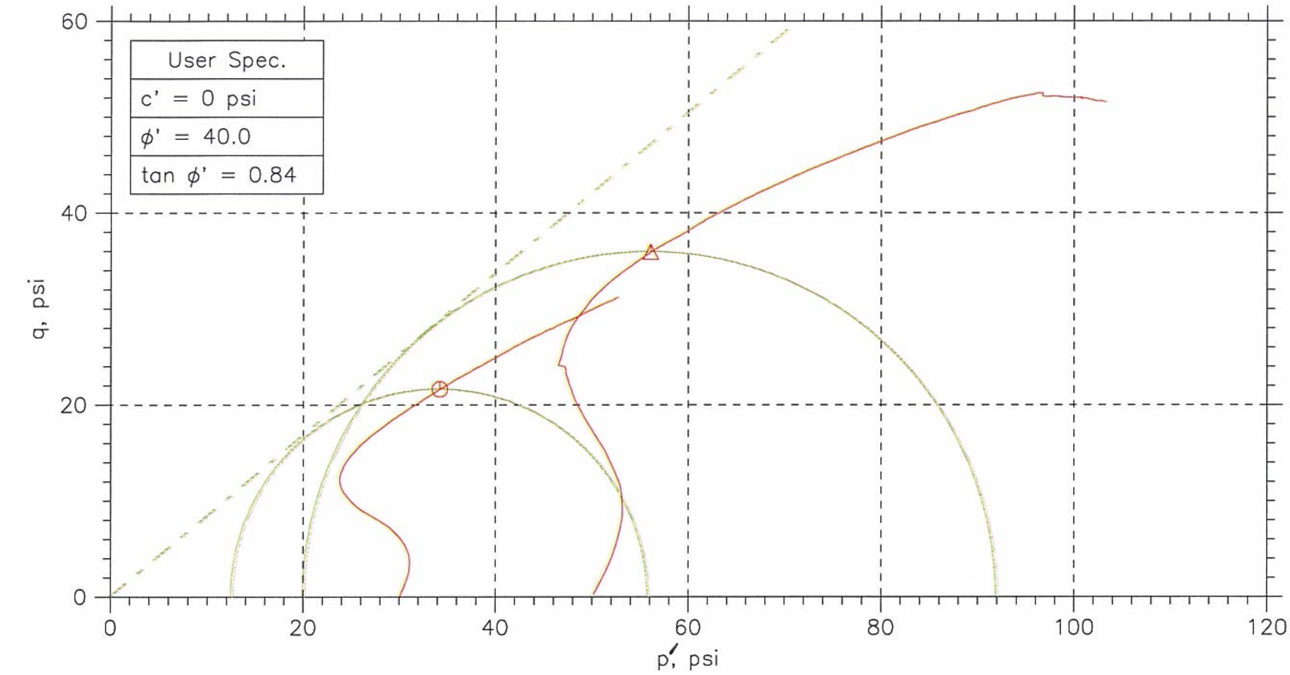


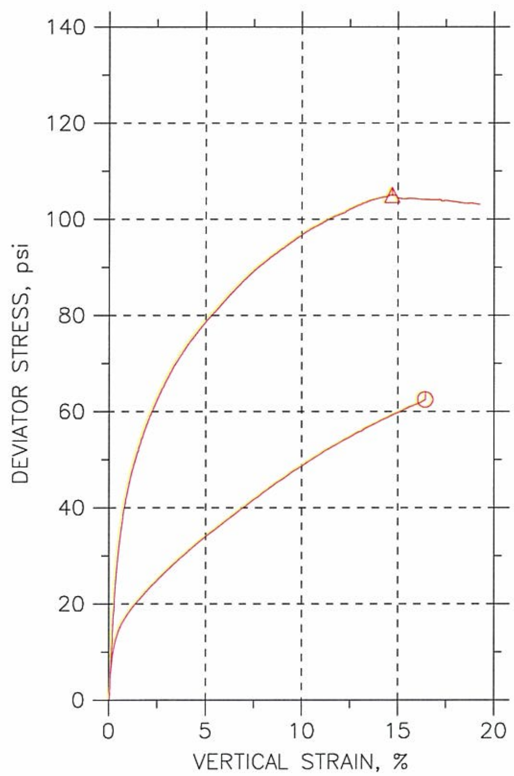
File: 175559023_cu_8 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△		
Sample No.		1239	1240		
Test No.		2.1	2.2		
Depth		7.7-8.2	11.3-11.8		
Initial	Diameter, in	2.871	2.882		
	Height, in	6.006	5.983		
	Water Content, %	15.8	15.1		
	Dry Density, pcf	116.5	115.4		
	Saturation, %	95.3	88.7		
	Void Ratio	0.447	0.461		
Before Shear	Water Content, %	15.7	15.4		
	Dry Density, pcf	118.4	119.		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.424	0.416		
	Back Press., psi	116	94.84		
Ver. Eff. Cons. Stress, psi		29.97	49.91		
Shear Strength, psi		31.27	52.52		
Strain at Failure, %		16.4	14.7		
Strain Rate, %/min		0.016	0.016		
B-Value		0.95	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

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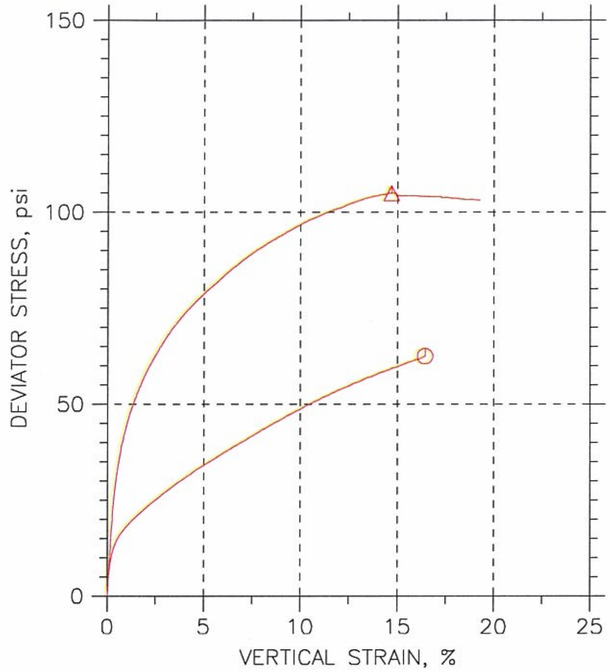
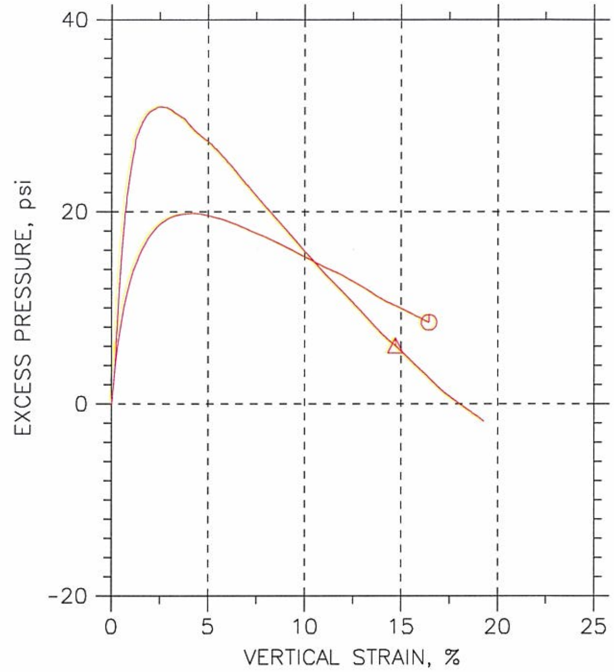
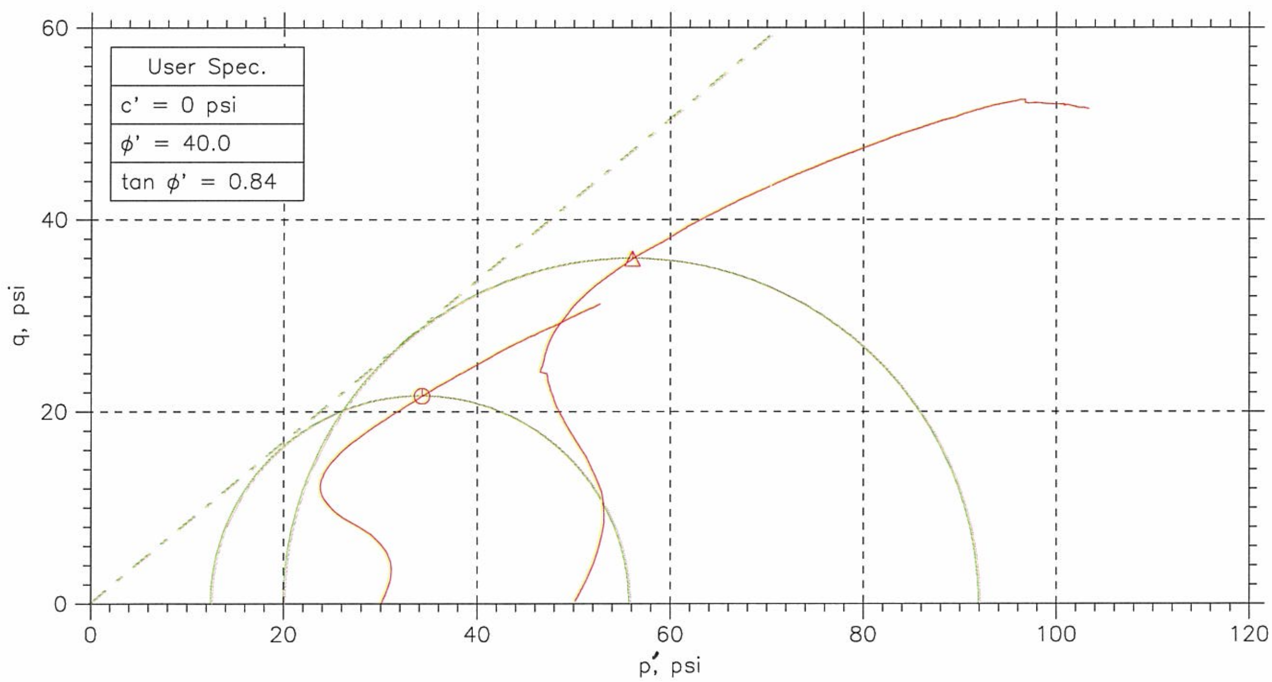
Project: Shawnee Ash Pond	
Location: ---	
Project No.: GTX-1547	
Boring No.: STN-17	
Sample Type: UD	
Description: Gray silty sand	
Remarks: System 1062	

Fri, 02-APR-2010 11:24:58

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⦶	1239	2.1	7.7-8.2	jm	3/22/10	mm		1547-2.1.dat
△	1240	2.2	11.3-11.8	jm	3/22/10	mm		1547 - 2.2.dat

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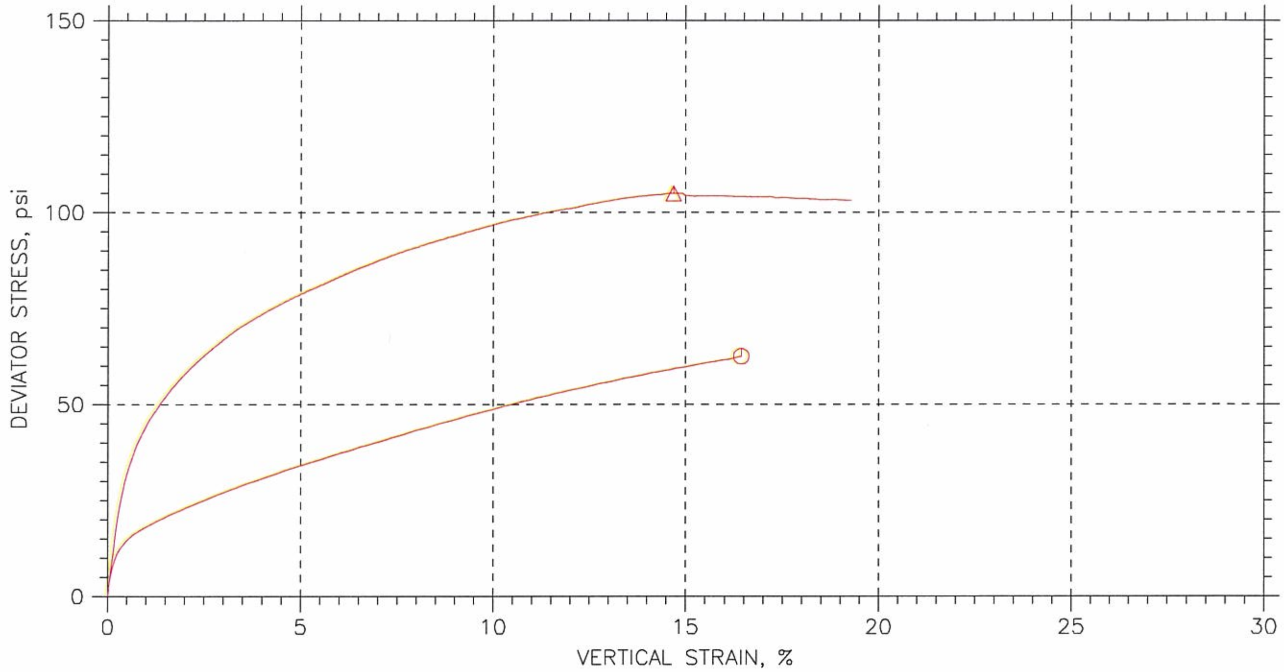
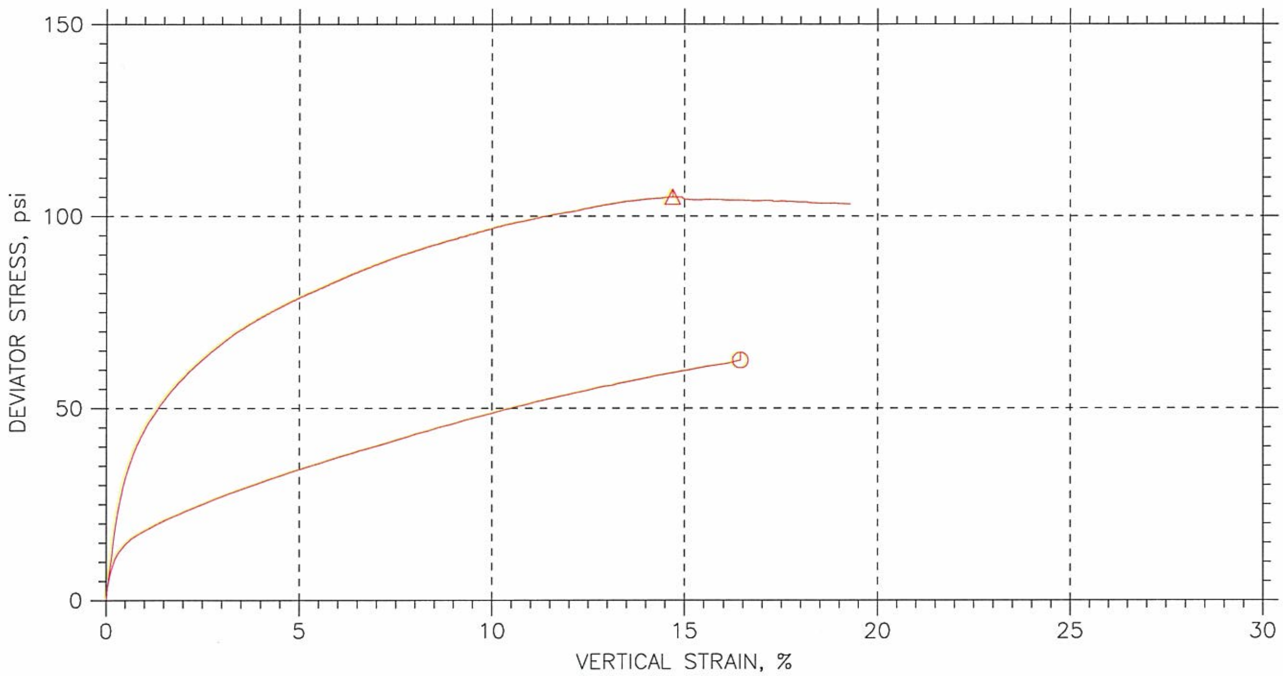
Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Gray silty sand		
Remarks: System 1062		

Fri, 02-APR-2010 11:24:58

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	1239	2.1	7.7-8.2	jm	3/22/10	mm		1547-2.1.dat
△	1240	2.2	11.3-11.8	jm	3/22/10	mm		1547 - 2.2.dat

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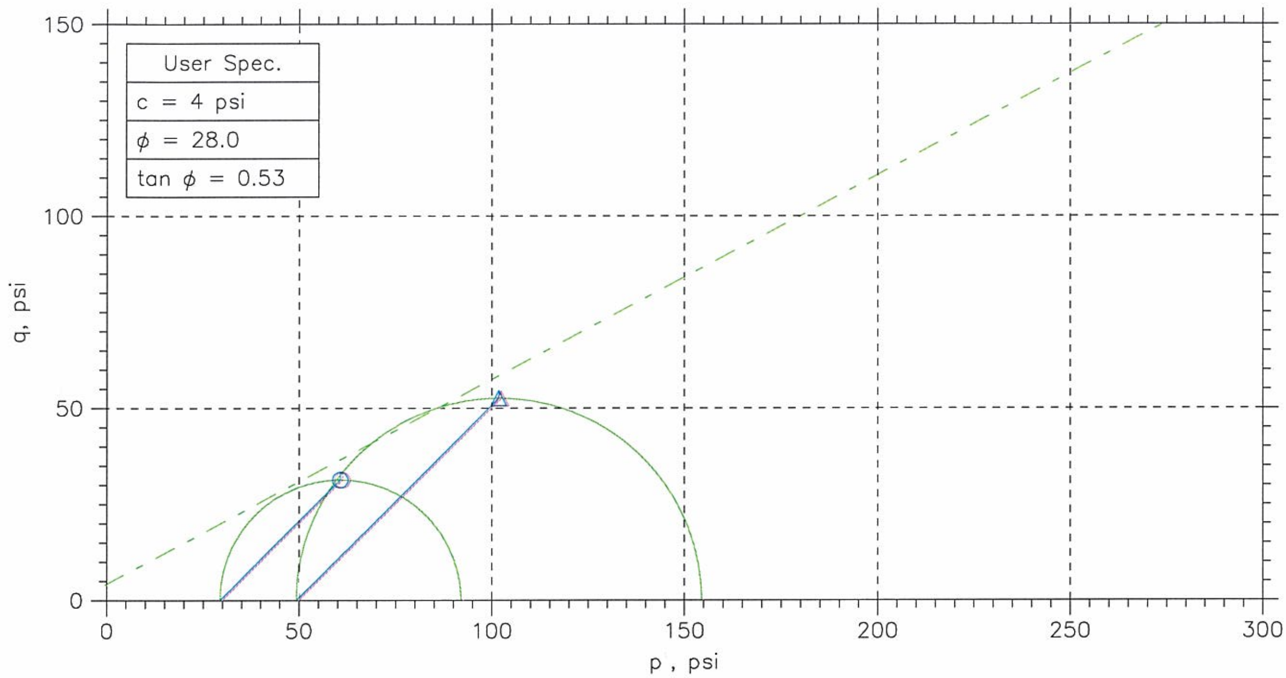
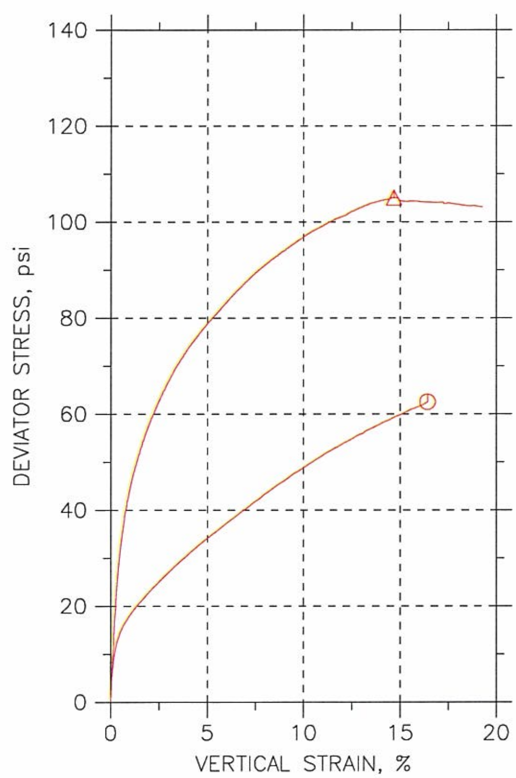
Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Gray silty sand		
Remarks: System 1062		

Fri, 02-APR-2010 11:24:59

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



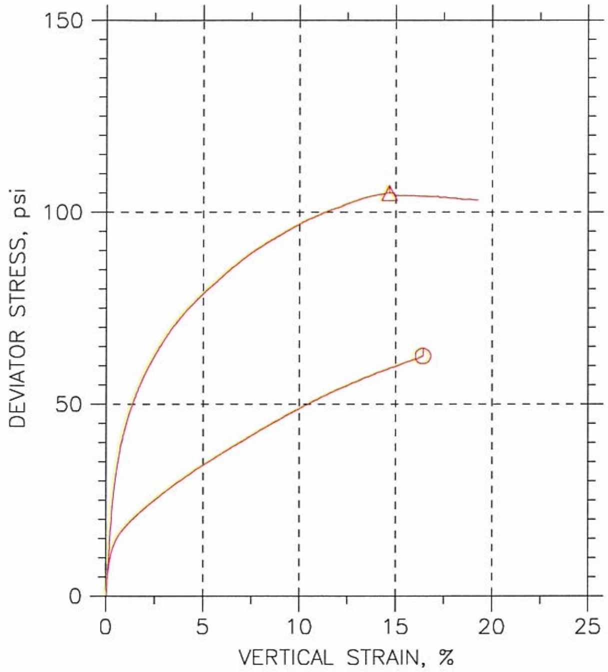


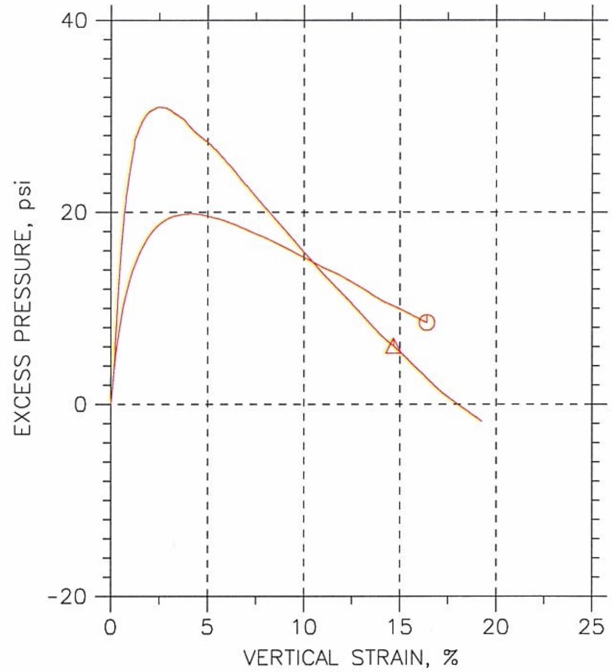
Symbol		○	△		
Sample No.		1239	1240		
Test No.		2.1	2.2		
Depth		7.7-8.2	11.3-11.8		
Initial	Diameter, in	2.871	2.882		
	Height, in	6.006	5.983		
	Water Content, %	15.8	15.1		
	Dry Density, pcf	116.5	115.4		
	Saturation, %	95.3	88.7		
	Void Ratio	0.447	0.461		
Before Shear	Water Content, %	15.7	15.4		
	Dry Density, pcf	118.4	119.		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.424	0.416		
	Back Press., psi	116	94.84		
Ver. Eff. Cons. Stress, psi		29.97	49.91		
Shear Strength, psi		31.27	52.52		
Strain at Failure, %		16.4	14.7		
Strain Rate, %/min		0.016	0.016		
B-Value		0.95	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

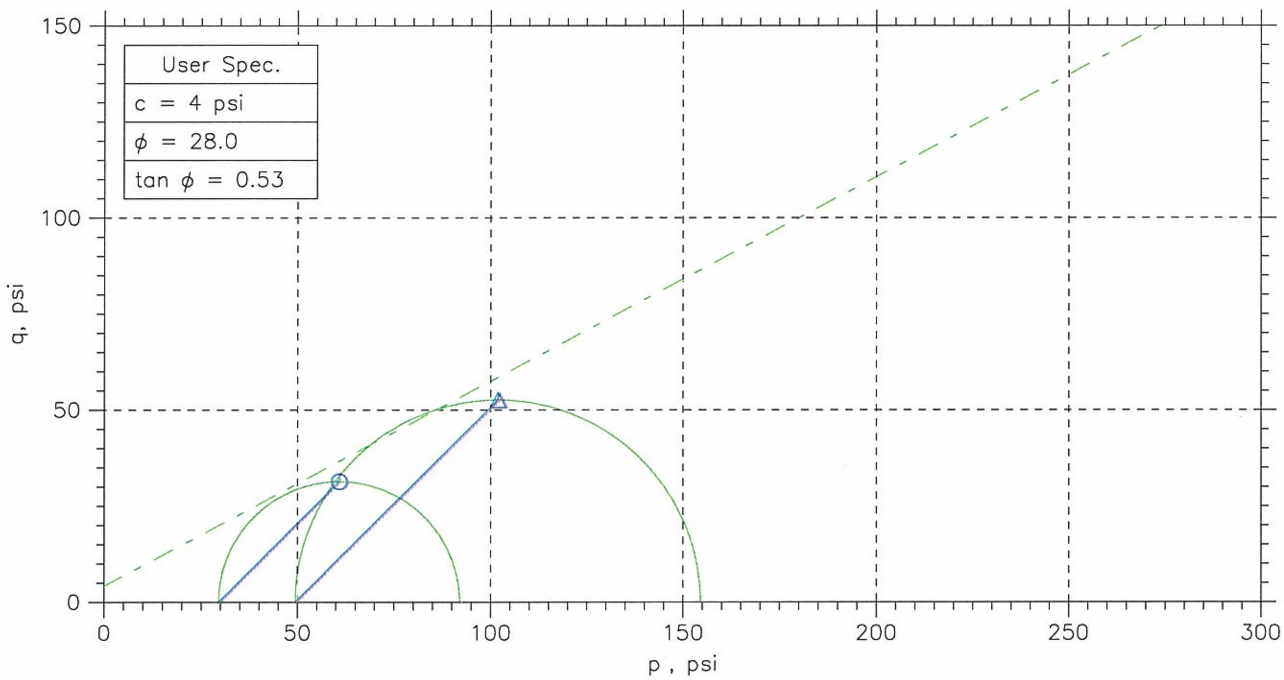
Project: Shawnee Ash Pond
Location: ---
Project No.: GTX-1547
Boring No.: STN-17
Sample Type: UD
Description: Gray silty sand
Remarks: System 1062

Fri, 23-APR-2010 09:53:05

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





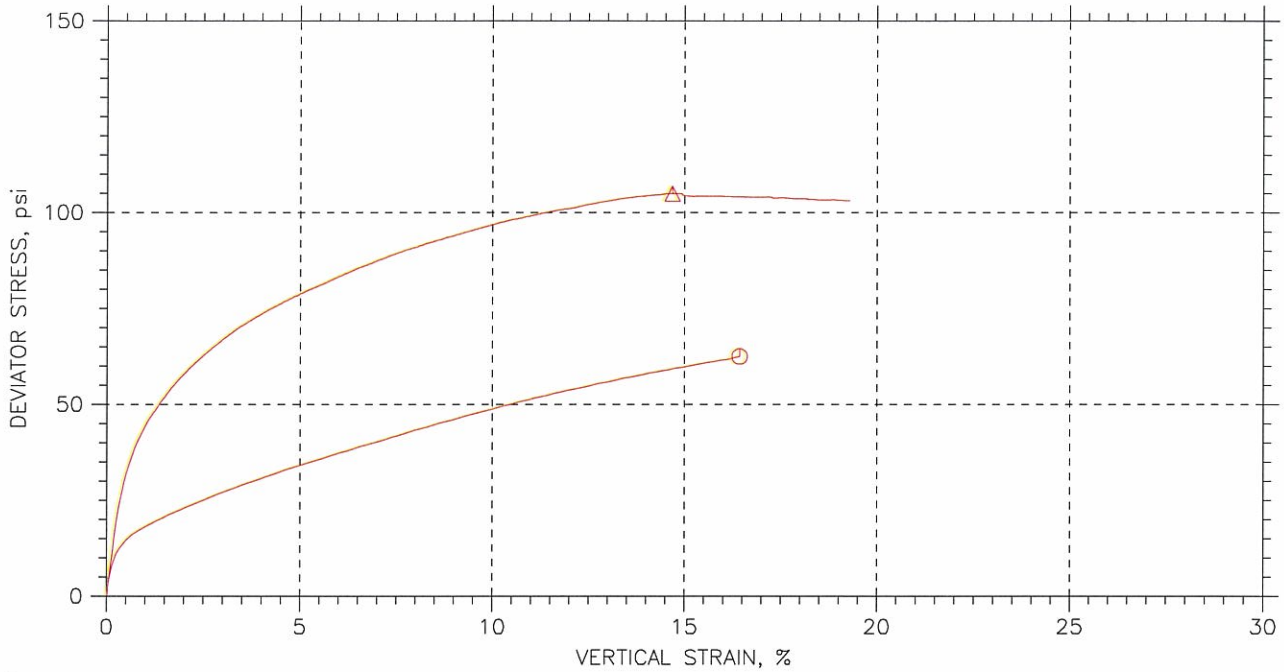


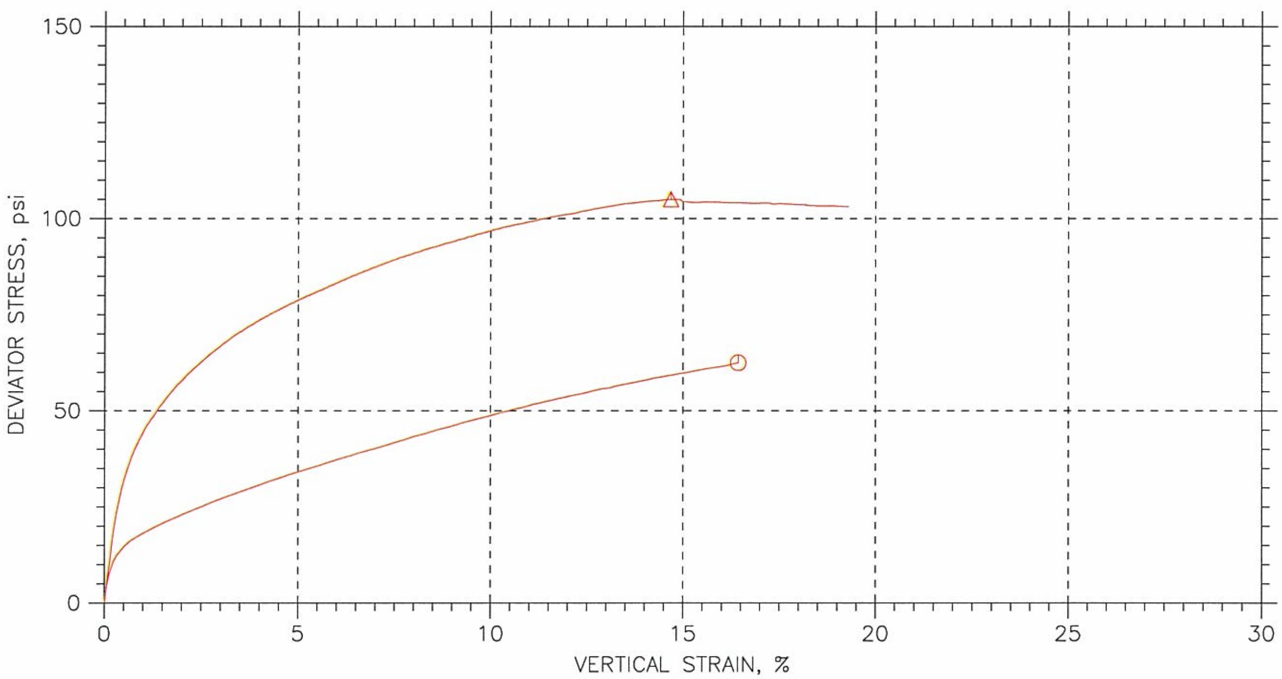
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1239	2.1	7.7-8.2	jm	3/22/10	mm		1547-2.1.dat
△	1240	2.2	11.3-11.8	jm	3/22/10	mm		1547 - 2.2.dat

Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Gray silty sand		
Remarks: System 1062		

Fri, 23-APR-2010 09:53:05

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



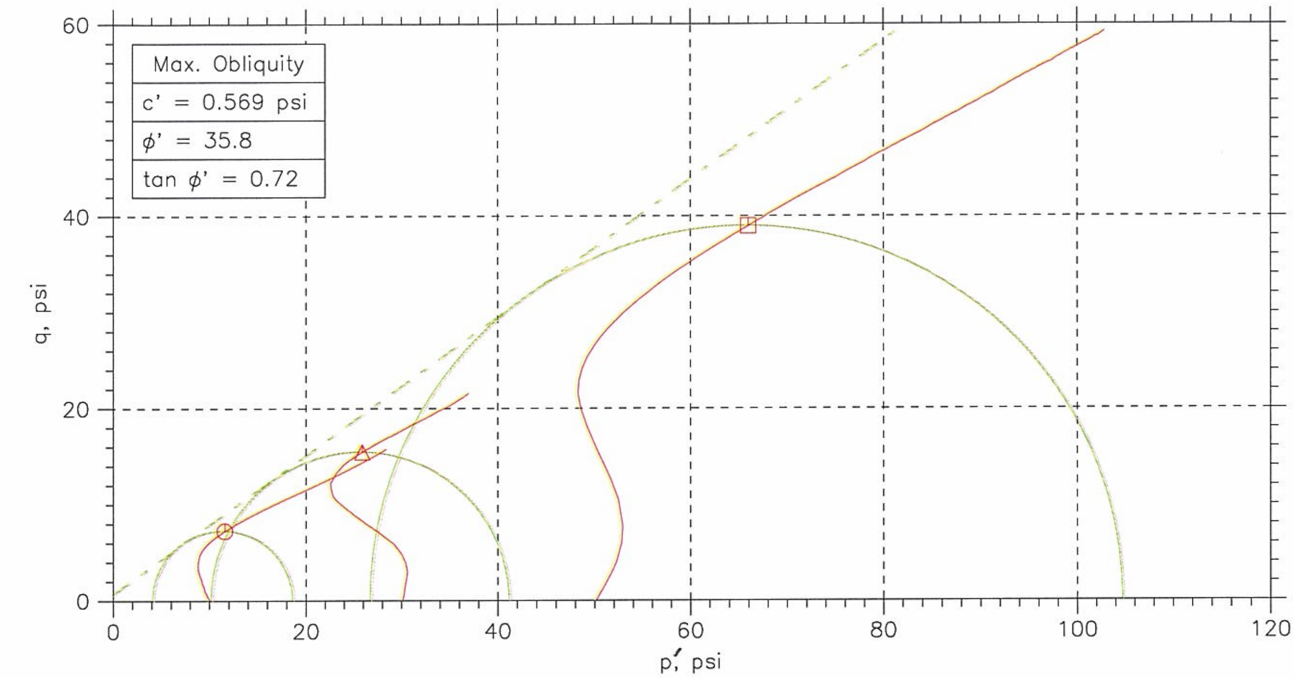


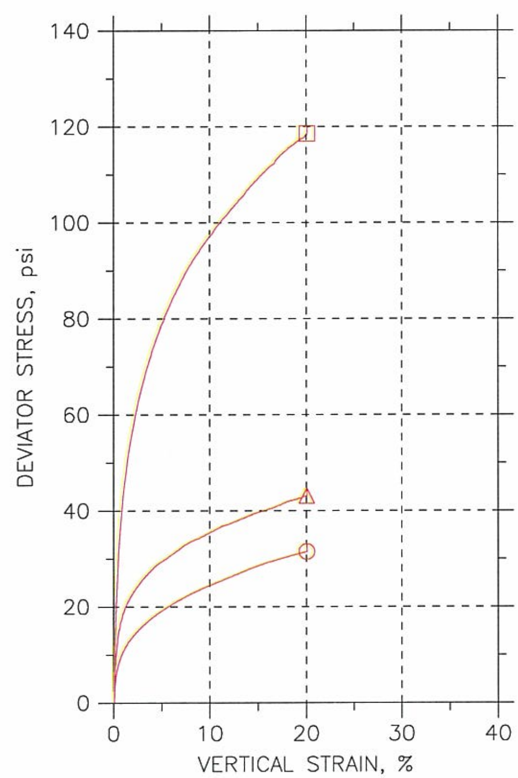
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⦶	1239	2.1	7.7-8.2	jm	3/22/10	mm		1547-2.1.dat
△	1240	2.2	11.3-11.8	jm	3/22/10	mm		1547 - 2.2.dat

Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Gray silty sand		
Remarks: System 1062		

Fri, 23-APR-2010 09:53:07

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



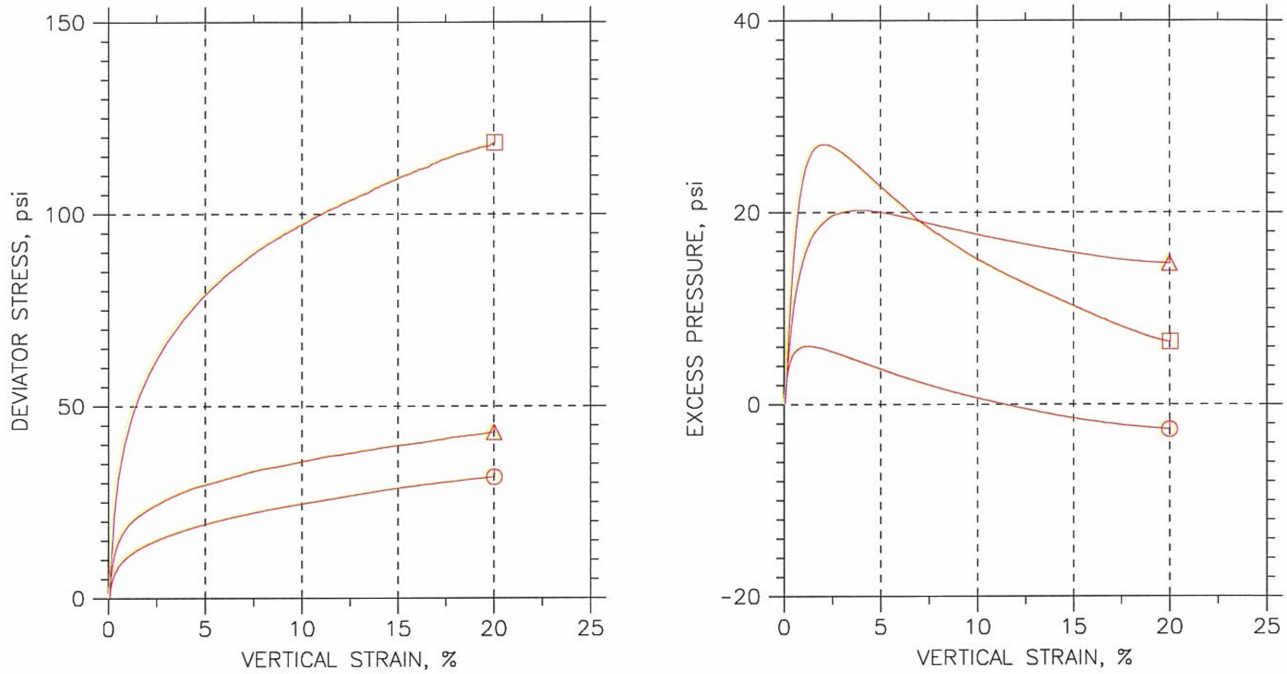


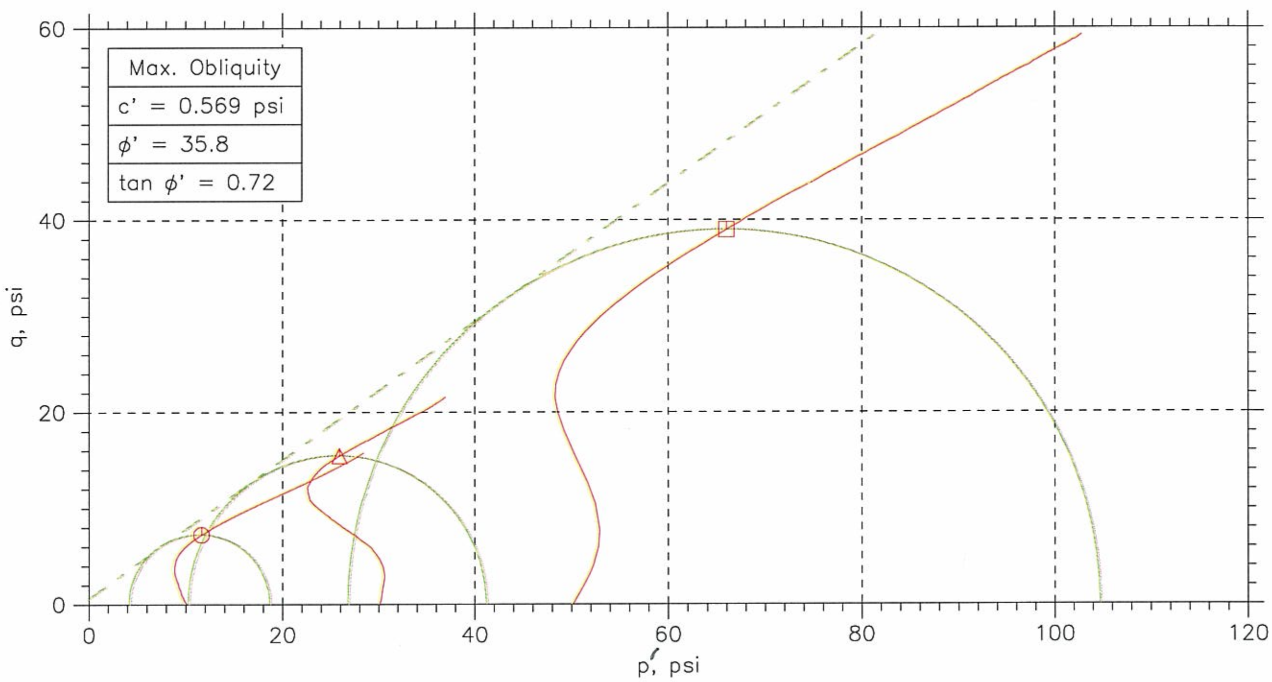
Symbol		○	△	□	
Sample No.		1241-B	1242--A	1242-B	
Test No.		3.1	3.2	3.3	
Depth		16.7-17.2	24.1-24.6	24.7-25.2	
Initial	Diameter, in	2.869	2.801	2.874	
	Height, in	6.019	5.985	6.016	
	Water Content, %	23.9	26.1	16.0	
	Dry Density, pcf	102.9	99.91	115.3	
	Saturation, %	98.3	99.8	90.2	
	Void Ratio	0.669	0.718	0.489	
Before Shear	Water Content, %	24.2	24.7	15.5	
	Dry Density, pcf	103.1	102.2	120.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.666	0.679	0.427	
	Back Press., psi	32.28	116	94.99	
Ver. Eff. Cons. Stress, psi		9.92	29.96	50	
Shear Strength, psi		15.75	21.56	59.27	
Strain at Failure, %		20	20	20	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.95	0.95	
Estimated Specific Gravity		2.75	2.75	2.75	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

GeoTesting express a subsidiary of Geocomp Corporation	Project: Shawnee Ash Pond
	Location:
	Project No.: GTX-1547
	Boring No.: STN-17
	Sample Type: UD
	Description: Moist, Light brown sandy lean clay
	Remarks: 2054

Tue, 23-MAR-2010 11:11:26

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1241-B	3.1	16.7-17.2	jm	3/18/10	mm		1547-3.1.dat
△	1242--A	3.2	24.1-24.6	jm	3/18/10	mm		1547 - 3.2.dat
□	1242-B	3.3	24.7-25.2	jm	3/18/10	mm		1547-3.3.dat

Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Moist, Light brown sandy lean clay		
Remarks: 2054		

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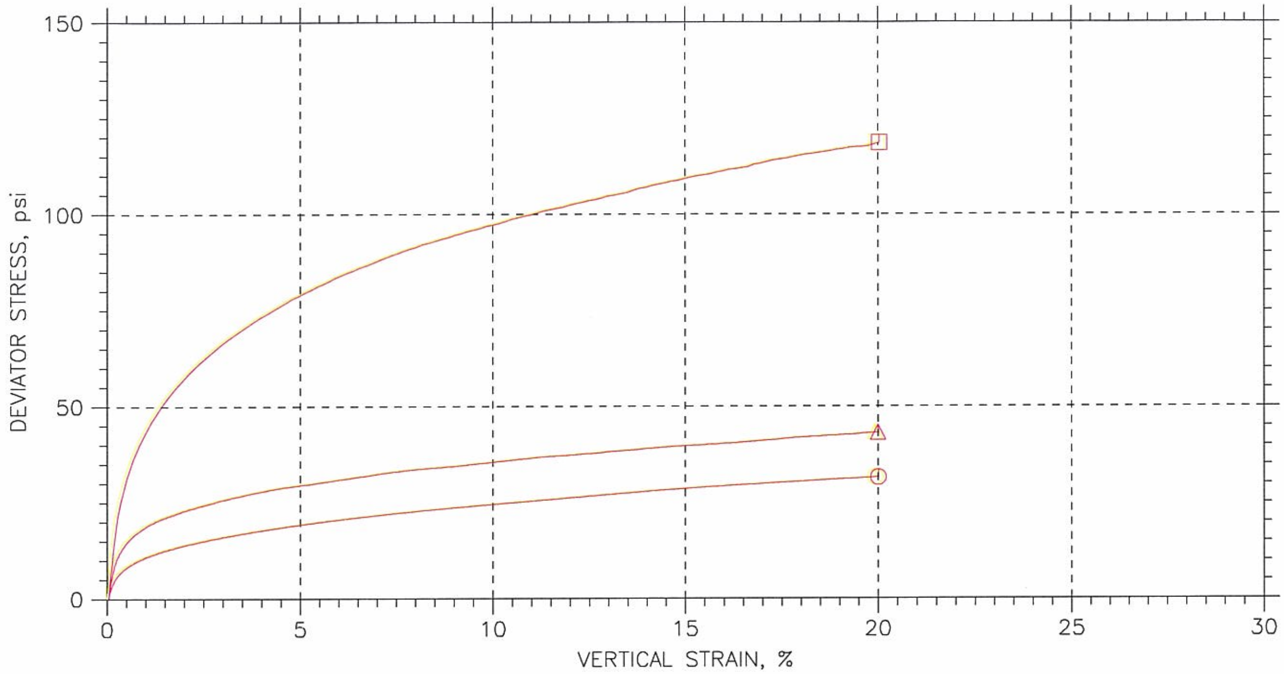
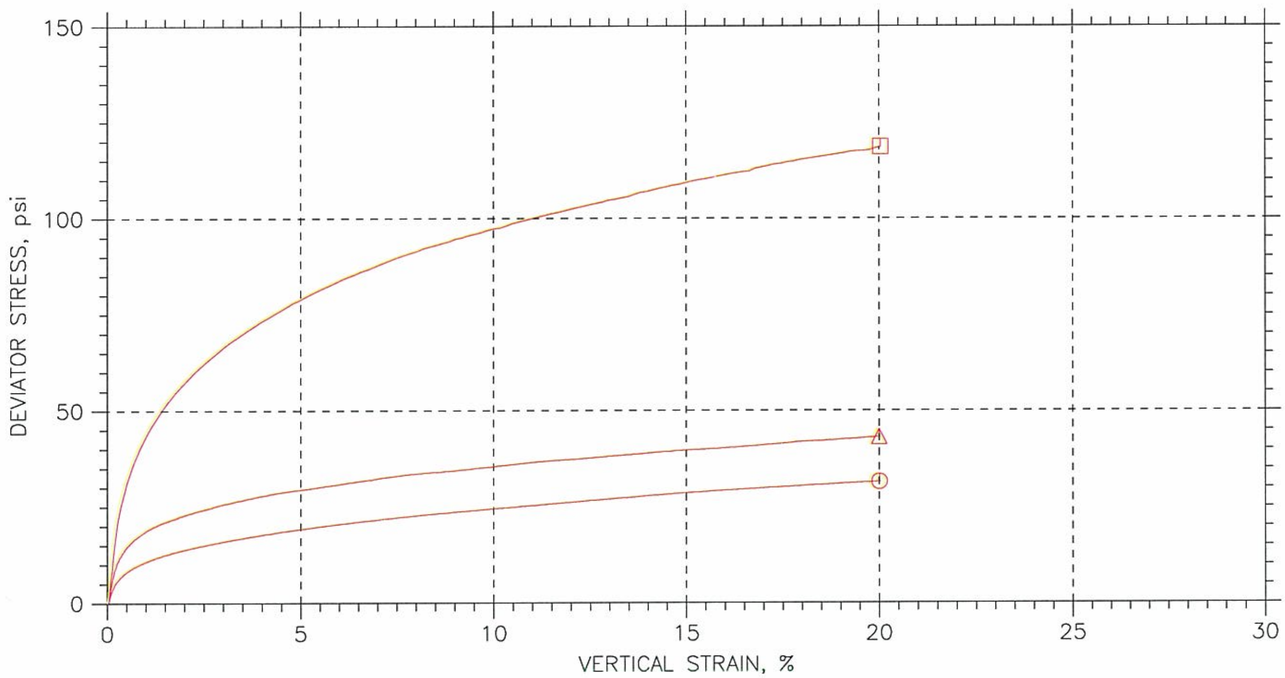
Tue, 23-MAR-2010 11:11:27

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	1241-B	3.1	16.7-17.2	jm	3/18/10	mm		1547-3.1.dat
△	1242--A	3.2	24.1-24.6	jm	3/18/10	mm		1547 - 3.2.dat
□	1242-B	3.3	24.7-25.2	jm	3/18/10	mm		1547-3.3.dat

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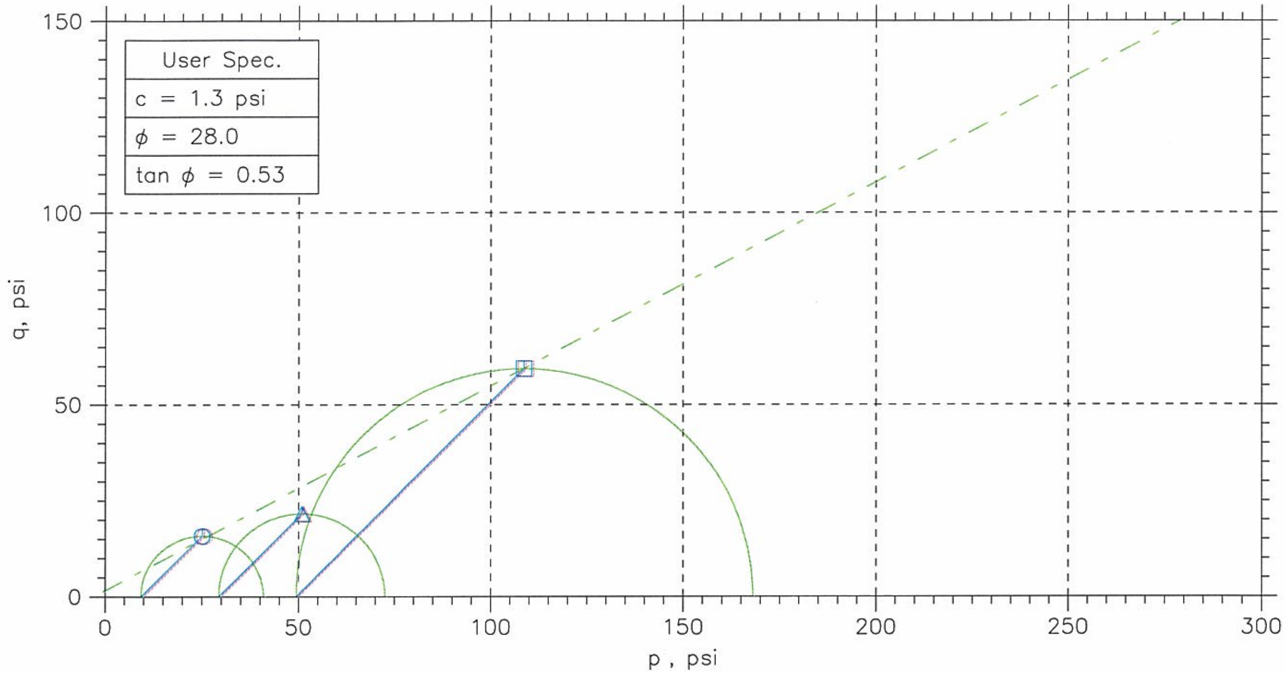
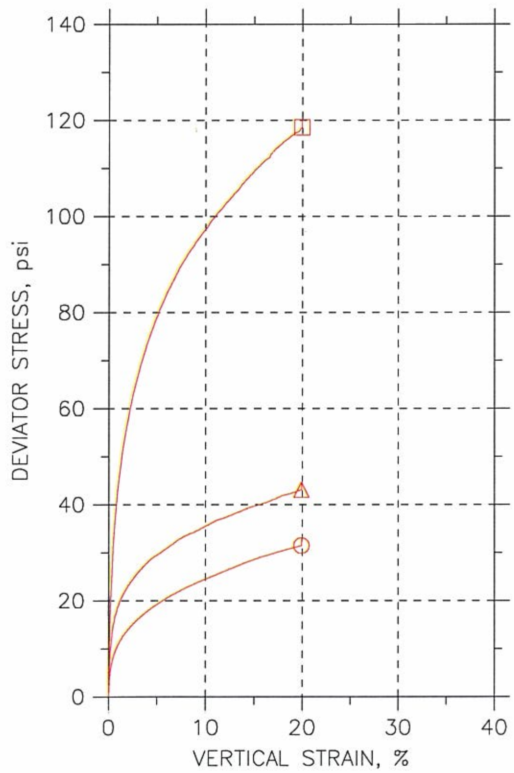
Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Moist, Light brown sandy lean clay		
Remarks: 2054		

Tue, 23-MAR-2010 11:11:27

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



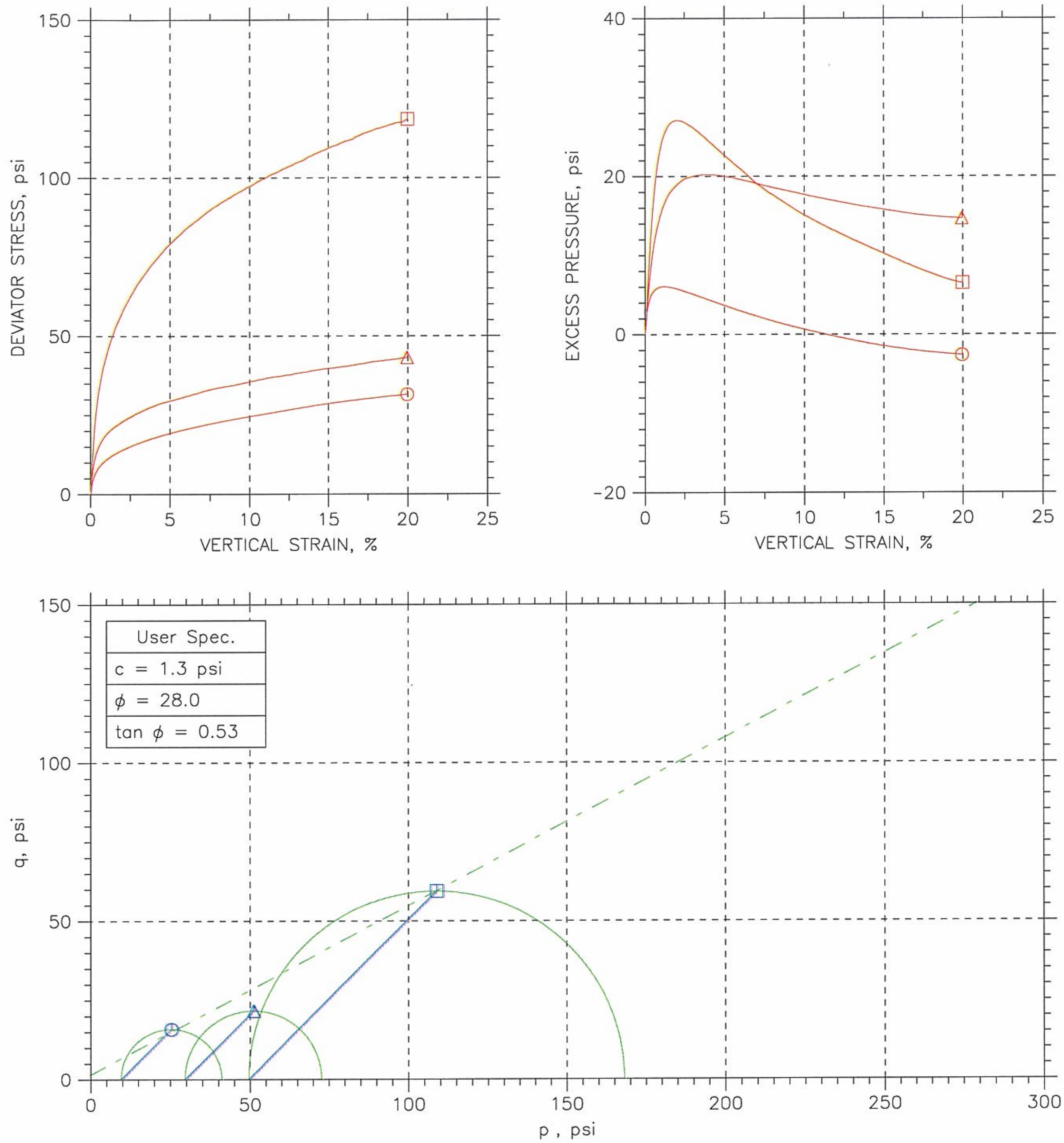


	Symbol	○	△	□	
	Sample No.	1241-B	1242--A	1242-B	
	Test No.	3.1	3.2	3.3	
	Depth	16.7-17.2	24.1-24.6	24.7-25.2	
Initial	Diameter, in	2.869	2.801	2.874	
Initial	Height, in	6.019	5.985	6.016	
Initial	Water Content, %	23.9	26.1	16.0	
Initial	Dry Density, pcf	102.9	99.91	115.3	
Initial	Saturation, %	98.3	99.8	90.2	
Initial	Void Ratio	0.669	0.718	0.489	
Before Shear	Water Content, %	24.2	24.7	15.5	
Before Shear	Dry Density, pcf	103.1	102.2	120.3	
Before Shear	Saturation*, %	100.0	100.0	100.0	
Before Shear	Void Ratio	0.666	0.679	0.427	
Before Shear	Back Press., psi	32.28	116	94.99	
	Ver. Eff. Cons. Stress, psi	9.92	29.96	50	
	Shear Strength, psi	15.75	21.56	59.27	
	Strain at Failure, %	20	20	20	
	Strain Rate, %/min	0.016	0.016	0.016	
	B-Value	0.96	0.95	0.95	
	Estimated Specific Gravity	2.75	2.75	2.75	
	Liquid Limit	---	---	---	
	Plastic Limit	---	---	---	

Project: Shawnee Ash Pond
Location:
Project No.: GTX-1547
Boring No.: STN-17
Sample Type: UD
Description: Moist, Light brown sandy lean clay
Remarks: 2054

Fri, 23-APR-2010 09:49:13

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

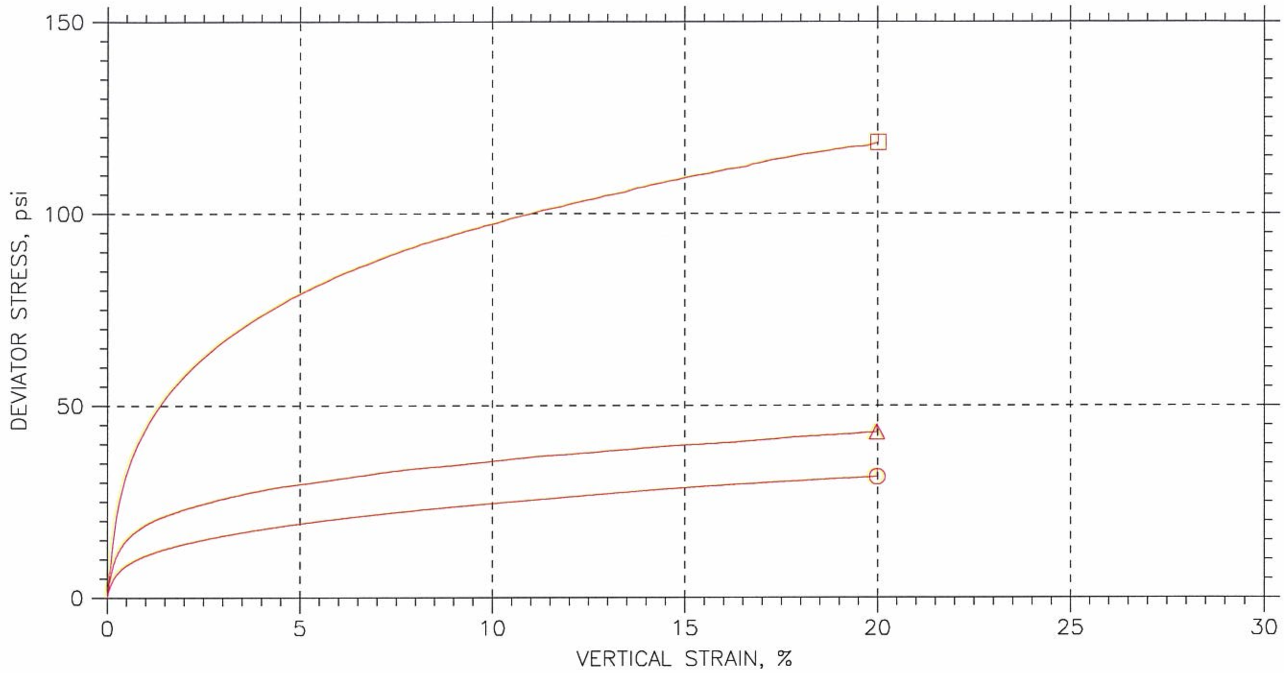


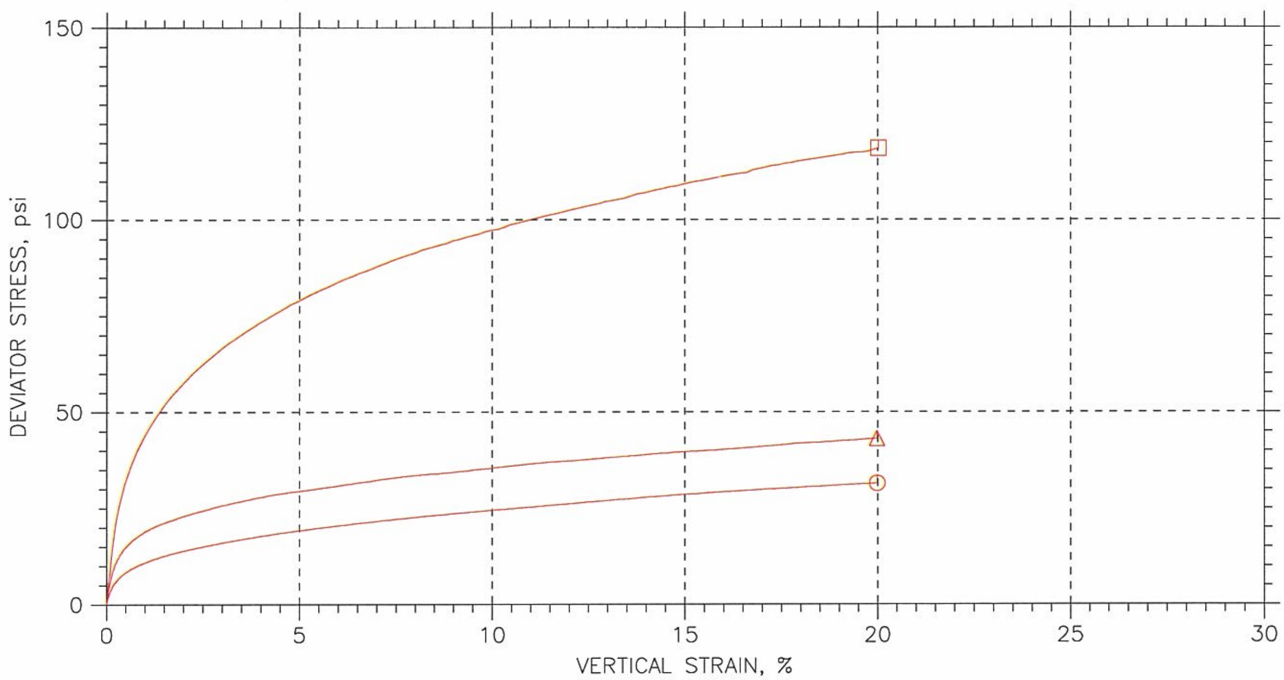
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	1241-B	3.1	16.7-17.2	jm	3/18/10	mm		1547-3.1.dat
△	1242--A	3.2	24.1-24.6	jm	3/18/10	mm		1547 - 3.2.dat
◫	1242-B	3.3	24.7-25.2	jm	3/18/10	mm		1547-3.3.dat

Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Moist, Light brown sandy lean clay		
Remarks: 2054		

Fri, 23-APR-2010 09:49:14

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



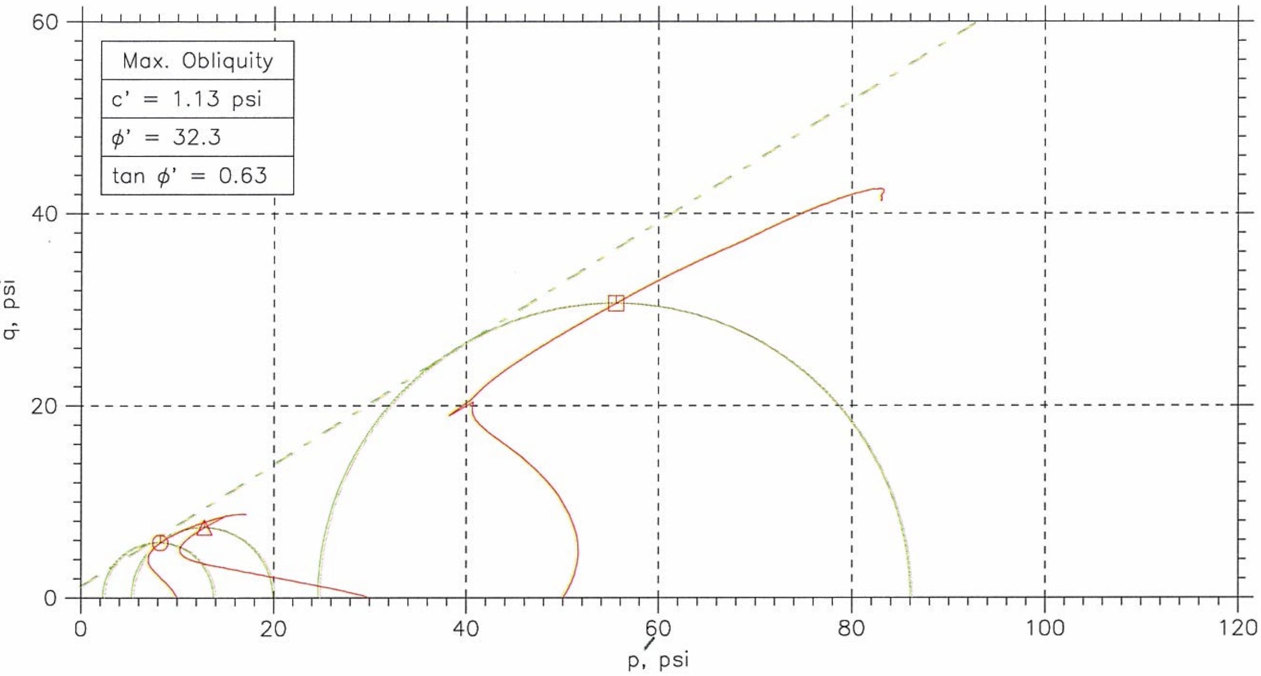


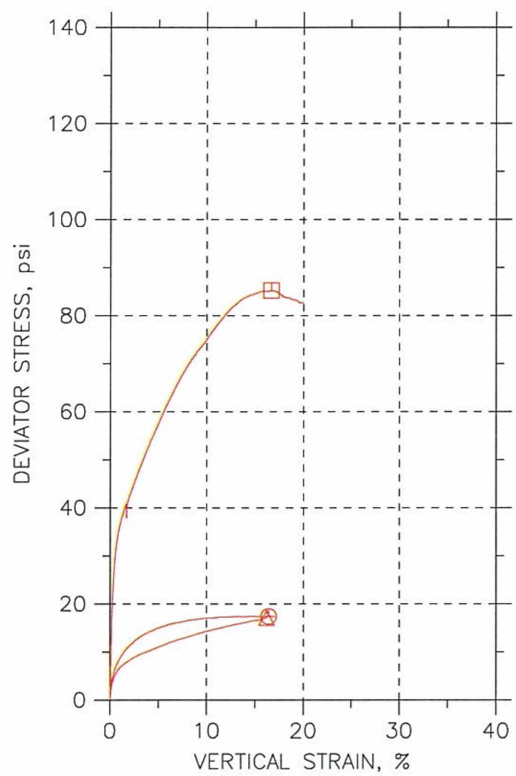
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1241-B	3.1	16.7-17.2	jm	3/18/10	mm		1547-3.1.dat
△	1242--A	3.2	24.1-24.6	jm	3/18/10	mm		1547 - 3.2.dat
□	1242-B	3.3	24.7-25.2	jm	3/18/10	mm		1547-3.3.dat

Project: Shawnee Ash Pond	Location:	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: Moist, Light brown sandy lean clay		
Remarks: 2054		

Fri, 23-APR-2010 09:49:14

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		1243	1244-A	1244-B	
Test No.		4.1	4.2	4.3	
Depth		35.6-36.1	40.1-40.6	40.7-41.2	
Initial	Diameter, in	2.83	2.836	2.838	
	Height, in	6.05	5.985	5.937	
	Water Content, %	23.0	23.1	19.0	
	Dry Density, pcf	104.5	104.7	111.	
	Saturation, %	98.7	99.4	95.7	
	Void Ratio	0.642	0.64	0.546	
Before Shear	Water Content, %	25.5	21.3	17.6	
	Dry Density, pcf	100.8	108.3	115.7	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.703	0.585	0.484	
	Back Press., psi	94.9	116.1	95.3	
Ver. Eff. Cons. Stress, psi		9.928	29.85	49.98	
Shear Strength, psi		8.734	8.608	42.62	
Strain at Failure, %		16.4	16.2	16.6	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.96	0.96	
Estimated Specific Gravity		2.75	2.75	2.75	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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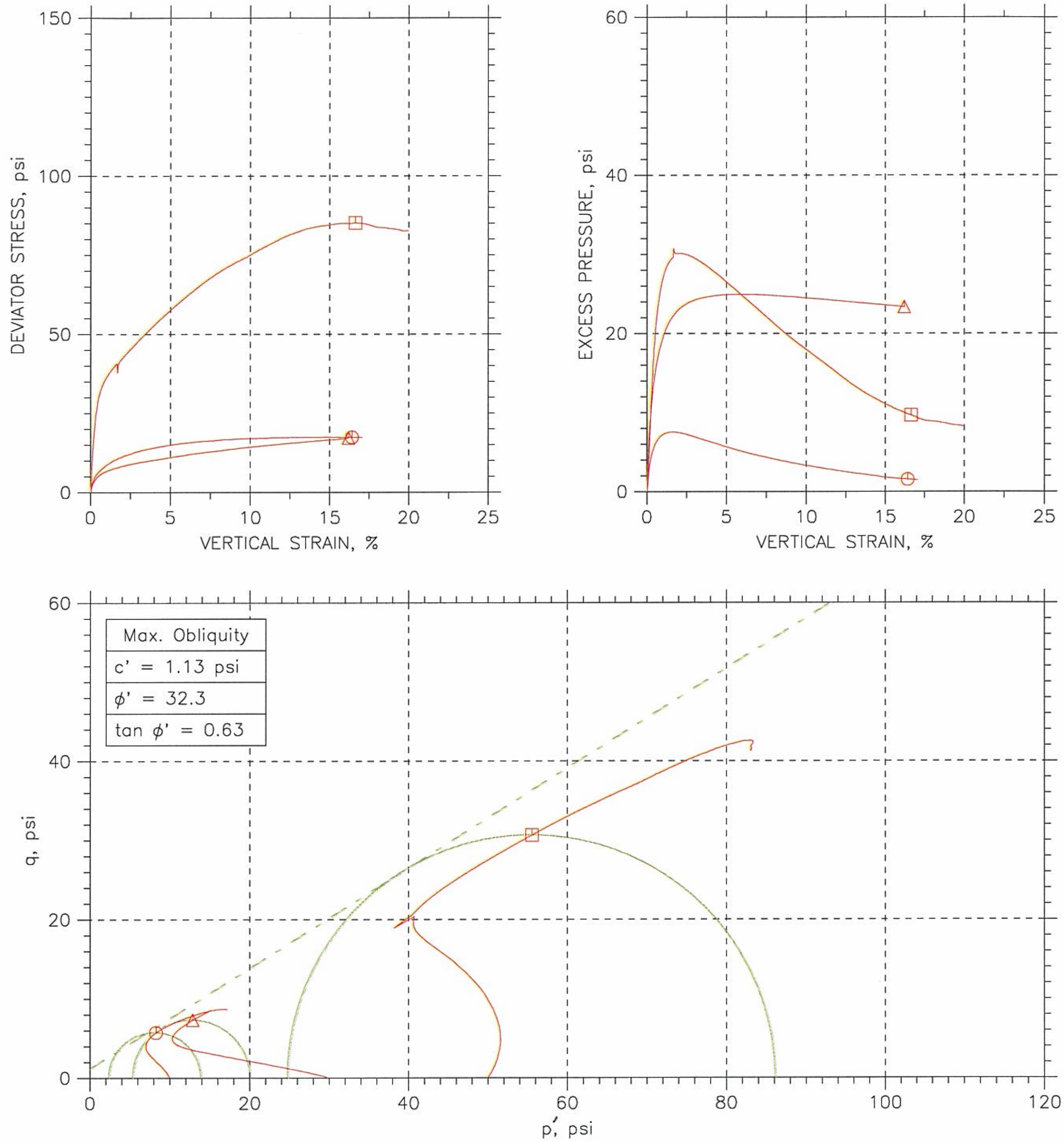
Project: Shawnee Ash Pond
Location: ---
Project No.: GTX-15
Boring No.: STN-17
Sample Type: UD
Description: light brown sandy clay
Remarks: System 1062

Fri, 02-APR-2010 10:48:10

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1243	4.1	35.6-36.1	jm	3/17/10	mm		1547-4.1.dat
△	1244-A	4.2	40.1-40.6	jm	3/17/10	mm		1547 - 4.2.dat
□	1244-B	4.3	40.7-41.2	jm	3/17/10	mm		1547-4.3.dat

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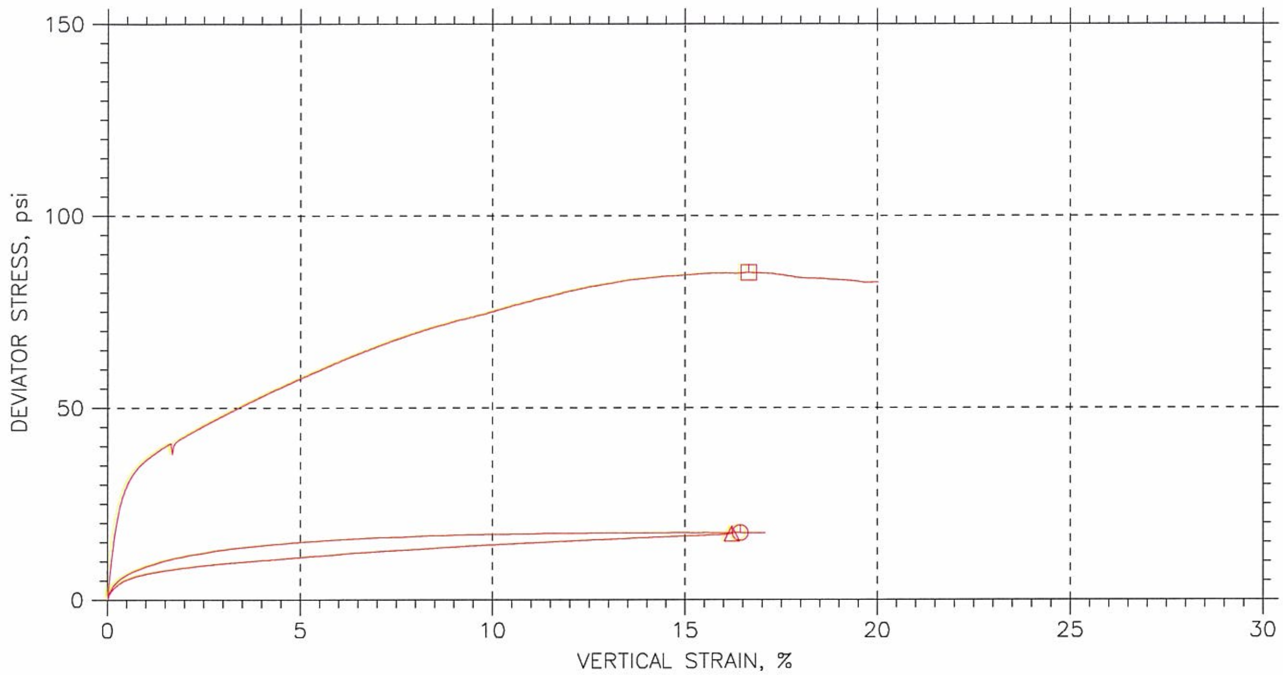
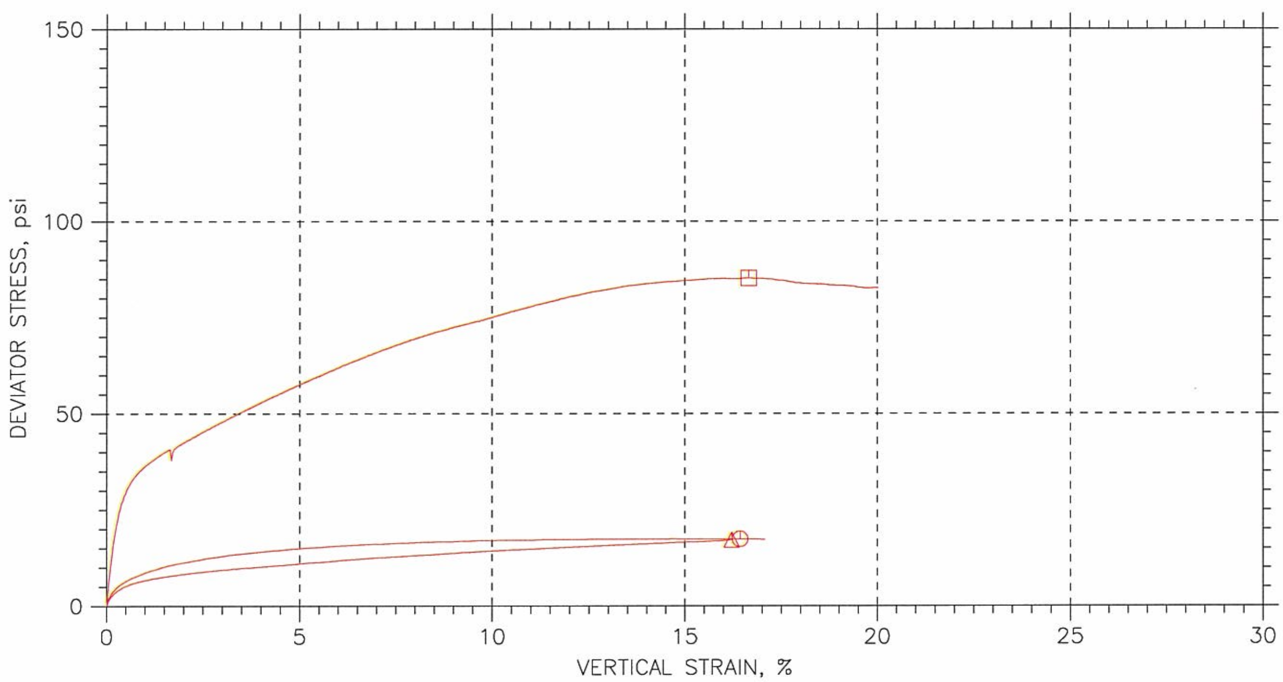
Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-15
Boring No.: STN-17	Sample Type: UD	
Description: light brown sandy clay		
Remarks: System 1062		

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⦶	1243	4.1	35.6-36.1	jm	3/17/10	mm		1547-4.1.dat
△	1244-A	4.2	40.1-40.6	jm	3/17/10	mm		1547 - 4.2.dat
⊞	1244-B	4.3	40.7-41.2	jm	3/17/10	mm		1547-4.3.dat

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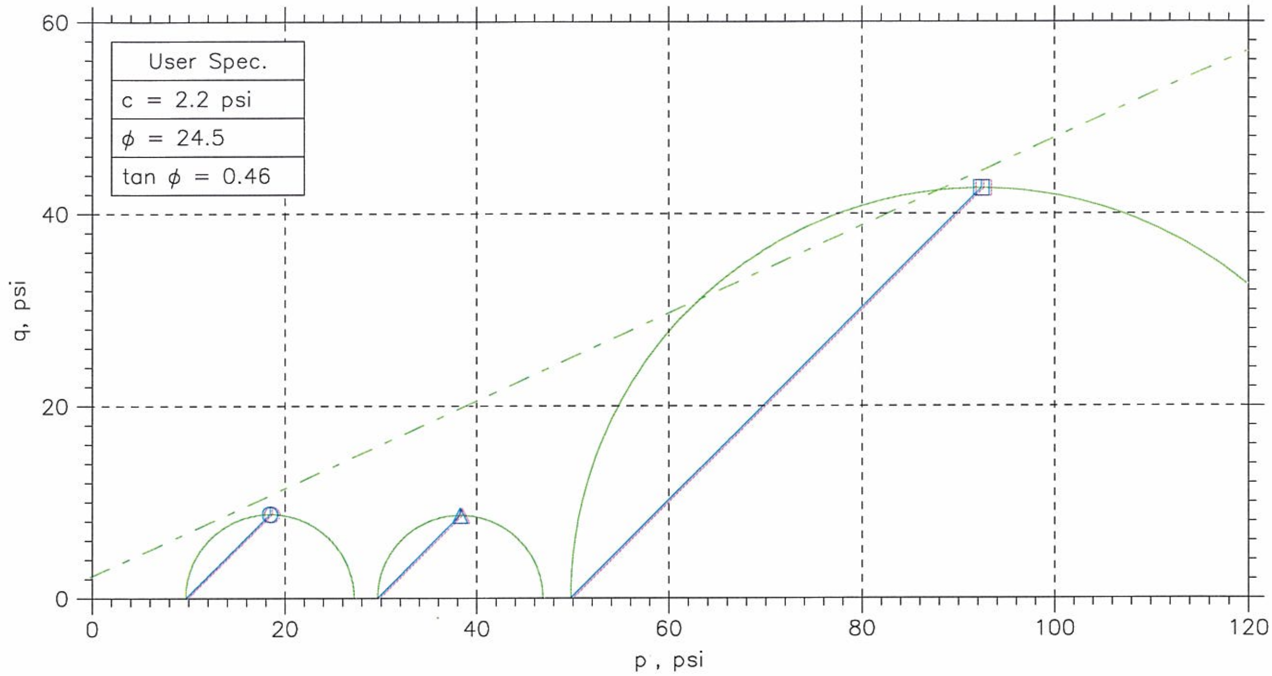
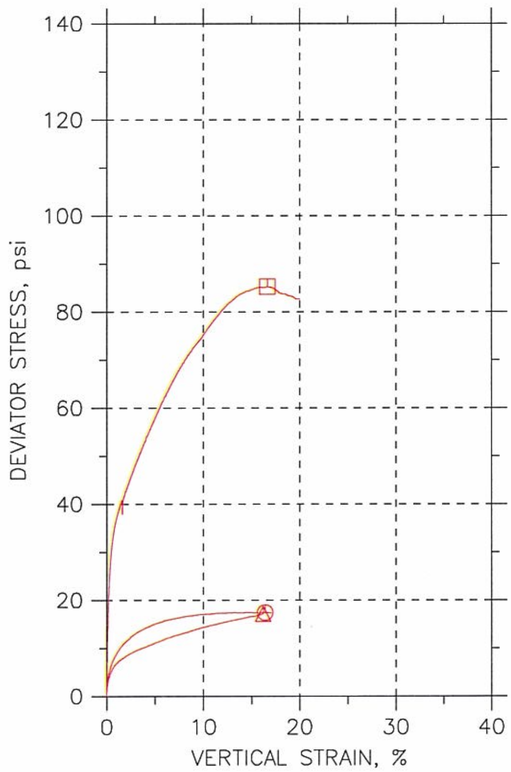
Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-15
Boring No.: STN-17	Sample Type: UD	
Description: light brown sandy clay		
Remarks: System 1062		

Fri, 02-APR-2010 10:48:11

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



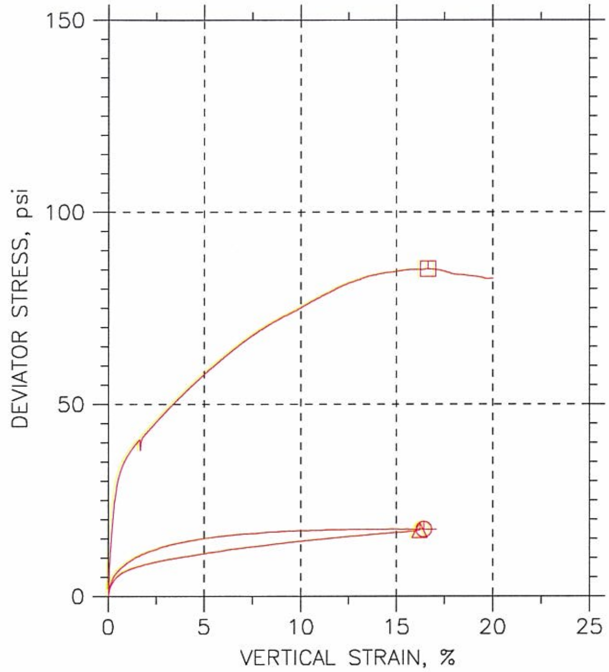


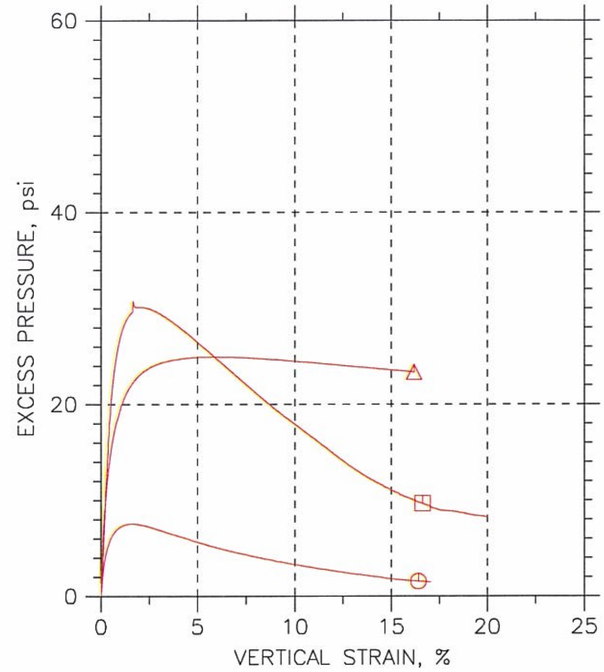
Symbol	○	△	□	
Sample No.	1243	1244-A	1244-B	
Test No.	4.1	4.2	4.3	
Depth	35.6-36.1	40.1-40.6	40.7-41.2	
Initial — Diameter, in	2.83	2.836	2.838	
Initial — Height, in	6.05	5.985	5.937	
Initial — Water Content, %	23.0	23.1	19.0	
Initial — Dry Density, pcf	104.5	104.7	111.	
Initial — Saturation, %	98.7	99.4	95.7	
Initial — Void Ratio	0.642	0.64	0.546	
Before Shear — Water Content, %	25.5	21.3	17.6	
Before Shear — Dry Density, pcf	100.8	108.3	115.7	
Before Shear — Saturation*, %	100.0	100.0	100.0	
Before Shear — Void Ratio	0.703	0.585	0.484	
Before Shear — Back Press., psi	94.9	116.1	95.3	
Ver. Eff. Cons. Stress, psi	9.928	29.85	49.98	
Shear Strength, psi	8.734	8.608	42.62	
Strain at Failure, %	16.4	16.2	16.6	
Strain Rate, %/min	0.016	0.016	0.016	
B-Value	0.95	0.96	0.96	
Estimated Specific Gravity	2.75	2.75	2.75	
Liquid Limit	---	---	---	
Plastic Limit	---	---	---	

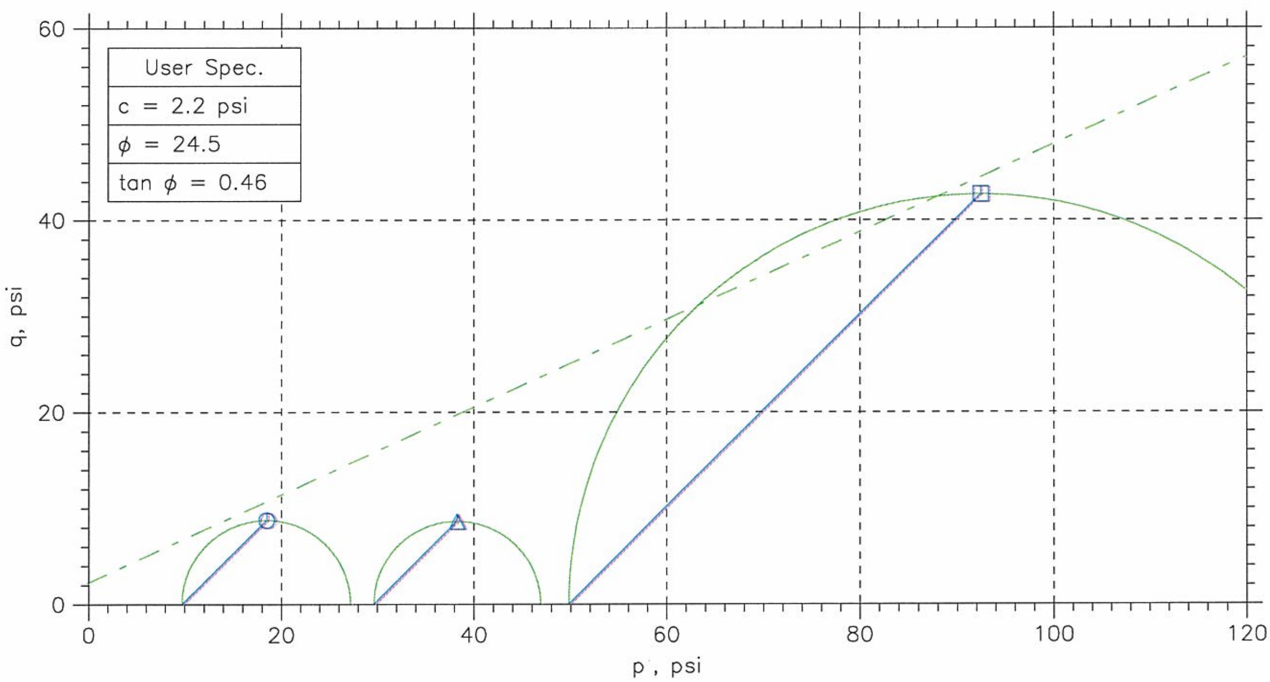
Project: Shawnee Ash Pond	
Location: ---	
Project No.: GTX-1547	
Boring No.: STN-17	
Sample Type: UD	
Description: light brown sandy clay	
Remarks: System 1062	

Fri, 23-APR-2010 09:46:40

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





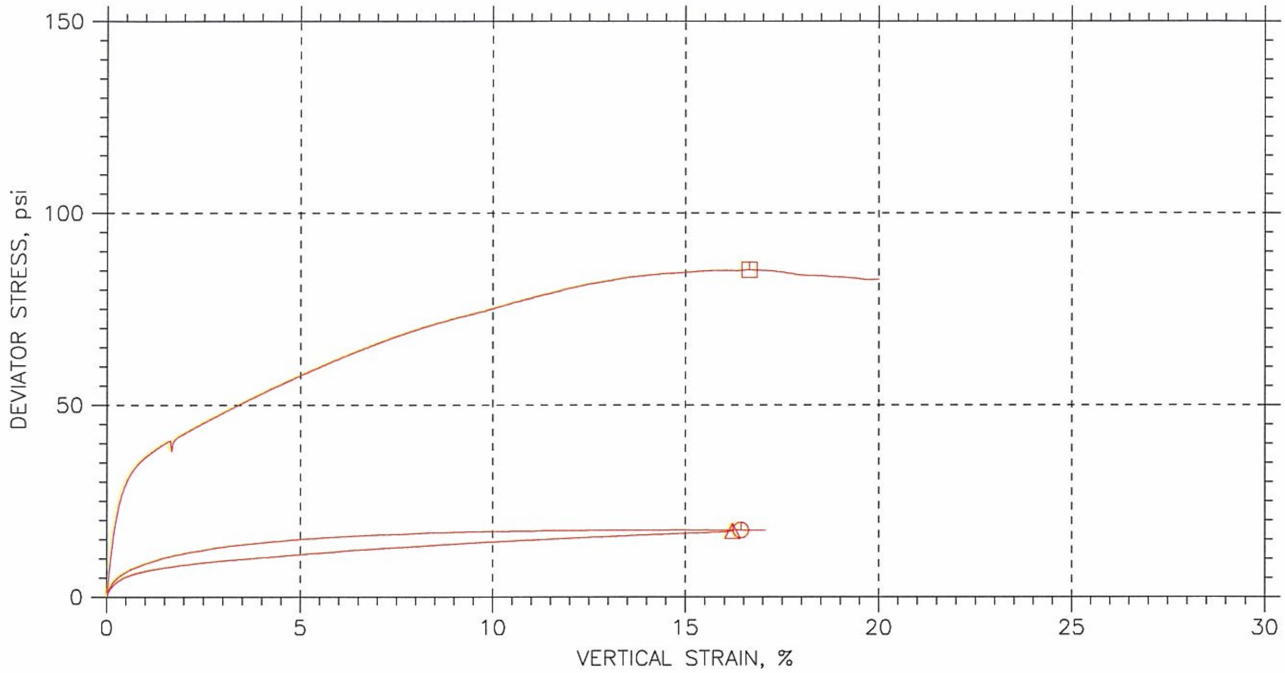


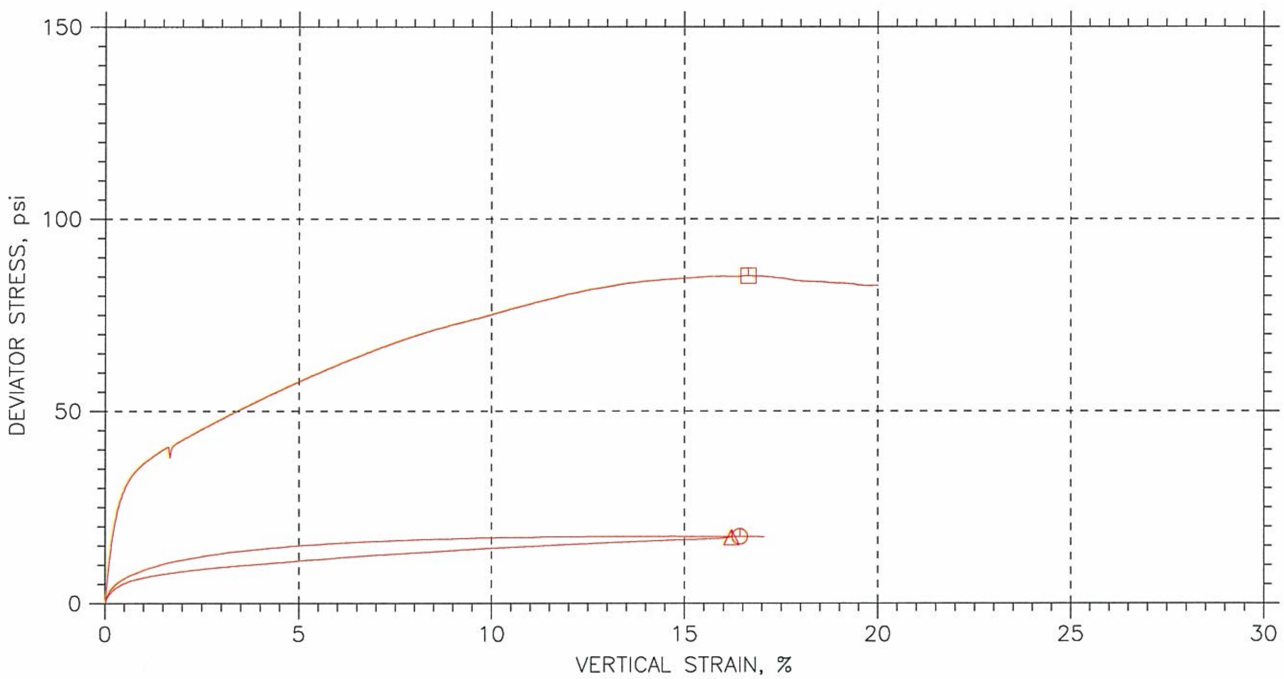
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
⊙	1243	4.1	35.6-36.1	jm	3/17/10	mm		1547-4.1.dat
△	1244-A	4.2	40.1-40.6	jm	3/17/10	mm		1547 - 4.2.dat
◫	1244-B	4.3	40.7-41.2	jm	3/17/10	mm		1547-4.3.dat

Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: light brown sandy clay		
Remarks: System 1062		

Fri, 23-APR-2010 09:46:41

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





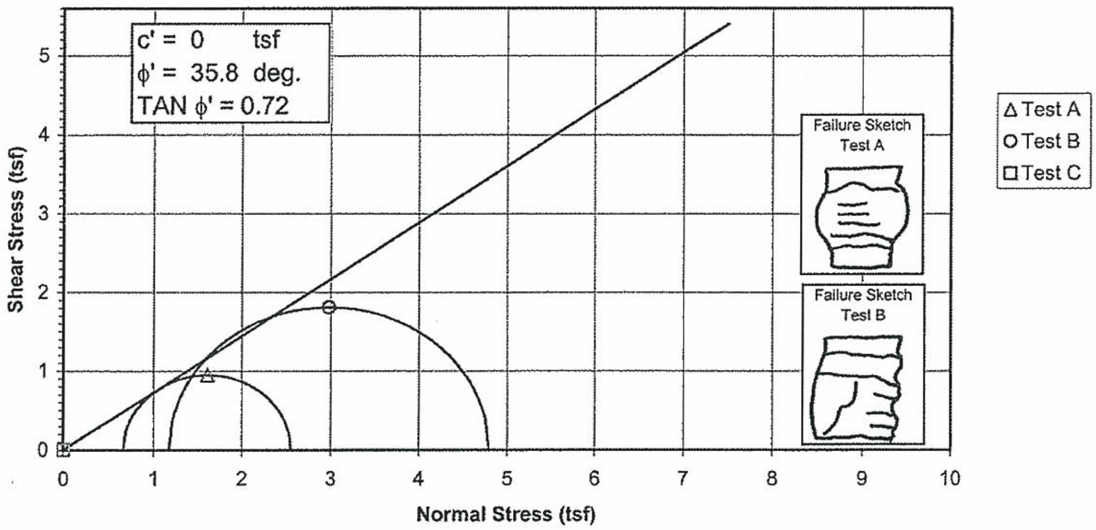
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	1243	4.1	35.6-36.1	jm	3/17/10	mm		1547-4.1.dat
△	1244-A	4.2	40.1-40.6	jm	3/17/10	mm		1547 - 4.2.dat
□	1244-B	4.3	40.7-41.2	jm	3/17/10	mm		1547-4.3.dat

Project: Shawnee Ash Pond	Location: ---	Project No.: GTX-1547
Boring No.: STN-17	Sample Type: UD	
Description: light brown sandy clay		
Remarks: System 1062		

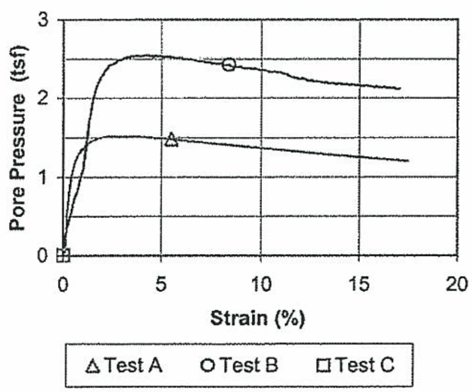
Fri, 23-APR-2010 09:46:42

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	17.7	31.0	######	
	Dry Density PCF	γ_{d_o}	109.9	87.0	######	
	Saturation %	S_o	87.5	88.4	######	
	Void Ratio	e_o	0.551	0.958	######	
After Shear	Water content %	W_f	17.3	25.9	######	
	Dry Density PCF	γ_{d_f}	115.7	99.9	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.473	0.707	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF @ failure		σ_3'f	0.67	1.18	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.88	3.61	0.00	
Time to (σ1'-σ3')max min.		t_f	447.1	801.6	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.880	2.868	######	
Initial Height, in.		H_o	5.955	5.990	######	

Controlled - Strain Test			
Description of Specimens	Lean Clay (CL), brown, moist, firm		
	Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL / PL / PI / Gs 2.73	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:			
	Boring No.	STN-21, STN-25	Sample No. 15
	Depth Elev.	9.1'-9.6', 29.1'-29.6'	
	Laboratory	Stantec	Date 4-14-10
	TRIAXIAL COMPRESSION TEST REPORT		

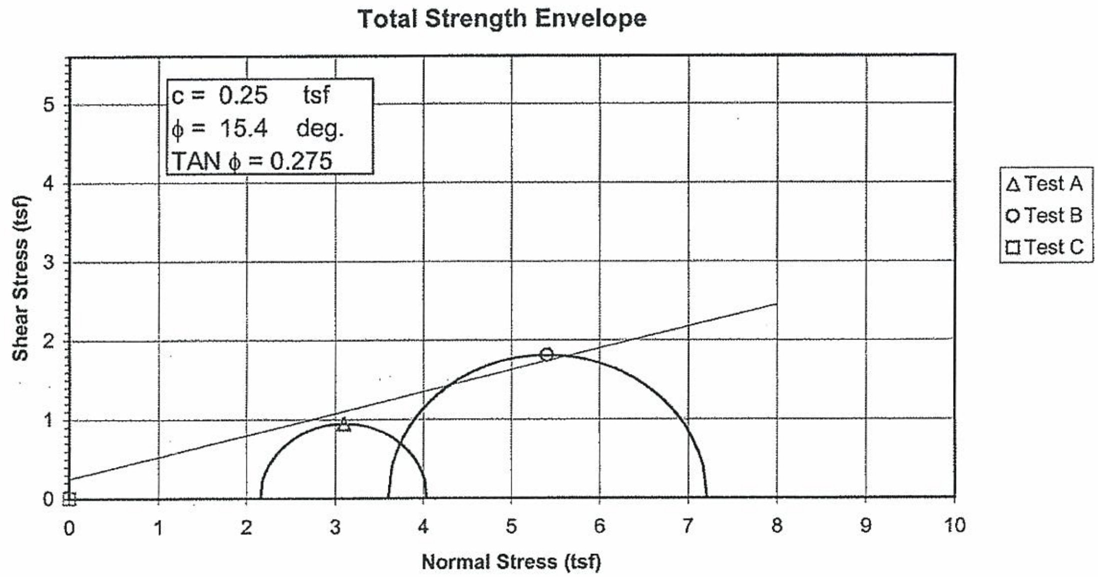
a
TLK

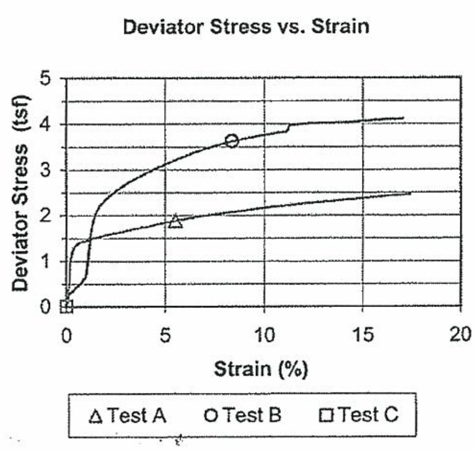
File: 175559023_cu_15 Sheet: CE_Final-E
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





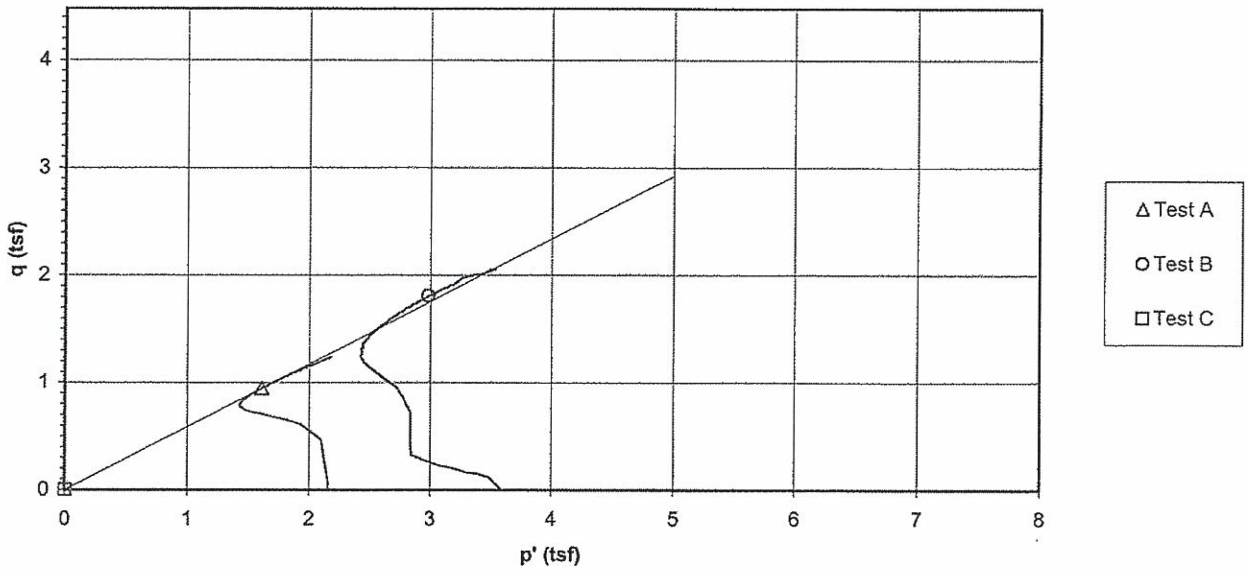
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	17.7	31.0	######	
	Dry Density PCF	γ_{d_o}	109.9	87.0	######	
	Saturation %	S_o	87.5	88.4	######	
	Void Ratio	e_o	0.551	0.958	######	
After Shear	Water content %	W_f	17.3	25.9	######	
	Dry Density PCF	γ_{d_f}	115.7	99.9	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.473	0.707	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.88	3.61	0.00	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	447.1	801.6	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.880	2.868	######	
Initial Height, in.		H_o	5.955	5.990	######	

Controlled - Strain Test					
Description of Specimens	Lean Clay (CL), brown, moist, firm				
			Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.73	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
			Boring No.	STN-21, STN-25	Sample No. 15
			Depth Elev.	9.1'-9.6', 29.1'-29.6'	
			Laboratory	Stantec	Date 4-14-10
			TRIAXIAL COMPRESSION TEST REPORT		

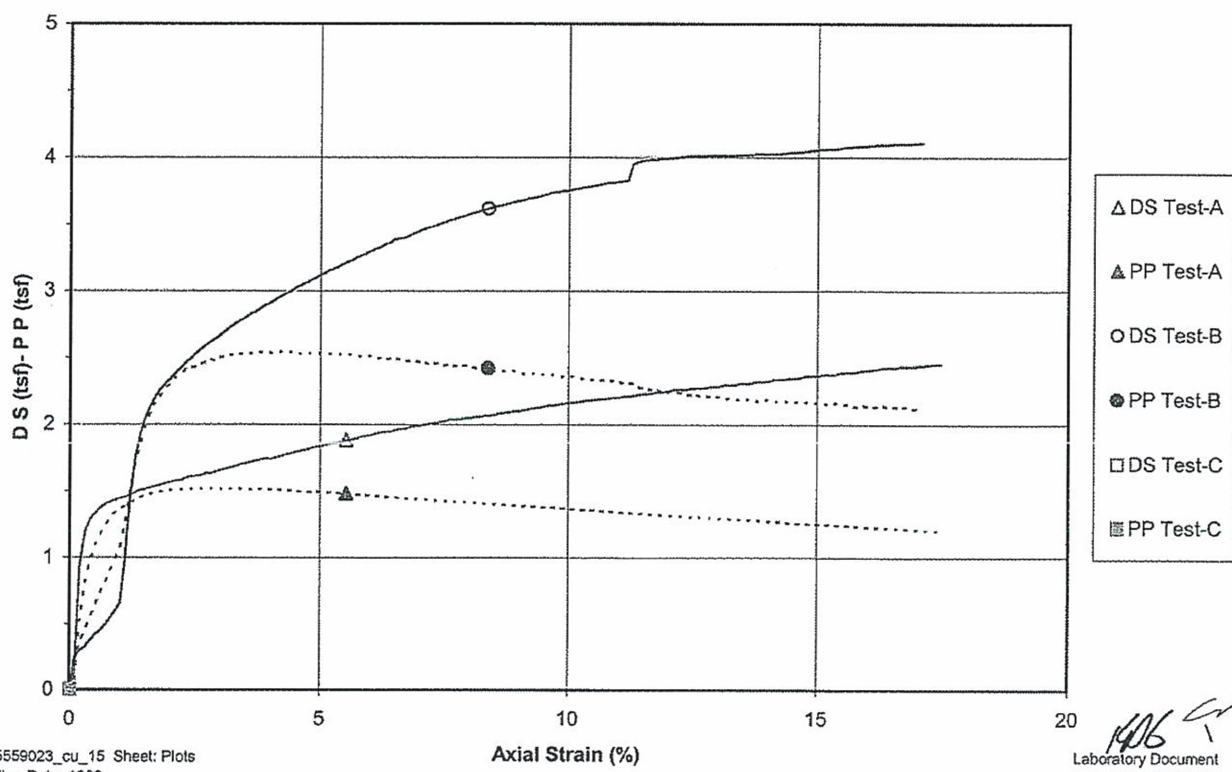
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-21, 9.1'-9.6' & STN-25, 29.1'-29.6'	Test Number	15
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 35.8 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

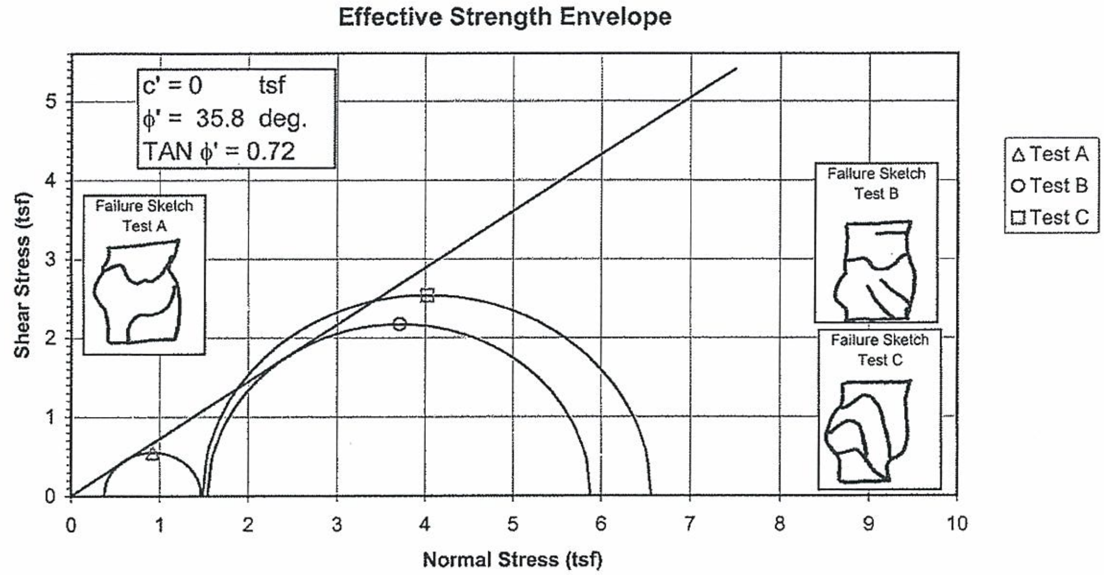


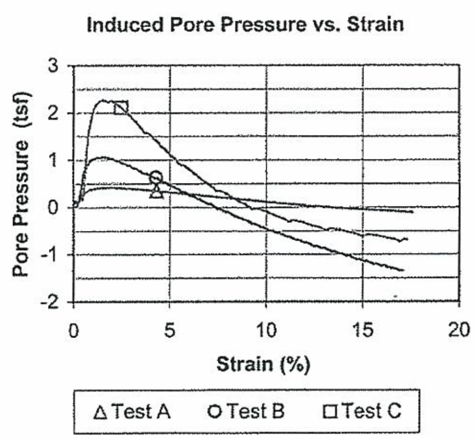
File: 175559023_cu_15 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





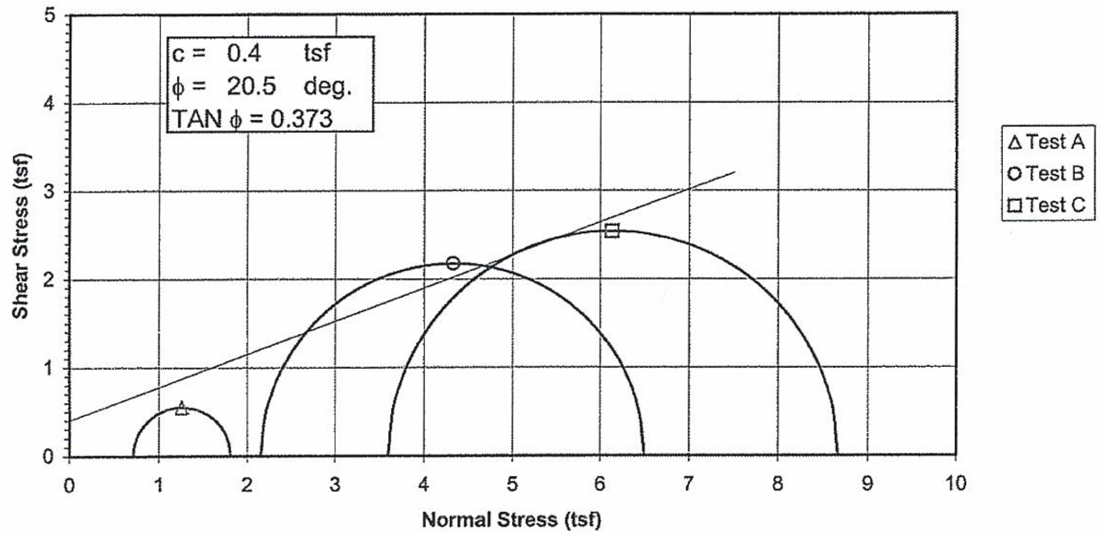
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	27.0	18.4	14.8	
	Dry Density PCF	γ_{d_o}	93.4	110.3	117.9	
	Saturation %	S_o	94.2	100.0	100.1	
	Void Ratio	e_o	0.751	0.482	0.388	
After Shear	Water content %	W_f	25.6	16.4	13.8	
	Dry Density PCF	γ_{d_f}	98.0	114.4	120.2	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.669	0.430	0.360	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.38	1.55	1.49	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.10	4.35	5.07	
Time to (σ1'-σ3')max min.		t_f	21.8	274.4	14.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.879	2.882	2.883	
Initial Height, in.		H_o	5.978	5.994	5.990	

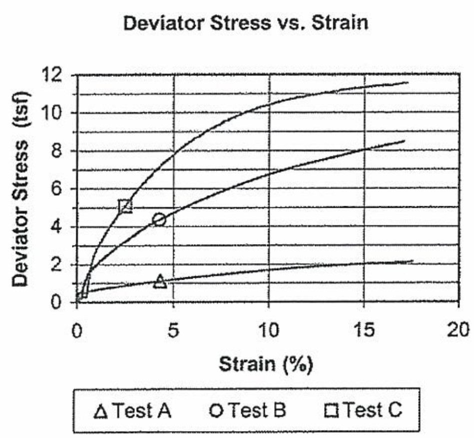
Controlled - Strain Test

Description of Specimens	Silt (ML), gray, moist, firm, with layers of CL, fly ash		
Type of Specimen	Undisturbed	Type of test	R
LL / PL / PI / Gs 2.62	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:			
Boring No.	STN-21	Sample No.	13
Depth Elev.	34.5'-35.0', 35.1'-35.6', 35.7'-36.2'		
Laboratory	Stantec	Date	4-14-10

TRIAXIAL COMPRESSION TEST REPORT

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	27.0	18.4	14.8	
	Dry Density PCF	γ_{d_o}	93.4	110.3	117.9	
	Saturation %	S_o	94.2	100.0	100.1	
	Void Ratio	e_o	0.751	0.482	0.388	
After Shear	Water content %	W_f	25.6	16.4	13.8	
	Dry Density PCF	γ_{d_f}	98.0	114.4	120.2	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.669	0.430	0.360	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.10	4.35	5.07	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	21.8	274.4	14.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.879	2.882	2.883	
Initial Height, in.		H_o	5.978	5.994	5.990	

Controlled - Strain Test

Description of Specimens Silt (ML), gray, moist, firm, with layers of CL, fly ash

		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.62	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
		Boring No.	STN-21	Sample No.	13
		Depth Elev.	34.5'-35.0', 35.1'-35.6', 35.7'-36.2'		
		Laboratory	Stantec	Date	4-14-10
		TRIAXIAL COMPRESSION TEST REPORT			

File: 175559023_cu_13 Sheet: CE_Final-T
Preparation Date: 1998
Revision Date: 1-2008

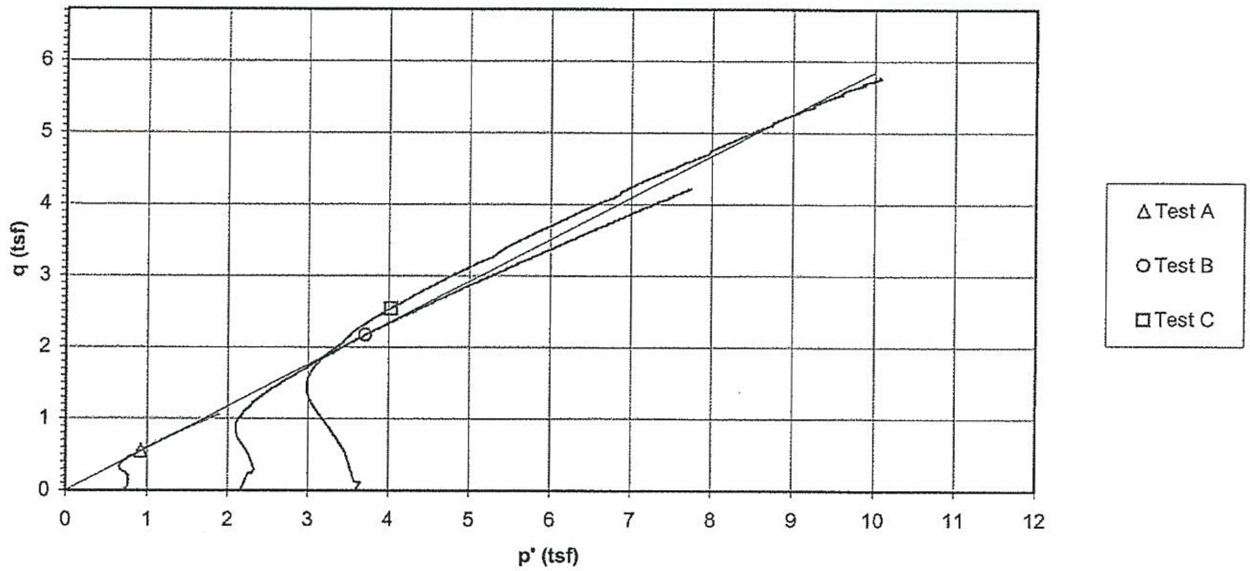
Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

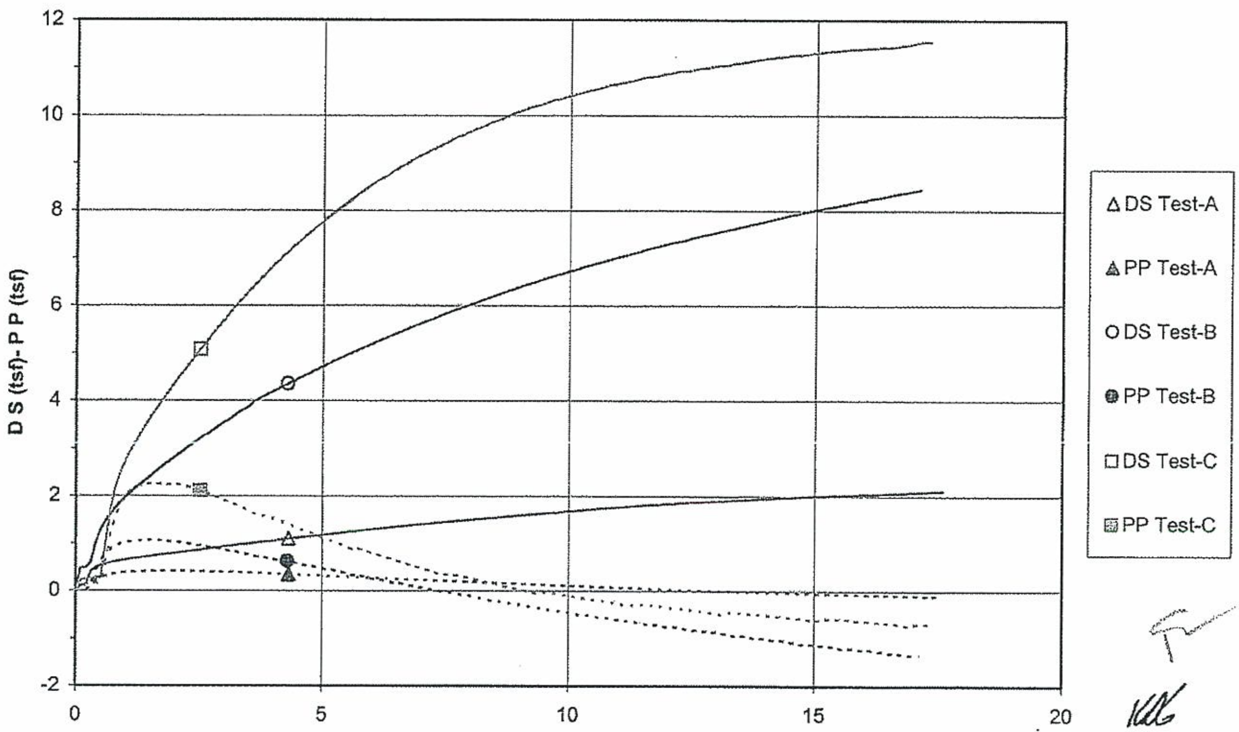
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-21, 34.5'-35.0' & STN-21, 35.1'-35.6' & STN-21, 35.7'-36.2'	Test Number	13
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 35.8 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



File: 175559023_cu_13 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

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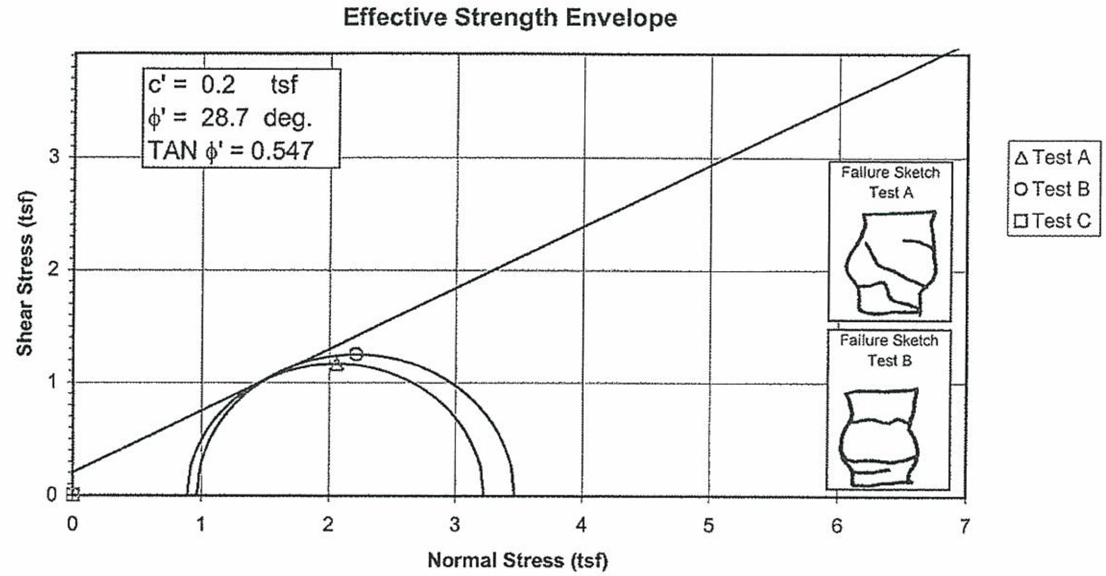
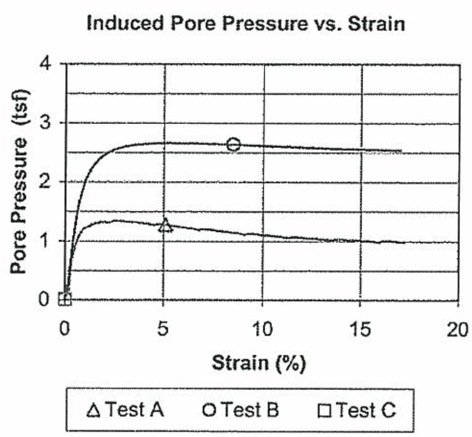
Laboratory Document
Prepared By: MW
Approved BY: TLK

EM 1110-2-1906
Appendix X
30 Nov. 70

Failure Criterion: Maximum Effective Principal Stress Ratio





			A	B	C
Specimen No.			A	B	C
Initial Data	Water content %	W_o	21.5	25.2	######
	Dry Density PCF	γ_{d_o}	98.9	100.2	######
	Saturation %	S_o	92.5	112.5	######
	Void Ratio	e_o	0.584	0.563	######
After Shear	Water content %	W_f	21.3	20.1	######
	Dry Density PCF	γ_{d_f}	102.1	104.1	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	0.535	0.505	######
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.89	0.97	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	2.34	2.50	0.00
Time to $(\sigma1'-\sigma3')$max min.		t_f	25.5	400.9	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.874	2.866	######
Initial Height, in.		H_o	5.986	5.912	######

Controlled - Strain Test

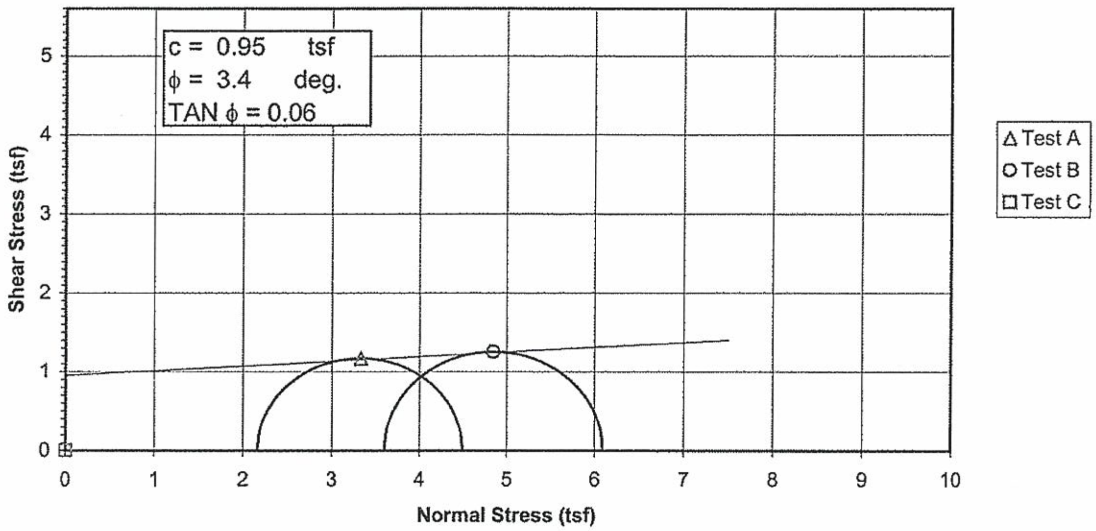
Description of Specimens: Lean Clay (CL), brown, moist, firm, layers of fly ash

Type of Specimen	Undisturbed	Type of test	$\bar{R}$		
LL	PL	PI	Gs 2.51	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
Boring No.	STN-23	Sample No.	14		
Depth Elev.	25.1'-25.6', 25.7'-26.2'				
Laboratory	Stantec	Date	4-14-10		

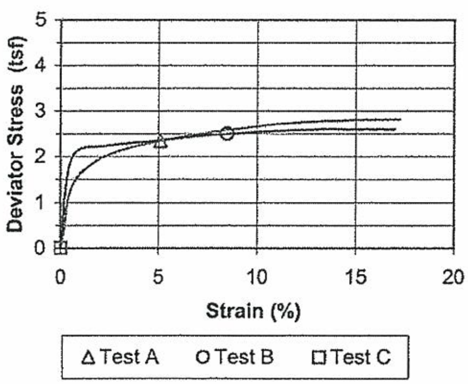
TRIAXIAL COMPRESSION TEST REPORT

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



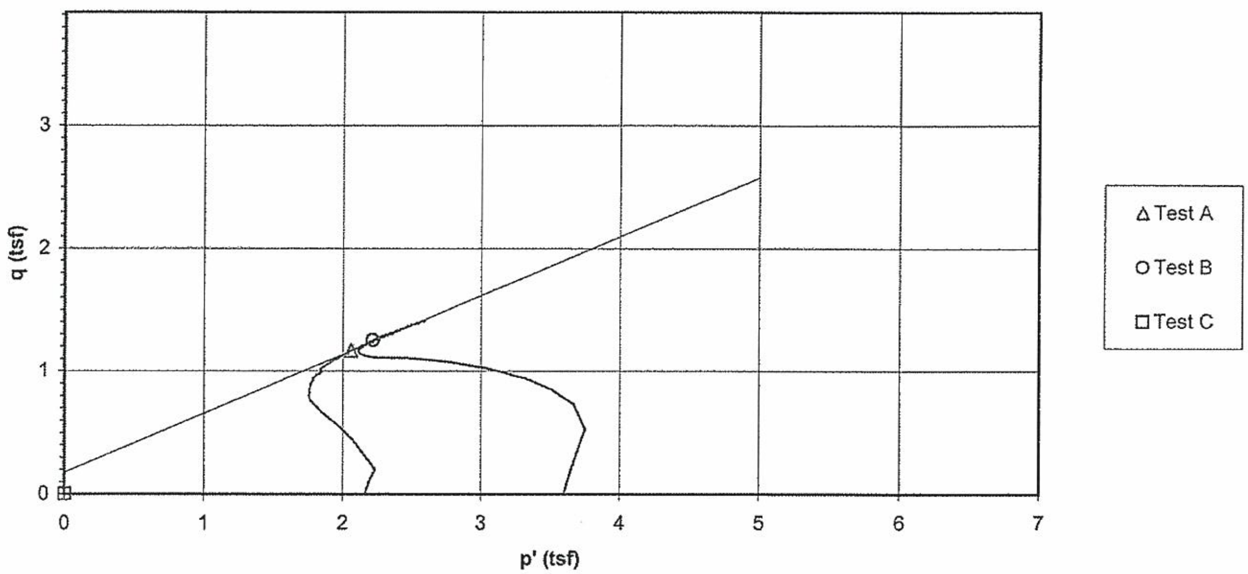
Specimen No.			A	B	C
Initial Data	Water content %	W_o	21.5	25.2	######
	Dry Density PCF	γ_{d_o}	98.9	100.2	######
	Saturation %	S_o	92.5	112.5	######
	Void Ratio	e_o	0.584	0.563	######
After Shear	Water content %	W_f	21.3	20.1	######
	Dry Density PCF	γ_{d_f}	102.1	104.1	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	0.535	0.505	######
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	2.34	2.50	0.00
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	25.5	400.9	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.874	2.866	######
Initial Height, in.		H_o	5.986	5.912	######

Controlled - Strain Test			
Description of Specimens	Lean Clay (CL), brown, moist, firm, layers of fly ash		
	Type of Specimen	Undisturbed	Type of test $\overline{R}$
LL PL PI Gs 2.51	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:			
	Boring No.	STN-23	Sample No. 14
	Depth Elev.	25.1'-25.6', 25.7'-26.2'	
	Laboratory	Stantec	Date 4-14-10
	TRIAXIAL COMPRESSION TEST REPORT		

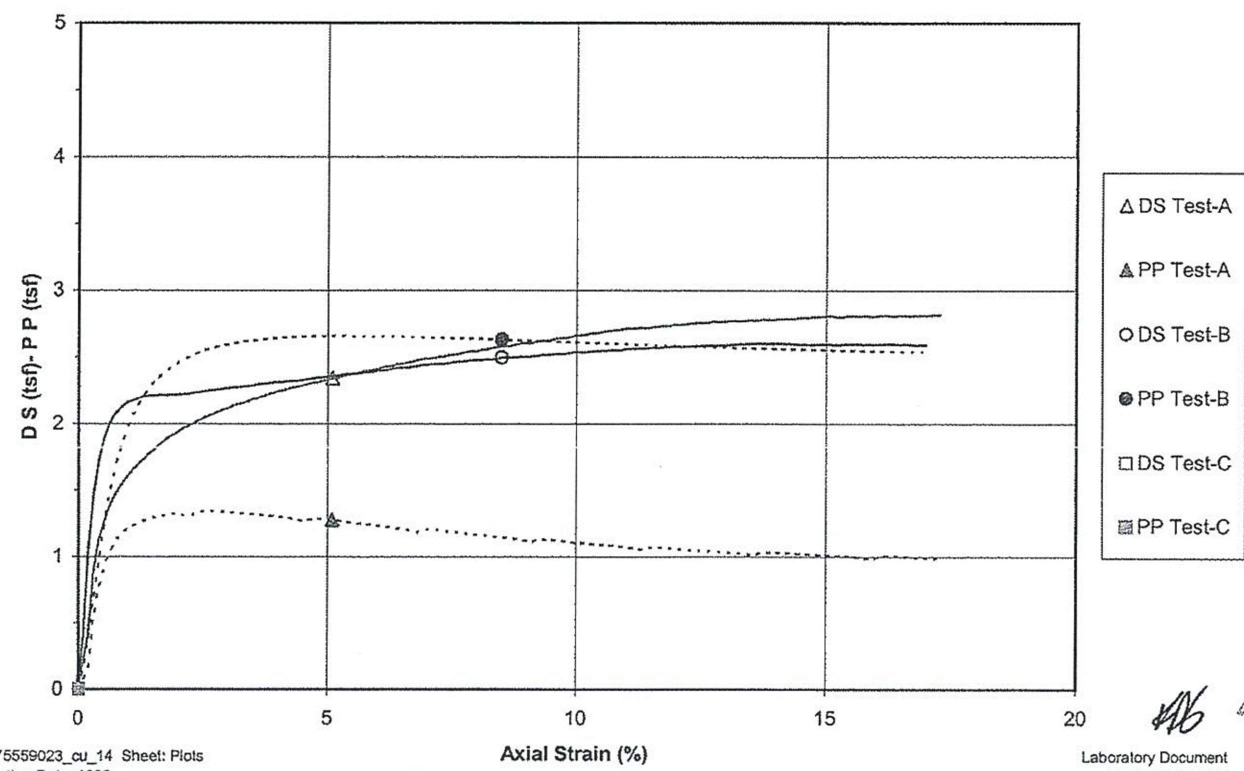
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-23, 25.1'-25.6' & STN-23, 25.7'-26.2'	Test Number	14
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 28.7 deg.	c' =	0.20 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



File: 175559023_cu_14 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

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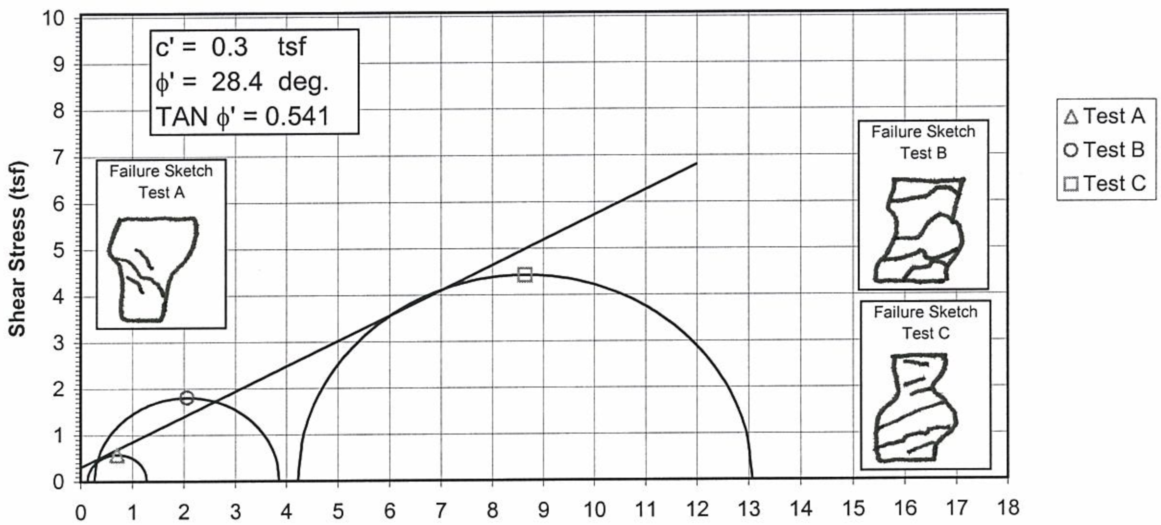
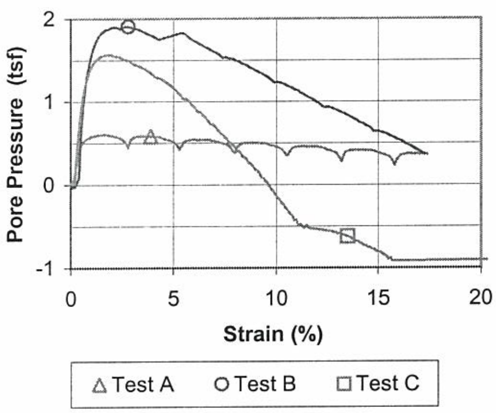
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



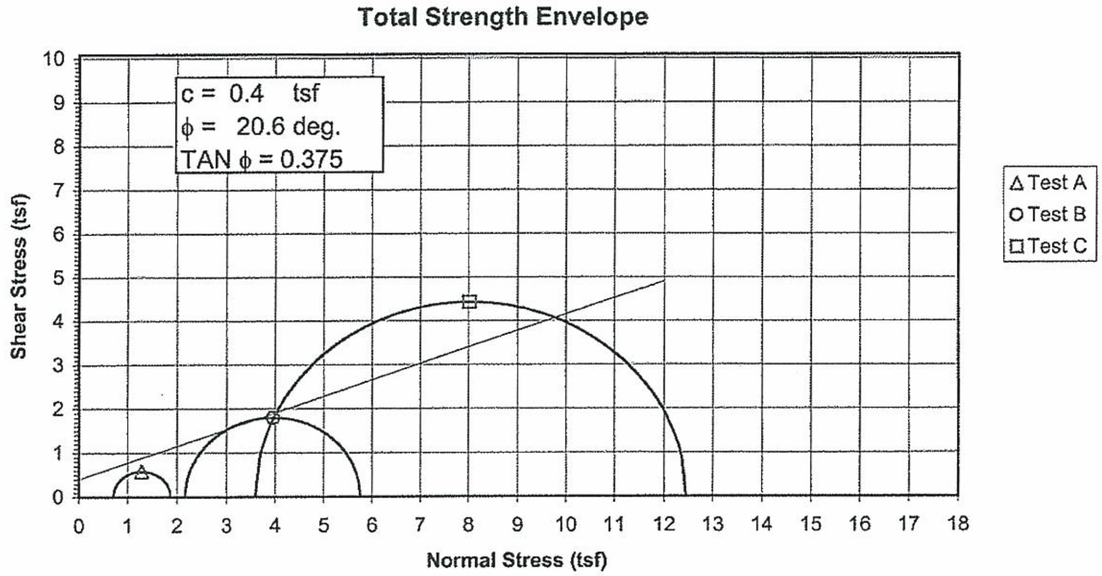
Induced Pore Pressure vs. Strain

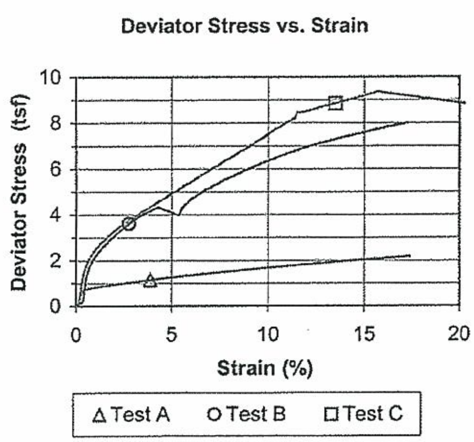


Specimen No.			A	B	C	
Initial Data	Water content %	W_o	13.4	15.4	15.1	
	Dry Density PCF	γ_{d_o}	113.4	115.4	112.1	
	Saturation %	S_o	75.8	91.8	82.3	
	Void Ratio	e_o	0.475	0.450	0.492	
After Shear	Water content %	W_f	16.4	15.7	14.8	
	Dry Density PCF	γ_{d_f}	116.2	117.9	119.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.439	0.420	0.396	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.13	0.27	4.23	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.14	3.61	8.85	
Time to (σ1'-σ3')max min.		t_f	14.7	11.3	1392.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.883	2.889	2.867	
Initial Height, in.		H_o	5.937	5.986	6.008	

Controlled - Strain Test					
Description of Specimens	Lean Clay (CL), brown, moist, firm				
	Type of Specimen	Undisturbed		Type of test	$\overline{R}$
LL	PL	PI	Gs 2.68	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
	Boring No.	STN-32A	Sample No.	1	
	Depth Elev.	7.1'-7.6', 7.7'-8.2', 12.1'-12.6'			
	Laboratory	Stantec	Date	3-29-10	
	TRIAXIAL COMPRESSION TEST REPORT				

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	13.4	15.4	15.1	
	Dry Density PCF	γ_{d_o}	113.4	115.4	112.1	
	Saturation %	S_o	75.8	91.8	82.3	
	Void Ratio	e_o	0.475	0.450	0.492	
After Shear	Water content %	W_f	16.4	15.7	14.8	
	Dry Density PCF	γ_{d_f}	116.2	117.9	119.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.439	0.420	0.396	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.14	3.61	8.85	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	14.7	11.3	1392.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.883	2.889	2.867	
Initial Height, in.		H_o	5.937	5.986	6.008	

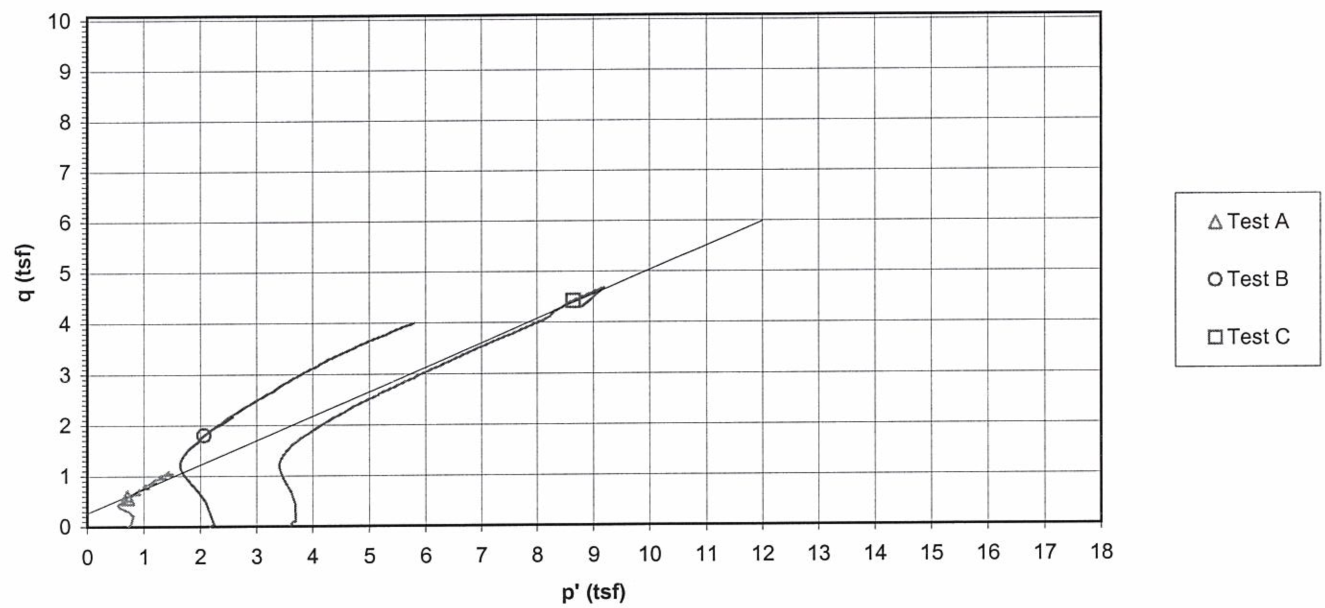
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), brown, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.68	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
		Boring No.	STN-32A	Sample No.	1
		Depth Elev.	7.1'-7.6', 7.7'-8.2', 12.1'-12.6'		
		Laboratory	Stantec	Date	3-29-10
		TRIAXIAL COMPRESSION TEST REPORT			

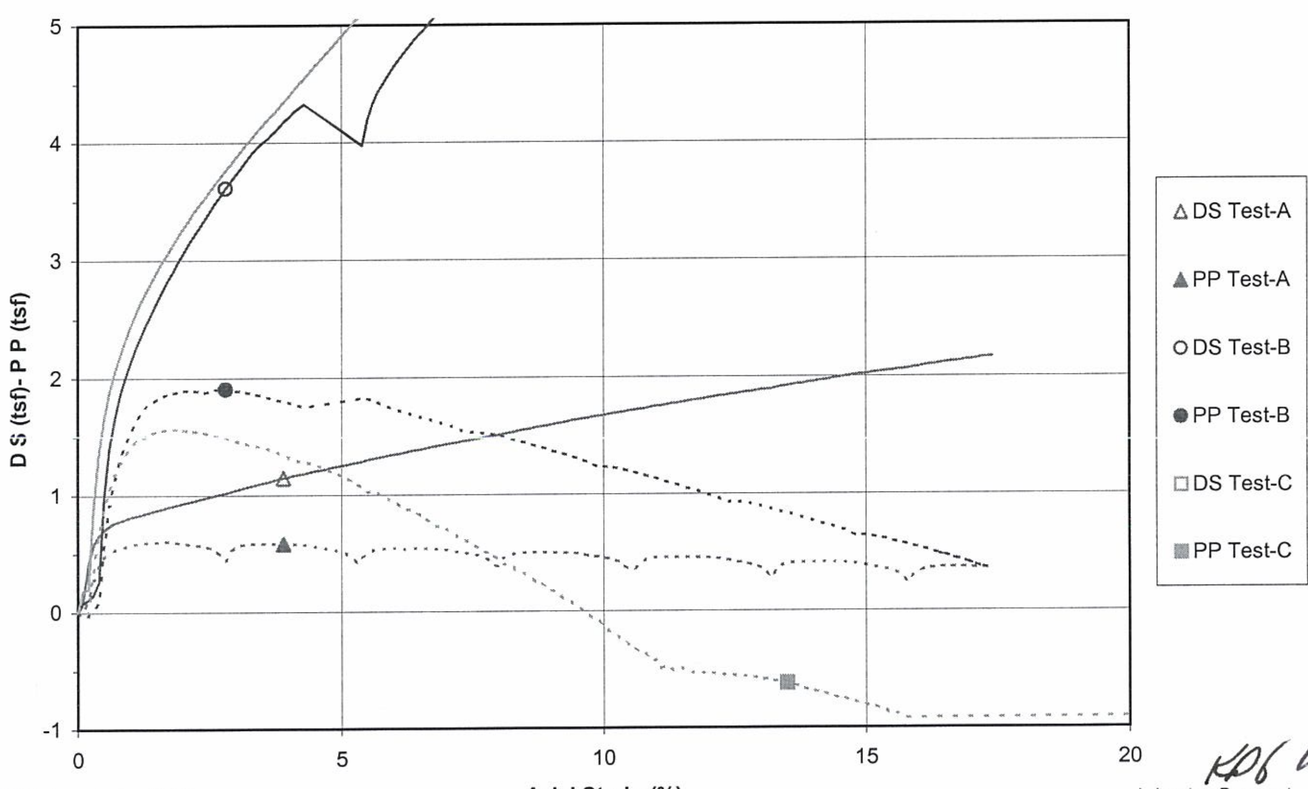
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-32A, 7.1'-7.6' & STN-32A, 7.7'-8.2' & STN-32A, 12.1'-12.6'	Test Number	1
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 28.4 deg.	c' =	0.30 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



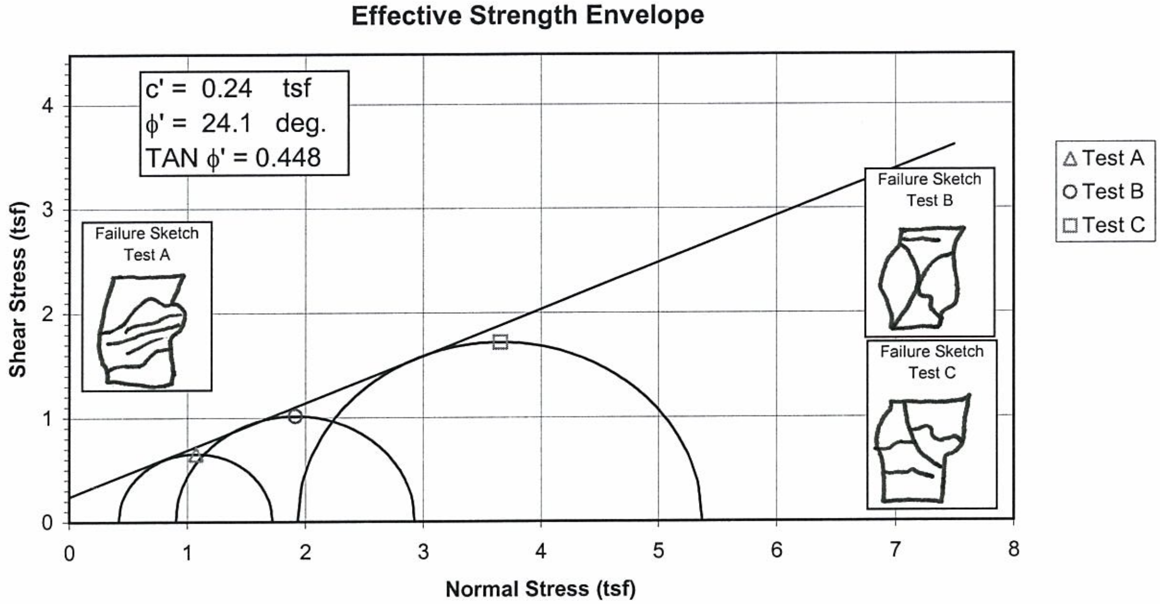
File: 175559023_cu_1 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

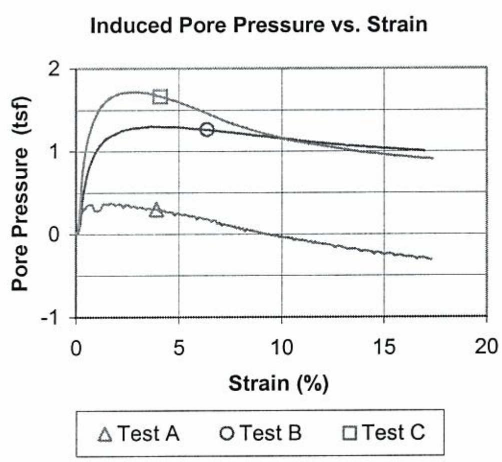
Stantec Consulting Services Inc.

KDG LW

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	19.1	24.2	23.0	
	Dry Density PCF	γ_{d_o}	108.1	100.4	102.3	
	Saturation %	S_o	92.4	96.2	96.1	
	Void Ratio	e_o	0.559	0.679	0.648	
After Shear	Water content %	W_f	19.4	22.0	21.9	
	Dry Density PCF	γ_{d_f}	110.6	105.8	105.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.524	0.593	0.592	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.42	0.90	1.94	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.30	2.03	3.43	
Time to (σ1'-σ3')max min.		t_f	103.4	417.4	140.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	3.21	
Initial Diameter, in.		D_o	2.875	2.886	2.876	
Initial Height, in.		H_o	5.988	5.996	5.979	

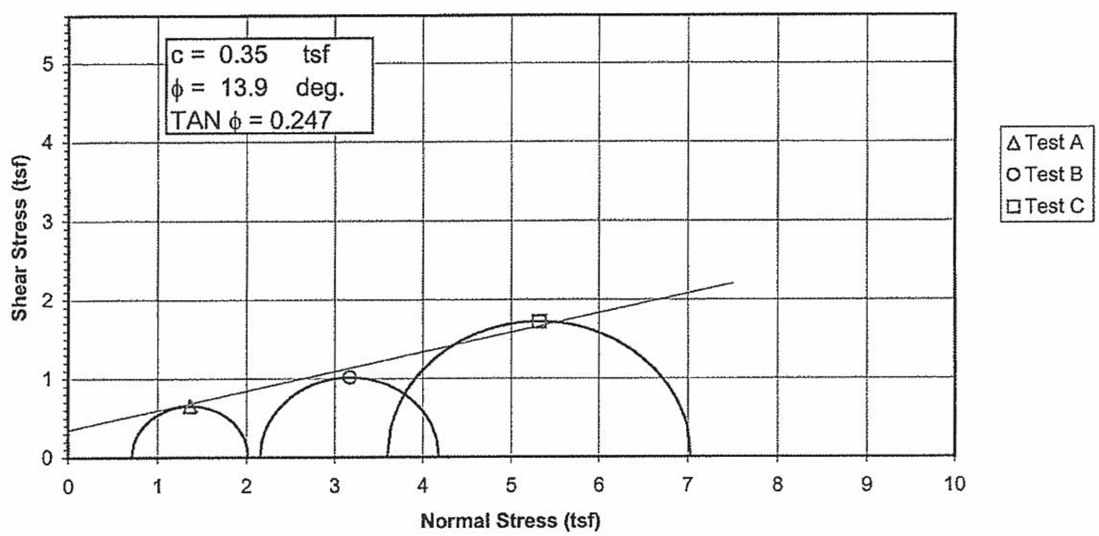
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), brown, moist, firm			
	Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL / PL / PI / Gs 2.7	Project	Shawnee Fossil Plant (SHF) - Ash Ponds		
Remarks:	Boring No.	STN-32A, STN-32B		
			Sample No.	2
	Depth Elev.	19.1'-19.6', 22.1'-22.6', 22.7'-23.2'		
	Laboratory	Stantec	Date	3-29-10
	TRIAXIAL COMPRESSION TEST REPORT			

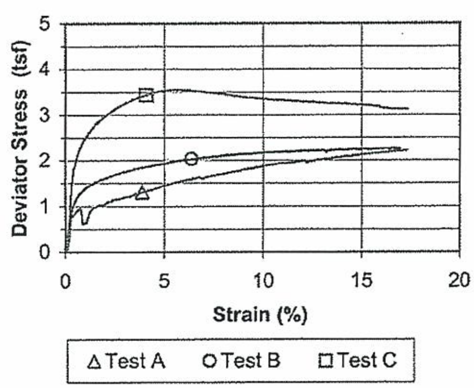
KDG GW

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	19.1	24.2	23.0	
	Dry Density PCF	γ_{d_o}	108.1	100.4	102.3	
	Saturation %	S_o	92.4	96.2	96.1	
	Void Ratio	e_o	0.559	0.679	0.648	
After Shear	Water content %	W_f	19.4	22.0	21.9	
	Dry Density PCF	γ_{d_f}	110.6	105.8	105.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.524	0.593	0.592	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.30	2.03	3.43	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	103.4	417.4	140.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	3.21	
Initial Diameter, in.		D_o	2.875	2.886	2.876	
Initial Height, in.		H_o	5.988	5.996	5.979	

Controlled - Strain Test

Description of Specimens Lean Clay (CL), brown, moist, firm

				Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.7	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:				Boring No.	STN-32A, STN-32B	
						Sample No. 2
				Depth Elev.	19.1'-19.6', 22.1'-22.6', 22.7'-23.2'	
				Laboratory	FMSM Engineers	Date 3-29-10
				TRIAXIAL COMPRESSION TEST REPORT		

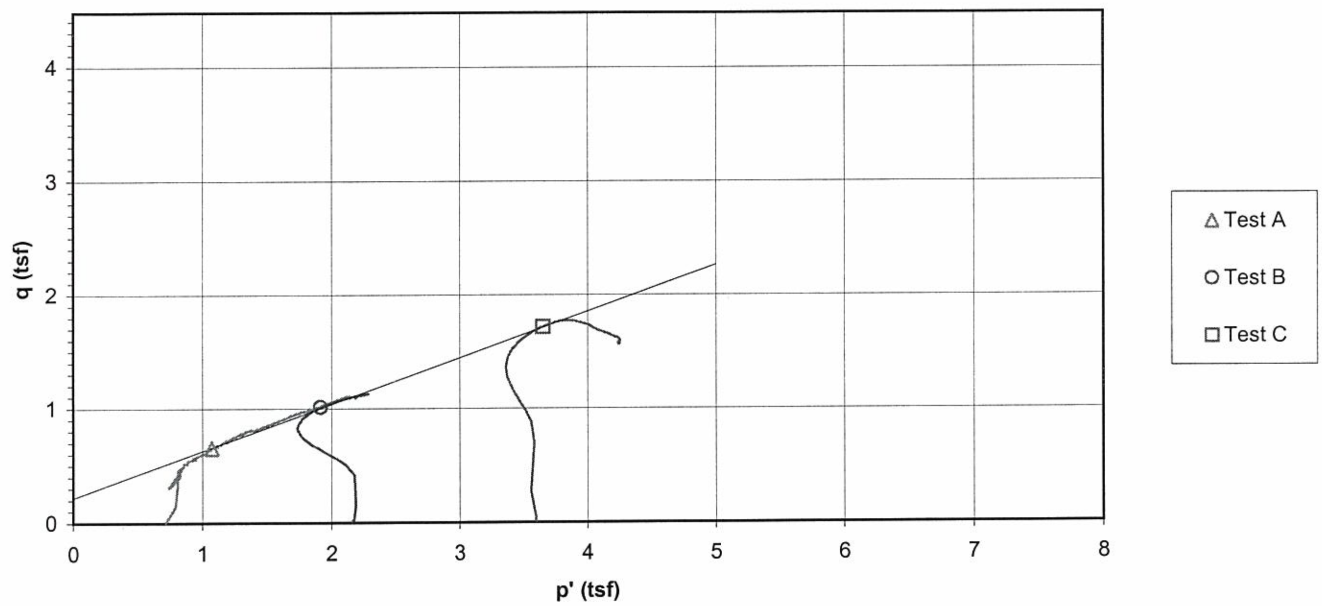
KDG

Laboratory Document
Prepared By: MW
Approved BY: TLK

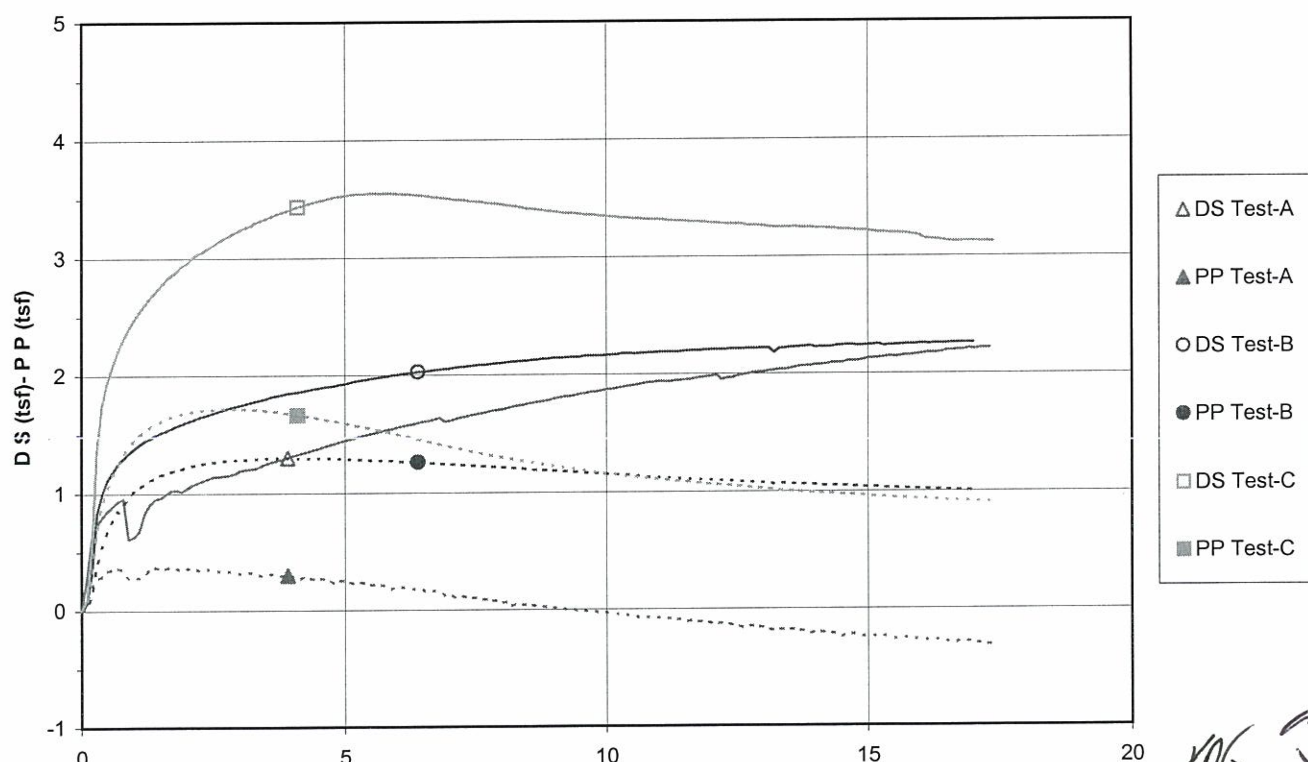
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-32B, 19.1'-19.6' & STN-32A, 22.1'-22.6' & STN-32A, 22.7'-23.2'	Test Number	2
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 24.1 deg.	c' =	0.24 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



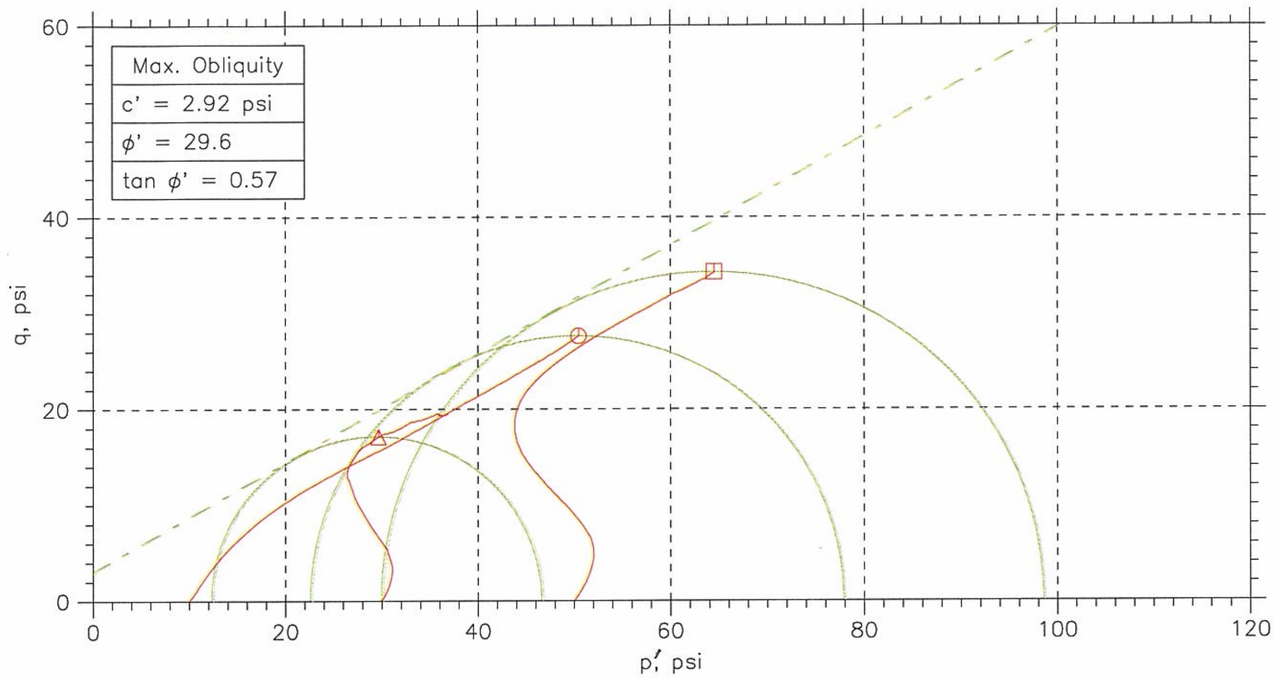
Axial Strain (%)

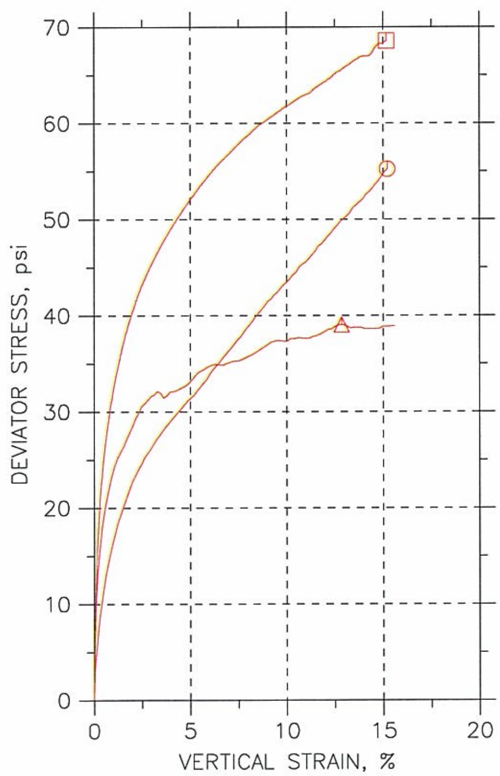
File: 175559023_cu_2 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





Symbol		○	△	□	
Sample No.		ST-2	ST-2	ST-2	
Test No.		4.1	4.2	4.3	
Depth		8.1-8.6	8.6-9.2	9.2-9.8'	
Initial	Diameter, in	1.313	2.84	2.83	
	Height, in	2.997	6.114	6.258	
	Water Content, %	23.8	23.5	24.3	
	Dry Density, pcf	102.6	102.3	102.1	
	Saturation, %	99.9	97.9	100.9	
	Void Ratio	0.643	0.647	0.651	
Before Shear	Water Content, %	22.9	22.5	22.3	
	Dry Density, pcf	104.1	104.8	105.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.619	0.608	0.601	
	Back Press., psi	136	119	74.24	
Ver. Eff. Cons. Stress, psi		9.986	29.96	49.98	
Shear Strength, psi		27.62	19.53	34.28	
Strain at Failure, %		15.2	12.9	15.2	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.96	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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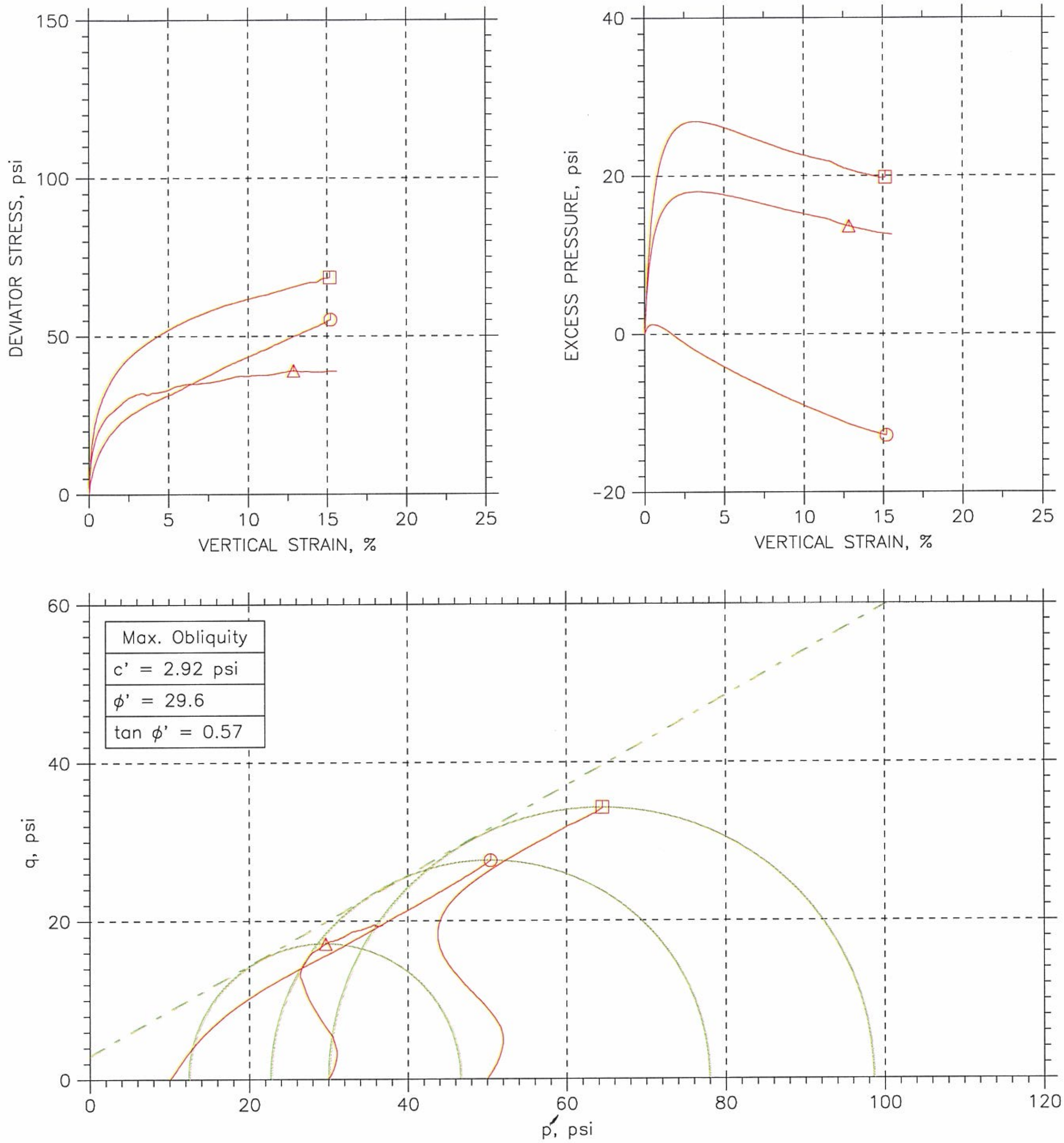
Project: Shawnee Fossil Plant-AP12	
Location: ---	
Project No.: GTX-1504	
Boring No.: STN-33 -SI	
Sample Type: UD	
Description: Brown Lean clay	
Remarks: System 1062	

Tue, 24-NOV-2009 09:49:55

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	4.1	8.1-8.6	jm	11/13/09	mm		1504-4.1.dat
△	ST-2	4.2	8.6-9.2	MM	10/28/09	GT		1504-4.2.dat
□	ST-2	4.3	9.2-9.8'	MM	10/28/09	GT		1504-4.3.dat

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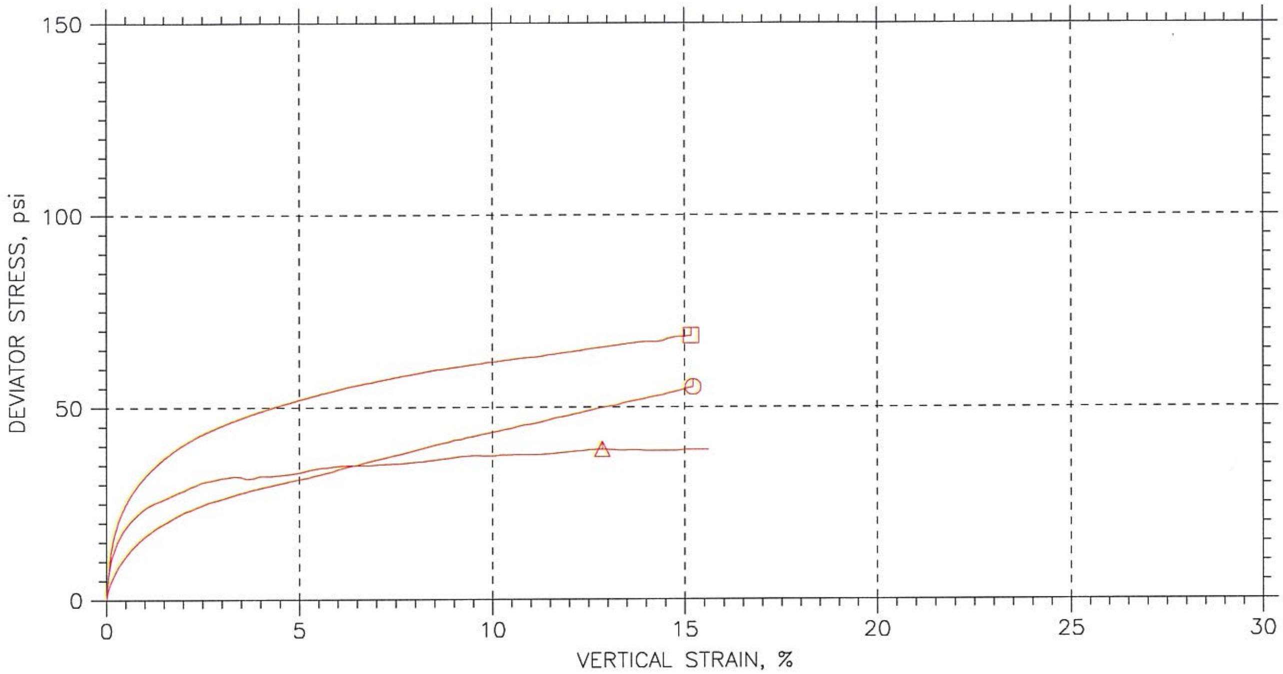
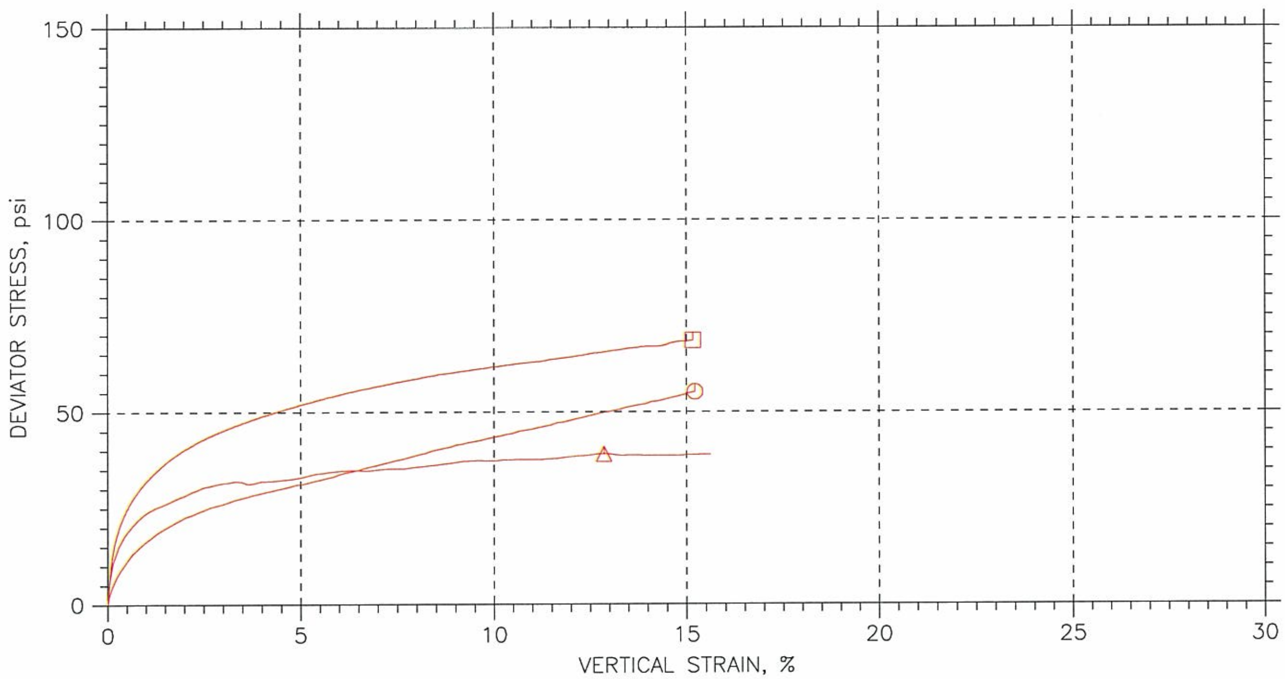
Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-33-SI	Sample Type: UD	
Description: Brown Lean clay		
Remarks: System 1062		

Tue, 24-NOV-2009 09:49:57

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	4.1	8.1-8.6	jm	11/13/09	mm		1504-4.1.dat
△	ST-2	4.2	8.6-9.2	MM	10/28/09	GT		1504-4.2.dat
□	ST-2	4.3	9.2-9.8'	MM	10/28/09	GT		1504-4.3.dat

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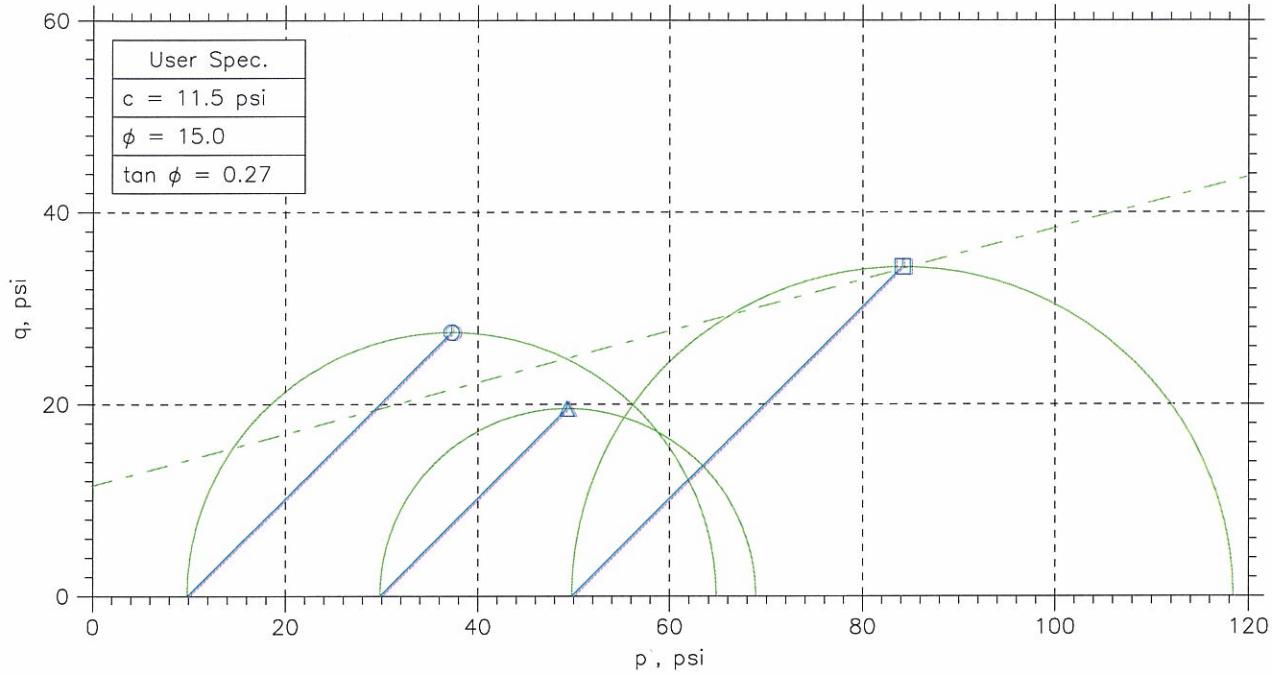
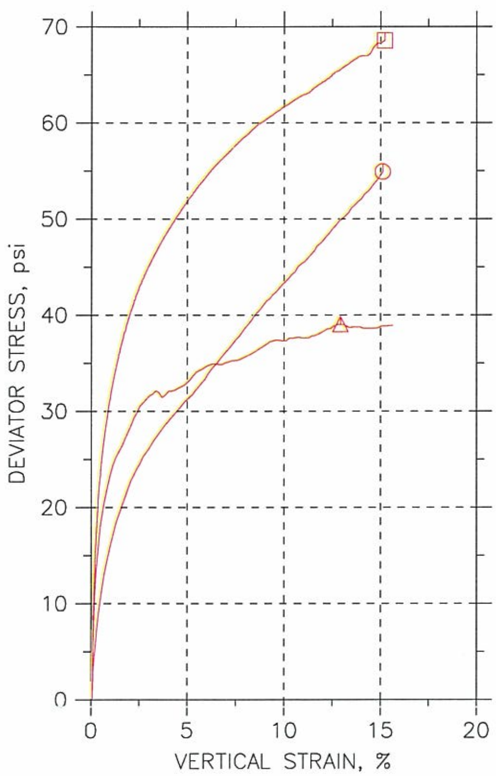
Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-33-SI	Sample Type: UD	
Description: Brown Lean clay		
Remarks: System 1062		

Tue, 24-NOV-2009 09:49:58

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



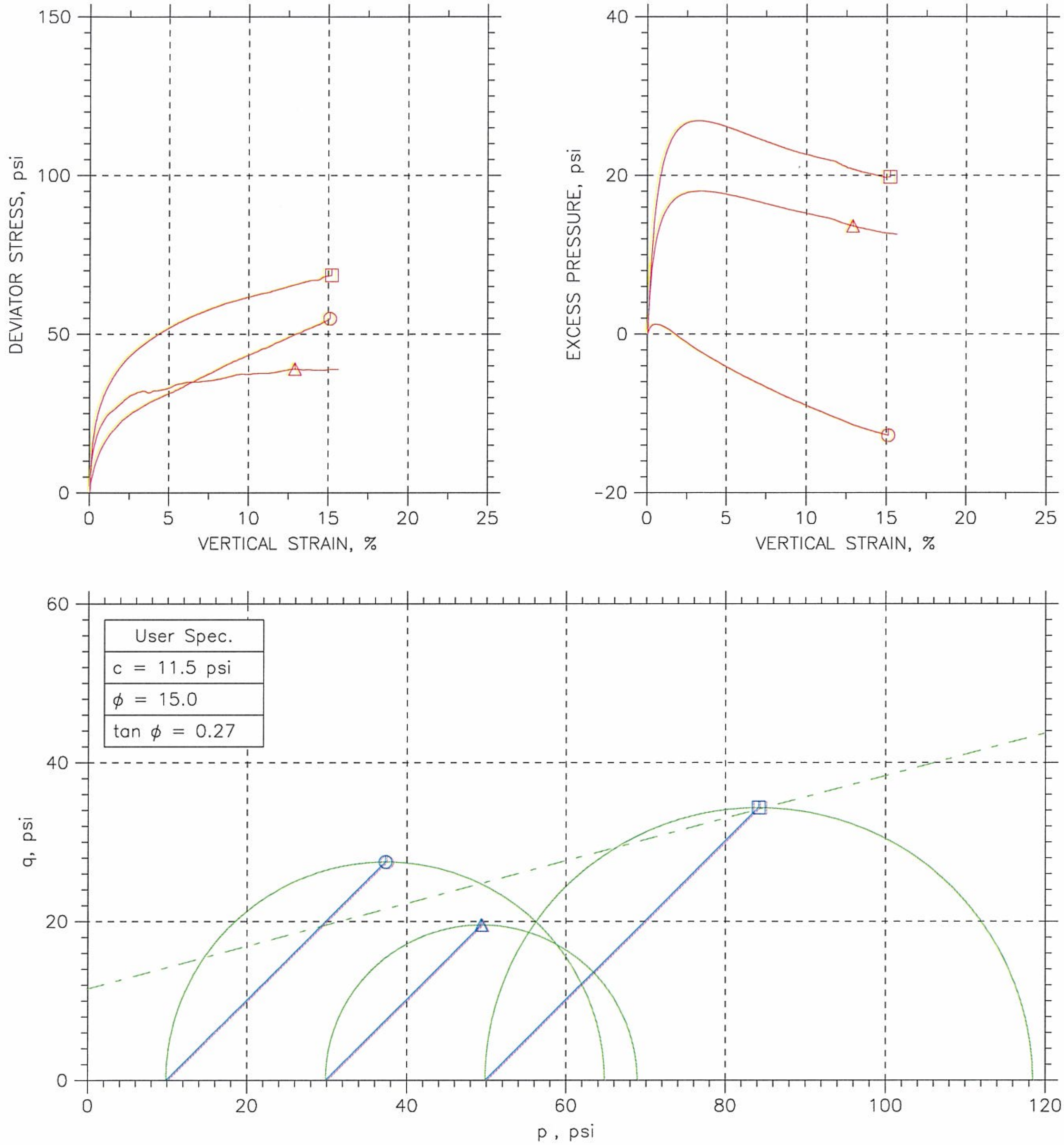


Symbol		○	△	□	
Sample No.		ST-2	ST-2	ST-2	
Test No.		4.1	4.2	4.3	
Depth		8.1-8.6	8.6-9.2	9.2-9.8'	
Initial	Diameter, in	1.313	2.84	2.83	
	Height, in	2.997	6.114	6.258	
	Water Content, %	23.8	23.5	24.3	
	Dry Density, pcf	102.6	102.3	102.1	
	Saturation, %	99.9	97.9	100.9	
	Void Ratio	0.643	0.647	0.651	
Before Shear	Water Content, %	22.9	22.5	22.3	
	Dry Density, pcf	104.1	104.8	105.3	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.619	0.608	0.601	
	Back Press., psi	136	119	74.24	
Ver. Eff. Cons. Stress, psi		9.986	29.96	49.98	
Shear Strength, psi		27.46	19.53	34.28	
Strain at Failure, %		15.1	12.9	15.2	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.96	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

Project: Shawnee Fossil Plant-AP12
Location: ---
Project No.: GTX-1504
Boring No.: STN-33- ST
Sample Type: UD
Description: Brown Lean clay
Remarks: System 1062

Fri, 23-APR-2010 13:54:11

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

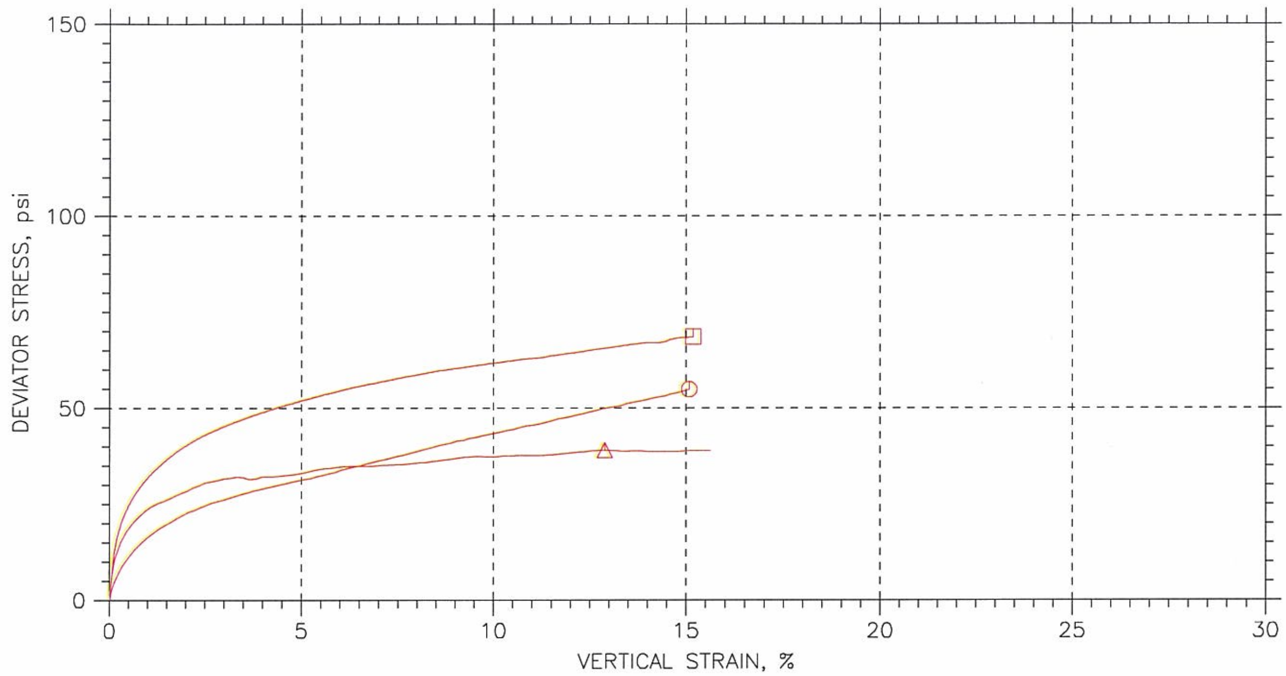


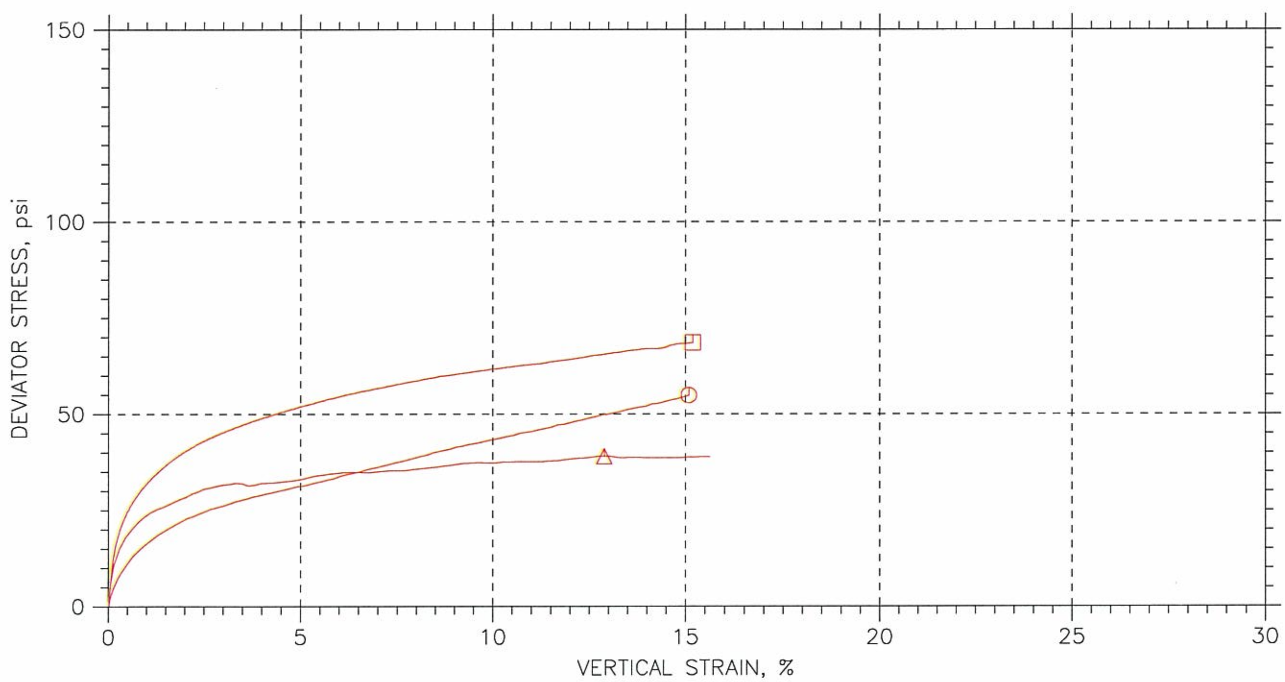
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	4.1	8.1-8.6	jm	11/13/09	mm		1504-4.1-15%.dat
△	ST-2	4.2	8.6-9.2	MM	10/28/09	GT		1504-4.2.dat
□	ST-2	4.3	9.2-9.8'	MM	10/28/09	GT		1504-4.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-33 ~ SI	Sample Type: UD	
Description: Brown Lean clay		
Remarks: System 1062		

Fri, 23-APR-2010 13:54:12

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



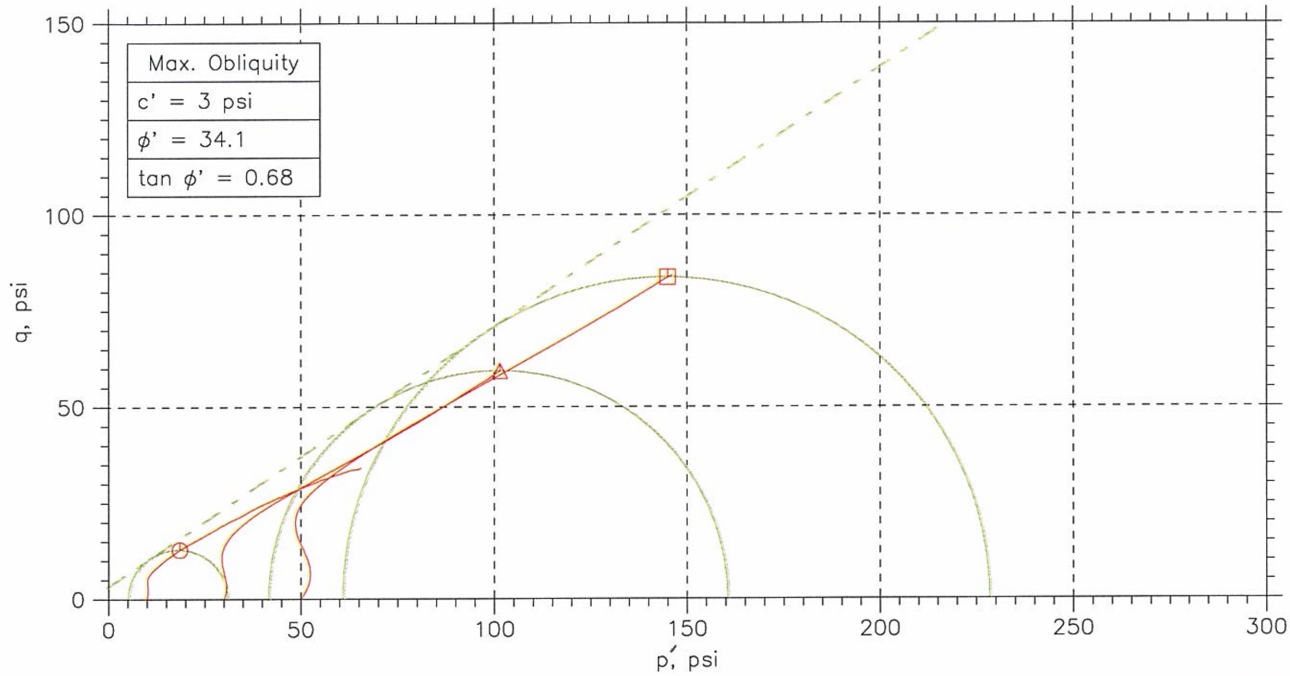


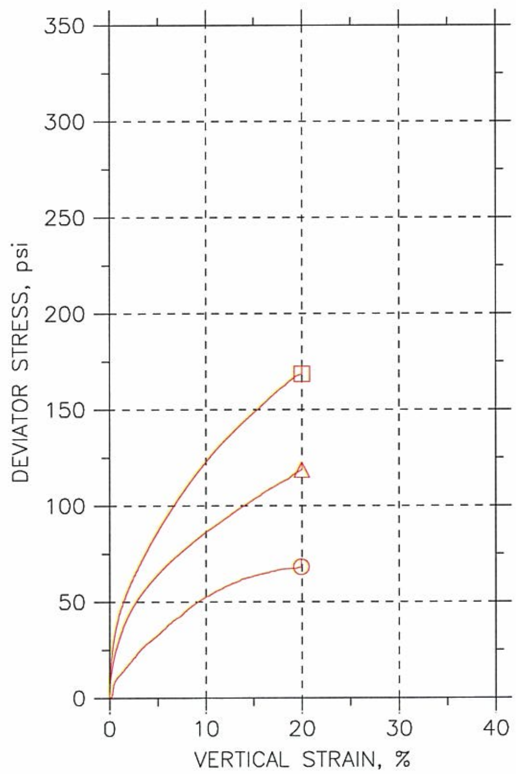
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	4.1	8.1-8.6	jm	11/13/09	mm		1504-4.1-15%.dat
△	ST-2	4.2	8.6-9.2	MM	10/28/09	GT		1504-4.2.dat
□	ST-2	4.3	9.2-9.8'	MM	10/28/09	GT		1504-4.3.dat

Project: Shawnee Fossil Plant-AP1	Location: ---	Project No.: GTX-1504
Boring No.: STN-33 ~ ST	Sample Type: UD	
Description: Brown Lean clay		
Remarks: System 1062		

Fri, 23-APR-2010 13:54:12

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





		○	△	□	
Symbol		○	△	□	
Sample No.		ST-2	ST-1	ST-1	
Test No.		5.1	5.2	5.3	
Depth		6.9 - 7.8	4.8 - 5.4	5.4-6.0	
Initial	Diameter, in	2.852	2.828	2.865	
	Height, in	6.52	6.191	6.43	
	Water Content, %	14.5	14.2	16.9	
	Dry Density, pcf	119.6	121.8	114.8	
	Saturation, %	95.5	100.1	97.4	
	Void Ratio	0.41	0.384	0.468	
Before Shear	Water Content, %	15.0	14.8	16.5	
	Dry Density, pcf	120.	120.5	116.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.405	0.399	0.446	
	Back Press., psi	134	119	74.36	
Ver. Eff. Cons. Stress, psi		9.989	29.96	49.98	
Shear Strength, psi		34.18	59.42	84.35	
Strain at Failure, %		20	20	20	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.95	0.96	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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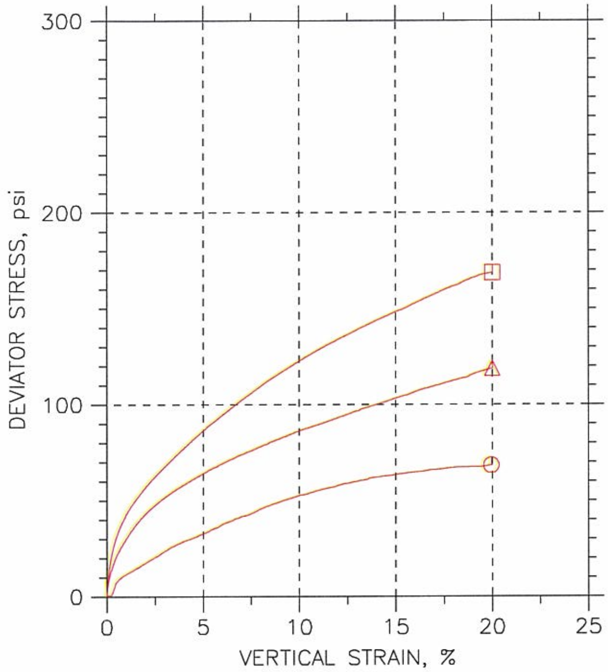
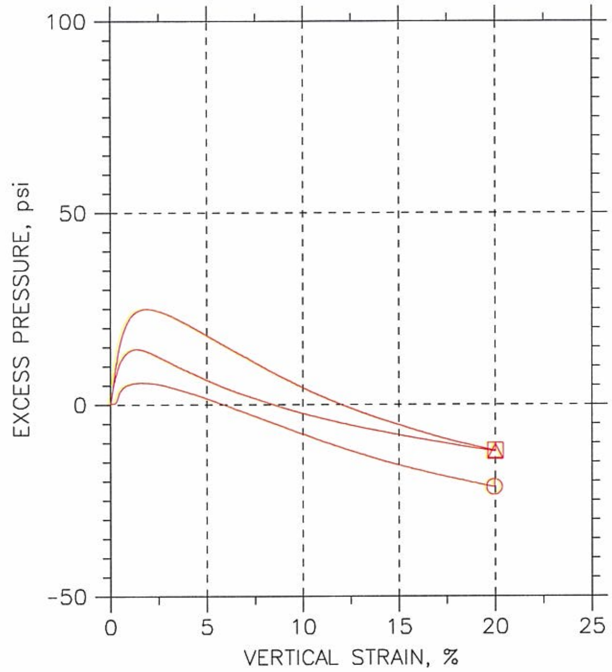
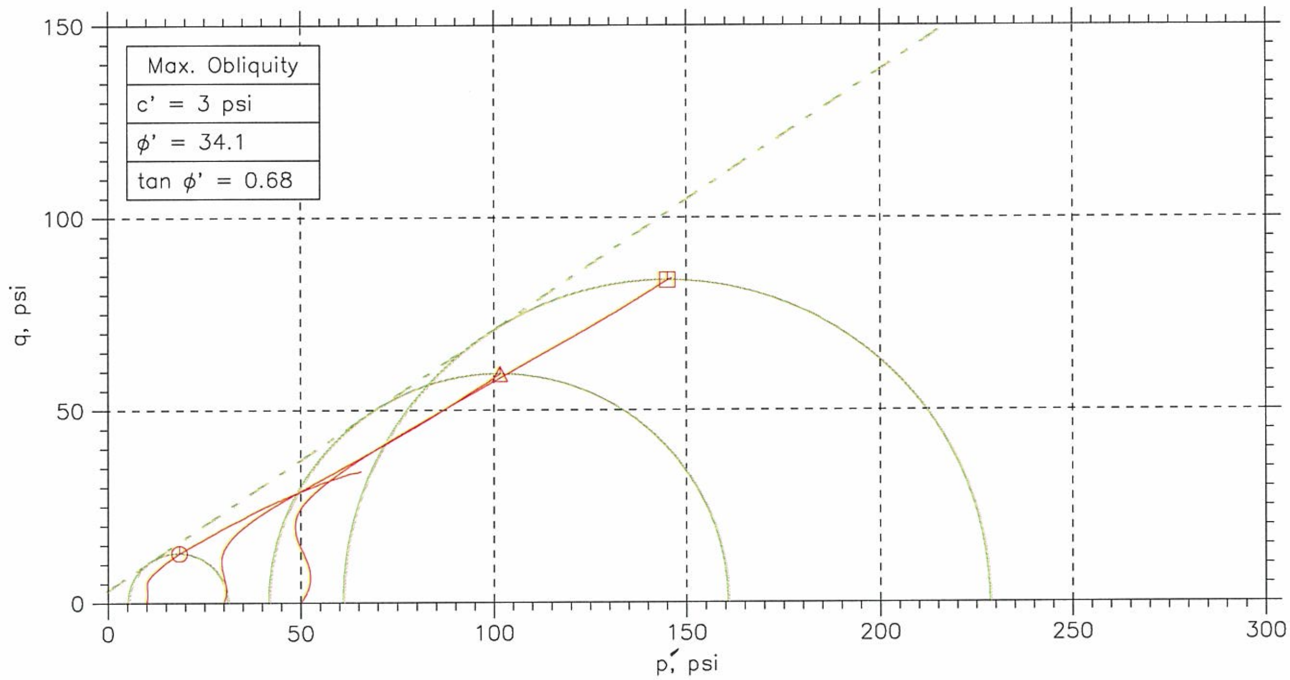
Project: Shawnee Fossil Plant-AP12
Location: ---
Project No.: GTX-1504
Boring No.: STN-39
Sample Type: UD
Description: Brown sandy lean clay
Remarks: System 1062

Wed, 25-NOV-2009 11:34:29

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767







	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	5.1	6.9 - 7.8	MM	10/30/09	GT		1504-5.1.dat
△	ST-1	5.2	4.8 - 5.4	jm	10/30/09	mm		1504-5.2.dat
□	ST-1	5.3	5.4-6.0	JM	10/30/09	MM		1504-5.3.dat

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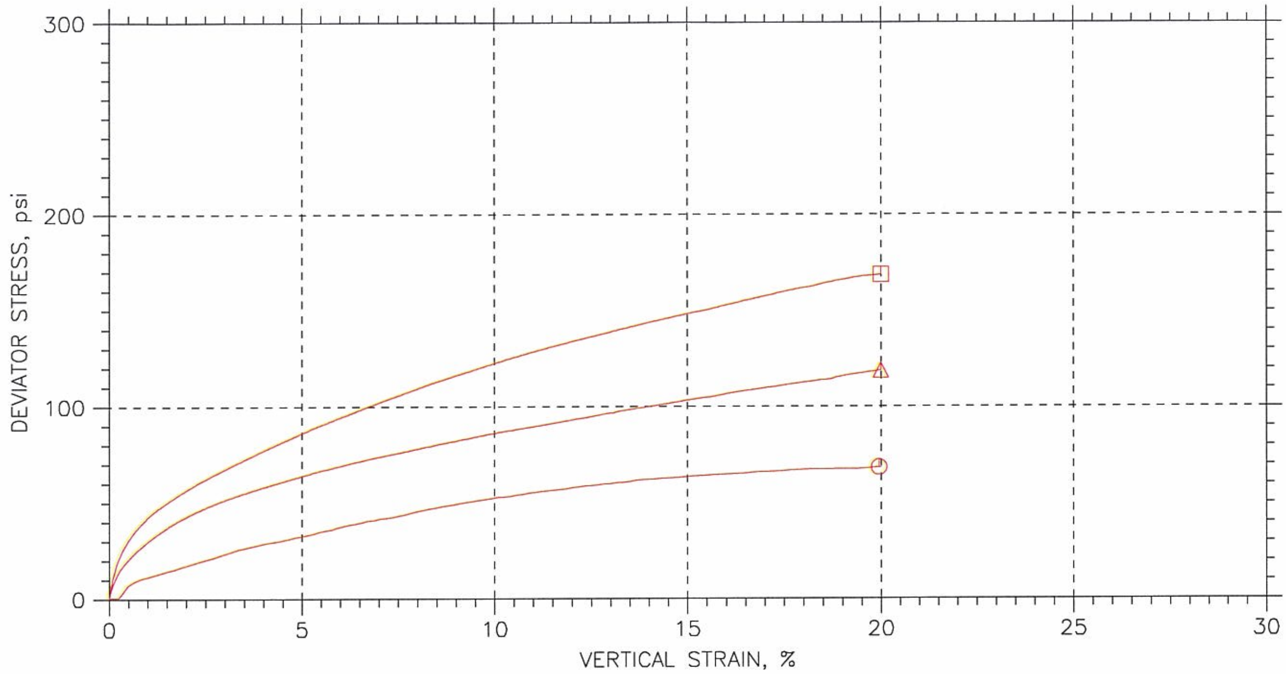
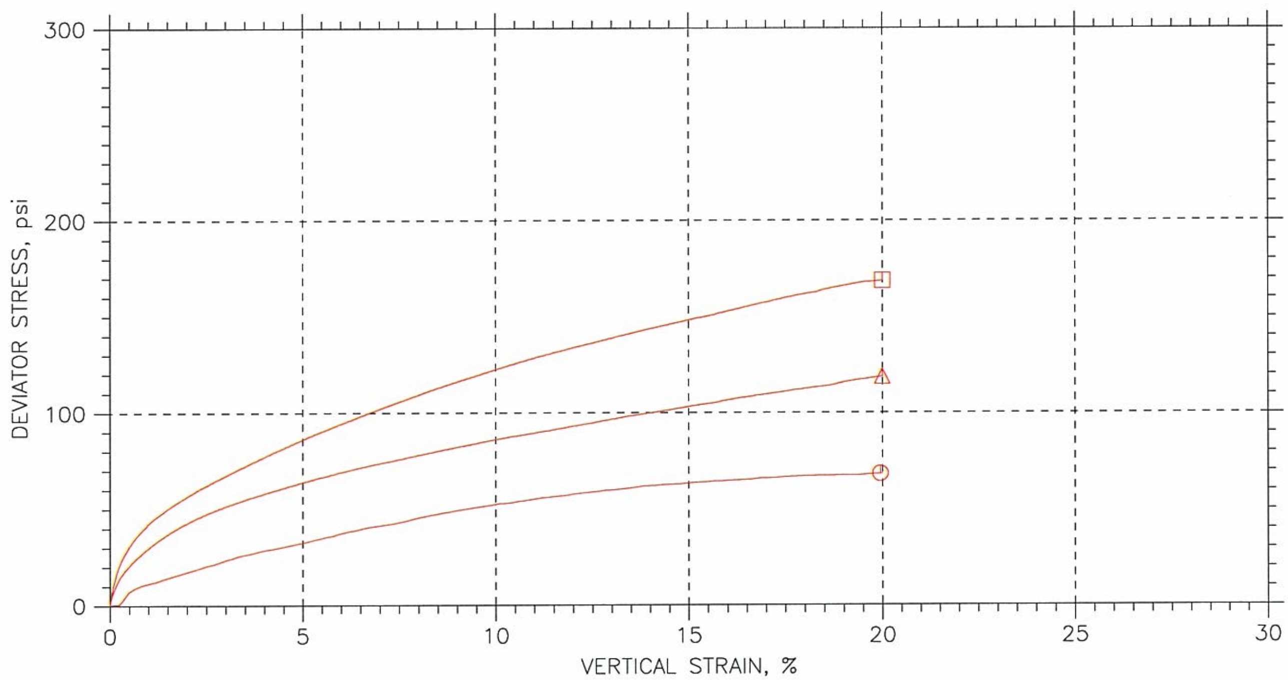
Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Brown sandy lean clay		
Remarks: System 1062		

Wed, 25-NOV-2009 11:34:30

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	5.1	6.9 - 7.8	MM	10/30/09	GT		1504-5.1.dat
△	ST-1	5.2	4.8 - 5.4	jm	10/30/09	mm		1504-5.2.dat
□	ST-1	5.3	5.4-6.0	JM	10/30/09	MM		1504-5.3.dat

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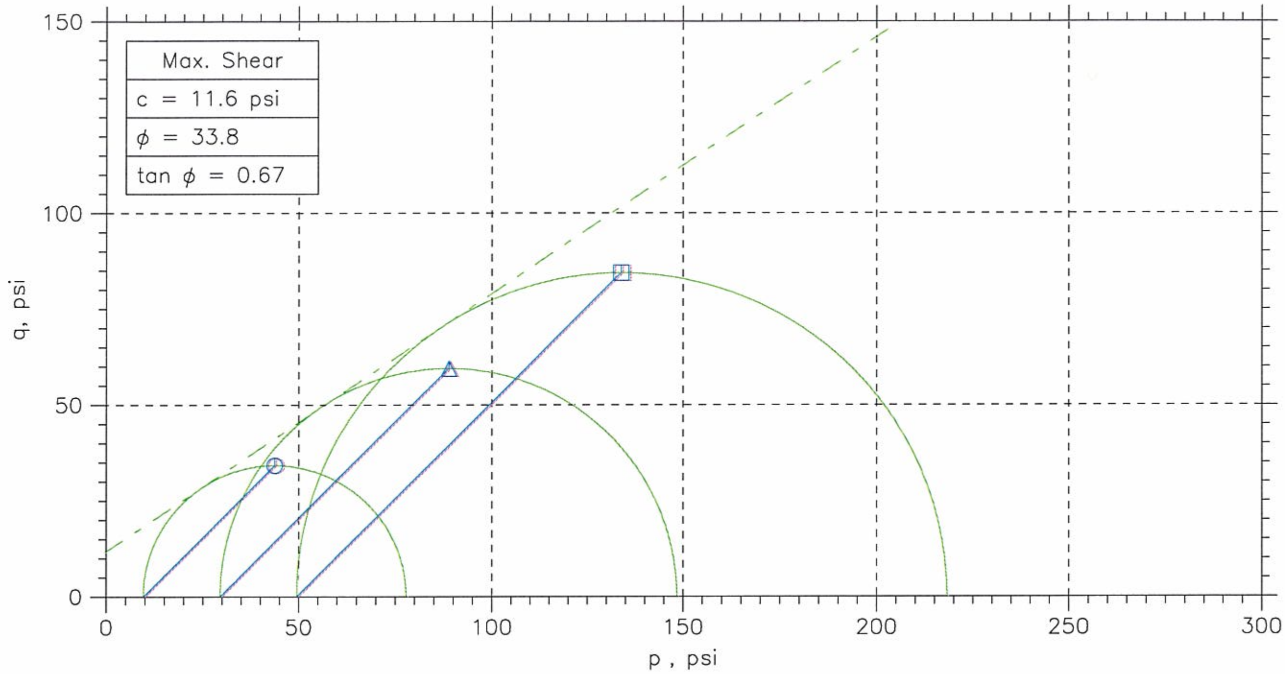
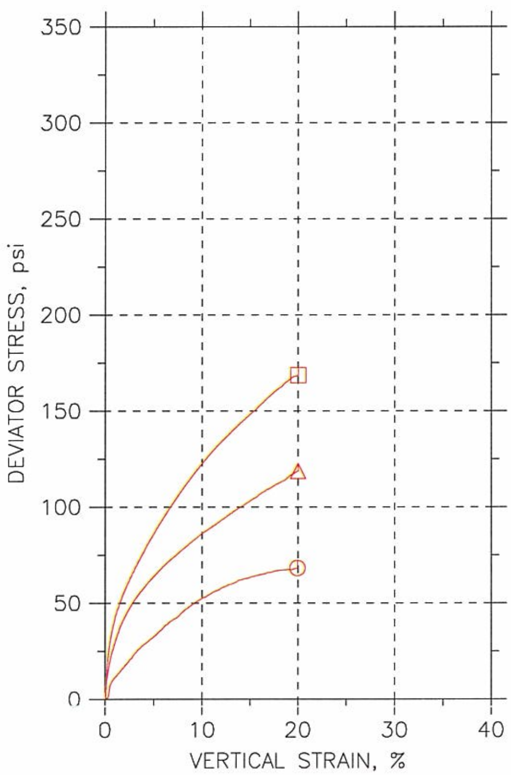
Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Brown sandy lean clay		
Remarks: System 1062		

Wed, 25-NOV-2009 11:34:32

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



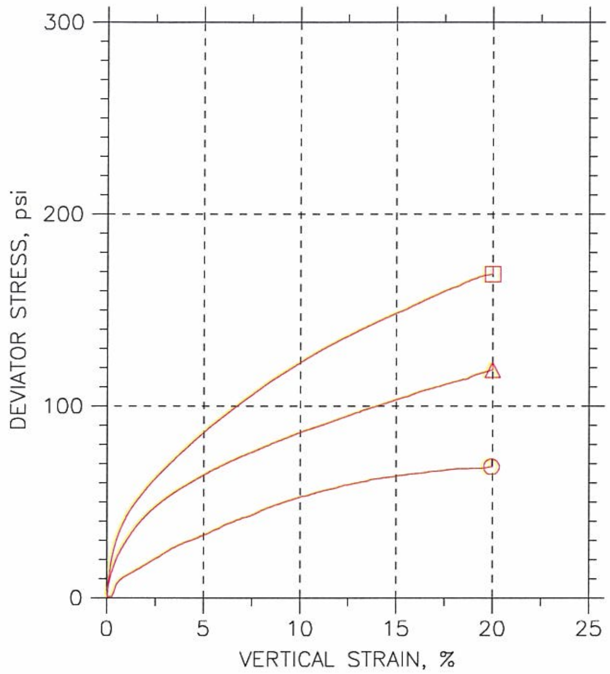


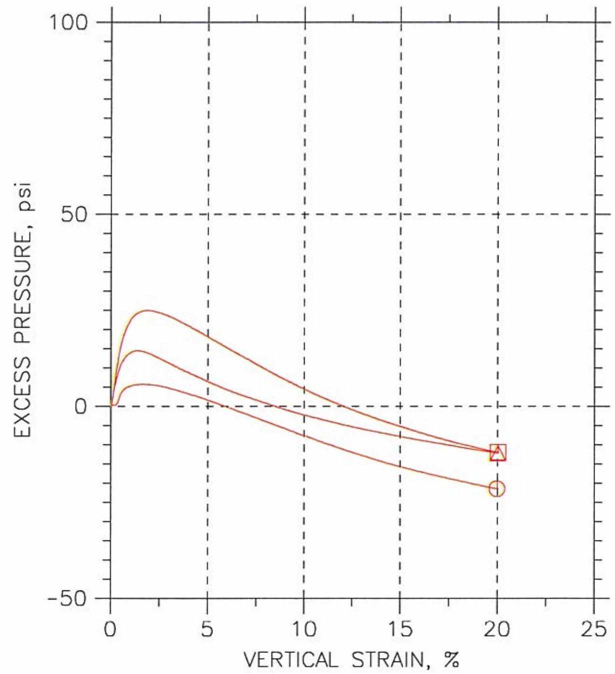
	Symbol	○	△	□	
	Sample No.	ST-2	ST-1	ST-1	
	Test No.	5.1	5.2	5.3	
	Depth	6.9 - 7.8	4.8 - 5.4	5.4-6.0	
Initial	Diameter, in	2.852	2.828	2.865	
	Height, in	6.52	6.191	6.43	
	Water Content, %	14.5	14.2	16.9	
	Dry Density, pcf	119.6	121.8	114.8	
	Saturation, %	95.5	100.1	97.4	
	Void Ratio	0.41	0.384	0.468	
Before Shear	Water Content, %	15.0	14.8	16.5	
	Dry Density, pcf	120.	120.5	116.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.405	0.399	0.446	
	Back Press., psi	134	119	74.36	
	Ver. Eff. Cons. Stress, psi	9.989	29.96	49.98	
	Shear Strength, psi	34.18	59.42	84.35	
	Strain at Failure, %	20	20	20	
	Strain Rate, %/min	0.016	0.016	0.016	
	B-Value	0.95	0.96	0.95	
	Estimated Specific Gravity	2.7	2.7	2.7	
	Liquid Limit	---	---	---	
	Plastic Limit	---	---	---	

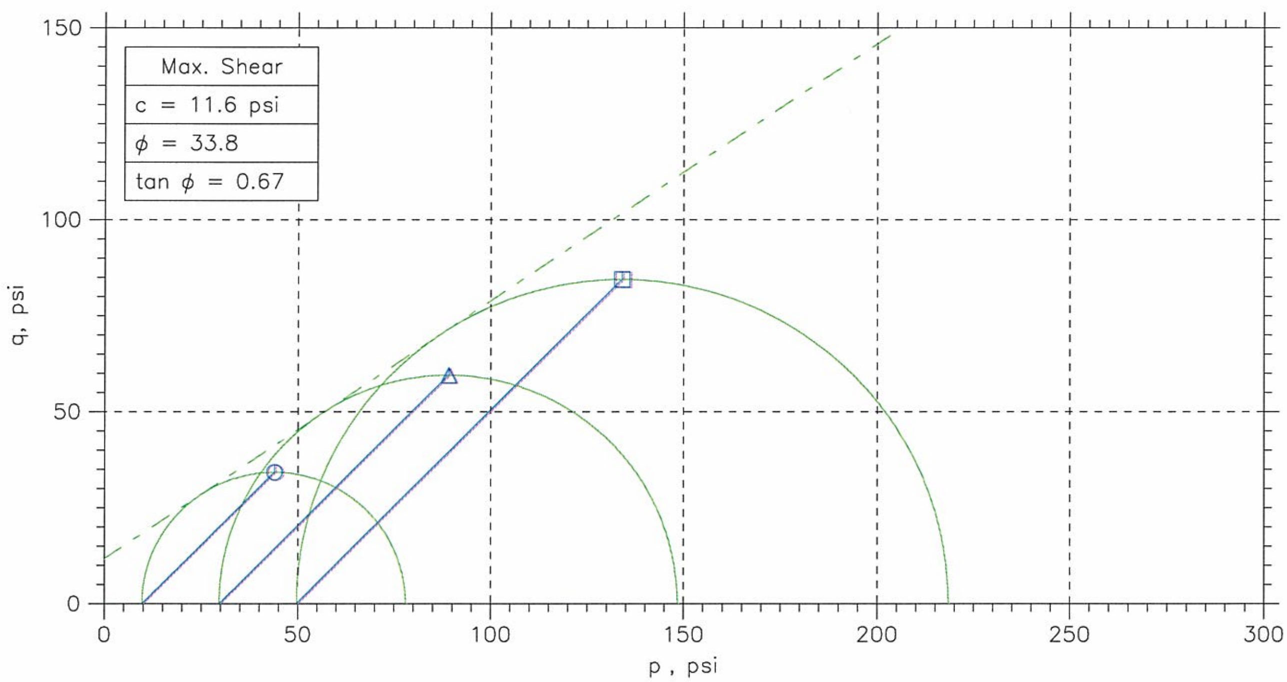
Project: Shawnee Fossil Plant-AP12
Location: ---
Project No.: GTX-1504
Boring No.: STN-39
Sample Type: UD
Description: Brown sandy lean clay
Remarks: System 1062

Fri, 23-APR-2010 10:45:39

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





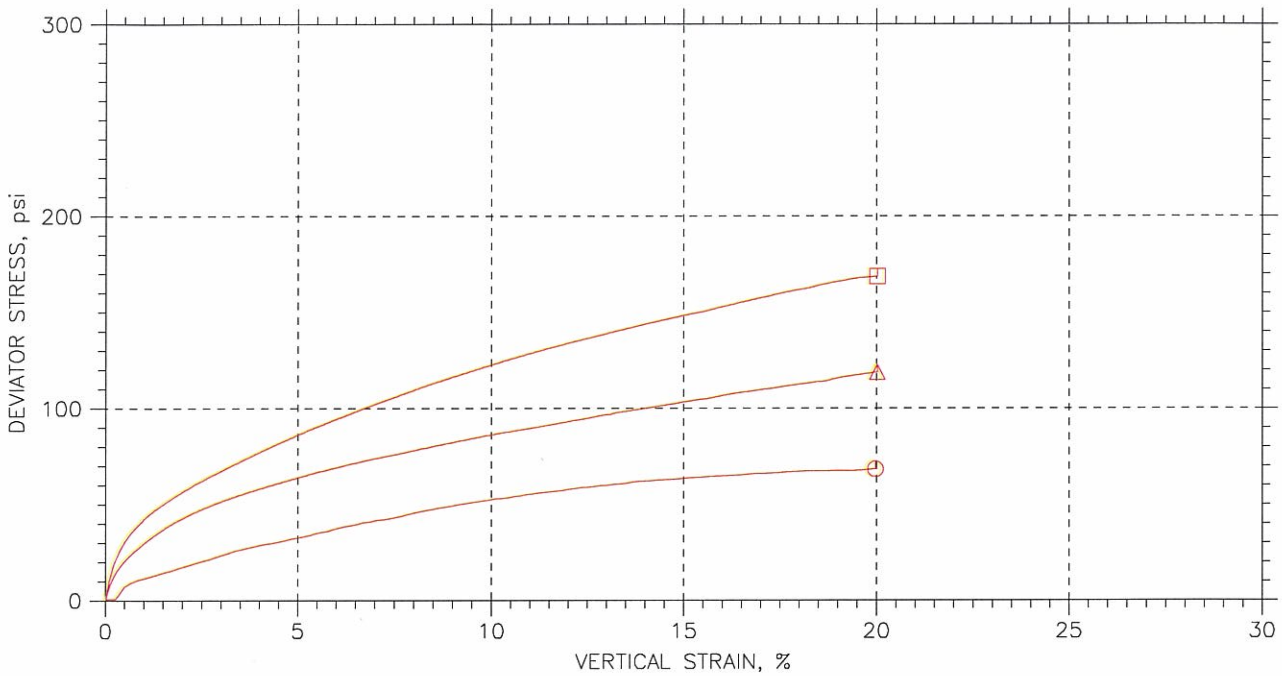


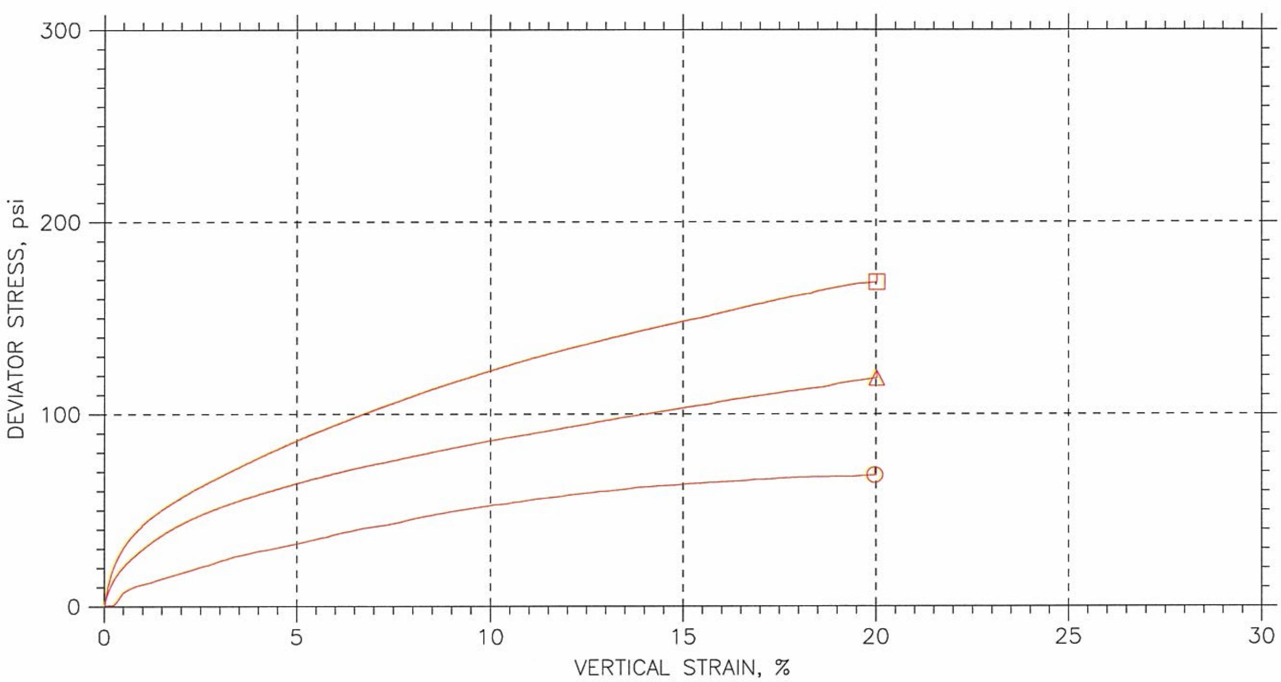
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	5.1	6.9 - 7.8	MM	10/30/09	GT		1504-5.1.dat
△	ST-1	5.2	4.8 - 5.4	jm	10/30/09	mm		1504-5.2.dat
□	ST-1	5.3	5.4-6.0	JM	10/30/09	MM		1504-5.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Brown sandy lean clay		
Remarks: System 1062		

Fri, 23-APR-2010 10:45:40

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



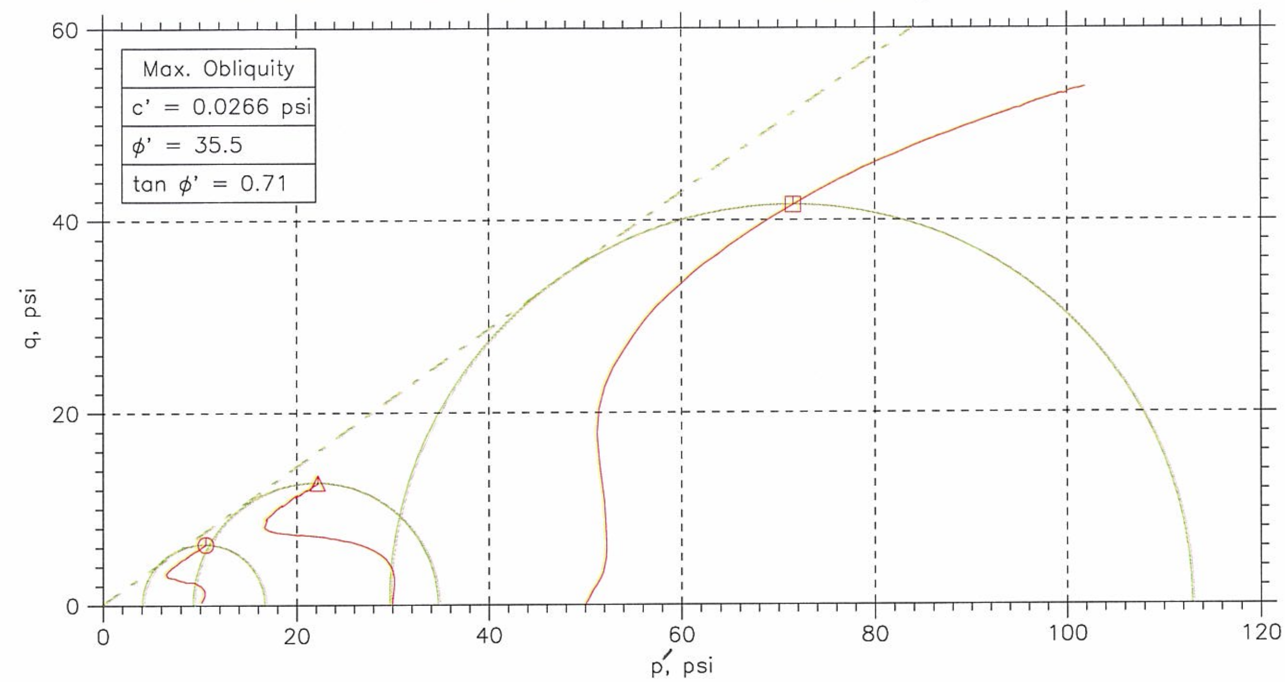


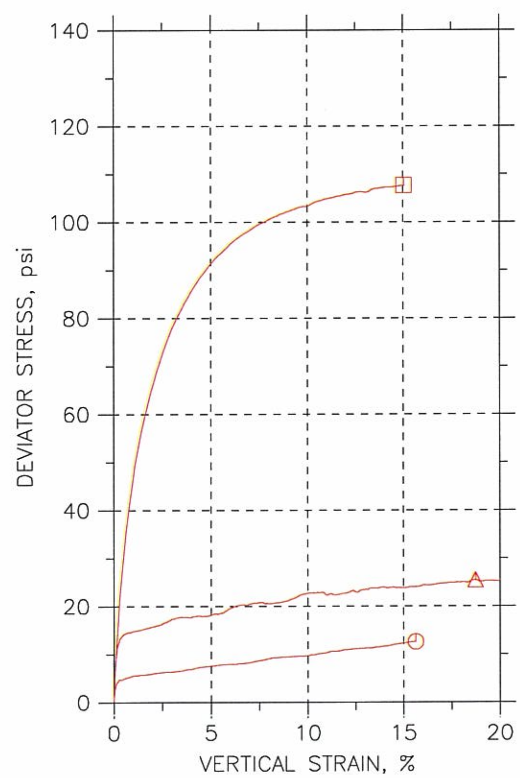
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-2	5.1	6.9 - 7.8	MM	10/30/09	GT		1504-5.1.dat
△	ST-1	5.2	4.8 - 5.4	jm	10/30/09	mm		1504-5.2.dat
□	ST-1	5.3	5.4-6.0	JM	10/30/09	MM		1504-5.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Brown sandy lean clay		
Remarks: System 1062		

Fri, 23-APR-2010 10:45:42

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





		○	△	□	
Symbol		○	△	□	
Sample No.		ST-3	ST-4	ST-4	
Test No.		6.1	6.2	6.3	
Depth		26.8-27.3'	28.7-29.3	29.3-30.0	
Initial	Diameter, in	2.855	2.844	2.823	
	Height, in	5.945	5.982	6.239	
	Water Content, %	18.4	22.6	19.7	
	Dry Density, pcf	109.9	101.1	112.	
	Saturation, %	93.1	91.4	105.3	
	Void Ratio	0.533	0.667	0.505	
Before Shear	Water Content, %	17.5	21.9	19.9	
	Dry Density, pcf	114.4	106.	109.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.473	0.591	0.538	
	Back Press., psi	107.1	91.86	101	
Ver. Eff. Cons. Stress, psi		9.851	29.93	49.98	
Shear Strength, psi		6.334	12.74	53.83	
Strain at Failure, %		15.7	18.8	15	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

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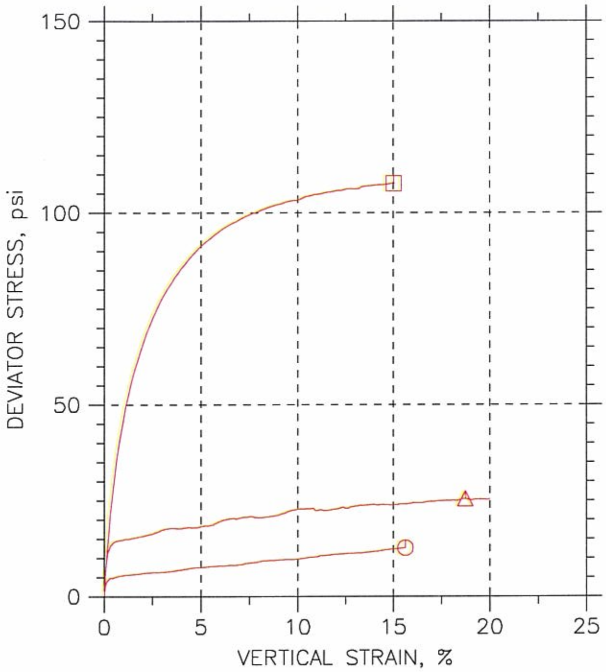
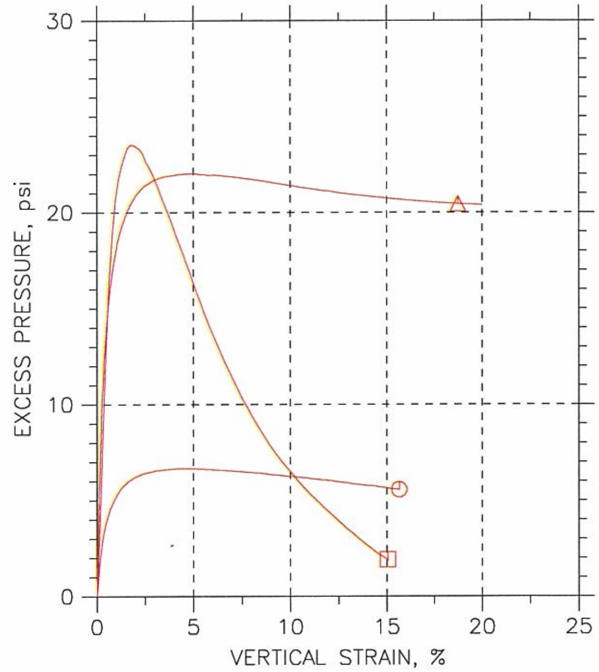
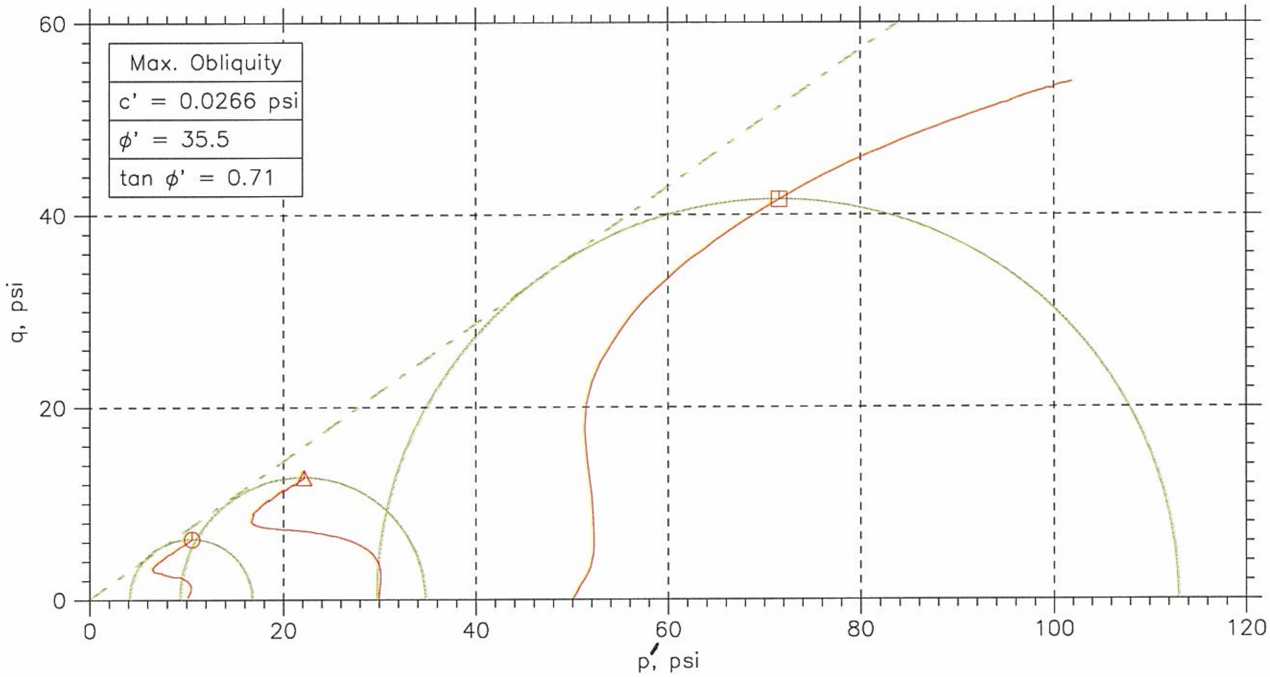
Project: Shawnee Fossil Plant-AP12	
Location: ---	
Project No.: GTX-1504	
Boring No.: STN-39	
Sample Type: UD	
Description: Gray Lean clay with sand	
Remarks: System 1057	

Wed, 11-NOV-2009 15:20:05

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





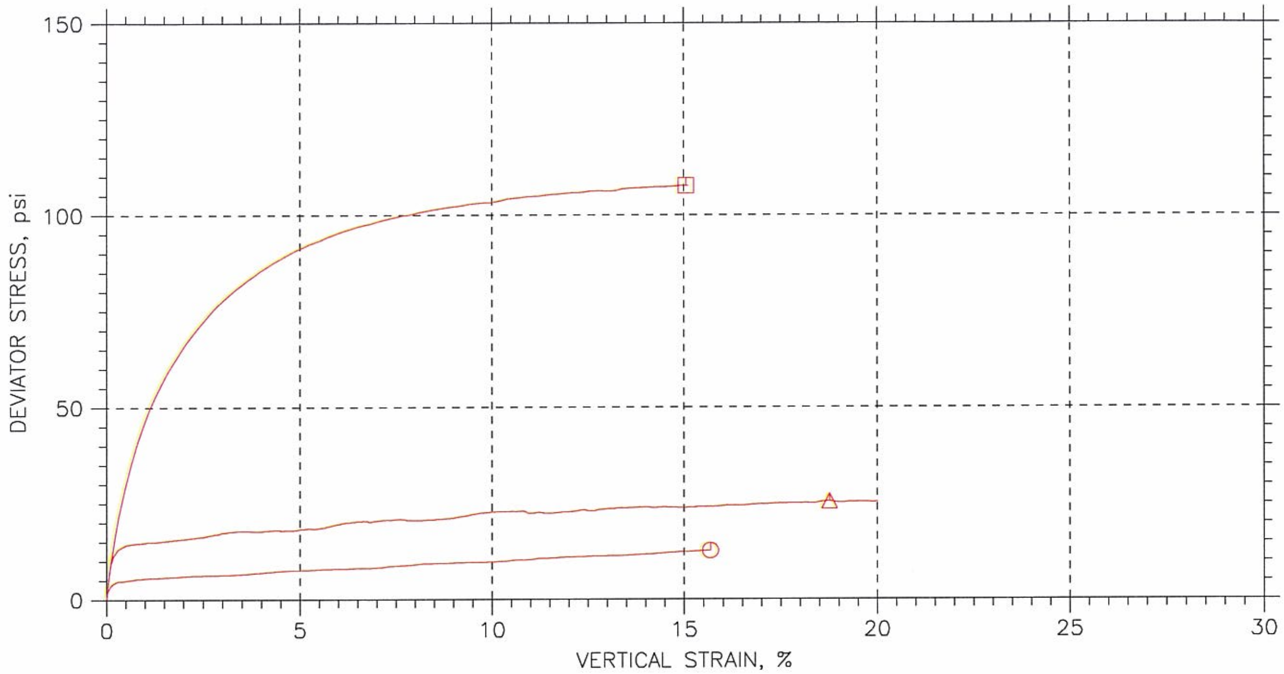


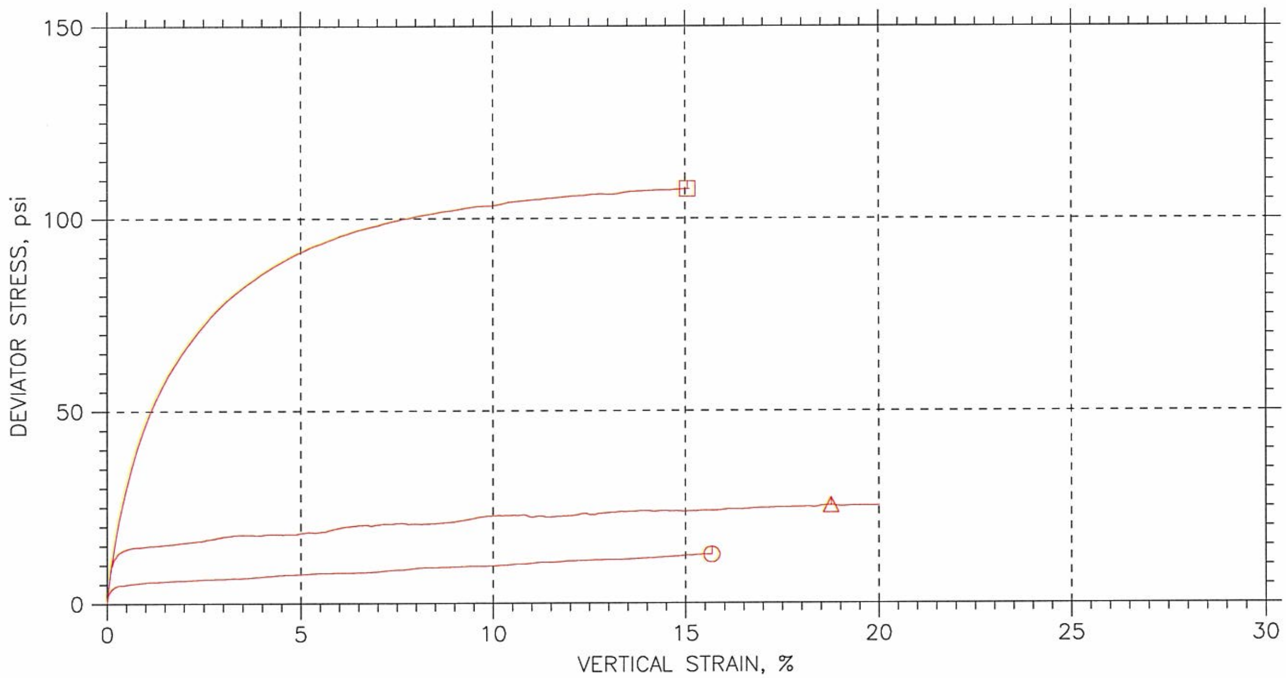
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	6.1	26.8-27.3'	MM	11/2/09	GT		1504-6.1.dat
△	ST-4	6.2	28.7-29.3	MM	11/3/09	GT		1504-6.2.dat
□	ST-4	6.3	29.3-30.0	jm	11/4/09	mm		1504-6.3.dat

GeoTesting express, a subsidiary of Geocomp Corporation	Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
	Boring No.: STN-39	Sample Type: UD	
	Description: Gray Lean clay with sand		
	Remarks: System 1057		

Wed, 11-NOV-2009 15:20:07

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	6.1	26.8-27.3'	MM	11/2/09	GT		1504-6.1.dat
△	ST-4	6.2	28.7-29.3	MM	11/3/09	GT		1504-6.2.dat
□	ST-4	6.3	29.3-30.0	jm	11/4/09	mm		1504-6.3.dat

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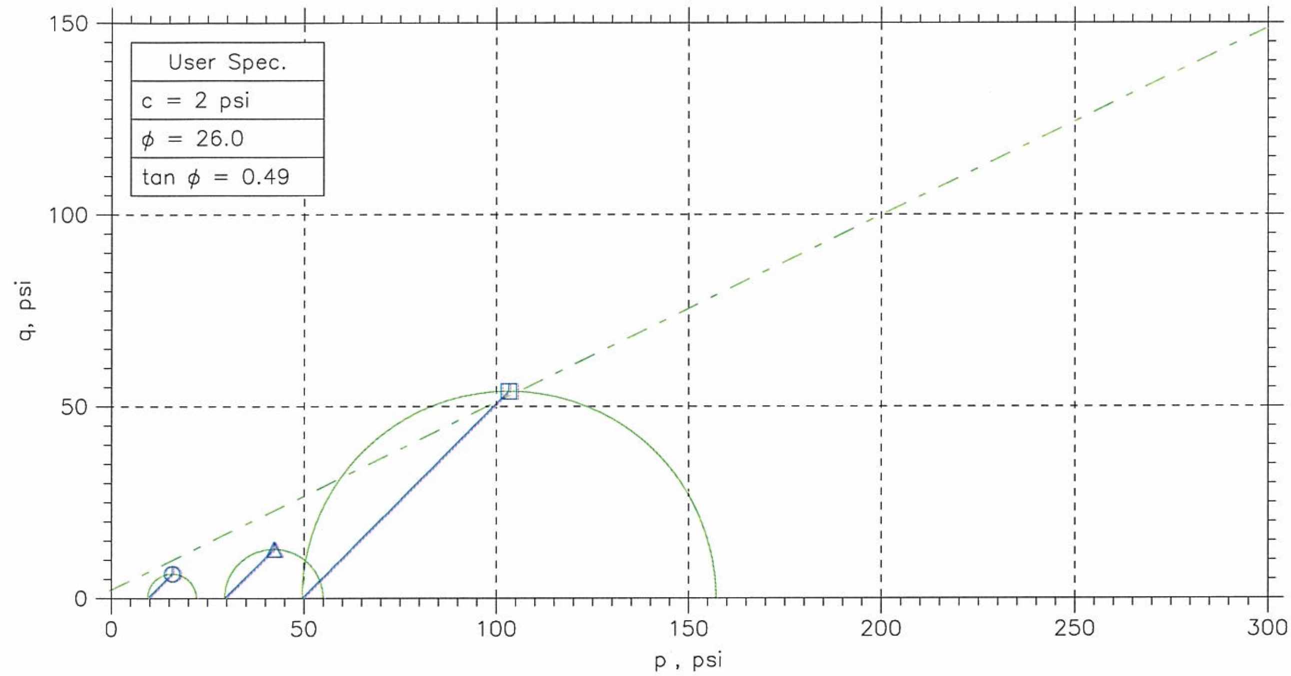
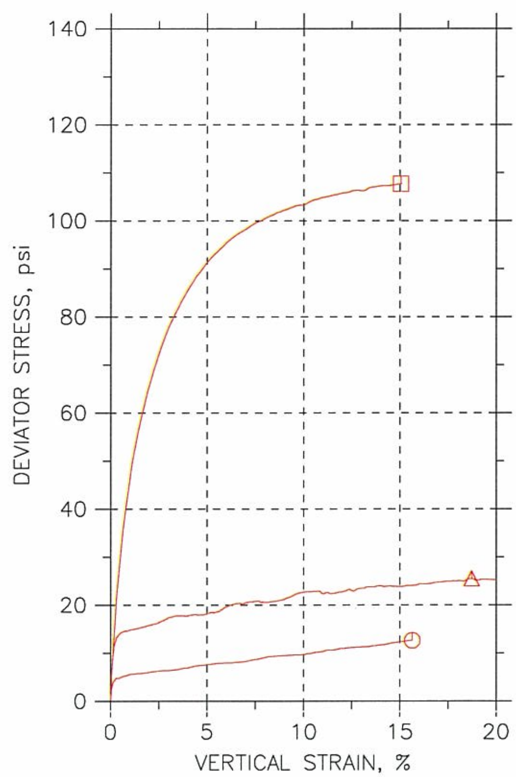
Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: System 1057		

Wed, 11-NOV-2009 15:20:08

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



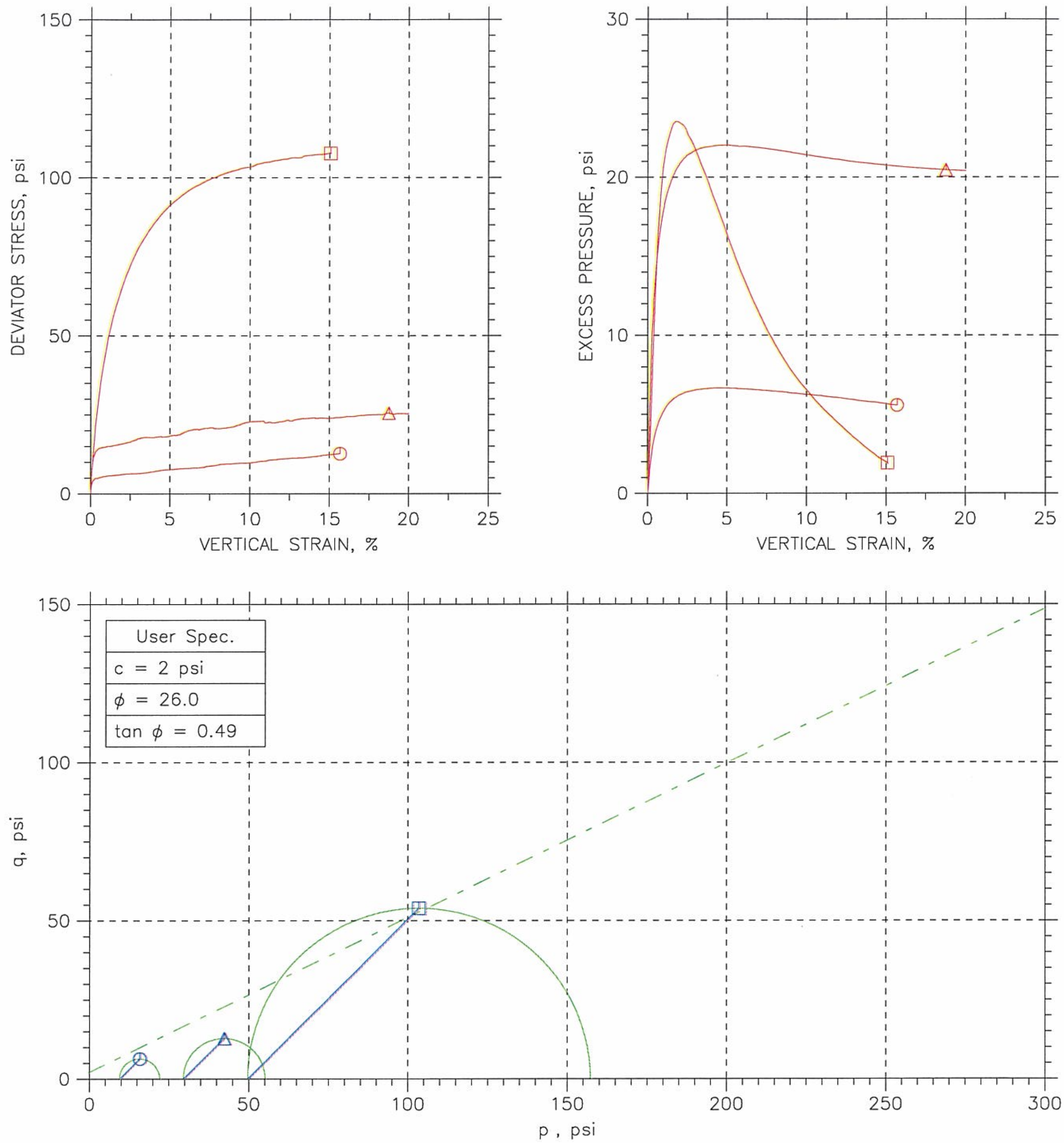


Symbol		○	△	□	
Sample No.		ST-3	ST-4	ST-4	
Test No.		6.1	6.2	6.3	
Depth		26.8-27.3'	28.7-29.3	29.3-30.0	
Initial	Diameter, in	2.855	2.844	2.823	
	Height, in	5.945	5.982	6.239	
	Water Content, %	18.4	22.6	19.7	
	Dry Density, pcf	109.9	101.1	112.	
	Saturation, %	93.1	91.4	105.3	
	Void Ratio	0.533	0.667	0.505	
Before Shear	Water Content, %	17.5	21.9	19.9	
	Dry Density, pcf	114.4	106.	109.6	
	Saturation*, %	100.0	100.0	100.0	
	Void Ratio	0.473	0.591	0.538	
	Back Press., psi	107.1	91.86	101	
Ver. Eff. Cons. Stress, psi		9.851	29.93	49.98	
Shear Strength, psi		6.334	12.74	53.83	
Strain at Failure, %		15.7	18.8	15	
Strain Rate, %/min		0.016	0.016	0.016	
B-Value		0.96	0.95	0.95	
Estimated Specific Gravity		2.7	2.7	2.7	
Liquid Limit		---	---	---	
Plastic Limit		---	---	---	

Project: Shawnee Fossil Plant-AP12
Location: ---
Project No.: GTX-1504
Boring No.: STN-39
Sample Type: UD
Description: Gray Lean clay with sand
Remarks: System 1057

Fri, 23-APR-2010 10:48:26

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

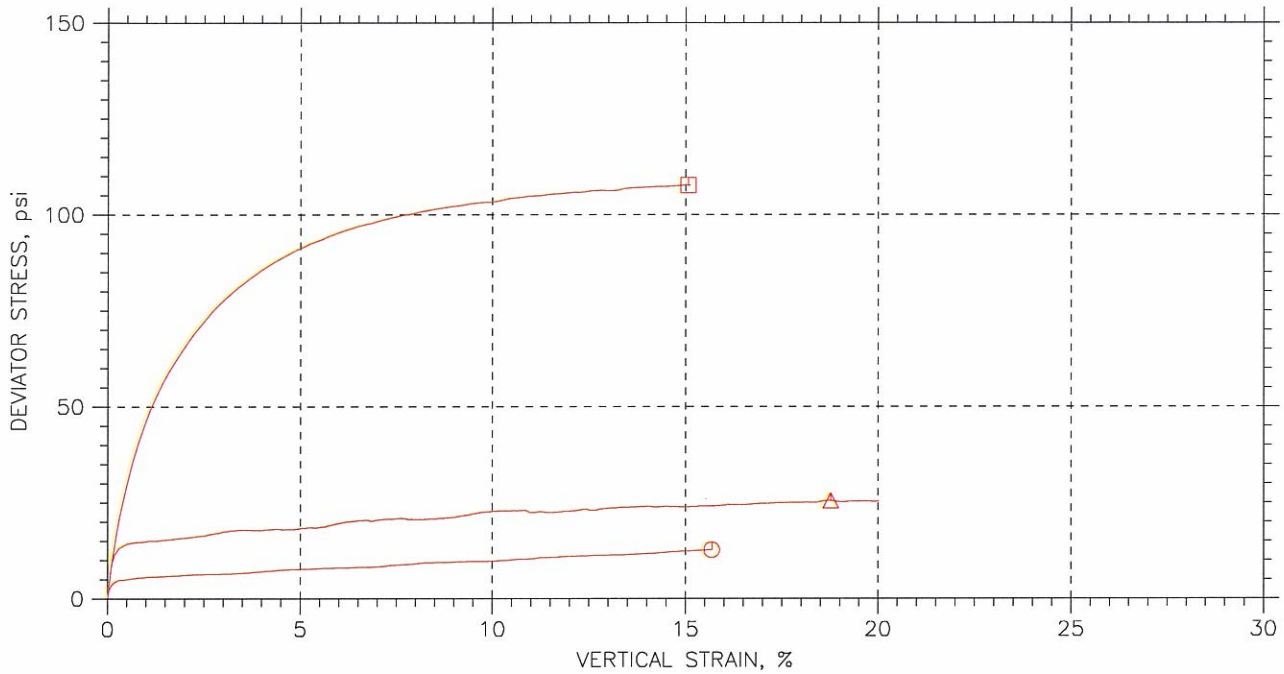


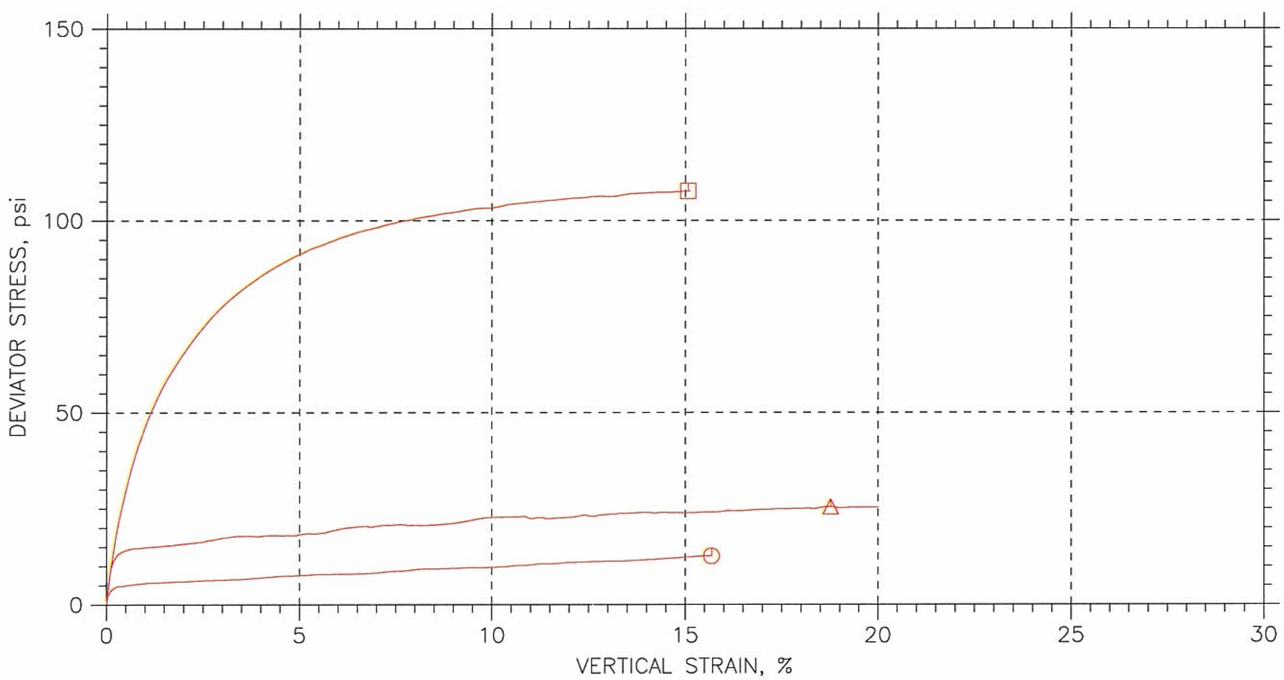
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	6.1	26.8-27.3'	MM	11/2/09	GT		1504-6.1.dat
△	ST-4	6.2	28.7-29.3	MM	11/3/09	GT		1504-6.2.dat
□	ST-4	6.3	29.3-30.0	jm	11/4/09	mm		1504-6.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: System 1057		

Fri, 23-APR-2010 10:48:26

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



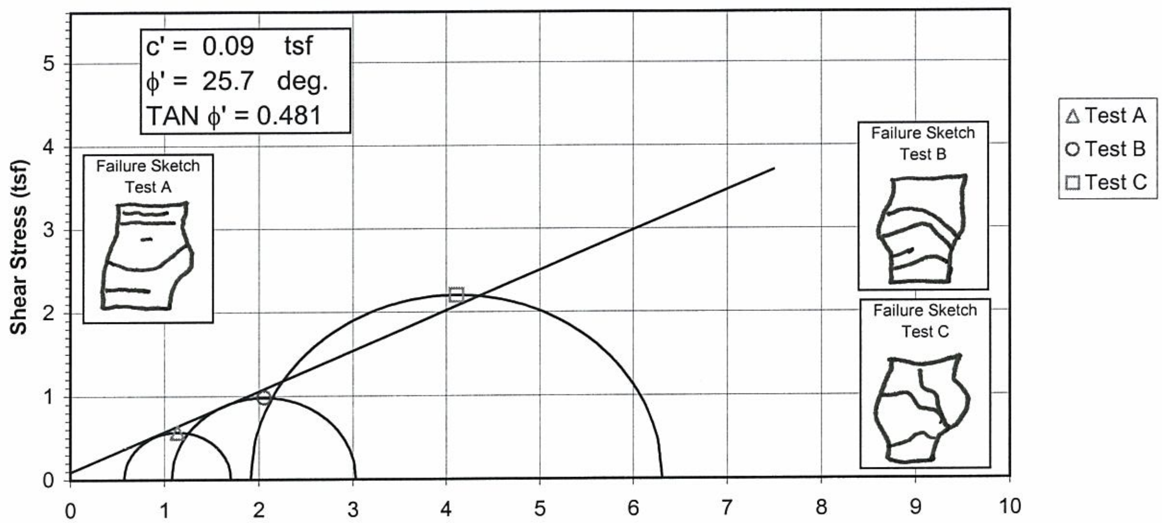


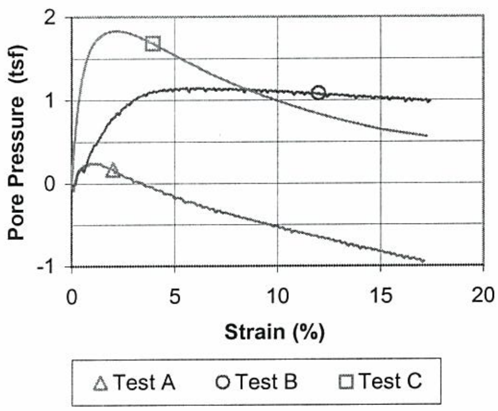
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-3	6.1	26.8-27.3'	MM	11/2/09	GT		1504-6.1.dat
△	ST-4	6.2	28.7-29.3	MM	11/3/09	GT		1504-6.2.dat
□	ST-4	6.3	29.3-30.0	jm	11/4/09	mm		1504-6.3.dat

Project: Shawnee Fossil Plant-AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-39	Sample Type: UD	
Description: Gray Lean clay with sand		
Remarks: System 1057		

Fri, 23-APR-2010 10:48:29

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.5	23.9	19.5	
	Dry Density PCF	γ_{d_o}	102.8	98.5	107.9	
	Saturation %	S_o	95.6	91.5	94.0	
	Void Ratio	e_o	0.633	0.704	0.557	
After Shear	Water content %	W_f	21.6	21.3	19.0	
	Dry Density PCF	γ_{d_f}	106.1	106.8	111.2	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.582	0.572	0.511	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.58	1.08	1.92	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.16	1.95	4.39	
Time to (σ1'-σ3')max min.		t_f	100.4	651.6	288.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.887	2.889	2.888	
Initial Height, in.		H_o	6.039	5.971	5.985	

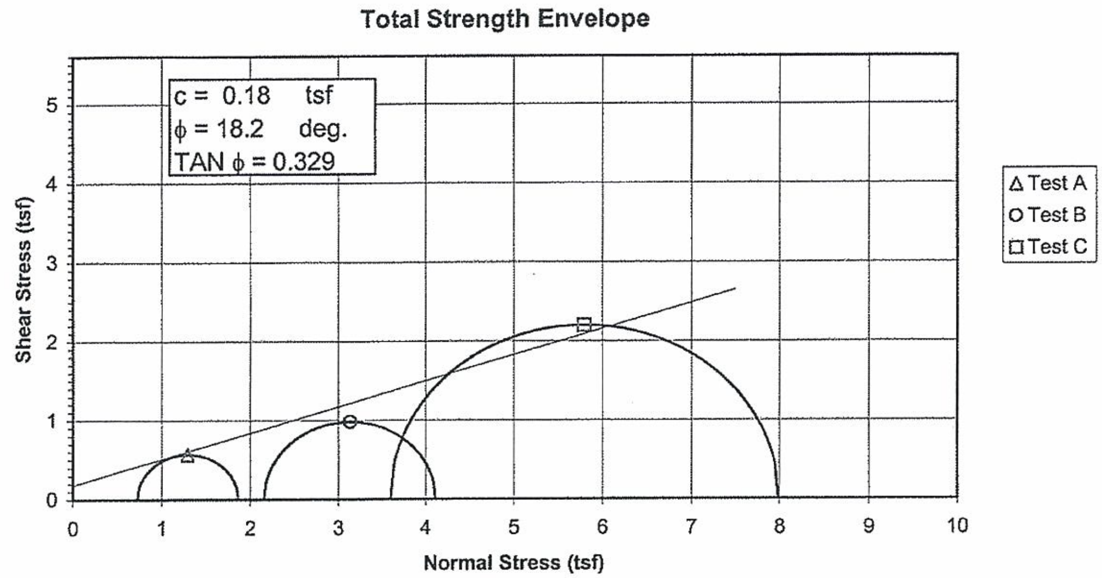
Controlled - Strain Test					
Description of Specimens	Lean Clay (CL), brown, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.69	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
		Boring No.	STN-39A	Sample No.	3
		Depth Elev.	20.1'-20.6', 21.1'-21.6', 21.7'-22.2'		
		Laboratory	Stantec	Date	3-29-10
		TRIAXIAL COMPRESSION TEST REPORT			

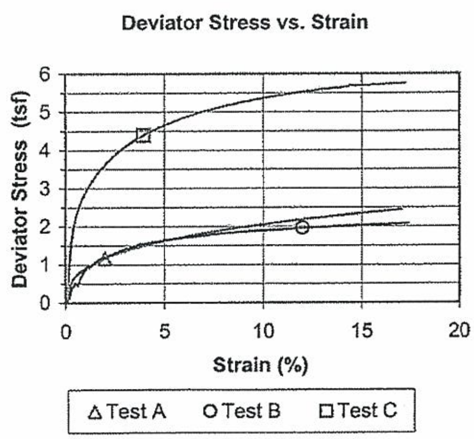
File: 175559023_cu_3 Sheet: CE_Final-E
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

KDG
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.5	23.9	19.5	
	Dry Density PCF	γ_{d_o}	102.8	98.5	107.9	
	Saturation %	S_o	95.6	91.5	94.0	
	Void Ratio	e_o	0.633	0.704	0.557	
After Shear	Water content %	W_f	21.6	21.3	19.0	
	Dry Density PCF	γ_{d_f}	106.1	106.8	111.2	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.582	0.572	0.511	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.16	1.95	4.39	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	100.4	651.6	288.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.887	2.889	2.888	
Initial Height, in.		H_o	6.039	5.971	5.985	

Controlled - Strain Test

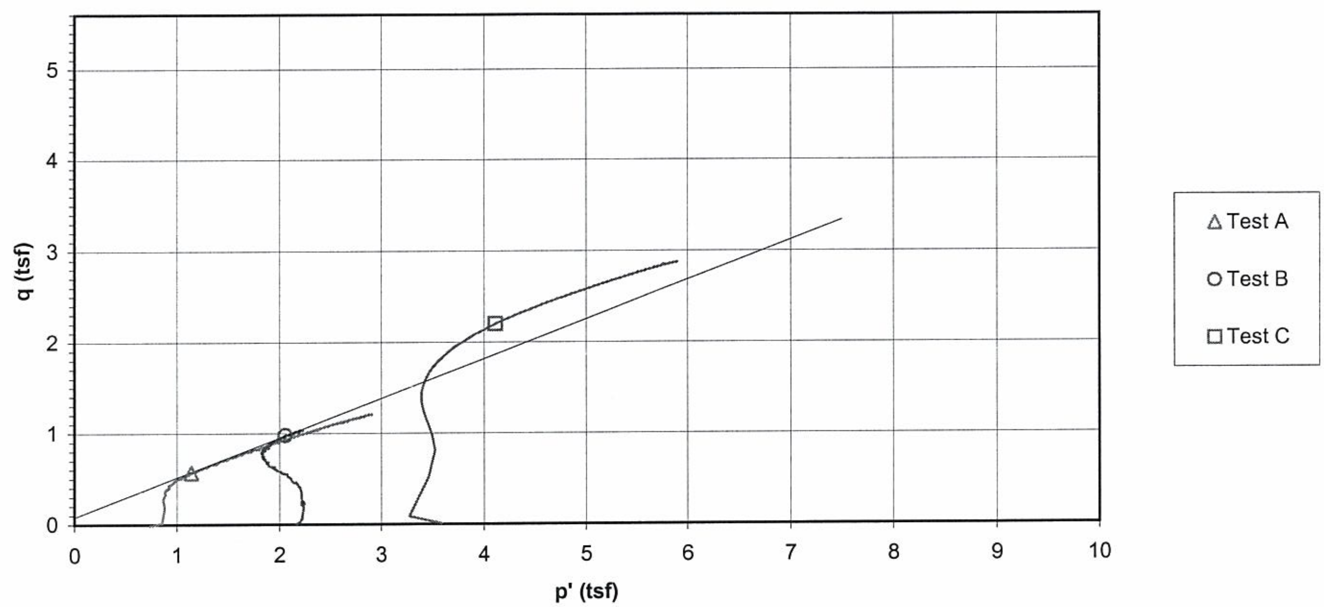
Description of Specimens Lean Clay (CL), brown, moist, firm

				Type of Specimen Undisturbed	Type of test $\overline{R}$
LL	PL	PI	Gs 2.69	Project Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:					
				Boring No. STN-39A	Sample No. 3
				Depth Elev. 20.1'-20.6', 21.1'-21.6', 21.7'-22.2'	
				Laboratory Stantec	Date 3-29-10
				TRIAXIAL COMPRESSION TEST REPORT	

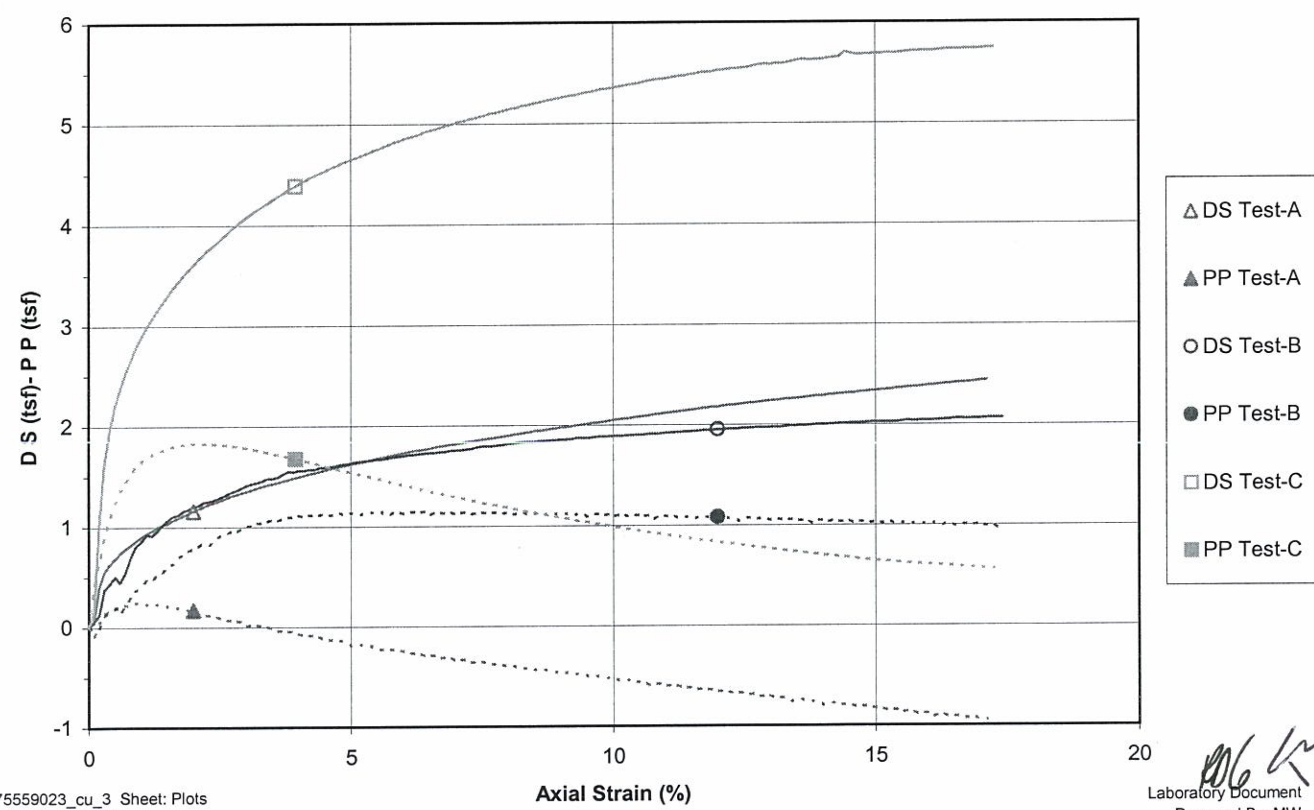
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Shawnee Fossil Plant (SHF) - Ash Ponds
Project No. 175559023
Sample ID: STN-39A, 20.1'-20.6' & STN-39A, 21.1'-21.6' & STN-39A, 21.7'-22.2'
Test Number: 3
Failure Criterion: Maximum Effective Principal Stress Ratio
ϕ' = 25.7 deg.
c' = 0.09 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

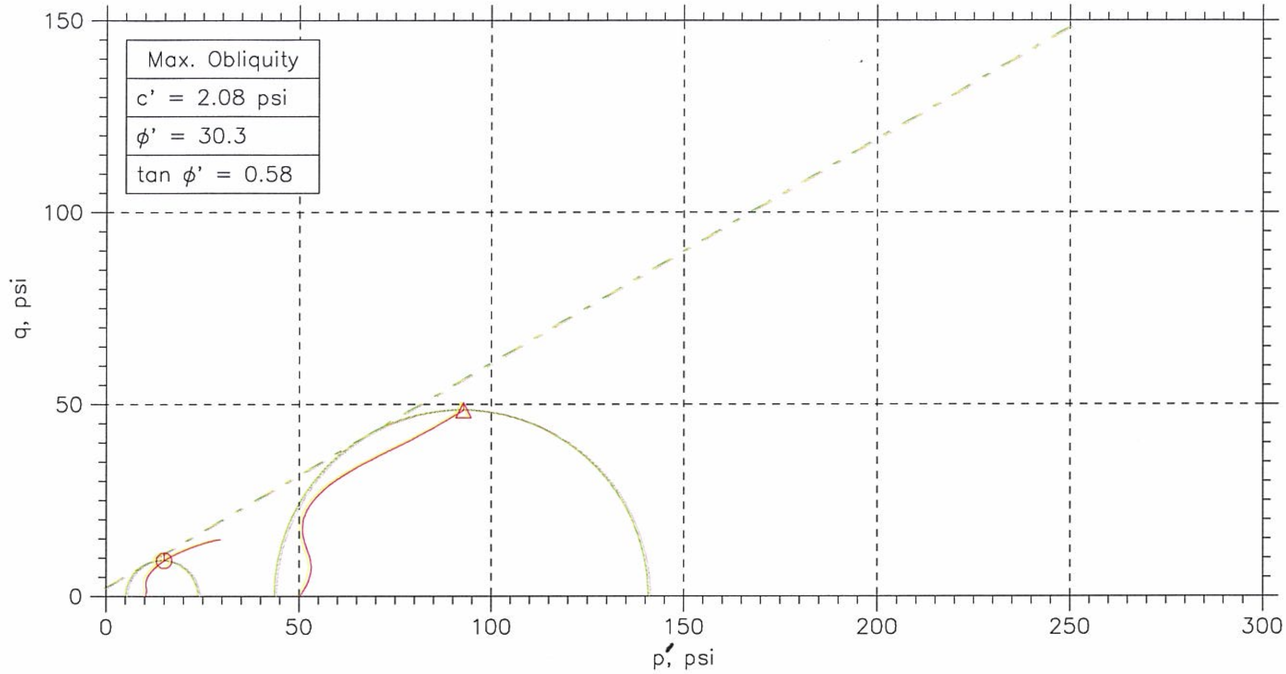


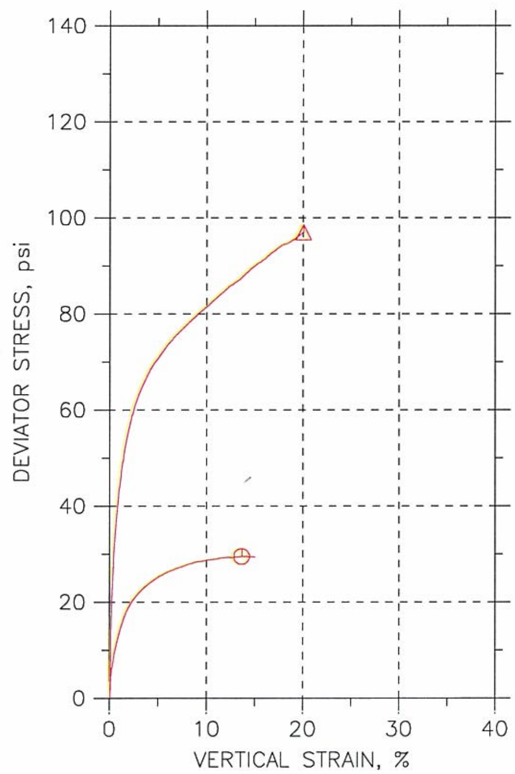
File: 175559023_cu_3 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



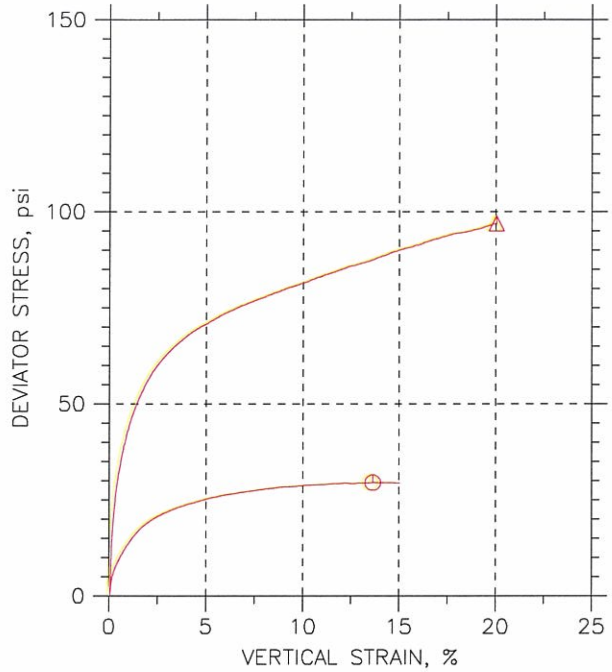


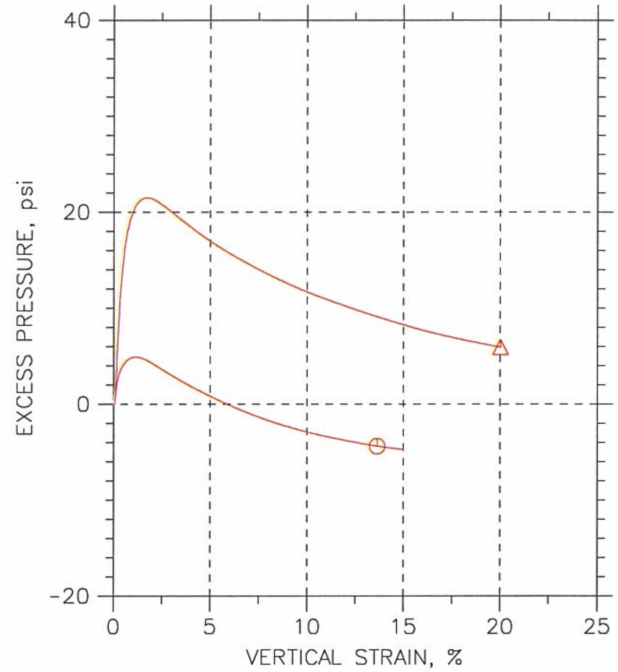
	Symbol	⊙	Δ		
	Sample No.	ST-4	ST-3		
	Test No.	7.1	7.3		
	Depth	38.6-39.2	29.4-30.0		
Initial	Diameter, in	2.853	2.832		
	Height, in	6.129	6.279		
	Water Content, %	23.9	23.9		
	Dry Density, pcf	104.1	105.1		
	Saturation, %	104.2	107.1		
	Void Ratio	0.619	0.603		
Before Shear	Water Content, %	25.1	23.4		
	Dry Density, pcf	100.5	103.3		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.677	0.632		
	Back Press., psi	110.5	101.4		
	Ver. Eff. Cons. Stress, psi	9.991	50		
	Shear Strength, psi	14.77	48.5		
	Strain at Failure, %	13.6	20		
	Strain Rate, %/min	0.016	0.016		
	B-Value	0.95	0.95		
	Estimated Specific Gravity	2.7	2.7		
	Liquid Limit	---	---		
	Plastic Limit	---	---		

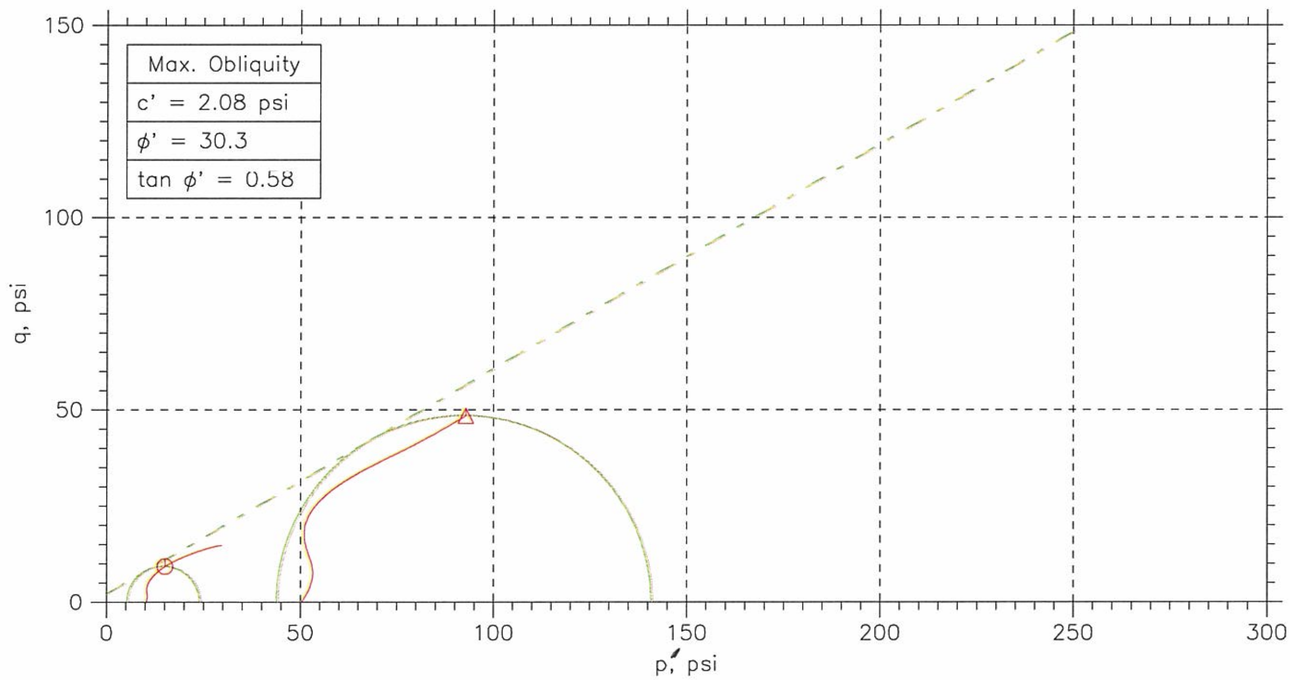
Project: Shawnee Fossil Plant:AP12
Location: ---
Project No.: GTX-1504
Boring No.: STN-50
Sample Type: UD
Description: Gray lean clay with sand
Remarks: 2054

Fri, 23-APR-2010 14:06:31

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





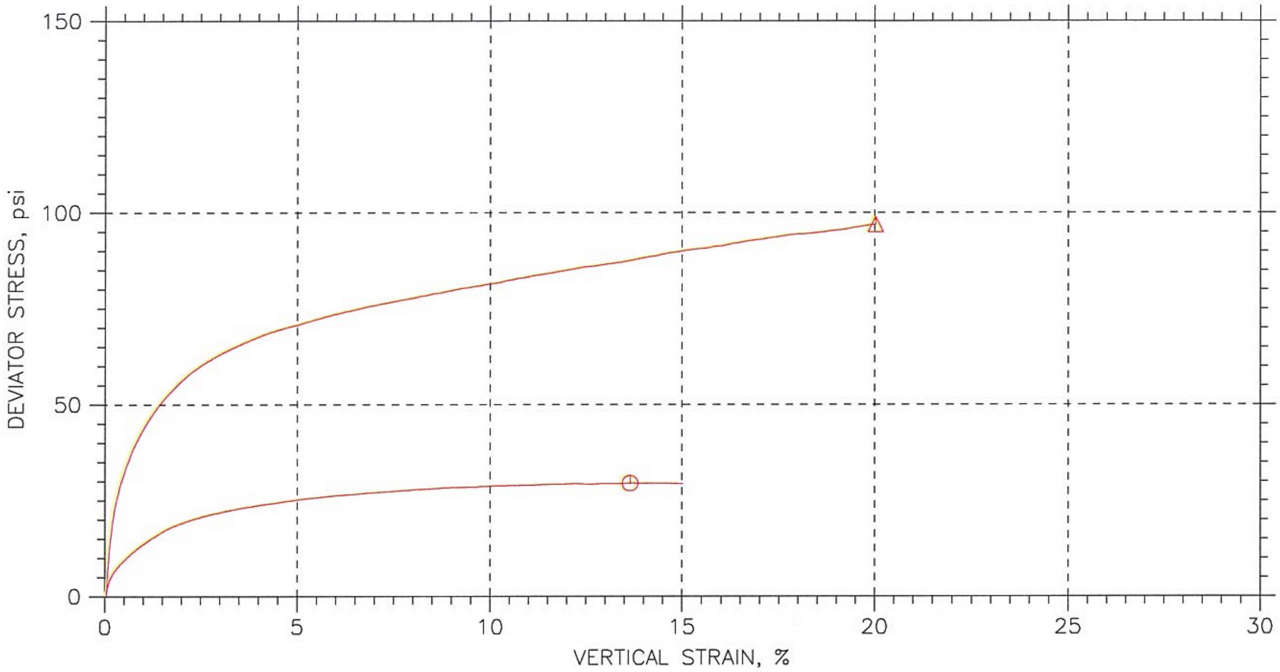


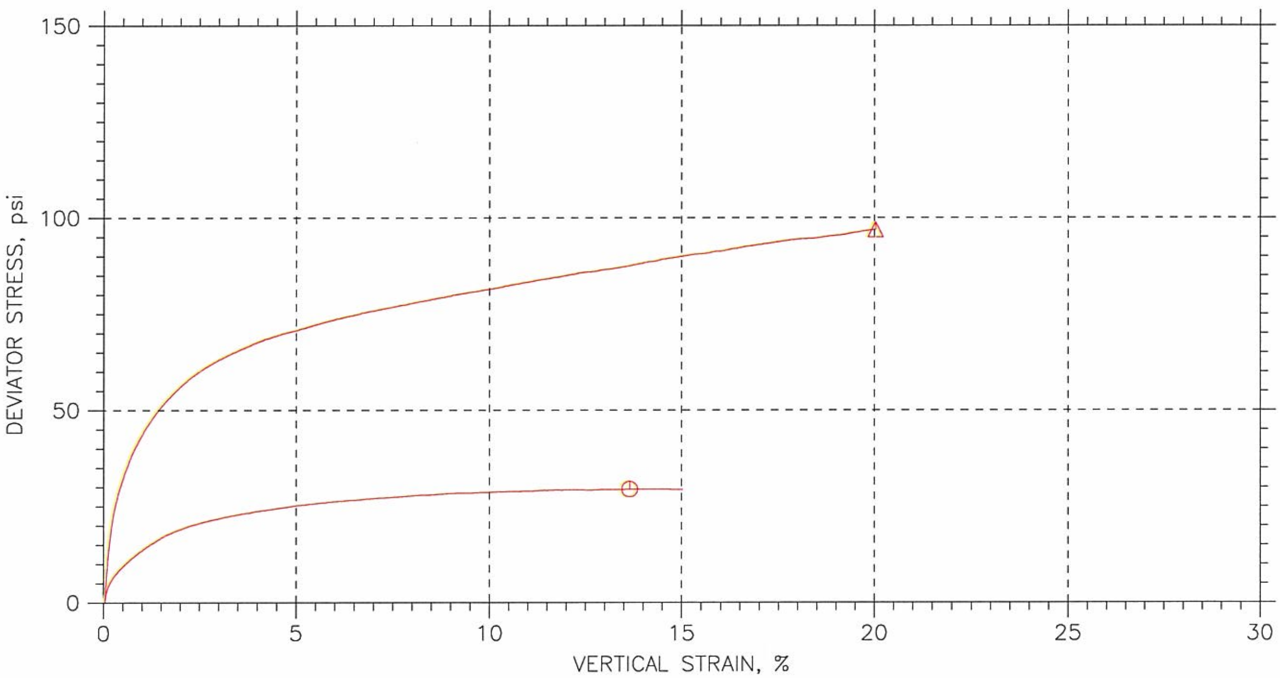
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-4	7.1	38.6-39.2	MM	11/9/09	GT		1504-7.1.dat
△	ST-3	7.3	29.4-30.0	JM	11/6/09	MM		1504-7.3.dat

Project: Shawnee Fossil Plant:AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-50	Sample Type: UD	
Description: Gray lean clay with sand		
Remarks: 2054		

Fri, 23-APR-2010 14:06:32

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



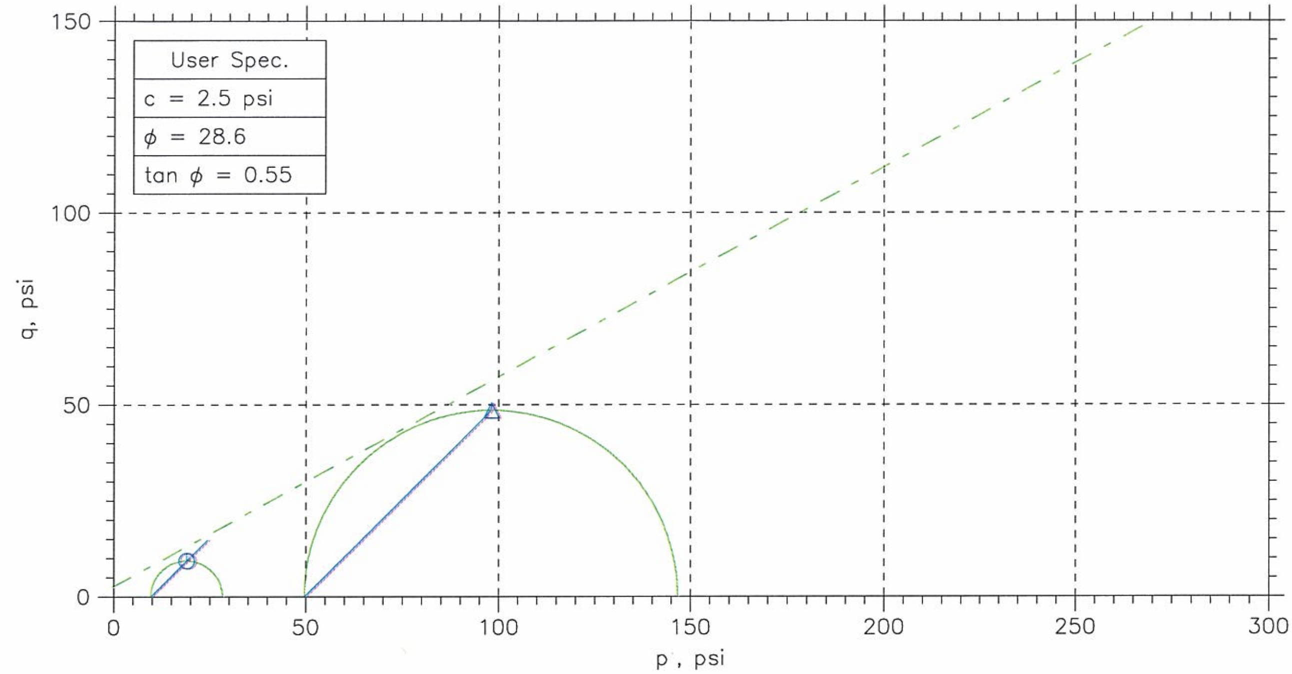


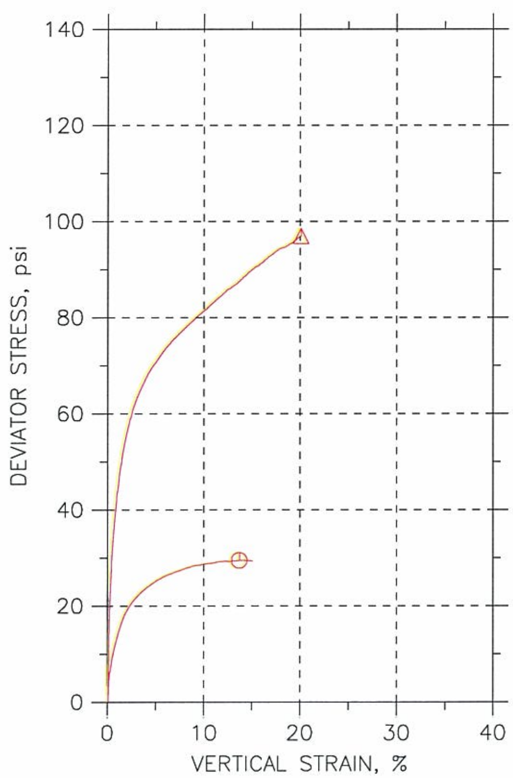
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
O	ST-4	7.1	38.6-39.2	MM	11/9/09	GT		1504-7.1.dat
Δ	ST-3	7.3	29.4-30.0	JM	11/6/09	MM		1504-7.3.dat

Project: Shawnee Fossil Plant:AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-50	Sample Type: UD	
Description: Gray lean clay with sand		
Remarks: 2054		

Fri, 23-APR-2010 14:06:33

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767



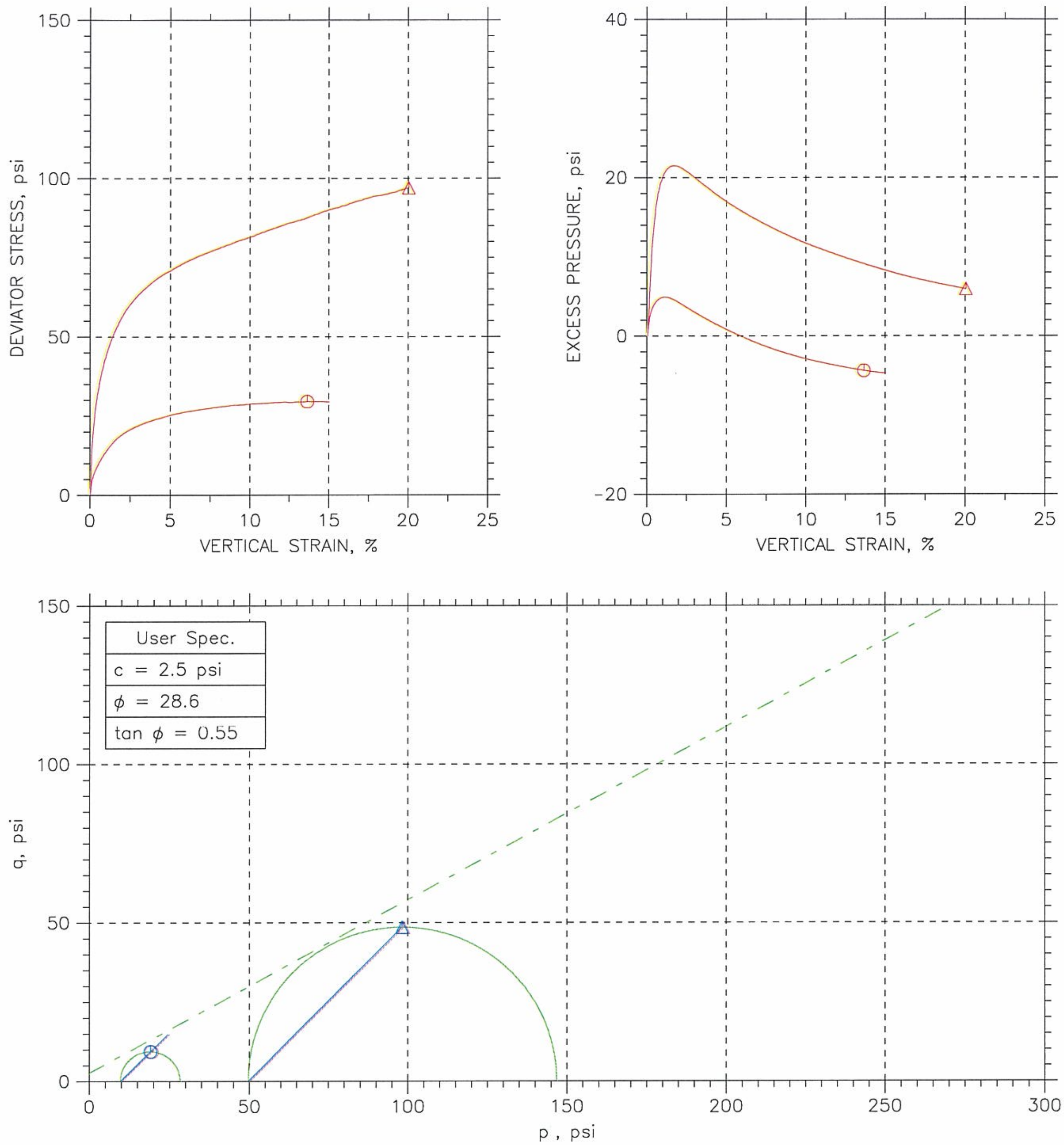


Symbol		○	△		
Sample No.		ST-4	ST-3		
Test No.		7.1	7.3		
Depth		38.6-39.2	29.4-30.0		
Initial	Diameter, in	2.853	2.832		
	Height, in	6.129	6.279		
	Water Content, %	23.9	23.9		
	Dry Density, pcf	104.1	105.1		
	Saturation, %	104.2	107.1		
	Void Ratio	0.619	0.603		
Before Shear	Water Content, %	25.1	23.4		
	Dry Density, pcf	100.5	103.3		
	Saturation*, %	100.0	100.0		
	Void Ratio	0.677	0.632		
	Back Press., psi	110.5	101.4		
Ver. Eff. Cons. Stress, psi		9.991	50		
Shear Strength, psi		14.77	48.5		
Strain at Failure, %		13.6	20		
Strain Rate, %/min		0.016	0.016		
B-Value		0.95	0.95		
Estimated Specific Gravity		2.7	2.7		
Liquid Limit		---	---		
Plastic Limit		---	---		

	Project: Shawnee Fossil Plant:AP12
	Location: ---
	Project No.: GTX-1504
	Boring No.: STN-50
	Sample Type: UD
	Description: Gray lean clay with sand
	Remarks: 2054

Fri, 23-APR-2010 13:59:00

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767

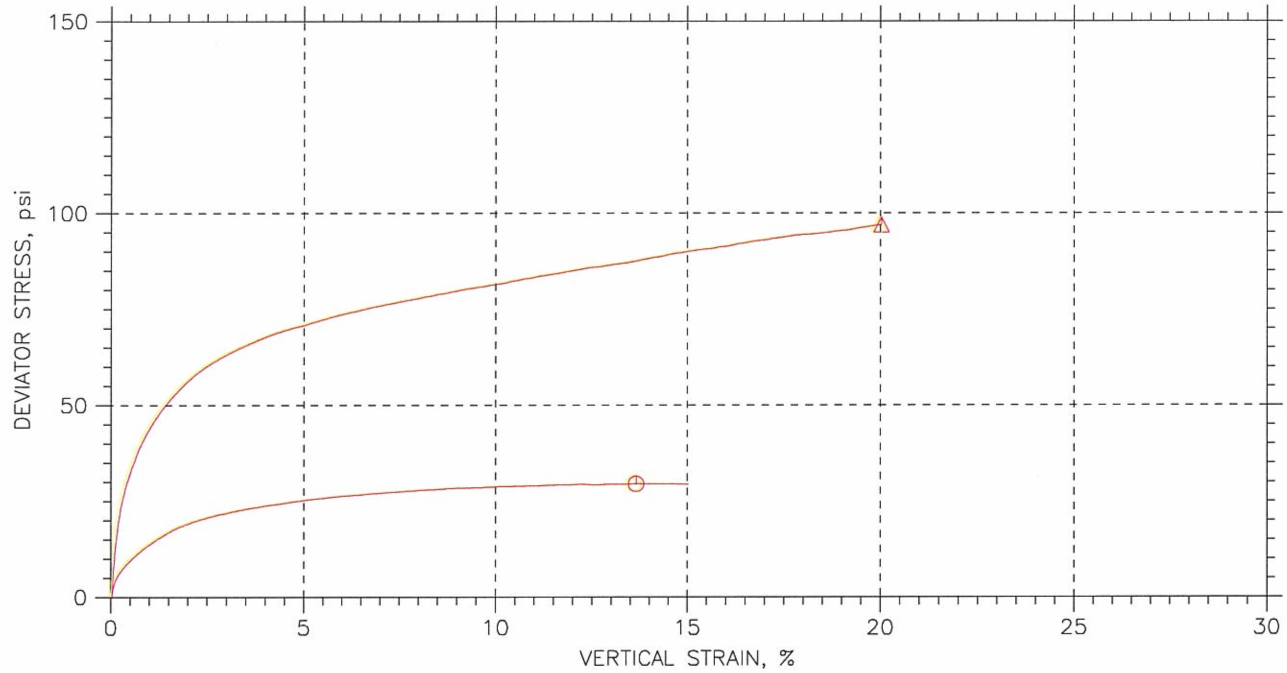


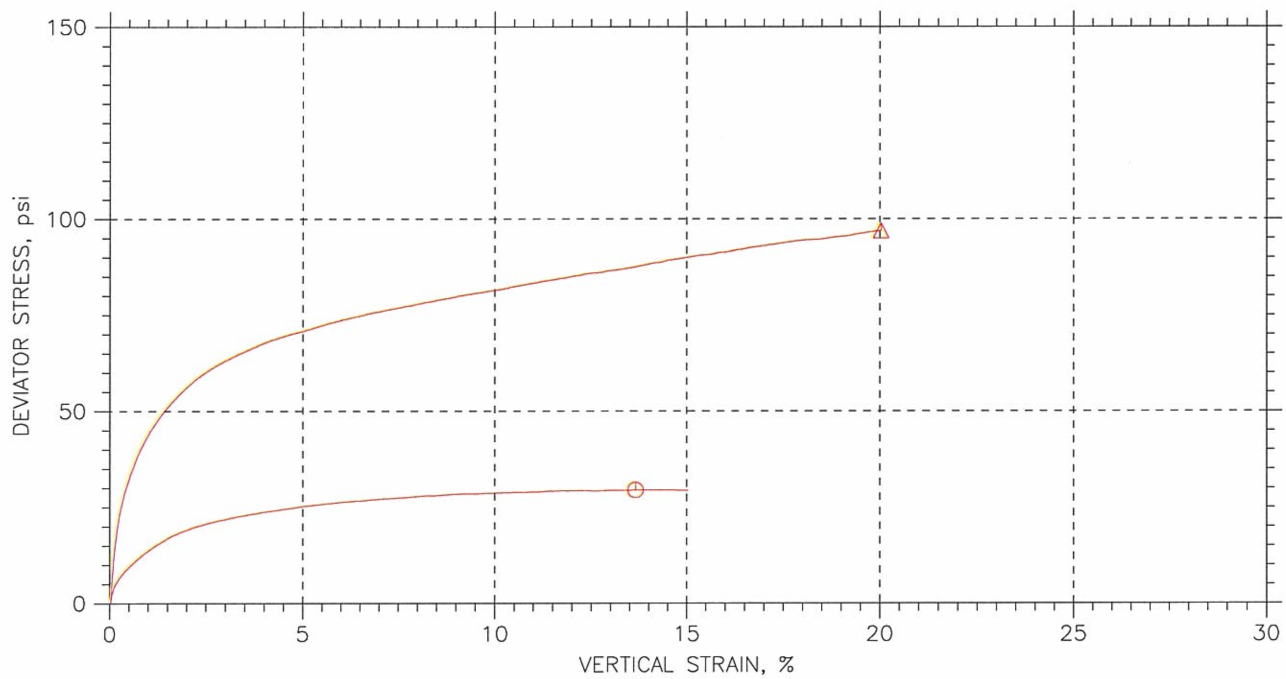
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-4	7.1	38.6-39.2	MM	11/9/09	GT		1504-7.1.dat
△	ST-3	7.3	29.4-30.0	JM	11/6/09	MM		1504-7.3.dat

Project: Shawnee Fossil Plant:AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-50	Sample Type: UD	
Description: Gray lean clay with sand		
Remarks: 2054		

Fri, 23-APR-2010 13:59:01

CONSOLIDATED UNDRAINED TRIAXIAL TEST by ASTM D4767





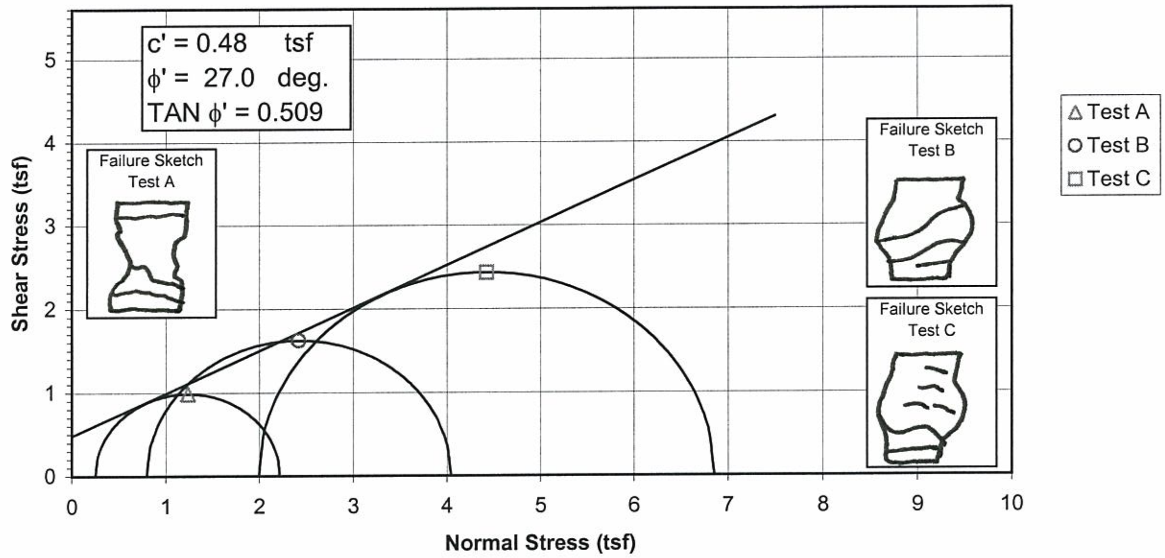
	Sample No.	Test No.	Depth	Tested By	Test Date	Checked By	Check Date	Test File
○	ST-4	7.1	38.6-39.2	MM	11/9/09	GT		1504-7.1.dat
△	ST-3	7.3	29.4-30.0	JM	11/6/09	MM		1504-7.3.dat

Project: Shawnee Fossil Plant:AP12	Location: ---	Project No.: GTX-1504
Boring No.: STN-50	Sample Type: UD	
Description: Gray lean clay with sand		
Remarks: 2054		

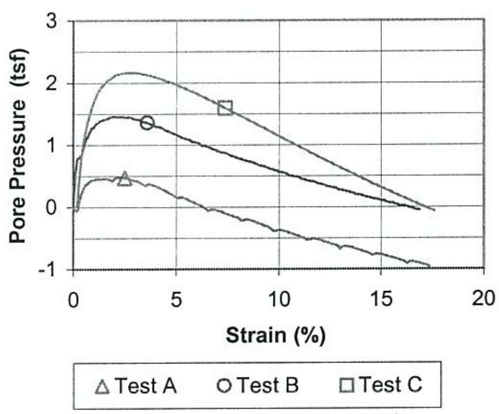
Fri, 23-APR-2010 13:59:02

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



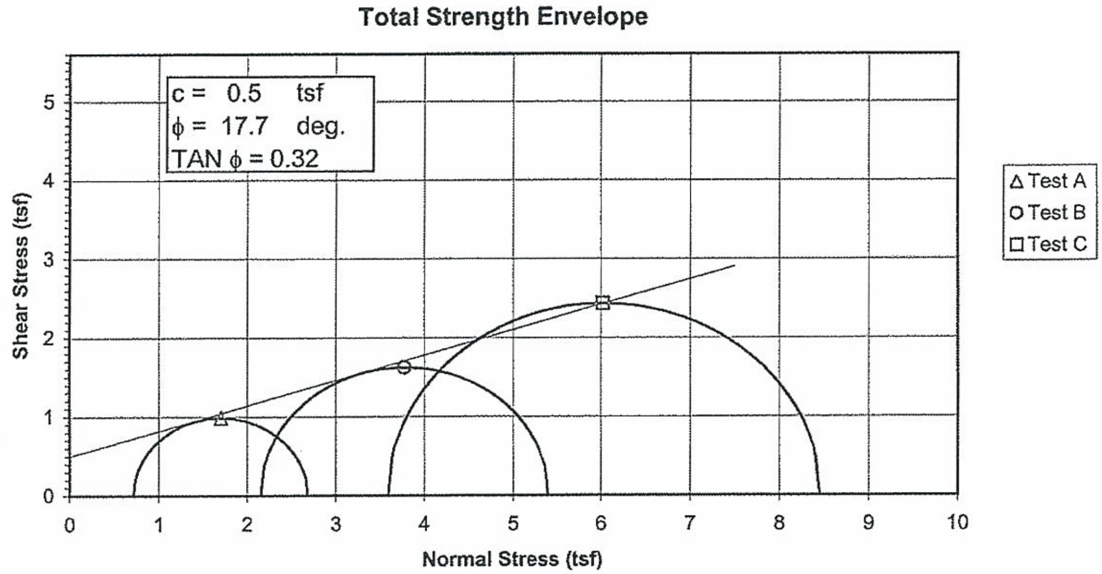
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	15.2	14.5	15.3	
	Dry Density PCF	γ_{d_o}	112.7	117.4	114.8	
	Saturation %	S_o	83.8	91.5	89.5	
	Void Ratio	e_o	0.485	0.426	0.457	
After Shear	Water content %	W_f	15.8	14.6	14.6	
	Dry Density PCF	γ_{d_f}	117.5	120.3	120.3	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.424	0.390	0.390	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.25	0.80	2.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.97	3.24	4.85	
Time to (σ1'-σ3')max min.		t_f	15.5	70.6	353.3	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.860	2.900	2.879	
Initial Height, in.		H_o	6.003	6.005	6.016	

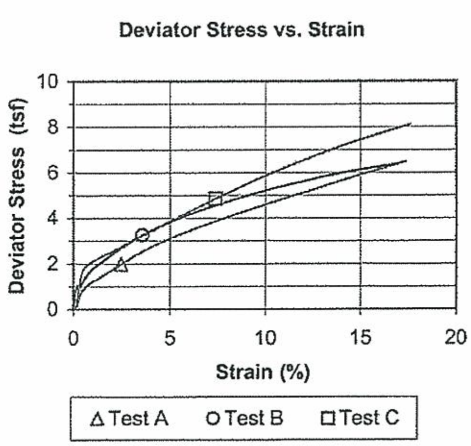
Controlled - Strain Test

Description of Specimens Lean Clay (CL), brown, moist, firm

			Type of Specimen Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.68	Project Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:				
			Boring No. STN-50P	Sample No. 4
			Depth Elev. 4.1'-4.6', 4.7'-5.2', 6.0'-6.5'	
			Laboratory Stantec	Date 3-29-10
			TRIAXIAL COMPRESSION TEST REPORT	

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	15.2	14.5	15.3	
	Dry Density PCF	γ_{d_o}	112.7	117.4	114.8	
	Saturation %	S_o	83.8	91.5	89.5	
	Void Ratio	e_o	0.485	0.426	0.457	
After Shear	Water content %	W_f	15.8	14.6	14.6	
	Dry Density PCF	γ_{d_f}	117.5	120.3	120.3	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.424	0.390	0.390	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.97	3.24	4.85	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	15.5	70.6	353.3	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.860	2.900	2.879	
Initial Height, in.		H_o	6.003	6.005	6.016	

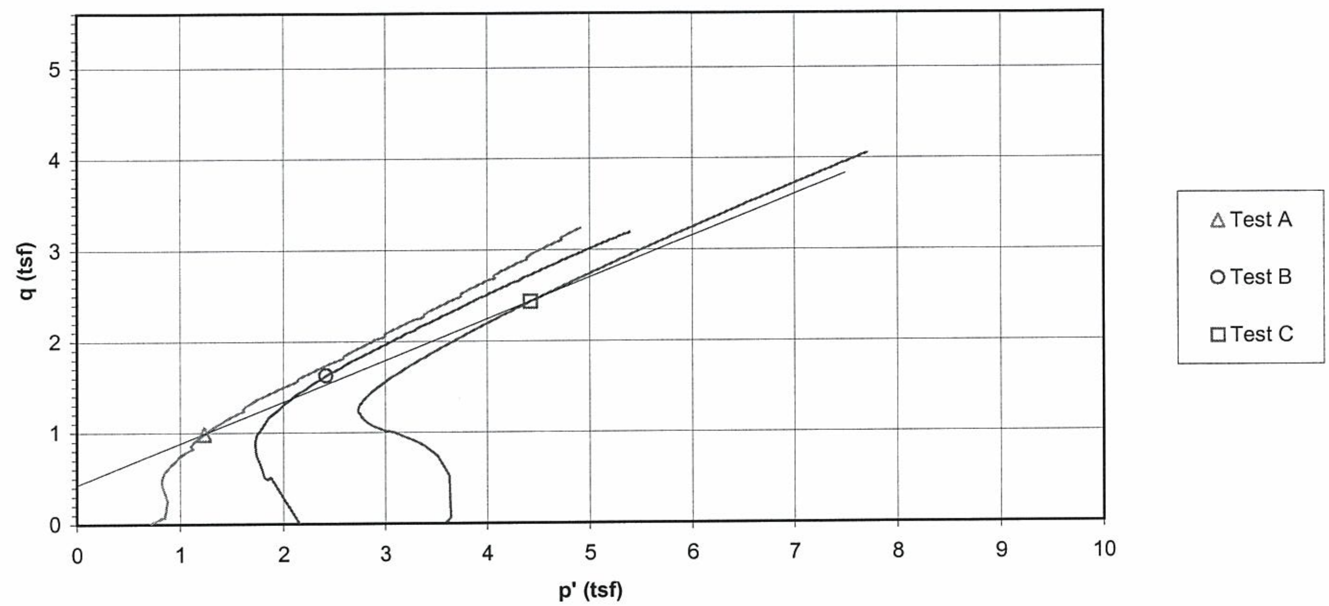
Controlled - Strain Test

Description of Specimens	Lean Clay (CL), brown, moist, firm			
	Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL / PL / PI / Gs 2.68	Project	Shawnee Fossil Plant (SHF) - Ash Ponds		
Remarks:				
	Boring No.	STN-50P	Sample No.	4
	Depth Elev.	4.1'-4.6', 4.7'-5.2', 6.0'-6.5'		
	Laboratory	FMSM Engineers	Date	3-29-10
	TRIAXIAL COMPRESSION TEST REPORT			

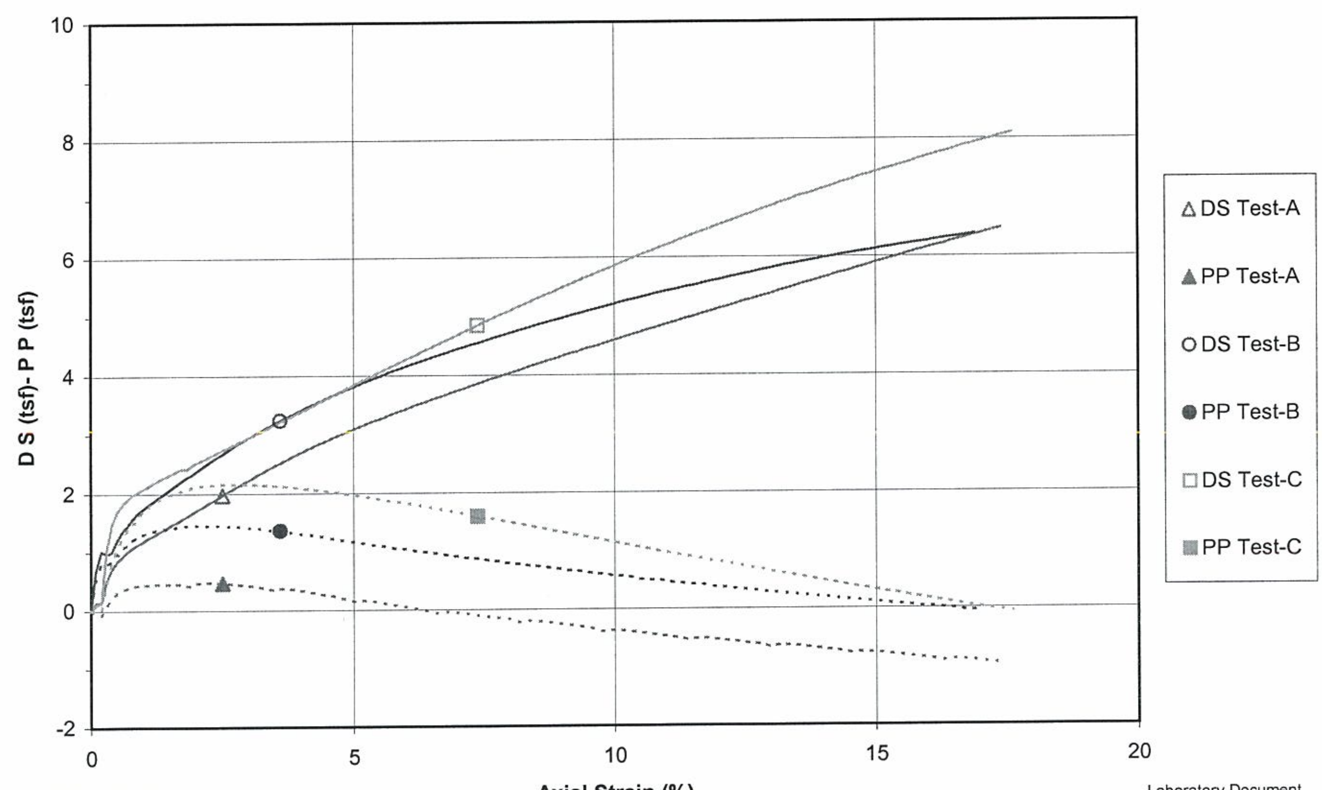
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Shawnee Fossil Plant (SHF) - Ash Ponds
Project No. 175559023
Sample ID: STN-50P, 4.1'-4.6' & STN-50P, 4.7'-5.2' & STN-50P, 6.0'-6.5'
Test Number: 4
Failure Criterion: Maximum Effective Principal Stress Ratio ϕ' = 27.0 deg. c' = 0.48 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

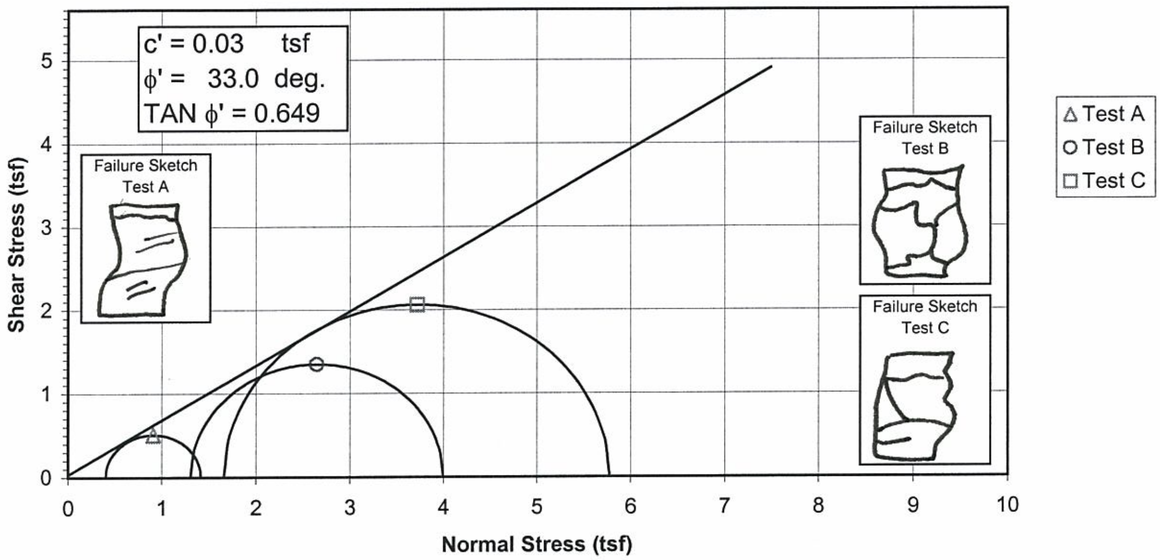


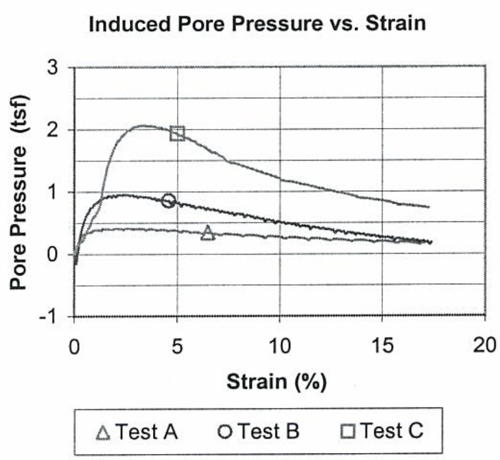
File: 175559023_cu_4 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





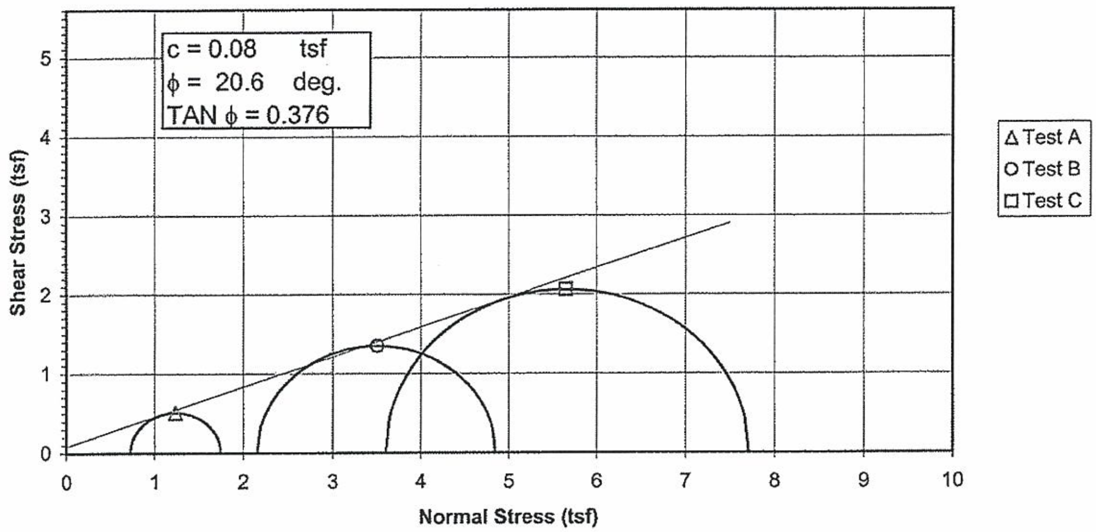
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.2	25.3	21.1	
	Dry Density PCF	γ_{d_o}	100.5	98.8	104.8	
	Saturation %	S_o	88.1	96.2	93.1	
	Void Ratio	e_o	0.684	0.711	0.614	
After Shear	Water content %	W_f	22.9	24.2	20.3	
	Dry Density PCF	γ_{d_f}	104.4	102.1	109.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.620	0.657	0.551	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.41	1.31	1.66	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.04	2.69	4.11	
Time to $(\sigma 1'-\sigma 3')$max min.		t_f	114.1	244.7	276.2	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.895	2.890	2.882	
Initial Height, in.		H_o	5.990	5.993	5.999	

Controlled - Strain Test					
Description of Specimens	Lean Clay (CL), brown, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.71	Project	Shawnee Fossil Plant (SHF) - Ash Ponds
Remarks:					
		Boring No.	STN-50P	Sample No.	5
		Depth Elev.	19.6'-20.1', 20.2'-20.7', 21.6'-22.1'		
		Laboratory	Stantec	Date	3-29-10
		TRIAXIAL COMPRESSION TEST REPORT			

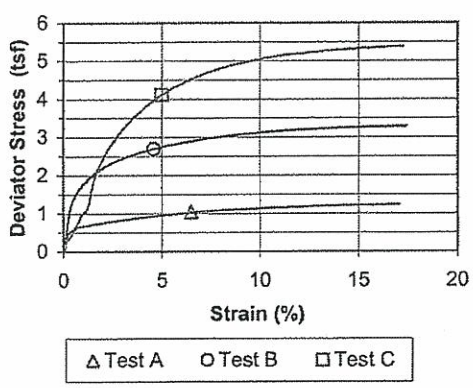
1406 W

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain

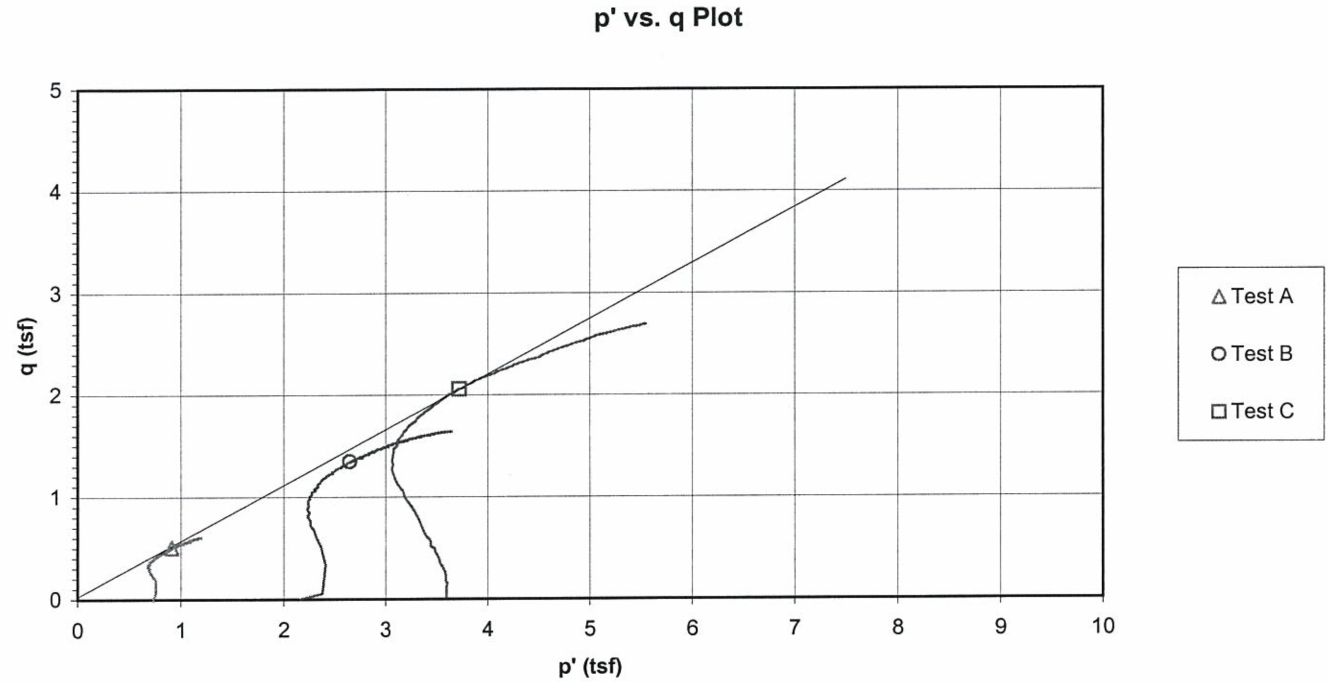


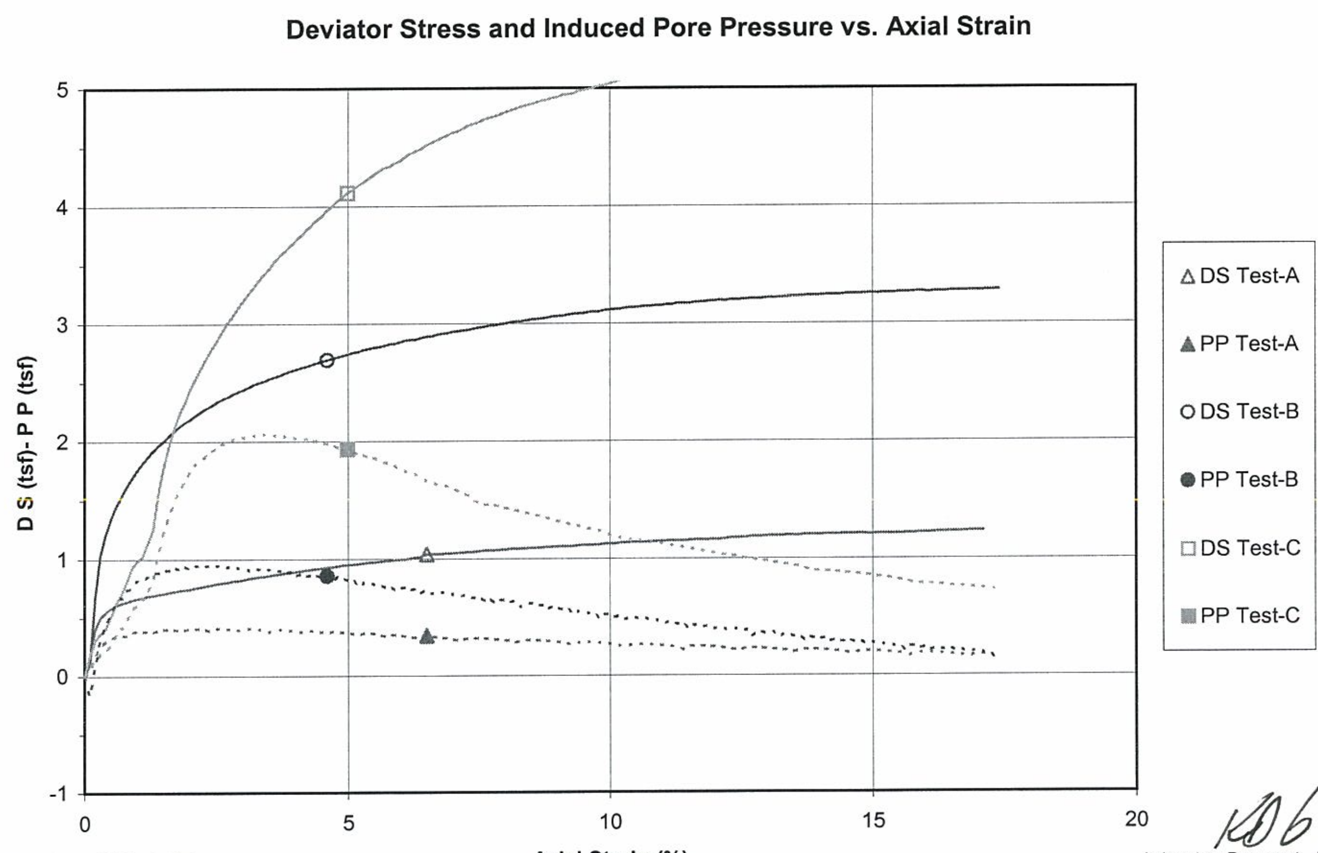
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.2	25.3	21.1	
	Dry Density PCF	γ_{d_o}	100.5	98.8	104.8	
	Saturation %	S_o	88.1	96.2	93.1	
	Void Ratio	e_o	0.684	0.711	0.614	
After Shear	Water content %	W_f	22.9	24.2	20.3	
	Dry Density PCF	γ_{d_f}	104.4	102.1	109.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.620	0.657	0.551	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.04	2.69	4.11	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	114.1	244.7	276.2	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.895	2.890	2.882	
Initial Height, in.		H_o	5.990	5.993	5.999	

Controlled - Strain Test			
Description of Specimens	Lean Clay (CL), brown, moist, firm		
	Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL / PL / PI / Gs 2.71	Project	Shawnee Fossil Plant (SHF) - Ash Ponds	
Remarks:			
	Boring No.	STN-50P	Sample No. 5
	Depth Elev.	19.6'-20.1', 20.2'-20.7', 21.6'-22.1'	
	Laboratory	Stantec	Date 3-29-10
	TRIAXIAL COMPRESSION TEST REPORT		

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Ash Ponds	Project No.	175559023
Sample ID	STN-50P, 19.6'-20.1' & STN-50P, 20.2'-20.7' & STN-50P, 21.6'-22.1'	Test Number	5
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 33.0 deg.	c' =	0.03 tsf



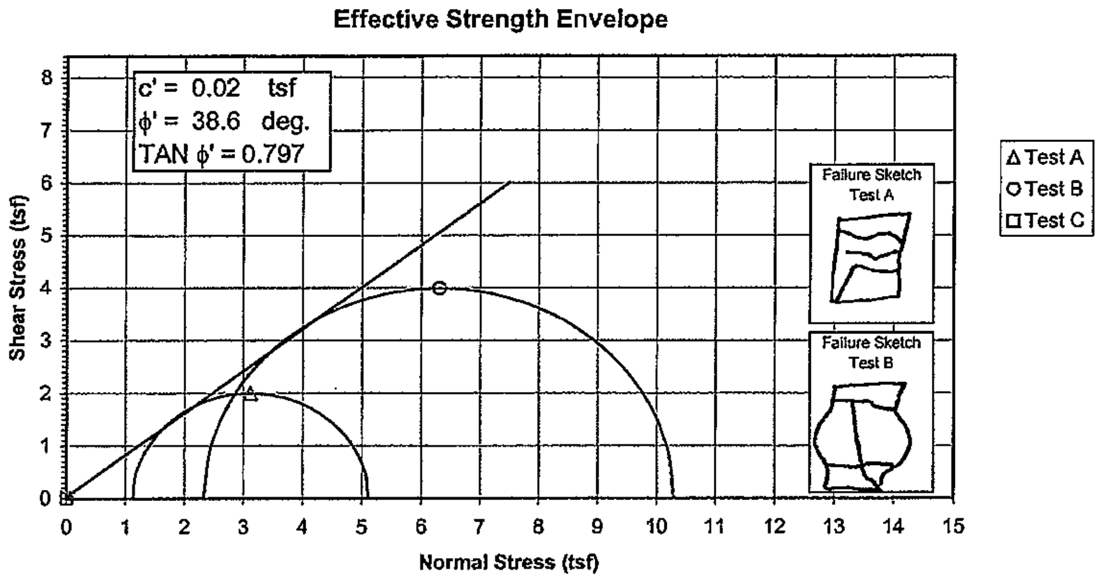


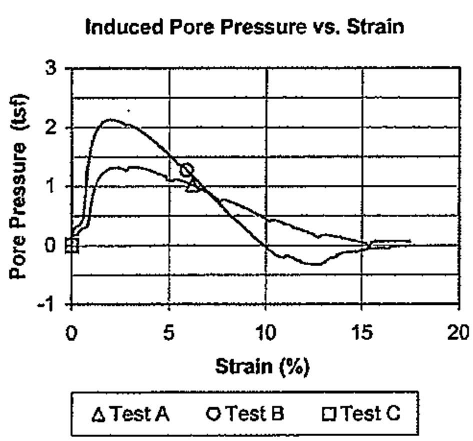
File: 175559023_cu_5 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	58.0	50.1	######	
	Dry Density PCF	γ_{d_o}	62.2	66.1	######	
	Saturation %	S_o	101.0	97.2	######	
	Void Ratio	e_o	1.337	1.200	######	
After Shear	Water content %	W_f	46.3	41.3	######	
	Dry Density PCF	γ_{d_f}	70.0	74.2	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	1.078	0.961	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	1.13	2.33	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	3.97	7.96	0.00	
Time to (σ1'-σ3')max min.		t_f	23.0	22.6	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.882	2.892	######	
Initial Height, in.		H_o	5.888	5.890	######	

Controlled - Strain Test

Description of Specimens: Silt (ML), dark gray, moist, firm, fly ash

		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.33	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-101	Sample No.	1
		Depth Elev.	20.1'-20.6', 20.7'-21.2'		
		Laboratory	Stantec	Date	4-14-10
		TRIAXIAL COMPRESSION TEST REPORT			

KG T

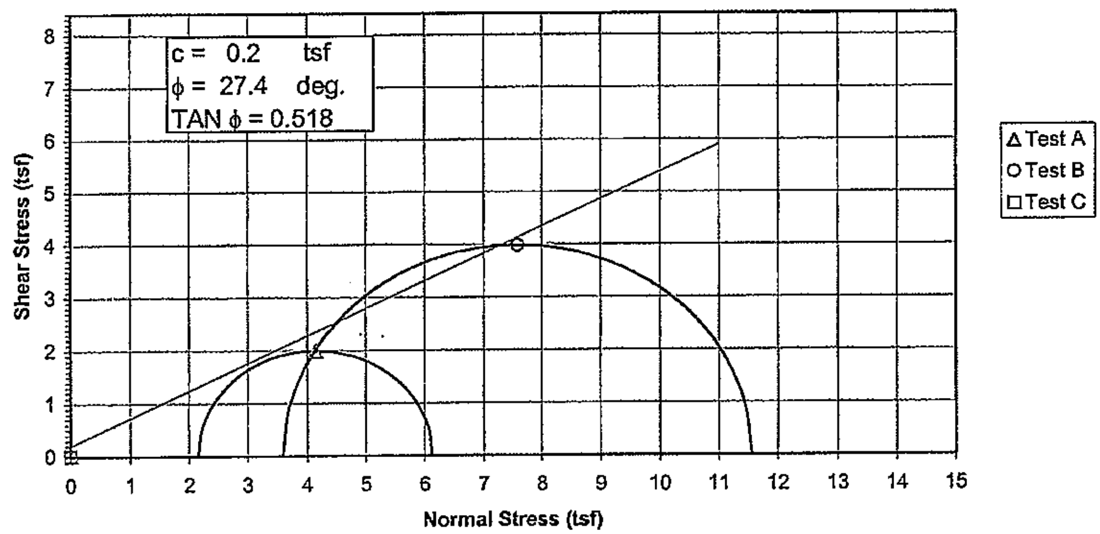
File: 175559035_CU-1 Sheet: CE_Final-E
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

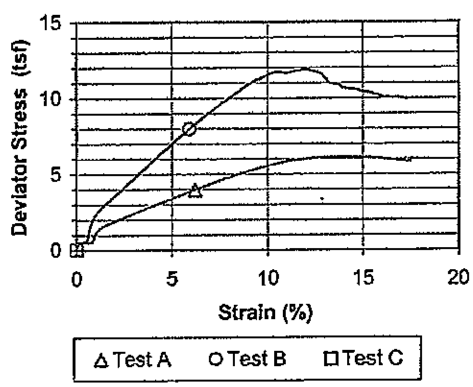
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



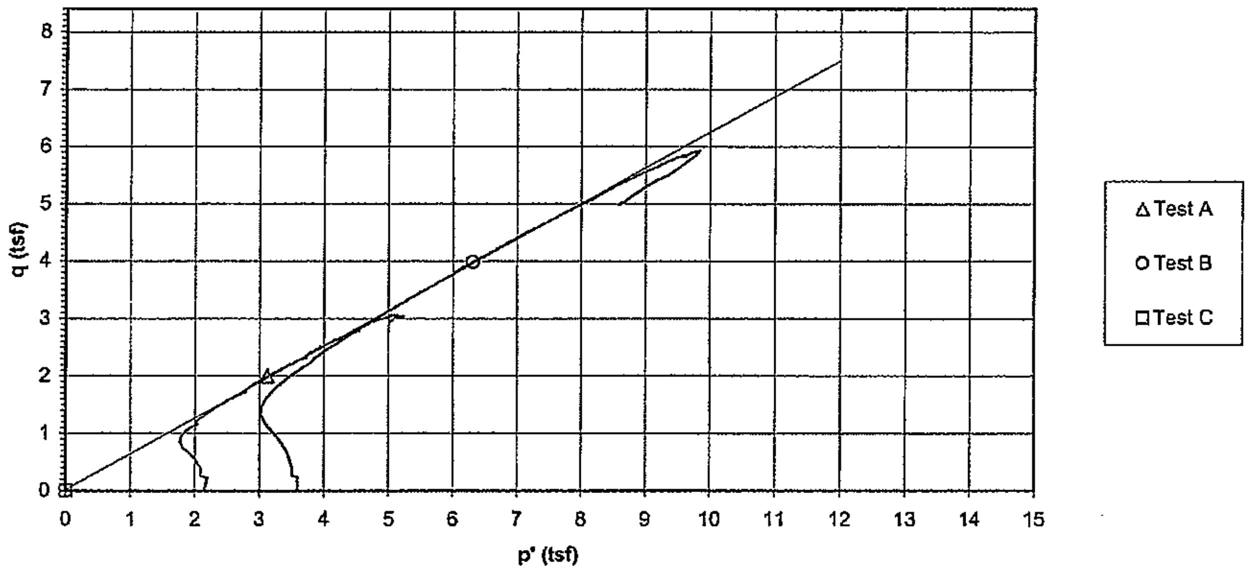
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	58.0	50.1	######	
	Dry Density PCF	γ_{d_o}	62.2	66.1	######	
	Saturation %	S_o	101.0	97.2	######	
	Void Ratio	e_o	1.337	1.200	######	
After Shear	Water content %	W_f	46.3	41.3	######	
	Dry Density PCF	γ_{d_f}	70.0	74.2	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	1.078	0.961	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	3.97	7.96	0.00	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	23.0	22.6	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.882	2.892	######	
Initial Height, in.		H_o	5.888	5.890	######	

Controlled - Strain Test			
Description of Specimens	Silt (ML), dark gray, moist, firm, fly ash		
	Type of Specimen	Undisturbed	Type of test $\bar{R}$
LL / PL / PI / Gs 2.33	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	
Remarks:			
	Boring No.	STN-101	Sample No. 1
	Depth Elev.	20.1'-20.6', 20.7'-21.2'	
	Laboratory	Stantec	Date 4-14-10
	TRIAXIAL COMPRESSION TEST REPORT		

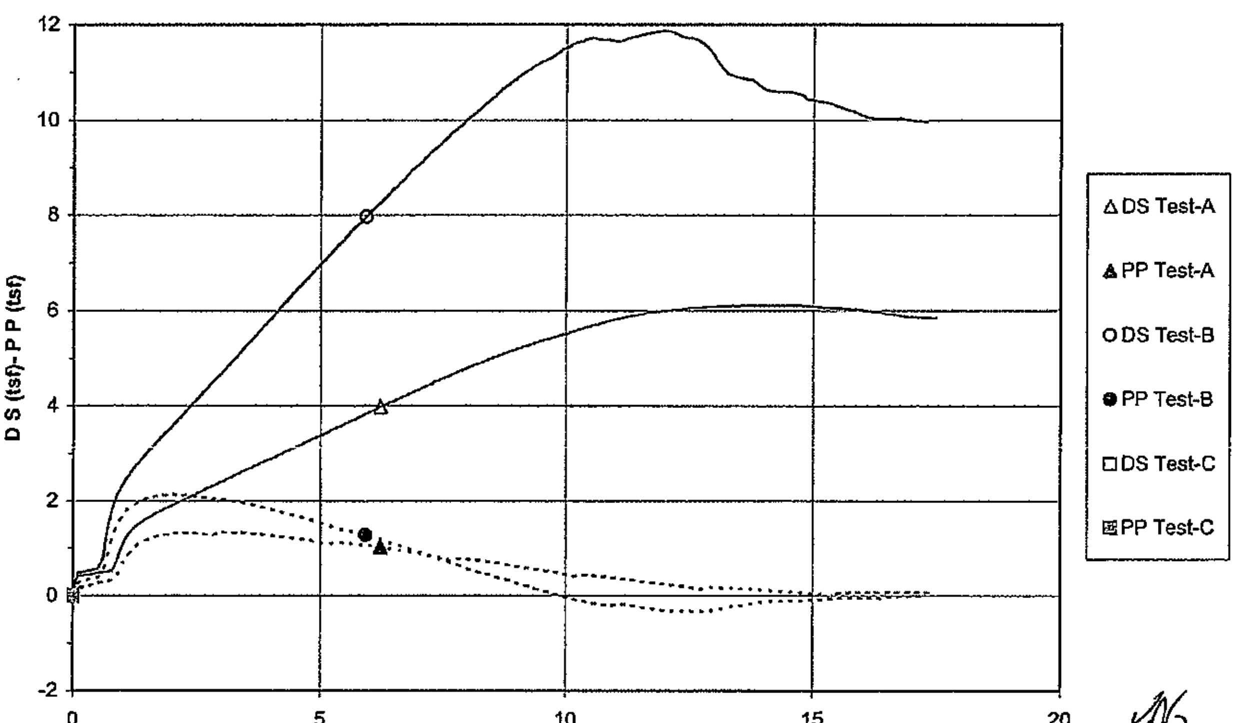
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-101, 20.1'-20.6' & STN-101, 20.7'-21.2'	Test Number	1
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 38.6 deg.	c' =	0.02 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

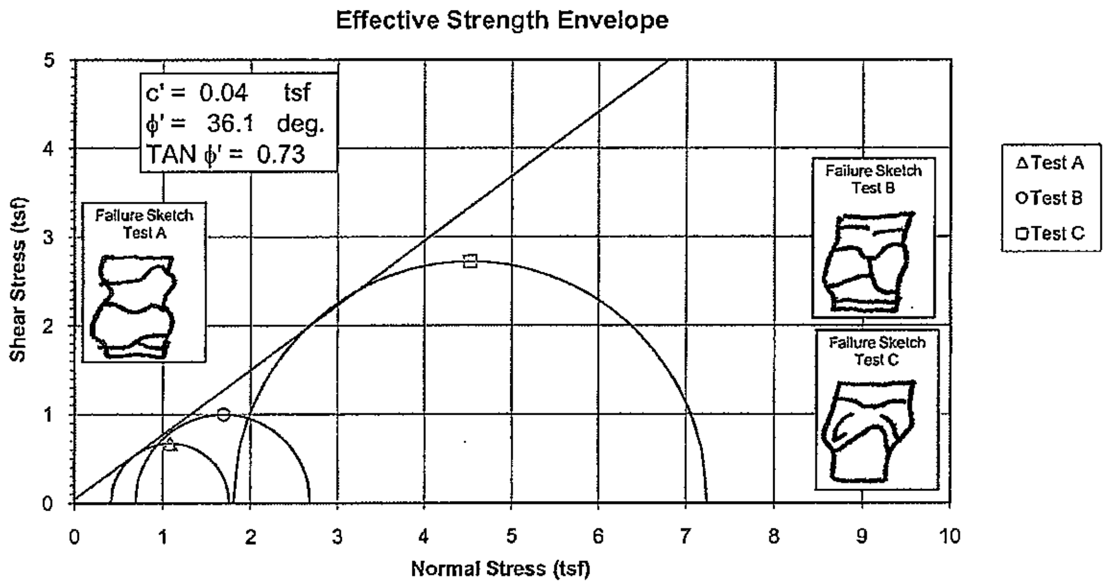


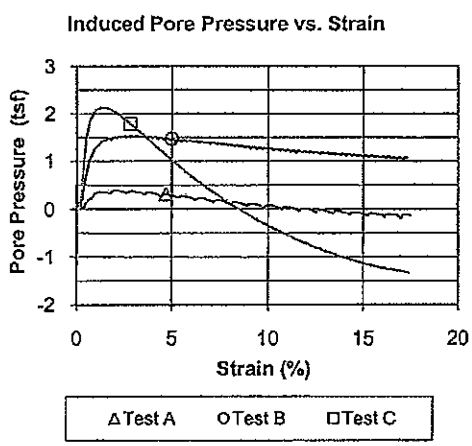
File: 175559035_CU-1 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	30.7	23.6	17.2	
	Dry Density PCF	γ_{d_o}	87.8	101.8	113.0	
	Saturation %	S_o	99.1	111.7	114.2	
	Void Ratio	e_o	0.771	0.527	0.376	
After Shear	Water content %	W_f	26.1	18.4	16.2	
	Dry Density PCF	γ_{d_f}	94.2	106.7	110.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.651	0.457	0.402	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.41	0.69	1.80	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.34	2.00	5.44	
Time to (σ1'-σ3')max min.		t_f	44.7	142.5	26.2	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.902	2.895	2.869	
Initial Height, in.		H_o	5.813	5.842	6.049	

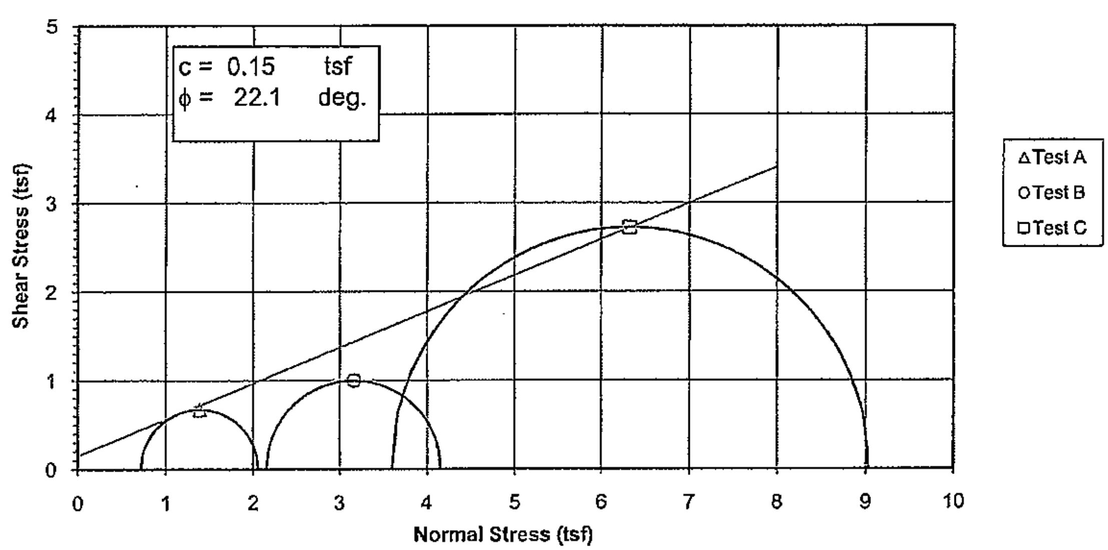
Controlled - Strain Test

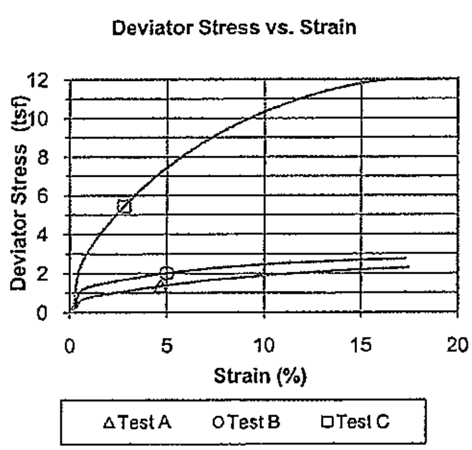
Description of Specimens Silt (ML), dark gray, moist, firm, fly ash with silt lenses

			Type of Specimen Undisturbed		Type of test $\bar{R}$
LL	PL	PI	Gs 2.49	Project Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	
Remarks:					
			Boring No. STN-105A	Sample No. 10	
			Depth Elev. 25.1'-25.6', 25.7'-26.2', 26.3'-26.8'		
			Laboratory Stantec		Date 4-26-10
			TRIAXIAL COMPRESSION TEST REPORT		

1006

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	30.7	23.6	17.2	
	Dry Density PCF	γd_o	87.8	101.8	113.0	
	Saturation %	S_o	99.1	111.7	114.2	
	Void Ratio	e_o	0.771	0.527	0.376	
After Shear	Water content %	W_f	26.1	18.4	16.2	
	Dry Density PCF	γd_f	94.2	106.7	110.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.651	0.457	0.402	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.34	2.00	5.44	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	44.7	142.5	26.2	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.902	2.895	2.869	
Initial Height, in.		H_o	5.813	5.842	6.049	

Controlled - Strain Test

Description of Specimens Silt (ML), dark gray, moist, firm, fly ash with silt lenses

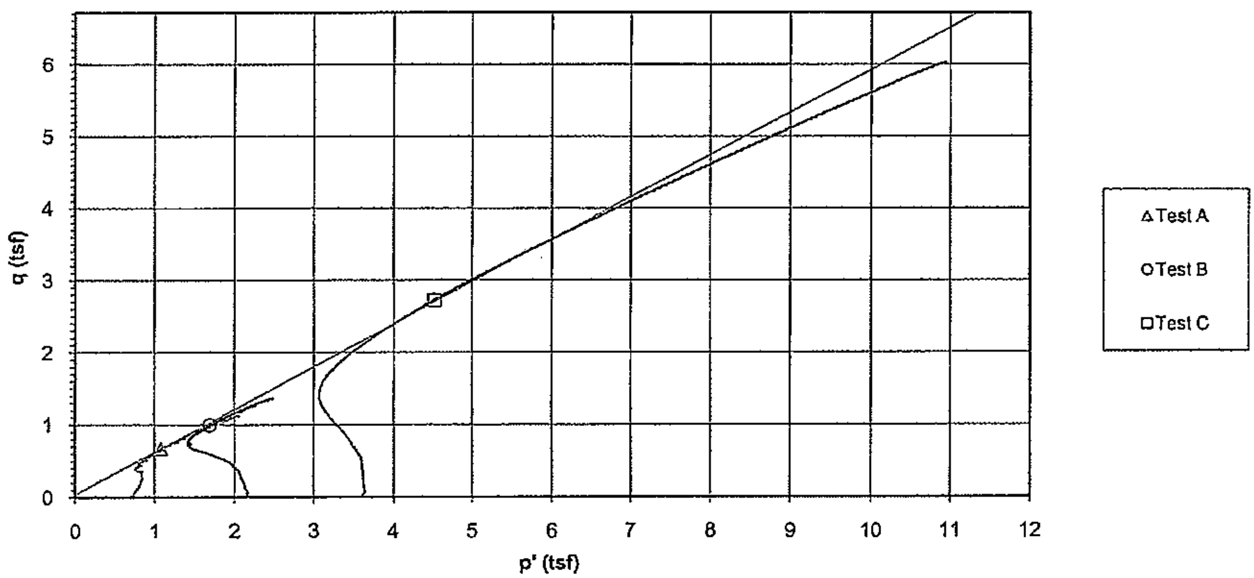
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.49	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-105A	Sample No.	10
		Depth Elev.	25.1'-25.6', 25.7'-26.2', 26.3'-26.8'		
		Laboratory	Stantec	Date	4-26-10
		TRIAXIAL COMPRESSION TEST REPORT			

MB [signature]

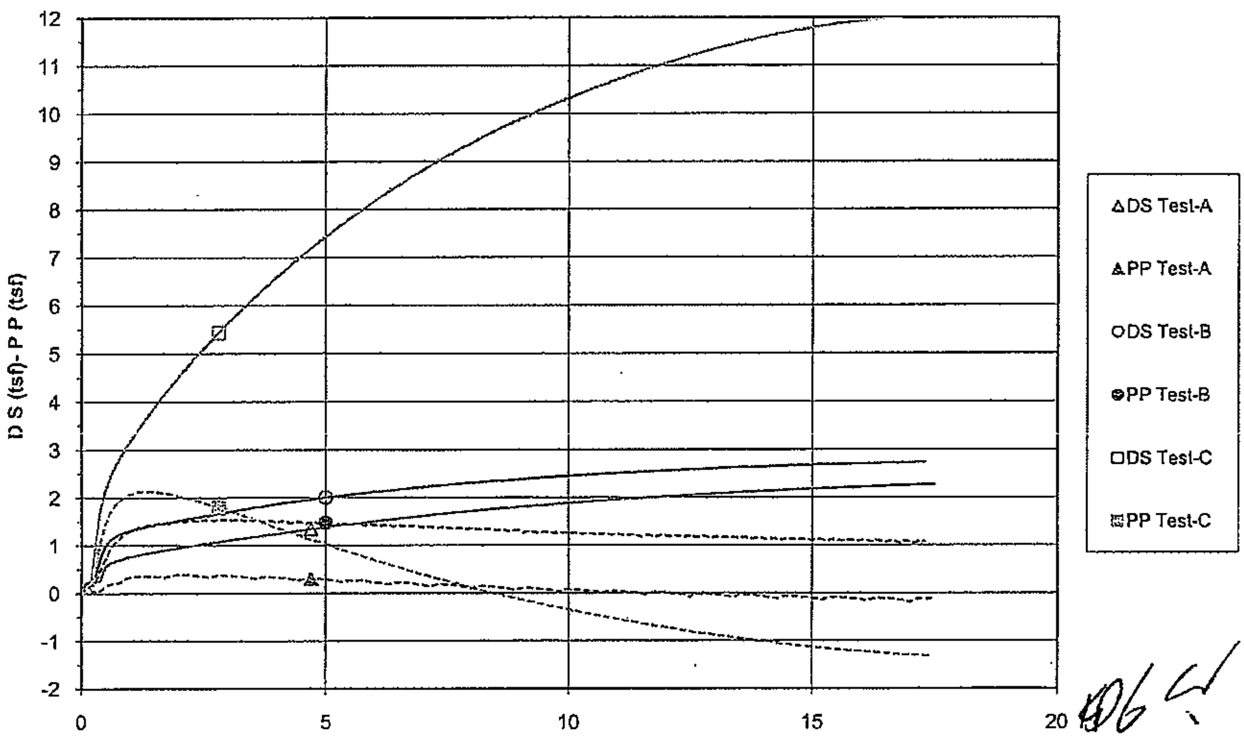
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project No.: 175559035
Sample ID: STN-105A, 25.1'-25.6' & STN-105A, 25.7'-26.2' & STN-105A, 26.3'-26.8'
Test Number: 10
Failure Criterion: Maximum Effective Principal Stress Ratio ϕ' = 36.1 deg. c' = 0.04 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

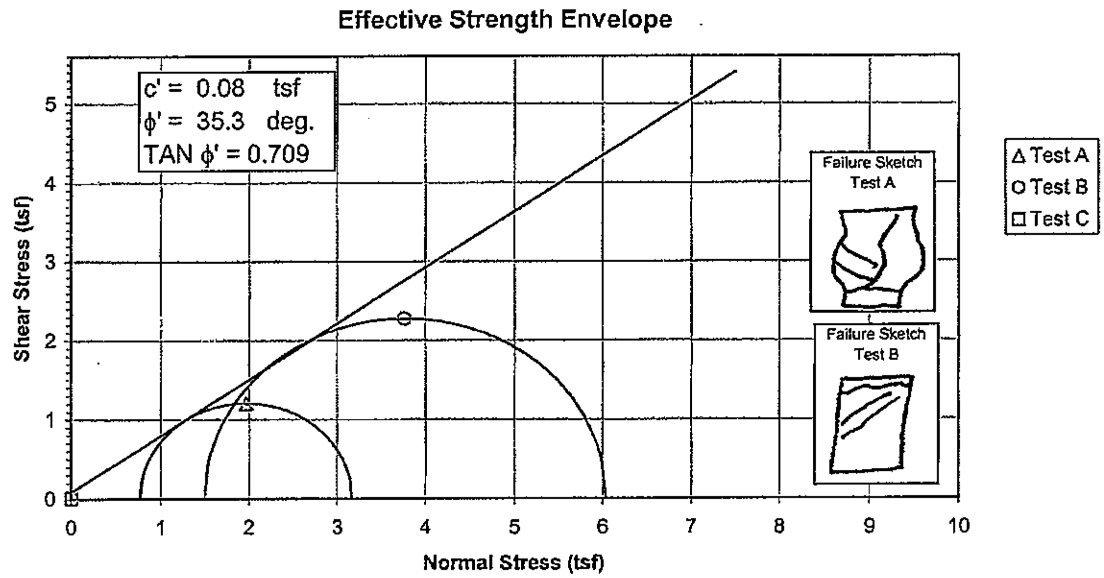


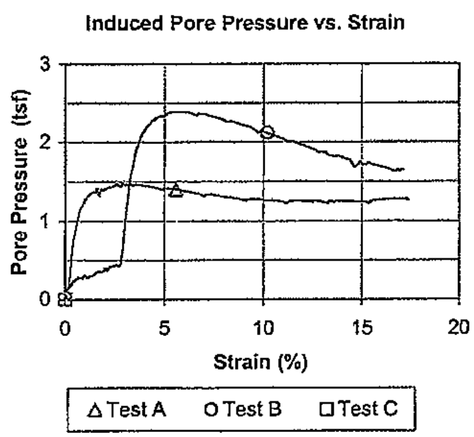
File: 175559035_CU-10.xlsm Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





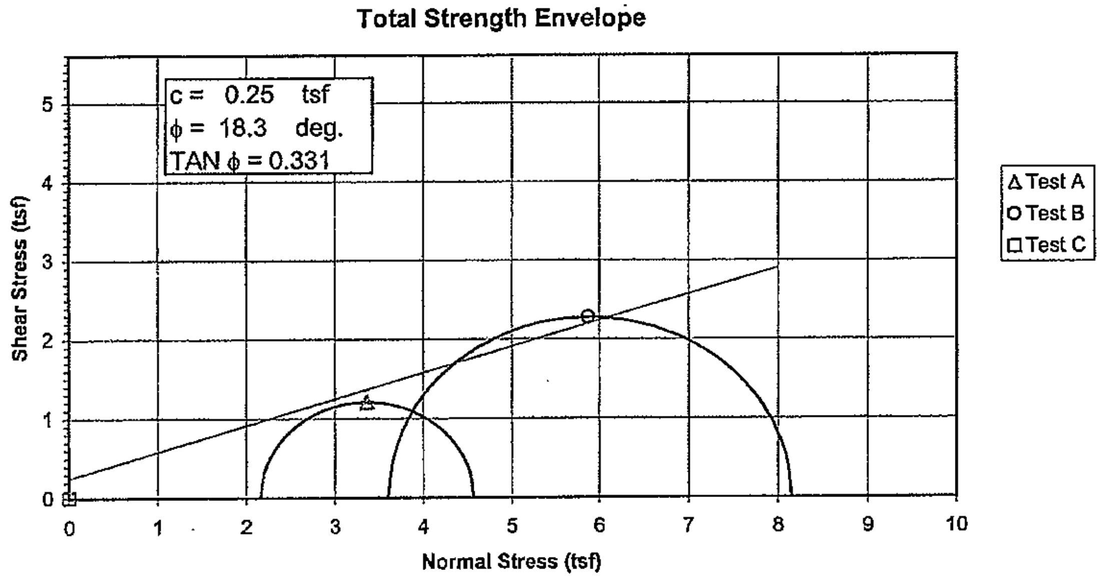
Specimen No.			A	B	C
Initial Data	Water content %	W_o	56.9	59.7	######
	Dry Density PCF	γd_o	62.2	61.5	######
	Saturation %	S_o	95.1	98.0	######
	Void Ratio	e_o	1.479	1.506	######
After Shear	Water content %	W_f	51.1	48.7	######
	Dry Density PCF	γd_f	68.2	70.0	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	1.262	1.204	######
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.77	1.50	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	2.41	4.56	0.00
Time to (σ1'-σ3')max min.		t_f	27.5	65.2	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.886	2.875	######
Initial Height, in.		H_o	5.980	5.916	######

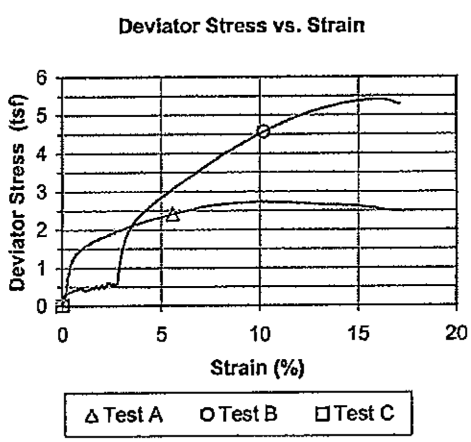
Controlled - Strain Test

Description of Specimens Silt (ML), dark gray, moist, firm

				Type of Specimen Undisturbed	Type of test R
LL	PL	PI	Gs 2.47	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
				Boring No. STN-108	Sample No. 6
				Depth Elev.	28.2'-28.7', 28.8'-29.3'
				Laboratory Stantec	Date 4-14-10
				TRIAXIAL COMPRESSION TEST REPORT	

Failure Criterion: Maximum Effective Principal Stress Ratio



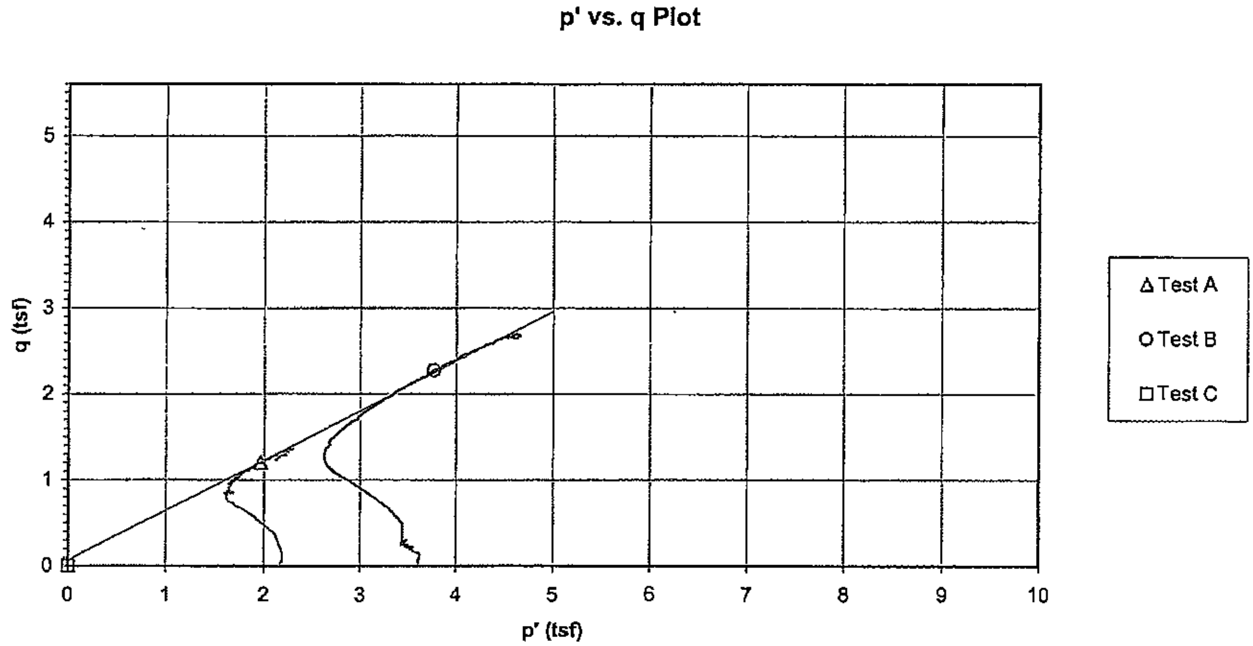


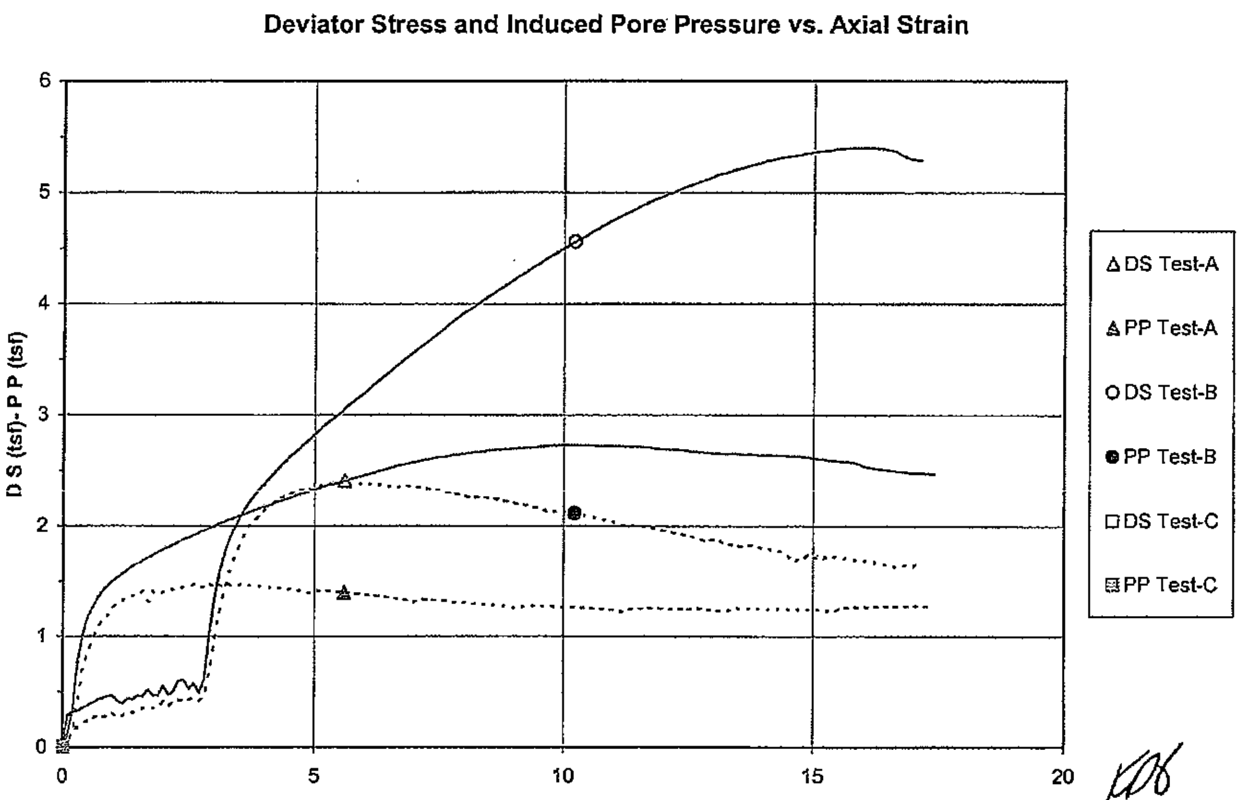
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	56.9	59.7	######	
	Dry Density PCF	γ_{d_o}	62.2	61.5	######	
	Saturation %	S_o	95.1	98.0	######	
	Void Ratio	e_o	1.479	1.506	######	
After Shear	Water content %	W_f	51.1	48.7	######	
	Dry Density PCF	γ_{d_f}	68.2	70.0	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	1.262	1.204	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	2.41	4.56	0.00	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	27.5	65.2	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.886	2.875	######	
Initial Height, in.		H_o	5.980	5.916	######	

Controlled - Strain Test				
Description of Specimens	Silt (ML), dark gray, moist, firm			
	Type of Specimen	Undisturbed	Type of test	R
LL PL PI Gs 2.47	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack		
Remarks:				
	Boring No.	STN-108	Sample No.	6
	Depth Elev.	28.2'-28.7', 28.8'-29.3'		
	Laboratory	Stantec	Date	4-14-10
	TRIAXIAL COMPRESSION TEST REPORT			

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-108, 28.2'-28.7' & STN-108, 28.8'-29.3'	Test Number	6
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 35.3 deg.	c' =	0.08 tsf





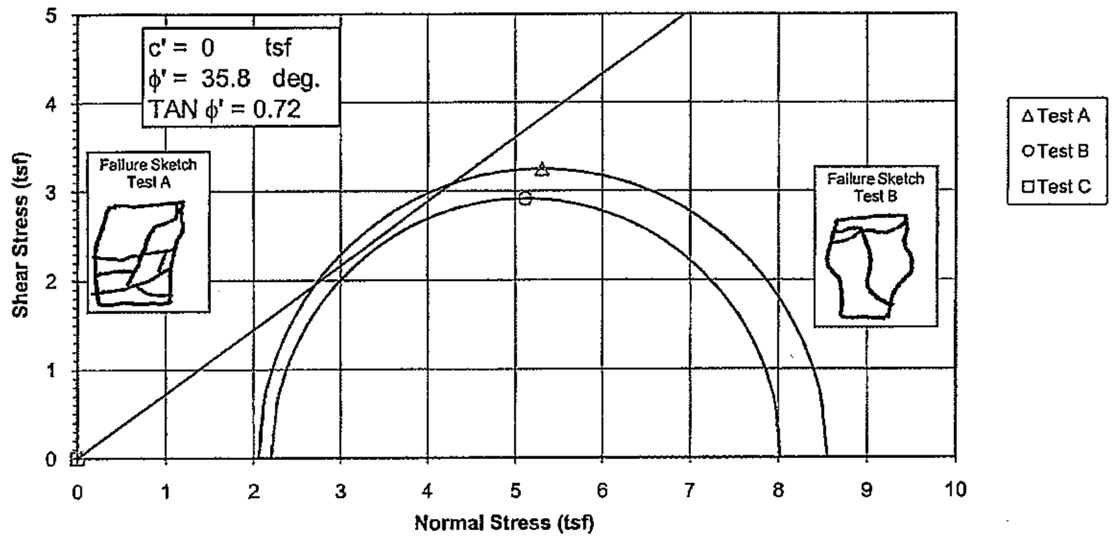
File: 175559035_CU-6 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

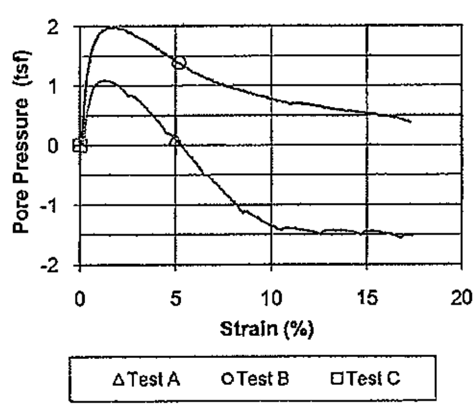
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C
Initial Data	Water content %	W_o	35.2	27.8	#####
	Dry Density PCF	γ_{d_o}	78.4	86.4	#####
	Saturation %	S_o	95.4	94.3	#####
	Void Ratio	e_o	0.862	0.690	#####
After Shear	Water content %	W_f	33.7	27.4	#####
	Dry Density PCF	γ_{d_f}	81.7	89.0	#####
	Saturation %	S_f	100.0	100.0	#####
	Void Ratio	e_f	0.789	0.641	#####
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF @ failure		$\sigma_3'f$	2.06	2.20	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	6.49	5.81	0.00
Time to (σ1'-σ3')max min.		t_f	22.9	196.1	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.878	2.878	#####
Initial Height, in.		H_o	5.969	5.992	#####

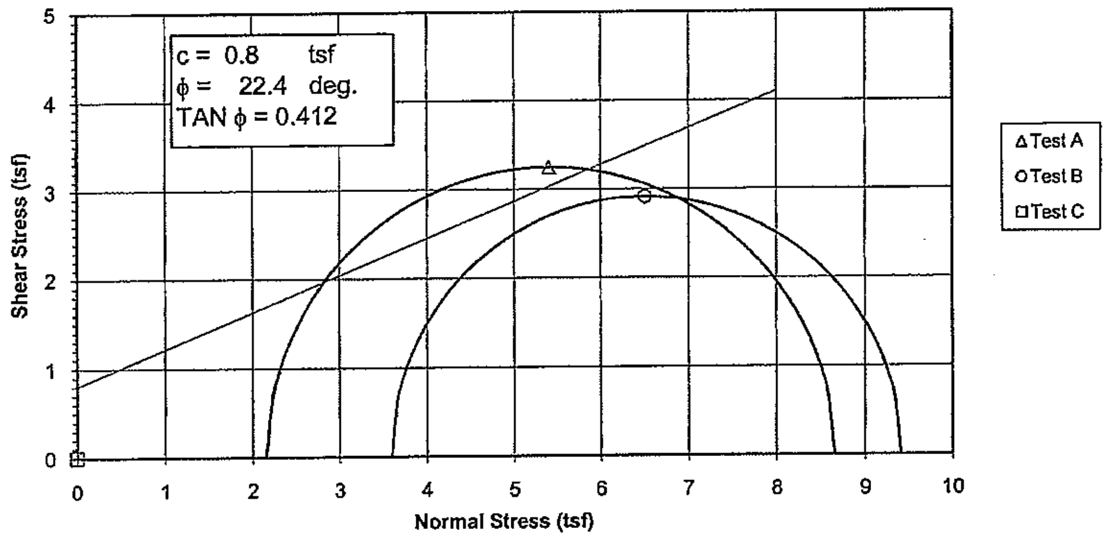
Controlled - Strain Test

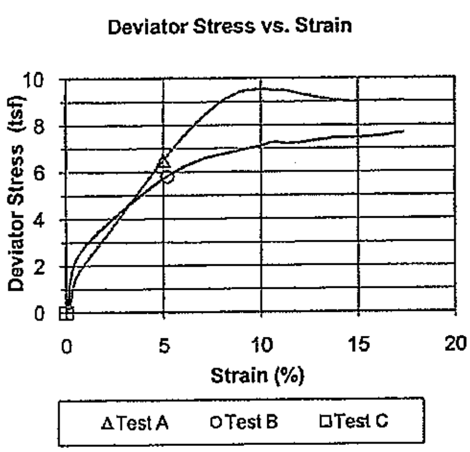
Description of Specimens Silt (ML), dark gray, moist, firm, fly ash

Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL / PL / PI / Gs 2.34	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	
Remarks:			
Boring No.	STN-110	Sample No.	11
Depth Elev.	40.1'-40.6', 40.7'-41.2'		
Laboratory	Stantec	Date	4-27-10

TRIAXIAL COMPRESSION TEST REPORT

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C
Initial Data	Water content %	W_o	35.2	27.8	#####
	Dry Density PCF	γ_{d_o}	78.4	86.4	#####
	Saturation %	S_o	95.4	94.3	#####
	Void Ratio	e_o	0.862	0.690	#####
After Shear	Water content %	W_f	33.7	27.4	#####
	Dry Density PCF	γ_{d_f}	81.7	89.0	#####
	Saturation %	S_f	100.0	100.0	#####
	Void Ratio	e_f	0.789	0.641	#####
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	6.49	5.81	0.00
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	22.9	196.1	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.878	2.878	#####
Initial Height, in.		H_o	5.969	5.992	#####

Controlled - Strain Test

Description of Specimens: Silt (ML), dark gray, moist, firm, fly ash

LL	PL	PI	Gs 2.34	Type of Specimen: Undisturbed — Type of test: $\overline{R}$
Remarks:				Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
				Boring No. STN-110 — Sample No. 11
				Depth Elev. 40.1'-40.6', 40.7'-41.2'
				Laboratory: Stantec — Date: 4-27-10

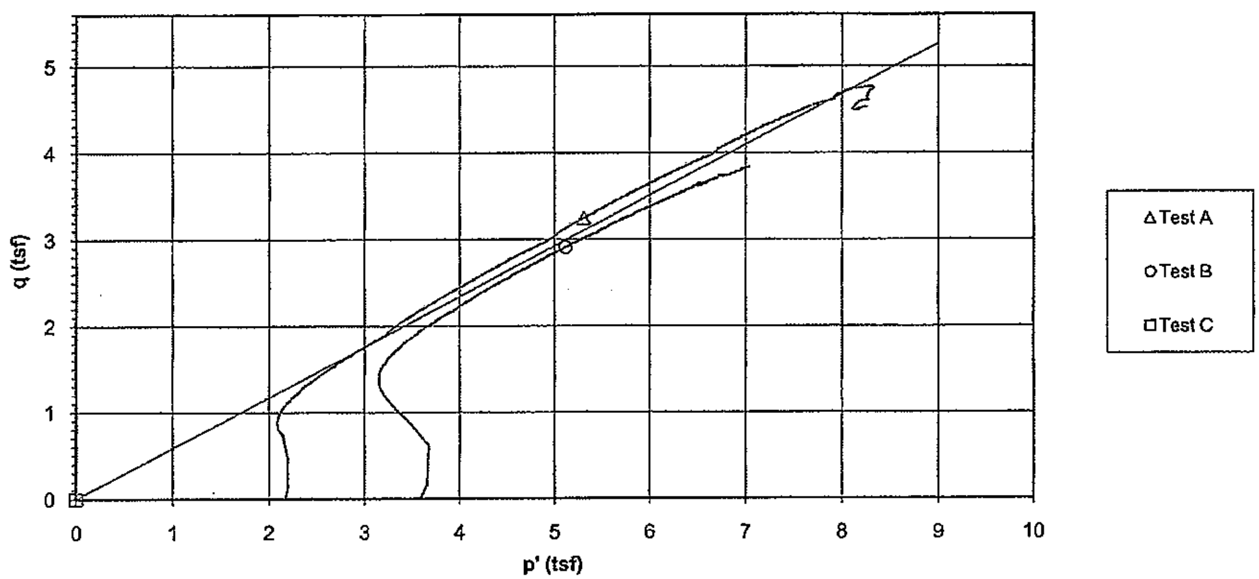
TRIAXIAL COMPRESSION TEST REPORT

KDG

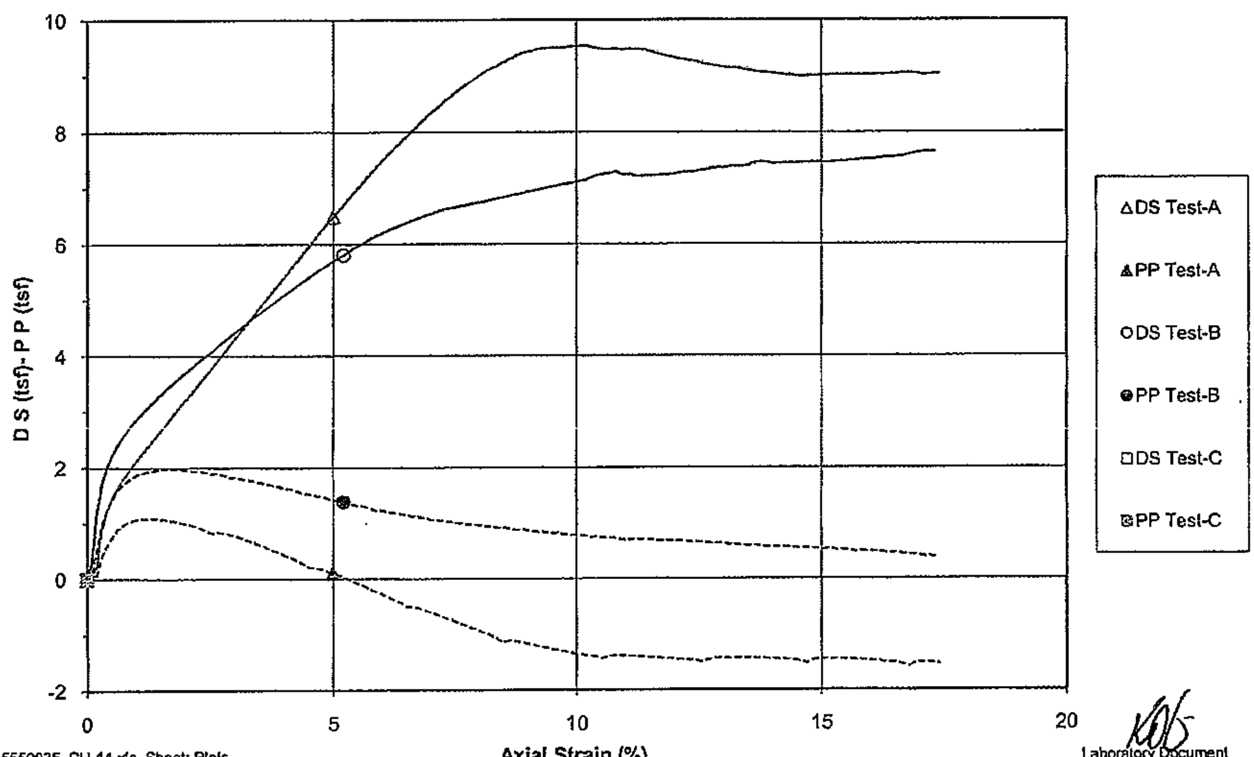
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-110, 40.1'-40.6' & STN-110, 40.7'-41.2'	Test Number	11
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 35.8 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

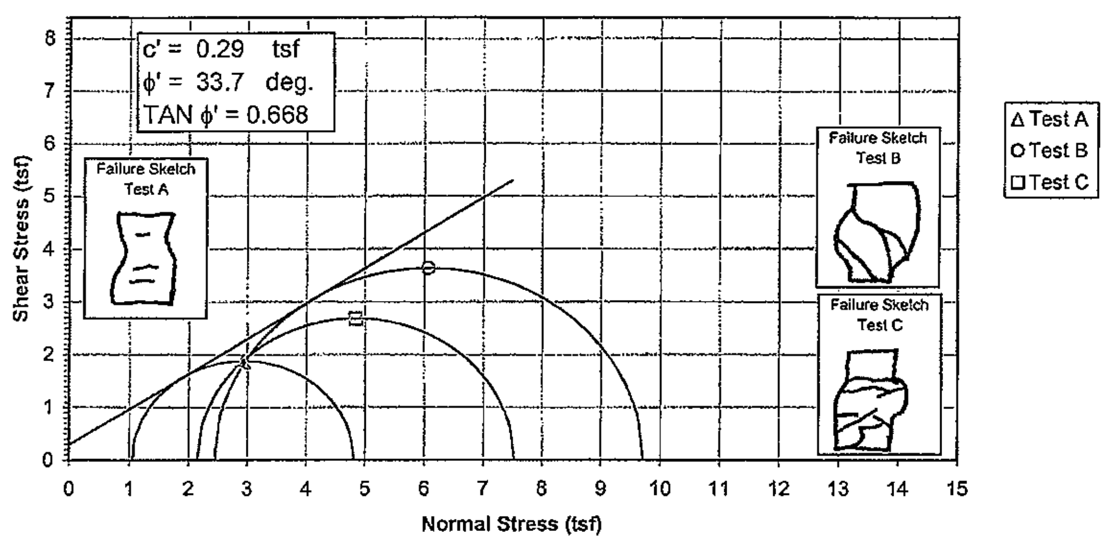


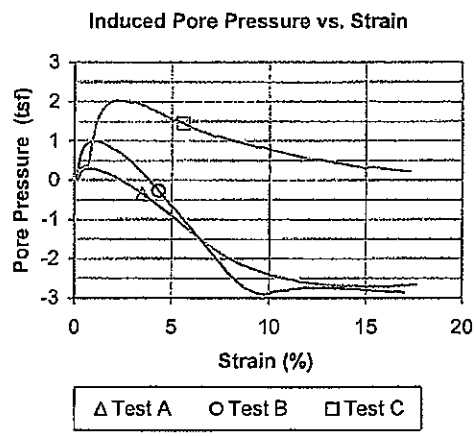
File: 175559035_CU-11.xls Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio



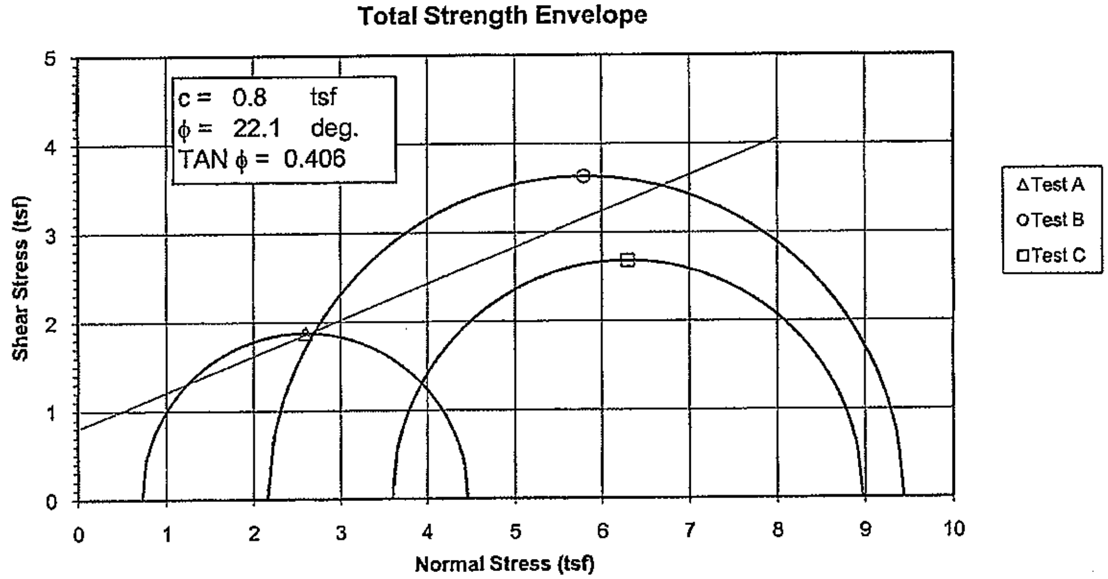


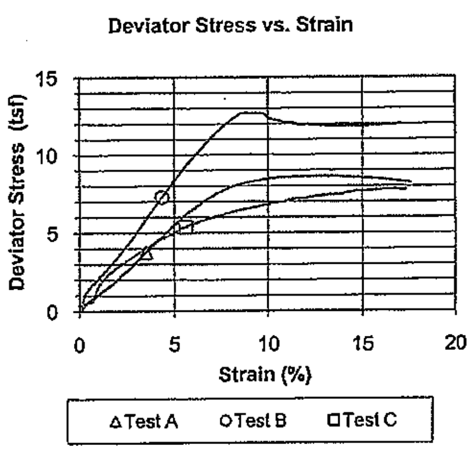
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	39.7	36.4	31.4	
	Dry Density PCF	γ_{d_o}	79.0	81.7	88.5	
	Saturation %	S_o	111.2	109.7	115.1	
	Void Ratio	e_o	0.825	0.766	0.630	
After Shear	Water content %	W_f	35.6	31.9	26.3	
	Dry Density PCF	γ_{d_f}	79.2	83.0	89.7	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.821	0.738	0.608	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	1.06	2.45	2.16	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	3.74	7.27	5.37	
Time to $(\sigma1'-\sigma3')$max min.		t_f	12.8	14.5	32.3	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.839	2.877	2.877	
Initial Height, in.		H_o	5.573	5.671	5.833	

Controlled - Strain Test

Description of Specimens	Silt (ML), dark gray, wet, firm, fly ash				
		Type of Specimen	Undisturbed	Type of test	$\overline{R}$
LL	PL	PI	Gs 2.31	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-111	Sample No.	2
		Depth Elev.	31.1'-31.6', 31.6'-32.2', 32.3'-32.8'		
		Laboratory	Stantec	Date	4-14-10
		TRIAXIAL COMPRESSION TEST REPORT			

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C
Initial Data	Water content %	W_o	39.7	36.4	31.4
	Dry Density PCF	γ_{d_o}	79.0	81.7	88.5
	Saturation %	S_o	111.2	109.7	115.1
	Void Ratio	e_o	0.825	0.766	0.630
After Shear	Water content %	W_f	35.6	31.9	26.3
	Dry Density PCF	γ_{d_f}	79.2	83.0	89.7
	Saturation %	S_f	100.0	100.0	100.0
	Void Ratio	e_f	0.821	0.738	0.608
	Final Back Pressure TSF	u_c	5.76	4.32	2.88
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	3.74	7.27	5.37
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	12.8	14.5	32.3
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a
Initial Diameter, in.		D_o	2.839	2.877	2.877
Initial Height, in.		H_o	5.573	5.671	5.833

Controlled - Strain Test

Description of Specimens: Silt (ML), dark gray, wet, firm, fly ash

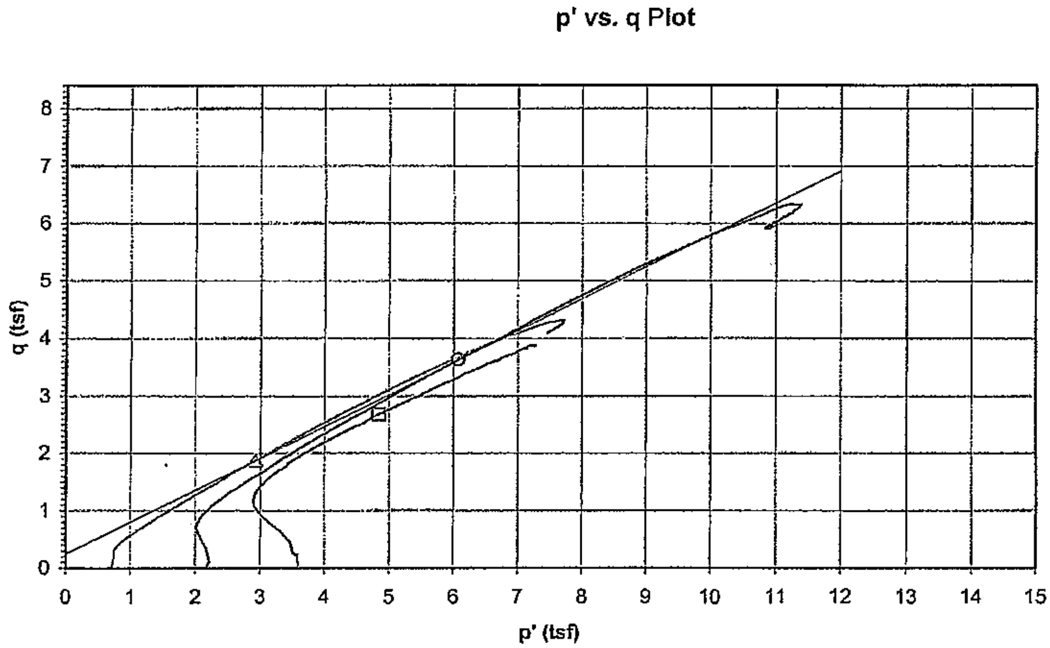
LL	PL	PI	Gs 2.31	Type of Specimen: Undisturbed	Type of test: $\bar{R}$
Remarks:				Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	
				Boring No.: STN-111	Sample No. 2
				Depth Elev.: 31.1'-31.6', 31.6'-32.2', 32.3'-32.8'	
				Laboratory: Stantec	Date 4-14-10

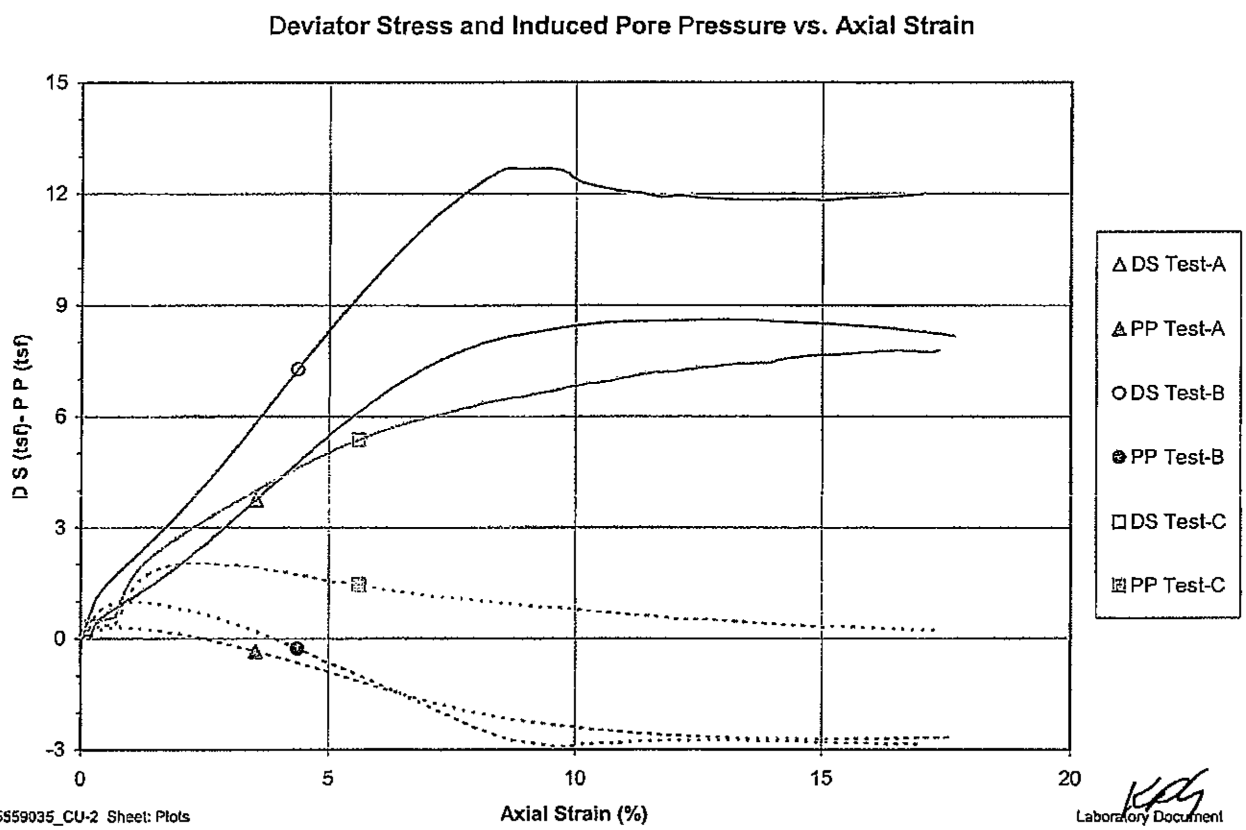
TRIAXIAL COMPRESSION TEST REPORT

WB

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-111, 31.1'-31.6' & STN-111, 31.6'-32.2' & STN-111, 32.3'-32.8'	Test Number	2
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 33.7 deg.	c' =	0.29 tsf



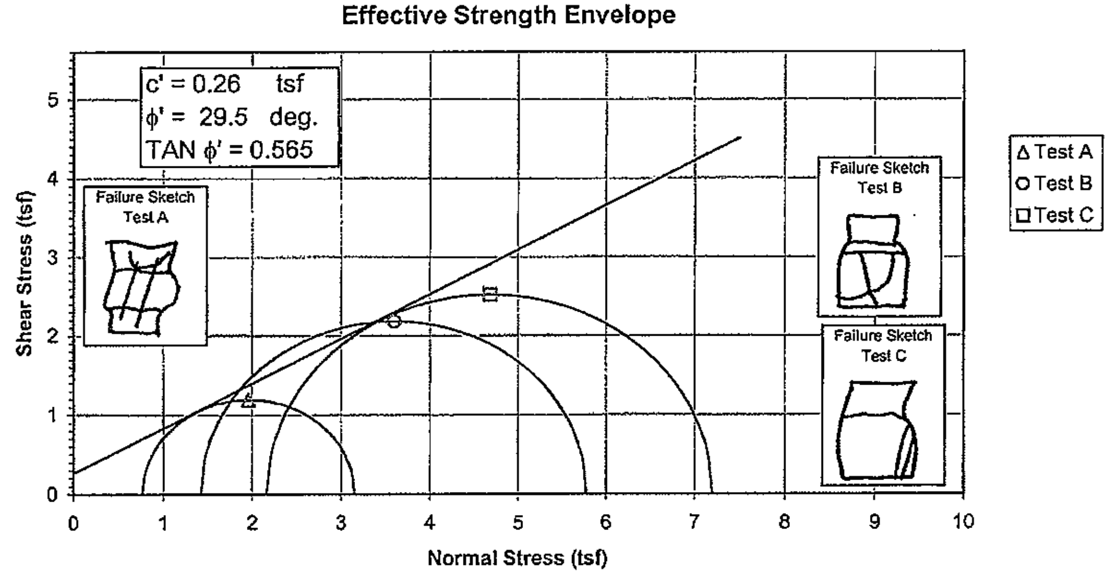


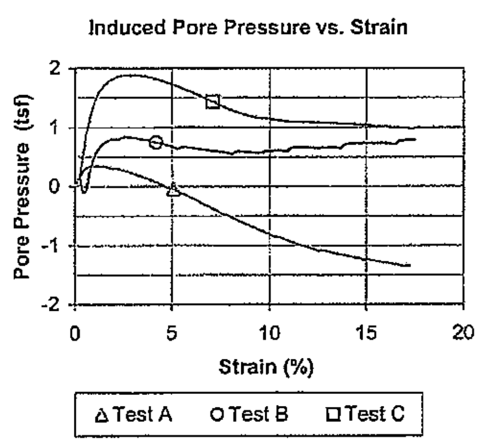
File: 175559035_CU-2 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	35.0	46.9	37.8	
	Dry Density PCF	γ_{d_o}	78.3	67.4	71.5	
	Saturation %	S_o	93.4	93.0	83.7	
	Void Ratio	e_o	0.889	1.195	1.070	
After Shear	Water content %	W_f	32.1	46.1	32.3	
	Dry Density PCF	γ_{d_f}	84.1	70.7	83.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.760	1.091	0.765	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.77	1.42	2.17	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	2.39	4.36	5.03	
Time to (σ1'-σ3')max min.		t_f	36.2	16.5	24.9	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	3.84	n/a	
Initial Diameter, in.		D_o	2.887	2.888	2.914	
Initial Height, in.		H_o	5.908	6.073	5.668	

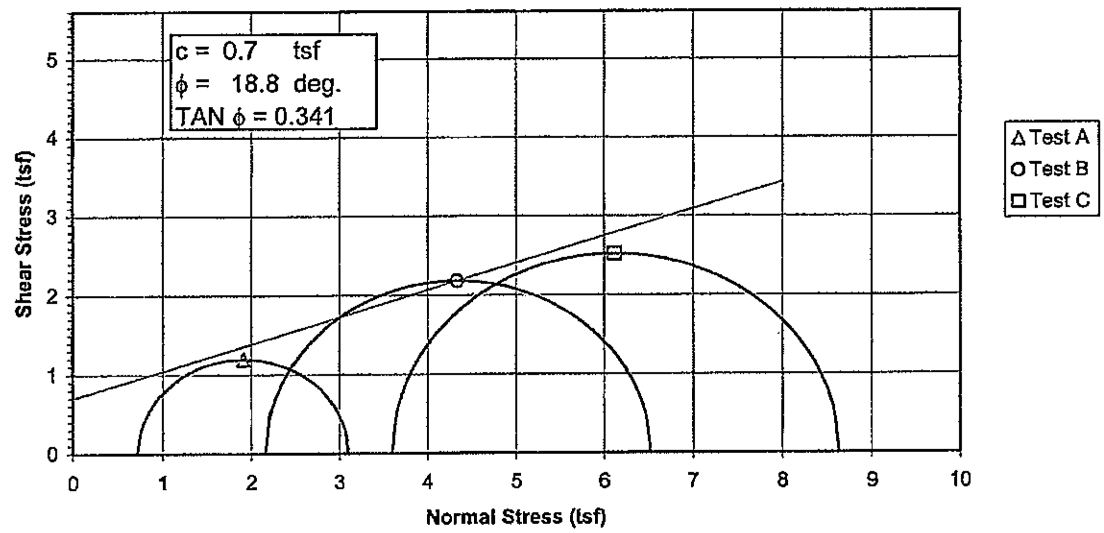
Controlled - Strain Test

Description of Specimens Silt (ML), dark gray, moist, firm

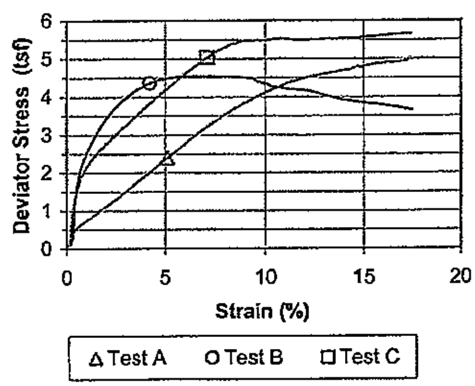
				Type of Specimen Undisturbed	Type of test $\bar{R}$
LL	PL	PI	Gs 2.37	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
				Boring No. STN-114	Sample No. 3
				Depth Elev.	5.2'-5.8', 5.9'-6.4', 9.6'-10.1'
				Laboratory FMSM Engineers	Date 4-14-10
				TRIAXIAL COMPRESSION TEST REPORT	

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	35.0	46.9	37.8	
	Dry Density PCF	γd_o	78.3	67.4	71.5	
	Saturation %	S_o	93.4	93.0	83.7	
	Void Ratio	e_o	0.889	1.195	1.070	
After Shear	Water content %	W_f	32.1	46.1	32.3	
	Dry Density PCF	γd_f	84.1	70.7	83.8	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.760	1.091	0.765	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	2.39	4.36	5.03	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	36.2	16.5	24.9	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	3.84	n/a	
Initial Diameter, in.		D_o	2.887	2.888	2.914	
Initial Height, in.		H_o	5.908	6.073	5.668	

Controlled - Strain Test					
Description of Specimens	Silt (ML), dark gray, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.37	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-114	Sample No.	3
		Depth Elev.	5.2'-5.8', 5.9'-6.4', 9.6'-10.1'		
		Laboratory	FMSM Engineers	Date	4-14-10
		TRIAXIAL COMPRESSION TEST REPORT			

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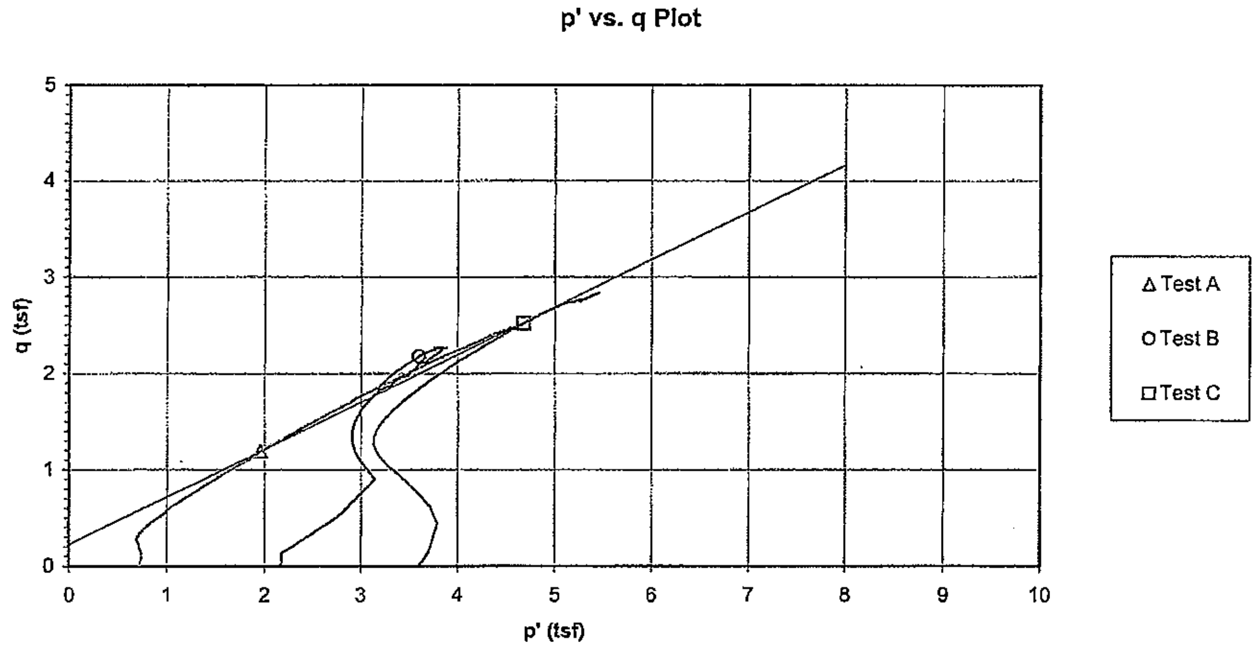
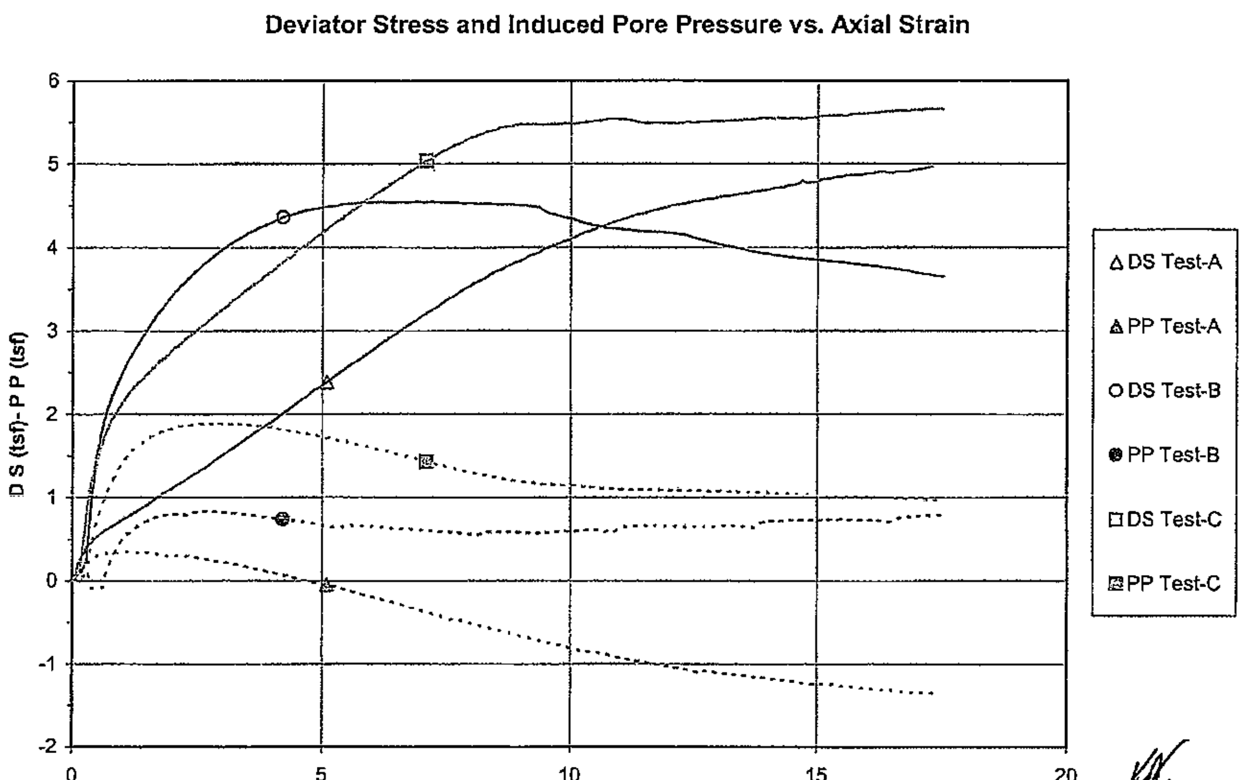
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Project No. 175559035
Sample ID: STN-114, 5.2'-5.8' & STN-114, 5.9'-6.4' & STN-114, 9.6'-10.1'
Test Number: 3
Failure Criterion: Maximum Effective Principal Stress Ratio ϕ' = 29.5 deg. c' = 0.26 tsf





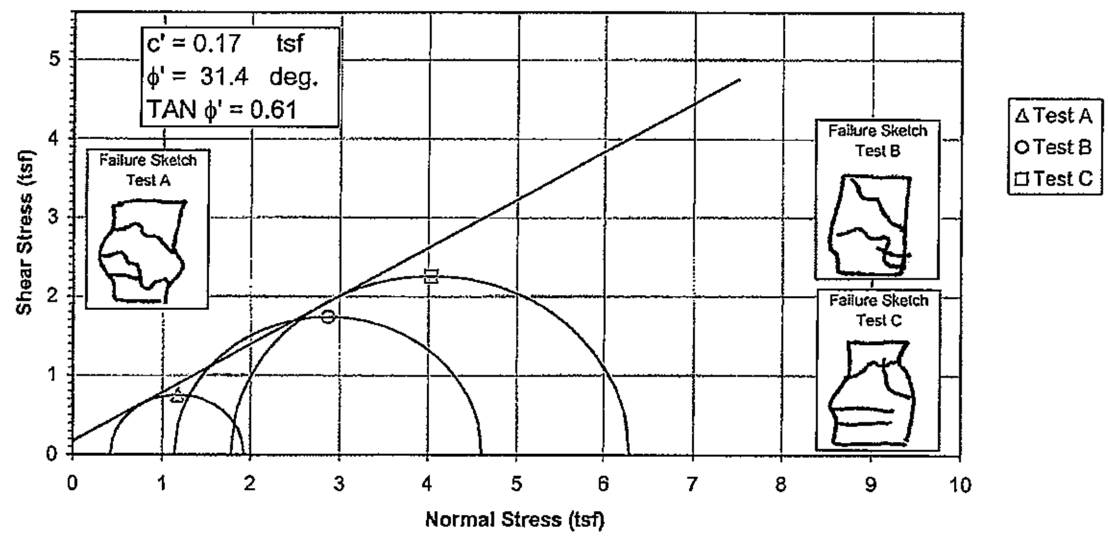
File: 175559035_CU-3 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

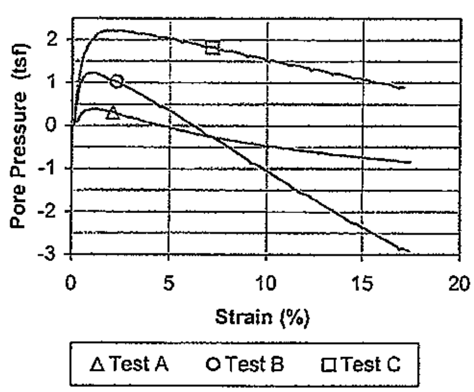
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



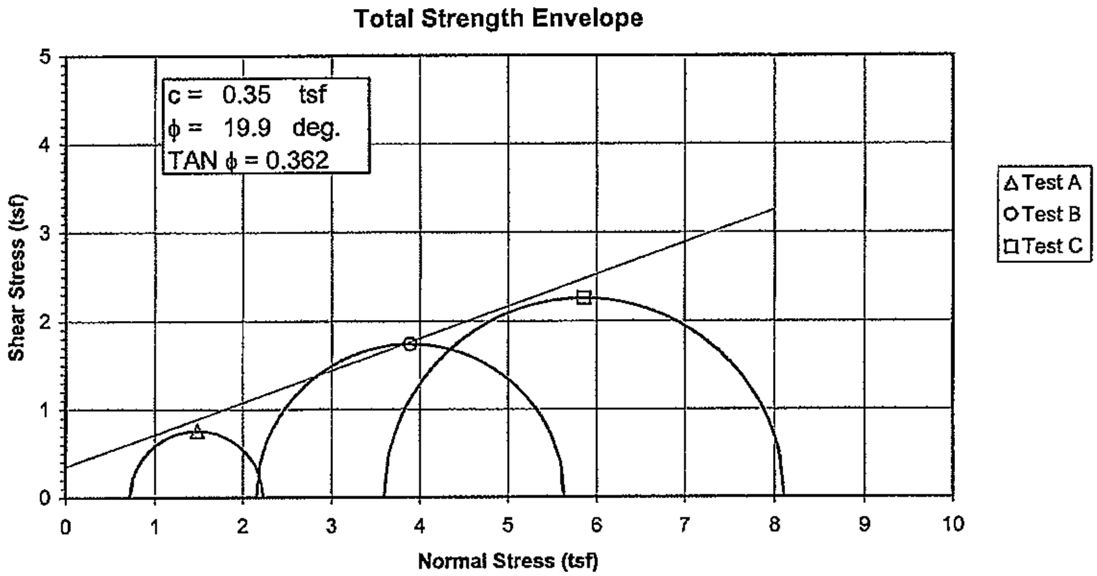
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	23.0	21.9	21.1	
	Dry Density PCF	γ_{d_o}	100.1	101.4	102.3	
	Saturation %	S_o	93.2	91.7	90.4	
	Void Ratio	e_o	0.653	0.632	0.618	
After Shear	Water content %	W_f	22.2	22.5	20.5	
	Dry Density PCF	γ_{d_f}	104.2	103.6	107.3	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.588	0.596	0.542	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	0.43	1.14	1.78	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.52	3.47	4.51	
Time to $(\sigma 1'-\sigma 3')$max min.		t_f	33.4	10.2	58.4	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.877	2.880	2.881	
Initial Height, in.		H_o	5.955	6.005	6.042	

Controlled - Strain Test

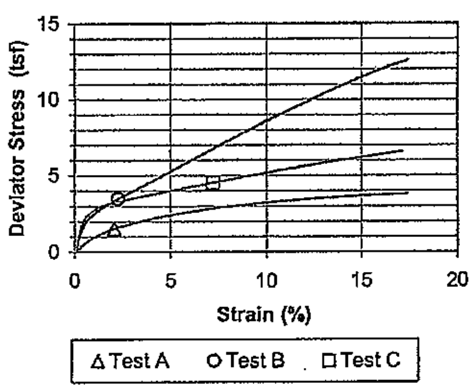
Description of Specimens Silt (ML), brown, moist, firm, gypsum

LL	PL	PI	Gs 2.65	Type of Specimen	Undisturbed	Type of test $\overline{R}$
				Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	
Remarks:				Boring No.	STN-114	Sample No. 4
				Depth Elev.	28.1'-28.6', 28.7'-29.2', 29.3'-29.8'	
				Laboratory	Stantec	Date 4-14-10
				TRIAXIAL COMPRESSION TEST REPORT		

Failure Criterion: Maximum Effective Principal Stress Ratio



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	23.0	21.9	21.1	
	Dry Density PCF	γd_o	100.1	101.4	102.3	
	Saturation %	S_o	93.2	91.7	90.4	
	Void Ratio	e_o	0.653	0.632	0.618	
After Shear	Water content %	W_f	22.2	22.5	20.5	
	Dry Density PCF	γd_f	104.2	103.6	107.3	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.588	0.596	0.542	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	1.52	3.47	4.51	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	33.4	10.2	58.4	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.877	2.880	2.881	
Initial Height, in.		H_o	5.955	6.005	6.042	

Controlled - Strain Test

Description of Specimens: Silt (ML), brown, moist, firm, gypsum

LL	PL	PI	Gs 2.65	
Type of Specimen	Undisturbed	Type of test	$\bar{R}$	
Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack			
Boring No.	STN-114	Sample No.	4	
Depth Elev.	28.1'-28.6', 28.7'-29.2', 29.3'-29.8'			
Laboratory	Stantec	Date	4-14-10	

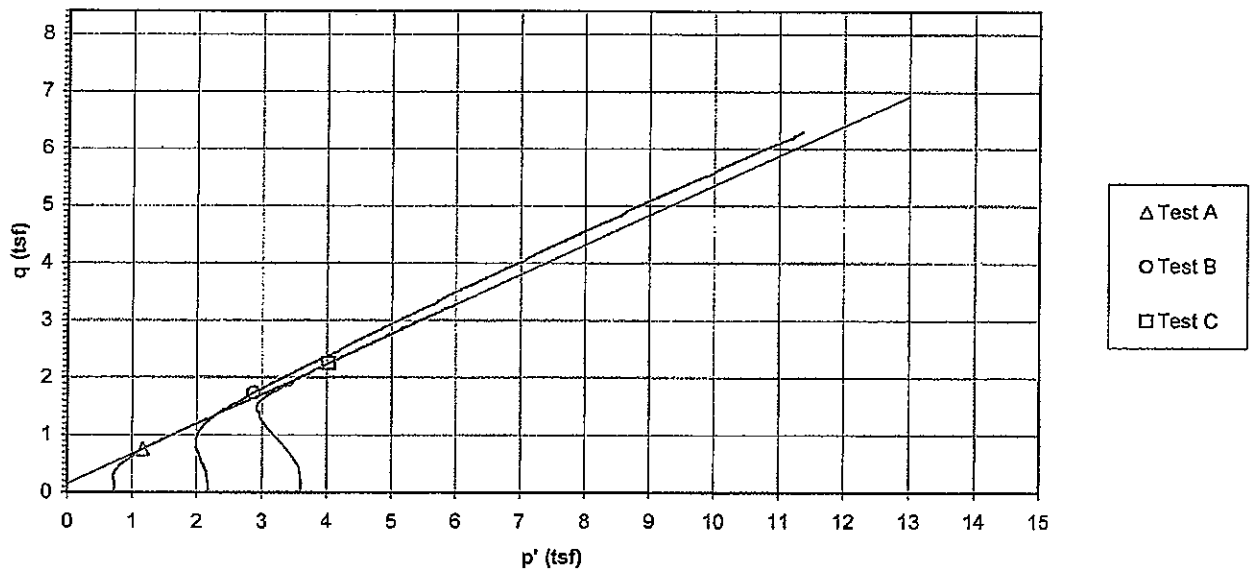
Remarks:

TRIAXIAL COMPRESSION TEST REPORT

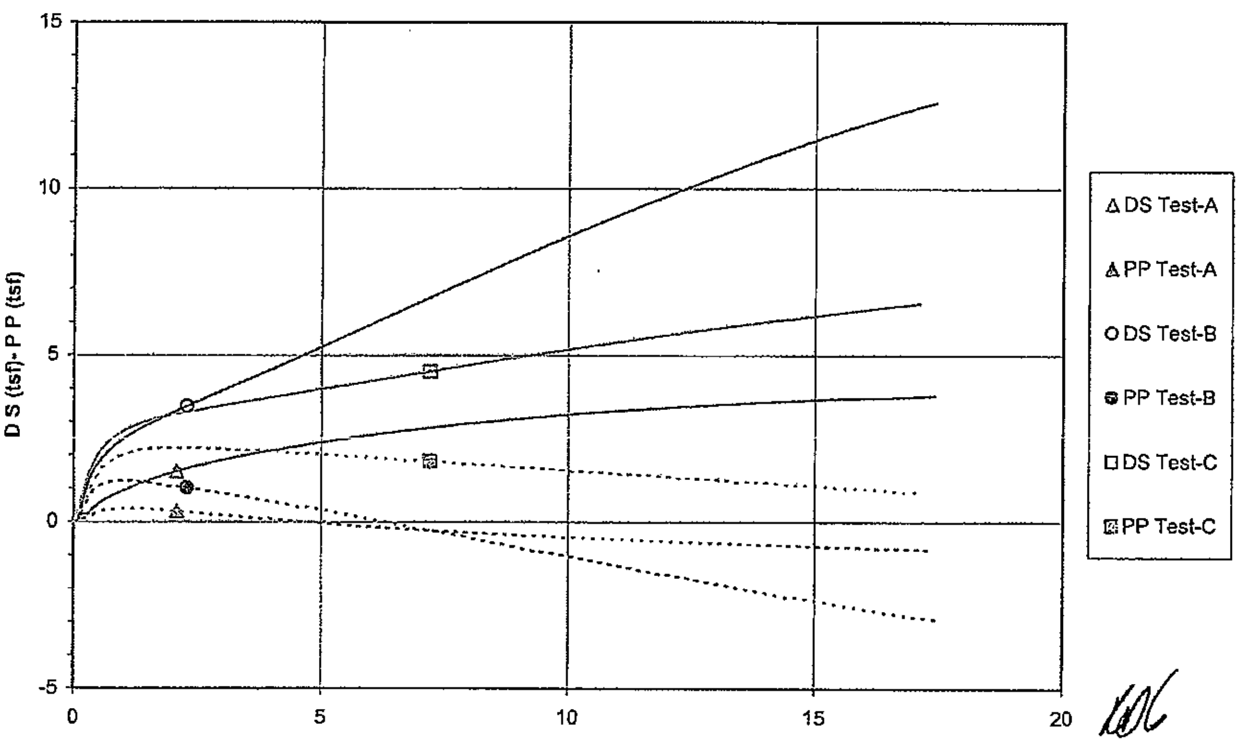
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-114, 28.1'-28.6' & STN-114, 28.7'-29.2' & STN-114, 29.3'-29.8'	Test Number	4
Failure Criterion:	Maximum Effective Principal Stress Ratio $\phi' =$ 31.4 deg.	c' =	0.17 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

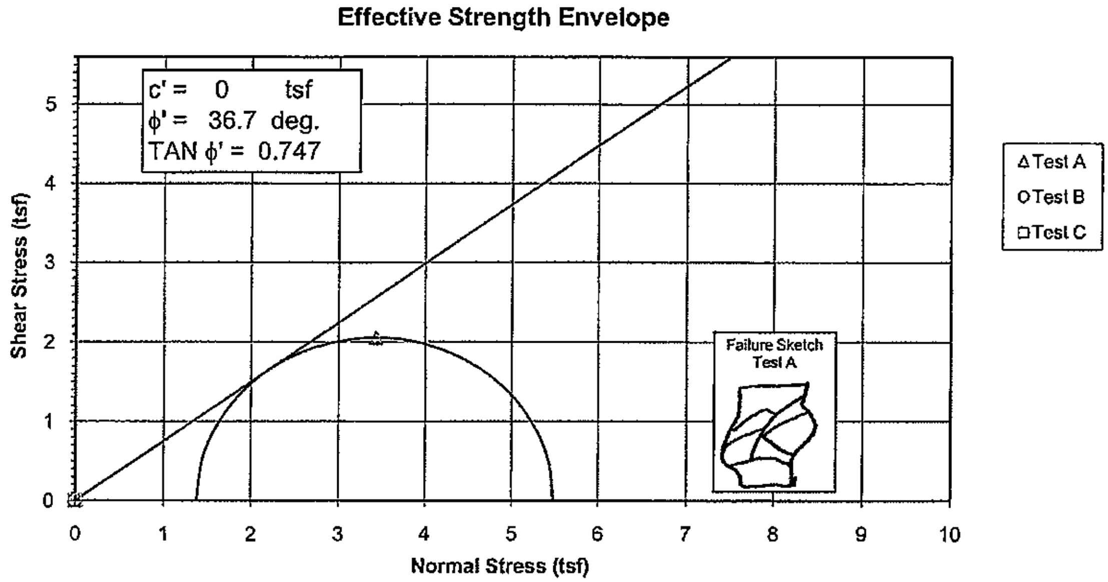


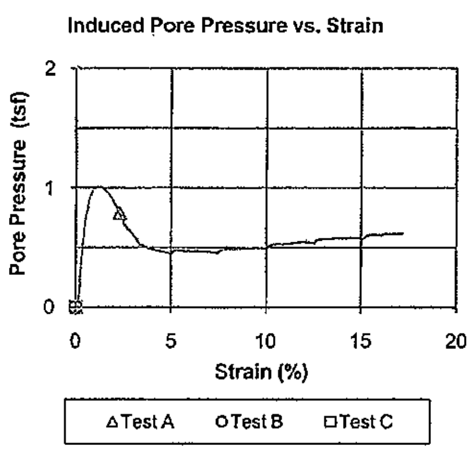
File: 175559035_CU-4 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





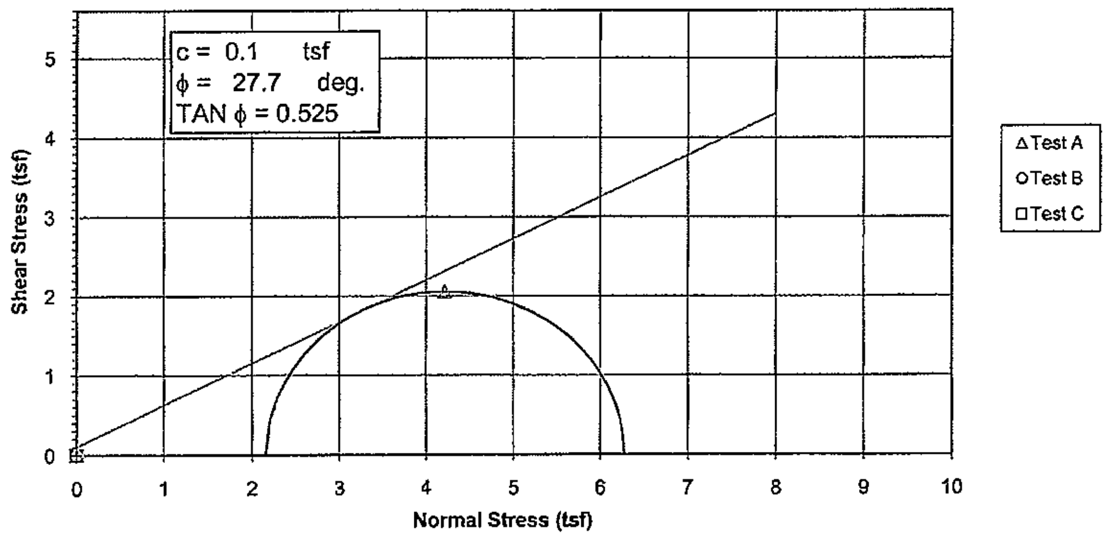
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	46.9	#####	#####	
	Dry Density PCF	γ_{d_o}	64.5	#####	#####	
	Saturation %	S_o	89.2	#####	#####	
	Void Ratio	e_o	1.188	#####	#####	
After Shear	Water content %	W_f	48.5	#####	#####	
	Dry Density PCF	γ_{d_f}	67.3	#####	#####	
	Saturation %	S_f	100.0	#####	#####	
	Void Ratio	e_f	1.096	#####	#####	
	Final Back Pressure TSF	u_c	4.32	0.00	0.00	
Minor Principal Stress TSF @ failure		σ_3'f	1.38	0.00	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	4.11	0.00	0.00	
Time to (σ1'-σ3')max min.		t_f	11.6	0.0	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	3.97	0.00	0.00	
Initial Diameter, in.		D_o	2.879	#####	#####	
Initial Height, in.		H_o	6.021	#####	#####	

Controlled - Strain Test

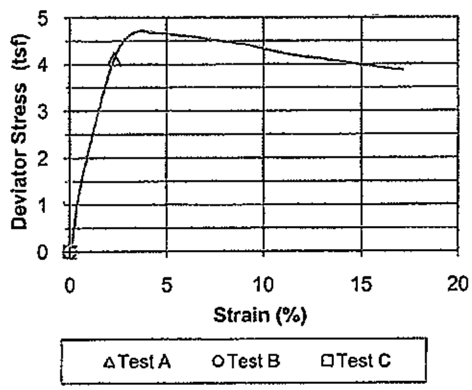
Description of Specimens	Silt (ML), dark gray, moist, firm, fly ash				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.26	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-116	Sample No.	12
		Depth Elev.	15.6'-16.1'		
		Laboratory	Stantec	Date	4-27-10
		TRIAXIAL COMPRESSION TEST REPORT			

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	46.9	#####	#####	
	Dry Density PCF	γ_{d_o}	64.5	#####	#####	
	Saturation %	S_o	89.2	#####	#####	
	Void Ratio	e_o	1.188	#####	#####	
After Shear	Water content %	W_f	48.5	#####	#####	
	Dry Density PCF	γ_{d_f}	67.3	#####	#####	
	Saturation %	S_f	100.0	#####	#####	
	Void Ratio	e_f	1.096	#####	#####	
	Final Back Pressure TSF	u_c	4.32	0.00	0.00	
Minor Principal Stress TSF		σ_3	2.16	0.00	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	4.11	0.00	0.00	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	11.6	0.0	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	3.97	0.00	0.00	
Initial Diameter, in.		D_o	2.879	#####	#####	
Initial Height, in.		H_o	6.021	#####	#####	

Controlled - Strain Test

Description of Specimens	Silt (ML), dark gray, moist, firm, fly ash				
	Type of Specimen	Undisturbed		Type of test	$\bar{R}$
LL / PL / PI / Gs 2.26	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack			
Remarks:					
	Boring No.	STN-116	Sample No.	12	
	Depth Elev.	15.6'-16.1'			
	Laboratory	FMSM Engineers		Date	4-27-10
	TRIAXIAL COMPRESSION TEST REPORT				

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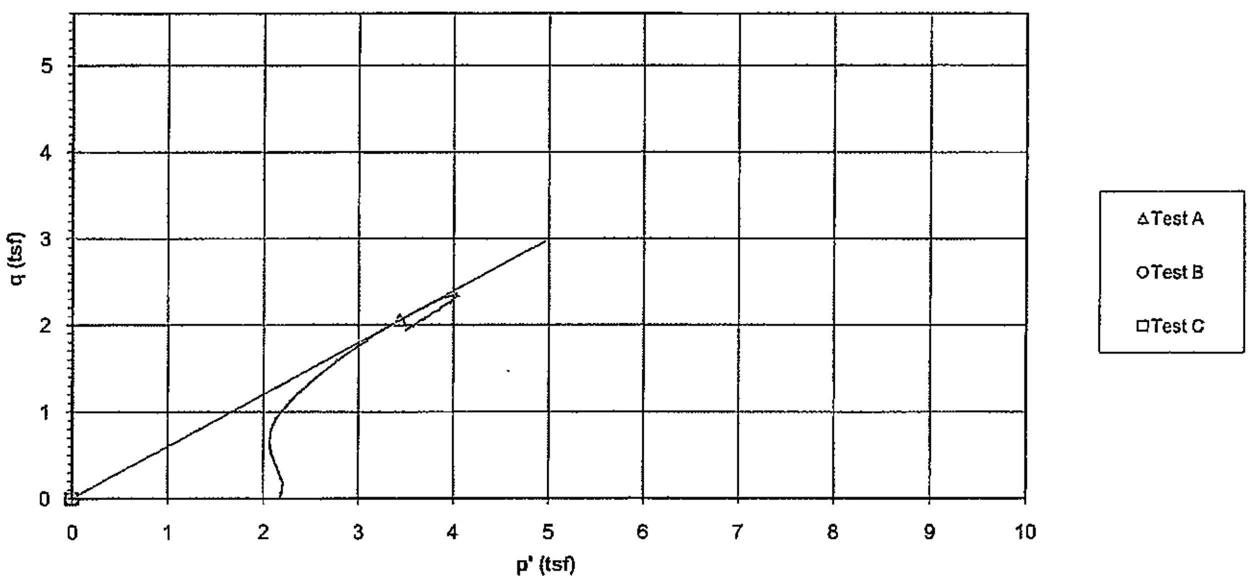
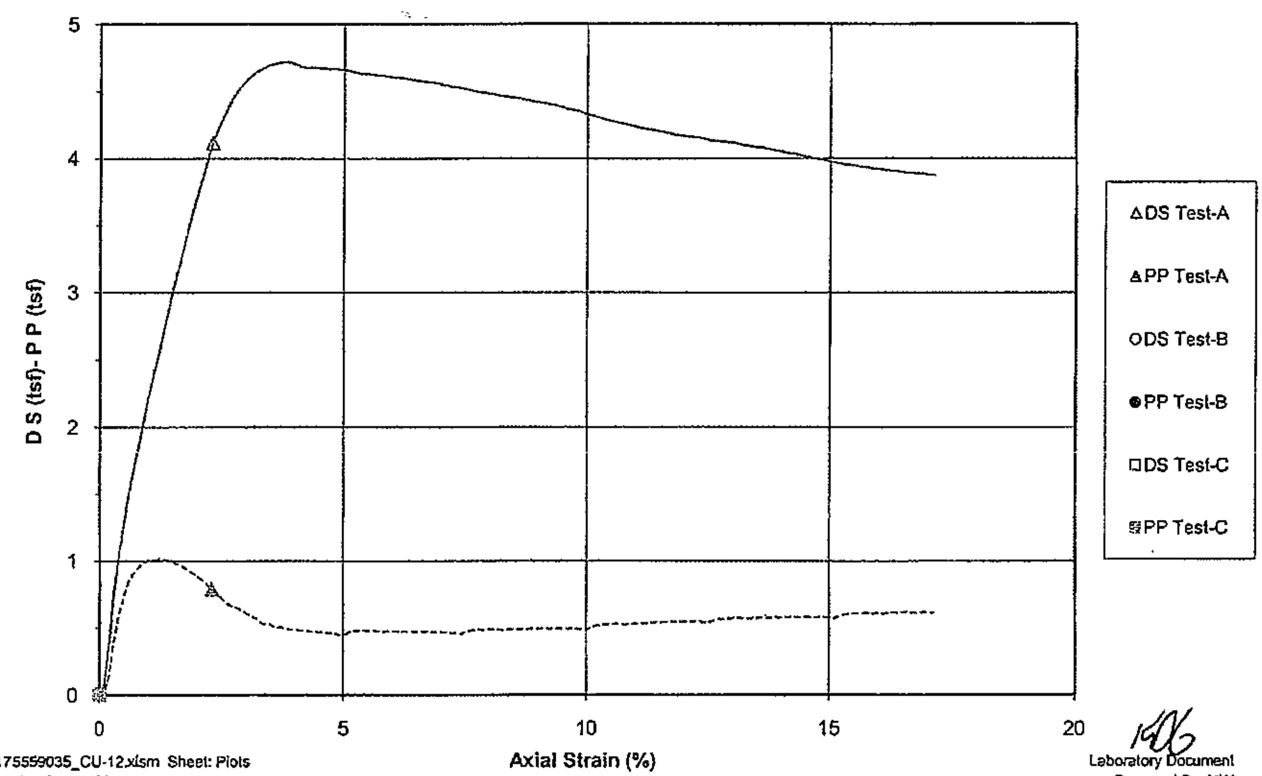
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-116, 15.6'-16.1'	Test Number	12
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 36.7 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

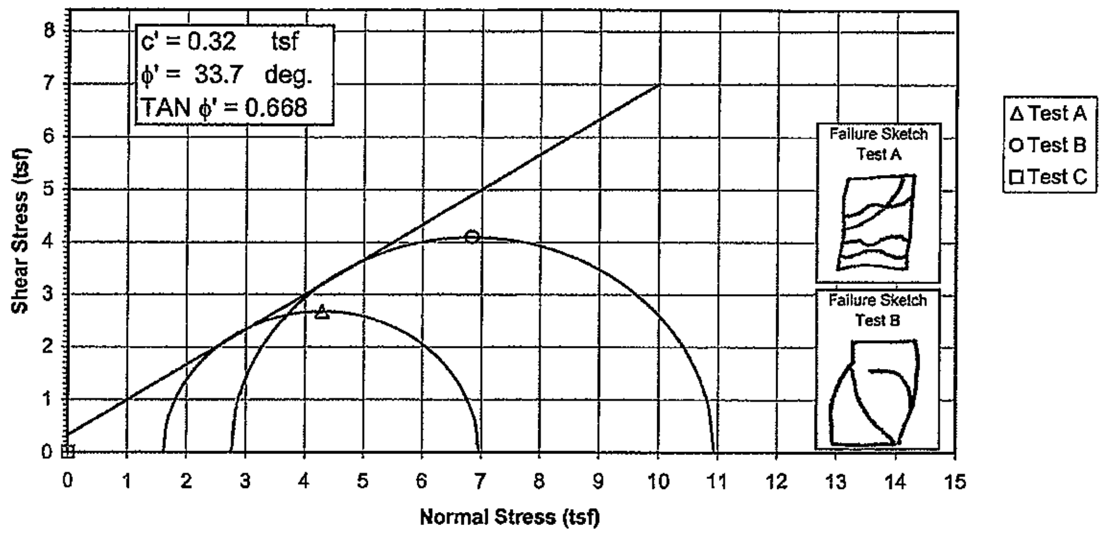


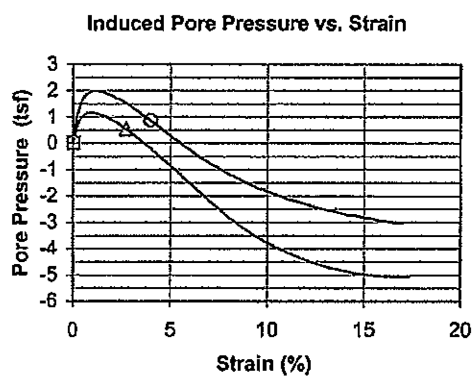
File: 175559035_CU-12.xlsm Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C
Initial Data	Water content %	W_o	22.5	20.8	######
	Dry Density PCF	γ_{d_o}	103.6	105.9	######
	Saturation %	S_o	100.5	98.9	######
	Void Ratio	e_o	0.590	0.556	######
After Shear	Water content %	W_f	20.3	18.5	######
	Dry Density PCF	γ_{d_f}	107.2	110.7	######
	Saturation %	S_f	100.0	100.0	######
	Void Ratio	e_f	0.537	0.489	######
	Final Back Pressure TSF	u_c	4.32	2.88	0.00
Minor Principal Stress TSF @ failure		$\sigma_3'f$	1.62	2.76	0.00
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	5.34	8.18	0.00
Time to (σ1'-σ3')max min.		t_f	25.6	30.0	0.0
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	0.00
Initial Diameter, in.		D_o	2.872	2.865	######
Initial Height, in.		H_o	5.859	6.054	######

Controlled - Strain Test

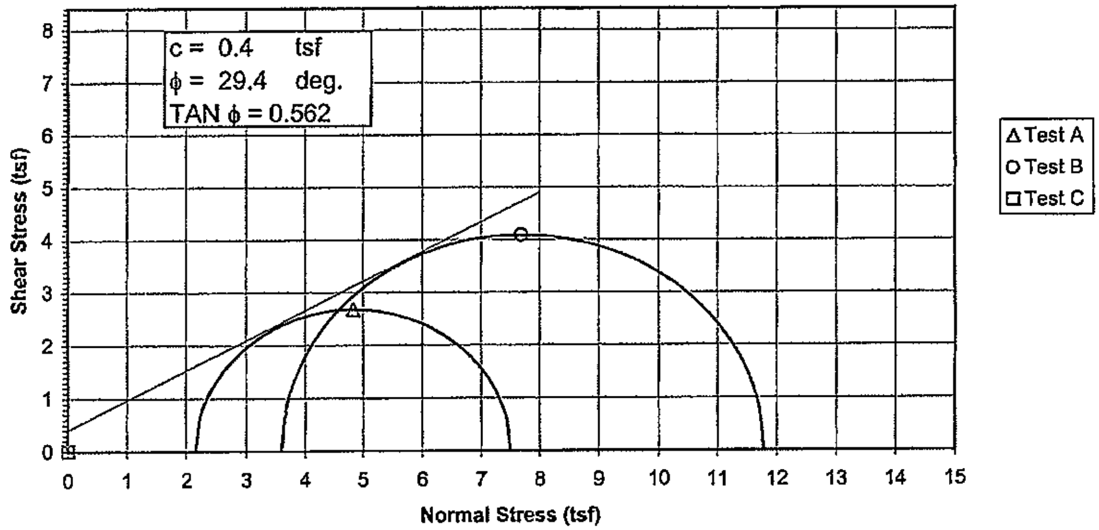
Description of Specimens Silt (ML), light gray, moist, firm

LL	PL	PI	Gs 2.64	Type of Specimen Undisturbed	Type of test $\bar{R}$
				Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:				Boring No. STN-118	Sample No. 7
				Depth Elev.	26.2'-26.7', 26.8'-27.3'
				Laboratory Stantec	Date 4-12-10
				TRIAXIAL COMPRESSION TEST REPORT	

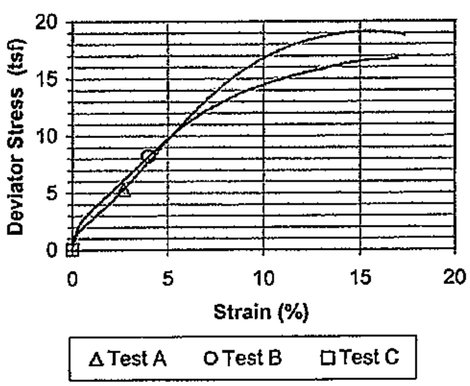
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Total Strength Envelope



Deviator Stress vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.5	20.8	######	
	Dry Density PCF	γ_{d_o}	103.6	105.9	######	
	Saturation %	S_o	100.5	98.9	######	
	Void Ratio	e_o	0.590	0.556	######	
After Shear	Water content %	W_f	20.3	18.5	######	
	Dry Density PCF	γ_{d_f}	107.2	110.7	######	
	Saturation %	S_f	100.0	100.0	######	
	Void Ratio	e_f	0.537	0.489	######	
	Final Back Pressure TSF	u_c	4.32	2.88	0.00	
Minor Principal Stress TSF		σ_3	2.16	3.60	0.00	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1-\sigma_3)_{max}$	5.34	8.18	0.00	
Time to $(\sigma_1-\sigma_3)_{Max.}$ min.		t_f	25.6	30.0	0.0	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1-\sigma_3)_{ult}$	n/a	n/a	0.00	
Initial Diameter, in.		D_o	2.872	2.865	######	
Initial Height, in.		H_o	5.859	6.054	######	

Controlled - Strain Test

Description of Specimens	Silt (ML), light gray, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.64	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-118	Sample No.	7
		Depth Elev.	26.2'-26.7', 26.8'-27.3'		
		Laboratory	FMSM Engineers	Date	4-12-10
		TRIAXIAL COMPRESSION TEST REPORT			

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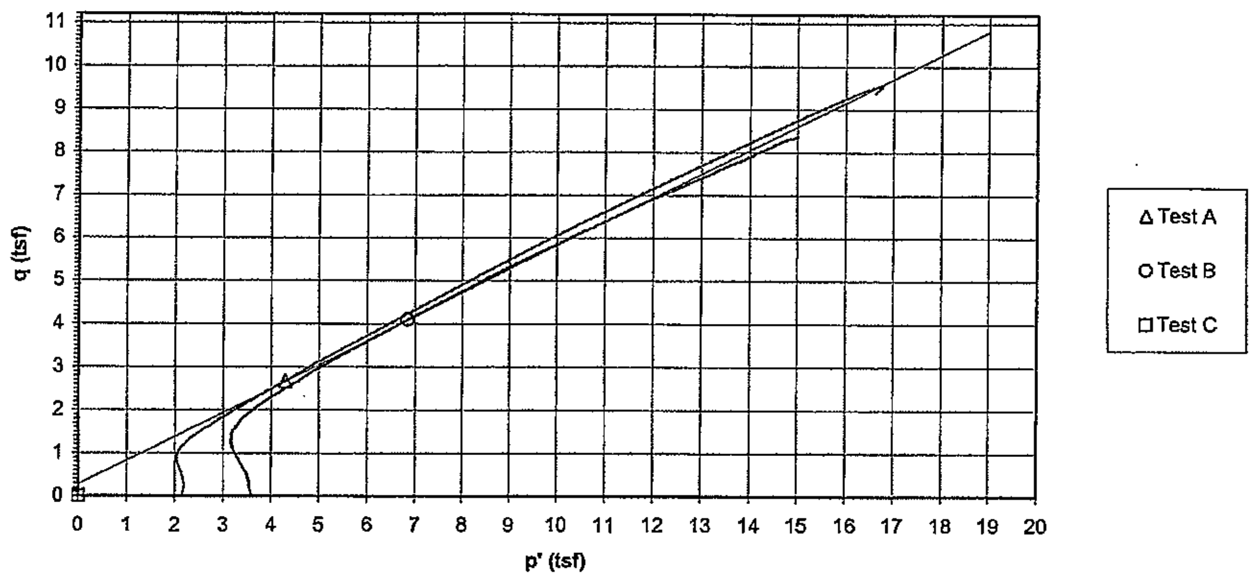
Laboratory Document
Prepared By: MW
Approved BY: TLK

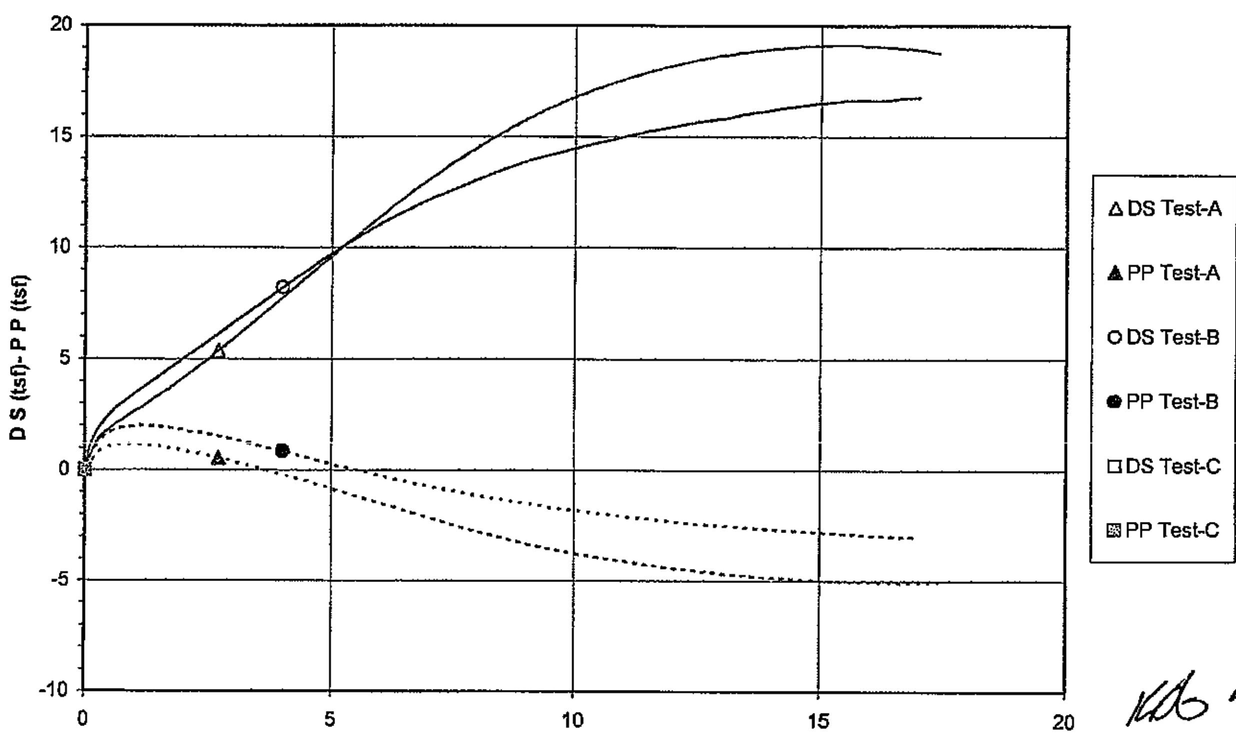
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-118, 26.2'-26.7' & STN-118, 26.8'-27.3'	Test Number	7
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 33.7 deg.	c' =	0.32 tsf

p' vs. q Plot

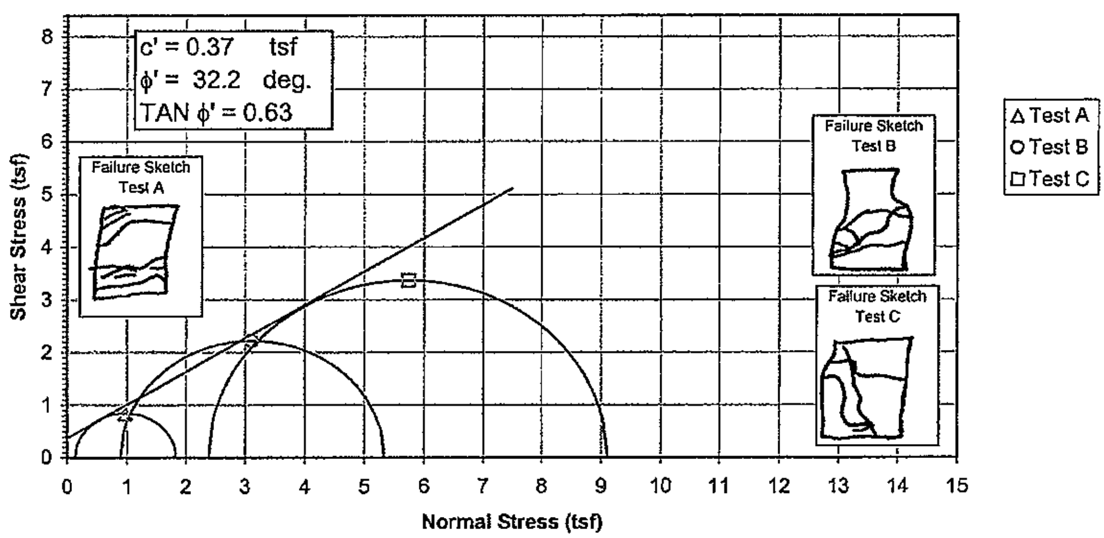


Deviator Stress and Induced Pore Pressure vs. Axial Strain

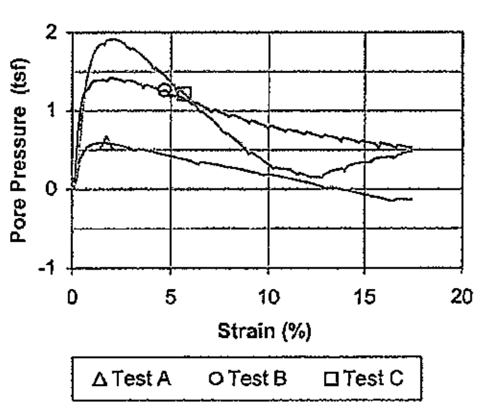


Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



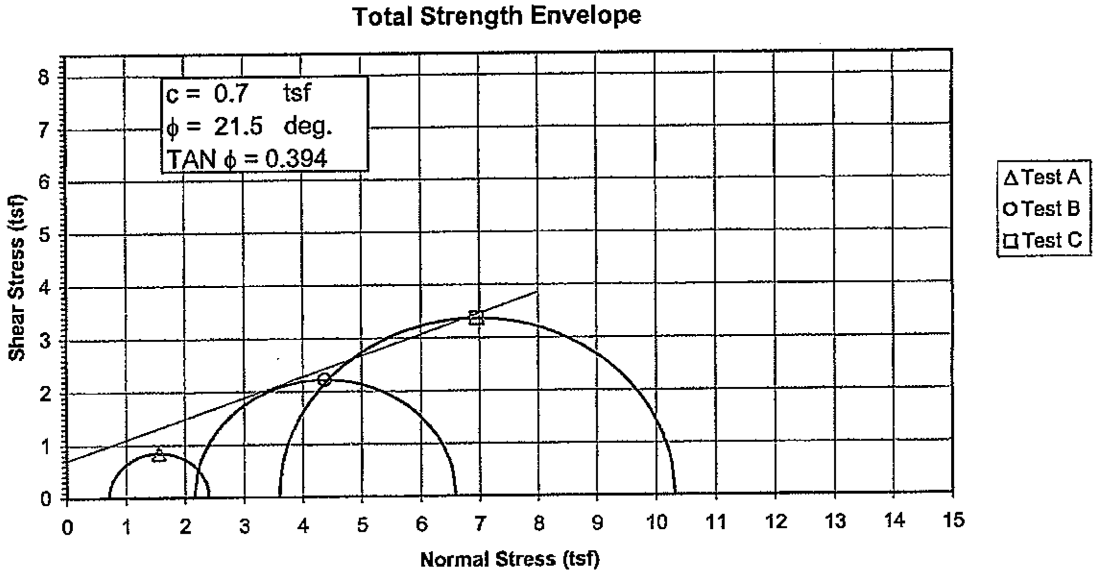
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	63.3	52.8	38.5	
	Dry Density PCF	γd_o	54.5	62.8	75.7	
	Saturation %	S_o	91.3	97.4	103.4	
	Void Ratio	e_o	1.531	1.197	0.822	
After Shear	Water content %	W_f	62.3	49.7	38.0	
	Dry Density PCF	γd_f	58.0	65.7	75.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.377	1.099	0.840	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.14	0.90	2.39	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.69	4.44	6.73	
Time to $(\sigma1'-\sigma3')$max min.		t_f	5.7	64.0	42.8	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.885	2.861	2.840	
Initial Height, in.		H_o	6.044	5.944	5.958	

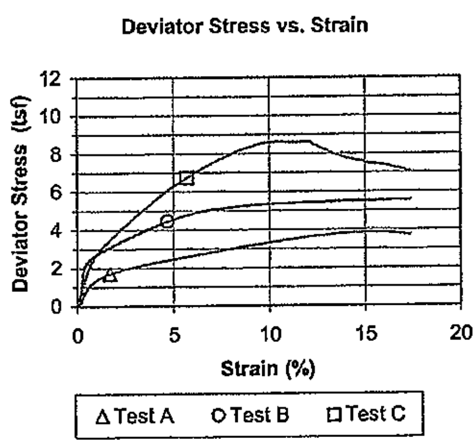
Controlled - Strain Test

Description of Specimens Silt (ML), dark gray, moist, firm

			Type of Specimen Undisturbed		Type of test $\bar{R}$
LL	PL	PI	Gs . 2.21	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
				Boring No. STN-122	Sample No. 5
				Depth Elev.	5.2'-5.7', 20.1'-20.6', 20.7'-21.2'
				Laboratory Stantec	Date 4-14-10
				TRIAXIAL COMPRESSION TEST REPORT	

Failure Criterion: Maximum Effective Principal Stress Ratio





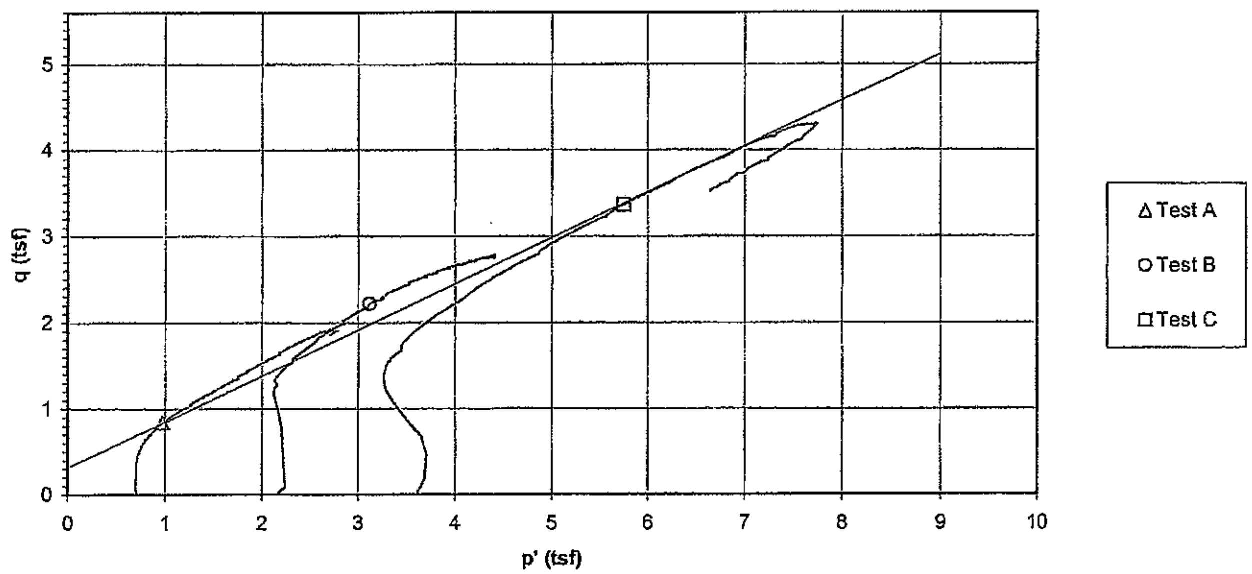
Specimen No.			A	B	C	
Initial Data	Water content %	W_o	63.3	52.8	38.5	
	Dry Density PCF	γd_o	54.5	62.8	75.7	
	Saturation %	S_o	91.3	97.4	103.4	
	Void Ratio	e_o	1.531	1.197	0.822	
After Shear	Water content %	W_f	62.3	49.7	38.0	
	Dry Density PCF	γd_f	58.0	65.7	75.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.377	1.099	0.840	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.69	4.44	6.73	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	5.7	64.0	42.8	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.885	2.861	2.840	
Initial Height, in.		H_o	6.044	5.944	5.958	

Controlled - Strain Test					
Description of Specimens	Silt (ML), dark gray, moist, firm				
		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.21	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-122	Sample No.	5
		Depth Elev.	5.2'-5.7', 20.1'-20.6', 20.7'-21.2'		
		Laboratory	Stantec	Date	4-14-10
		TRIAXIAL COMPRESSION TEST REPORT			

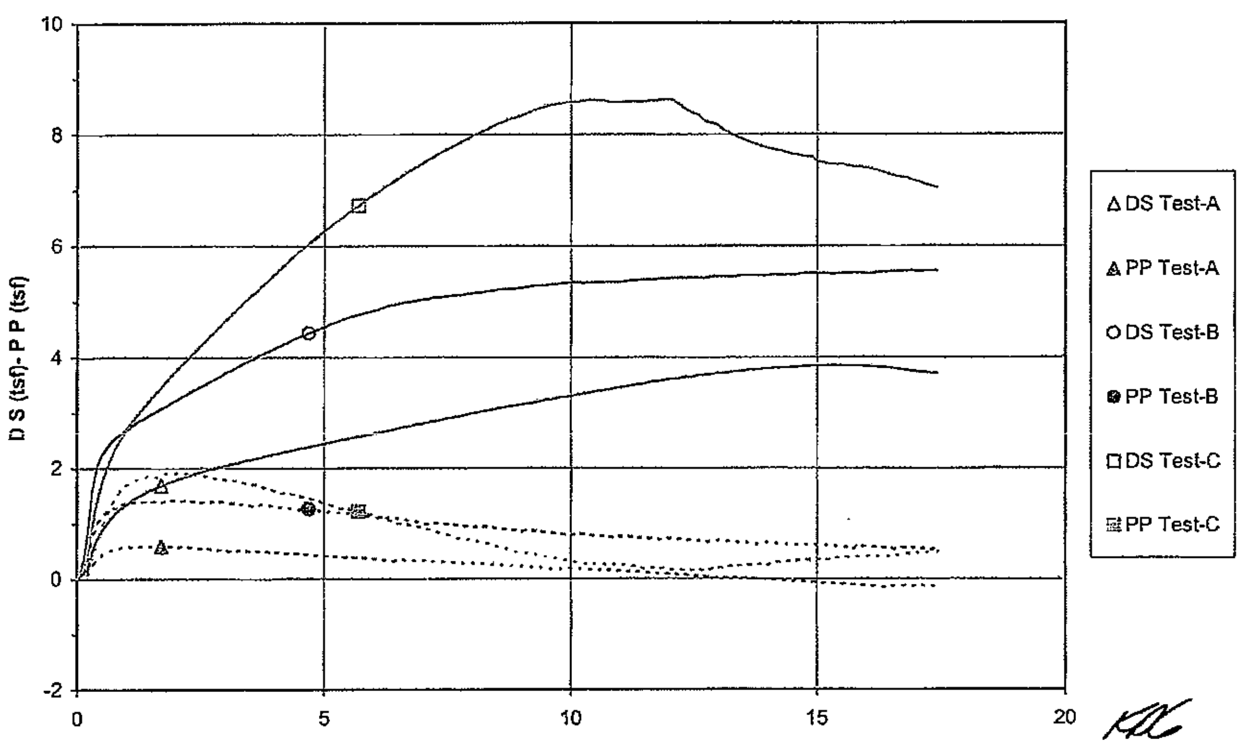
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-122, 5.2'-5.7' & STN-122, 20.1'-20.6' & STN-122, 20.7'-21.2'	Test Number	5
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 32.2 deg.	c' =	0.37 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain



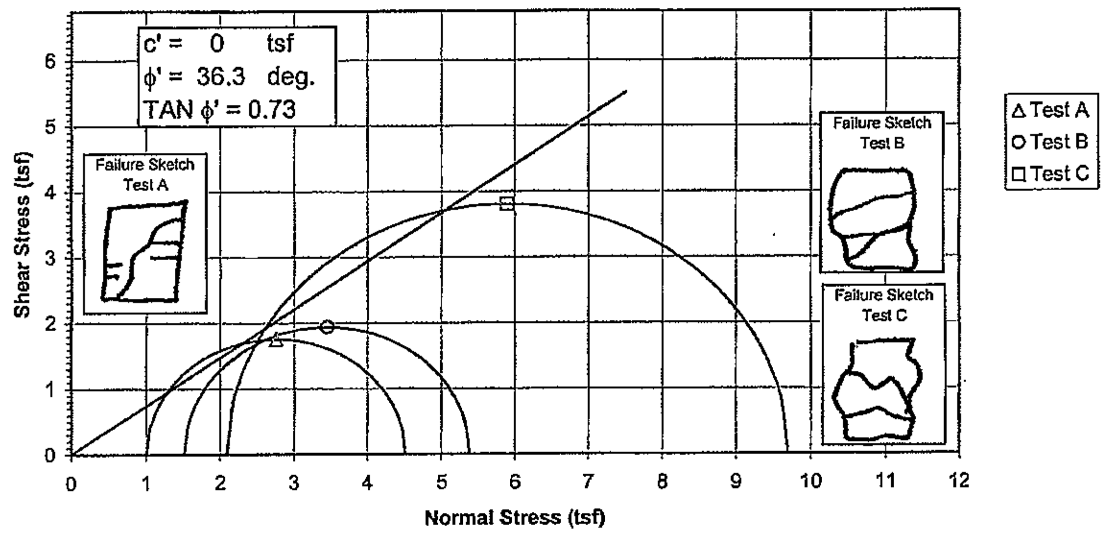
File: 175559035_CU-5 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

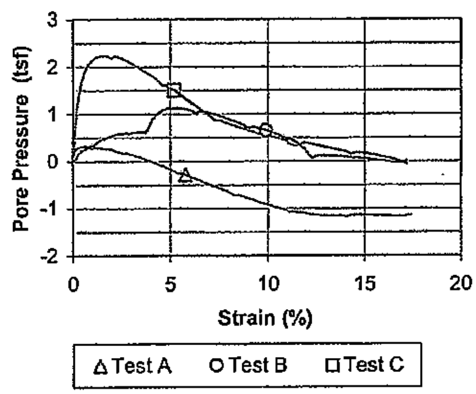
Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio

Effective Strength Envelope



Induced Pore Pressure vs. Strain



Specimen No.			A	B	C	
Initial Data	Water content %	W_o	56.5	86.2	43.8	
	Dry Density PCF	γ_{d_o}	61.2	64.2	72.3	
	Saturation %	S_o	100.0	166.5	107.0	
	Void Ratio	e_o	1.243	1.140	0.900	
After Shear	Water content %	W_f	50.5	44.3	36.4	
	Dry Density PCF	γ_{d_f}	65.1	69.5	76.2	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.110	0.975	0.802	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		$\sigma_3'f$	1.01	1.52	2.09	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	3.51	3.88	7.60	
Time to $(\sigma1'-\sigma3')$max min.		t_f	21.4	35.9	18.9	
Ultimate Deviator Stress, t/sq ft		$(\sigma1'-\sigma3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.855	2.864	2.867	
Initial Height, in.		H_o	5.712	5.610	5.932	

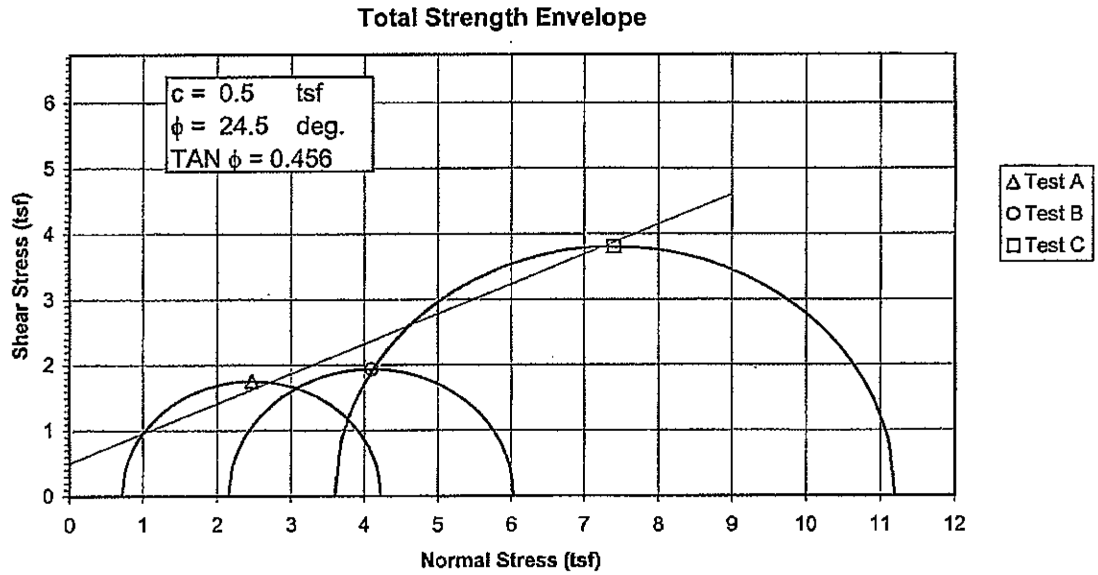
Controlled - Strain Test

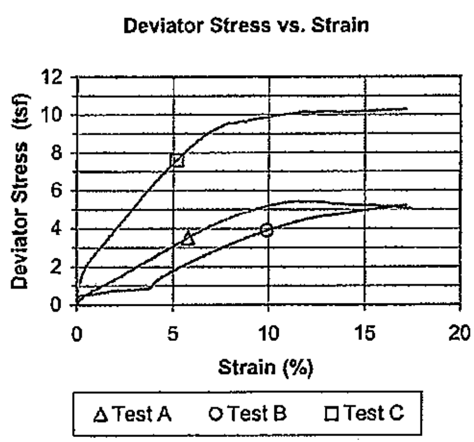
Description of Specimens Silt (ML), dark gray, moist, firm

			Type of Specimen Undisturbed		Type of test R
LL	PL	PI	Gs 2.2	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
				Boring No. STN-128A	Sample No. 8
				Depth Elev.	10.1'-10.6', 10.7'-11.2', 11.3'-11.8'
				Laboratory Stantec	Date 4-20-10
				TRIAXIAL COMPRESSION TEST REPORT	

KDb

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	56.5	86.2	43.8	
	Dry Density PCF	γ_{d_o}	61.2	64.2	72.3	
	Saturation %	S_o	100.0	166.5	107.0	
	Void Ratio	e_o	1.243	1.140	0.900	
After Shear	Water content %	W_f	50.5	44.3	36.4	
	Dry Density PCF	γ_{d_f}	65.1	69.5	76.2	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	1.110	0.975	0.802	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	3.51	3.88	7.60	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	21.4	35.9	18.9	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.855	2.864	2.867	
Initial Height, in.		H_o	5.712	5.610	5.932	

Controlled - Strain Test

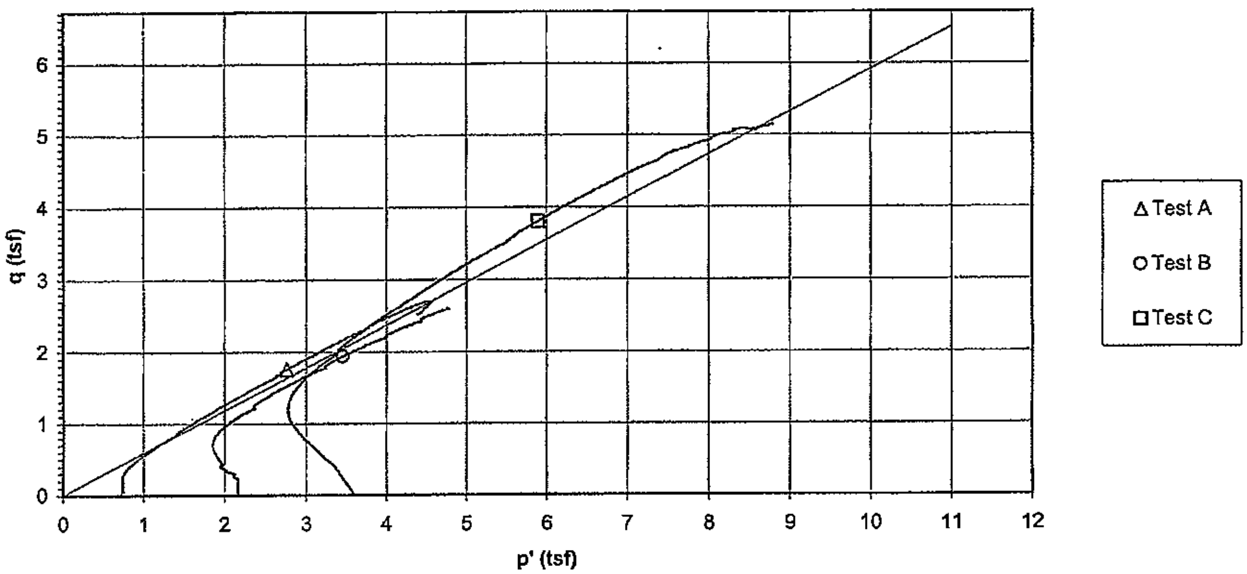
Description of Specimens Silt (ML), dark gray, moist, firm

		Type of Specimen	Undisturbed	Type of test	$\bar{R}$
LL	PL	PI	Gs 2.2	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
		Boring No.	STN-128A	Sample No.	8
		Depth Elev.	10.1'-10.6', 10.7'-11.2', 11.3'-11.8'		
		Laboratory	Stantec	Date	4-20-10
		TRIAXIAL COMPRESSION TEST REPORT			

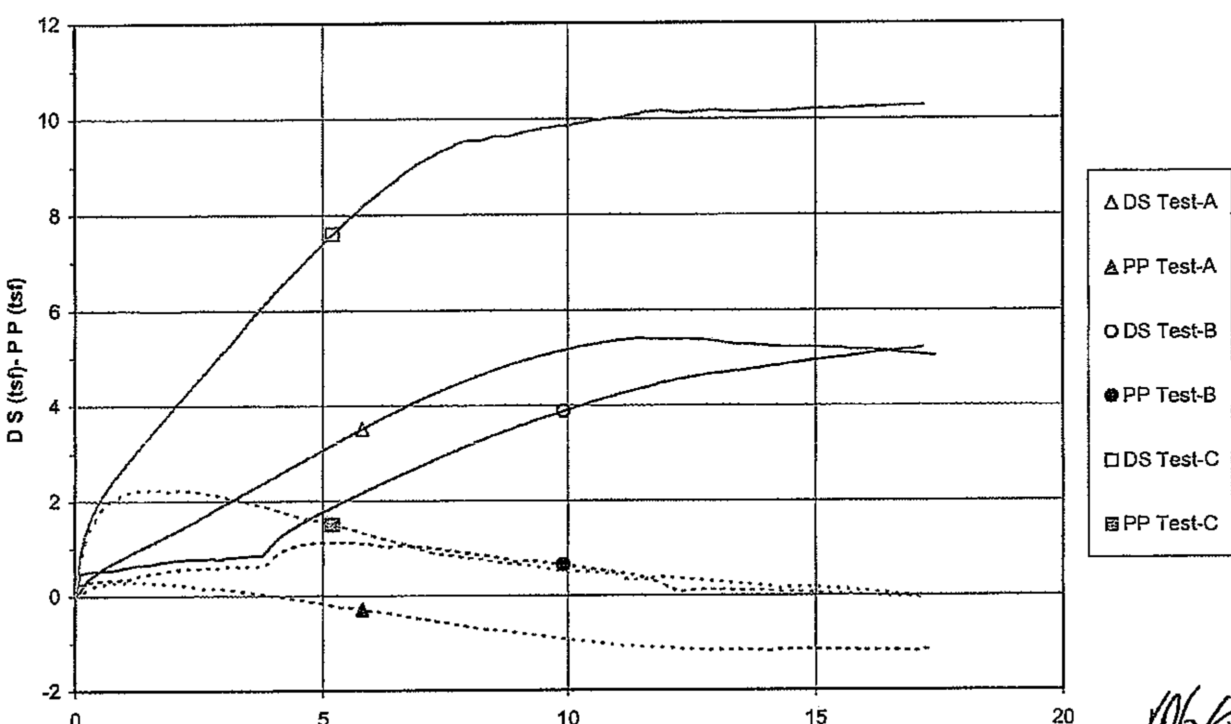
Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	Project No.	175559035
Sample ID	STN-128A, 10.1'-10.6' & STN-128A, 10.7'-11.2' & STN-128A, 11.3'-11.8'	Test Number	8
Failure Criterion:	Maximum Effective Principal Stress Ratio ϕ' = 36.3 deg.	c' =	0.00 tsf

p' vs. q Plot



Deviator Stress and Induced Pore Pressure vs. Axial Strain

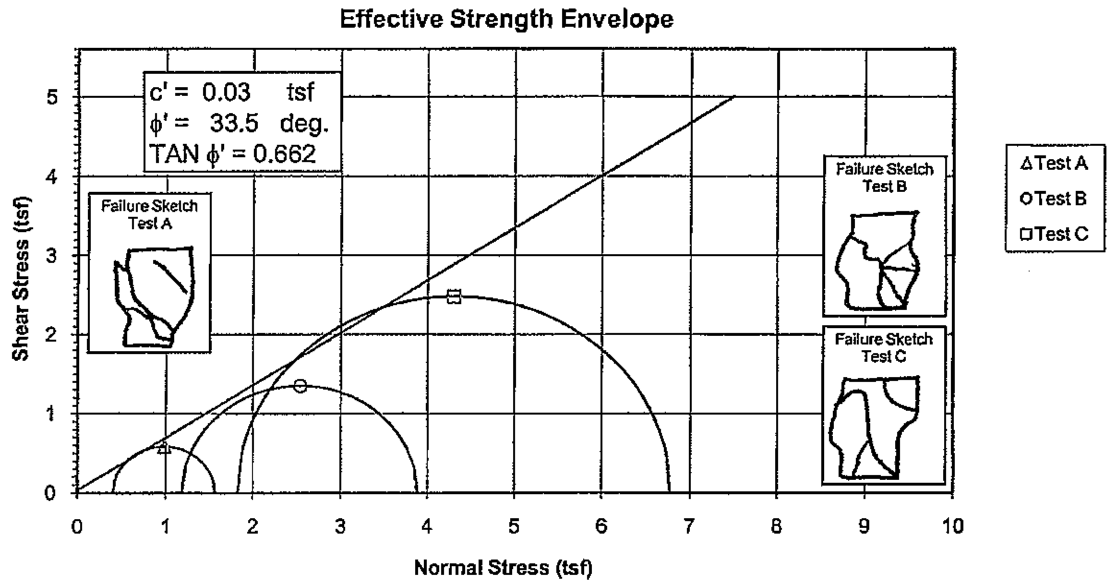


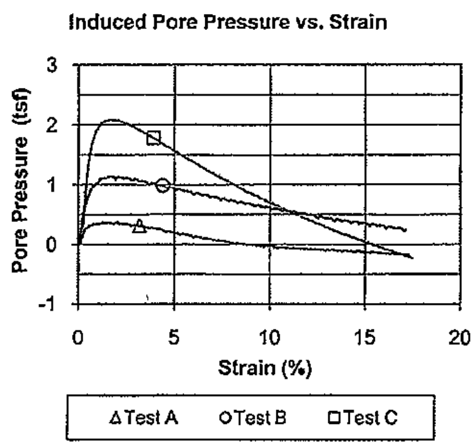
File: 175559035_CU-8 Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.7	22.6	23.0	
	Dry Density PCF	γ_{d_o}	101.7	101.5	100.8	
	Saturation %	S_o	94.4	93.3	93.1	
	Void Ratio	e_o	0.644	0.649	0.660	
After Shear	Water content %	W_f	22.5	21.2	21.6	
	Dry Density PCF	γ_{d_f}	104.4	106.6	106.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.602	0.569	0.579	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF @ failure		σ_3'f	0.40	1.19	1.83	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1'-\sigma_3')_{max}$	1.16	2.71	4.96	
Time to (σ1'-σ3')max min.		t_f	179.5	88.6	25.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma 1'-\sigma 3')_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.885	2.861	2.884	
Initial Height, in.		H_o	5.977	5.977	5.989	

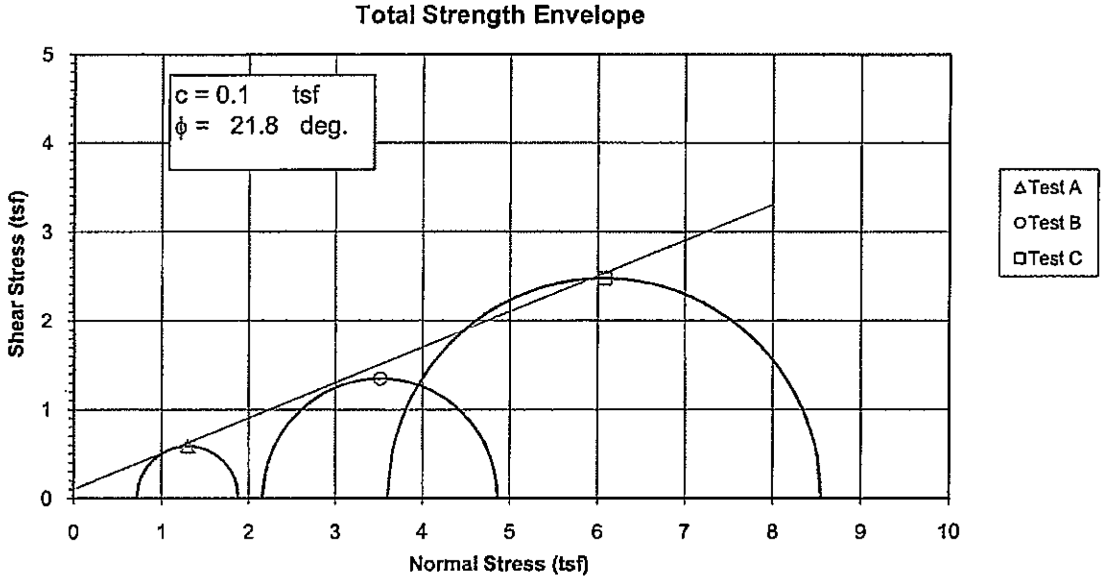
Controlled - Strain Test

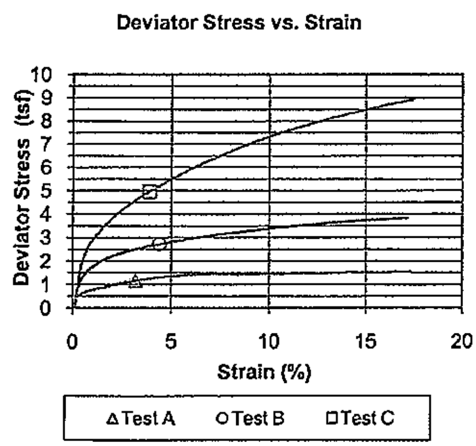
Description of Specimens Lean Clay (CL), brown, moist, firm

			Type of Specimen	Undisturbed	Type of test $\overline{R}$
LL	PL	PI	Gs 2.68	Project	Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack
Remarks:					
			Boring No.	STN-128B	Sample No. 9
			Depth Elev.	39.1'-39.6', 39.7'-40.2', 40.3'-40.8'	
			Laboratory	Stantec	Date 4-26-10
			TRIAXIAL COMPRESSION TEST REPORT		

K06

Failure Criterion: Maximum Effective Principal Stress Ratio





Specimen No.			A	B	C	
Initial Data	Water content %	W_o	22.7	22.6	23.0	
	Dry Density PCF	γ_{d_o}	101.7	101.5	100.8	
	Saturation %	S_o	94.4	93.3	93.1	
	Void Ratio	e_o	0.644	0.649	0.660	
After Shear	Water content %	W_f	22.5	21.2	21.6	
	Dry Density PCF	γ_{d_f}	104.4	106.6	106.0	
	Saturation %	S_f	100.0	100.0	100.0	
	Void Ratio	e_f	0.602	0.569	0.579	
	Final Back Pressure TSF	u_c	5.76	4.32	2.88	
Minor Principal Stress TSF		σ_3	0.72	2.16	3.60	
Maximum Deviator Stress (tsf) @ failure		$(\sigma_1\text{-}\sigma_3)_{max}$	1.16	2.71	4.96	
Time to $(\sigma_1\text{-}\sigma_3)_{Max.}$ min.		t_f	179.5	88.6	25.1	
Ultimate Deviator Stress, t/sq ft		$(\sigma_1\text{-}\sigma_3)_{ult}$	n/a	n/a	n/a	
Initial Diameter, in.		D_o	2.885	2.861	2.884	
Initial Height, in.		H_o	5.977	5.977	5.989	

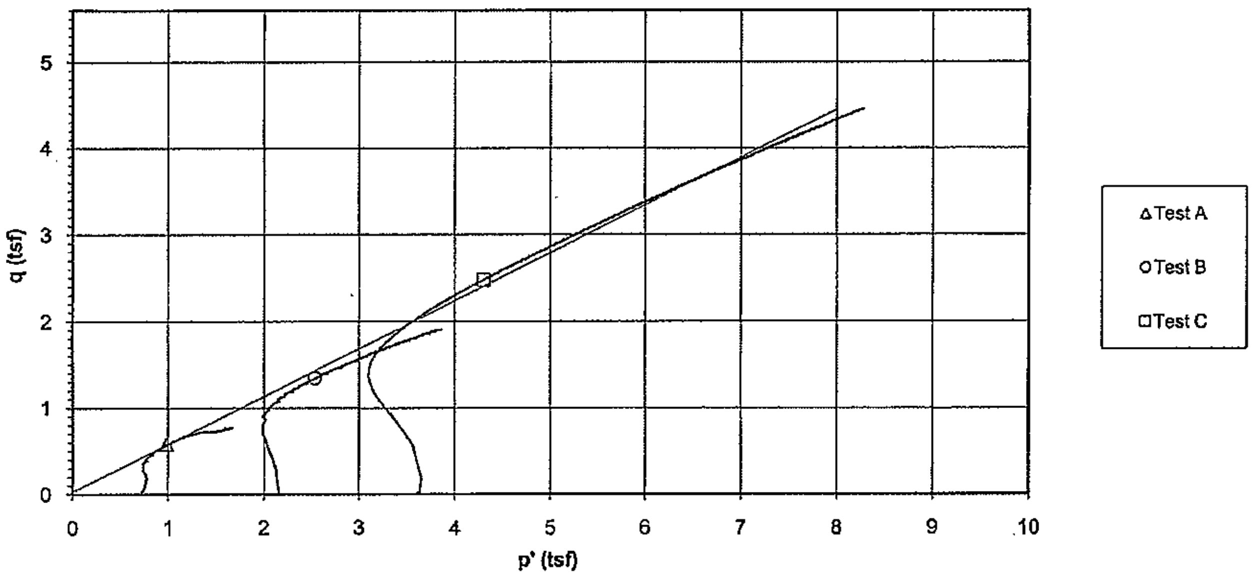
Controlled - Strain Test

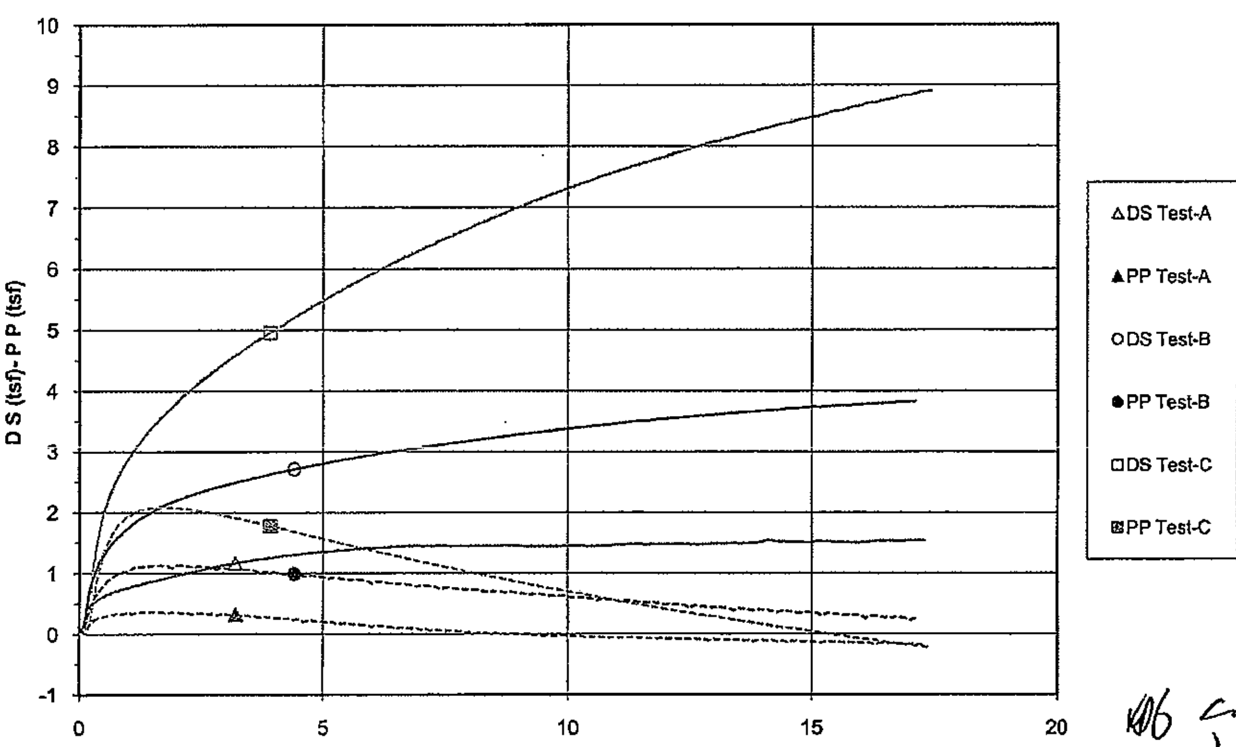
Description of Specimens: Lean Clay (CL), brown, moist, firm

			Type of Specimen: Undisturbed		Type of test: $\bar{R}$
LL	PL	PI	Gs 2.68	Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack	
Remarks:					
			Boring No.: STN-128B	Sample No. 9	
			Depth Elev.: 39.1'-39.6', 39.7'-40.2', 40.3'-40.8'		
			Laboratory: Stantec	Date 4-26-10	
			TRIAXIAL COMPRESSION TEST REPORT		

Consolidated Undrained Triaxial Test
EM 1110-2-1906 Appendix X

Project: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Sample ID: STN-128B, 39.1'-39.6' & STN-128B, 39.7'-40.2' & STN-128B, 40.3'-40.8' — Test Number 9
Failure Criterion: Maximum Effective Principal Stress Ratio — φ' = 33.5 deg. — c' = 0.03 tsf





KJB

File: 175559035_CU-9.xlsm Sheet: Plots
Preparation Date: 1998
Revision Date: 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By: MW
Approved BY: TLK

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No. 175559023
Source: STN-8P, 6.0'-8.0'
Test ID 829
Visual Classification: Lean Clay with Gravel (CL), brown, moist, firm
Prepared By BWT
Undisturbed XX
Specific Gravity 2.72 ASTM D854-A
Date 3-1-10
Maximum Dry Density (pcf)
Percent of Maximum
Permeant: De-aired tap water
Selection and Preparation Comments:

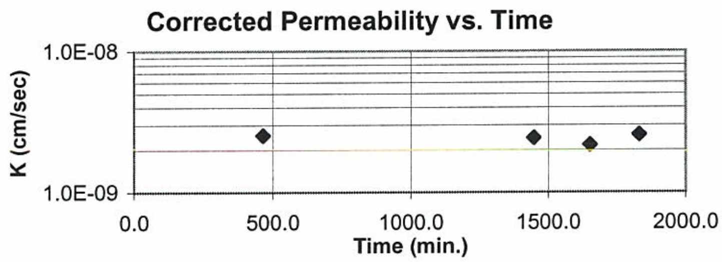
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	1.4745	1.4507	1.4515
Diameter (in.)	2.8033		2.8031
Moisture Content (%)	14.2		15.7
Dry Unit Weight (pcf)	116.6		118.5
Void Ratio	0.456		0.433
Degree of Saturation (%)	84.7		98.4
Trimmings MC (%)	14.2		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-24-10	7:30	71.0	22.19	3.26	0	---	---	---	---
3-24-10	15:15	71.0	21.84	3.60	2.79E+04	2.6E-11	2.6E-09	2.5E-11	2.5E-09
3-25-10	7:37	72.0	21.14	4.31	5.89E+04	2.6E-11	2.6E-09	2.4E-11	2.4E-09
3-25-10	11:02	72.0	21.01	4.44	1.23E+04	2.3E-11	2.3E-09	2.2E-11	2.2E-09
3-25-10	14:02	72.0	20.88	4.58	1.08E+04	2.7E-11	2.7E-09	2.6E-11	2.6E-09



A gradient of approximately 93.6 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 2.42E-11 cm/s 2.42E-09
Average Hydraulic Conductivity @ 20° C (last run) m/s 2.42E-11 cm/s 2.42E-09

Reviewed by:

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds — Project No. 175559023
Source: ST-9, 9.0'-11.0', TI 9.7'-10.2' — Test ID 1237B
Visual Classification: Lean Clay (CL), brown, moist, firm — Prepared By CSM
Undisturbed: XX — Specific Gravity 2.71 ASTM D854-A — Date 3-30-10
Maximum Dry Density (pcf) ______ — Percent of Maximum ______

Permeant: De-aired tap water
Selection and Preparation Comments: ______

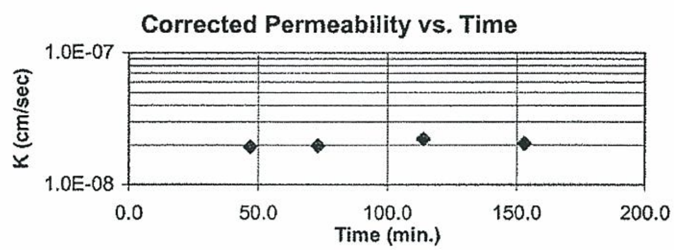
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4591	2.4259	2.4309
Diameter (in.)	2.8017		2.7889
Moisture Content (%)	23.2		22.7
Dry Unit Weight (pcf)	102.4		104.6
Void Ratio	0.652		0.618
Degree of Saturation (%)	96.3		99.3
Trimmings MC (%)	24.9		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi)	5
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	10
Minimum Effective Consolidation Stress (psi)	5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-7-10	9:15	72.0	22.05	3.59	0	---	---	---	---
4-7-10	10:02	72.0	21.89	3.75	2.82E+03	2.0E-10	2.0E-08	1.9E-10	1.9E-08
4-7-10	10:28	72.0	21.79	3.83	1.56E+03	2.1E-10	2.1E-08	2.0E-10	2.0E-08
4-7-10	11:09	72.0	21.62	3.98	2.46E+03	2.3E-10	2.3E-08	2.2E-10	2.2E-08
4-7-10	11:48	72.0	21.49	4.13	2.34E+03	2.2E-10	2.2E-08	2.0E-10	2.0E-08



A gradient of approximately 56.1 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) — m/s 2.04E-10 — cm/s 2.04E-08
Average Hydraulic Conductivity @ 20° C (last run) — m/s 2.04E-10 — cm/s 2.04E-08

Reviewed by: _[signature]_

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No. 175559023
Source: STN-10, 7.5'-9.5'
Test ID 833
Visual Classification: Lean Clay with Gravel (CL), brown, moist, firm
Prepared By RM
Undisturbed XX
Specific Gravity 2.68 ASTM D854-A
Date 3-2-10
Maximum Dry Density (pcf)
Percent of Maximum

Permeant: De-aired tap water
Selection and Preparation Comments:

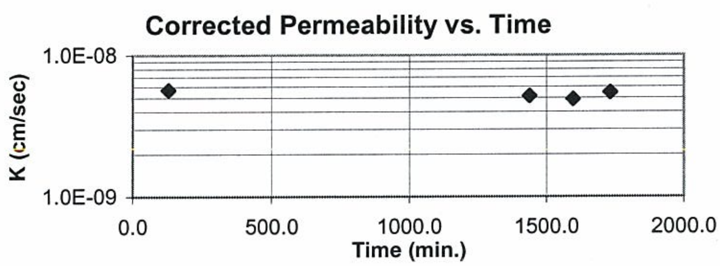
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4661	2.4198	2.4278
Diameter (in.)	2.8033		2.8037
Moisture Content (%)	14.4		15.0
Dry Unit Weight (pcf)	117.3		119.1
Void Ratio	0.426		0.404
Degree of Saturation (%)	90.6		99.6
Trimmings MC (%)	14.9		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-23-10	10:22	71.0	21.96	3.26	0	---	---	---	---
3-23-10	12:32	71.0	21.83	3.39	7.80E+03	5.9E-11	5.9E-09	5.7E-11	5.7E-09
3-24-10	10:20	72.0	20.59	4.52	7.85E+04	5.4E-11	5.4E-09	5.1E-11	5.1E-09
3-24-10	12:58	72.0	20.46	4.66	9.48E+03	5.2E-11	5.2E-09	4.9E-11	4.9E-09
3-24-10	15:15	72.0	20.33	4.79	8.22E+03	5.7E-11	5.7E-09	5.4E-11	5.4E-09



A gradient of approximately 56 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 5.28E-11 cm/s 5.28E-09
Average Hydraulic Conductivity @ 20° C (last run) m/s 5.28E-11 cm/s 5.28E-09

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name	Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2	Project No.	175559023
Source	STN-10, 20.0'-22.0'	Test ID	834
Visual Classification	Sandy Lean Clay (CL), brown, moist, firm, with organics and gravel	Prepared By	RM
Undisturbed	XX Specific Gravity 2.68 ASTM D854-A	Date	3-21-10
	Maximum Dry Density (pcf)	Percent of Maximum	

Permeant: De-aired tap water

Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

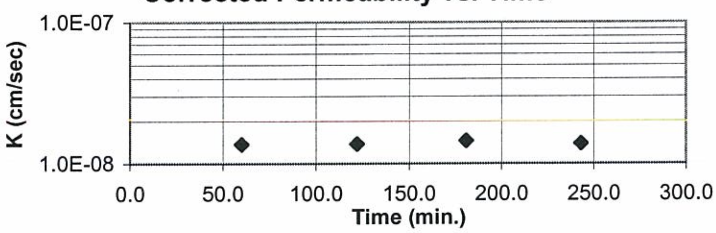
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4631	2.4178	2.4250
Diameter (in.)	2.8047		2.7890
Moisture Content (%)	18.4		18.6
Dry Unit Weight (pcf)	109.2		112.1
Void Ratio	0.533		0.492
Degree of Saturation (%)	92.5		101.1
Trimmings MC (%)	18.9		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi)	5
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	10
Minimum Effective Consolidation Stress (psi)	5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-24-10	10:28	72.0	22.14	3.08	0	---	---	---	---
3-24-10	11:28	72.0	22.00	3.23	3.60E+03	1.4E-10	1.4E-08	1.4E-10	1.4E-08
3-24-10	12:30	72.0	21.86	3.39	3.72E+03	1.4E-10	1.4E-08	1.4E-10	1.4E-08
3-24-10	13:29	72.0	21.71	3.54	3.54E+03	1.5E-10	1.5E-08	1.4E-10	1.4E-08
3-24-10	14:31	72.0	21.57	3.70	3.72E+03	1.5E-10	1.5E-08	1.4E-10	1.4E-08

Corrected Permeability vs. Time



A gradient of approximately 56 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations)	m/s	1.39E-10	cm/s	1.39E-08
Average Hydraulic Conductivity @ 20° C (last run)	m/s	1.39E-10	cm/s	1.39E-08

Reviewed by: KNL

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds | Project No. 175559023
Source: STN-20 10.5-12.5 TI 10.6-11.1 | Test ID 1249
Visual Classification: Lean Clay (CL), brown, moist, firm | Prepared By CSM
Undisturbed: XX | Specific Gravity 2.68 ASTM D854-A | Date 3-31-10
Maximum Dry Density (pcf) | Percent of Maximum
Permeant: De-aired tap water
Selection and Preparation Comments:

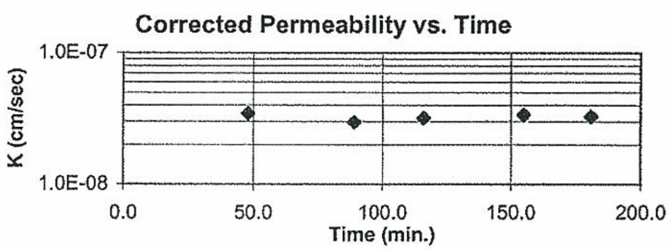
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 19 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	1.4830	1.4595	1.4606
Diameter (in.)	2.8010		2.7972
Moisture Content (%)	14.3		15.3
Dry Unit Weight (pcf)	115.6		117.7
Void Ratio	0.447		0.421
Degree of Saturation (%)	85.5		97.6
Trimmings MC (%)	13.9		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi)	5
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	10
Minimum Effective Consolidation Stress (psi)	5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-7-10	8:41	72.0	21.79	3.67	0	---	---	---	---
4-7-10	9:29	72.0	21.32	4.17	2.88E+03	3.6E-10	3.6E-08	3.4E-10	3.4E-08
4-7-10	10:10	72.0	20.96	4.52	2.46E+03	3.1E-10	3.1E-08	3.0E-10	3.0E-08
4-7-10	10:37	72.0	20.73	4.79	1.62E+03	3.4E-10	3.4E-08	3.2E-10	3.2E-08
4-7-10	11:16	72.0	20.37	5.19	2.34E+03	3.5E-10	3.5E-08	3.4E-10	3.4E-08
4-7-10	11:42	72.0	20.11	5.42	1.56E+03	3.4E-10	3.4E-08	3.3E-10	3.3E-08



A gradient of approximately 93.1 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations)	m/s	3.19E-10	cm/s	3.19E-08
Average Hydraulic Conductivity @ 20° C (last run)	m/s	3.24E-10	cm/s	3.24E-08

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Shawnee Fossil Plant (SHF) - Ash Ponds — Project No. 175559023
Source STN-20 34.0-36.0 TI 34.1-34.6 — Test ID 1251A
Visual Classification Lean Clay (CL), brown and light gray, moist, firm — Prepared By CSM
Undisturbed XX — Specific Gravity 2.7 ASTM D854-A — Date 3-31-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______

Permeant: De-aired tap water
Selection and Preparation Comments: ______

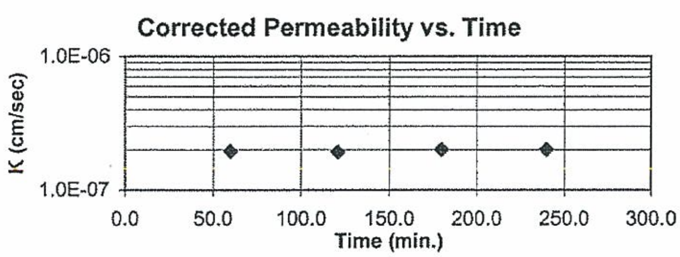
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4459	2.4096	2.4096
Diameter (in.)	2.7997		2.7750
Moisture Content (%)	23.3		23.1
Dry Unit Weight (pcf)	100.7		104.1
Void Ratio	0.673		0.620
Degree of Saturation (%)	93.3		100.8
Trimmings MC (%)	24.7		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-13-10	8:05	70.0	22.00	3.09	0	---	---	---	---
4-13-10	9:05	70.0	21.50	3.59	3.60E+03	2.0E-09	2.0E-07	1.9E-09	1.9E-07
4-13-10	10:06	70.0	21.00	4.09	3.66E+03	2.0E-09	2.0E-07	1.9E-09	1.9E-07
4-13-10	11:05	70.0	20.51	4.60	3.54E+03	2.1E-09	2.1E-07	2.0E-09	2.0E-07
4-13-10	12:05	70.0	20.01	5.11	3.60E+03	2.1E-09	2.1E-07	2.0E-09	2.0E-07



A gradient of approximately 56.4 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 1.97E-09 cm/s 1.97E-07
Average Hydraulic Conductivity @ 20° C (last run) m/s 1.97E-09 cm/s 1.97E-07

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Shawnee Fossil Plant (SHF) - Ash Ponds — Project No. 175559023
Source STN-23, 27.0-29.0 TI 27.0-27.5 — Test ID 1258A
Visual Classification Lean Clay (CL), tan, moist, firm — Prepared By CSM
Undisturbed XX — Specific Gravity 2.68 ASTM D854-A — Date 3-31-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______

Permeant: De-aired tap water
Selection and Preparation Comments: ______

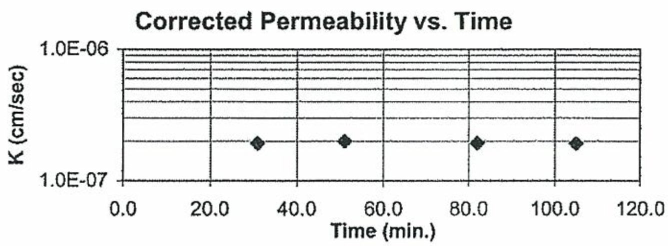
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4479	2.3588	2.3633
Diameter (in.)	2.7977		2.7938
Moisture Content (%)	21.7		19.2
Dry Unit Weight (pcf)	106.3		110.4
Void Ratio	0.574		0.516
Degree of Saturation (%)	101.1		99.6
Trimmings MC (%)	22.8		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi)	5
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	10
Minimum Effective Consolidation Stress (psi)	5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-7-10	9:38	72.0	20.26	5.48	0	---	---	---	---
4-7-10	10:09	72.0	19.25	6.62	1.86E+03	2.0E-09	2.0E-07	1.9E-09	1.9E-07
4-7-10	10:29	72.0	18.57	7.36	1.20E+03	2.1E-09	2.1E-07	2.0E-09	2.0E-07
4-7-10	11:00	72.0	17.59	8.48	1.86E+03	2.0E-09	2.0E-07	1.9E-09	1.9E-07
4-7-10	11:23	72.0	16.86	9.27	1.38E+03	2.0E-09	2.0E-07	1.9E-09	1.9E-07



A gradient of approximately 56.4 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations)	m/s	1.93E-09	cm/s	1.93E-07
Average Hydraulic Conductivity @ 20° C (last run)	m/s	1.93E-09	cm/s	1.93E-07

Reviewed by: KBG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds
Project No.: 175559023
Source: STN-25, 29.0'-31.0', TI 29.8'-30.3'
Test ID: 1260
Visual Classification: Silt (ML), gray, wet, soft
Prepared By: CSM
Undisturbed: XX
Specific Gravity: 2.68 ASTM D854-A
Date: 4-20-10
Maximum Dry Density (pcf):
Percent of Maximum:
Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

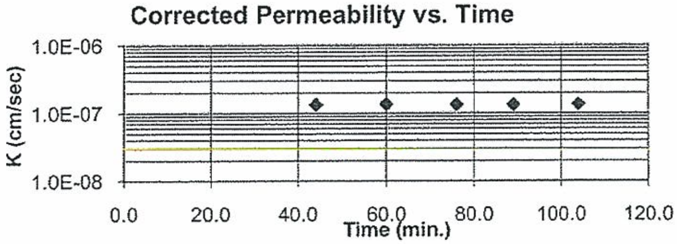
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4945	2.3885	2.3886
Diameter (in.)	2.7727		2.7652
Moisture Content (%)	29.9		27.5
Dry Unit Weight (pcf)	89.9		94.3
Void Ratio	0.862		0.773
Degree of Saturation (%)	92.9		95.1
Trimmings MC (%)	27.9		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi)	5
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	10
Minimum Effective Consolidation Stress (psi)	5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-26-10	11:58	72.0	22.05	3.39	0	---	---	---	---
4-26-10	12:42	72.0	21.05	4.44	2.64E+03	1.4E-09	1.4E-07	1.3E-09	1.3E-07
4-26-10	12:58	72.0	20.68	4.82	9.60E+02	1.4E-09	1.4E-07	1.4E-09	1.4E-07
4-26-10	13:14	72.0	20.32	5.20	9.60E+02	1.4E-09	1.4E-07	1.3E-09	1.3E-07
4-26-10	13:27	72.0	20.06	5.53	7.80E+02	1.4E-09	1.4E-07	1.3E-09	1.3E-07
4-26-10	13:42	72.0	19.73	5.89	9.00E+02	1.4E-09	1.4E-07	1.3E-09	1.3E-07

Corrected Permeability vs. Time



A gradient of approximately 55.3 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 1.34E-09 cm/s 1.34E-07
Average Hydraulic Conductivity @ 20° C (last run) m/s 1.34E-09 cm/s 1.34E-07

Reviewed by: KDG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

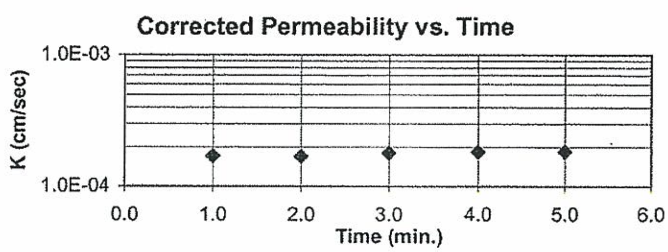
Project Name Shawnee Fossil Plant (SHF) - Ash Ponds Project No. 175559023
Source STN-28 30.0-32.0 TI 30.1-30.6 Test ID 1263
Visual Classification Silt (ML), dark gray, moist, firm Prepared By CSM
Undisturbed XX Specific Gravity 2.68 ASTM D854-A Date 3-31-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4770	2.2450	2.2454	Chamber	71
Diameter (in.)	2.7823		2.8280	Influent	66
Moisture Content (%)	26.6		28.4	Effluent	65
Dry Unit Weight (pcf)	87.9		93.8		
Void Ratio	0.904		0.783		
Degree of Saturation (%)	79.0		97.2		
Trimmings MC (%)	28.0				

Applied Head Difference (psi)	1
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	6
Minimum Effective Consolidation Stress (psi)	5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
6-6-10	10:56	72.0	18.47	7.10	0	---	---	---	---
6-6-10	10:57	72.0	16.94	8.73	6.00E+01	1.8E-06	1.8E-04	1.7E-06	1.7E-04
6-6-10	10:58	72.0	15.51	10.09	6.00E+01	1.8E-06	1.8E-04	1.7E-06	1.7E-04
6-6-10	10:59	72.0	14.19	11.38	6.00E+01	1.9E-06	1.9E-04	1.8E-06	1.8E-04
6-6-10	11:00	72.0	13.03	12.56	6.00E+01	1.9E-06	1.9E-04	1.8E-06	1.8E-04
6-6-10	11:01	72.0	11.99	13.58	6.00E+01	1.9E-06	1.9E-04	1.8E-06	1.8E-04



A gradient of approximately 55.7 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 1.79E-06 cm/s 1.79E-04
Average Hydraulic Conductivity @ 20° C (last run) m/s 1.77E-06 cm/s 1.77E-04

Reviewed by:

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Stantec

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No.: 175559023
Source: STN-32A, 3.0'-5.0'
Test ID: 843B
Visual Classification: Lean Clay with Gravel (CL), brown, moist, firm
Prepared By: RM
Undisturbed: XX
Specific Gravity: 2.66 ASTM D854-A
Date: 3-2-10
Maximum Dry Density (pcf):
Percent of Maximum:

Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

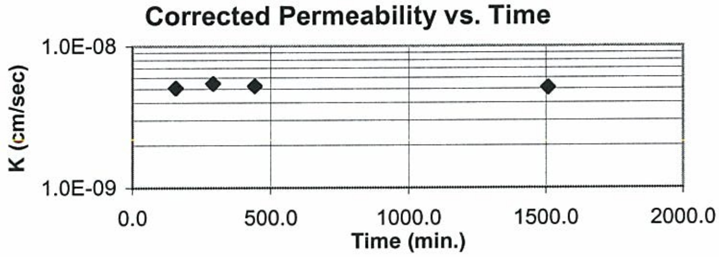
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4781	2.4767	2.4348
Diameter (in.)	2.8027		2.8028
Moisture Content (%)	15.5		15.5
Dry Unit Weight (pcf)	115.6		117.7
Void Ratio	0.436		0.411
Degree of Saturation (%)	94.2		100.3
Trimmings MC (%)	16.4		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi)	5
Back Pressure Saturated to (psi)	65
Maximum Effective Consolidation Stress (psi)	10
Minimum Effective Consolidation Stress (psi)	5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-24-10	10:22	72.0	22.51	2.76	0	---	---	---	---
3-24-10	12:58	72.0	22.37	2.90	9.36E+03	5.3E-11	5.3E-09	5.1E-11	5.1E-09
3-24-10	15:13	72.0	22.24	3.03	8.10E+03	5.7E-11	5.7E-09	5.4E-11	5.4E-09
3-24-10	17:45	72.0	22.10	3.17	9.12E+03	5.5E-11	5.5E-09	5.2E-11	5.2E-09
3-25-10	11:30	72.0	21.10	4.07	6.39E+04	5.4E-11	5.4E-09	5.1E-11	5.1E-09

Corrected Permeability vs. Time



A gradient of approximately 55.7 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 5.19E-11 cm/s 5.19E-09
Average Hydraulic Conductivity @ 20° C (last run) m/s 5.19E-11 cm/s 5.19E-09

Reviewed by: KLG

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2 Project No. 175559023
Source STN-32B, 23.0'-25.0' Test ID 850
Visual Classification Lean Clay with Gravel (CL), brown, moist, firm Prepared By RM
Undisturbed XX Specific Gravity 2.68 ASTM D854-A Date 3-2-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______

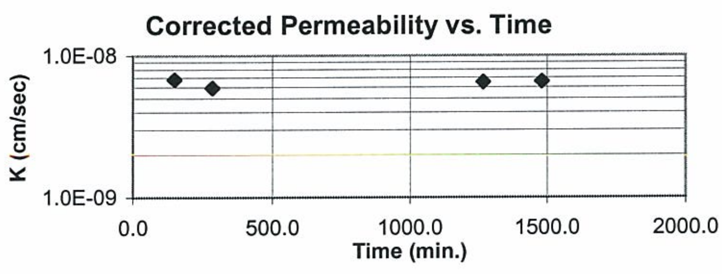
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4725	2.4415	2.4398	Chamber	75
Diameter (in.)	2.8027		2.7911	Influent	70
Moisture Content (%)	21.4		20.7	Effluent	65
Dry Unit Weight (pcf)	105.1		107.4		
Void Ratio	0.592		0.558		
Degree of Saturation (%)	96.9		99.2		
Trimmings MC (%)	22.8				

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-24-10	10:30	71.0	22.05	3.31	0	---	---	---	---
3-24-10	12:59	71.0	21.90	3.51	8.94E+03	7.0E-11	7.0E-09	6.8E-11	6.8E-09
3-24-10	15:16	71.0	21.75	3.64	8.22E+03	6.1E-11	6.1E-09	5.9E-11	5.9E-09
3-25-10	7:38	72.0	20.66	4.76	5.89E+04	6.8E-11	6.8E-09	6.5E-11	6.5E-09
3-25-10	11:11	72.0	20.42	5.00	1.28E+04	6.9E-11	6.9E-09	6.5E-11	6.5E-09



A gradient of approximately 55.8 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 6.42E-11 cm/s 6.42E-09
Average Hydraulic Conductivity @ 20° C (last run) m/s 6.42E-11 cm/s 6.42E-09

Reviewed by: [signature]

File: frm_175559023_fhp_850 Sheet: Report
Preparation Date 2-20-98
Revision Date 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By:JW
Approved By: TLK

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1504*	Tested By	*JM*
Project Name	*Sawnee Ash Ponds 1&2*	Test Date	*11/5/2009*
Boring No.	*STN-33-* SI	Reviewed By	*MM*
Sample No.	*ST-3*	Review Date	*11/12/2009*
Sample Depth	*16-16.3 ft*	Lab No.	*4*
Sample Description	*Brown Lean clay with sand*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*23.8*
Wet Unit Weight, pcf:	*129.5*
Dry Unit Weight, pcf:	*104.6*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***4.4E-08***

Remarks: ______________________

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1504*	Tested By	*JM*
Project Name	*Shawnee-Ash Ponds 1&2*	Test Date	*11/6/2009*
Boring No.	*STN-35*	Reviewed By	*MM*
Sample No.	*ST-1*	Review Date	*11/12/2009*
Sample Depth	*37.5-37.8 ft*	Lab No.	*5*
Sample Description	*Gray Brown lean clay with sand*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*25.2*
Wet Unit Weight, pcf:	*120.5*
Dry Unit Weight, pcf:	*96.3*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***3.7E-08***

Remarks: ______________________________

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HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1504*	Tested By	*JM*
Project Name	*Shawnee-Ash Popnds 1&2*	Test Date	*11/2/2009*
Boring No.	*STN-39*	Reviewed By	*MM*
Sample No.	*ST-1*	Review Date	*11/7/2009*
Sample Depth	*4.5-4.8*	Lab No.	*1*
Sample Description	*Brown lean clay with sand*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*15.3*
Wet Unit Weight, pcf:	*125.2*
Dry Unit Weight, pcf:	*108.6*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***7.4E-08***

Remarks: ______________________________

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Stantec

Project Name Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No. 175559023
Source STN-39A, 19.0'-21.0'
Test ID 854A
Visual Classification Lean Clay with Gravel (CL), brown, moist, firm
Prepared By RM
Undisturbed XX
Specific Gravity 2.66 ASTM D854-A
Date 3-2-10
Maximum Dry Density (pcf)
Percent of Maximum

Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

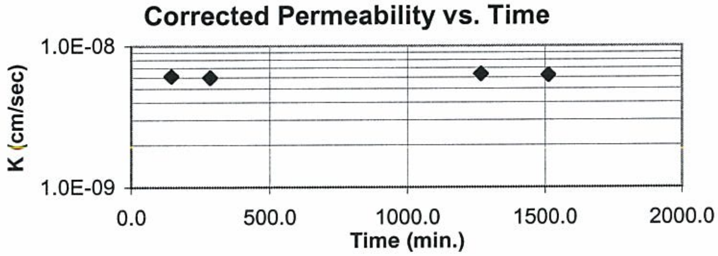
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4631	2.4262	2.4293
Diameter (in.)	2.8003		2.8008
Moisture Content (%)	20.5		20.3
Dry Unit Weight (pcf)	106.0		107.5
Void Ratio	0.566		0.545
Degree of Saturation (%)	96.3		99.1
Trimmings MC (%)	21.7		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-24-10	10:33	71.0	19.84	2.72	0	---	---	---	---
3-24-10	12:58	71.0	19.69	2.88	8.70E+03	6.3E-11	6.3E-09	6.1E-11	6.1E-09
3-24-10	15:17	71.0	19.56	3.04	8.34E+03	6.2E-11	6.2E-09	6.0E-11	6.0E-09
3-25-10	7:39	72.0	18.44	4.10	5.89E+04	6.7E-11	6.7E-09	6.3E-11	6.3E-09
3-25-10	11:45	72.0	18.18	4.37	1.48E+04	6.5E-11	6.5E-09	6.2E-11	6.2E-09

Corrected Permeability vs. Time



A gradient of approximately 56 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 6.14E-11 cm/s 6.14E-09
Average Hydraulic Conductivity @ 20° C (last run) m/s 6.14E-11 cm/s 6.14E-09

Reviewed by: KNe

GeoTesting
express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1504*	Tested By	*JM*
Project Name	*Shawnee-Ash ponds 1&2*	Test Date	*11/3/2009*
Boring No.	~~A-15~~ STN - 50	Reviewed By	*MM*
Sample No.	*ST-2*	Review Date	*11/7/2009*
Sample Depth	*8.7-9.0 ft*	Lab No.	*2*
Sample Description	*Brown lean clay with sand*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*15.9*
Wet Unit Weight, pcf:	*123.8*
Dry Unit Weight, pcf:	*106.8*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***5.9E-08***

Remarks:

GeoTesting express

HYDRAULIC CONDUCTIVITY

Project No.	*GTX-1504*	Tested By	*JM*
Project Name	*Shawnee-Ash Ponds 1&2*	Test Date	*11/3/2009*
Boring No.	*STN-50*	Reviewed By	*MM*
Sample No.	*ST-4*	Review Date	*11/8/2009*
Sample Depth	*3~~9~~8.2-38.5 ft*	Lab No.	*3*
Sample Description	*Brown lean clay with sand*		

ASTM D5084 - Falling Head (Method C RisingTail)

Sample Type:	*UD*
Sample Orientation:	*Vertical*
Initial Water Content, %:	*24.0*
Wet Unit Weight, pcf:	*122.9*
Dry Unit Weight, pcf:	*99.1*
Compaction, %:	*N/A*
Hydraulic Conductivity, cm/sec. @20 °C	***5.1E-08***

Remarks:

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Ash Ponds 1 & 2
Project No. 175559023
Source: STN-50P, 17.5'-19.5'
Test ID 860
Visual Classification: Lean Clay (CL), brown, moist, firm, with organics and gravel
Prepared By RM
Undisturbed XX
Specific Gravity 2.71 ASTM D854-A
Date 3-2-10
Maximum Dry Density (pcf)
Percent of Maximum

Permeant: De-aired tap water

Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

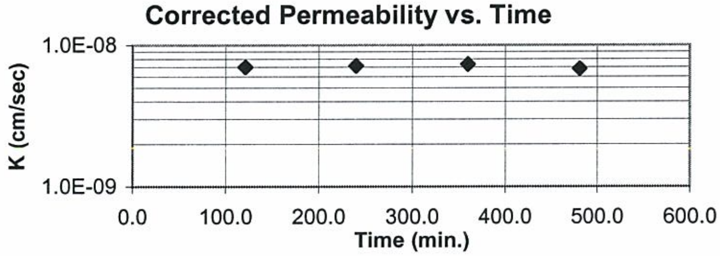
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4615	2.4329	2.4379
Diameter (in.)	2.8033		2.8028
Moisture Content (%)	23.8		24.2
Dry Unit Weight (pcf)	101.3		102.3
Void Ratio	0.671		0.654
Degree of Saturation (%)	96.1		100.4
Trimmings MC (%)	24.0		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
3-24-10	7:30	72.0	22.30	2.99	0	---	---	---	---
3-24-10	9:31	72.0	22.15	3.14	7.26E+03	7.4E-11	7.4E-09	7.0E-11	7.0E-09
3-24-10	11:30	72.0	22.01	3.30	7.14E+03	7.5E-11	7.5E-09	7.1E-11	7.1E-09
3-24-10	13:30	72.0	21.86	3.46	7.20E+03	7.7E-11	7.7E-09	7.3E-11	7.3E-09
3-24-10	15:31	72.0	21.72	3.61	7.26E+03	7.2E-11	7.2E-09	6.8E-11	6.8E-09

Corrected Permeability vs. Time



A gradient of approximately 56.1 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 7.05E-11 cm/s 7.05E-09
Average Hydraulic Conductivity @ 20° C (last run) m/s 7.05E-11 cm/s 7.05E-09

Reviewed by: KB

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

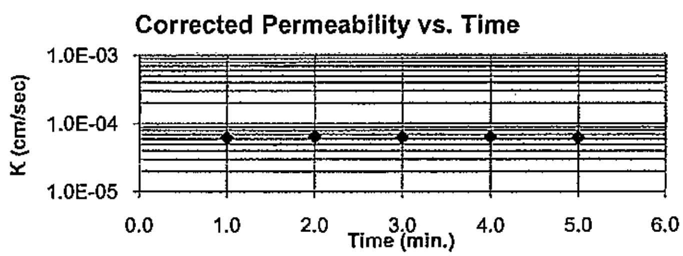
Project Name Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source STN-105A, 23.0'-25.0' TI 23.1'-23.6' — Test ID 596A
Visual Classification Silt (ML), dark gray, moist, firm, (flyash) — Prepared By BWT
Undisturbed XX — Specific Gravity 2.3 ASTM D854-A — Date 4-27-10
Maximum Dry Density (pcf) ____ — Percent of Maximum ____
Permeant: De-aired tap water
Selection and Preparation Comments: Moisture contents and specimen dried at 60° C.

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4535	2.4005	2.3974	Chamber	67
Diameter (in.)	2.7927		2.7883	Influent	66
Moisture Content (%)	46.1		42.9	Effluent	65
Dry Unit Weight (pcf)	70.0		71.8		
Void Ratio	1.052		0.999		
Degree of Saturation (%)	100.8		98.7		
Trimmings MC (%)	45.8				

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 2
Minimum Effective Consolidation Stress (psi) 1

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-27-10	13:35	72.0	20.43	5.21	0	---	---	---	---
4-27-10	13:36	72.0	19.86	5.73	6.00E+01	6.5E-07	6.5E-05	6.2E-07	6.2E-05
4-27-10	13:37	72.0	19.35	6.31	6.00E+01	6.8E-07	6.8E-05	6.5E-07	6.5E-05
4-27-10	13:38	72.0	18.84	6.81	6.00E+01	6.6E-07	6.6E-05	6.2E-07	6.2E-05
4-27-10	13:39	72.0	18.33	7.29	6.00E+01	6.7E-07	6.7E-05	6.4E-07	6.4E-05
4-27-10	13:40	72.0	17.87	7.75	6.00E+01	6.5E-07	6.5E-05	6.2E-07	6.2E-05



A gradient of approximately 56.2 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 6.30E-07 cm/s 6.30E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 6.28E-07 cm/s 6.28E-05

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source: STN-105A, 29.0'-31.0' — Test ID 599
Visual Classification: Gravelly Silt (ML), brown, moist, soft — Prepared By BWT
Undisturbed: XX — Specific Gravity 2.63 ASTM D854-A — Date 4-7-10
Maximum Dry Density (pcf) ______ — Percent of Maximum ______

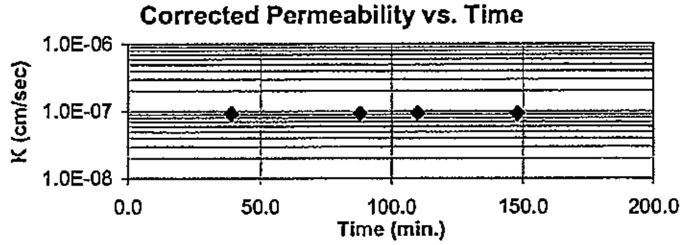
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4366	2.3446	2.3574	Chamber	75
Diameter (in.)	2.7970		2.7950	Influent	70
Moisture Content (%)	14.2		13.1	Effluent	65
Dry Unit Weight (pcf)	118.1		122.2		
Void Ratio	0.390		0.343		
Degree of Saturation (%)	95.8		100.5		
Trimmings MC (%)	14.5				

Applied Head Difference (psi): 5
Back Pressure Saturated to (psi): 65
Maximum Effective Consolidation Stress (psi): 10
Minimum Effective Consolidation Stress (psi): 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-13-10	13:11	68.0	19.98	5.90	0	---	---	---	---
4-13-10	13:50	68.0	19.29	6.43	2.34E+03	9.1E-10	9.1E-08	9.1E-10	9.1E-08
4-13-10	14:39	68.0	18.52	7.20	2.94E+03	9.2E-10	9.2E-08	9.2E-10	9.2E-08
4-13-10	15:01	68.0	18.19	7.56	1.32E+03	9.3E-10	9.3E-08	9.3E-10	9.3E-08
4-13-10	15:39	68.0	17.60	8.14	2.28E+03	9.2E-10	9.2E-08	9.2E-10	9.2E-08



A gradient of approximately 56.6 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) — m/s 9.17E-10 — cm/s 9.17E-08
Average Hydraulic Conductivity @ 20° C (last run) — m/s 9.17E-10 — cm/s 9.17E-08

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

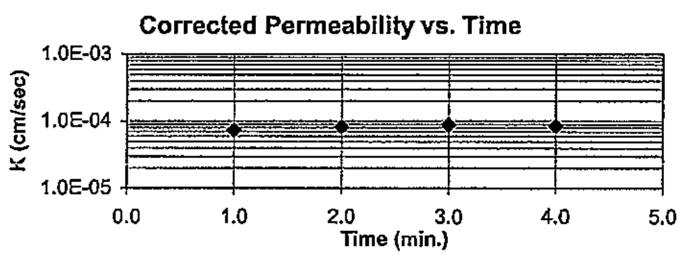
Project Name Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source STN-106, 15.0'-17.0' — Test ID 600
Visual Classification Silt (ML), dark gray, moist, firm, flyash — Prepared By BWT
Undisturbed XX — Specific Gravity 2.19 ASTM D854-A — Date 4-8-10
Maximum Dry Density (pcf) ______ — Percent of Maximum ______
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4446	2.3987	2.3994	Chamber	71
Diameter (in.)	2.7917		2.7936	Influent	66
Moisture Content (%)	48.9		48.4	Effluent	65
Dry Unit Weight (pcf)	64.2		65.3		
Void Ratio	1.130		1.094		
Degree of Saturation (%)	94.7		96.8		
Trimmings MC (%)	50.0				

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-12-10	14:31	73.0	17.49	8.11	0	---	---	---	---
4-12-10	14:32	73.0	16.90	8.83	6.00E+01	7.9E-07	7.9E-05	7.4E-07	7.4E-05
4-12-10	14:33	73.0	16.70	10.00	6.00E+01	8.6E-07	8.6E-05	8.1E-07	8.1E-05
4-12-10	14:34	73.0	15.48	10.19	6.00E+01	9.4E-07	9.4E-05	8.8E-07	8.8E-05
4-12-10	14:35	73.0	14.81	10.79	6.00E+01	9.0E-07	9.0E-05	8.4E-07	8.4E-05



A gradient of approximately 56.5 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 8.16E-07 cm/s 8.16E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 8.16E-07 cm/s 8.16E-05

Reviewed by: KDG [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source: STN-111, 38.0'-40.0' — Test ID 7A
Visual Classification: Poorly Graded Sand (SP), dark gray, moist, firm — Prepared By BWT
Undisturbed: XX — Specific Gravity 2.66 ASTM D854-A — Date 4-5-10
Maximum Dry Density (pcf) ______ — Percent of Maximum ______

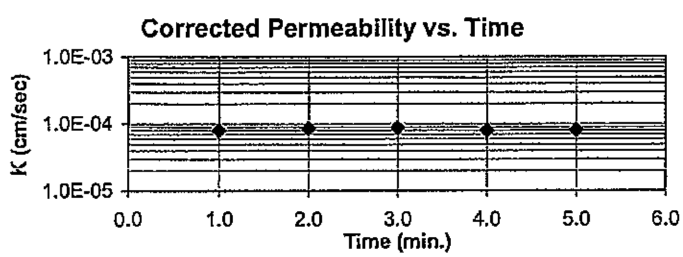
Permeant: De-aired tap water
Selection and Preparation Comments:

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4351	2.3754	2.3759	Chamber	71
Diameter (in.)	2.7840		2.7894	Influent	66
Moisture Content (%)	16.7		15.0	Effluent	65
Dry Unit Weight (pcf)	115.1		117.5		
Void Ratio	0.443		0.414		
Degree of Saturation (%)	100.4		96.5		
Trimmings MC (%)	14.2				

Applied Head Difference (psi): 1
Back Pressure Saturated to (psi): 65
Maximum Effective Consolidation Stress (psi): 6
Minimum Effective Consolidation Stress (psi): 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-9-10	15:01	72.0	19.78	5.49	0	—	—	—	—
4-9-10	15:02	72.0	19.08	6.19	6.00E+01	8.4E-07	8.4E-05	7.9E-07	7.9E-05
4-9-10	15:03	72.0	18.36	6.90	6.00E+01	9.0E-07	9.0E-05	8.5E-07	8.5E-05
4-9-10	15:04	72.0	17.75	7.67	6.00E+01	9.2E-07	9.2E-05	8.7E-07	8.7E-05
4-9-10	15:05	72.0	17.15	8.26	6.00E+01	8.4E-07	8.4E-05	7.9E-07	7.9E-05
4-9-10	15:06	72.0	16.50	8.75	6.00E+01	8.5E-07	8.5E-05	8.0E-07	8.0E-05



A gradient of approximately 56.7 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 8.30E-07 cm/s 8.30E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 8.23E-07 cm/s 8.23E-05

Reviewed by: [signature]

File: frm_175559035_fhp_7a Sheet: Report
Preparation Date 2-20-98
Revision Date 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By:JW
Approved By: TLK

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack | Project No. 175559035
Source STN-114, 4.5'-6.1' | Test ID 8A
Visual Classification Silt (ML), dark gray, moist, firm (flyash) | Prepared By BWT
Undisturbed XX | Specific Gravity 2.45 ASTM D854-A | Date 4-6-10
Maximum Dry Density (pcf) ______ | Percent of Maximum ______

Permeant: De-aired tap water
Selection and Preparation Comments:

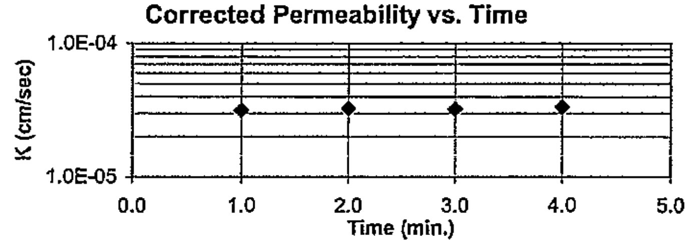
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4528	2.3915	2.3941
Diameter (in.)	2.8010		2.7871
Moisture Content (%)	32.9		35.1
Dry Unit Weight (pcf)	79.7		82.5
Void Ratio	0.919		0.855
Degree of Saturation (%)	87.7		100.7
Trimmings MC (%)	33.3		

Final Pressures (psi)	
Chamber	71
Influent	66
Effluent	65

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-12-10	9:04	68.0	20.25	5.39	0	---	---	---	---
4-12-10	9:05	68.0	20.08	5.75	6.00E+01	3.1E-07	3.1E-05	3.1E-07	3.1E-05
4-12-10	9:06	68.0	19.77	5.98	6.00E+01	3.3E-07	3.3E-05	3.3E-07	3.3E-05
4-12-10	9:07	68.0	19.54	6.27	6.00E+01	3.2E-07	3.2E-05	3.2E-07	3.2E-05
4-12-10	9:08	68.0	19.27	6.53	6.00E+01	3.3E-07	3.3E-05	3.3E-07	3.3E-05



A gradient of approximately 56.3 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 3.24E-07 cm/s 3.24E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 3.24E-07 cm/s 3.24E-05

Reviewed by:

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source: STN-114, 33.0'-34.0' — Test ID 11B
Visual Classification: Silt (ML), brown, moist, hard, gypsum — Prepared By BWT
Undisturbed: XX — Specific Gravity 2.65 ASTM D854-A — Date 4-6-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______

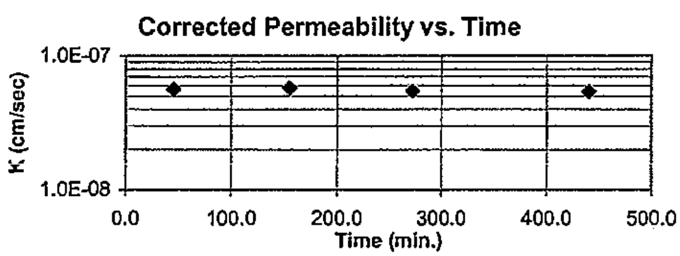
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4655	2.4338	2.4364	Chamber	75
Diameter (in.)	2.8027		2.8067	Influent	70
Moisture Content (%)	16.6		17.4	Effluent	65
Dry Unit Weight (pcf)	110.4		111.4		
Void Ratio	0.498		0.485		
Degree of Saturation (%)	88.2		95.4		
Trimmings MC (%)	17.1				

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-15-10	8:50	70.0	21.27	4.31	0	---	---	---	---
4-15-10	9:35	70.0	21.16	4.42	2.70E+03	5.8E-10	5.8E-08	5.6E-10	5.6E-08
4-15-10	11:25	70.0	20.89	4.70	6.60E+03	5.9E-10	5.9E-08	5.8E-10	5.8E-08
4-15-10	13:22	70.0	20.61	4.97	7.02E+03	5.6E-10	5.6E-08	5.4E-10	5.4E-08
4-15-10	16:10	70.0	20.21	5.35	1.01E+04	5.5E-10	5.5E-08	5.4E-10	5.4E-08



A gradient of approximately 56 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 5.55E-10 cm/s 5.55E-08
Average Hydraulic Conductivity @ 20° C (last run) m/s 5.55E-10 cm/s 5.55E-08

Reviewed by:

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
ASTM D 5084-03

Project Name Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source STN-122, 34.0'-36.0' — Test ID 14A
Visual Classification Silt (ML), dark gray, moist, firm — Prepared By BWT
Undisturbed XX — Specific Gravity 2.36 ASTM D854-A — Date 4-6-10
Maximum Dry Density (pcf) ______ — Percent of Maximum ______
Permeant: De-aired tap water
Selection and Preparation Comments: ______

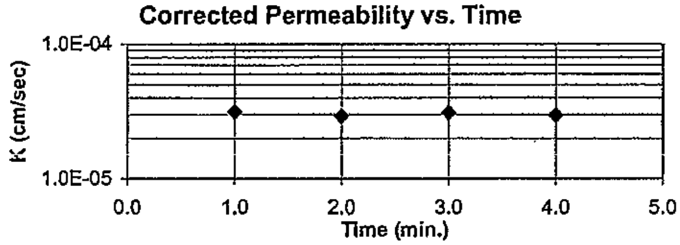
Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4301	2.3509	2.3835	Chamber	71
Diameter (in.)	2.8160		2.7901	Influent	66
Moisture Content (%)	40.6		37.8	Effluent	65
Dry Unit Weight (pcf)	73.3		76.1		
Void Ratio	1.011		0.936		
Degree of Saturation (%)	94.8		95.4		
Trimmings MC (%)	43.2				

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-9-10	14:04	72.0	20.82	4.47	0	---	---	---	---
4-9-10	14:05	72.0	20.52	4.73	6.00E+01	3.3E-07	3.3E-05	3.1E-07	3.1E-05
4-9-10	14:06	72.0	20.21	4.93	6.00E+01	3.1E-07	3.1E-05	2.9E-07	2.9E-05
4-9-10	14:07	72.0	20.05	5.30	6.00E+01	3.2E-07	3.2E-05	3.1E-07	3.1E-05
4-9-10	14:08	72.0	19.80	5.55	6.00E+01	3.1E-07	3.1E-05	3.0E-07	3.0E-05

Corrected Permeability vs. Time



A gradient of approximately 56.8 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 3.02E-07 cm/s 3.02E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 3.02E-07 cm/s 3.02E-05

Reviewed by: [signature]

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name: Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack — Project No. 175559035
Source: STN-128A, 20.0'-22.0' — Test ID 40A
Visual Classification: Silt (ML), dark gray, moist, firm, flyash — Prepared By BWT
Undisturbed: XX — Specific Gravity 2.27 ASTM D854-A — Date 4-7-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______

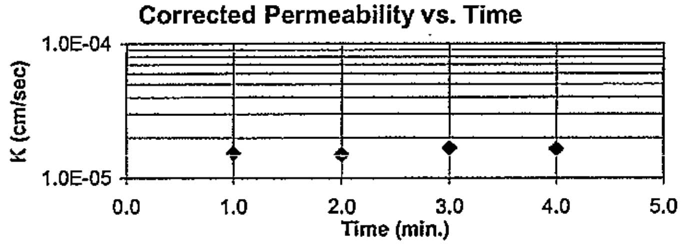
Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

	Initial Specimen Data	After Consolidation Data	After Test Data	Final Pressures (psi)	
Height (in.)	2.4518	2.4175	2.4198	Chamber	71
Diameter (in.)	2.7970		2.7818	Influent	66
Moisture Content (%)	40.9		38.7	Effluent	65
Dry Unit Weight (pcf)	75.0		76.8		
Void Ratio	0.889		0.844		
Degree of Saturation (%)	104.5		104.1		
Trimmings MC (%)	47.4				

Applied Head Difference (psi) 1
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 6
Minimum Effective Consolidation Stress (psi) 5

Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	Hydraulic Conductivity k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-12-10	10:37	72.0	20.88	4.87	0	---	---	---	---
4-12-10	10:38	72.0	20.75	5.01	6.00E+01	1.6E-07	1.6E-05	1.5E-07	1.5E-05
4-12-10	10:39	72.0	20.65	5.17	6.00E+01	1.6E-07	1.6E-05	1.5E-07	1.5E-05
4-12-10	10:40	72.0	20.48	5.29	6.00E+01	1.8E-07	1.8E-05	1.7E-07	1.7E-05
4-12-10	10:41	72.0	20.31	5.40	6.00E+01	1.7E-07	1.7E-05	1.6E-07	1.6E-05



A gradient of approximately 56.3 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 1.58E-07 cm/s 1.58E-05
Average Hydraulic Conductivity @ 20° C (last run) m/s 1.58E-07 cm/s 1.58E-05

Reviewed by: [signature]

File: frm_175559035_fhp_40a Sheet: Report
Preparation Date 2-20-98
Revision Date 1-2008

Stantec Consulting Services Inc.

Laboratory Document
Prepared By:JW
Approved By: TLK

Stantec

Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter ASTM D 5084-03

Project Name Shawnee Fossil Plant (SHF) - Consolidated Waste Dry Stack Project No. 175559035
Source STN-128B, 41.0'-42.0' Test ID 42
Visual Classification Silt (ML), tan, moist, firm Prepared By BWT
Undisturbed XX Specific Gravity 2.65 ASTM D854-A Date 4-7-10
Maximum Dry Density (pcf) ______ Percent of Maximum ______

Permeant: De-aired tap water
Selection and Preparation Comments: ______

Specimens (if compacted) were compacted in a Proctor Mold as follows: The Maximum Dry Density was converted to Wet Density, this mass was divided by 4 (layers) and 3 of the 4 layers were compacted into the mold using a Proctor Hammer using 25 blows per layer. The density was varied by reducing the height of the drop by the amount listed beside "Compacted". The specimen was trimmed from the bottom two layers.

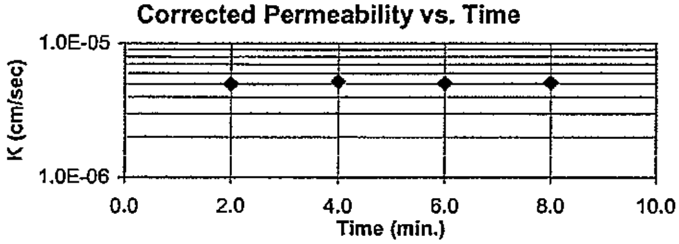
	Initial Specimen Data	After Consolidation Data	After Test Data
Height (in.)	2.4550	2.4269	2.4305
Diameter (in.)	2.8030		2.7952
Moisture Content (%)	21.5		21.3
Dry Unit Weight (pcf)	104.1		105.8
Void Ratio	0.589		0.564
Degree of Saturation (%)	96.6		100.2
Trimmings MC (%)	20.0		

Final Pressures (psi)	
Chamber	75
Influent	70
Effluent	65

Applied Head Difference (psi) 5
Back Pressure Saturated to (psi) 65
Maximum Effective Consolidation Stress (psi) 10
Minimum Effective Consolidation Stress (psi) 5

						Hydraulic Conductivity			
Date	Clock (24H:M)	Temp. °F	Bottom Head	Top Head	Test Time (sec)	k (m/s)	k (cm/s)	k @ 20° C (m/s)	k @ 20° C (cm/s)
4-13-10	14:02	70.0	18.20	7.89	0	---	---	---	---
4-13-10	14:04	70.0	17.80	8.35	1.20E+02	5.1E-08	5.1E-06	5.0E-08	5.0E-06
4-13-10	14:06	70.0	17.33	8.77	1.20E+02	5.3E-08	5.3E-06	5.2E-08	5.2E-06
4-13-10	14:08	70.0	16.89	9.19	1.20E+02	5.2E-08	5.2E-06	5.0E-08	5.0E-06
4-13-10	14:10	70.0	16.47	9.63	1.20E+02	5.2E-08	5.2E-06	5.1E-08	5.1E-06

Corrected Permeability vs. Time



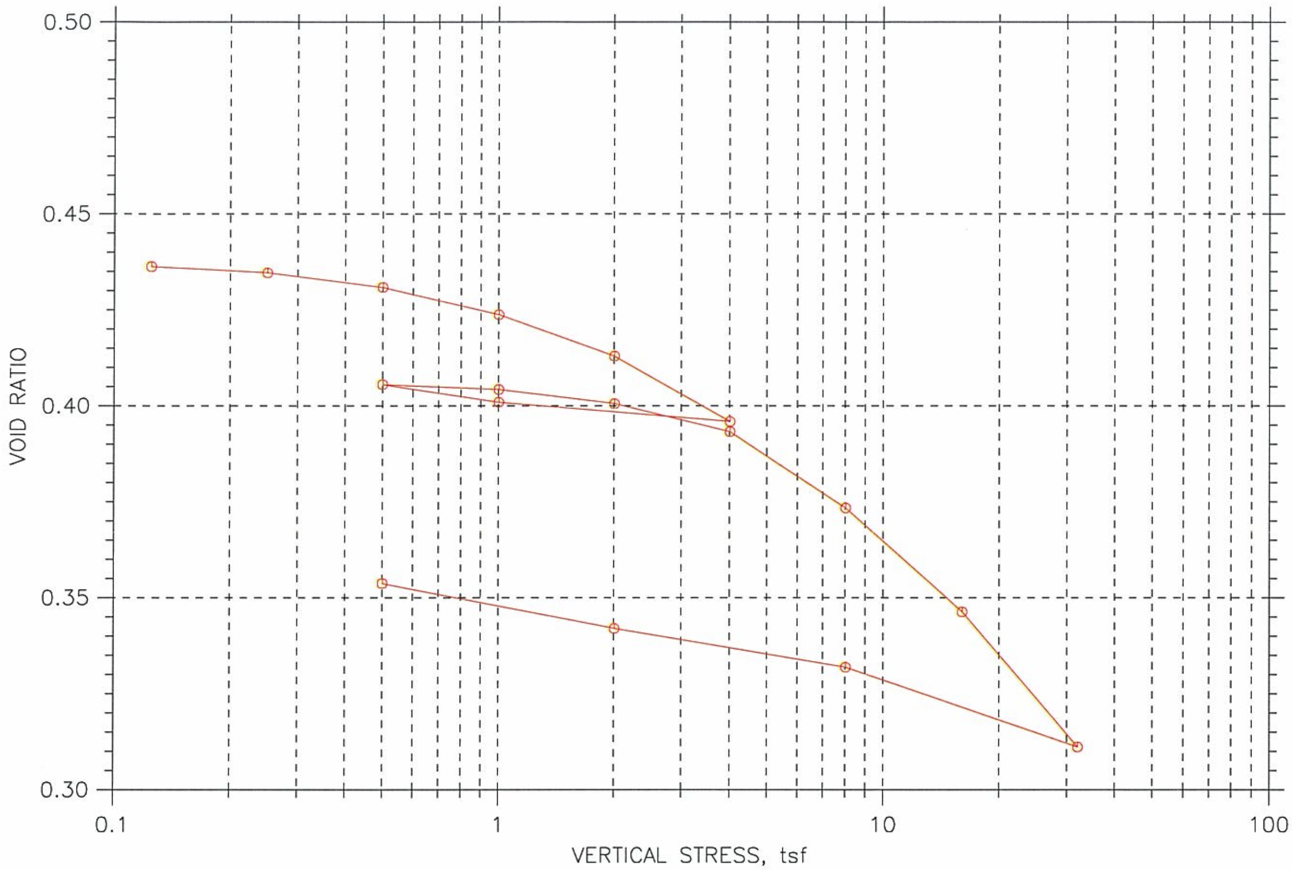
A gradient of approximately 56.2 was used for this test. This gradient exceeds ASTM guidelines for maximum gradient, but was used to achieve the requestors desired test duration. Examination of the sample shows no signs of material loss or clogging that may affect test results.

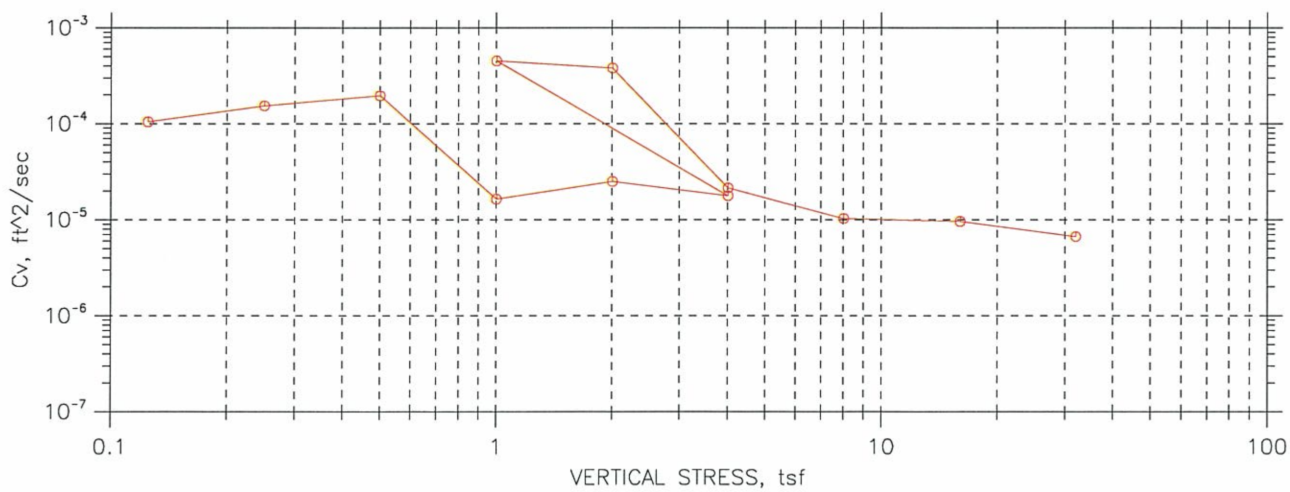
Average Hydraulic Conductivity @ 20° C (last 4 determinations) m/s 5.07E-08 cm/s 5.07E-06
Average Hydraulic Conductivity @ 20° C (last run) m/s 5.07E-08 cm/s 5.07E-06

Reviewed by: [signature]

CONSOLIDATION TEST DATA

SUMMARY REPORT



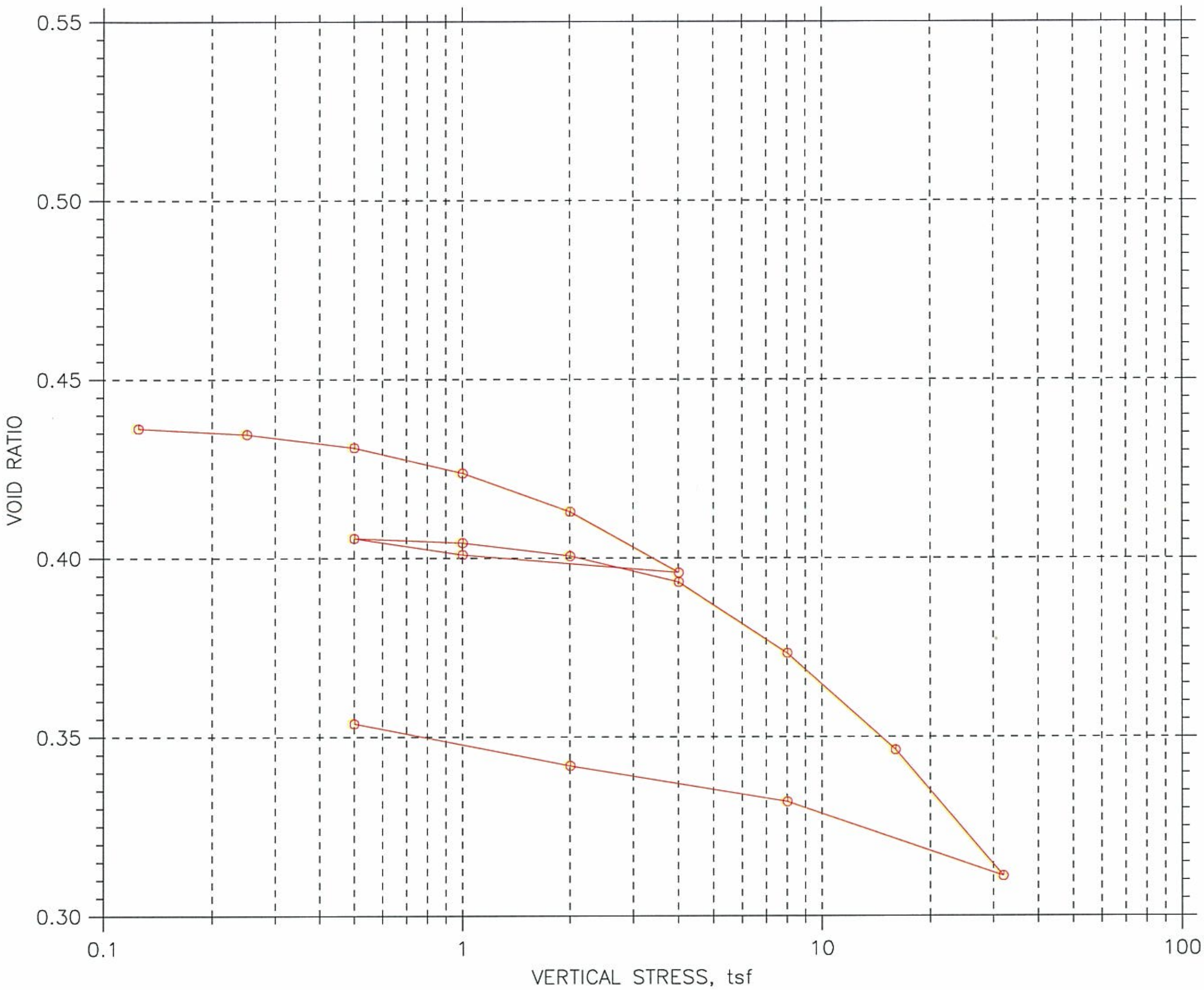


	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN - 8P	Test Date: 5/20/10	Depth: 6-8 ft
	Test No.: C-1.1	Sample Type: UD	Elevation: ---
	Description: moist, brown sandy clay		
	Remarks: 5077		

Wed, 02-JUN-2010 10:35:21

CONSOLIDATION TEST DATA

SUMMARY REPORT



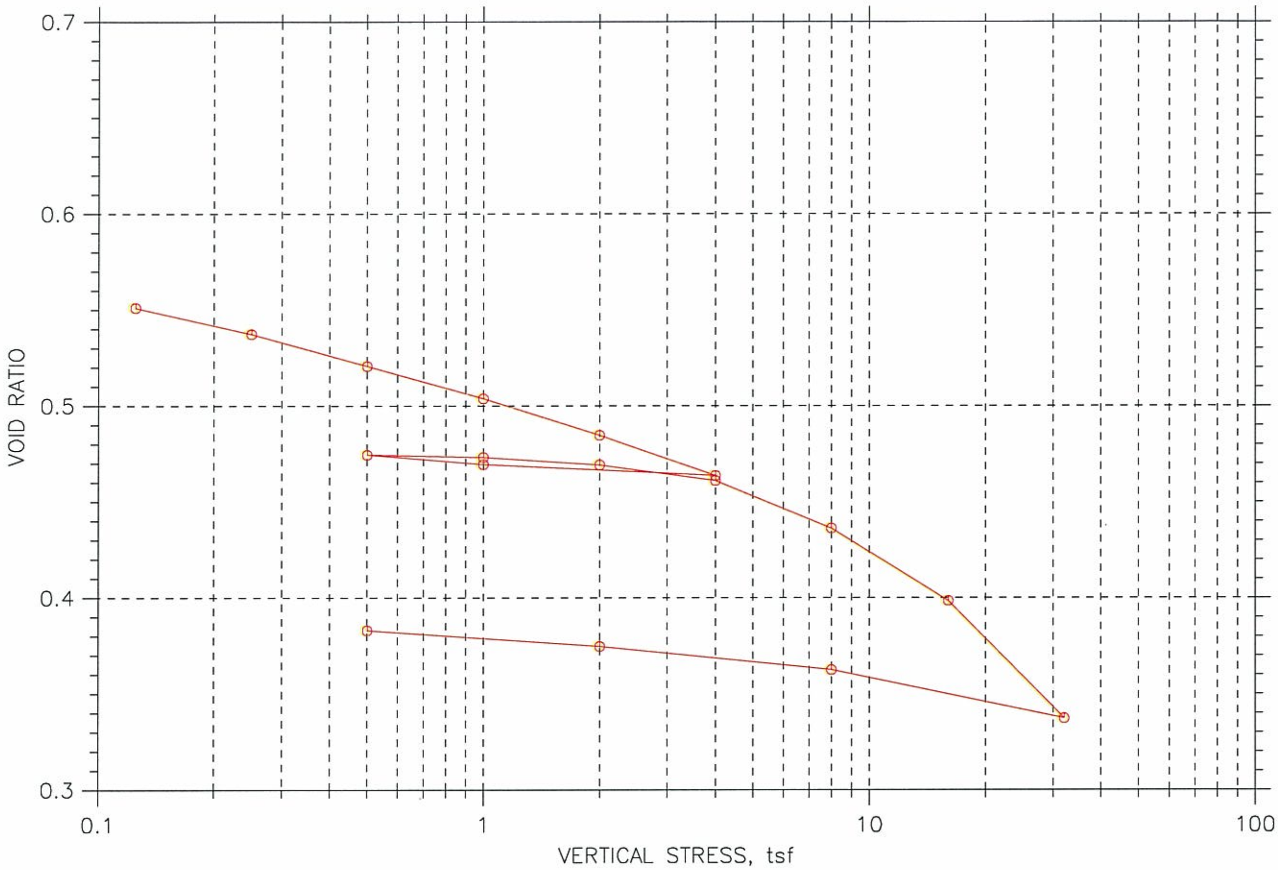
					Before Test	After Test
Overburden Pressure: ---				Water Content, %	14.27	12.61
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	121.	128.7
Compression Index: ---				Saturation, %	90.52	99.42
Diameter: 2.5 in		Height: 1 in		Void Ratio	0.44	0.35
LL: ---	PL: ---	PI: ---	GS: 2.79			

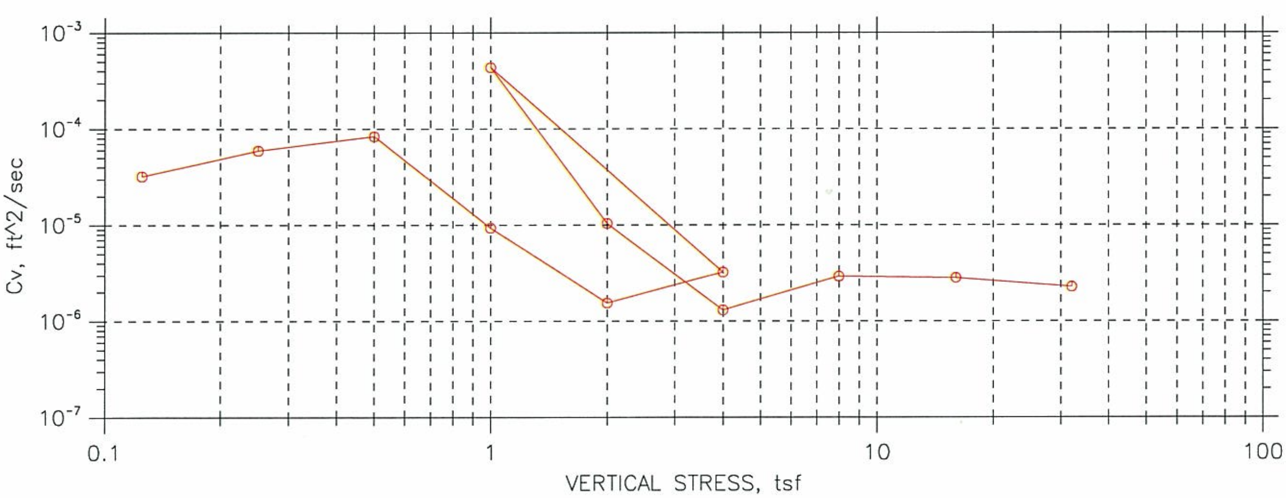
	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN- 8P	Test Date: 5/20/10	Depth: 6-8 ft
	Test No.: C-1.1	Sample Type: UD	Elevation: ---
	Description: moist, brown sandy clay		
	Remarks: 5077		

Wed, 02-JUN-2010 10:35:21

CONSOLIDATION TEST DATA

SUMMARY REPORT



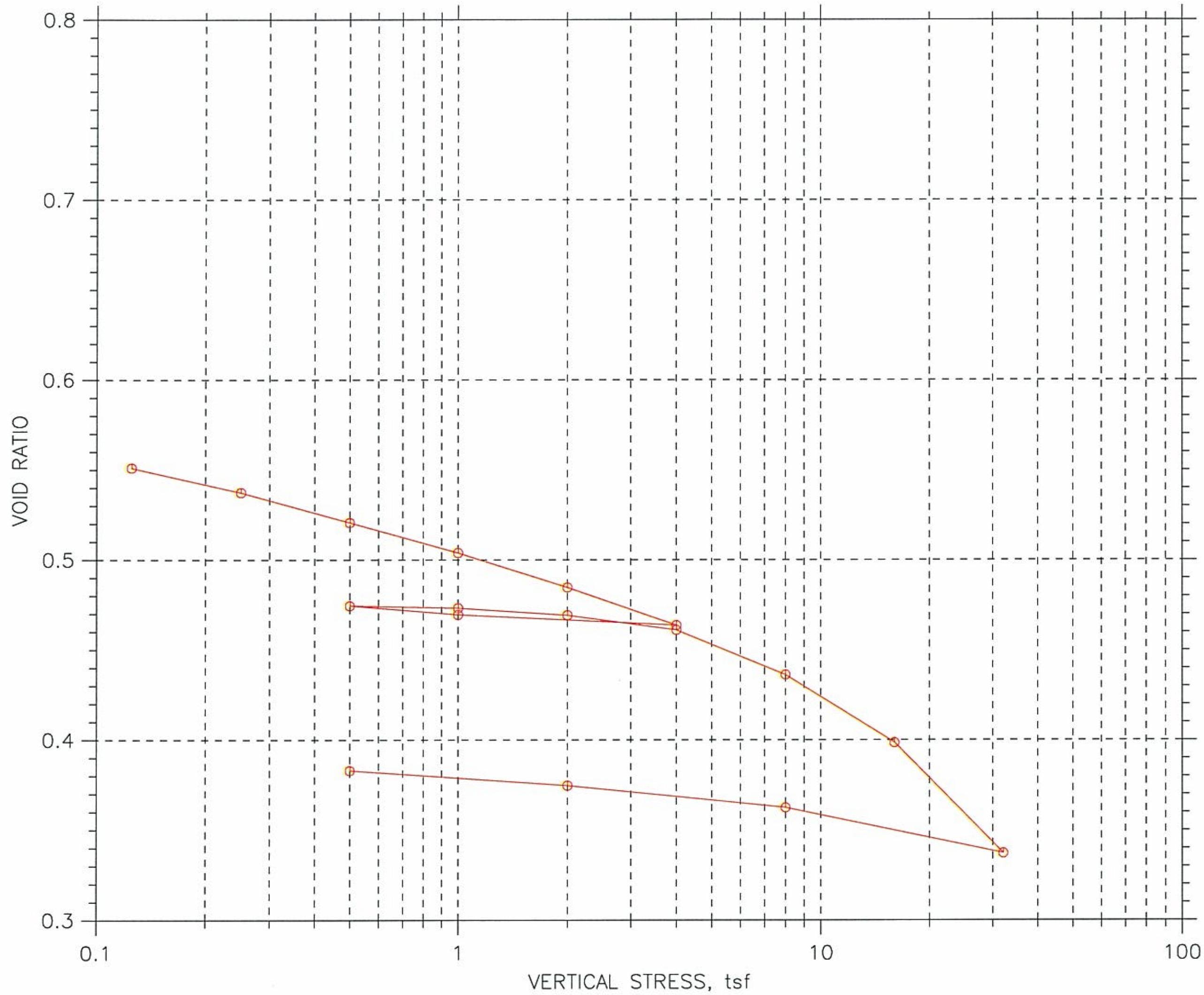


	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN-15	Test Date: 5/21/10	Depth: 30-32ft
	Test No.: C-2.1	Sample Type: UD	Elevation: ---
	Description: Moist, brown Clay		
	Remarks: 5077		

Wed, 02-JUN-2010 10:47:02

CONSOLIDATION TEST DATA

SUMMARY REPORT



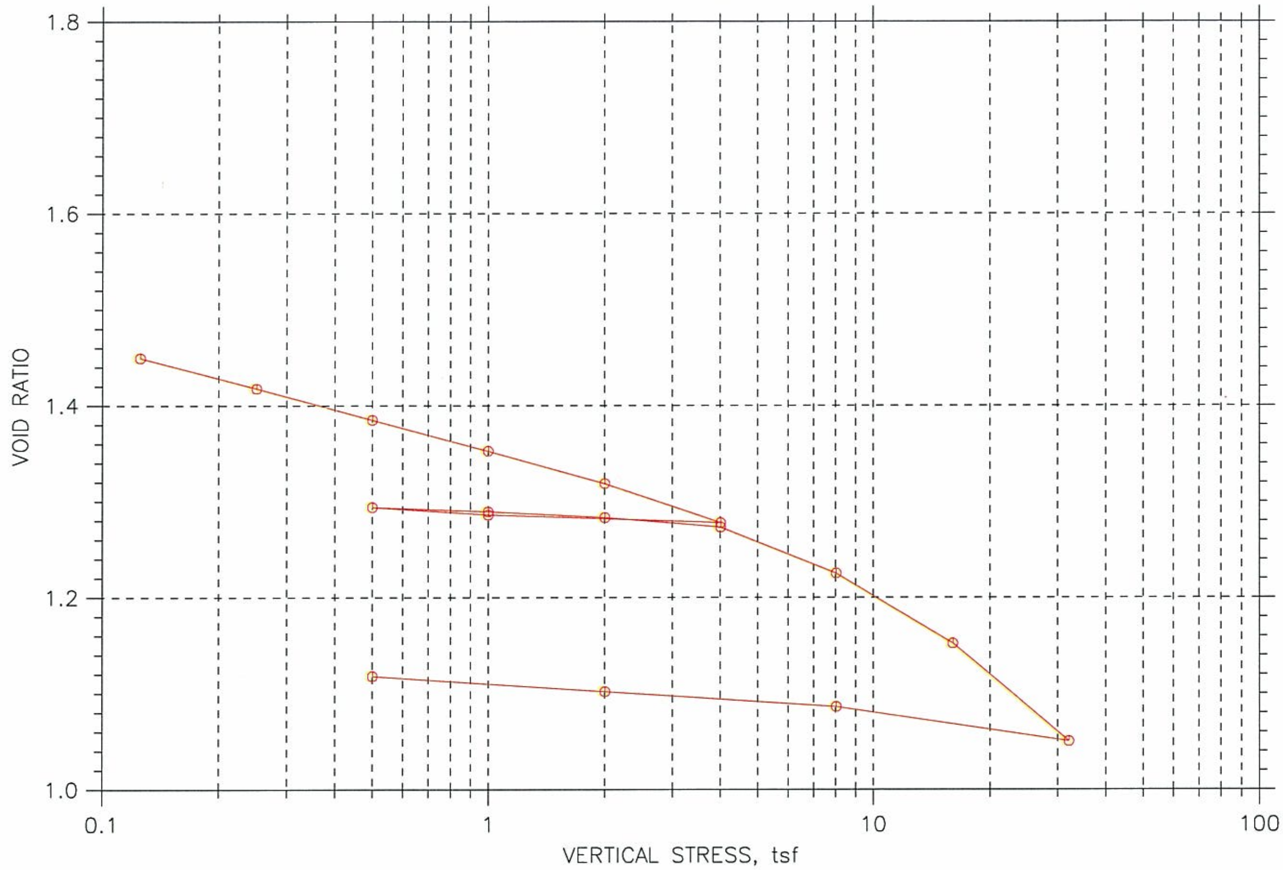
				Before Test	After Test
Overburden Pressure: ---					
			Water Content, %	19.57	13.69
Preconsolidation Pressure: ---			Dry Unit Weight, pcf	110.3	124.1
Compression Index: ---			Saturation, %	96.67	98.30
Diameter: 2.5 in		Height: 1 in	Void Ratio	0.56	0.38
LL: ---	PL: ---	PI: ---	GS: 2.75		

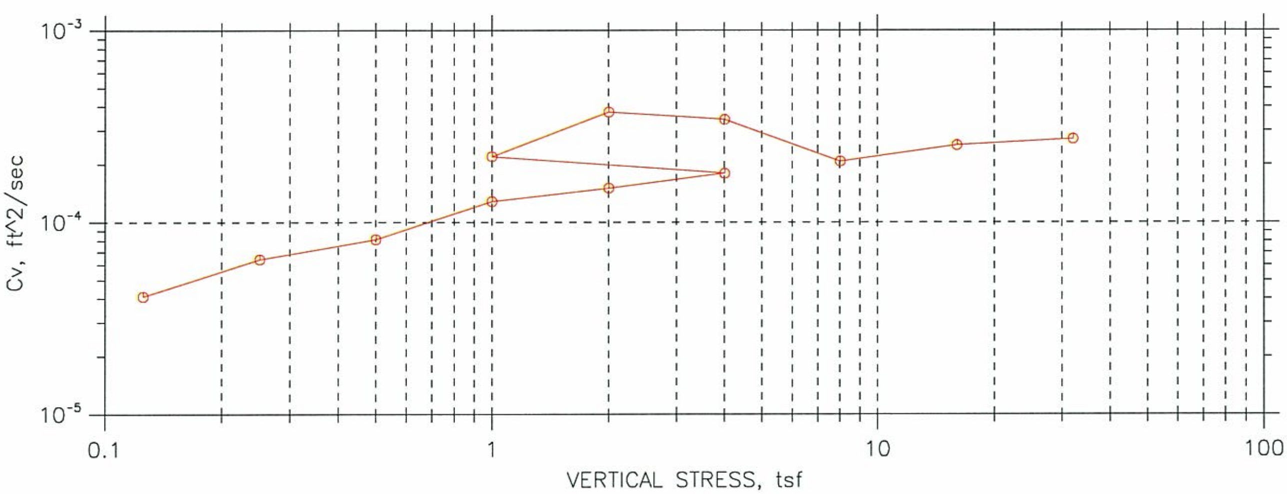
	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN-15	Test Date: 5/21/10	Depth: 30-32 ft
	Test No.: C-2.1	Sample Type: UD	Elevation: ---
	Description: Moist, brown Clay		
	Remarks: 5077		

Wed, 02-JUN-2010 10:47:02

CONSOLIDATION TEST DATA

SUMMARY REPORT



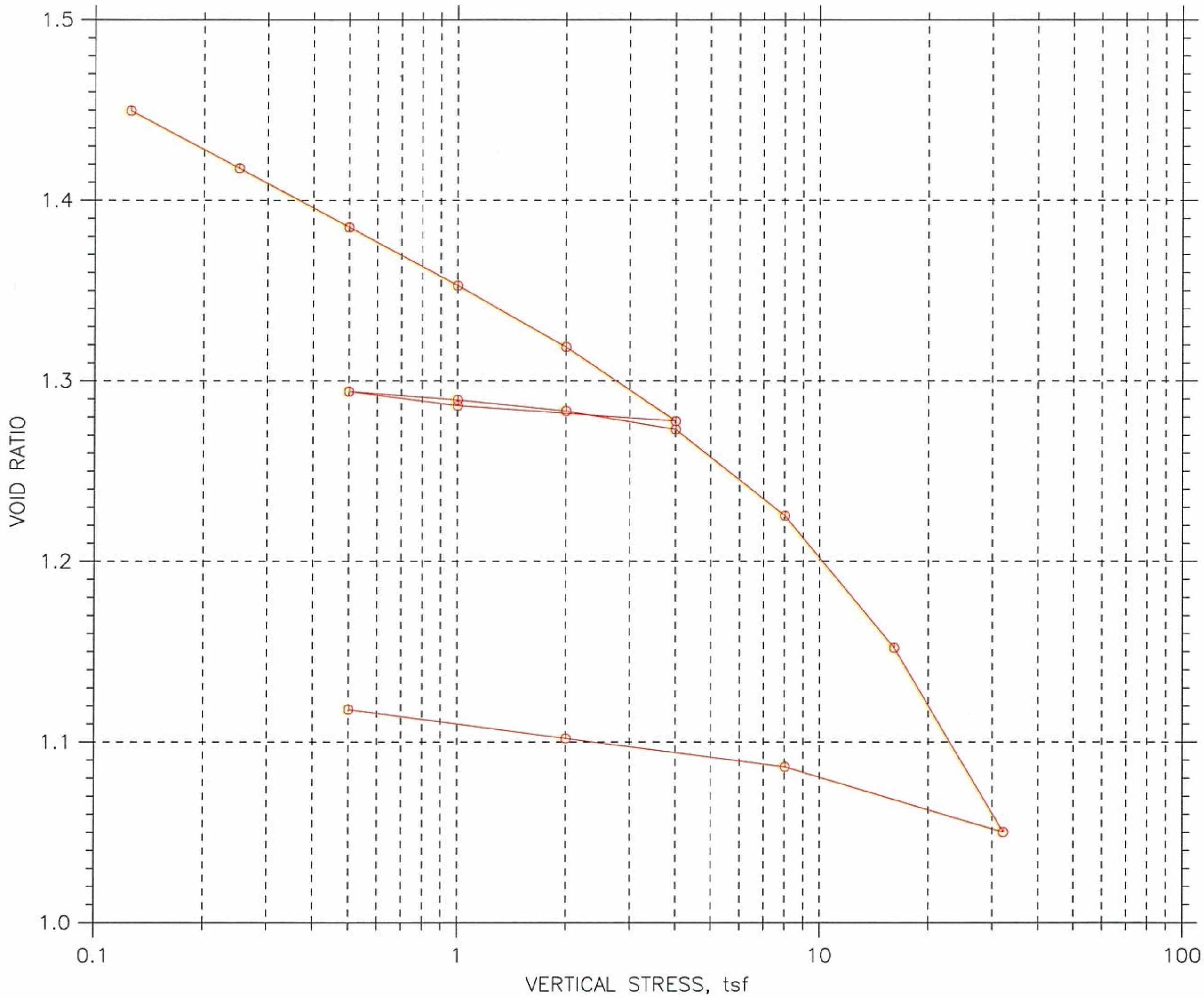


	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN-23	Test Date: 5/26/10	Depth: 15-17 ft
	Test No.: C-8.1	Sample Type: UD	Elevation: ---
	Description: Moist, dark gray ash		
	Remarks: 5077		

Wed, 02-JUN-2010 10:59:44

CONSOLIDATION TEST DATA

SUMMARY REPORT



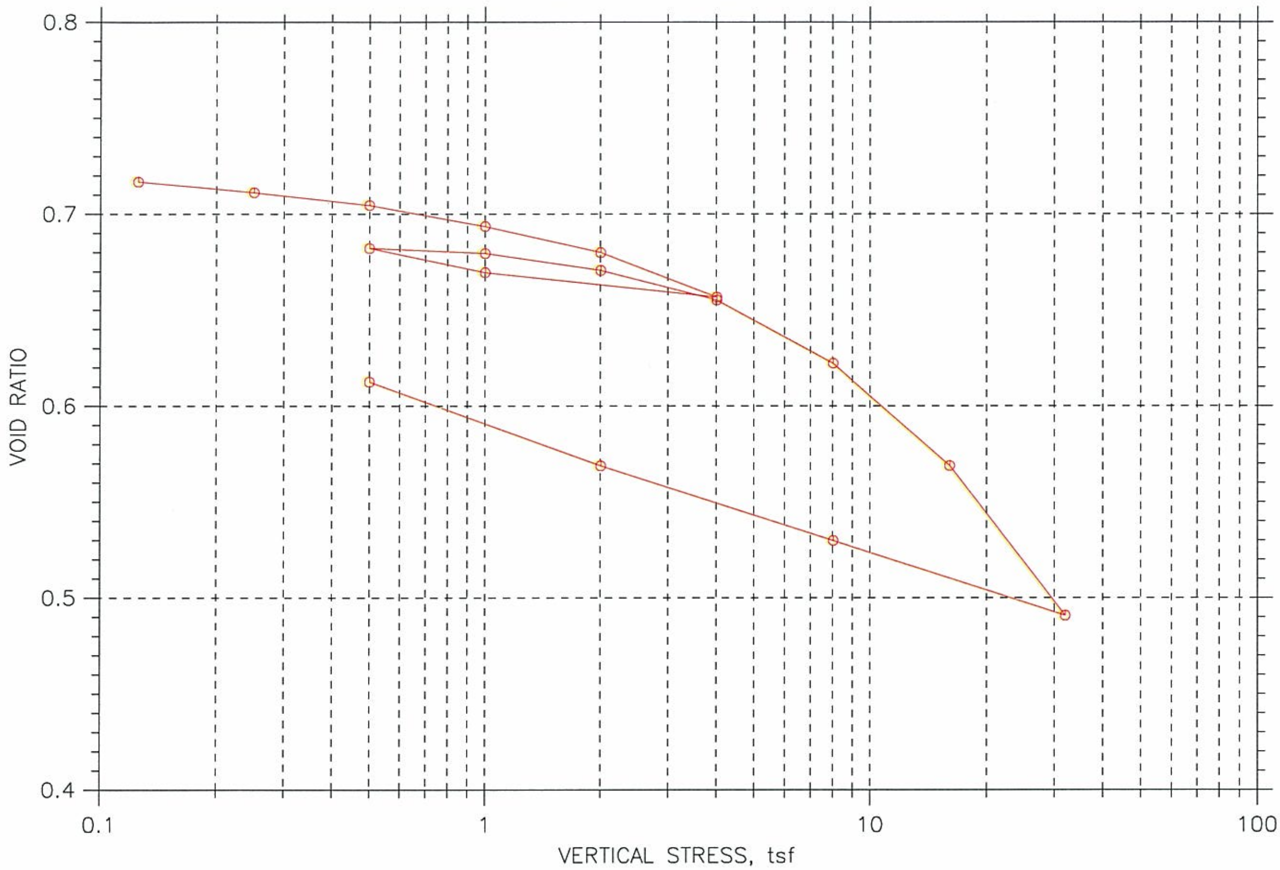
					Before Test	After Test
Overburden Pressure: ---				Water Content, %	33.53	40.01
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	69.81	81.06
Compression Index: ---				Saturation, %	63.19	98.42
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.46	1.12
LL: ---	PL: ---	PI: ---	GS: 2.75			

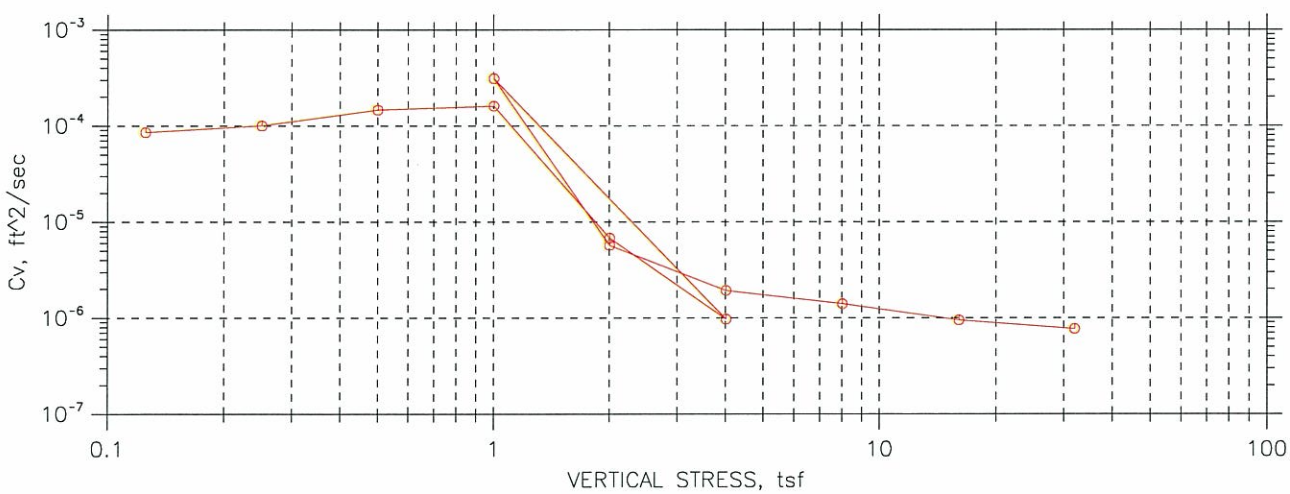
	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN-23	Test Date: 5/26/10	Depth: 15-17 ft
	Test No.: C-8.1	Sample Type: UD	Elevation: ---
	Description: Moist, dark gray ash		
	Remarks: 5077		

Wed, 02-JUN-2010 10:59:45

CONSOLIDATION TEST DATA

SUMMARY REPORT



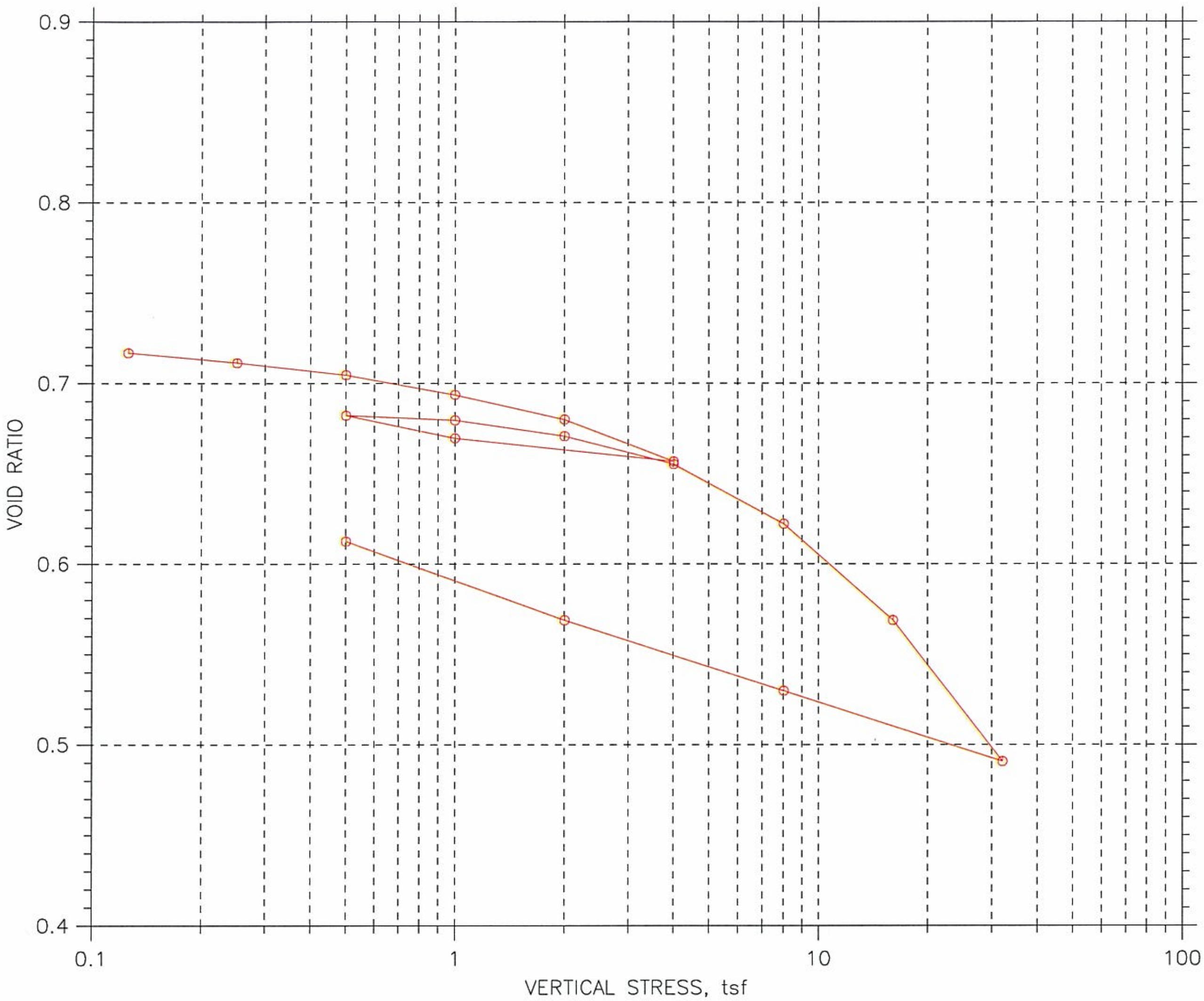


	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN-32P	Test Date: 5/25/10	Depth: 20-22 ft
	Test No.: C-3.1	Sample Type: UD	Elevation: ---
	Description: Moist, light brown clay		
	Remarks: 5077		

Wed, 02-JUN-2010 10:51:24

CONSOLIDATION TEST DATA

SUMMARY REPORT



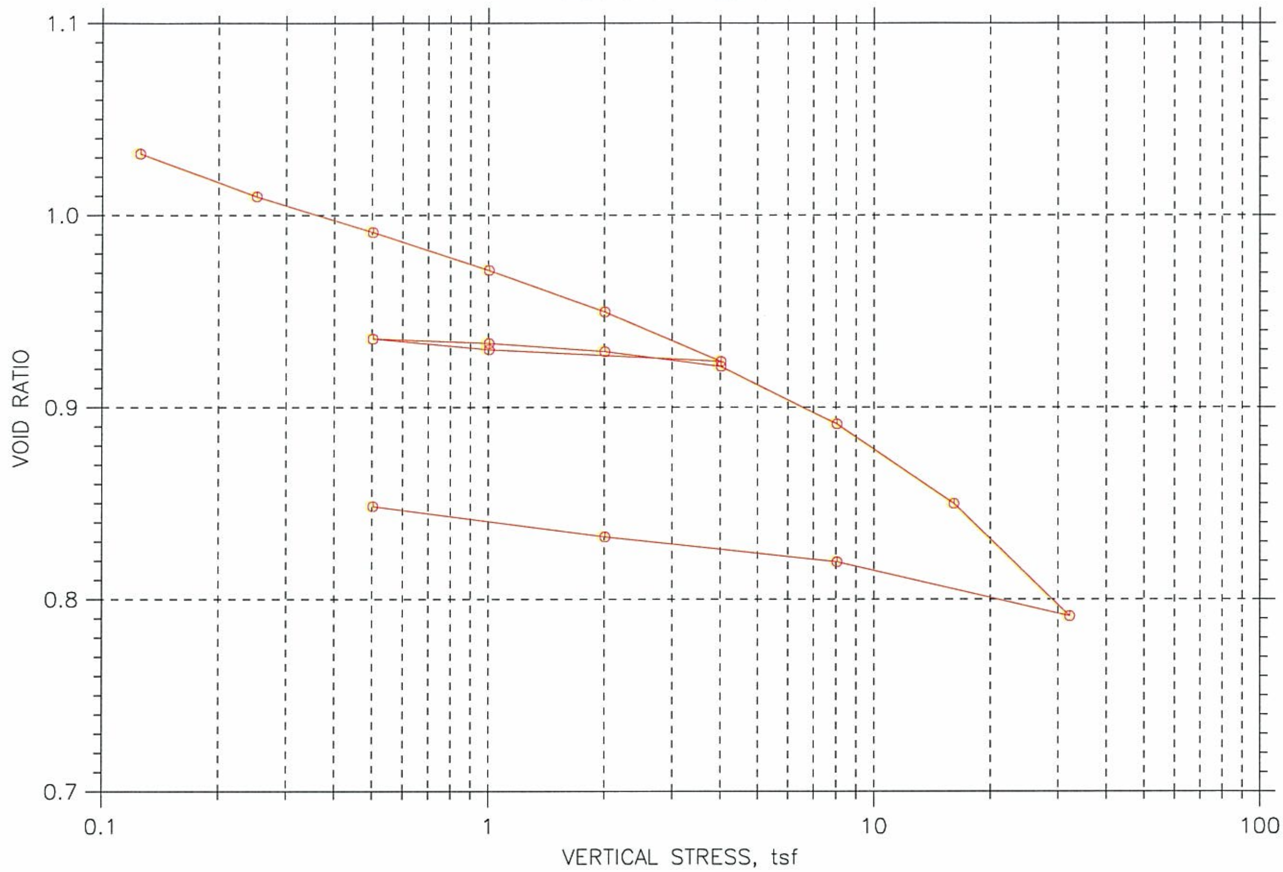
					Before Test	After Test
Overburden Pressure: ---				Water Content, %	25.32	22.13
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	99.68	106.5
Compression Index: ---				Saturation, %	96.40	99.36
Diameter: 2.5 in		Height: 1 in		Void Ratio	0.72	0.61
LL: ---	PL: ---	PI: ---	GS: 2.75			

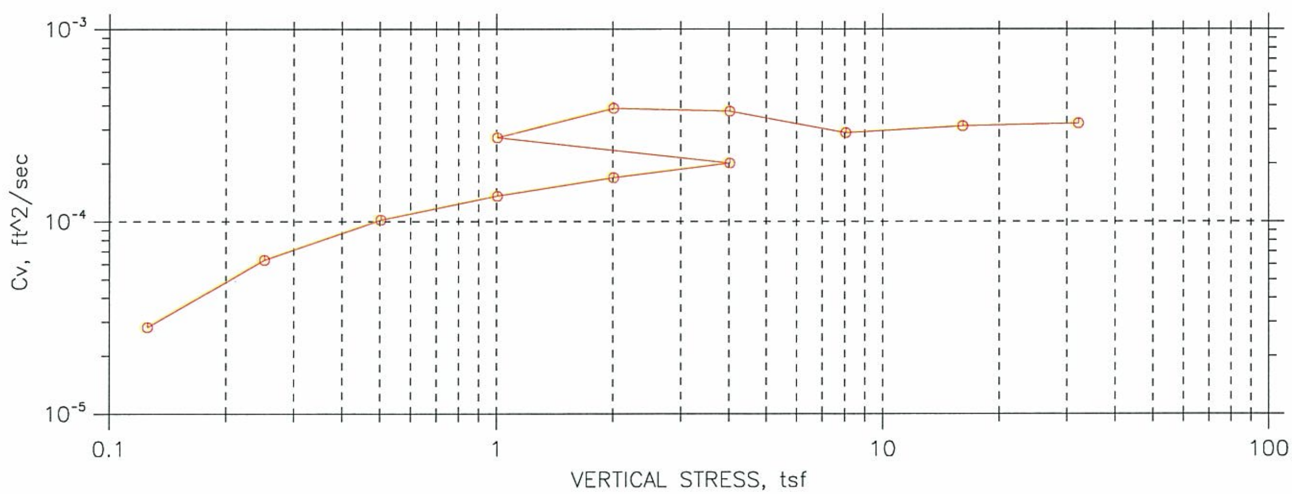
	Project: Shawnee Ash Ponds 1&2	Location: ---	Project No.: GTX-1570
	Boring No.: ----	Tested By: jm	Checked By: mm
	Sample No.: STN-32P	Test Date: 5/25/10	Depth: 20-22 ft
	Test No.: C-3.1	Sample Type: UD	Elevation: ---
	Description: Moist, light brown clay		
	Remarks: 5077		

Wed, 02-JUN-2010 10:51:24

CONSOLIDATION TEST DATA

SUMMARY REPORT



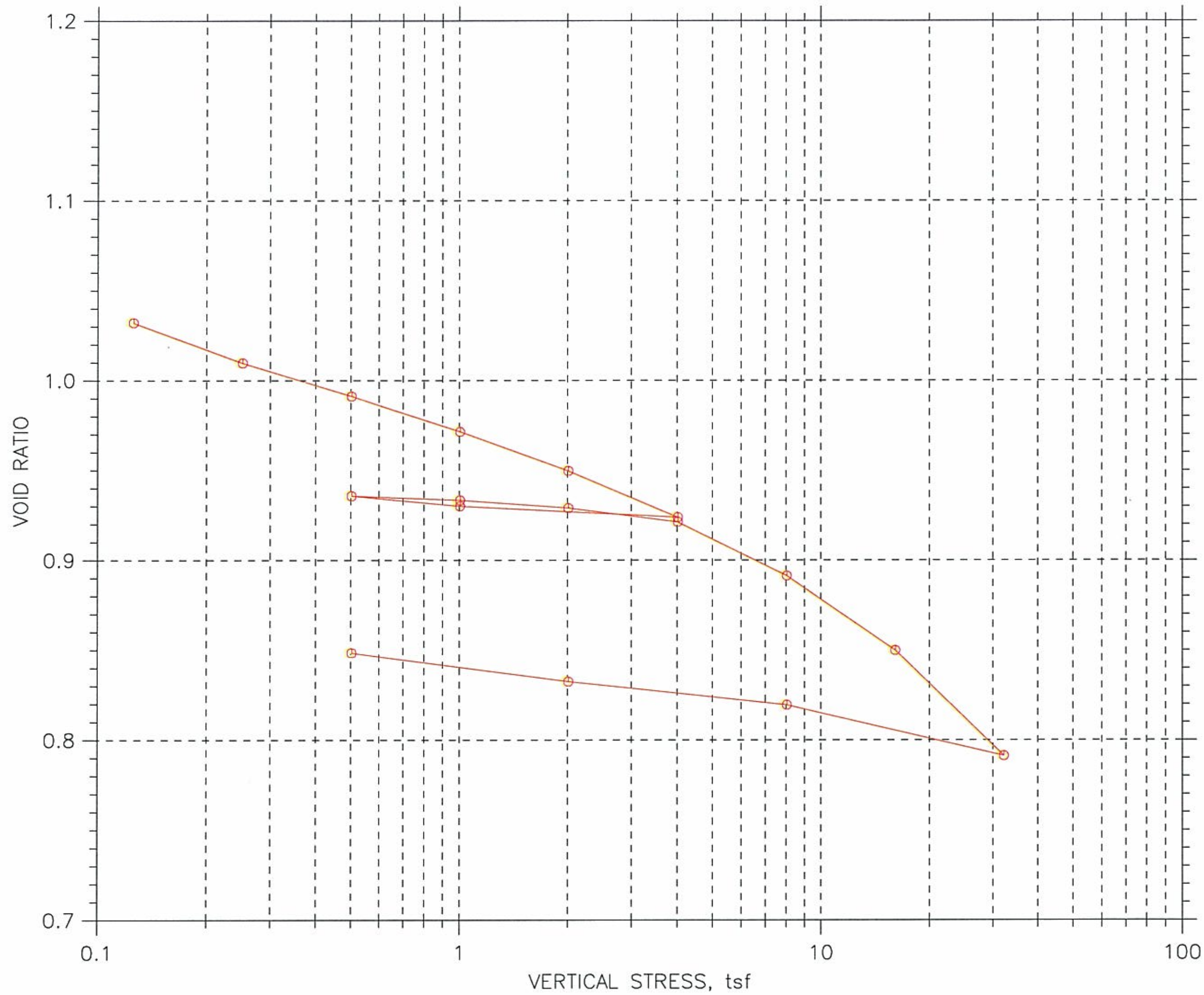


	Project: Shawnee Consol. Waste	Location: ---	Project No.: GTX-1569
	Boring No.: ----	Tested By: mm	Checked By: Gt
	Sample No.: STN-117	Test Date: 5/17/10	Depth: 22-24 ft
	Test No.: C-2.1	Sample Type: UD	Elevation: ---
	Description: Moist, gray ash		
	Remarks: 5077		

Wed, 02-JUN-2010 14:53:37

CONSOLIDATION TEST DATA

SUMMARY REPORT



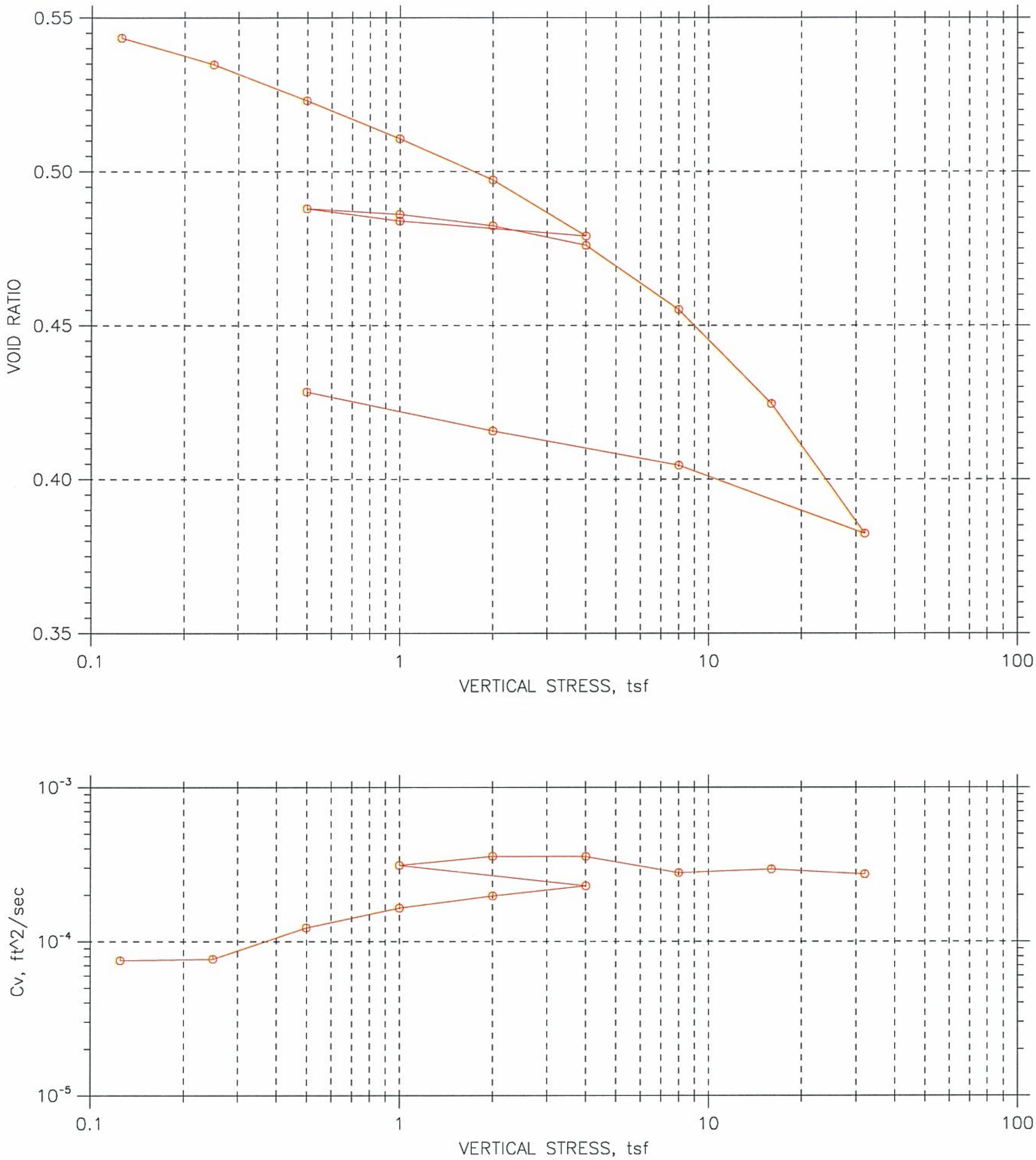
					Before Test	After Test
Overburden Pressure: ---				Water Content, %	31.68	30.83
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	83.46	92.87
Compression Index: ---				Saturation, %	82.44	99.91
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.06	0.85
LL: ---	PL: ---	PI: ---	GS: 2.75			

	Project: Shawnee Consol. Waste	Location: ---	Project No.: GTX-1569
	Boring No.: ----	Tested By: mm	Checked By: Gt
	Sample No.: STN-117	Test Date: 5/17/10	Depth: 22-24 ft
	Test No.: C-2.1	Sample Type: UD	Elevation: ---
	Description: Moist, gray ash		
	Remarks: 5077		

Wed, 02-JUN-2010 14:53:37

CONSOLIDATION TEST DATA

SUMMARY REPORT

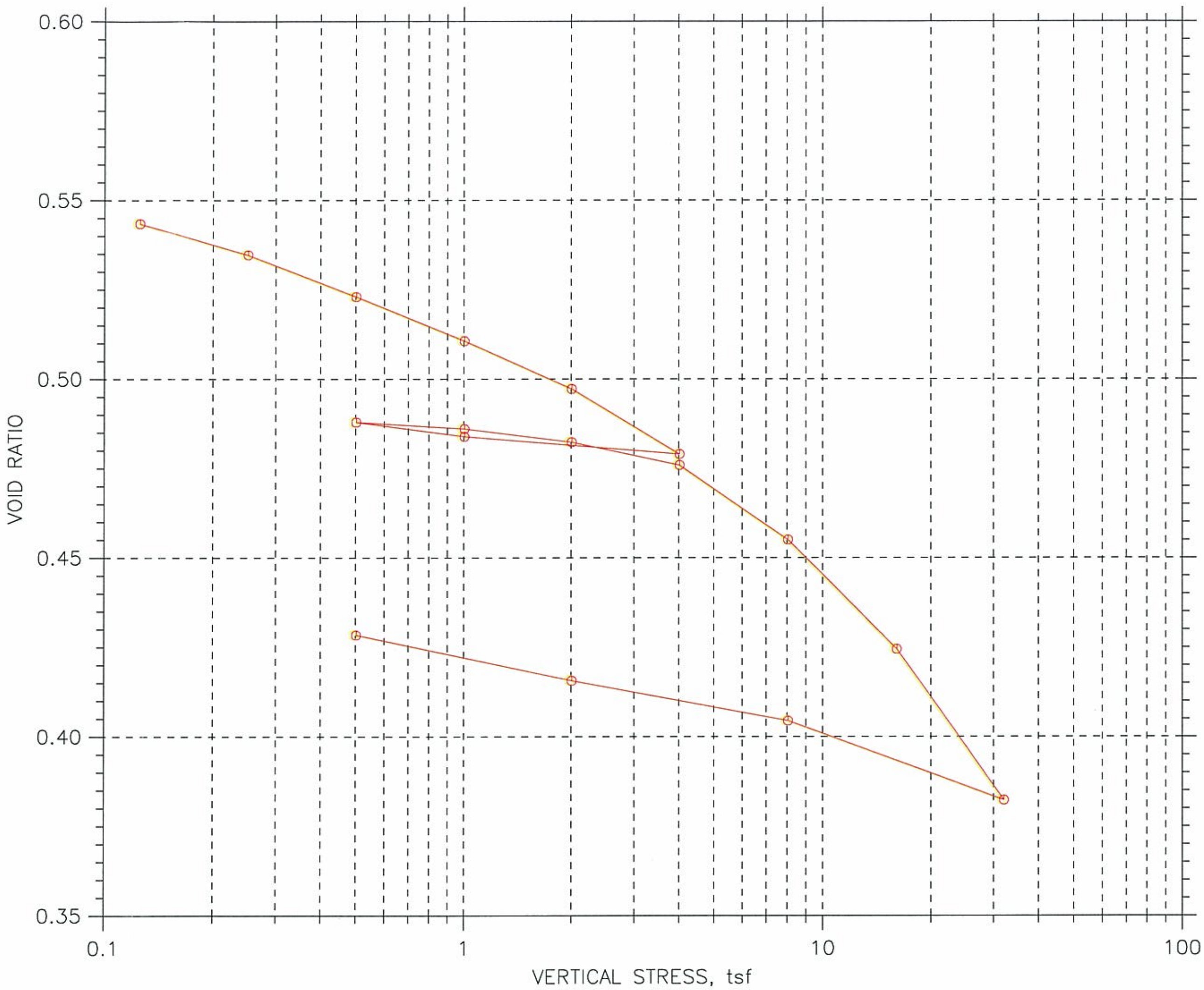


	Project: Shawnee Consol. Waste	Location: ---	Project No.: GTX-1569
	Boring No.: ----	Tested By: mm	Checked By: Gt
	Sample No.: STN-118	Test Date: 5/19/10	Depth: 27.5-29.5 ft
	Test No.: C-3.1	Sample Type: UD	Elevation: ---
	Description: Moist light gray sandy clay		
	Remarks: 5077		

Wed, 02-JUN-2010 15:05:01

CONSOLIDATION TEST DATA

SUMMARY REPORT



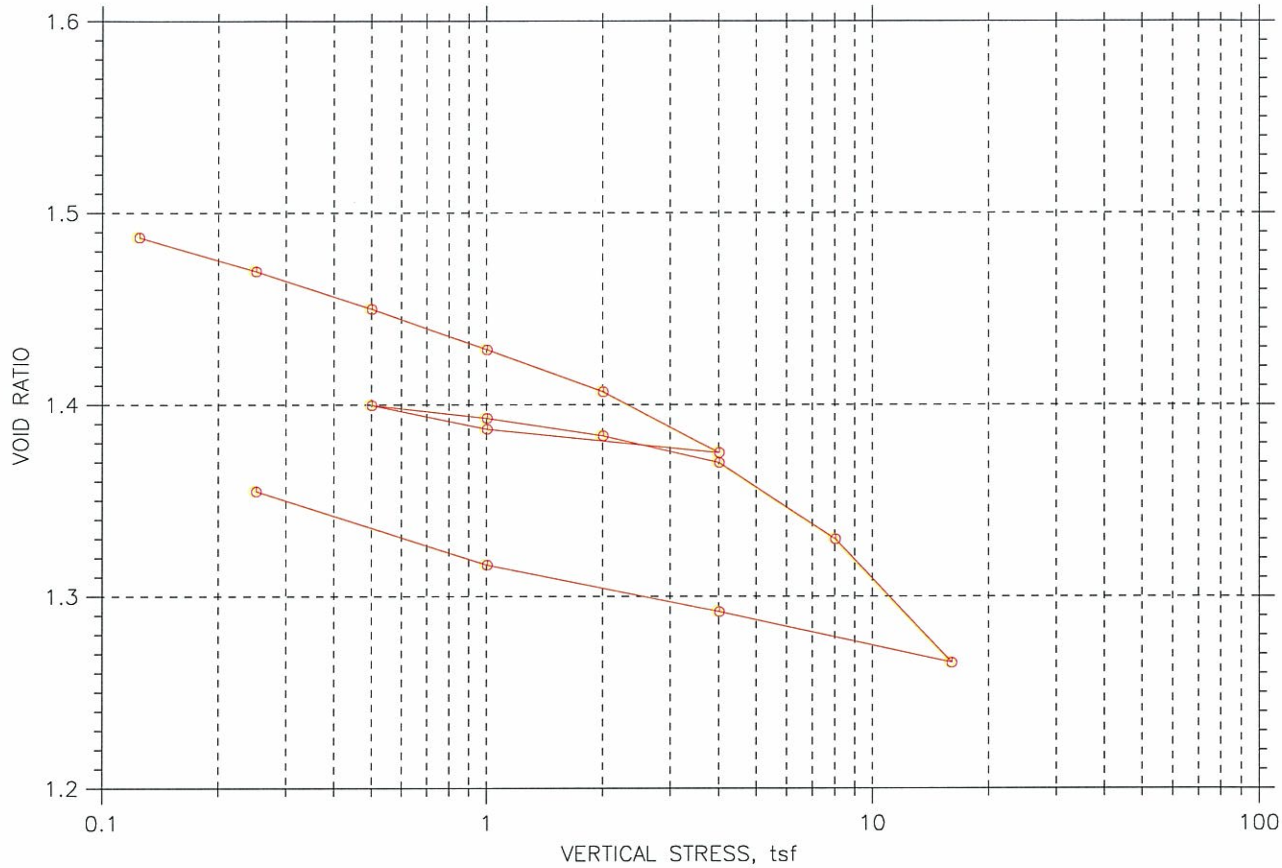
					Before Test	After Test
Overburden Pressure: ---				Water Content, %	16.82	15.43
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	110.7	120.2
Compression Index: ---				Saturation, %	83.99	99.03
Diameter: 2.5 in		Height: 1 in		Void Ratio	0.55	0.43
LL: ---	PL: ---	PI: ---	GS: 2.75			

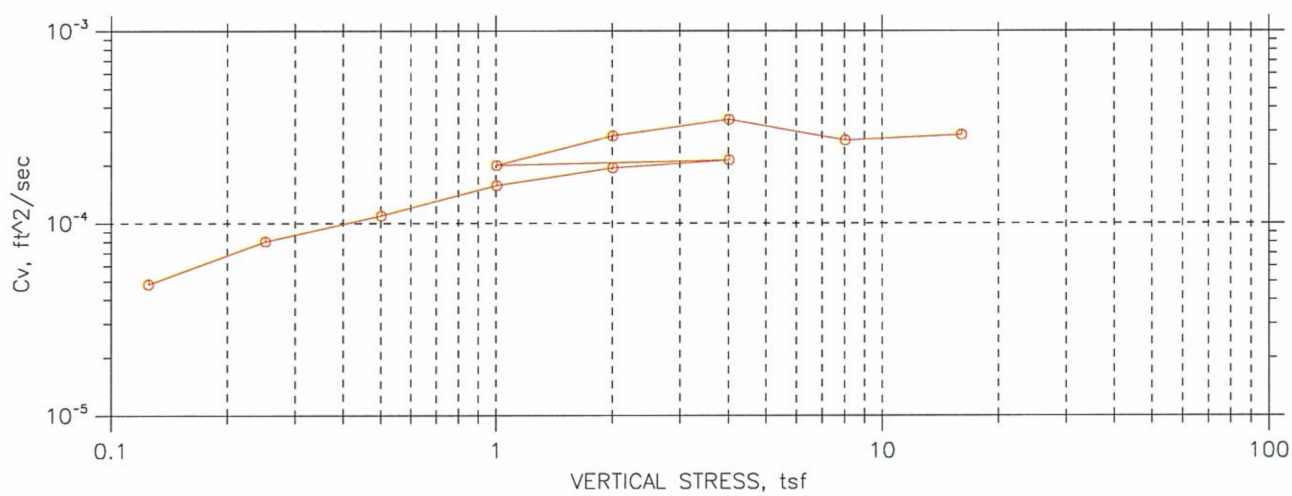
	Project: Shawnee Consol. Waste	Location: ---	Project No.: GTX-1569
	Boring No.: ----	Tested By: mm	Checked By: Gt
	Sample No.: STN-118	Test Date: 5/19/10	Depth: 27.5-29.5 ft
	Test No.: C-3.1	Sample Type: UD	Elevation: ---
	Description: Moist light gray sandy clay		
	Remarks: 5077		

Wed, 02-JUN-2010 15:05:01

CONSOLIDATION TEST DATA

SUMMARY REPORT



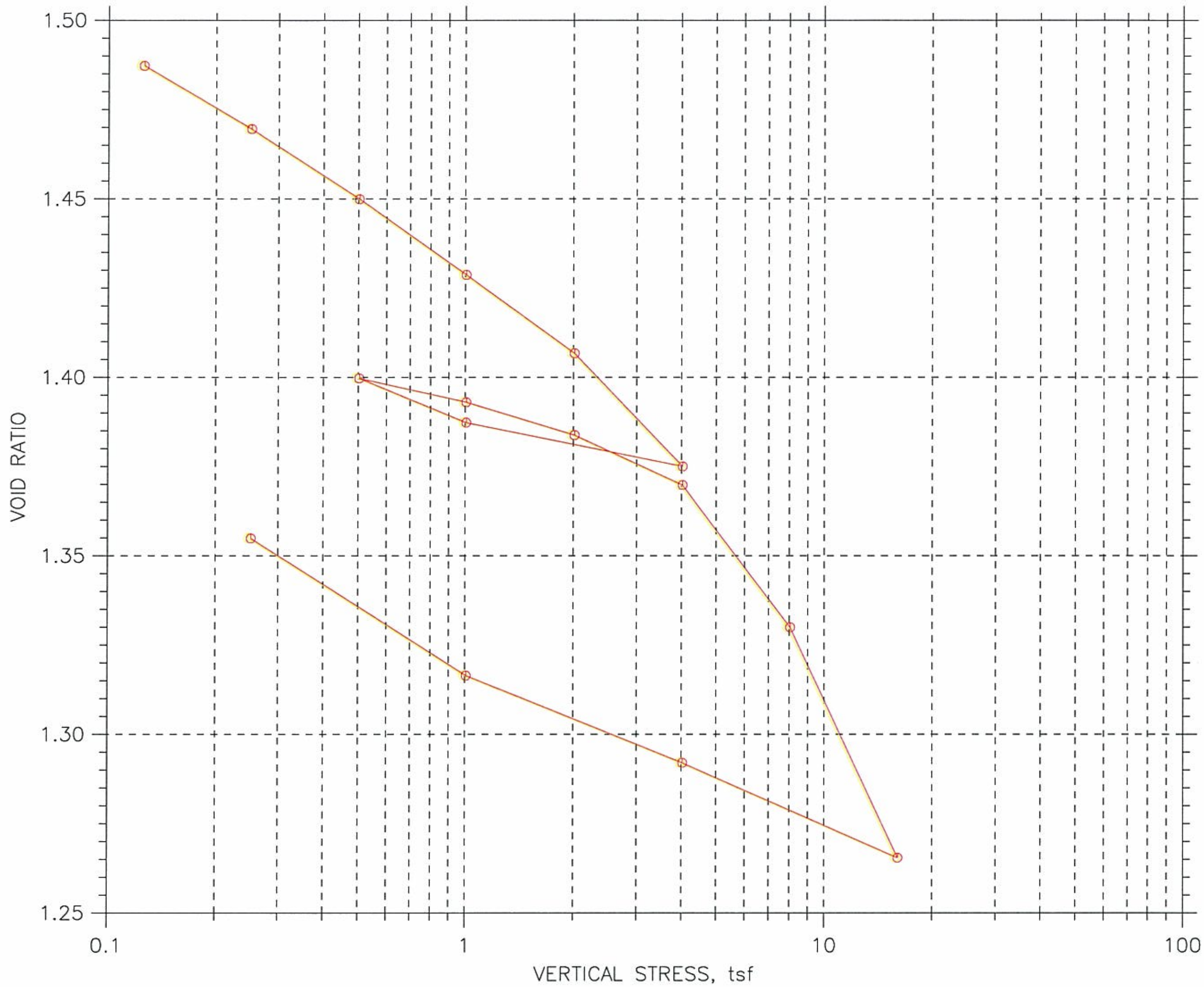


	Project: Shawnee Cosolidated Waste	Location: ---	Project No.: GTX-1569
	Boring No.: ----	Tested By: mm	Checked By: Gt
	Sample No.: STN-125	Test Date: 5/17/10	Depth: 95-97 ft
	Test No.: C-1.1	Sample Type: UD	Elevation: ---
	Description: moist, gray ash		
	Remarks: 5077		

Wed, 02-JUN-2010 14:38:57

CONSOLIDATION TEST DATA

SUMMARY REPORT



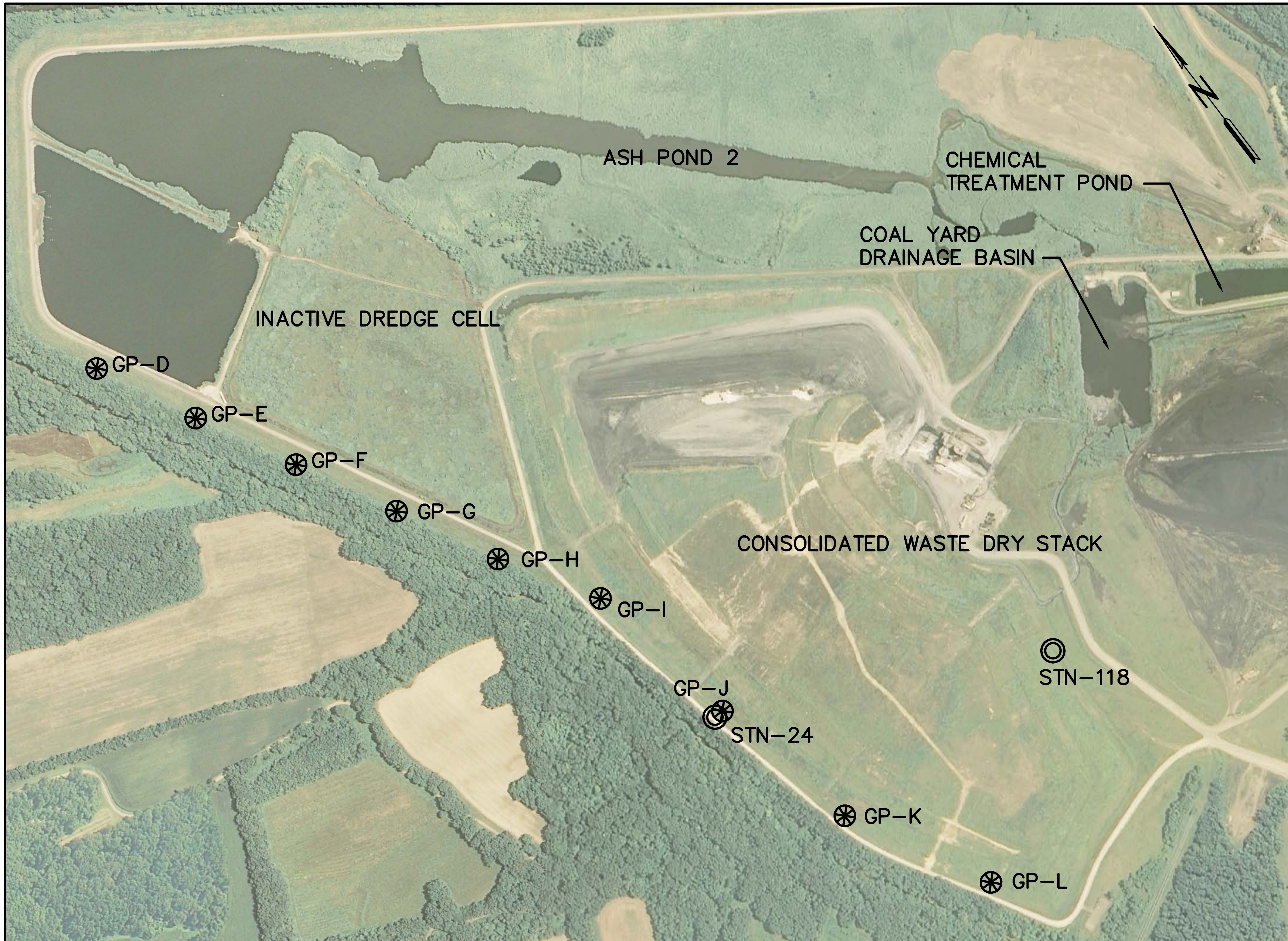
					Before Test	After Test
Overburden Pressure: ---				Water Content, %	42.27	50.13
Preconsolidation Pressure: ---				Dry Unit Weight, pcf	66.14	70.25
Compression Index: ---				Saturation, %	74.60	98.05
Diameter: 2.5 in		Height: 1 in		Void Ratio	1.50	1.35
LL: ---	PL: ---	PI: ---	GS: 2.65			

	Project: Shawnee Cosolidated Waste	Location: ---	Project No.: GTX-1569
	Boring No.: ----	Tested By: mm	Checked By: Gt
	Sample No.: STN-125	Test Date: 5/17/10	Depth: 95-97 ft
	Test No.: C-1.1	Sample Type: UD	Elevation: ---
	Description: moist, gray ash		
	Remarks: 5077		

Wed, 02-JUN-2010 14:38:57

Appendix D

Environmental Sample Laboratory Test Results and Layout



BORING LOCATION TABLE

NO.	NORTHING	EASTING	ELEV. (FT.)
GP-D	316,421.79	1,112,308.63	330.0
GP-E	315,976.54	1,112,539.30	327.7
GP-F	315,539.07	1,112,782.75	328.6
GP-G	315,101.52	1,113,027.14	329.3
GP-H	314,655.92	1,113,271.43	329.5
GP-I	314,239.19	1,113,541.88	345.0
GP-J	313,502.09	1,113,688.86	347.3
GP-K	312,792.36	1,113,858.41	348.9
GP-L	312,159.79	1,114,216.30	350.4
STN-24	313,499.27	1,113,645.11	349.0
STN-118	312,843.34	1,115,059.61	348.2

Northing, Easting and Ground Surface Elevations were provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27 (Kentucky Lambert South).
Vertical Datum: NGVD29.

250 0 500 1000 Feet

Graphic Scale: 1"=500'

March 2010
175559023

SaveDate: 2010/04/28 9:28 AM Login: Petty, Richard
v:\1755\active\175559023\geotechnical\drawing\ash_pond\rev0_ifr\59023b-shf-101-fg_d1.dwg

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax. 502.212.5055
www.stantec.com

Legend

◎ Soil Boring With Standard Penetration Tests And/Or Shelby Tube Sampling

⊛ Geoprobe Boring

Notes

1. Horizontal and vertical locations of borings provided by T.V.A.
2. Depths of enviromental water samples obtained at the boring locations shown are identified on the environmental laboratory test result sheets included in this appendix and provided by the TVA.

Client/Project
TENNESSEE VALLEY AUTHORITY
ASH PONDS 1 & 2 AND CONSOLIDATED WASTE DRY STACK

Figure No.
D-1

Title
ENVIROMENTAL SAMPLE LAYOUT

SHAWNEE FOSSIL PLANT

R0 - 10/16/09 - KEE

STANTEC - GEOPROBE IN ENVIRONMENTALLY SENSATIVE AREA

SAMPLE RESULTS FOR TECHNETIUM-99 (Tc-99) AND TRICHLOROETHTLENE (TCE)

Provided below is a summary of the geo-probes information and results of South West Research Labs for Tc-99 and TCE detection. Blank items will need input from Stantec

See location map for Geo-probe locations

An extra sample was taken by TVA from Ground Water Well D-8A

ID	Location in reference to dike	Elevation in feet - ground at geo-probe location	Depth - ft	Sample elevation - ft.	TCE - detected	Tc-99 detected	Comments
GP-D	At toe	329.95	36	293.95	No	No	Can drill to depth of sample for geothechnical info
GP-E	At toe	327.70	32.8	294.90	No	No	Can drill to depth of sample for geothechnical info
GP-F	At toe	328.56	30.5	298.06	No	No	Can drill to depth of sample for geothechnical info
GP-G	At toe	329.26	27.3	301.96	No	No	Can drill to depth of sample for geothechnical info
GP-H	At toe	329.54	23.9	305.64	No	No	Can drill to depth of sample for geothechnical info
GP-I	At top of Dike	344.96	41.3	303.66	No	No	Can drill to depth of sample for geothechnical info
GP-J	At top od Dike	*		*			No sample obtained - water not encountered
GP-K	At top of Dike	348.92	41	307.92	No	No	Can drill to depth of sample for geothechnical info
GP-L	At top of Dike	350.40	40	310.40	No	No	Can drill to depth of sample for geothechnical info
D-8A	At toe of Dike next to Little Bayou Creek Bank	N/A	23	308.9	No results	Yes	TVA ground water monitoring well. ~ between GPJ and GPI. Monte Starks performed a micro-purge 7 meters (23.0 ft)from top of well (at 101.14 meters - 331.8 ft.)

* Need additional information

SOUTHWEST RESEARCH INSTITUTE
LIQUID SCINTILLATION COUNTING DATA SHEET

Lab Name: Southwest Research Institute

Client: Tennessee Valley Authority

Lab Code: SwRI

Project No.: 12871.01.00X

Matrix: Water

Date Received: 01/29/10

SRR #: 39210

SDG: 412703

Task Order #: 100202-3

TECHNETIUM-99								
Sample ID	Lab System ID	Analyte	Results (pCi/L)	Q	TPU (pCi/L)	MDA (pCi/L)	Counting Error (1s)	Date Analyzed
Prep Blank	pbwb02j1	^{99}Tc	2.80E+00	B	8.52E-01	2.68E+00	8.36E-01	02/04/10
Lab Control	lcswb02j1	^{99}Tc	1.22E+03		7.06E+01	2.68E+00	5.67E+00	02/04/10
True Value	-----	^{99}Tc	1.25E+03		-----	-----	-----	-----
Recovery	-----	^{99}Tc	97.7%		-----	-----	-----	-----
Lab Control 2	lcswb02j2	^{99}Tc	1.24E+03		7.15E+01	2.68E+00	5.70E+00	02/05/10
True Value	-----	^{99}Tc	1.25E+03		-----	-----	-----	-----
Recovery	-----	^{99}Tc	98.8%		-----	-----	-----	-----
STN-118	412703	^{99}Tc	4.64E+00	B	9.04E-01	2.68E+00	8.63E-01	02/05/10
STN-24	412704	^{99}Tc	4.16E+00	B	8.91E-01	2.69E+00	8.58E-01	02/05/10
Duplicate result	412704D	^{99}Tc	3.19E+00	B	8.62E-01	2.68E+00	8.42E-01	02/05/10
Dup Evaluation	-----	^{99}Tc	0.78		-----	-----	-----	-----
Spike result	412704S	^{99}Tc	1.21E+03		7.01E+01	2.70E+00	5.66E+00	02/05/10
Spike added	-----	^{99}Tc	1.25E+03		-----	-----	-----	-----
Recovery	-----	^{99}Tc	97.0%		-----	-----	-----	-----
Spike Duplicate result	412704SD	^{99}Tc	1.25E+03		7.21E+01	2.70E+00	5.74E+00	02/05/10
Spike added	-----	^{99}Tc	1.25E+03		-----	-----	-----	-----
Recovery	-----	^{99}Tc	99.7%		-----	-----	-----	-----
STN-EB	412705	^{99}Tc	3.79E+00	B	8.79E-01	2.68E+00	8.51E-01	02/05/10
STN-FB	412706	^{99}Tc	4.28E+00	B	8.93E-01	2.68E+00	8.59E-01	02/05/10
STN-TB	412707	^{99}Tc	3.12E+00	B	8.60E-01	2.68E+00	8.41E-01	02/05/10

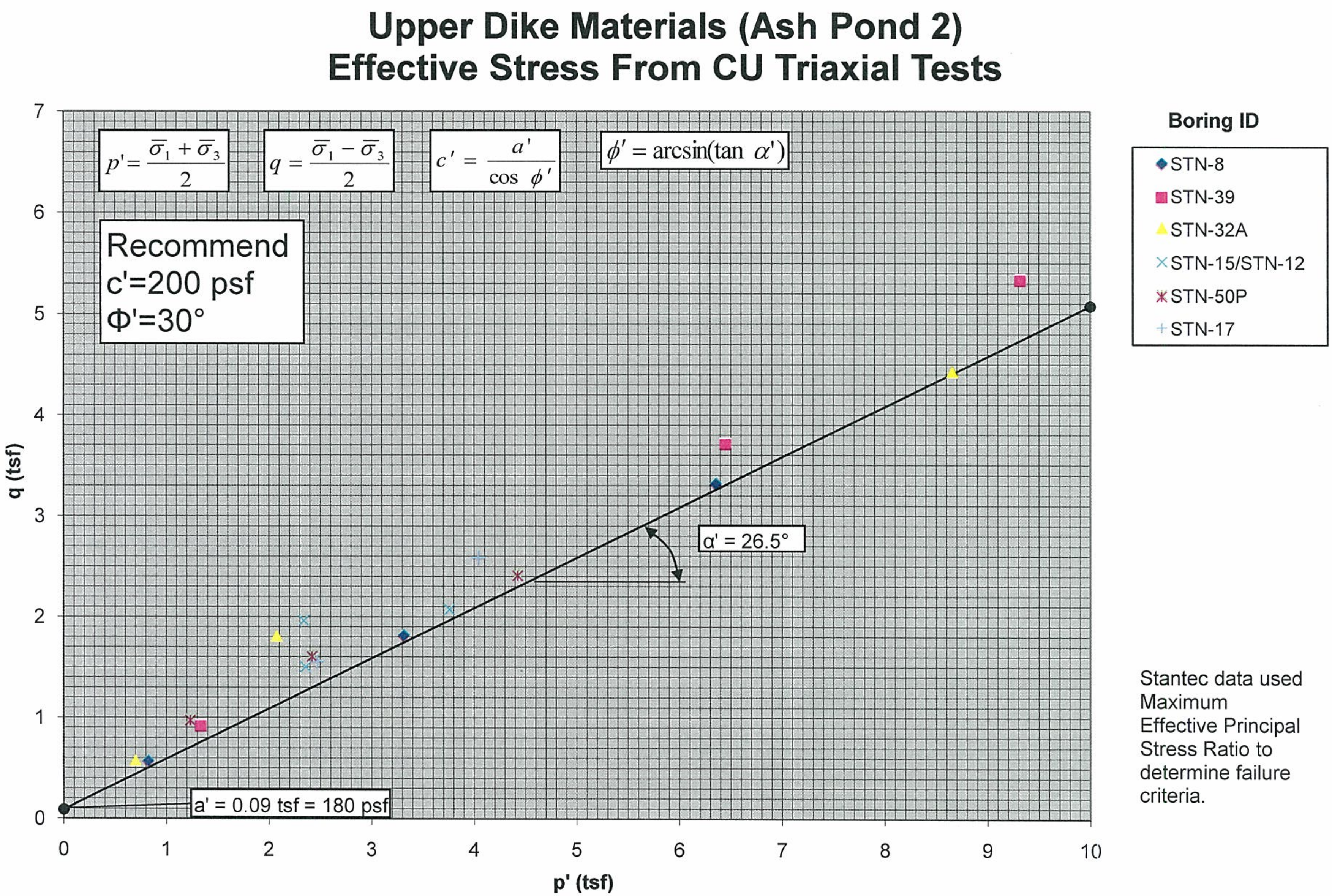
Reporting Limit (RL): 10 pCi/L

U - Less than MDA.

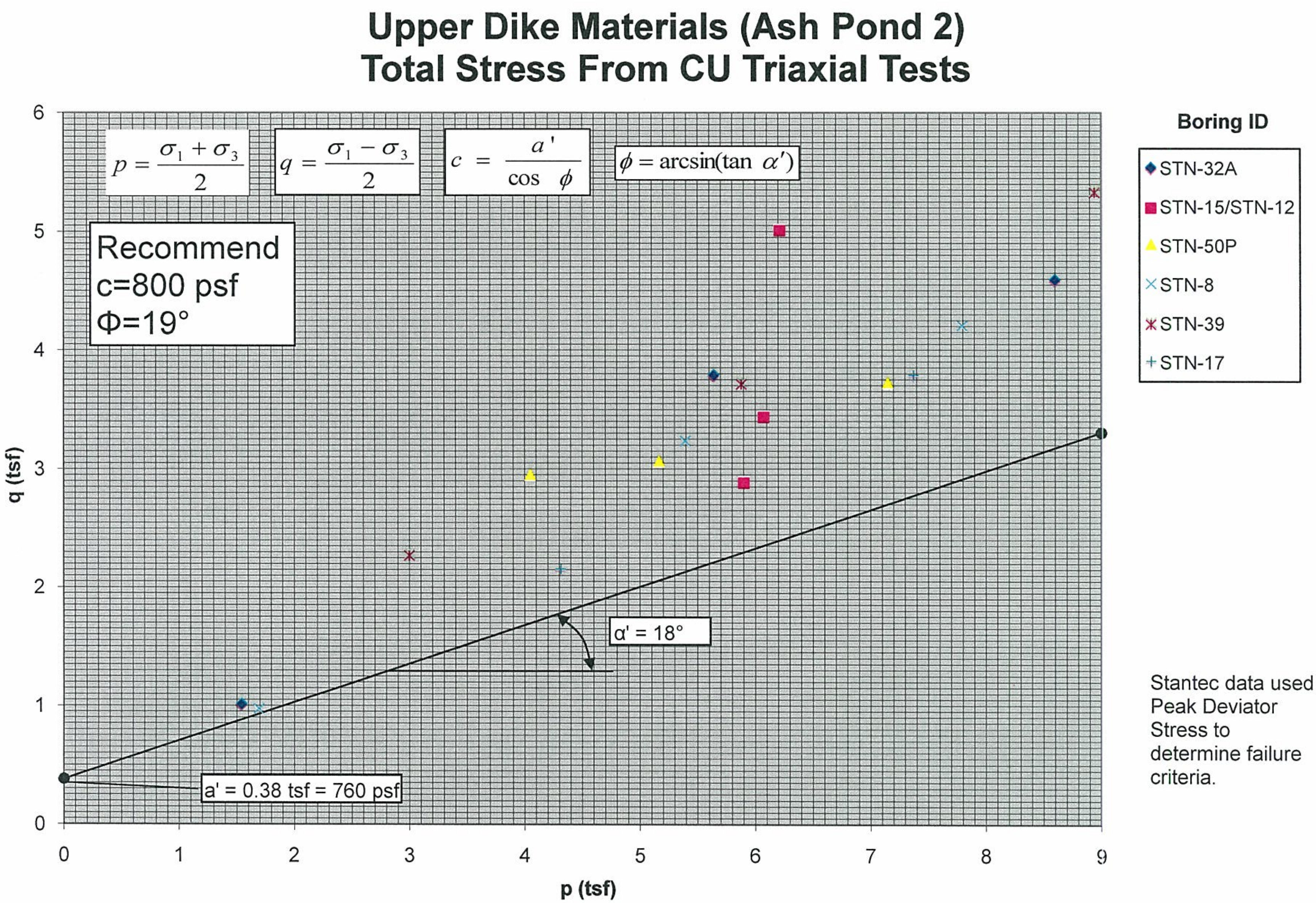
B - Is greater than the MDA but less than the reporting limit.

Appendix E

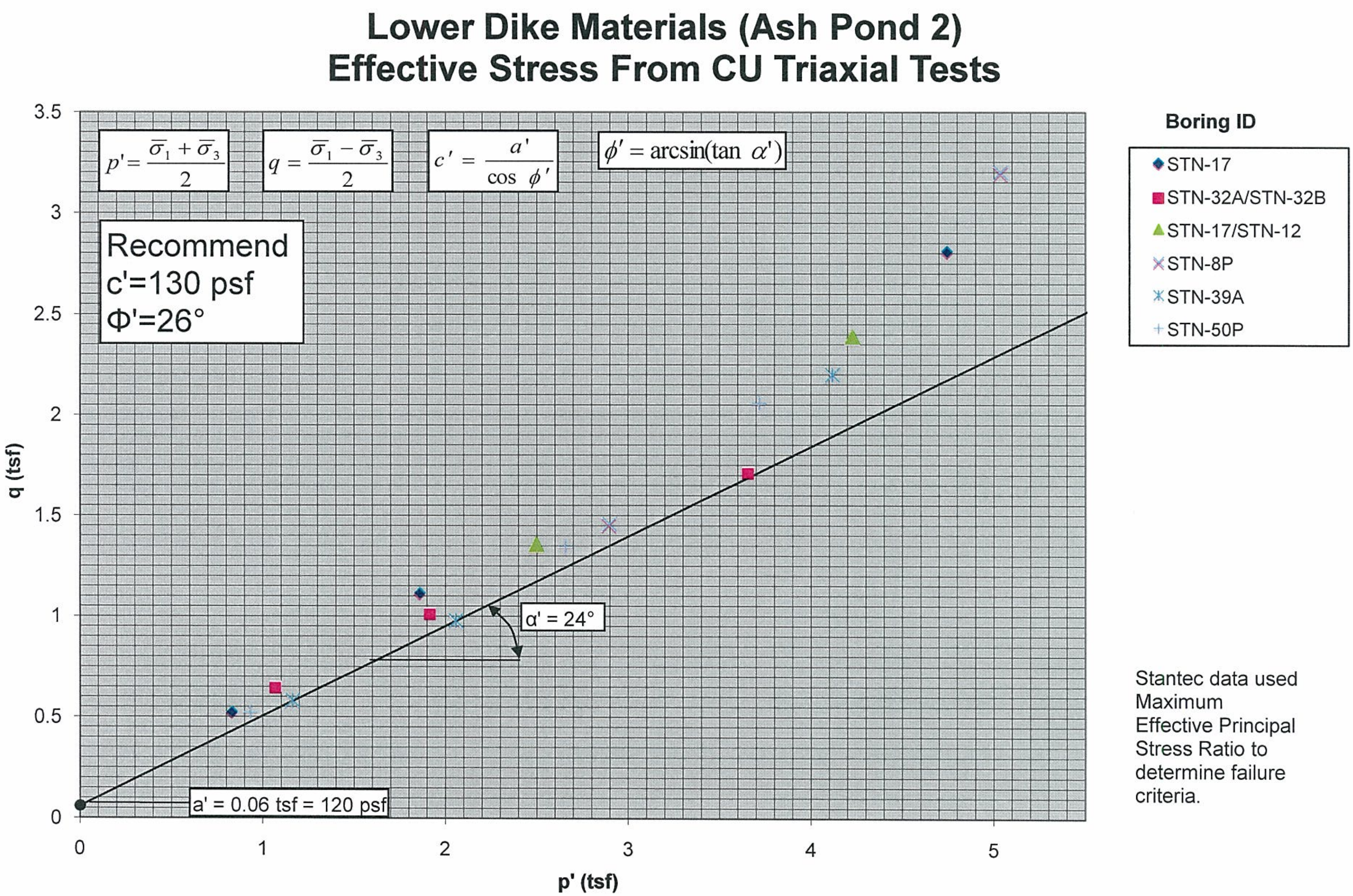
Strength Parameter Selection



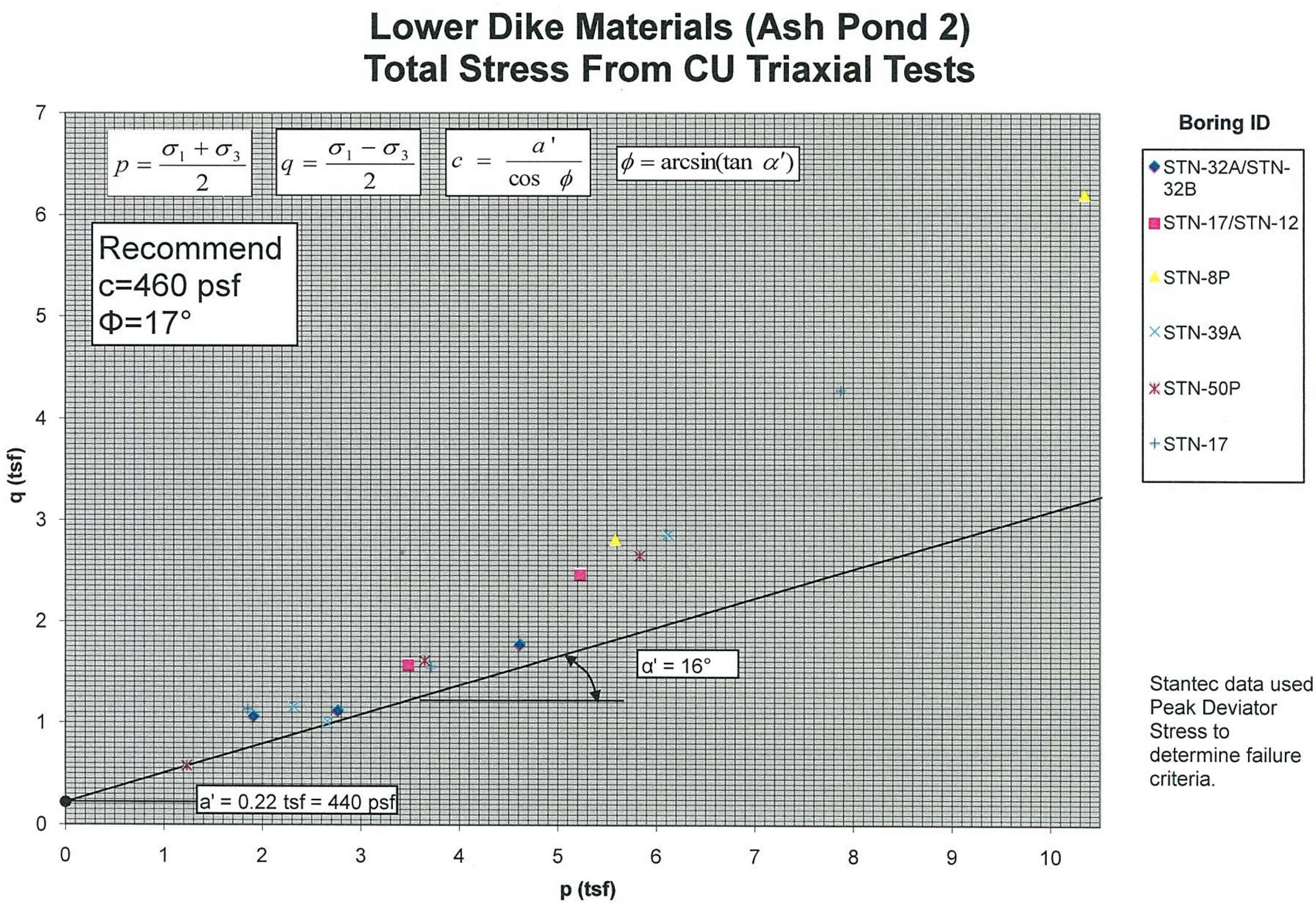
Stantec data used Maximum Effective Principal Stress Ratio to determine failure criteria.



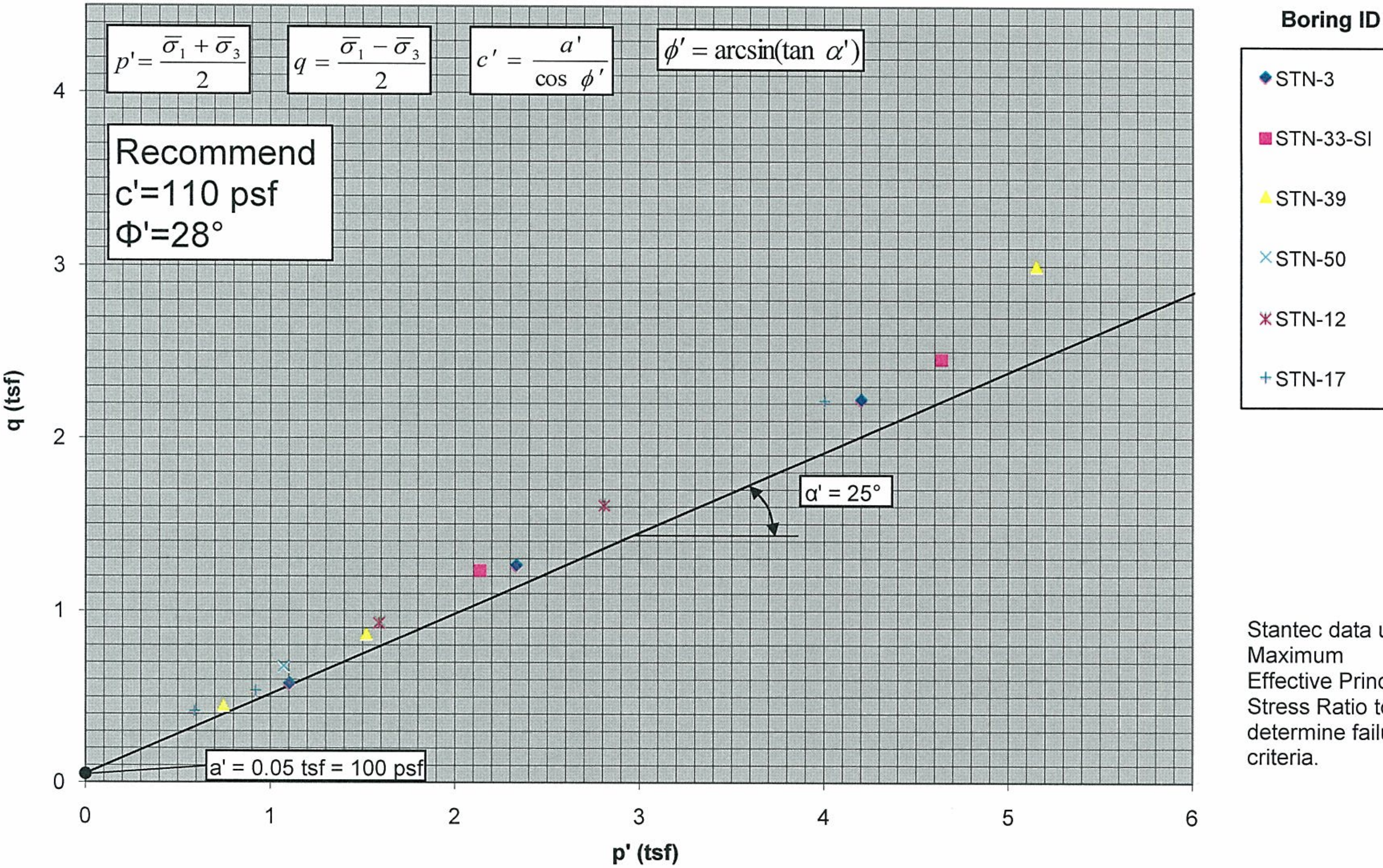
Upper Dike Materials (Ash Pond 2)
Total Stress From CU Triaxial Tests
$p = \frac{\sigma_1 + \sigma_3}{2}$
$q = \frac{\sigma_1 - \sigma_3}{2}$
$c = \frac{a'}{\cos \phi}$
$\phi = \arcsin(\tan \alpha')$
Recommend
c=800 psf
Φ=19°
α' = 18°
a' = 0.38 tsf = 760 psf
q (tsf)
p (tsf)
Boring ID
STN-32A
STN-15/STN-12
STN-50P
STN-8
STN-39
STN-17
Stantec data used Peak Deviator Stress to determine failure criteria.



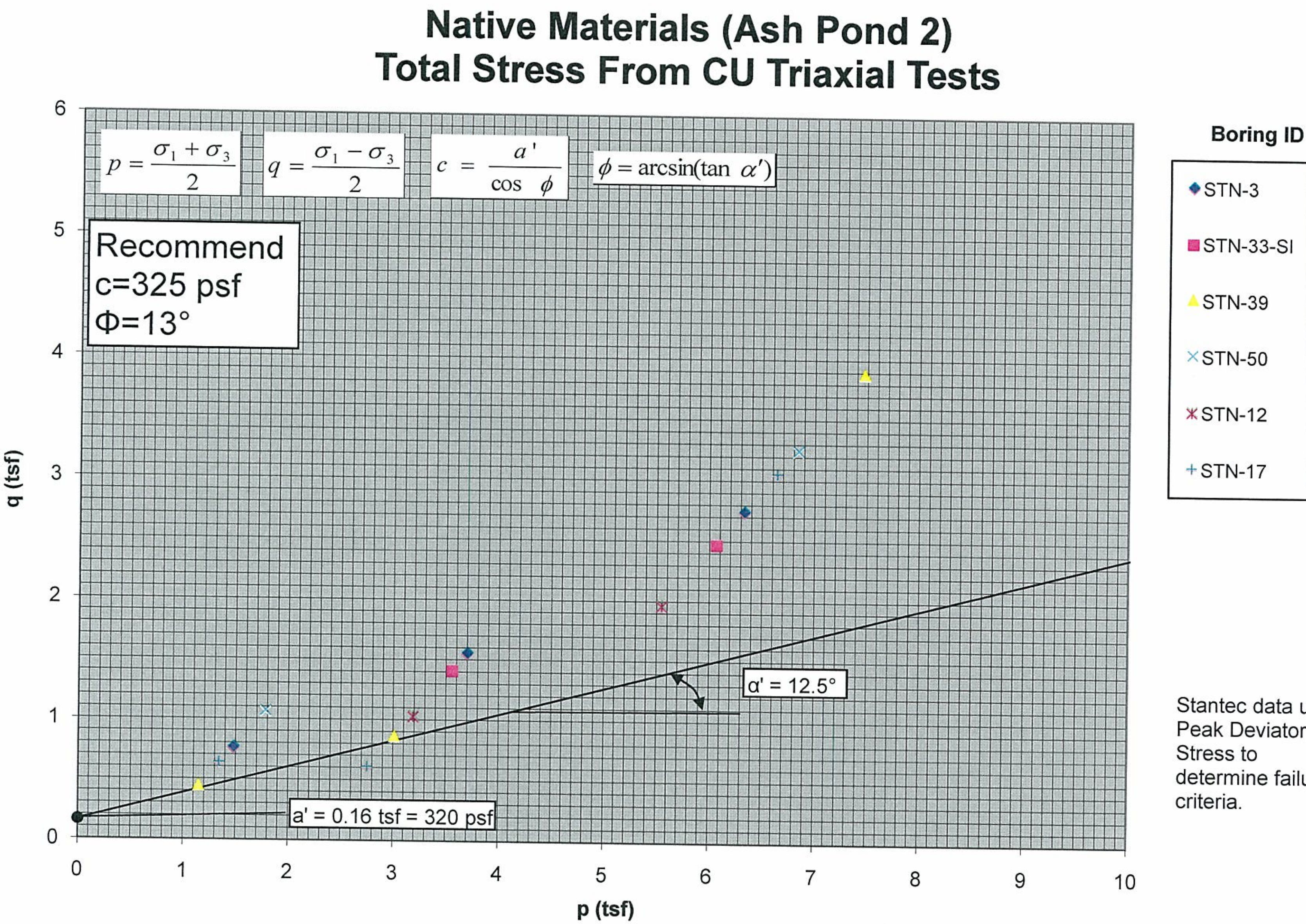
Lower Dike Materials (Ash Pond 2)
Effective Stress From CU Triaxial Tests
$p' = \frac{\bar{\sigma}_1 + \bar{\sigma}_3}{2}$
$q = \frac{\bar{\sigma}_1 - \bar{\sigma}_3}{2}$
$c' = \frac{a'}{\cos \phi'}$
$\phi' = \arcsin(\tan \alpha')$
Recommend
c'=130 psf
Φ'=26°
α' = 24°
a' = 0.06 tsf = 120 psf
q (tsf)
p' (tsf)
0
0.5
1
1.5
2
2.5
3
3.5
0
1
2
3
4
5
Boring ID
STN-17
STN-32A/STN-32B
STN-17/STN-12
STN-8P
STN-39A
STN-50P
Stantec data used Maximum Effective Principal Stress Ratio to determine failure criteria.


Lower Dike Materials (Ash Pond 2)
Total Stress From CU Triaxial Tests
$p = \frac{\sigma_1 + \sigma_3}{2}$
$q = \frac{\sigma_1 - \sigma_3}{2}$
$c = \frac{a'}{\cos \phi}$
$\phi = \arcsin(\tan \alpha')$
Recommend
c=460 psf
Φ=17°
α' = 16°
a' = 0.22 tsf = 440 psf
q (tsf)
p (tsf)
Boring ID
STN-32A/STN-32B
STN-17/STN-12
STN-8P
STN-39A
STN-50P
STN-17
Stantec data used Peak Deviator Stress to determine failure criteria.

Native Materials (Ash Pond 2)
Effective Stress From CU Triaxial Tests

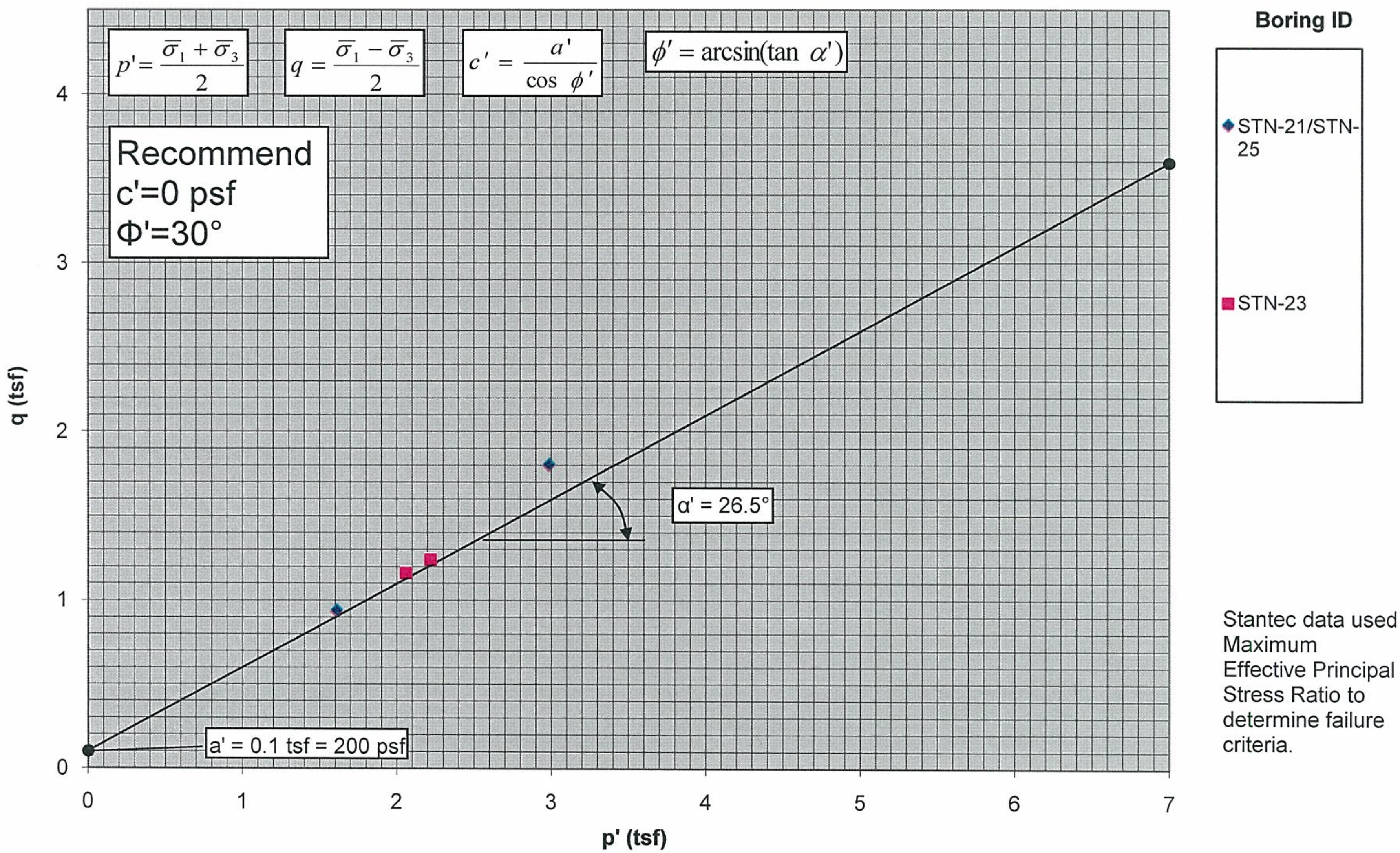


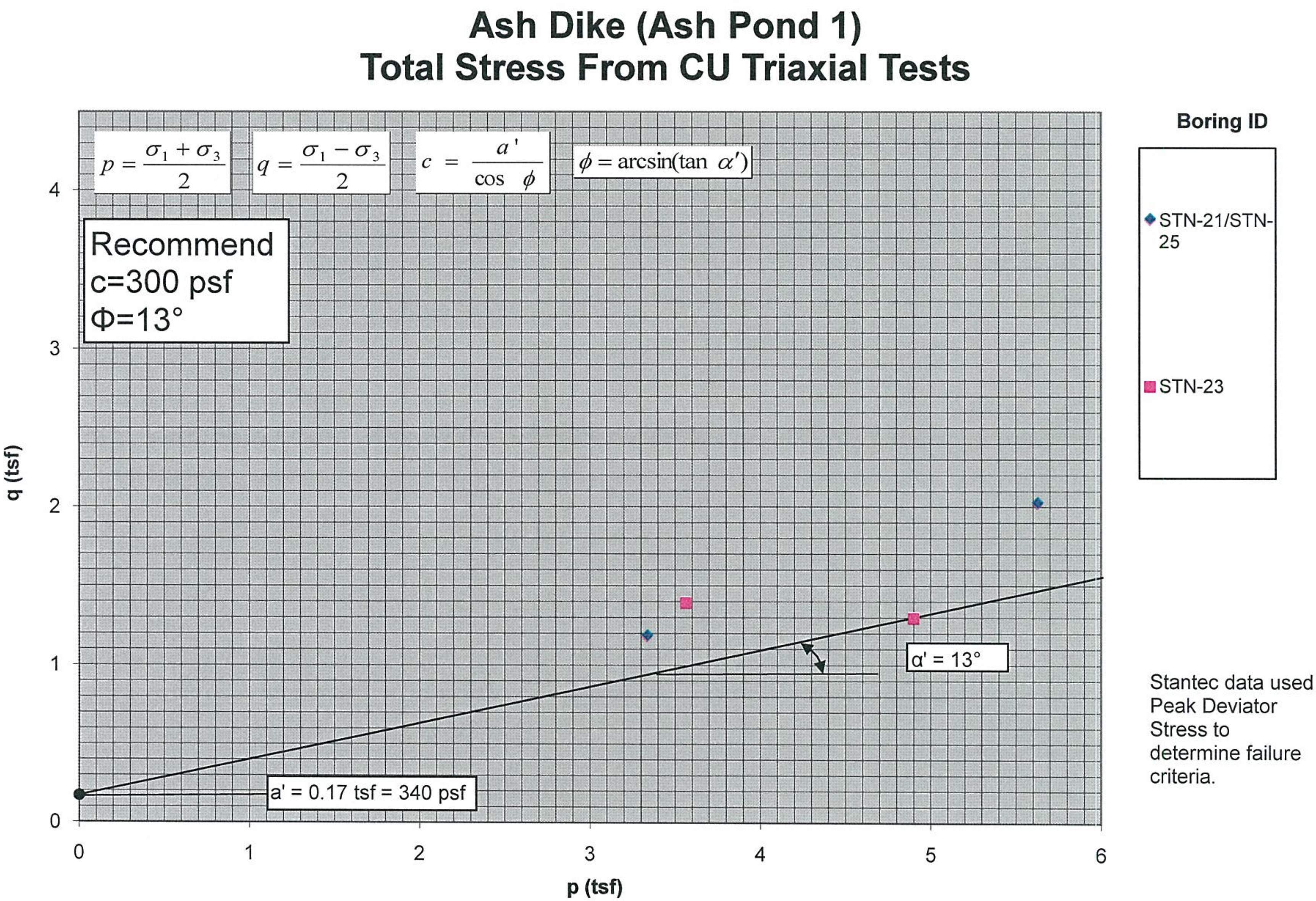
Stantec data used Maximum Effective Principal Stress Ratio to determine failure criteria.



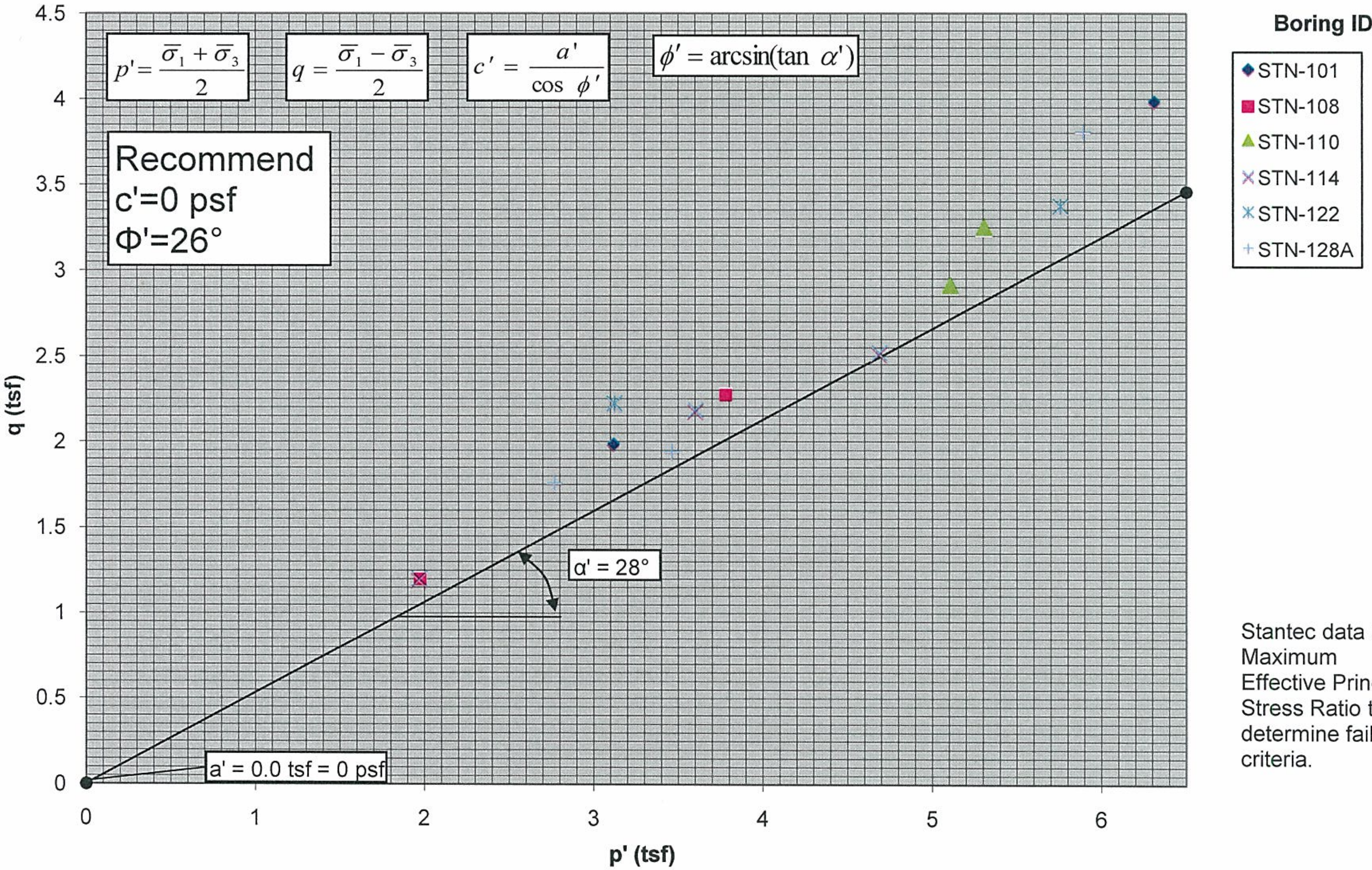
Stantec data used Peak Deviator Stress to determine failure criteria.

Ash Dike (Ash Pond 1)
Effective Stress From CU Triaxial Tests

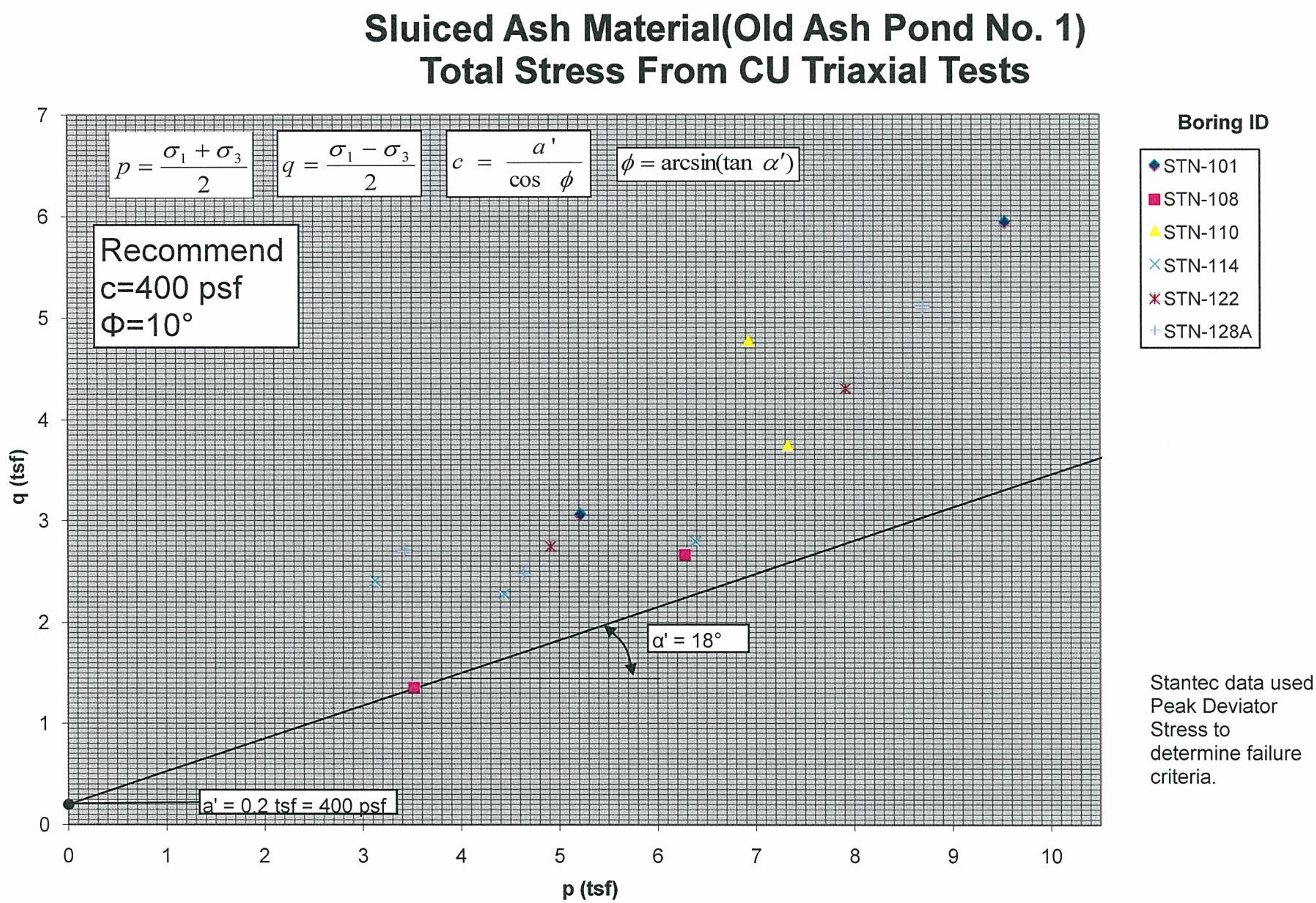


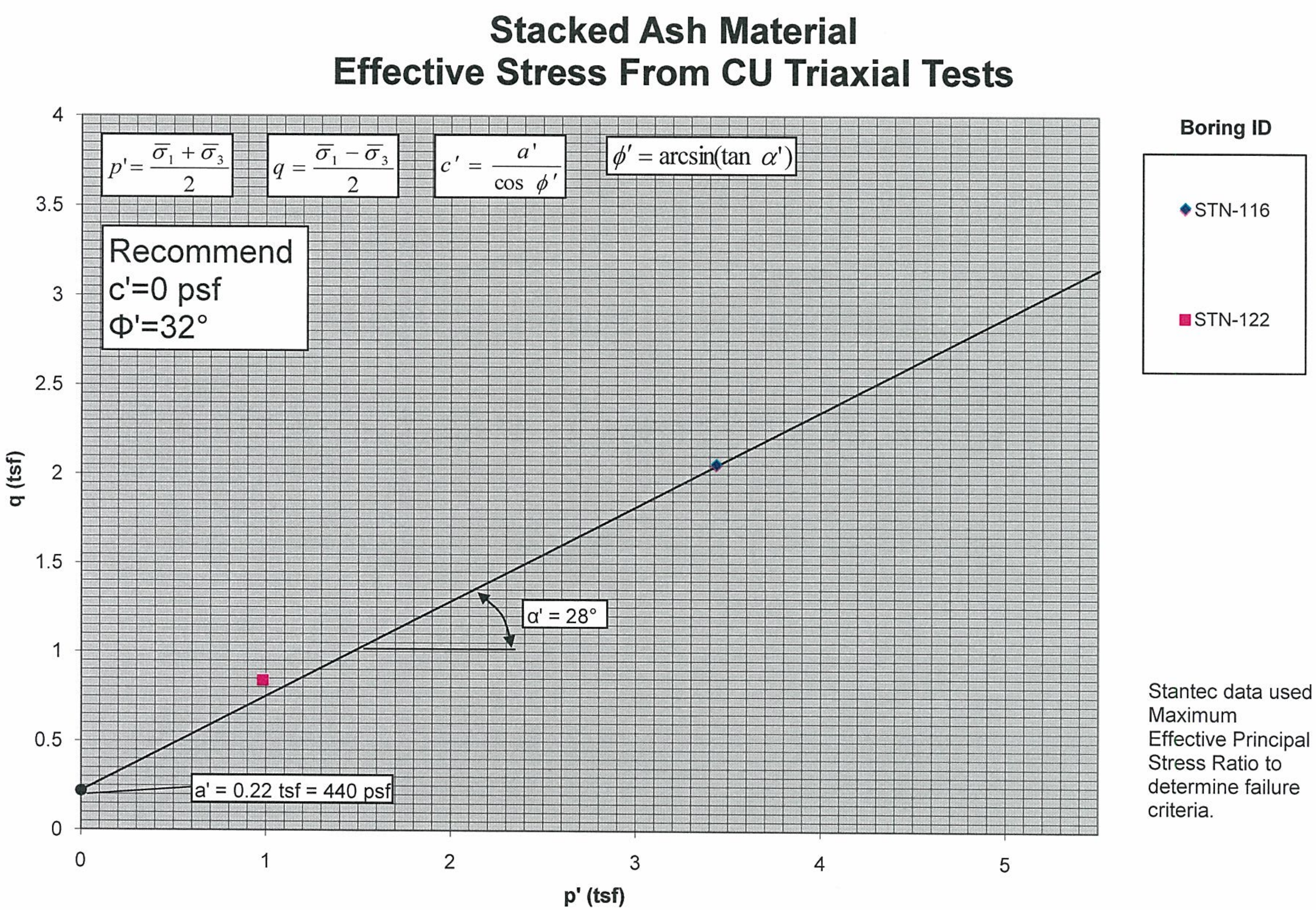

Ash Dike (Ash Pond 1)
Total Stress From CU Triaxial Tests
$p = \frac{\sigma_1 + \sigma_3}{2}$
$q = \frac{\sigma_1 - \sigma_3}{2}$
$c = \frac{a'}{\cos \phi}$
$\phi = \arcsin(\tan \alpha')$
Recommend
c=300 psf
Φ=13°
α' = 13°
a' = 0.17 tsf = 340 psf
q (tsf)
p (tsf)
0
1
2
3
4
5
6
Boring ID
STN-21/STN-25
STN-23
Stantec data used Peak Deviator Stress to determine failure criteria.

Sluiced Ash Material(Old Ash Pond No. 1)
Effective Stress From CU Triaxial Tests

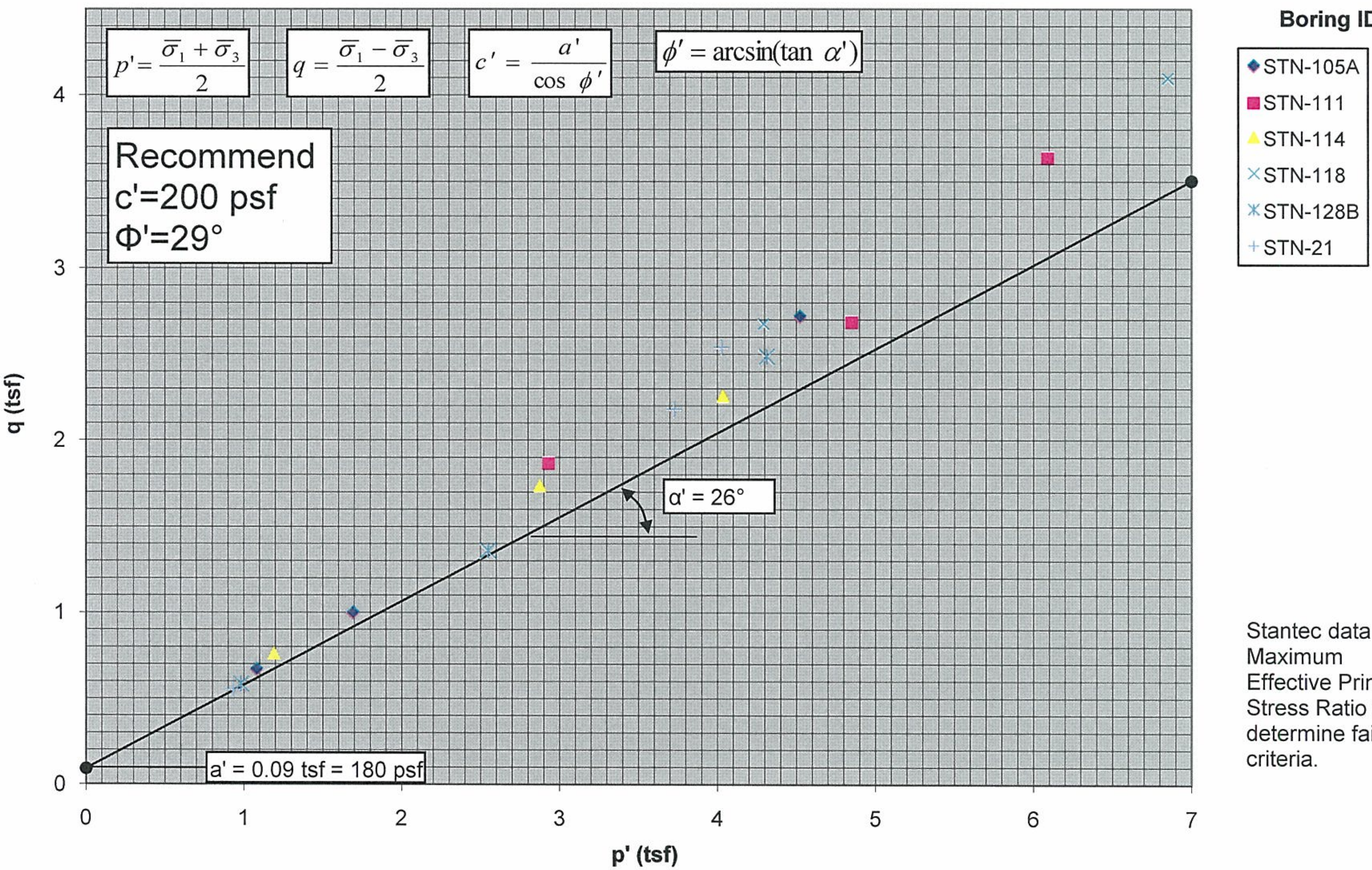


Stantec data used Maximum Effective Principal Stress Ratio to determine failure criteria.


Sluiced Ash Material(Old Ash Pond No. 1)
Total Stress From CU Triaxial Tests
$p = \frac{\sigma_1 + \sigma_3}{2}$
$q = \frac{\sigma_1 - \sigma_3}{2}$
$c = \frac{a'}{\cos \phi}$
$\phi = \arcsin(\tan \alpha')$
Recommend
c=400 psf
Φ=10°
α' = 18°
a' = 0.2 tsf = 400 psf
q (tsf)
p (tsf)
0
1
2
3
4
5
6
7
8
9
10
Boring ID
STN-101
STN-108
STN-110
STN-114
STN-122
STN-128A
Stantec data used Peak Deviator Stress to determine failure criteria.

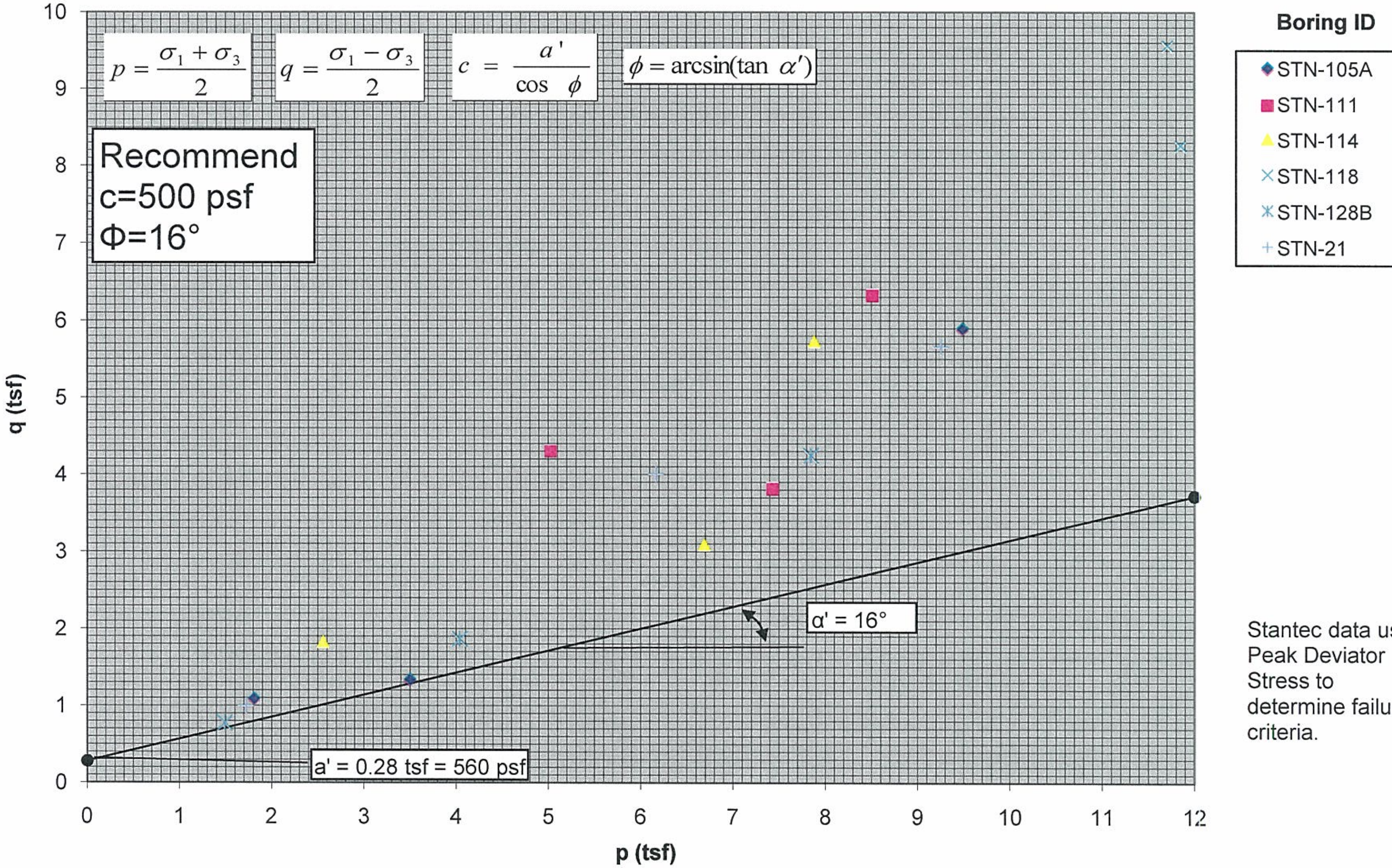

Stacked Ash Material
Effective Stress From CU Triaxial Tests
$p' = \frac{\bar{\sigma}_1 + \bar{\sigma}_3}{2}$
$q = \frac{\bar{\sigma}_1 - \bar{\sigma}_3}{2}$
$c' = \frac{a'}{\cos \phi'}$
$\phi' = \arcsin(\tan \alpha')$
Recommend
c'=0 psf
Φ'=32°
α' = 28°
a' = 0.22 tsf = 440 psf
q (tsf)
p' (tsf)
Boring ID
STN-116
STN-122
Stantec data used Maximum Effective Principal Stress Ratio to determine failure criteria.

Native Clay/Silt (Ash Pond 1 & Consolidated Waste Dry Stack) Effective Stress From CU Triaxial Tests



Stantec data used Maximum Effective Principal Stress Ratio to determine failure criteria.

Native Clay/Silt (Ash Pond 1 & Consolidated Waste Dry Stack) Total Stress From CU Triaxial Tests



Stantec data used Peak Deviator Stress to determine failure criteria.

Appendix F

Seepage Analyses Results

Seepage Analysis
Section A-A'
Ash Pond 2

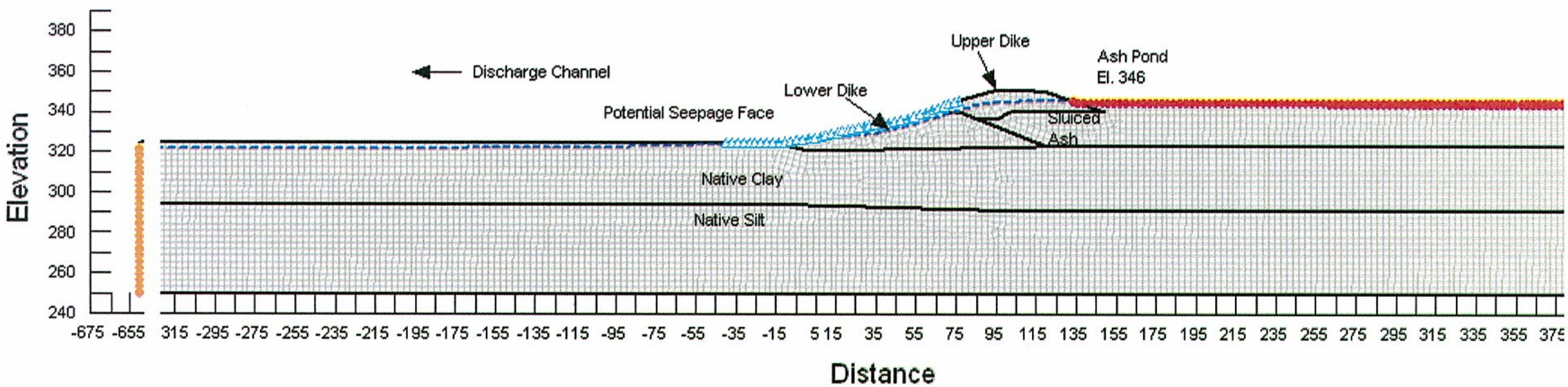
Long-Term Loading Condition
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3



Seepage Analysis
Section A-A'
Ash Pond 2

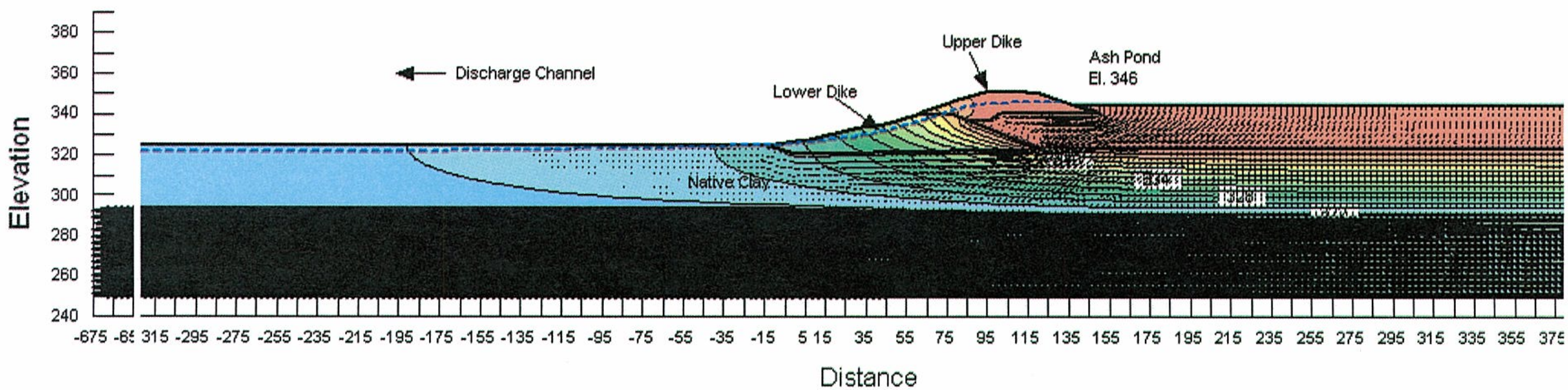
Long-Term Loading Condition
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3



Seepage Analysis
Section A-A'
Ash Pond 2

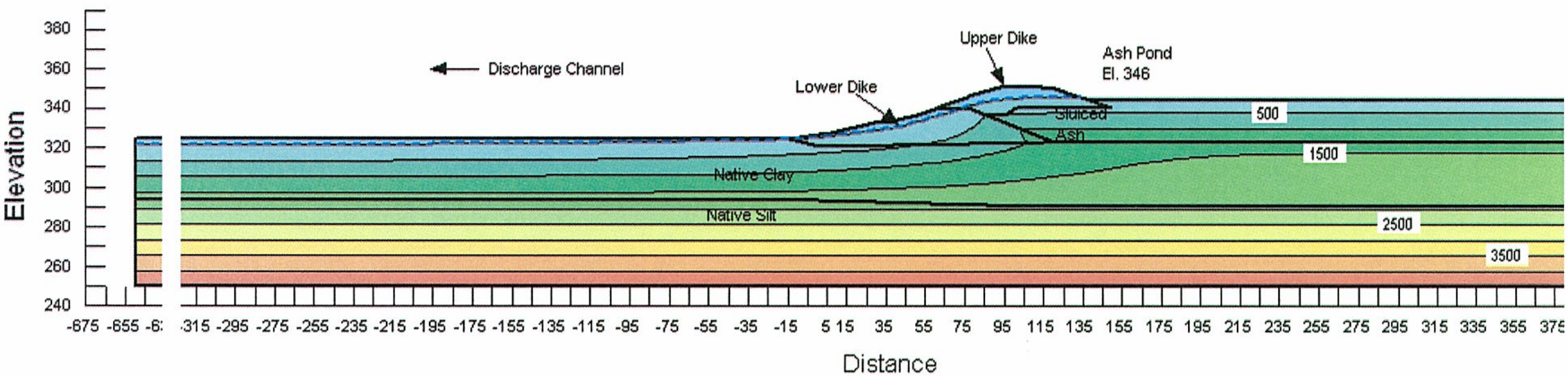
Long-Term Loading Condition
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³



Seepage Analysis
Section A-A'
Ash Pond 2

Long-Term Loading Condition
Vertical Gradient

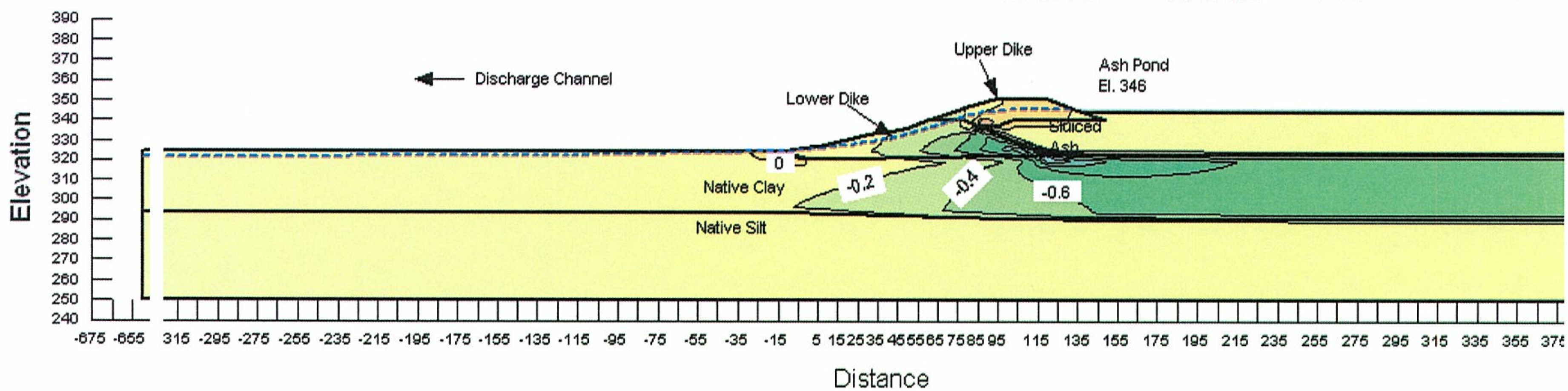
Shawnee Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum occurs at (-16.78, 324.7)
Total Head = 324.53 ft
At (-16.89, 321.75)
Total Head = 324.6 ft
dH = 0.07ft   dL =2.95ft
i = 0.02   i(criticial) = 1.06
FSpiping = >4

May 2010
Method: Steady-State
File Name: SHF_SectionA_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3



Seepage Analysis
Section A-A'
Ash Pond 2

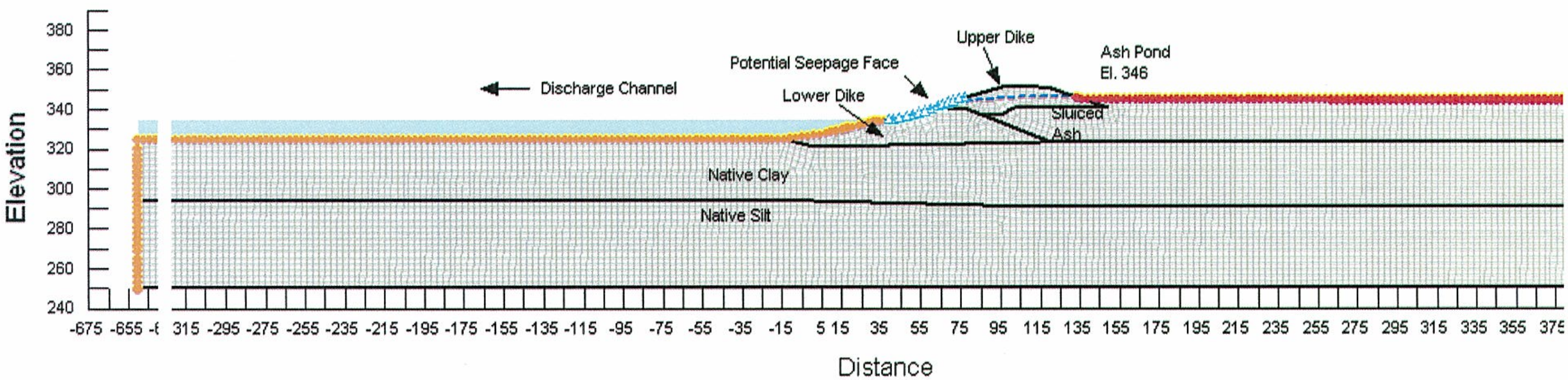
Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³



Seepage Analysis
Section A-A'
Ash Pond 2

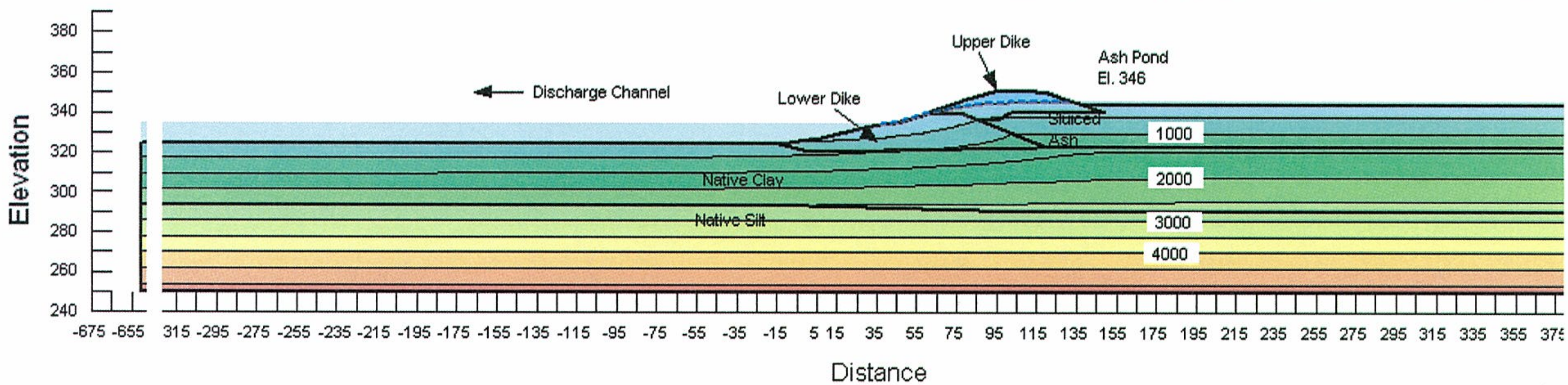
Rapid Drawdown High Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³



Seepage Analysis
Section A-A'
Ash Pond 2

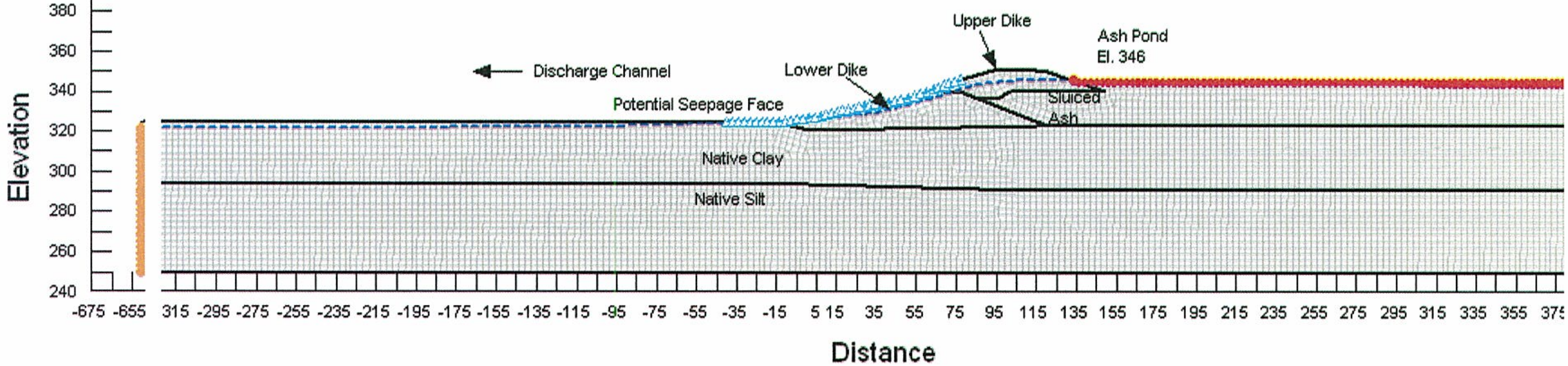
Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³



Seepage Analysis
Section A-A'
Ash Pond 2

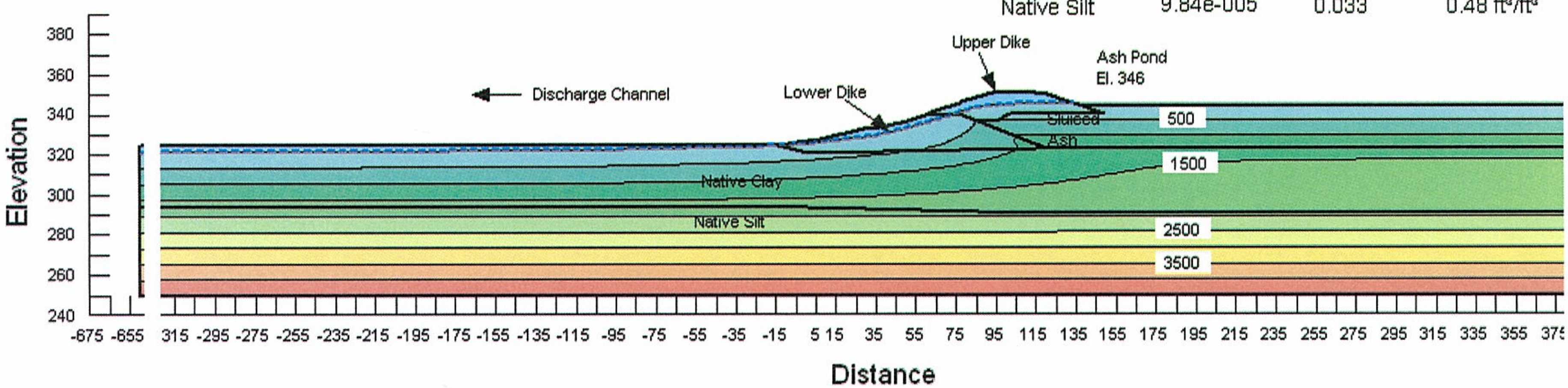
Rapid Drawdown Low Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionA_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-010	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³



Seepage Analysis
Section C-C'
Ash Pond 2

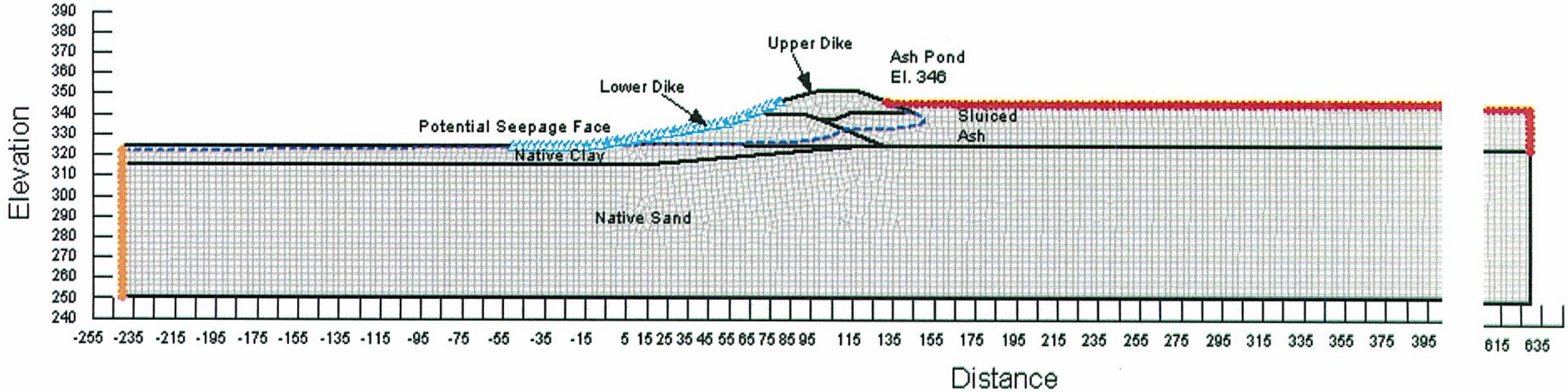
Long-Term Loading Conditions
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³



Seepage Analysis
Section C-C'
Ash Pond 2

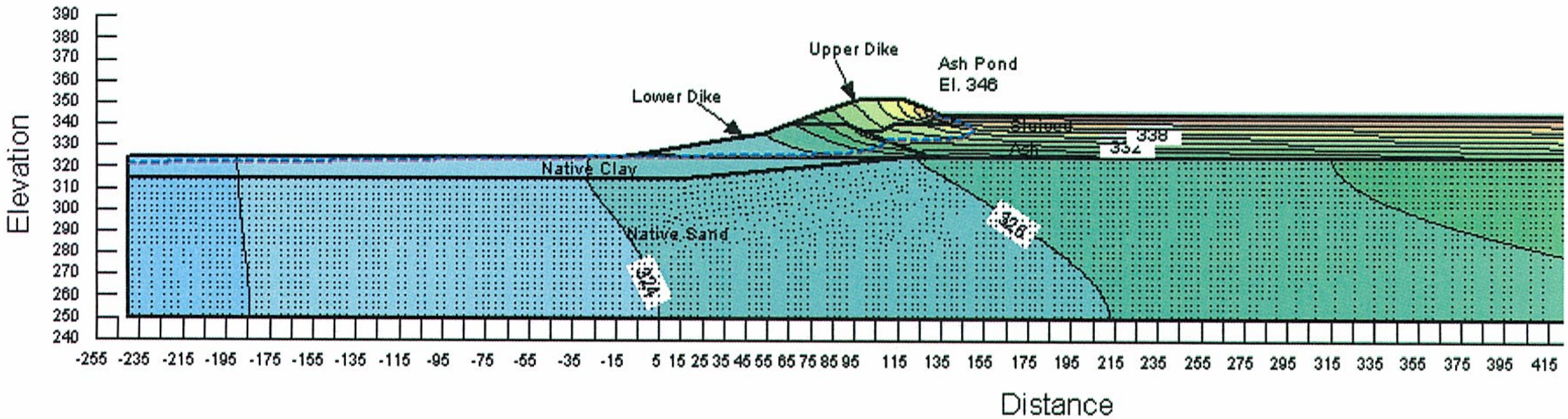
Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³



Seepage Analysis
Section C-C'
Ash Pond 2

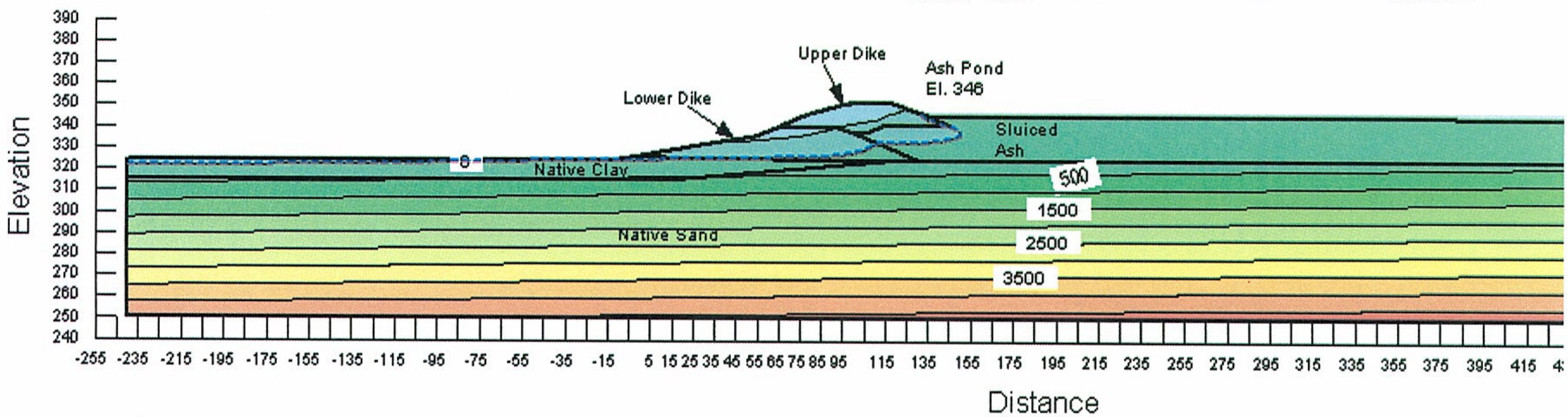
Long-Term Loading Conditions
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section C-C'
Ash Pond 2

Long-Term Loading Conditions
Vertical Gradient

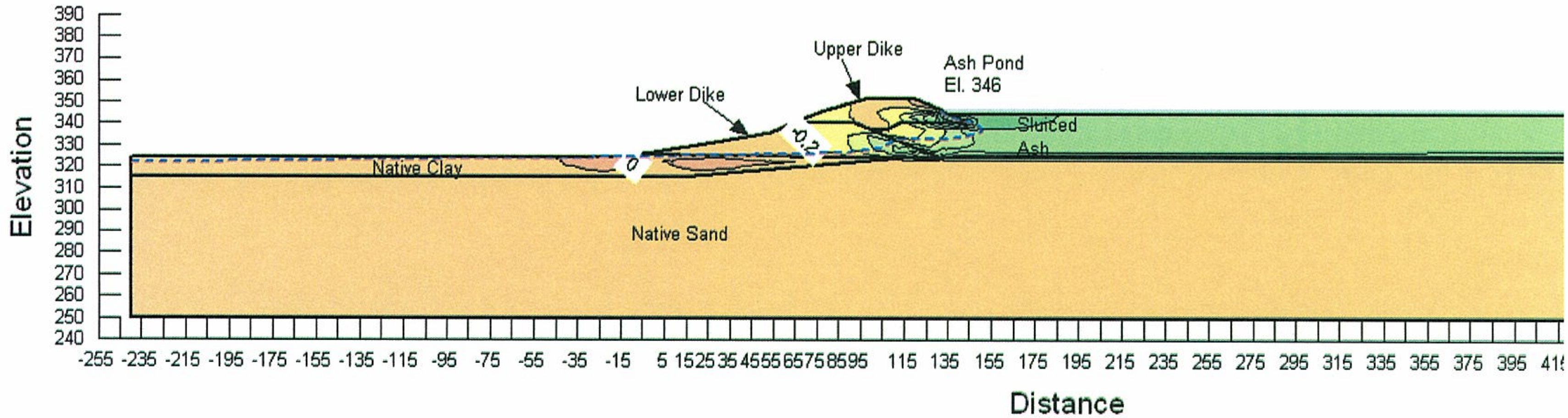
Shawnee Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum occurs at (-14.5, 324.1)
Total Head = 324.1 ft
At (-14.27, 321.02)
Total Head = 324.2 ft
dH = 0.1ft   dL =3.09ft
i = 0.03   i(criticial) = 1.06
FSpiping = >4

May 2010
Method: Steady-State
File Name: SHF_SectionC_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³



Seepage Analysis
Section C-C'
Ash Pond 2

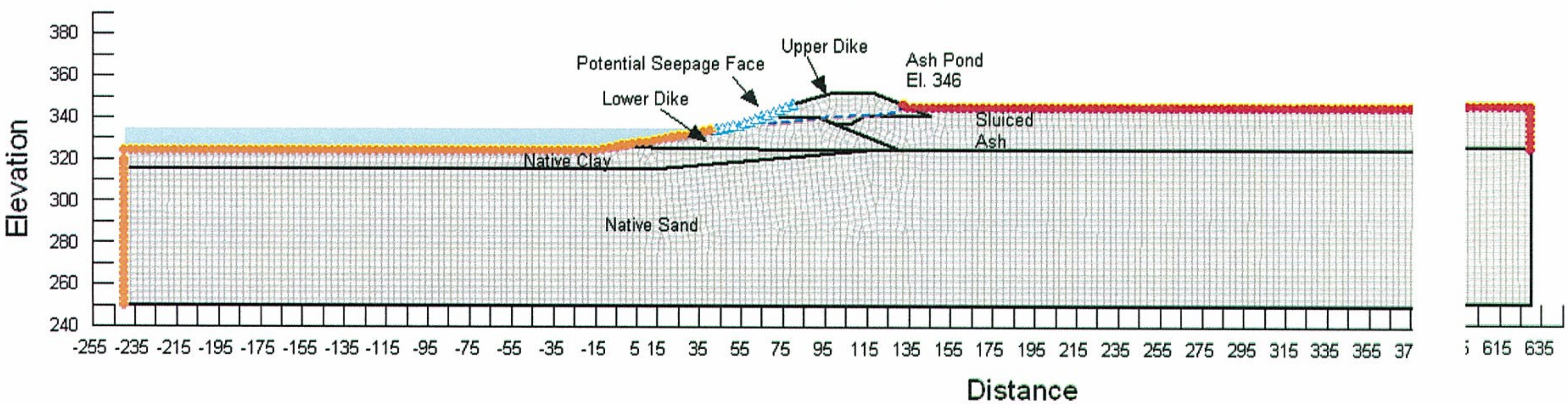
Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section C-C'
Ash Pond 2

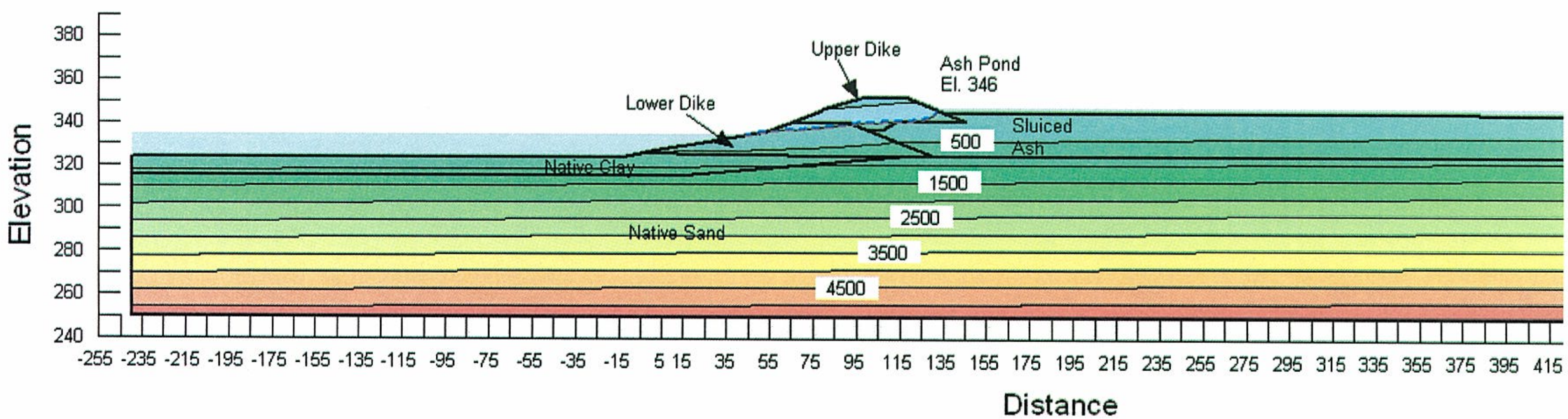
Rapid Drawdown High Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³



Seepage Analysis
Section C-C'
Ash Pond 2

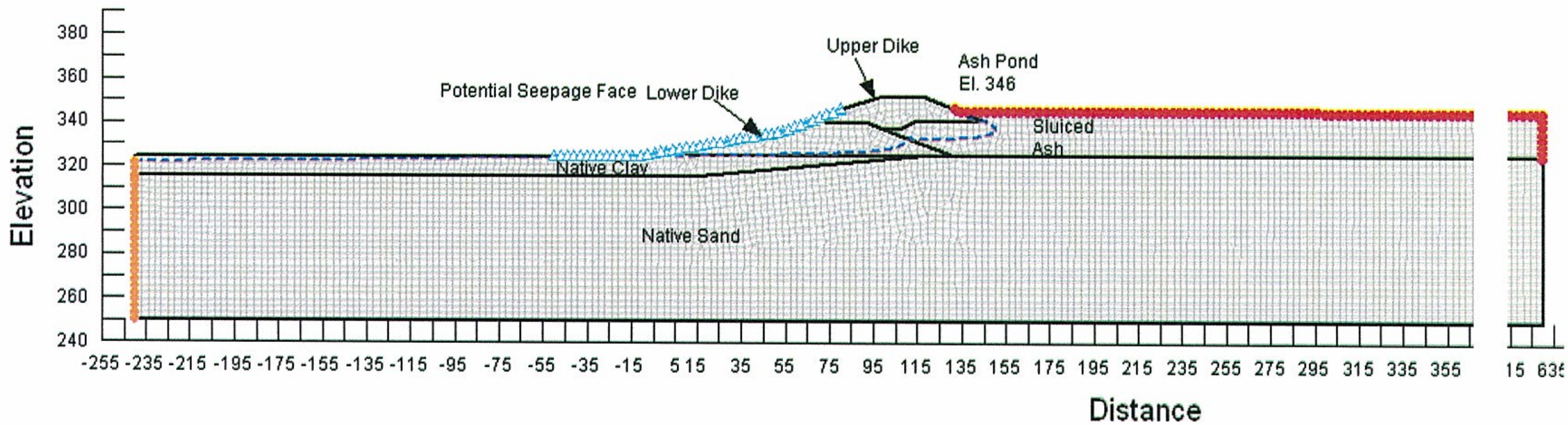
Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section C-C'
Ash Pond 2

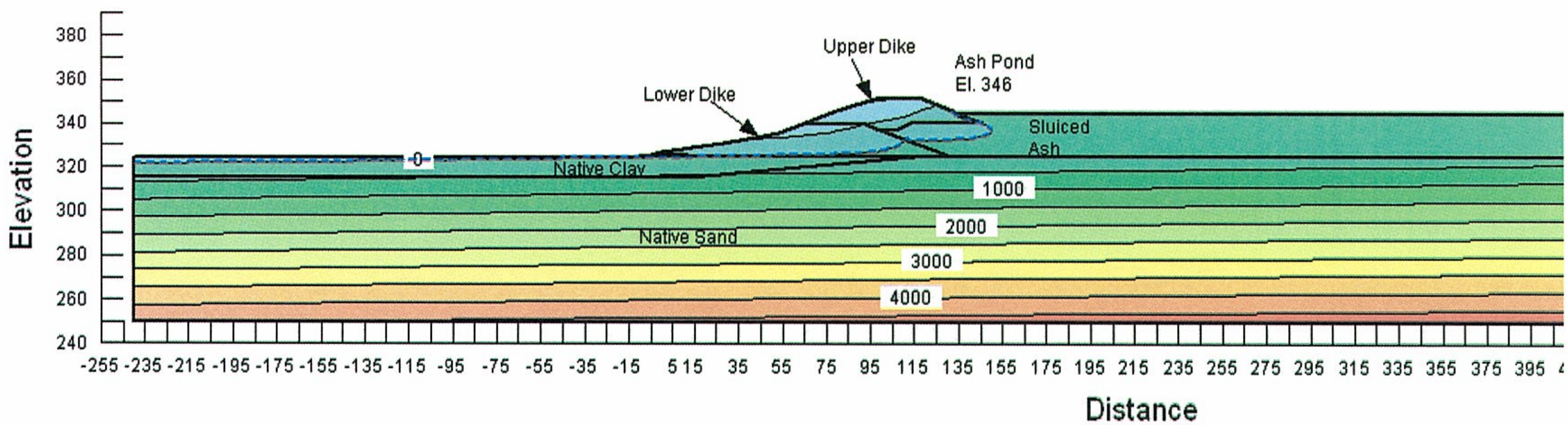
Rapid Drawdown Low Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionC_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section E-E'
Ash Pond 2

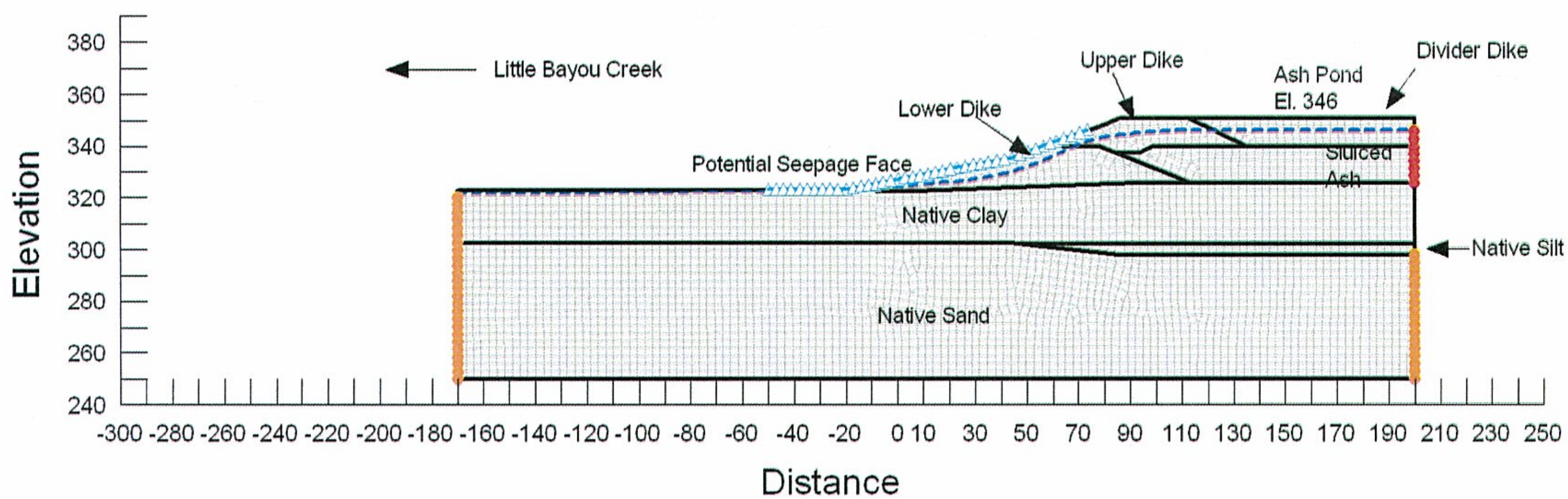
Long-Term Loading Condition
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3
Divider Dike	0.0328	1	0.62 ft^3/ft^3



Seepage Analysis
Section E-E'
Ash Pond 2

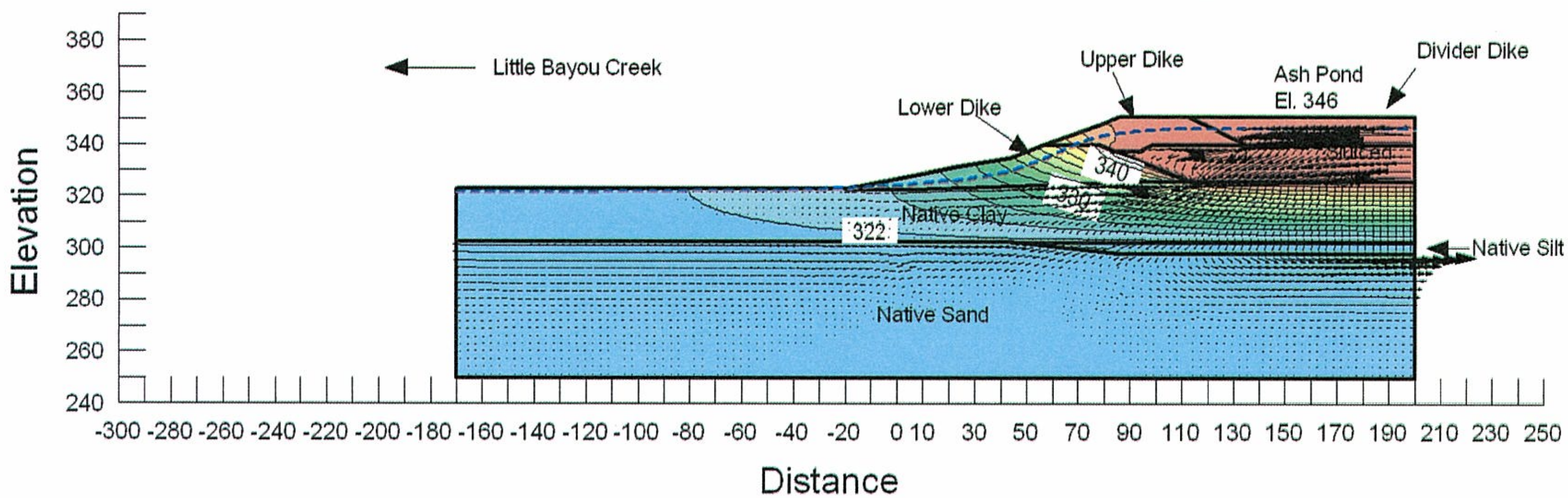
Long-Term Loading Condition
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³
Divider Dike	0.0328	1	0.62 ft³/ft³



Seepage Analysis
Section E-E'
Ash Pond 2

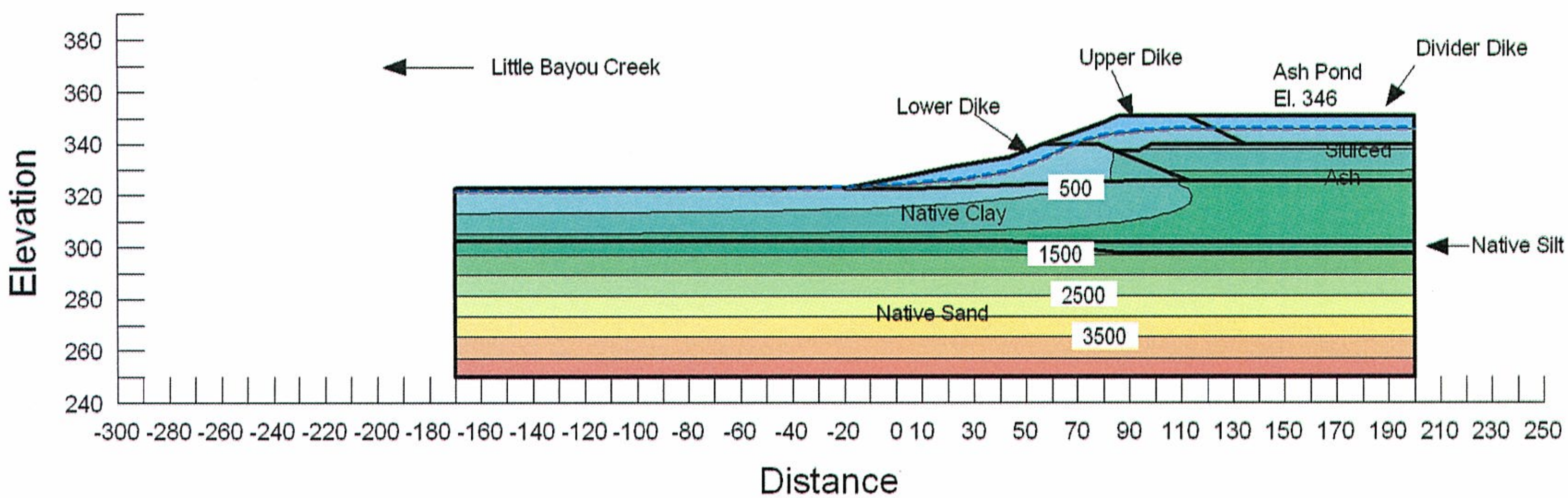
Long-Term Loading Condition
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³
Divider Dike	0.0328	1	0.62 ft³/ft³



Seepage Analysis
Section E-E'
Ash Pond 2

Long-Term Loading Condition
Vertical Gradient

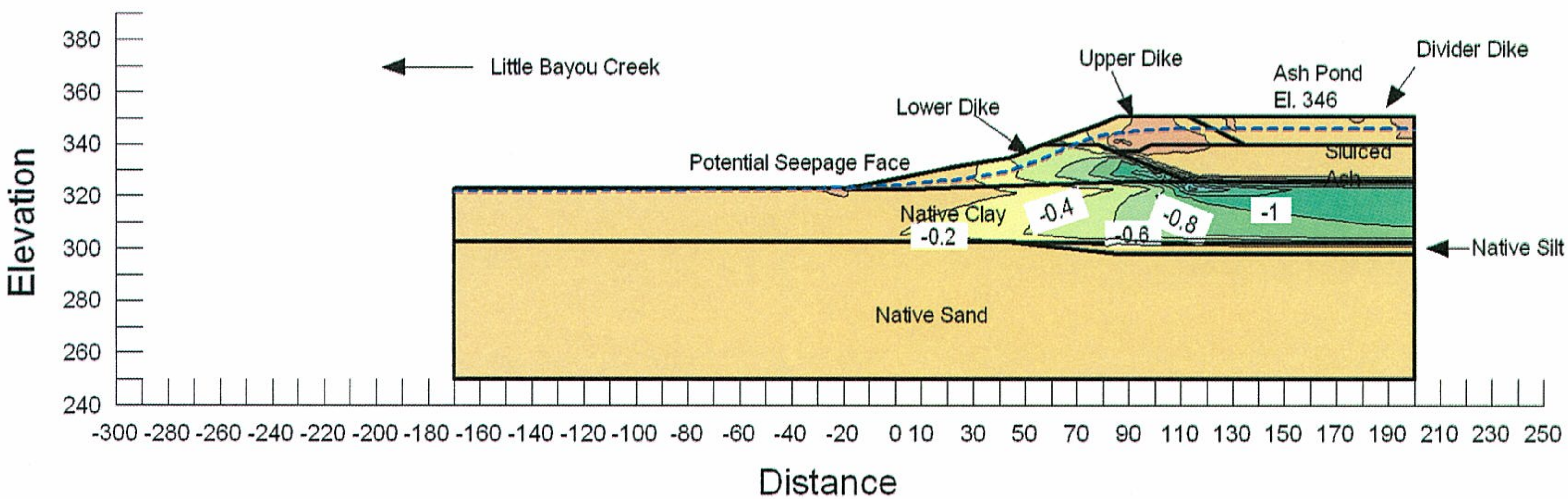
Shawnee Fossil Plant
Tennessee Valley Authority

Piping Potential
Maximum occurs at (-23.0, 323.0)
Total Head = 322.98 ft
At (-23.01, 320.06)
Total Head = 323.06 ft
dH = 0.08ft dL =2.94ft
i = 0.03 i(criticial) = 1.06
FSpiping = >4

May 2010
Method: Steady-State
File Name: SHF_SectionE_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3
Divider Dike	0.0328	1	0.62 ft^3/ft^3



Seepage Analysis
Section E-E'
Ash Pond 2

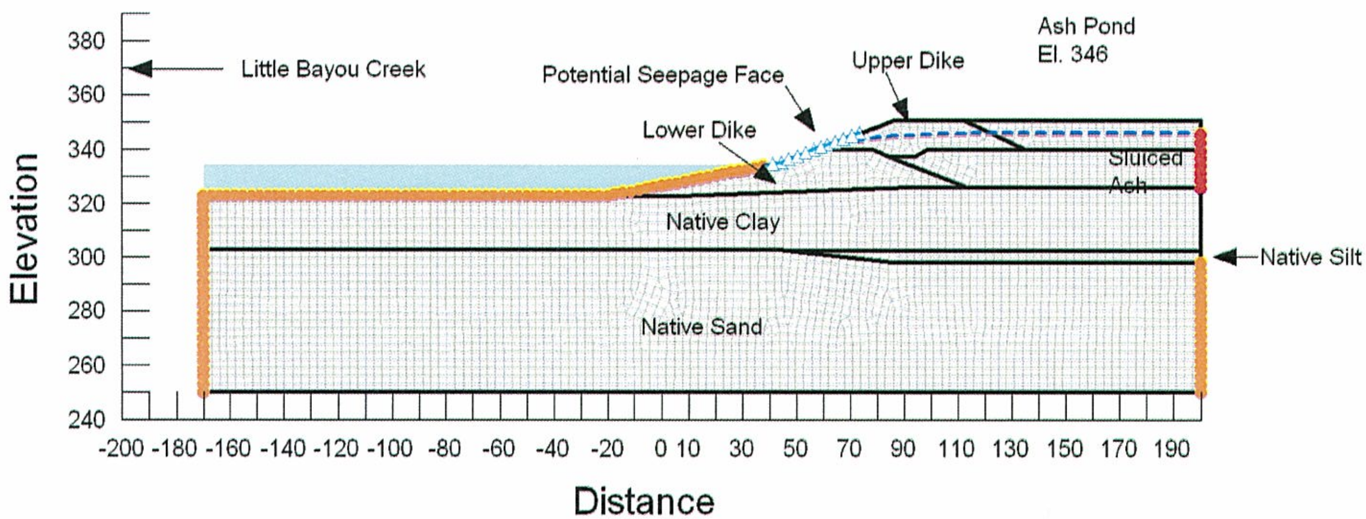
Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3
Divider Dike	0.0328	1	0.62 ft^3/ft^3



Seepage Analysis
Section E-E'
Ash Pond 2

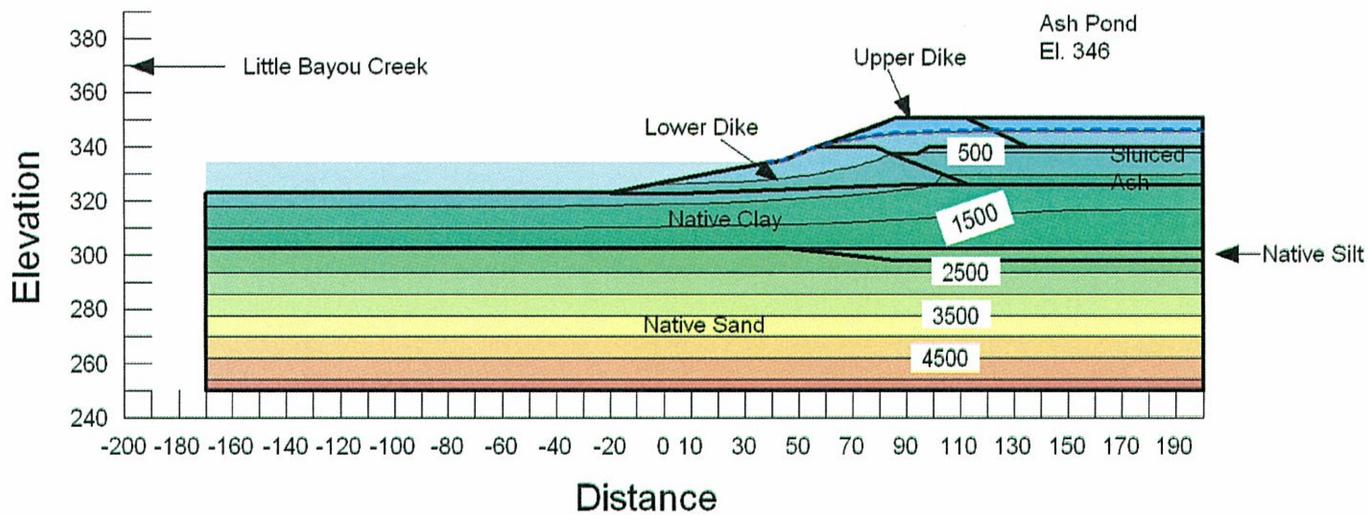
Rapid Drawdown High Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³
Divider Dike	0.0328	1	0.62 ft³/ft³



Seepage Analysis
Section E-E'
Ash Ponds 2

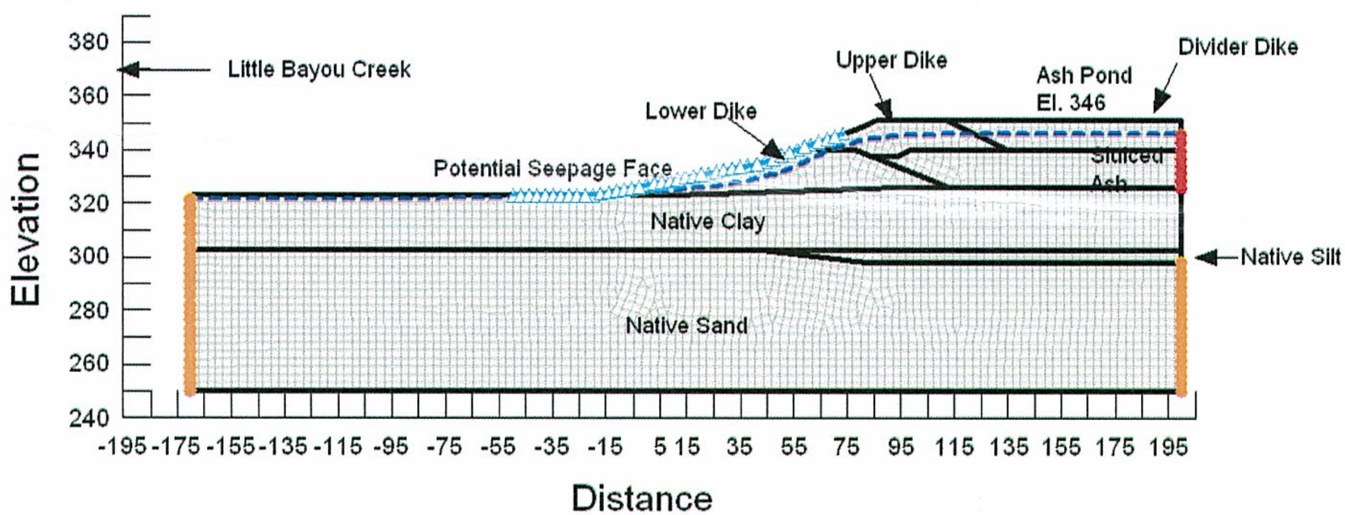
Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3
Divider Dike	0.0328	1	0.62 ft^3/ft^3



Seepage Analysis
Section E-E'
Ash Ponds 2

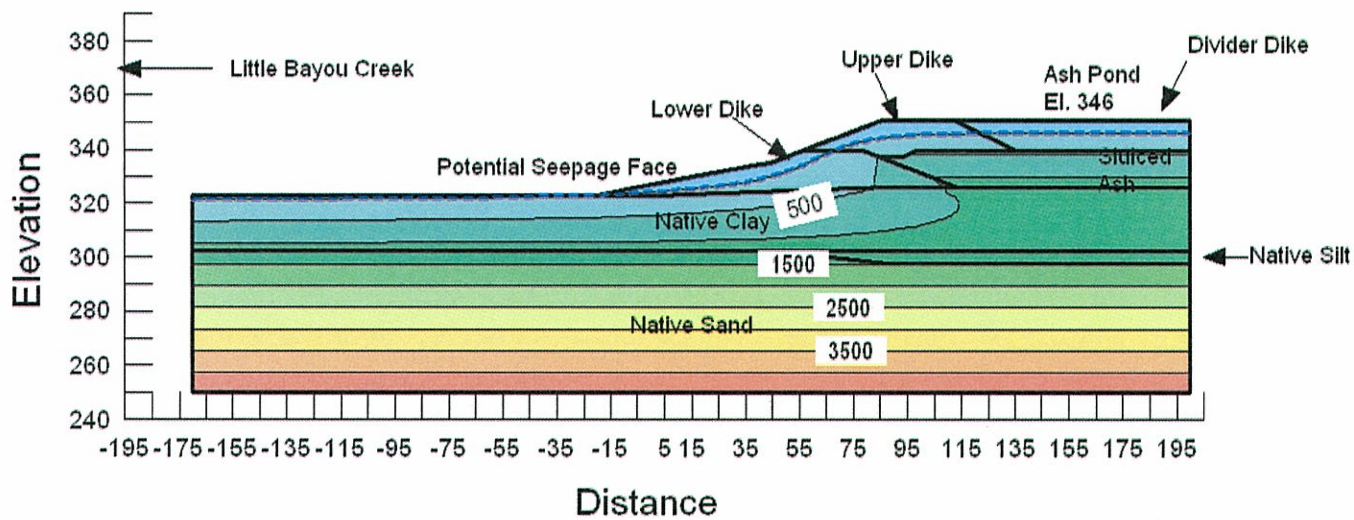
Rapid Drawdown Low Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionE_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3
Divider Dike	0.0328	1	0.62 ft^3/ft^3



Seepage Analysis
Section F-F'
Ash Ponds 2

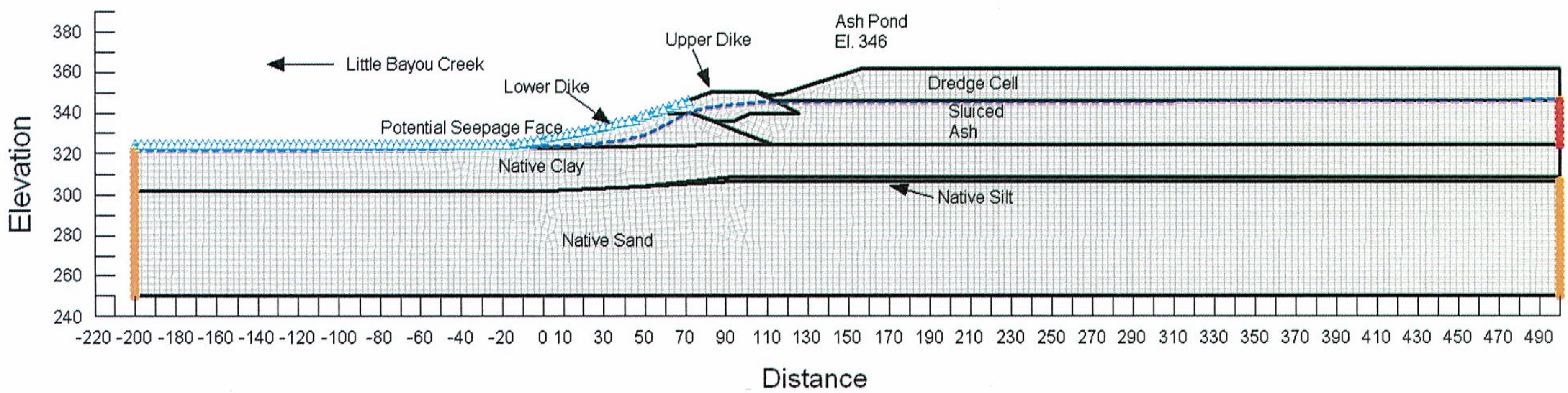
Long-Term Loading Condition
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.48 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.35 ft^3/ft^3
Dredge Cell	1.71e-005	0.05	0.49 ft^3/ft^3



Seepage Analysis
Section F-F'
Ash Ponds 2

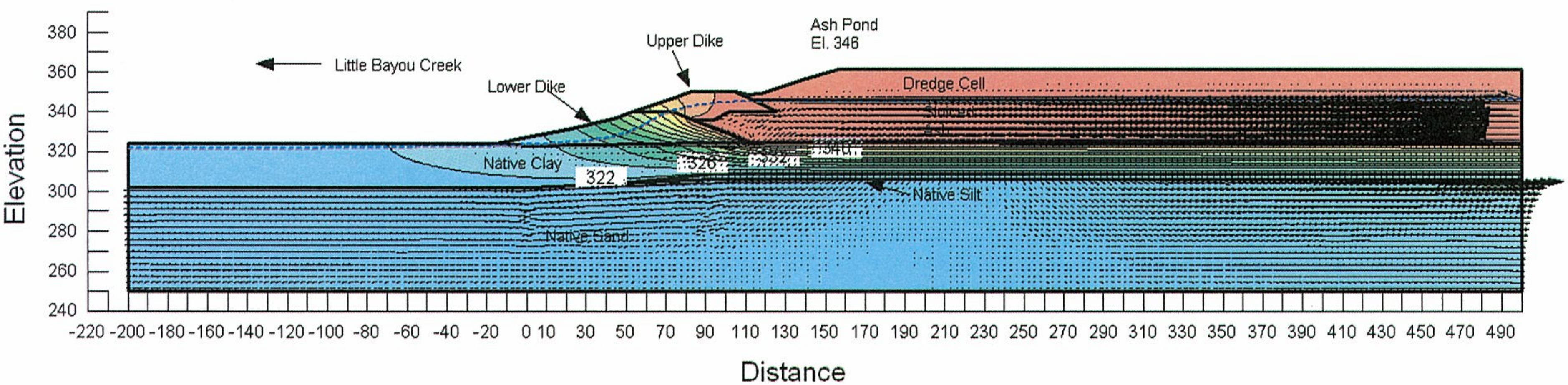
Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.48 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.35 ft^3/ft^3
Dredge Cell	1.71e-005	0.05	0.49 ft^3/ft^3



Seepage Analysis
Section F-F'
Ash Ponds 2

Long-Term Loading Conditions
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
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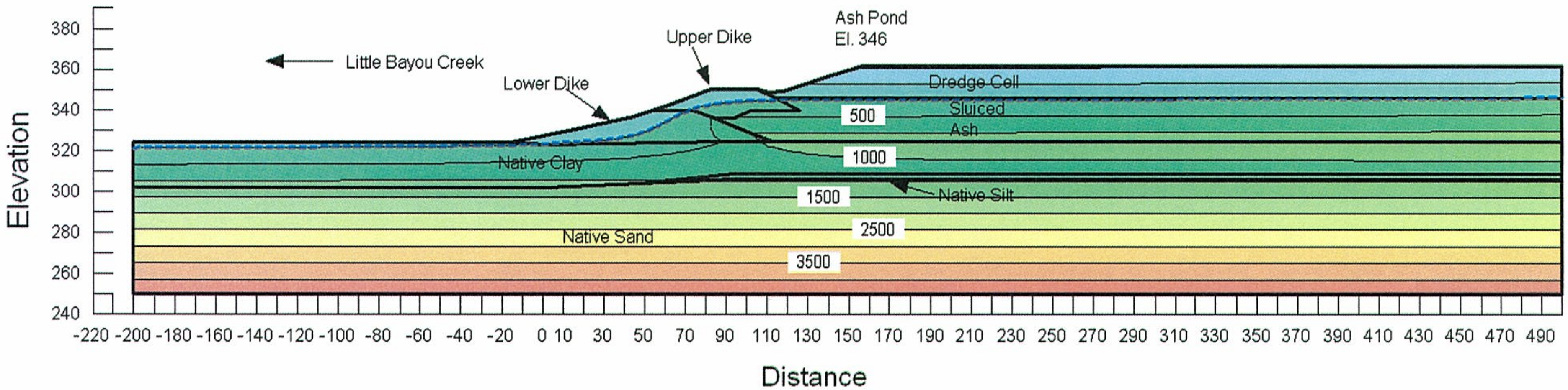
Native Sand	0.0246	0.02	0.48 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.35 ft^3/ft^3
Dredge Cell	1.71e-005	0.05	0.49 ft^3/ft^3



Seepage Analysis
Section F-F'
Ash Ponds 2

Long-Term Loading Condition
Vertical Gradient

Shawnee Fossil Plant
Tennessee Valley Authority

Piping Potential
FSpiping = >4

May 2010
Method: Steady-State
File Name: SHF_SectionF_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
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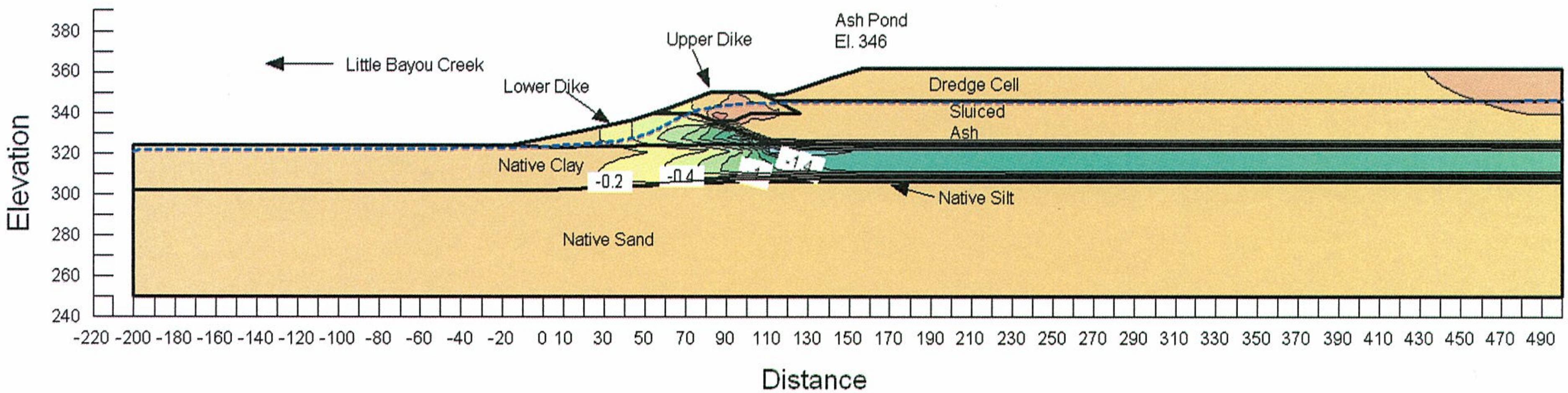
Native Silt	9.84e-005	0.033	0.35 ft^3/ft^3
Dredge Cell	1.71e-005	0.05	0.49 ft^3/ft^3



Seepage Analysis
Section F-F'
Ash Pond 2

Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper DIke	1.48e-009	0.2	0.32 ft³/ft³
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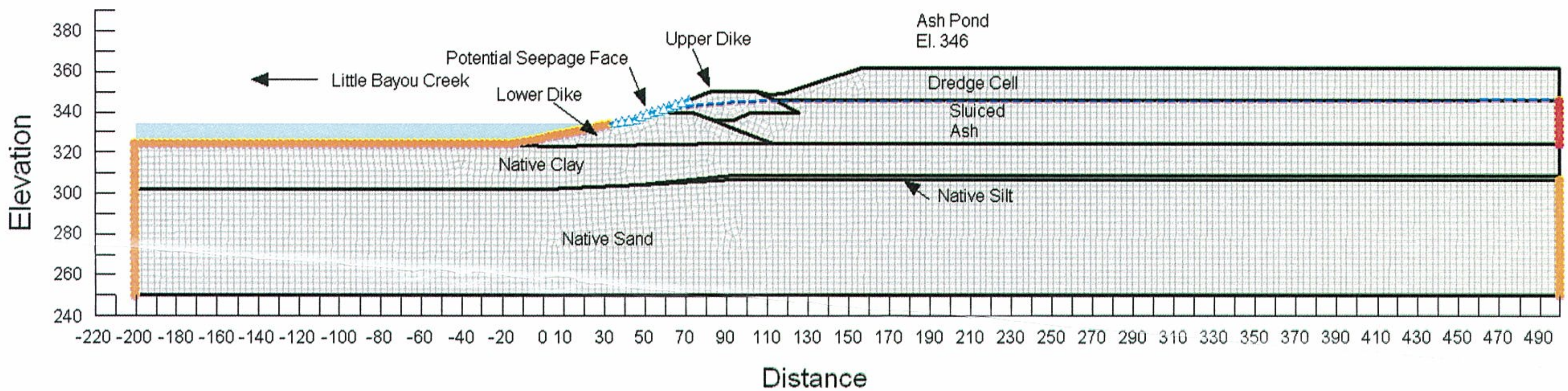
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³
Dredge Cell	1.71e-005	0.05	0.49 ft³/ft³



Seepage Analysis
Section F-F'
Ash Pond 2

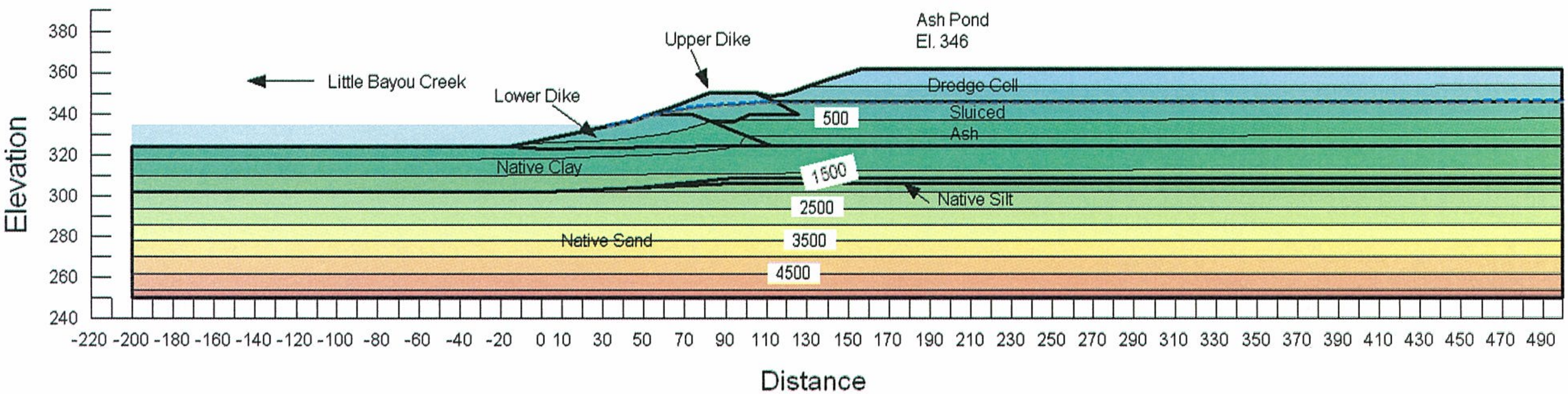
Rapid Drawdown High Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dlke	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3
Dredge Cell	1.71e-005	0.05	0.49 ft^3/ft^3



Seepage Analysis
Section F-F'
Ash Ponds 2

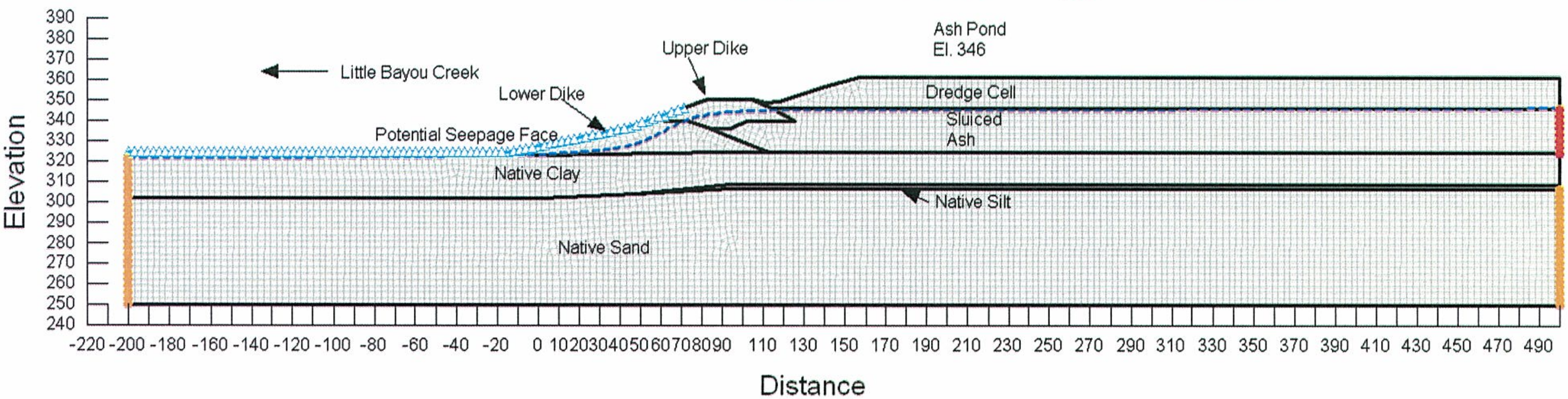
Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³
Dredge Cell	1.71e-005	0.05	0.49 ft³/ft³



Seepage Analysis
Section F-F'
Ash Pond 2

Rapid Drawdown Low Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionF_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
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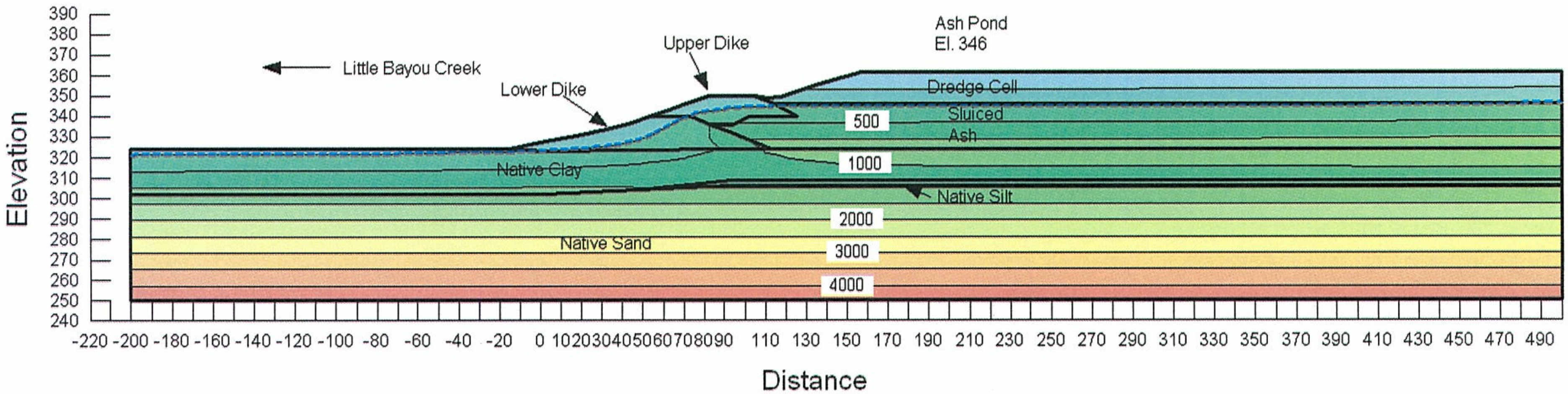

Seepage Analysis
Section H-H'
Ash Pond 2

Long-Term Loading Conditions
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	4.86e-009	0.2	0.32 ft^3/ft^3
Lower Dike	9.12e-010	0.5	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand and Gravel	0.0246	0.02	0.35 ft^3/ft^3
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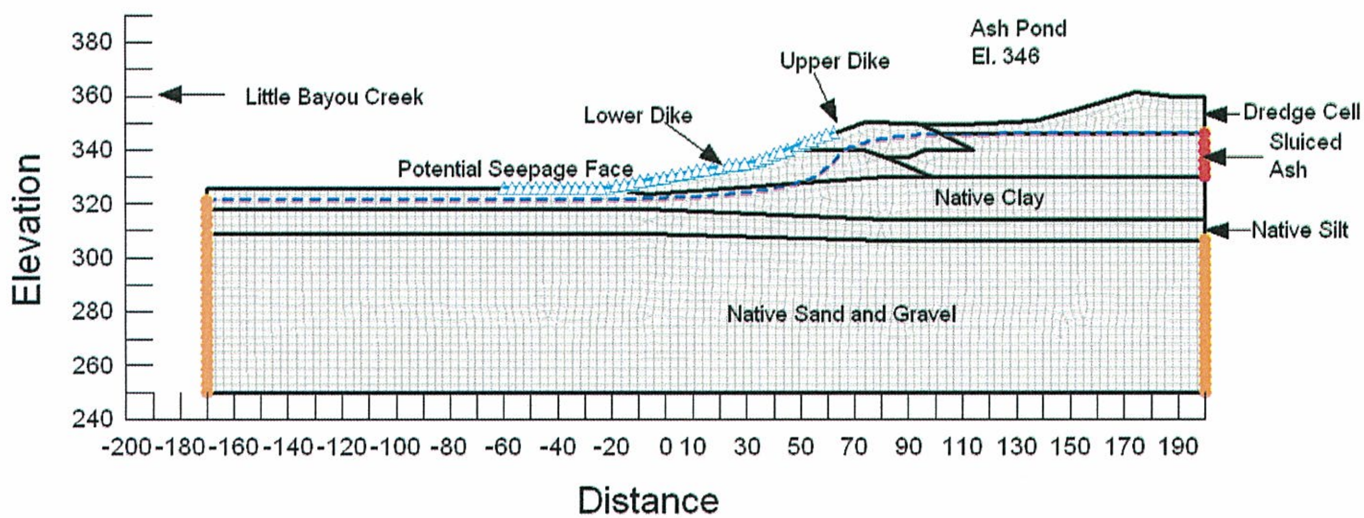

Seepage Analysis
Section H-H'
Ash Pond 2

Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

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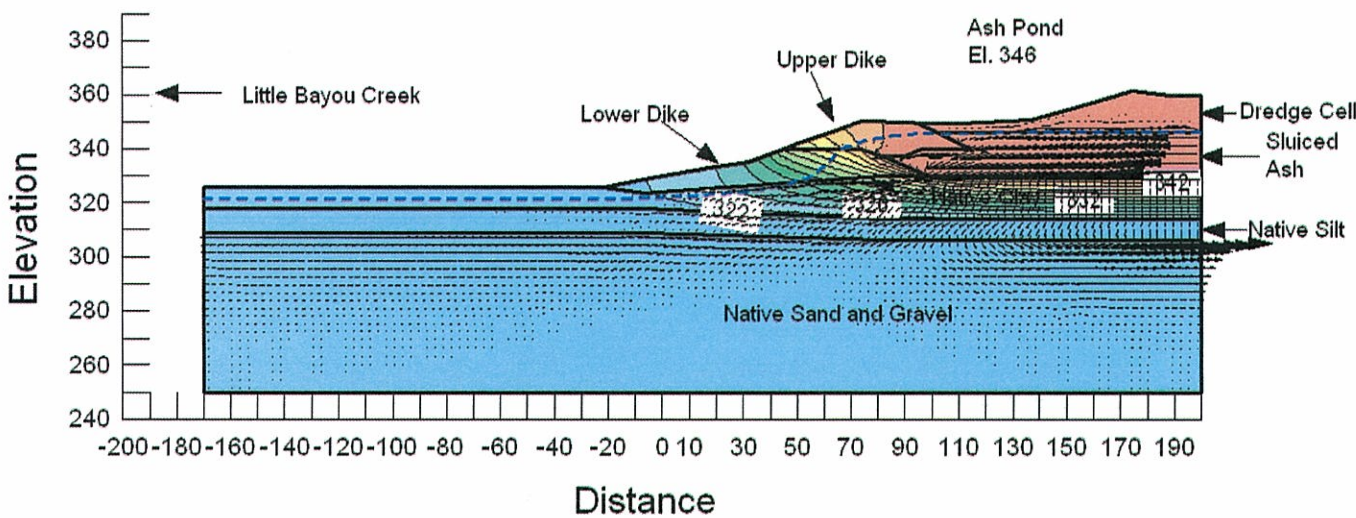
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand and Gravel	0.0246	0.02	0.35 ft³/ft³
Dredge Cell	1.71e-005	0.05	0.49 ft³/ft³



Seepage Analysis
Section H-H'
Ash Pond 2

Long-Term Loading Conditions
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_LT.gsz

Note:
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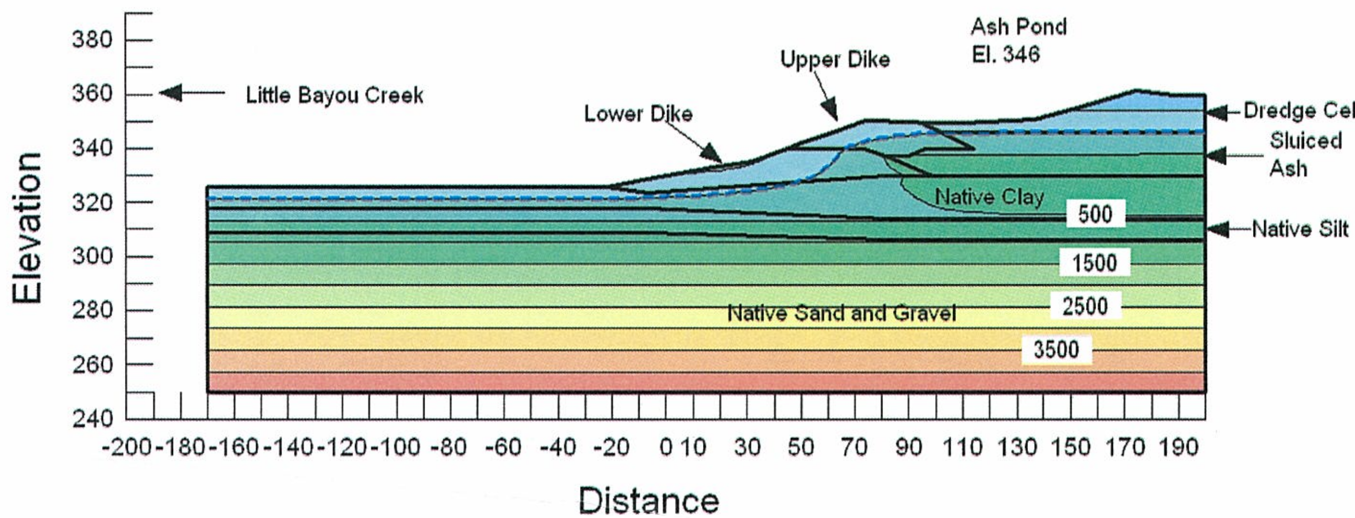

Seepage Analysis
Section H-H'
Ash Pond 2

Long-Term Loading Conditions
Vertical Gradient

Shawnee Fossil Plant
Tennessee Valley Authority

Piping Potential
Fspiping = >4

May 2010
Method: Steady-State
File Name: SHF_SectionH_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

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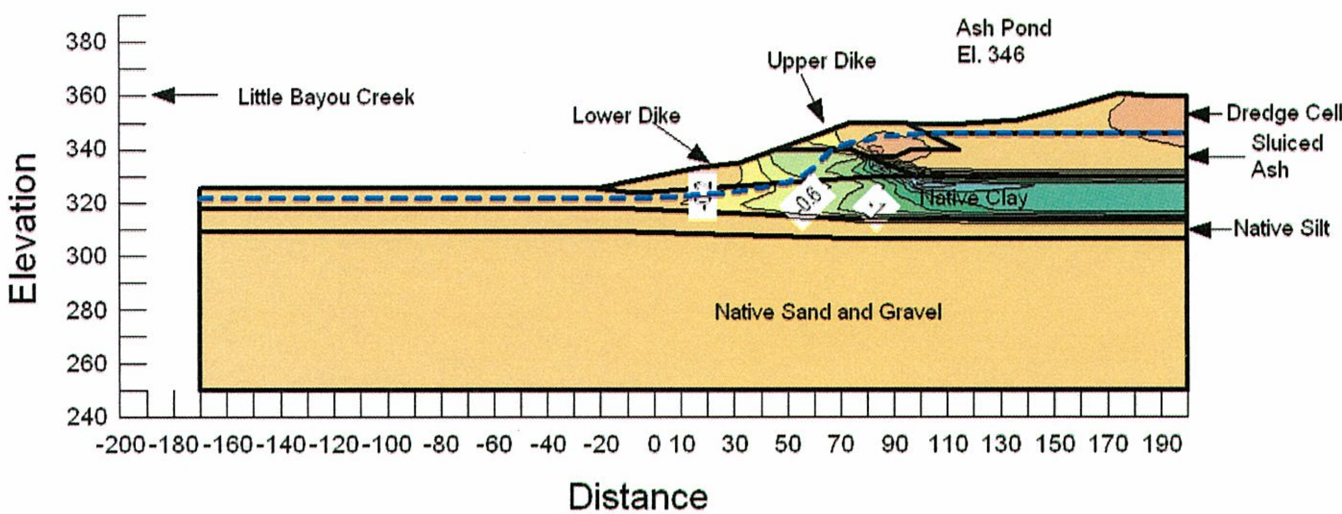

Seepage Analysis
Section H-H'
Ash Pond 2

Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_RD_High.gsz

Note:
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Native Sand and Gravel	0.0246	0.02	0.35 ft^3/ft^3
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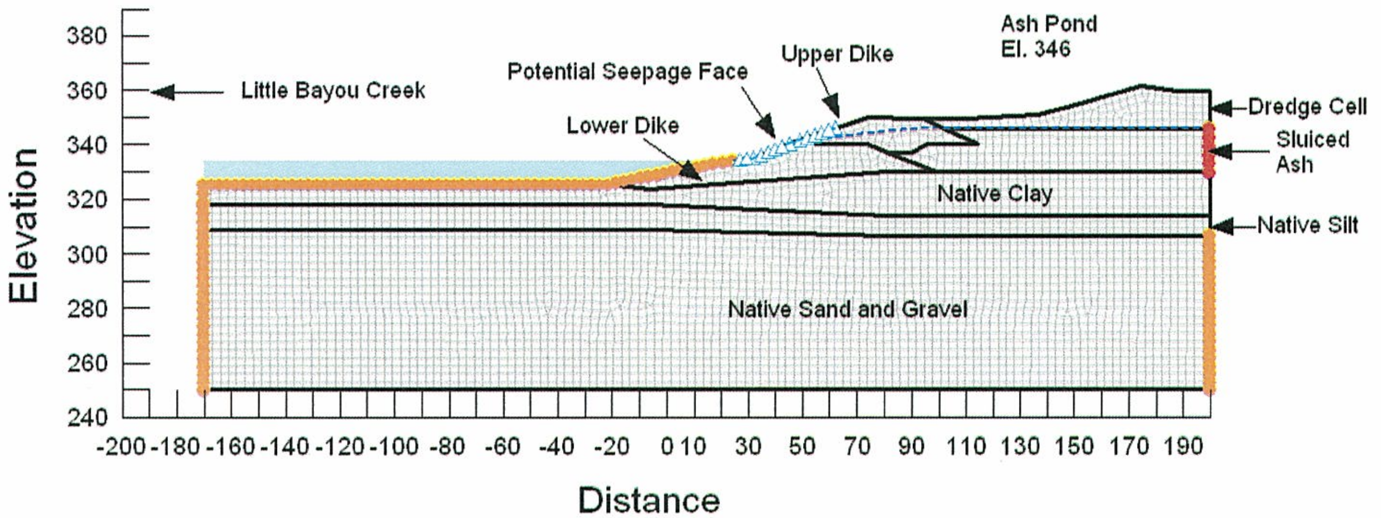

Seepage Analysis
Section H-H'
Ash Pond 2

Rapid Drawdown High Water Level
Pore Water Pressures

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_RD_High.gsz

Note:
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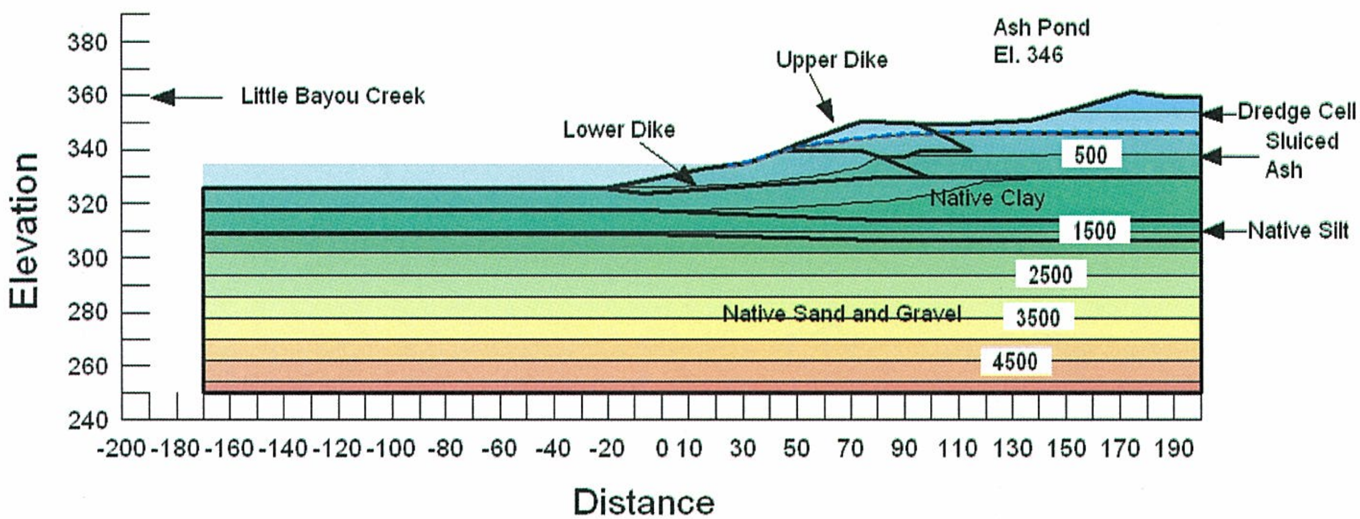

Seepage Analysis
Section H-H'
Ash Pond 2

Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_RD_Low.gsz

Note:
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Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
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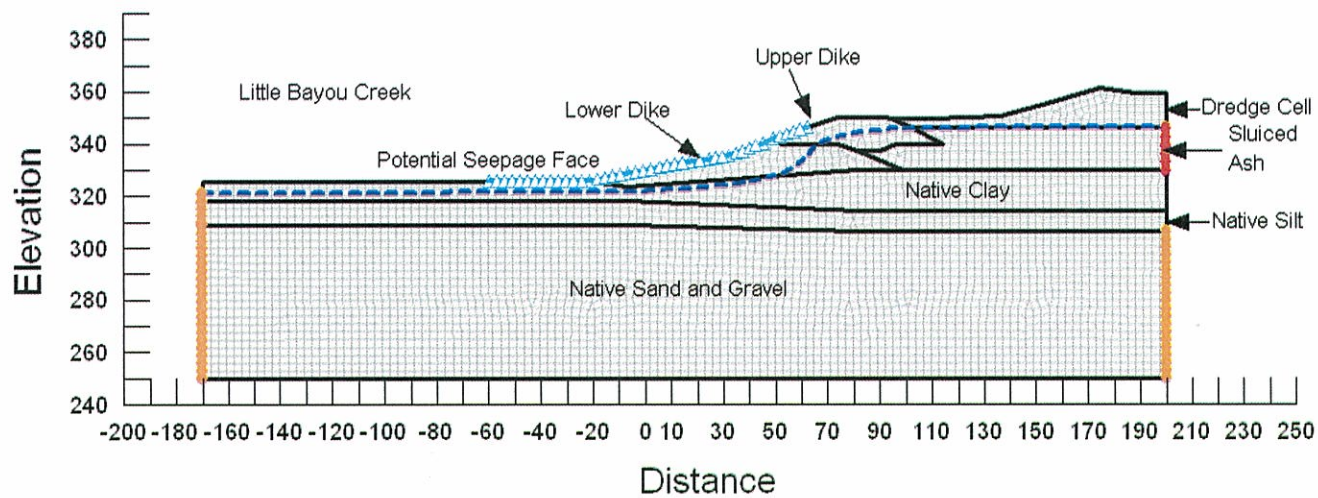
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand and Gravel	0.0246	0.02	0.35 ft³/ft³
Dredge Cell	1.71e-005	0.05	0.49 ft³/ft³



Seepage Analysis
Section H-H'
Ash Pond 2

Rapid Drawdown Low Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionH_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

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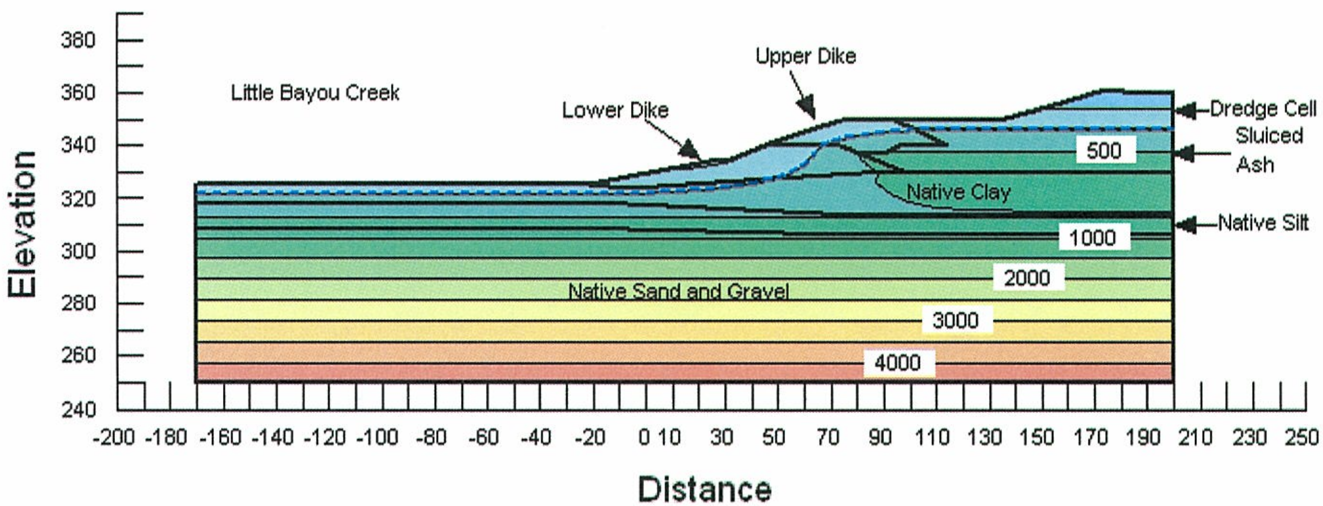
Dredge Cell	1.71e-005	0.05	0.49 ft³/ft³



Seepage Analysis
Section N-N'
Ash Pond 2

Long-Term Loading Conditions
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
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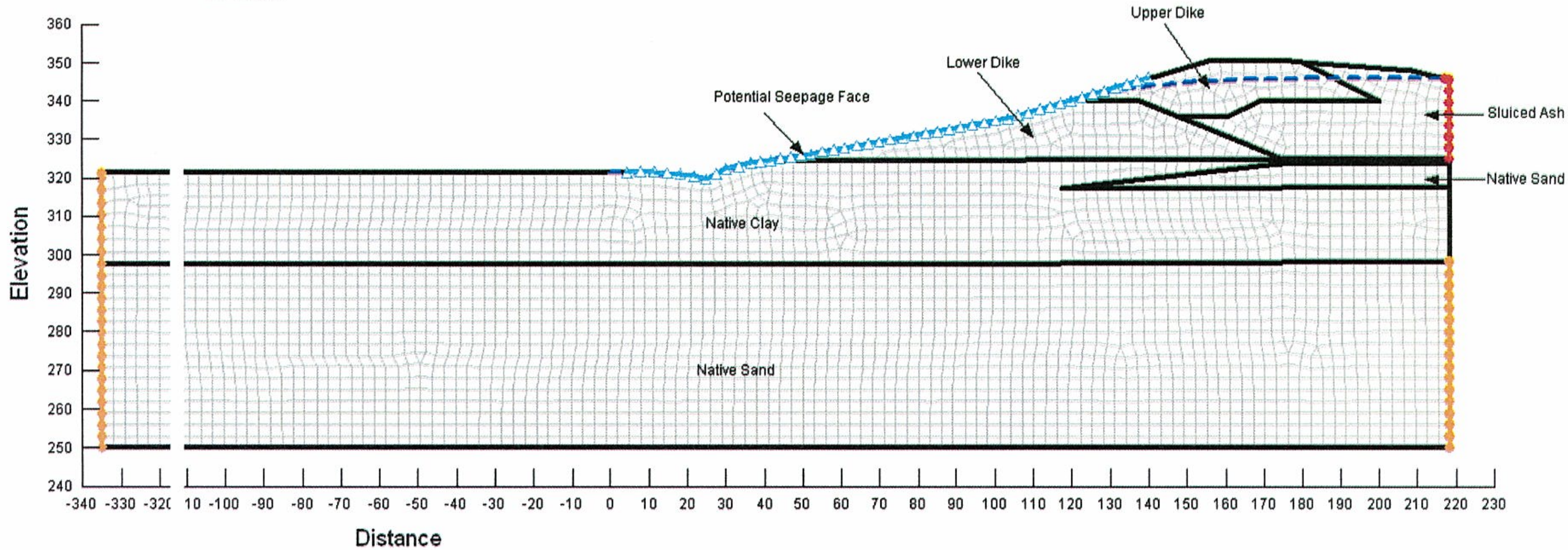

Seepage Analysis
Section N-N'
Ash Pond 2

Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
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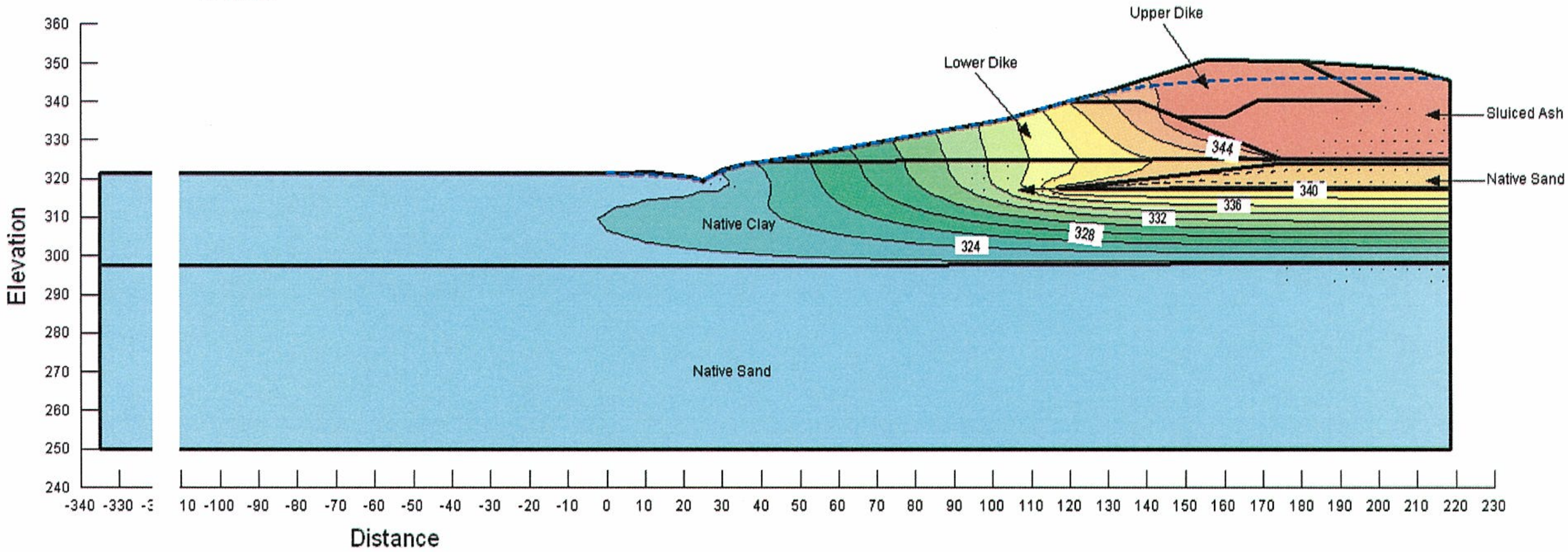
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section N-N'
Ash Pond 2

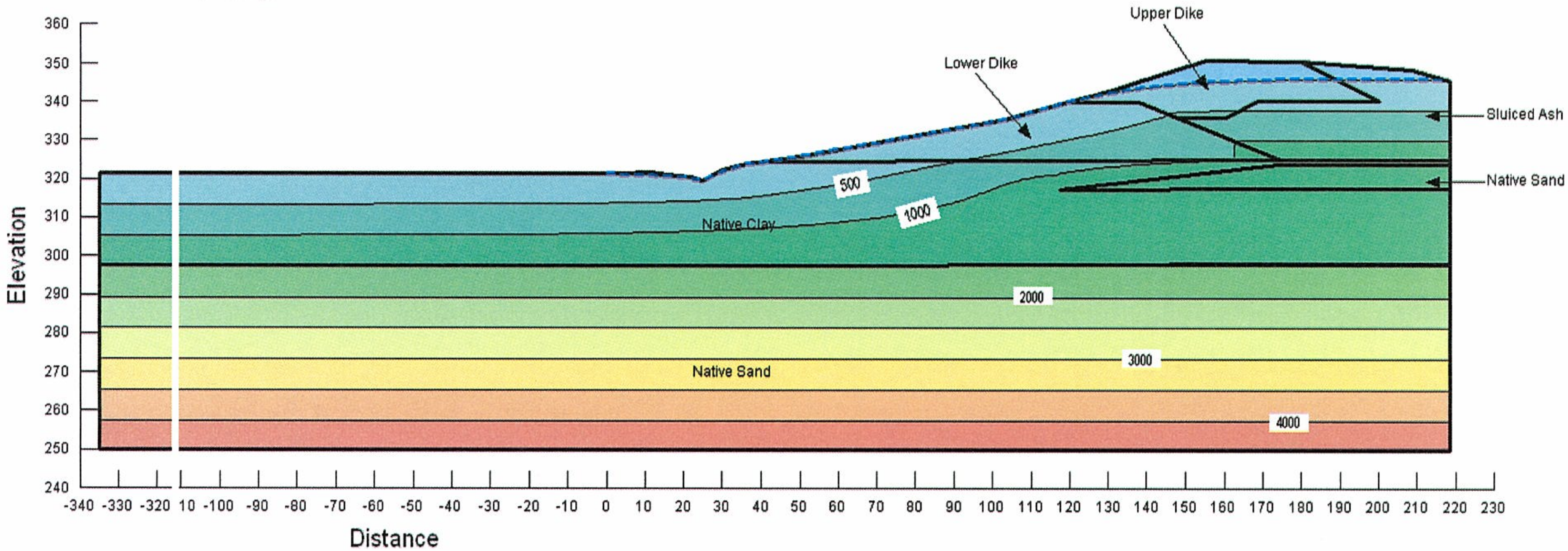
Long-Term Loading Conditions
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section N-N'
Ash Pond 2

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Long-Term Loading Conditions
Vertical Gradient

Piping Potential
Maximum occurs at (24.96,319.59)
Total Head = 319.59 ft
At (26.47, 313.82)
Total Head = 322.79 ft
dH = 3.2 ft dL = 5.97
i = 0.54 i(criticial) = 1.06
FSpiping = 2.0

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
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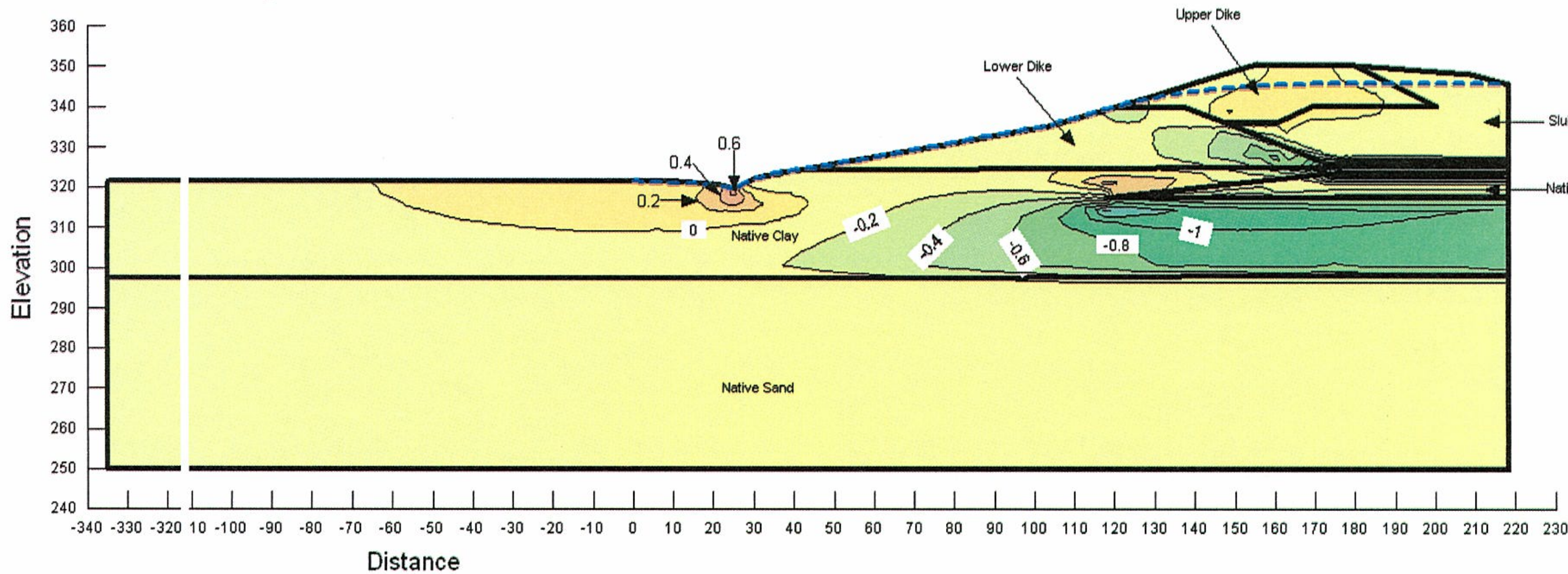


Seepage Analysis
Section N-N'
Ash Pond 2

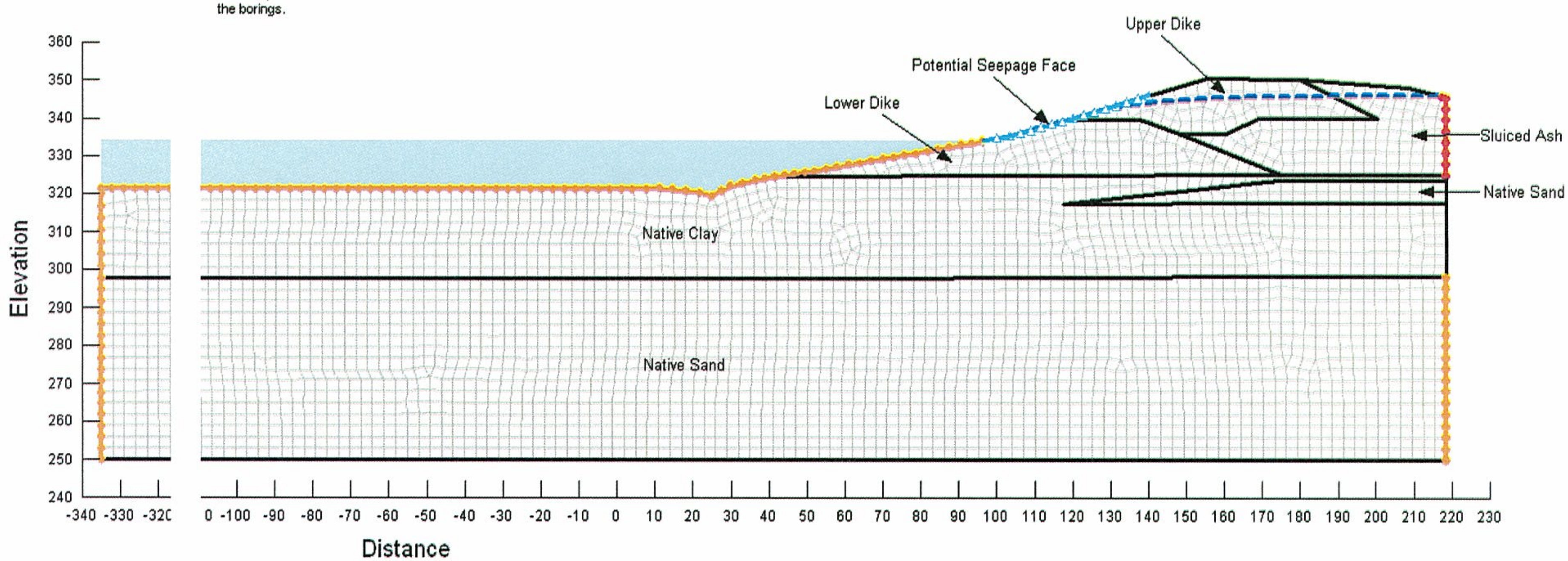
Shawnee Fossil Plant
Tennessee Valley Authority

Rapid Drawdown High Water Level
Boundary Conditions with Mesh

May 2010
Method: Steady-State
File Name: SHF_SectionN_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section N-N'
Ash Pond 2

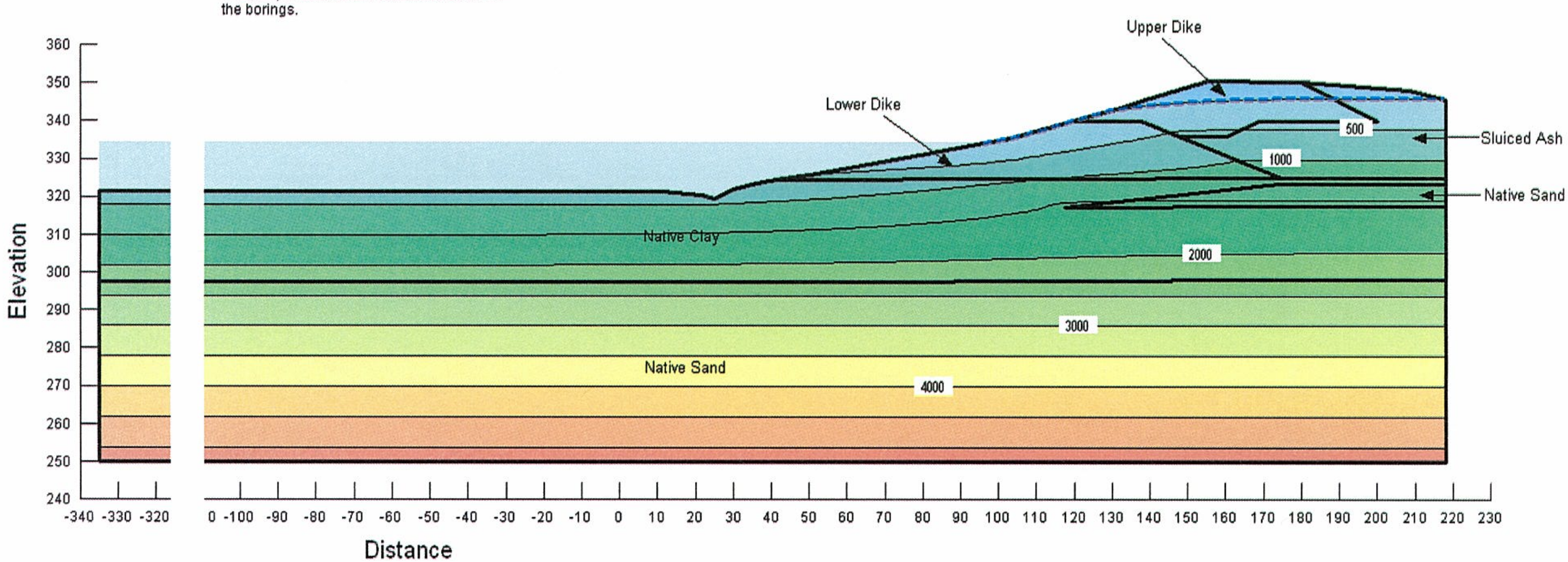
Rapid Drawdown High Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_RD_High.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section N-N'
Ash Pond 2

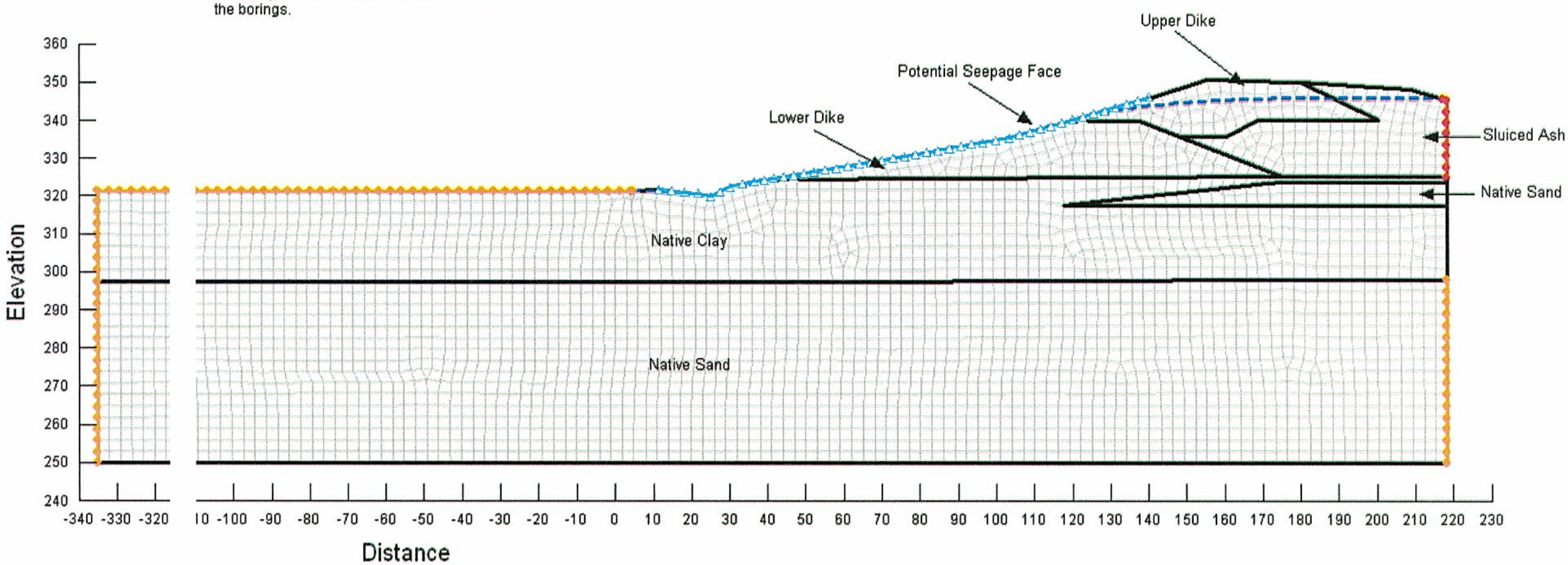
Rapid Drawdown Low Water Level
Boundary Conditions and Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_RD_Low.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³



Seepage Analysis
Section N-N'
Ash Pond 2

Rapid Drawdown Low Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionN_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
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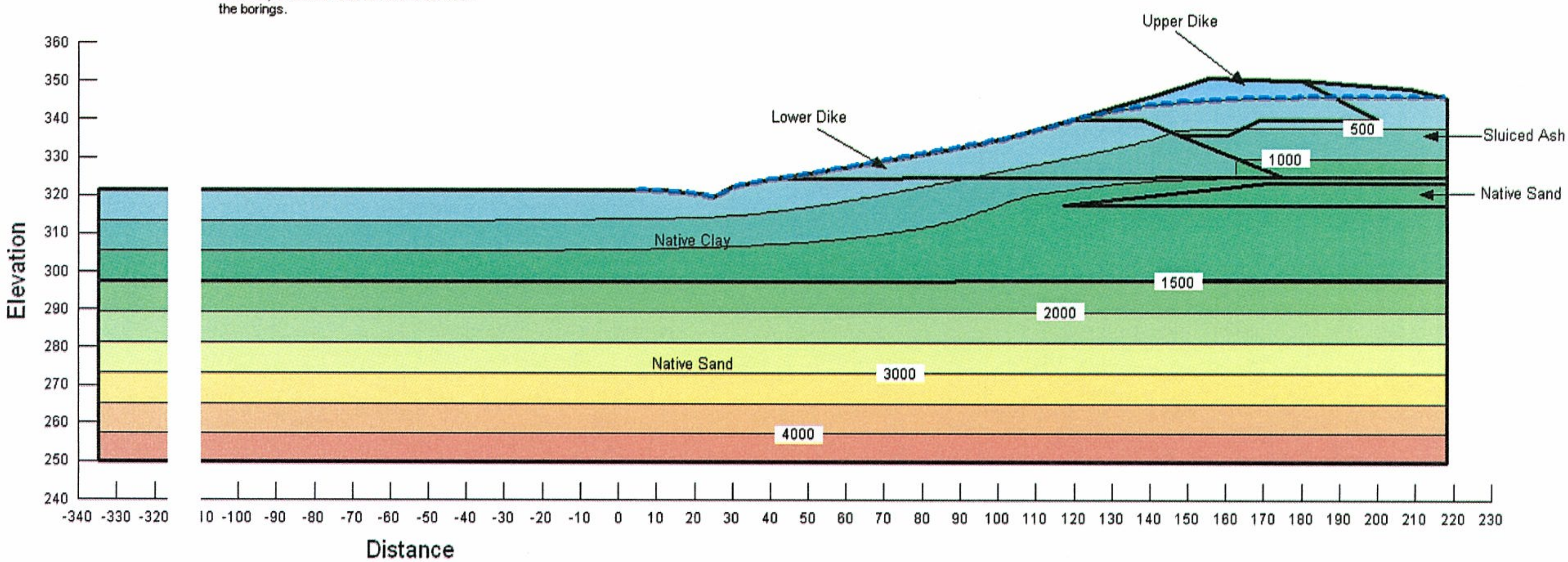


Seepage Analysis
Section P-P'
Ash Pond 2

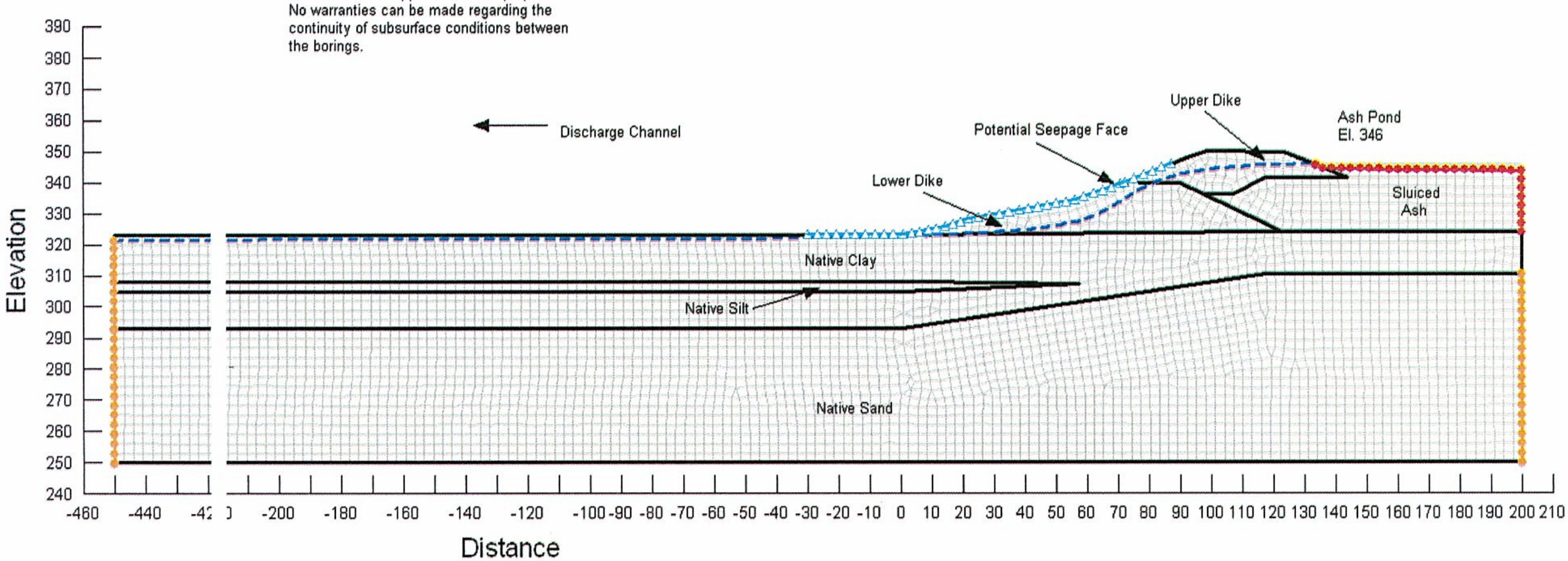
Long-Term Loading Conditions
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section P-P'
Ash Pond 2

Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
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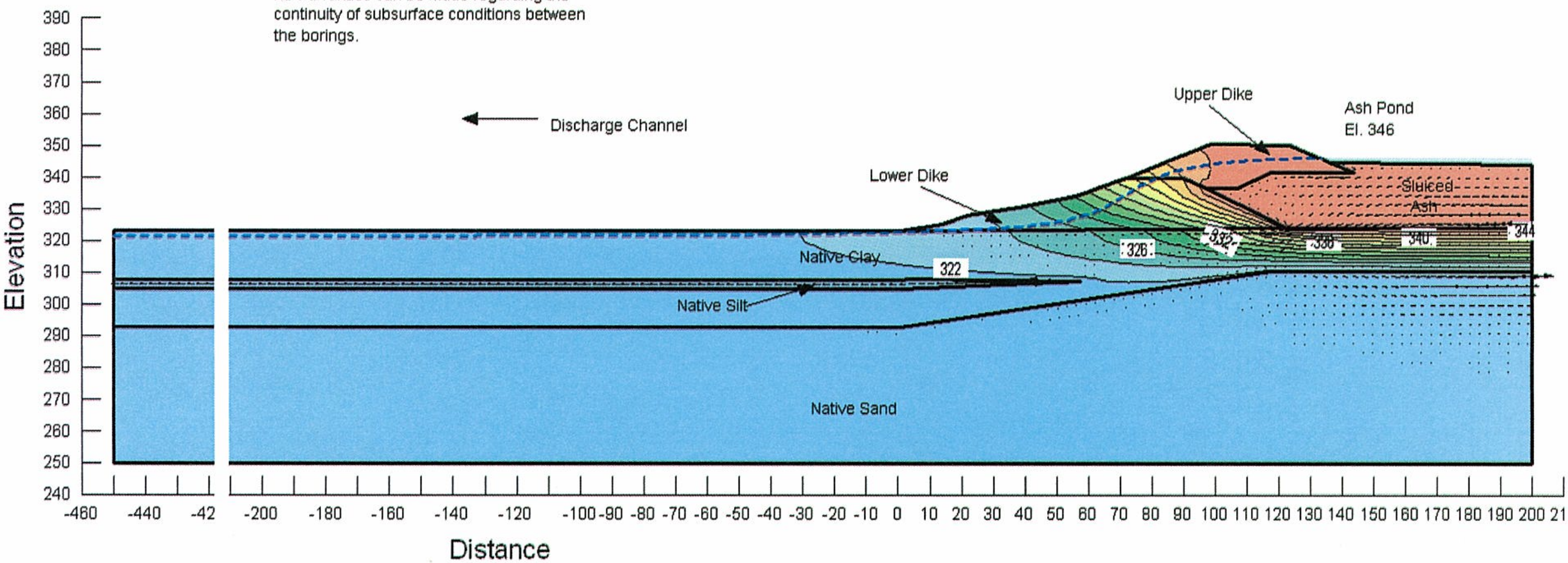


Seepage Analysis
Section P-P'
Ash Pond 2

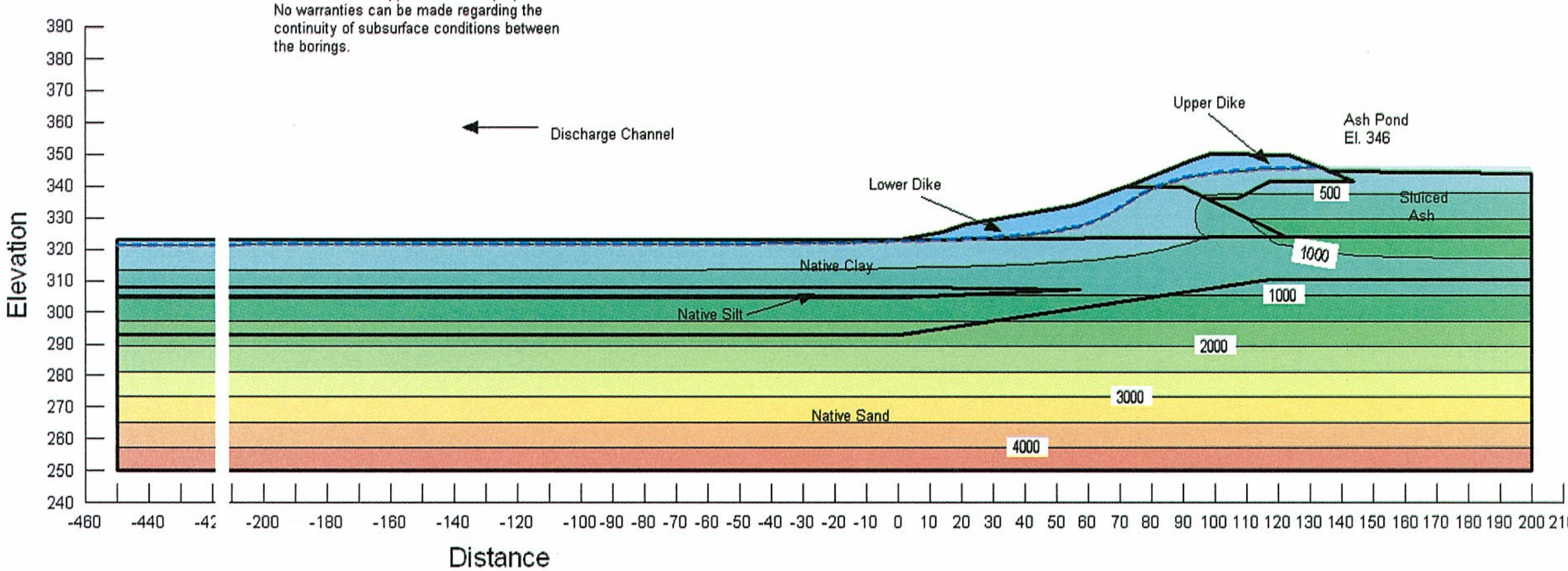
Long-Term Loading Conditions
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section P-P'
Ash Pond 2

Long-Term Loading Conditions
Vertical Gradient

Piping Potential
FSpiping = >4

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
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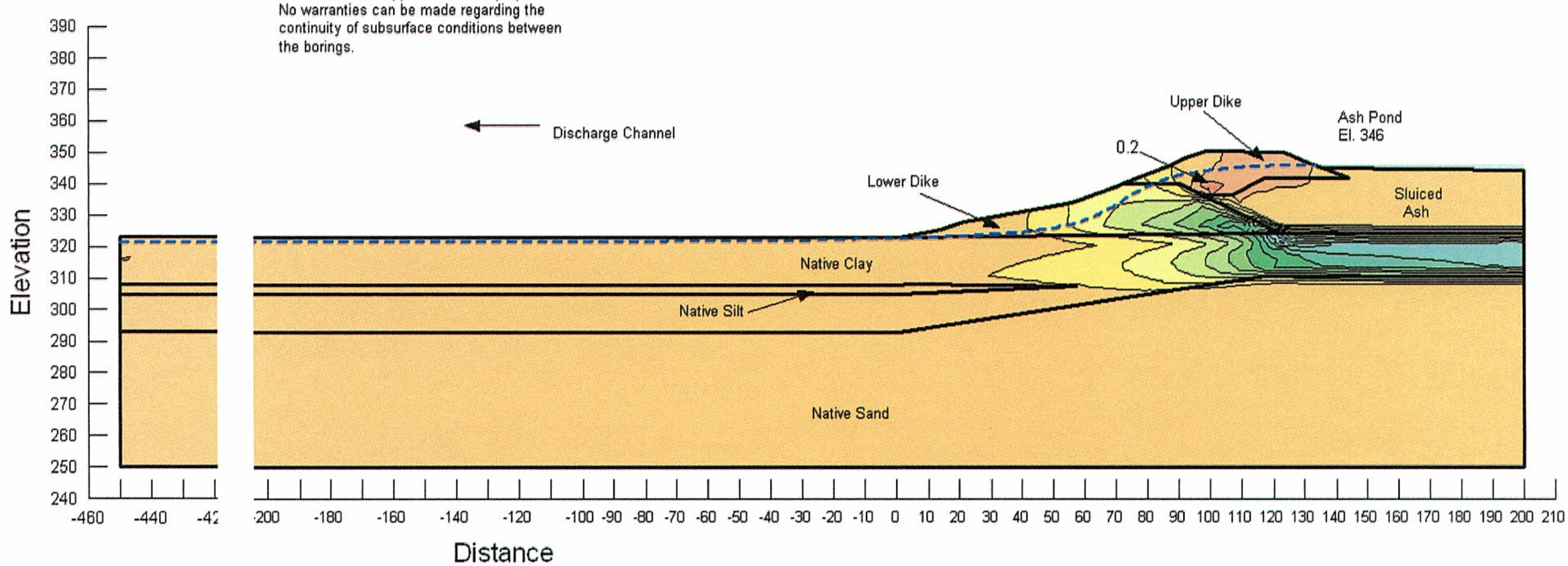


Seepage Analysis
Section P-P'
Ash Pond 2

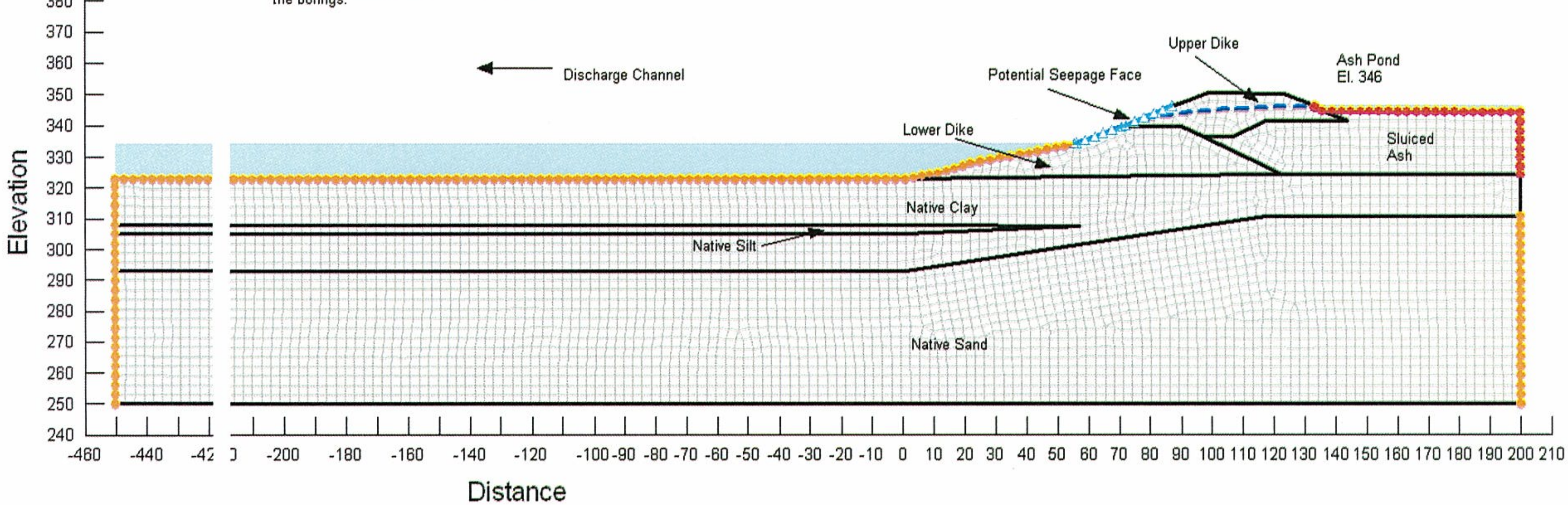
Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_RD_High.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Silt	9.84e-005	0.033	0.48 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section P-P'
Ash Pond 2

Rapid Drawdown High Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_RD_High.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
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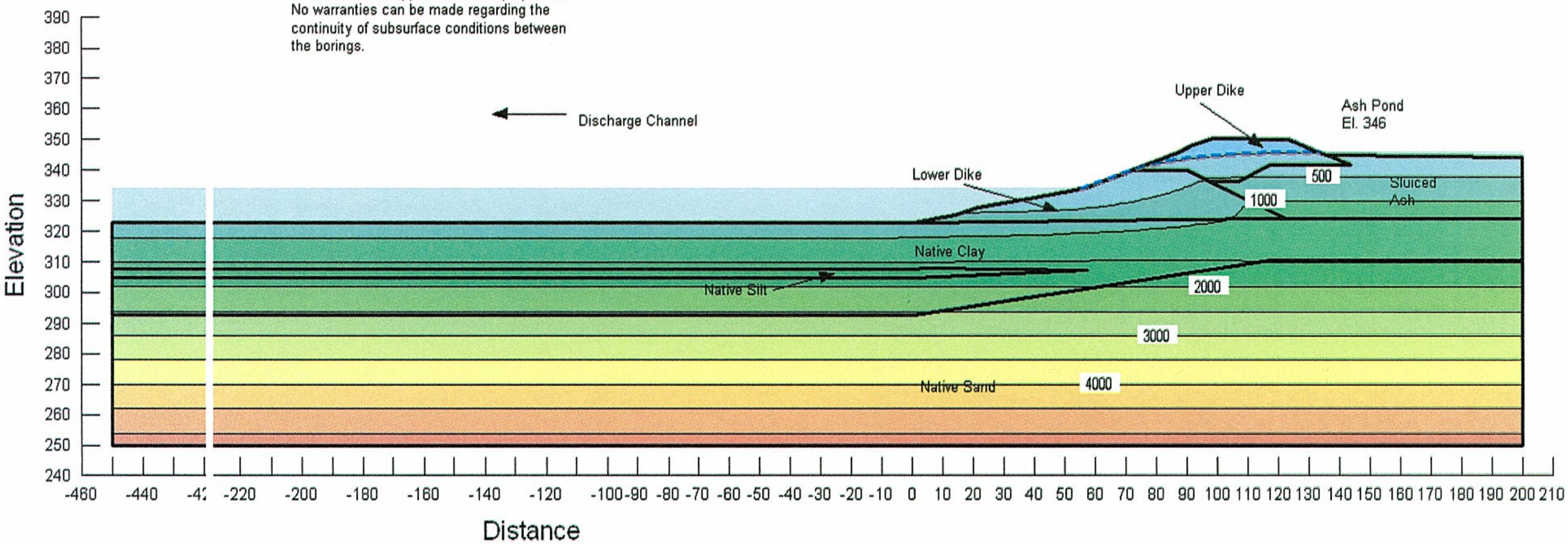

Seepage Analysis
Section P-P'
Ash Pond 2

Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Silt	9.84e-005	0.033	0.48 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
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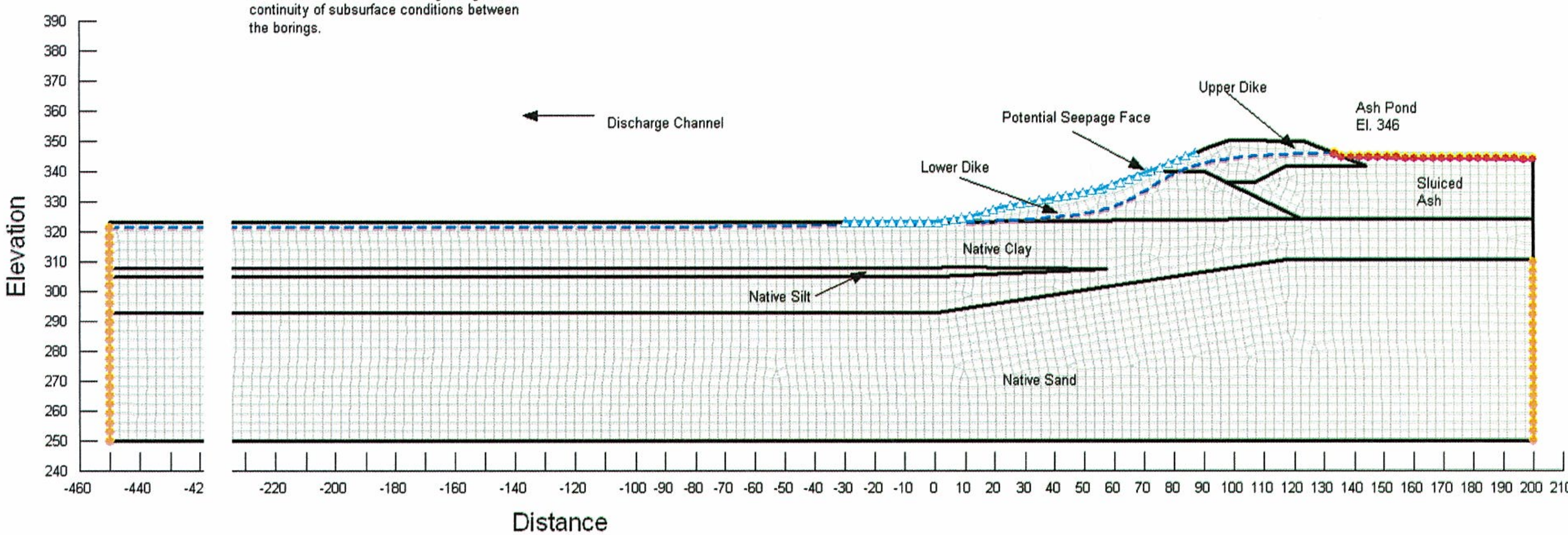

Seepage Analysis
Section P-P'
Ash Pond 2

Rapid Drawdown Low Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionP_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
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Note:
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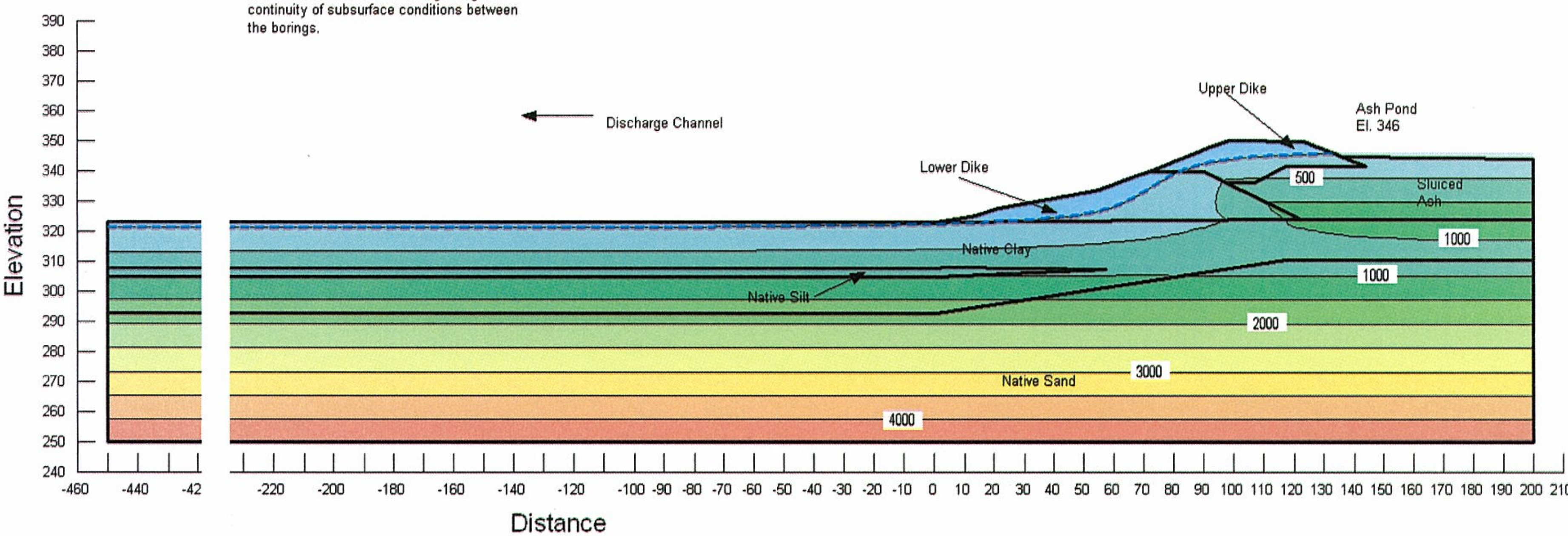


Seepage Analysis
Section R-R'
Ash Pond 2

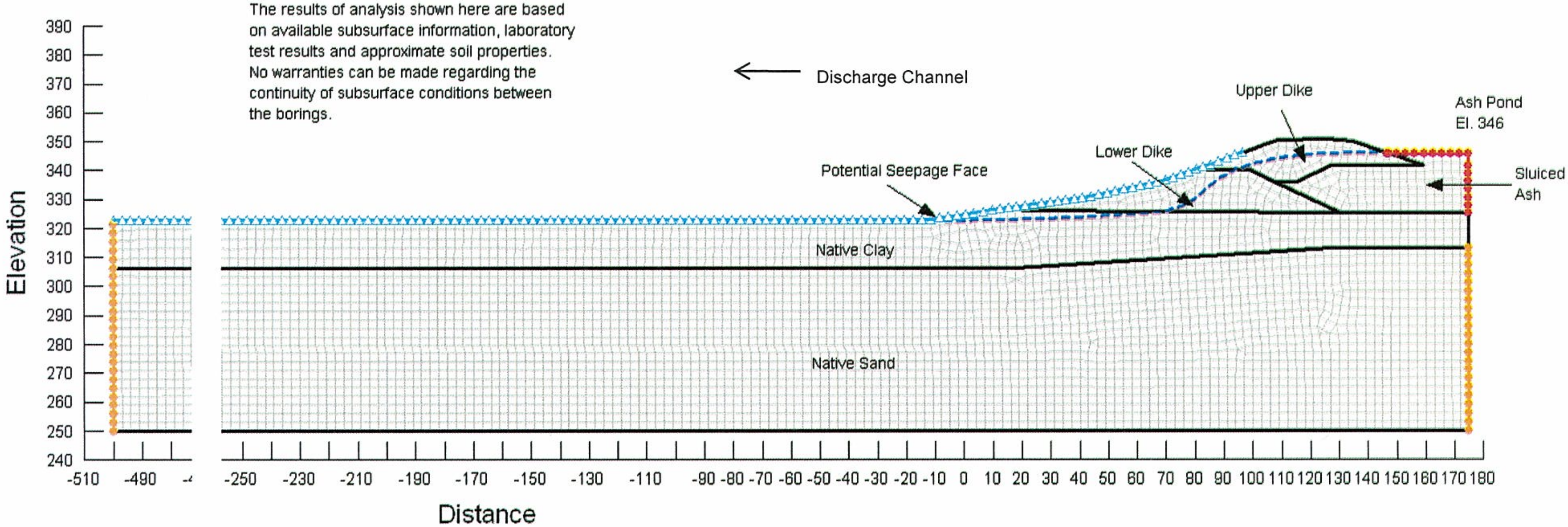
Long-Term Loading Conditions
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

May 2010
Method: Steady-State
File Name: SHF_SectionR_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section R-R'
Ash Pond 2

Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionR_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
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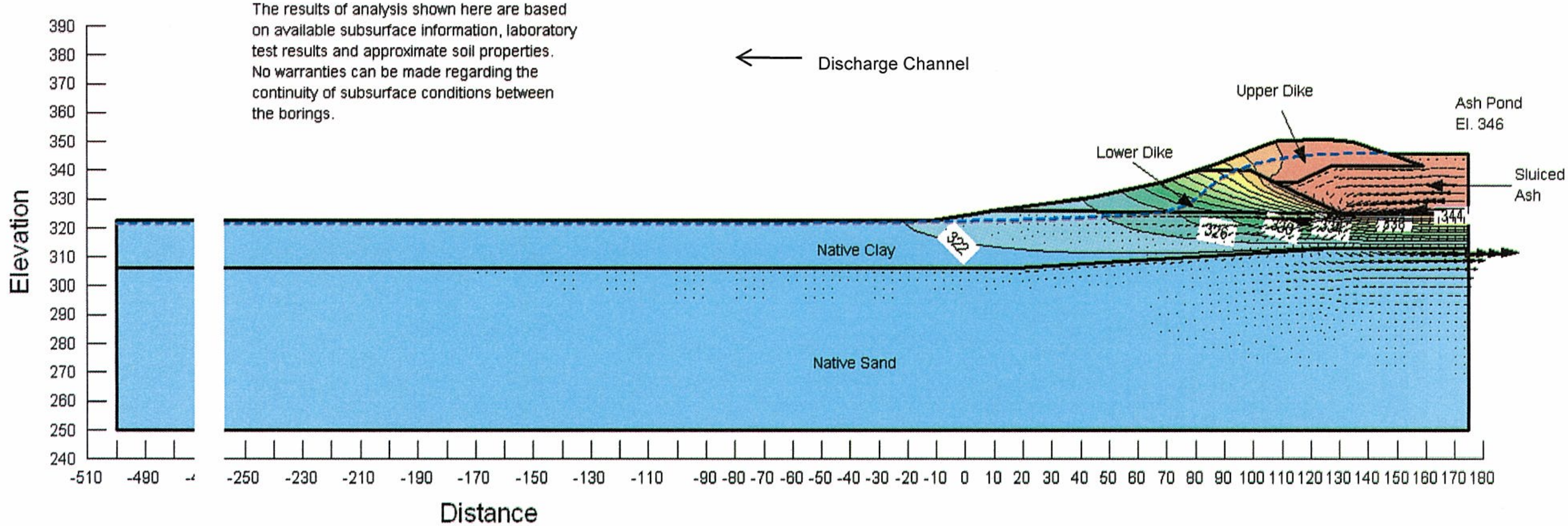

Seepage Analysis
Section R-R'
Ash Pond 2

Long-Term Loading Conditions
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionR_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

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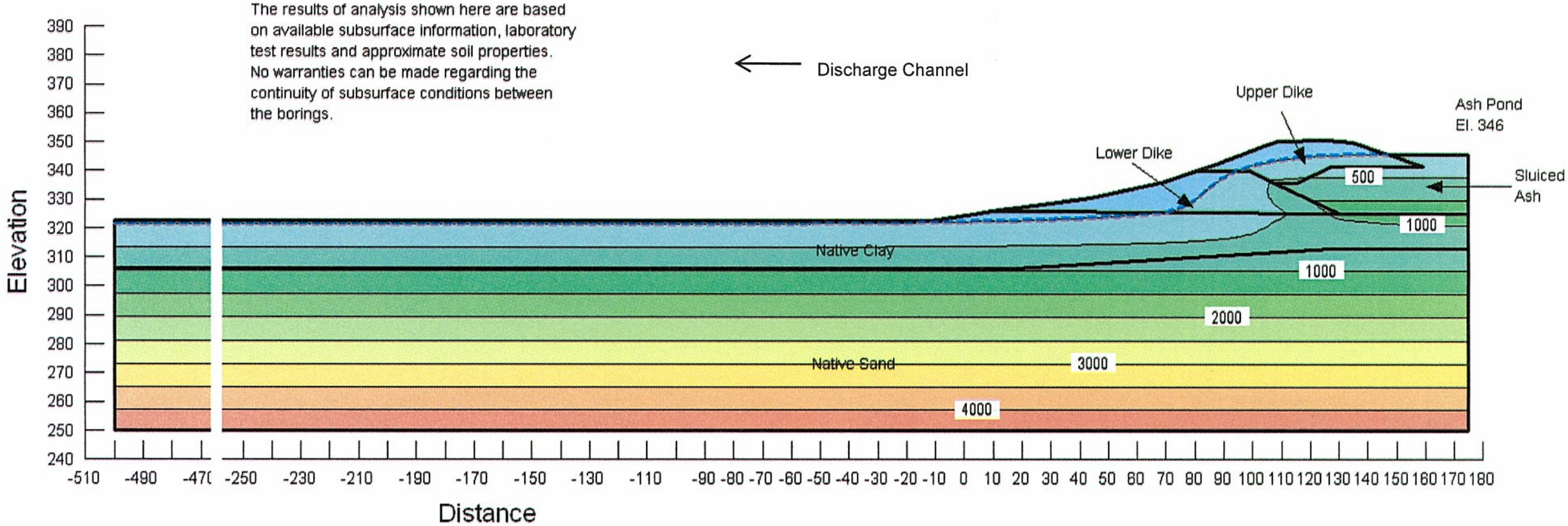


Seepage Analysis
Section R-R'
Ash Pond 2

Long-Term Loading Conditions
Vertical Gradient

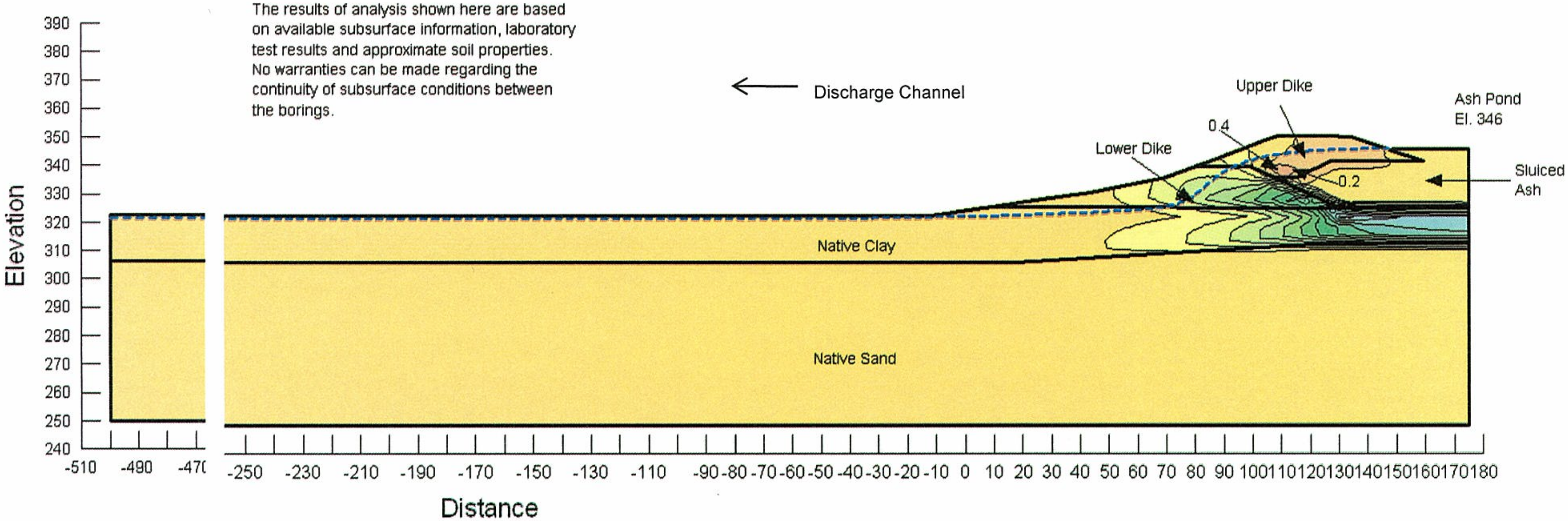
Piping Potential
FSpiping= >4

Shawnee Fossil Plant
Tennessee Valley Authority

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

May 2010
Method: Steady-State
File Name: SHF_SectionR_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section R-R'
Ash Pond 2

Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionR_RD_High.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
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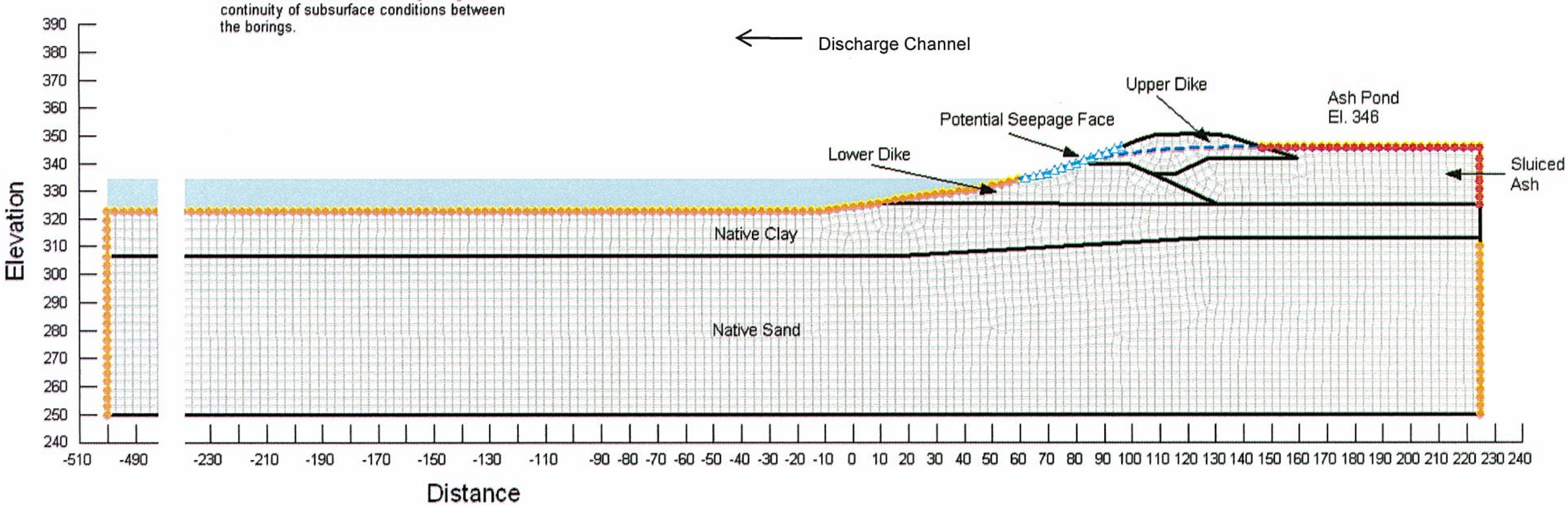

Seepage Analysis
Section R-R'
Ash Pond 2

Rapid Drawdown High Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionR_RD_High.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

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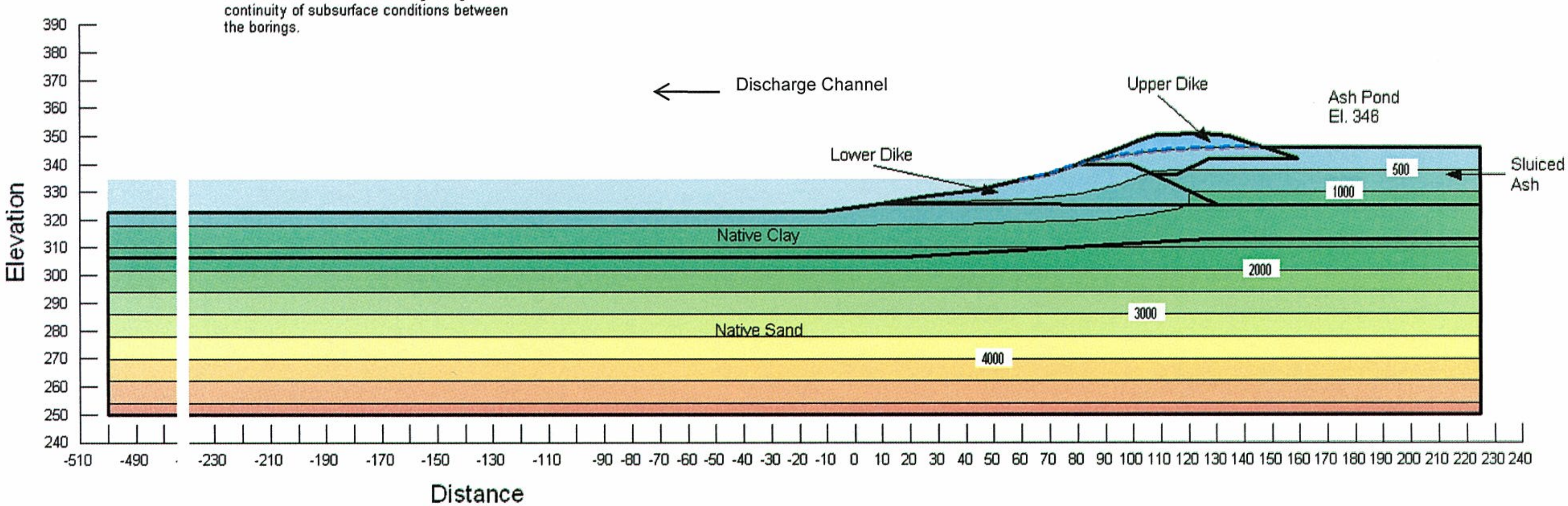

Seepage Analysis
Section R-R'
Ash Pond 2

Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionR_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
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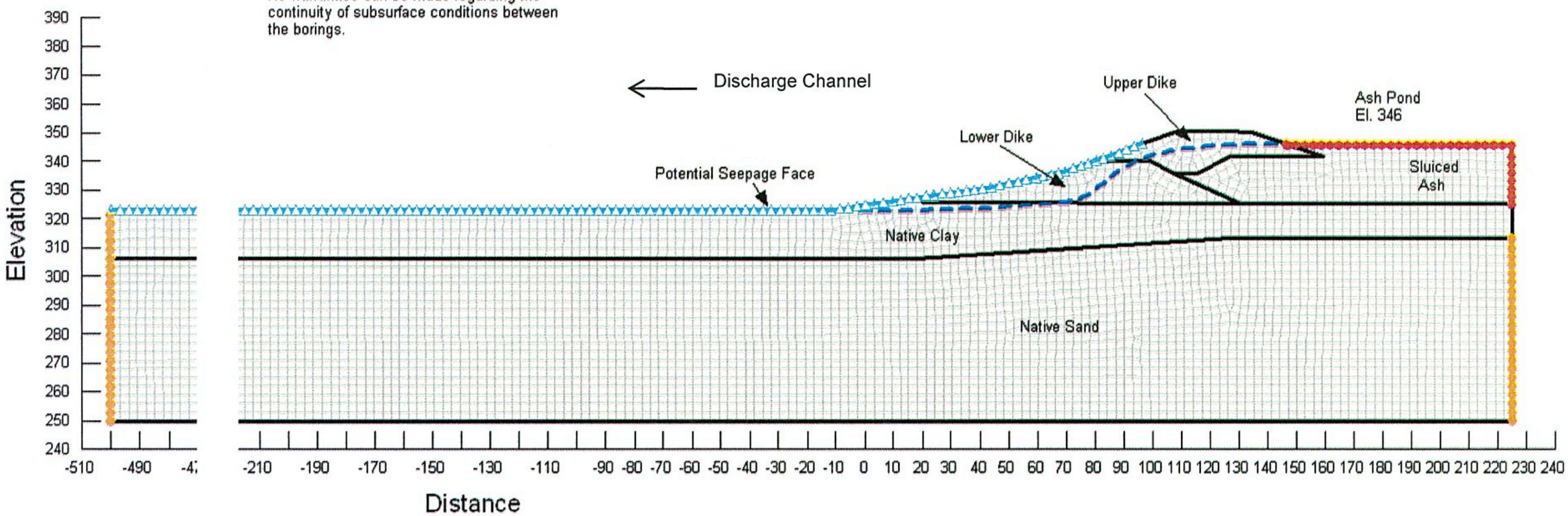


Seepage Analysis
Section R-R'
Ash Pond 2

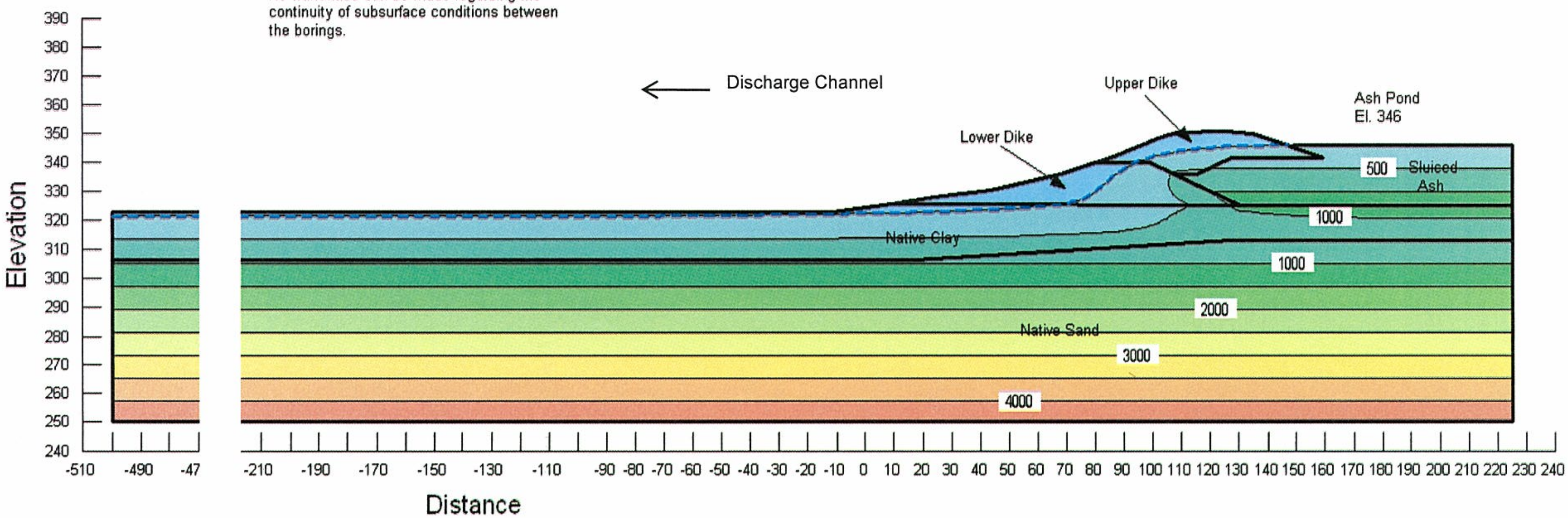
Rapid Drawdown Low Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionR_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U'
Ash Pond 2

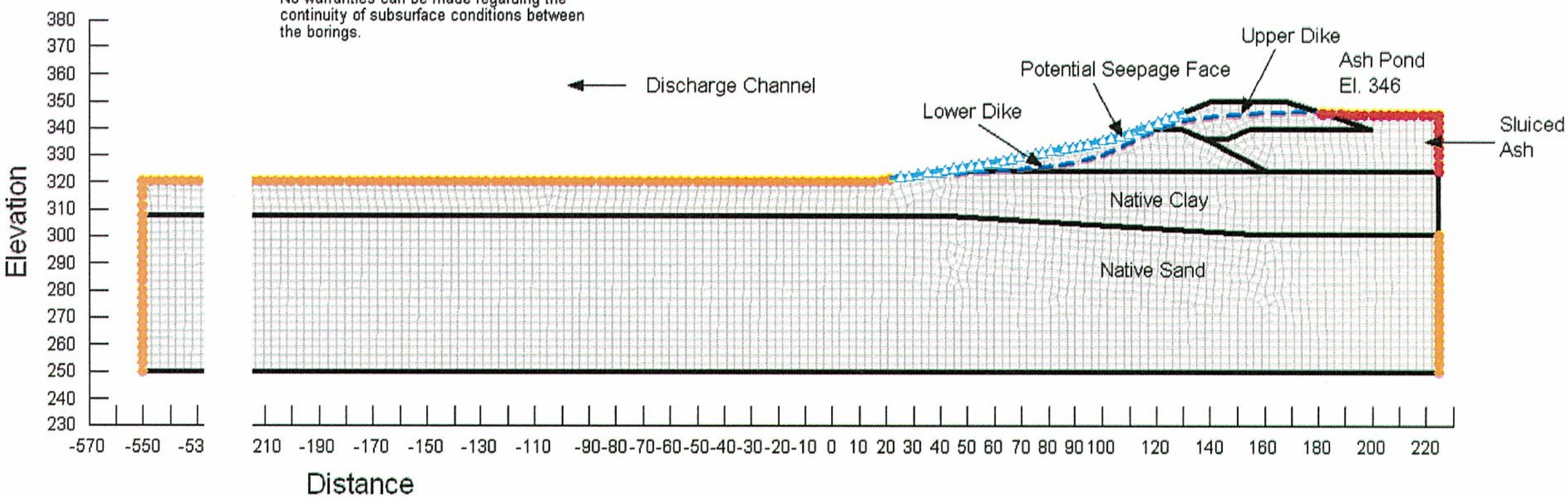
Long-Term Loading Conditions
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U'
Ash Pond 2

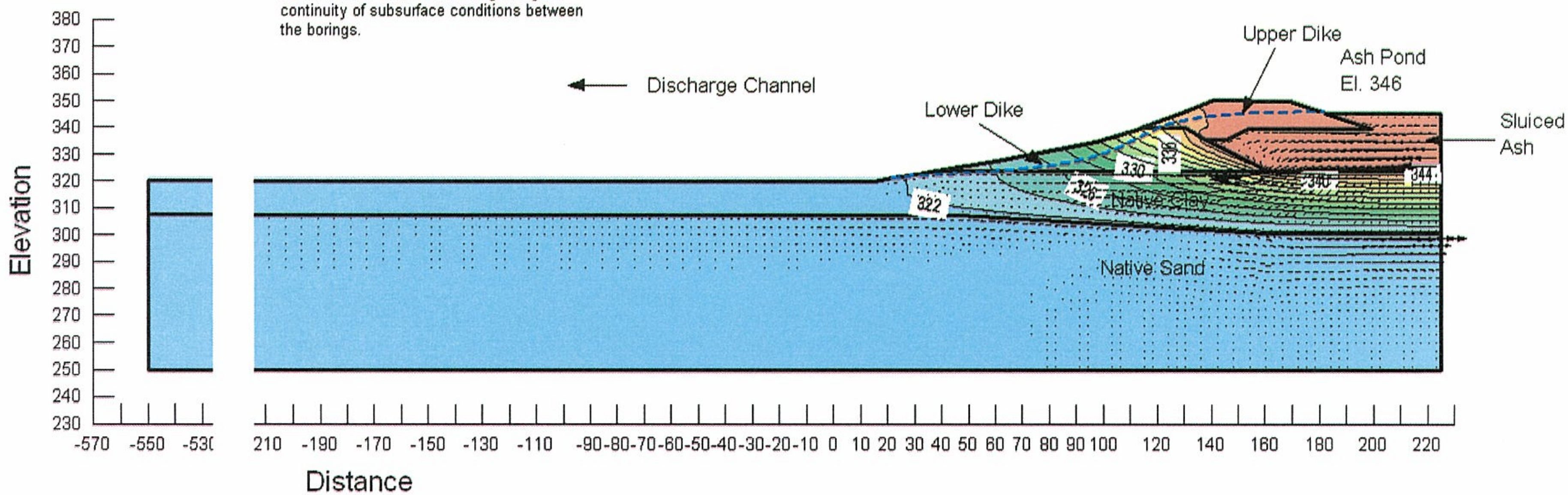
Long-Term Loading Conditions
Total Head with Flow Vectors

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U’
Ash Pond 2

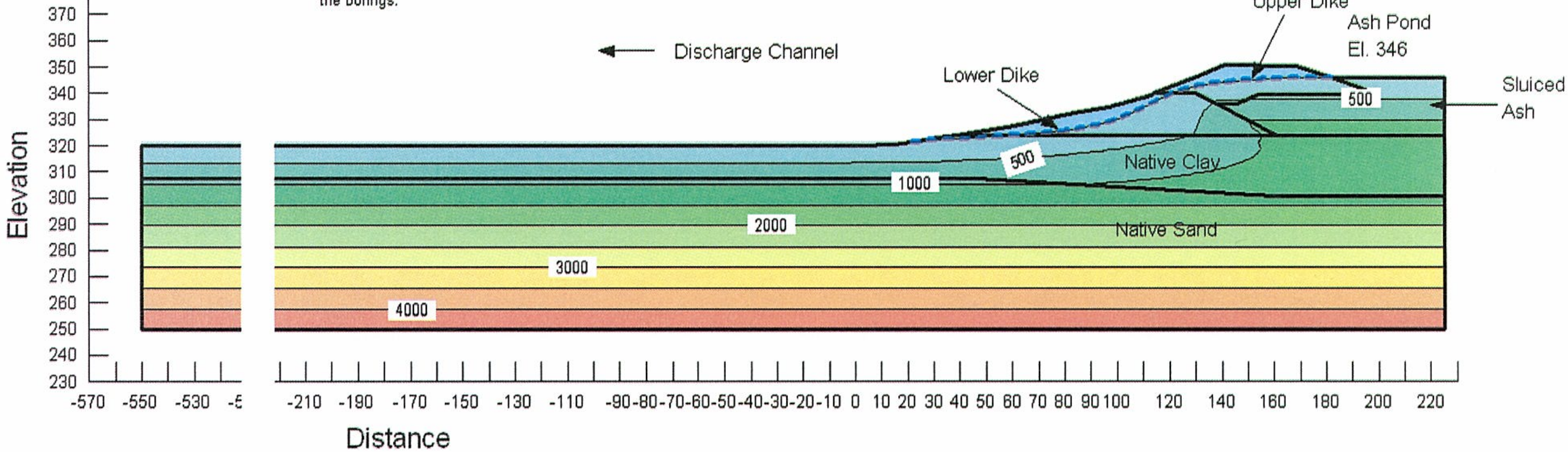
Long-Term Loading Conditions
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_LT.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U'
Ash Pond 2

Shawnee Fossil Plant
Tennessee Valley Authority

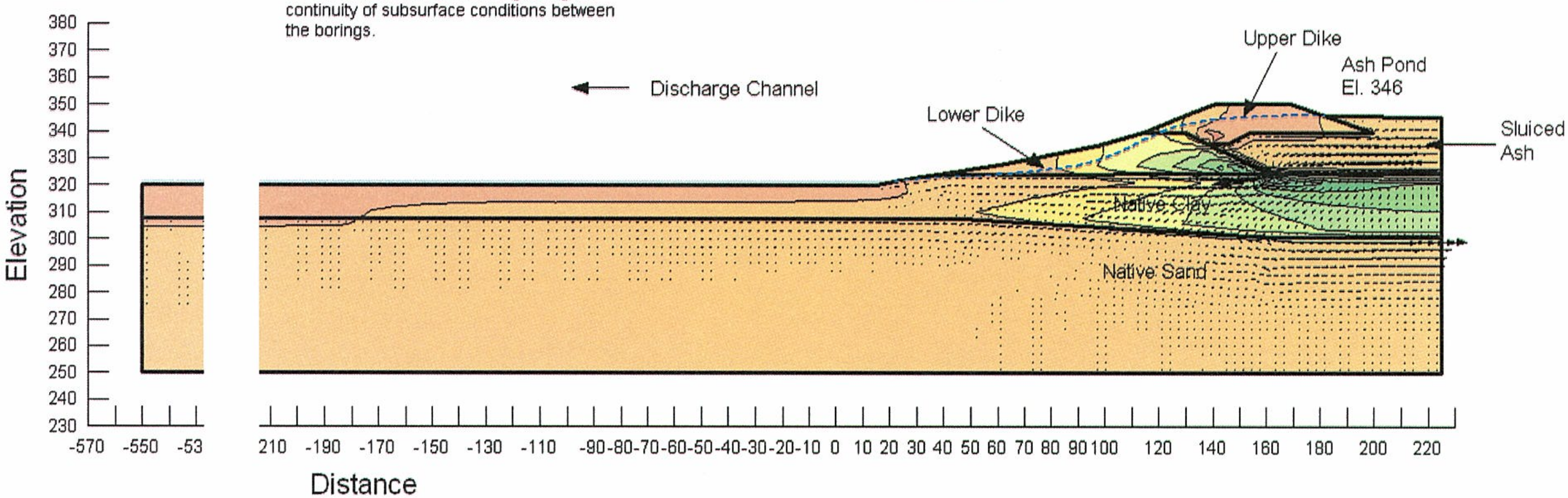
May 2010
Method: Steady-State
File Name: SHF_SectionU_LT.gsz

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.

Long-Term Loading Conditions
Vertical Gradient

Piping Potential
Maximum occurs at (21.7, 327.4)
Total Head = 321.4 ft
At (22.07, 317.15)
Total Head = 321.91 ft
dH = 0.51 ft dL = 4.27 ft
i = 0.12 i(criticial) = 1.06
FSpiping = >4

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft^3/ft^3
Lower Dike	1.37e-009	0.2	0.38 ft^3/ft^3
Sluiced Ash	1.71e-005	0.05	0.49 ft^3/ft^3
Native Clay	5.93e-008	0.05	0.38 ft^3/ft^3
Native Sand	0.0246	0.02	0.35 ft^3/ft^3



Seepage Analysis
Section U-U'
Ash Pond 2

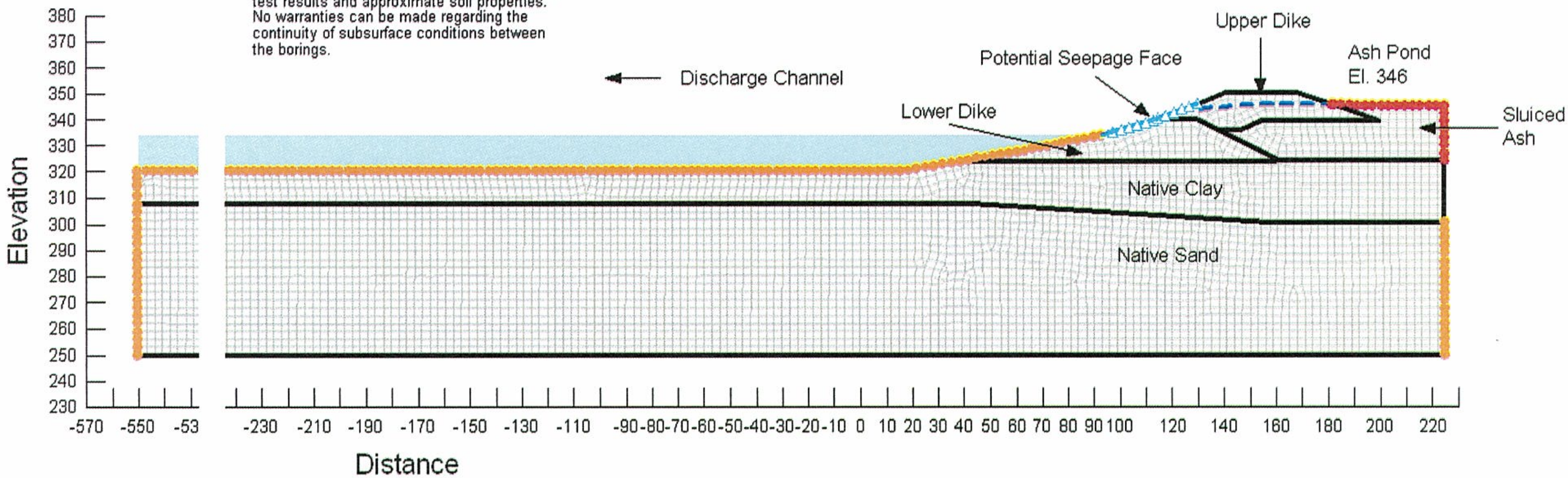
Rapid Drawdown High Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_RD_High.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U'
Ash Pond 2

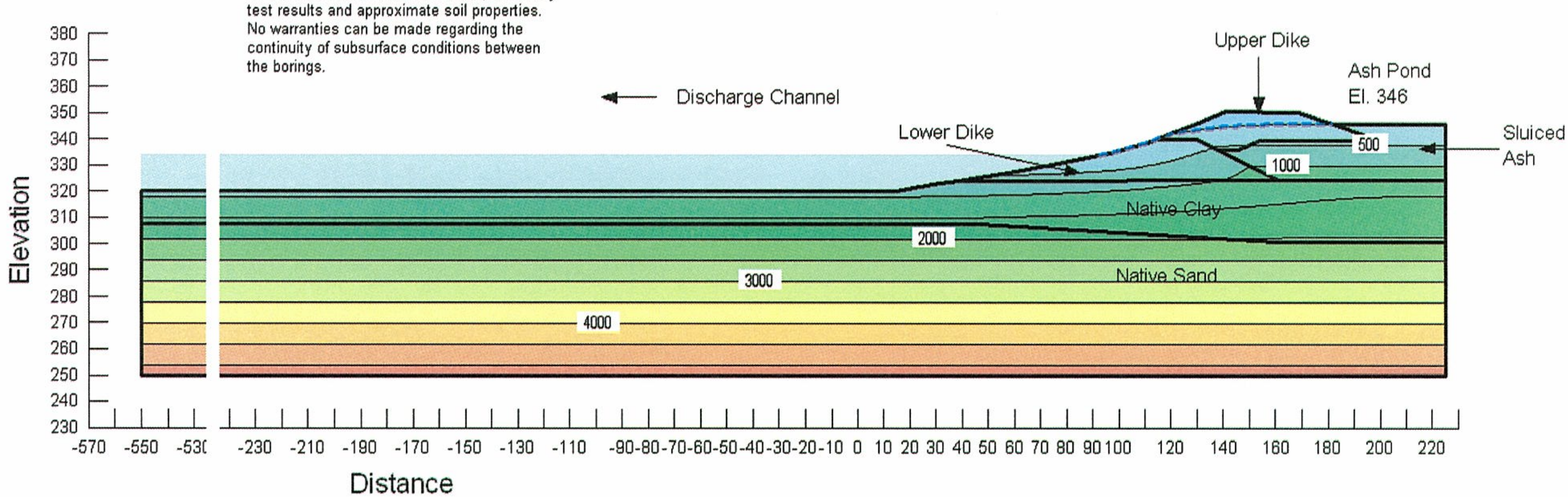
Rapid Drawdown High Water Level
Pore Water Pressure

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_RD_High.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U'
Ash Pond 2

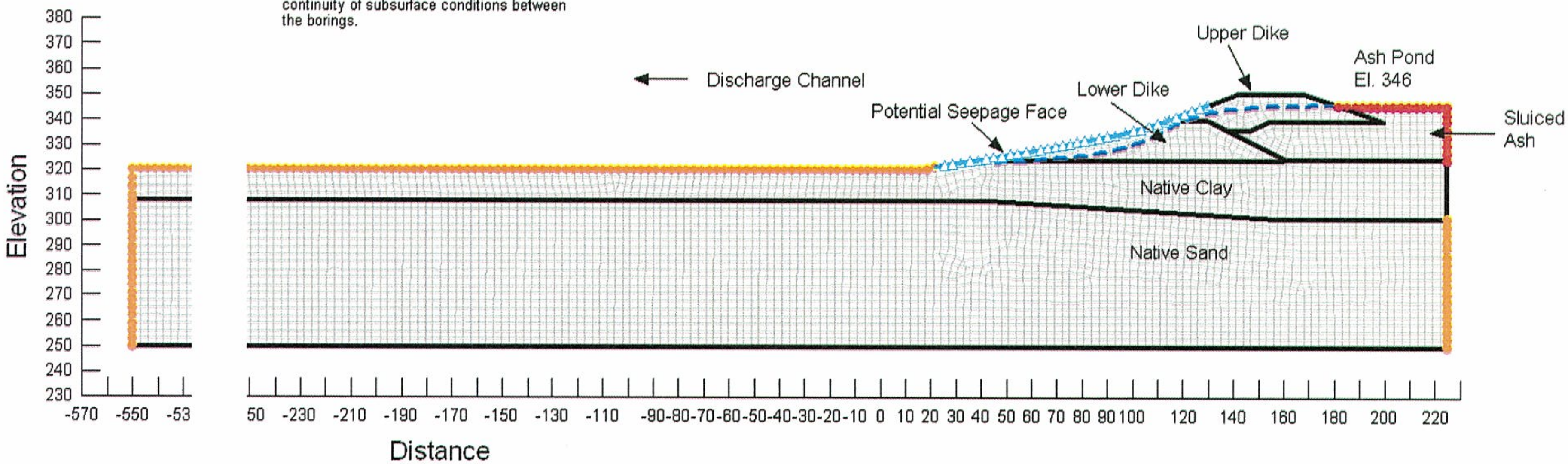
Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Seepage Analysis
Section U-U'
Ash Pond 2

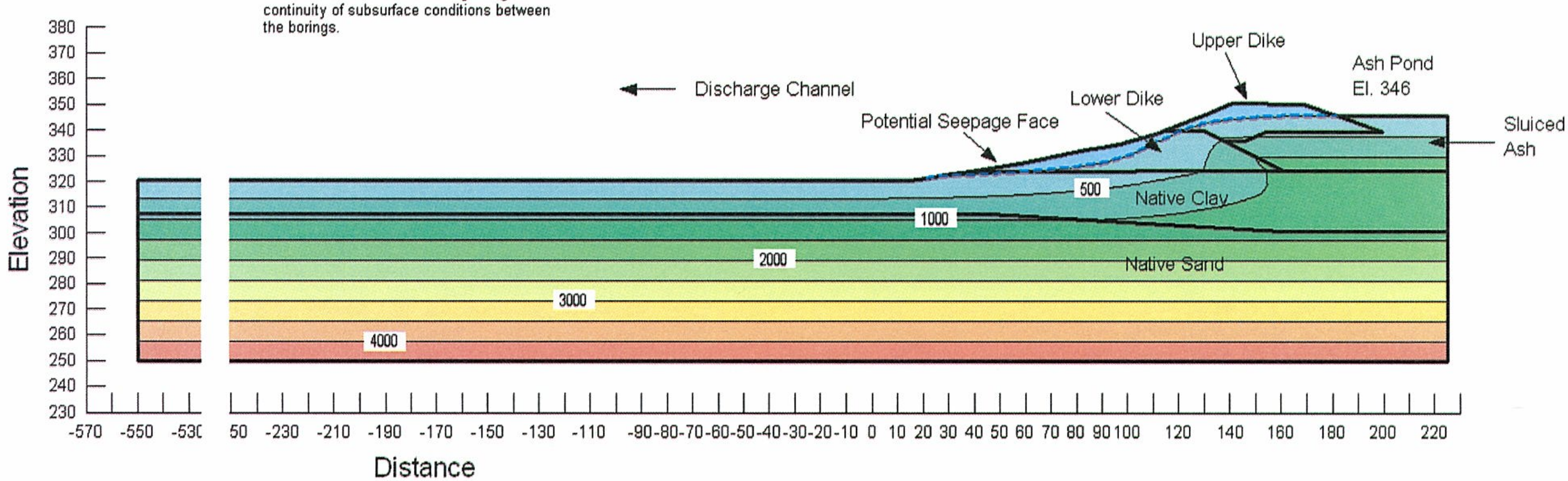
Rapid Drawdown Low Water Level
Boundary Conditions with Mesh

Shawnee Fossil Plant
Tennessee Valley Authority

May 2010
Method: Steady-State
File Name: SHF_SectionU_RD_Low.gsz

Material Type	Ksat(kh) (ft/sec)	Kratio (kh/kv)	Wsat
Upper Dike	1.48e-009	0.2	0.32 ft³/ft³
Lower Dike	1.37e-009	0.2	0.38 ft³/ft³
Sluiced Ash	1.71e-005	0.05	0.49 ft³/ft³
Native Clay	5.93e-008	0.05	0.38 ft³/ft³
Native Sand	0.0246	0.02	0.35 ft³/ft³

Note:
The results of analysis shown here are based on available subsurface information, laboratory test results and approximate soil properties. No warranties can be made regarding the continuity of subsurface conditions between the borings.



Appendix G

Geotechnical Drawings

35 | C | 10W501-01

GEOTECHNICAL EXPLORATION
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
SHAWNEE FOSSIL PLANT

PADUCAH, McCRACKEN COUNTY, KENTUCKY

PREPARED FOR

TENNESSEE VALLEY AUTHORITY

PREPARED BY

Stantec

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

VICINITY MAP

INDEX OF SHEETS

PLOT DATE: 07/09/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\REV0_RECORD\10W501-01-R0.DWG

RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
–											
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
COVER SHEET

STATE OF KENTUCKY NATHAN A. BADER 22611 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

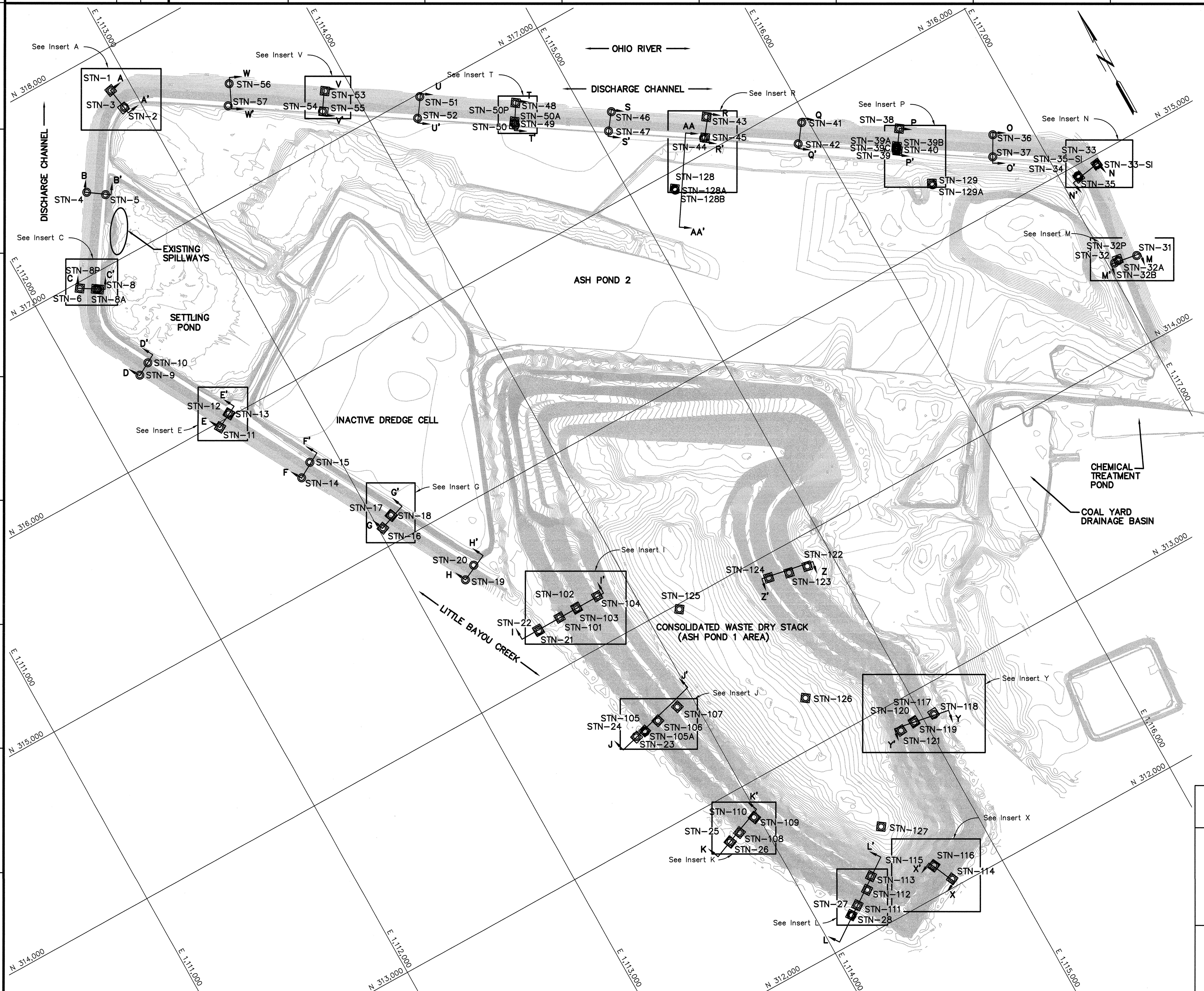
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 07/14/10	35	C	10W501–01	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



BORING LOCATION TABLE			
NO.	NORTHING	EASTING	ELEV. (FT.)
STN-1	317,797.70	1,112,894.71	326.9
STN-2	317,685.89	1,112,914.65	351.1
STN-3	317,685.06	1,112,908.87	351.2
STN-4	317,392.53	1,112,524.92	328.1
STN-5	317,333.36	1,112,605.34	351.6
STN-6	316,969.98	1,112,248.35	328.6
STN-8	316,915.52	1,112,335.31	351.9
STN-8A	316,921.21	1,112,325.90	351.9
STN-8P	316,924.83	1,112,319.91	351.9
STN-9	316,418.46	1,112,301.70	328.6
STN-10	316,454.21	1,112,370.24	350.7
STN-11	315,974.74	1,112,535.84	327.3
STN-12	316,016.50	1,112,610.36	351.0
STN-13	316,012.54	1,112,611.83	350.8
STN-14	315,536.24	1,112,778.56	327.5
STN-15	315,586.82	1,112,855.70	350.5
STN-16	315,098.19	1,113,021.92	328.5
STN-17	315,137.42	1,113,091.63	350.3
STN-18	315,133.53	1,113,093.60	350.4
STN-19	314,652.04	1,113,265.95	328.5
STN-20	314,698.36	1,113,341.04	350.1
STN-21	314,231.64	1,113,471.65	349.7
STN-22	314,238.31	1,113,470.52	349.7
STN-23	313,495.53	1,113,645.65	349.0
STN-24	313,499.27	1,113,645.11	349.0
STN-25	312,778.59	1,113,804.66	349.9
STN-26	312,774.78	1,113,806.04	349.9
STN-27	312,133.86	1,114,170.06	349.4
STN-28	312,131.19	1,114,171.87	349.4
STN-31	314,432.30	1,117,155.39	327.0
STN-32	314,454.28	1,117,034.48	350.6
STN-32A	314,457.23	1,117,058.23	350.6
STN-32B	314,455.26	1,117,057.91	350.6
STN-32P	314,461.18	1,117,058.88	350.6
STN-33	314,954.00	1,117,204.67	327.6
STN-33-SI	314,949.58	1,117,204.80	327.4
STN-34	314,943.07	1,117,089.94	350.5
STN-35	314,938.34	1,117,090.74	350.7
STN-35-SI	314,947.72	1,117,089.80	350.2
STN-36	315,351.57	1,116,807.82	324.6
STN-37	315,250.60	1,116,750.94	351.3
STN-38	315,618.68	1,116,395.32	322.9
STN-39	315,524.60	1,116,324.97	350.5
STN-39A	315,541.32	1,116,337.61	350.5
STN-39B	315,538.57	1,116,334.63	350.5
STN-39C	315,533.05	1,116,333.74	350.5
STN-40	315,521.49	1,116,330.97	350.7
STN-41	315,894.30	1,115,966.79	326.6
STN-42	315,805.38	1,115,896.21	350.1
STN-43	316,162.64	1,115,545.71	327.4
STN-44	316,072.06	1,115,478.40	350.4
STN-45	316,070.97	1,115,485.44	350.8
STN-46	316,427.81	1,115,126.31	328.2
STN-47	316,346.29	1,115,063.75	350.5
STN-48	316,712.60	1,114,710.52	326.6
STN-49	316,611.94	1,114,653.63	350.5
STN-50	316,615.65	1,114,648.22	350.6
STN-50A	316,622.47	1,114,652.40	350.6
STN-50P	316,630.15	1,114,657.10	350.6
STN-51	316,984.36	1,114,289.89	325.7
STN-52	316,890.61	1,114,224.53	350.4
STN-53	317,251.66	1,113,870.22	326.0
STN-54	317,164.29	1,113,807.60	350.6
STN-55	317,161.11	1,113,811.71	350.2
STN-56	317,528.33	1,113,453.65	325.1
STN-57	317,429.25	1,113,392.39	350.4
STN-101	314,239.59	1,113,599.85	345.6
STN-102	314,242.14	1,113,701.41	375.9
STN-103	314,237.20	1,113,701.82	375.9
STN-104	314,242.09	1,113,825.68	411.3
STN-105	313,503.36	1,113,698.42	347.7

Northing, Easting and Ground Surface Elevations were provided by TVA, Power Systems Operations, Surveying and Project Services.
Horizontal Datum: NAD 27 (Kentucky Lambert South).
Vertical Datum: NGVD29.

BORING LOCATION TABLE			
NO.	NORTHING	EASTING	ELEV. (FT.)
STN-105A	313,498.36	1,113,698.42	347.7
STN-106	313,516.57	1,113,784.54	375.3
STN-107	313,531.32	1,113,908.57	408.1
STN-108	312,796.11	1,113,871.67	350.3
STN-109	312,824.38	1,113,978.97	386.0
STN-110	312,829.42	1,113,977.17	385.9
STN-111	312,163.61	1,114,222.26	351.0
STN-112	312,209.67	1,114,305.60	381.8
STN-113	312,261.99	1,114,359.00	403.6
STN-114	312,043.43	1,114,723.51	349.6
STN-115	312,148.78	1,114,670.38	388.2
STN-116	312,151.06	1,114,675.00	388.2
STN-117	312,849.17	1,115,060.52	348.1
STN-118	312,843.34	1,115,059.61	348.2
STN-119	312,857.74	1,114,949.90	380.9
STN-120	312,862.75	1,114,950.57	380.8
STN-121	312,853.82	1,114,867.54	405.6
STN-122	313,845.00	1,114,860.16	360.0
STN-123	313,861.58	1,114,760.17	386.3
STN-124	313,889.25	1,114,655.68	413.9
STN-125	313,973.57	1,114,166.63	444.5
STN-126	313,245.28	1,114,516.15	441.9
STN-127	312,463.74	1,114,532.22	441.4
STN-128	315,914.33	1,115,215.99	348.5
STN-128A	315,910.33	1,115,215.99	348.5
STN-128B	315,906.33	1,115,215.99	348.5
STN-129	315,283.90	1,116,404.12	349.3
STN-129A	315,275.92	1,116,404.53	349.3

LEGEND

- Soil Boring With Standard Penetration Tests And/Or Shelby Tube Sampling And Piezometer Location
- Soil Boring With Standard Penetration Tests And/Or Shelby Tube Sampling
- Slope Inclinometer
- Piezometer Location With Limited Sampling

NOTES:

1. Horizontal and vertical locations of borings provided by T.V.A. The topographic information shown was provided by T.V.A. from a survey performed in March 2008.
2. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.

RECORD DRAWING

100 0 200 400 FEET
GRAPHIC SCALE: 1"=200'
CONTOUR INTERVAL = 1'

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY
NATHAN A. BADER
22811
LICENSED
PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE
1
2
3
4

SCALE: 1"=200' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION BORING AND STABILITY CROSS SECTION LAYOUT

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
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Fax 502.212.5055
www.stantec.com

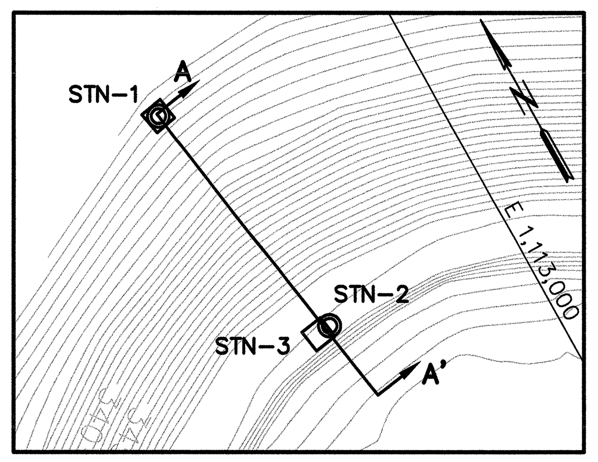
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 07/14/10	35	C	10W501-02	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



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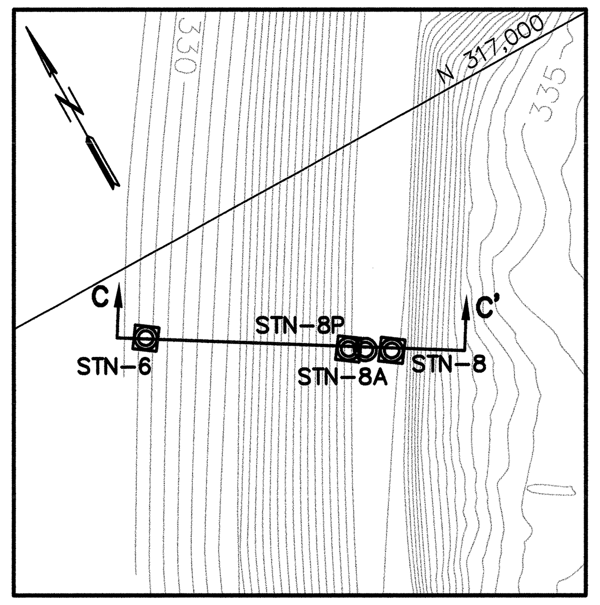

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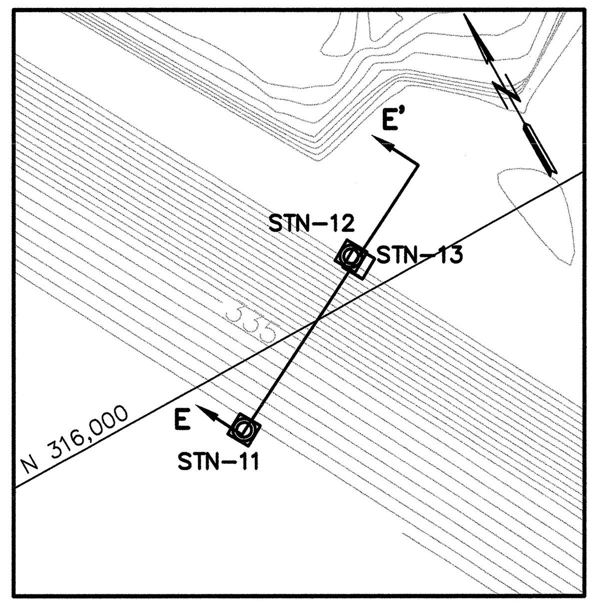

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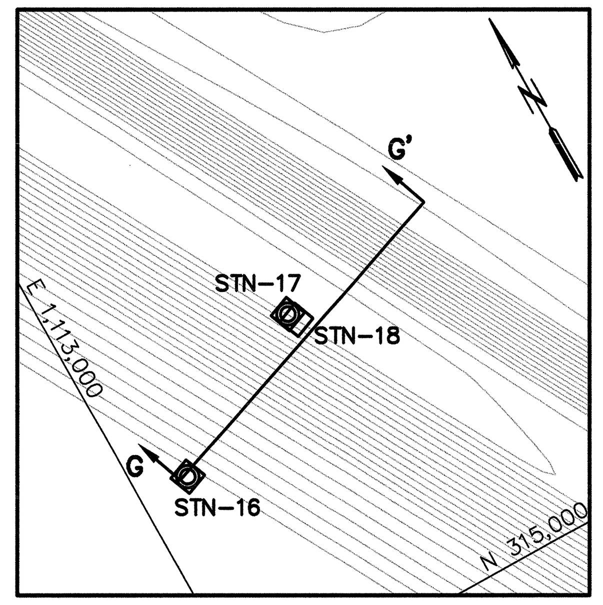

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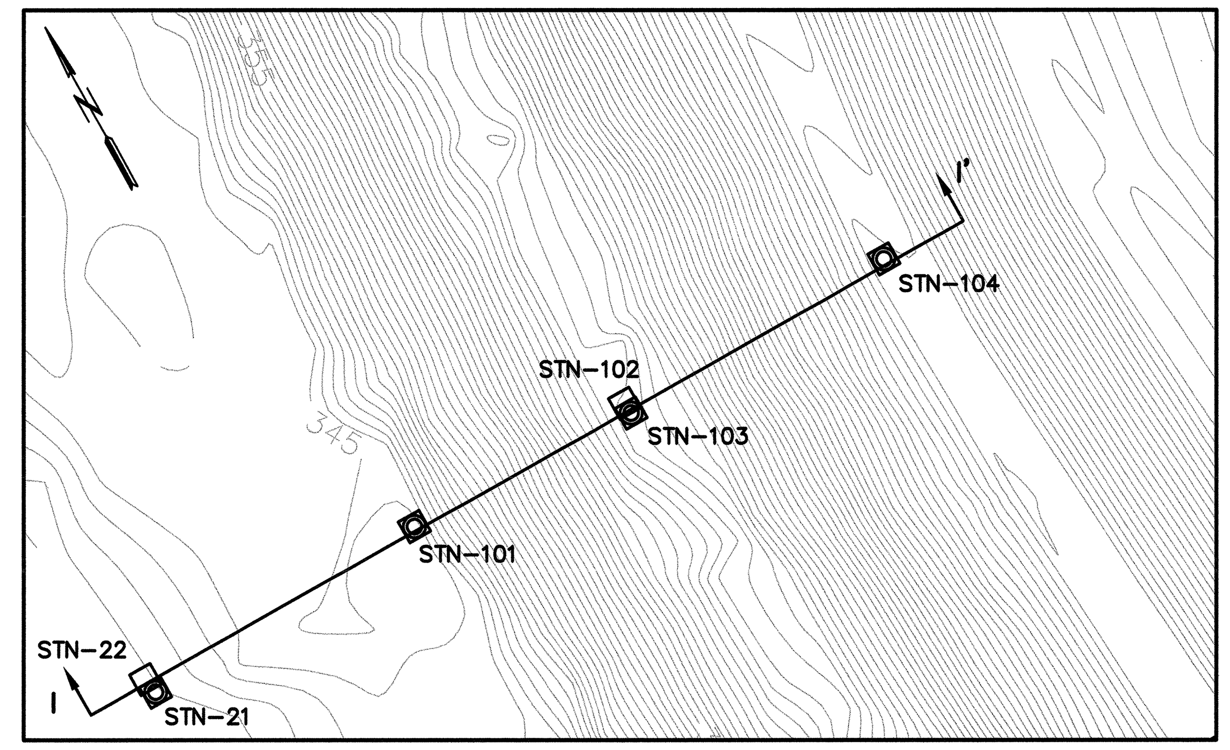

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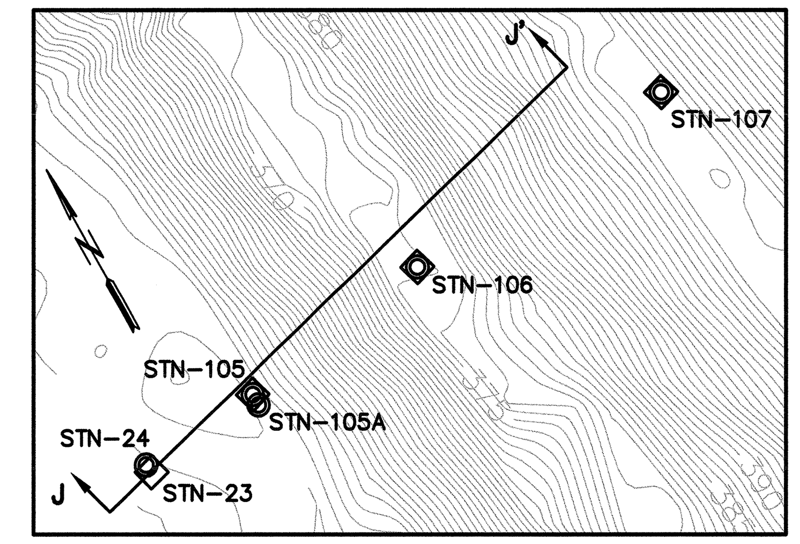

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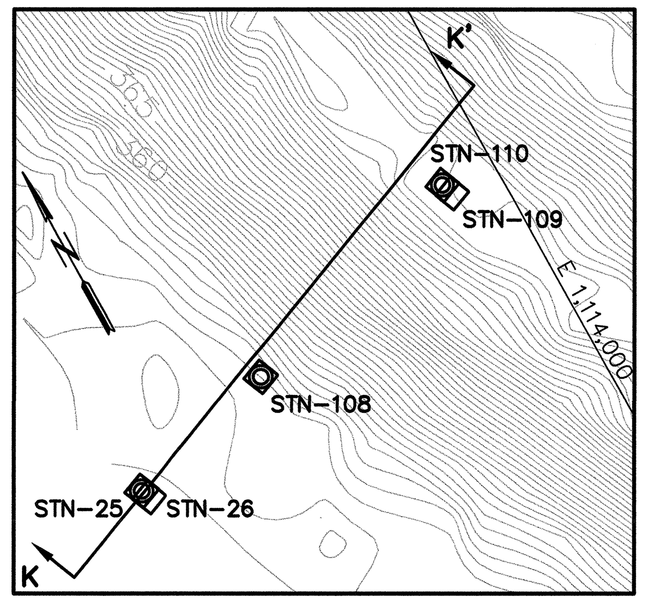

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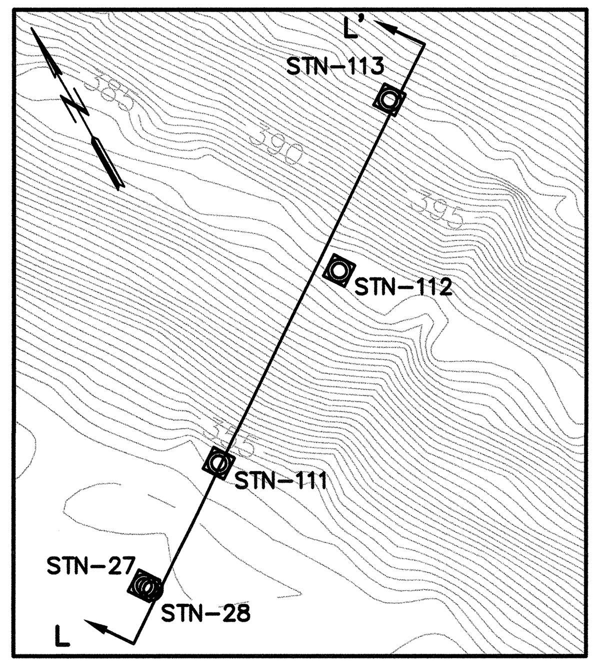

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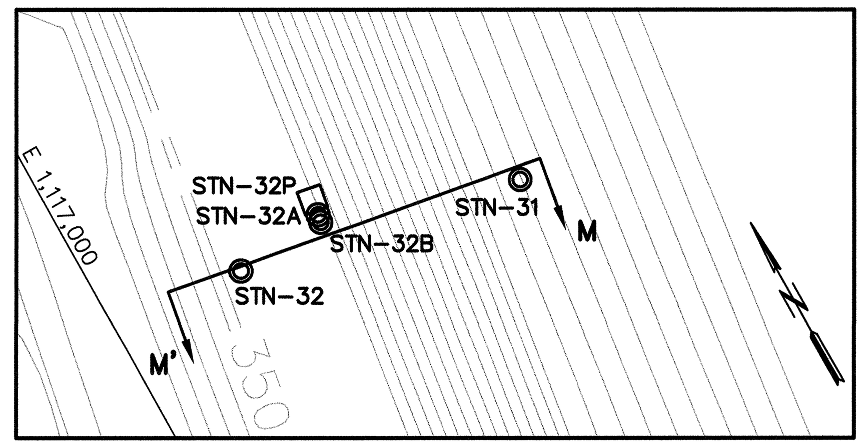
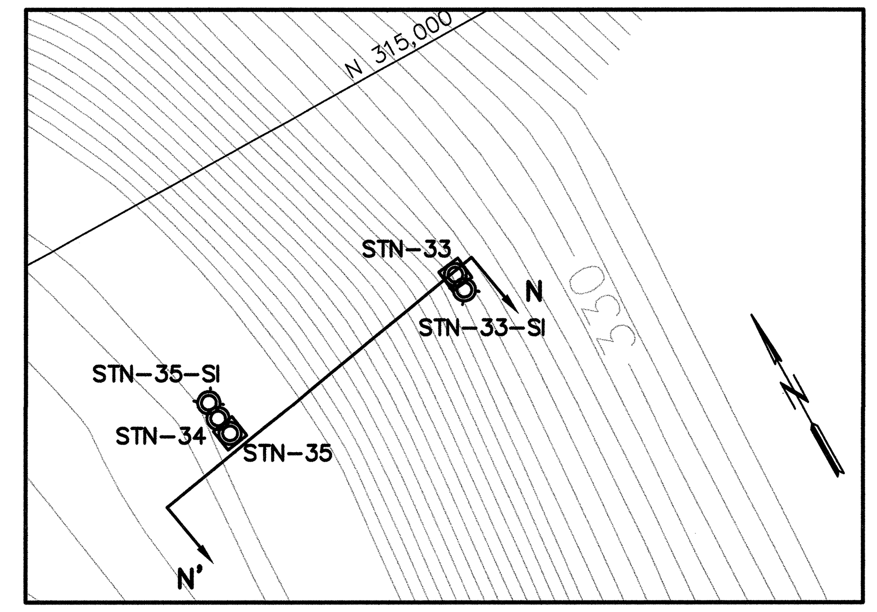
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'



INSERT M
15 0 30 60 FEET
GRAPHIC SCALE: 1"=30'
CONTOUR INTERVAL = 1'



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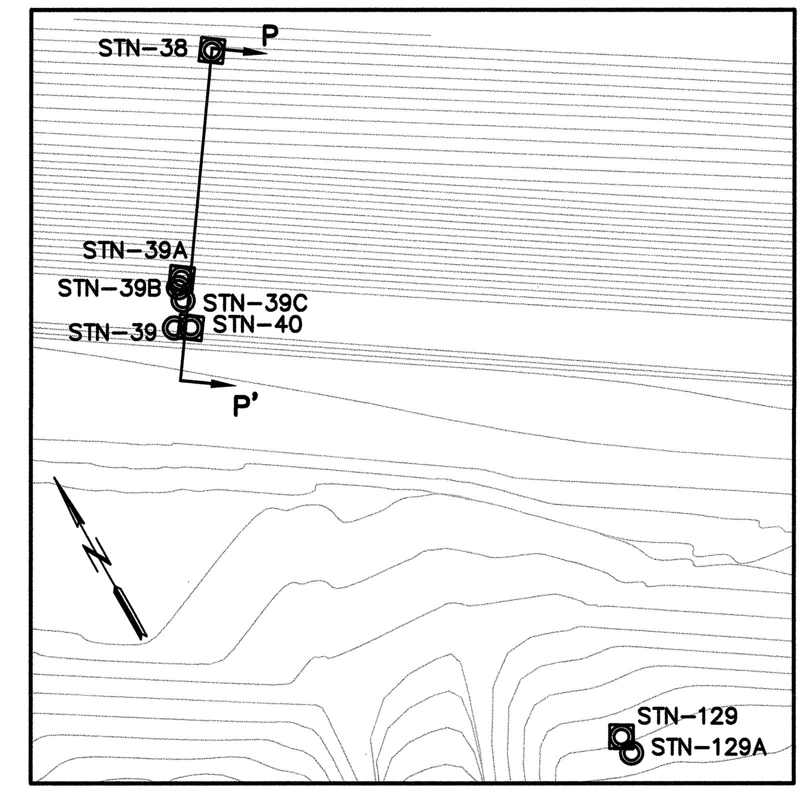
CONTOUR INTERVAL = 1'



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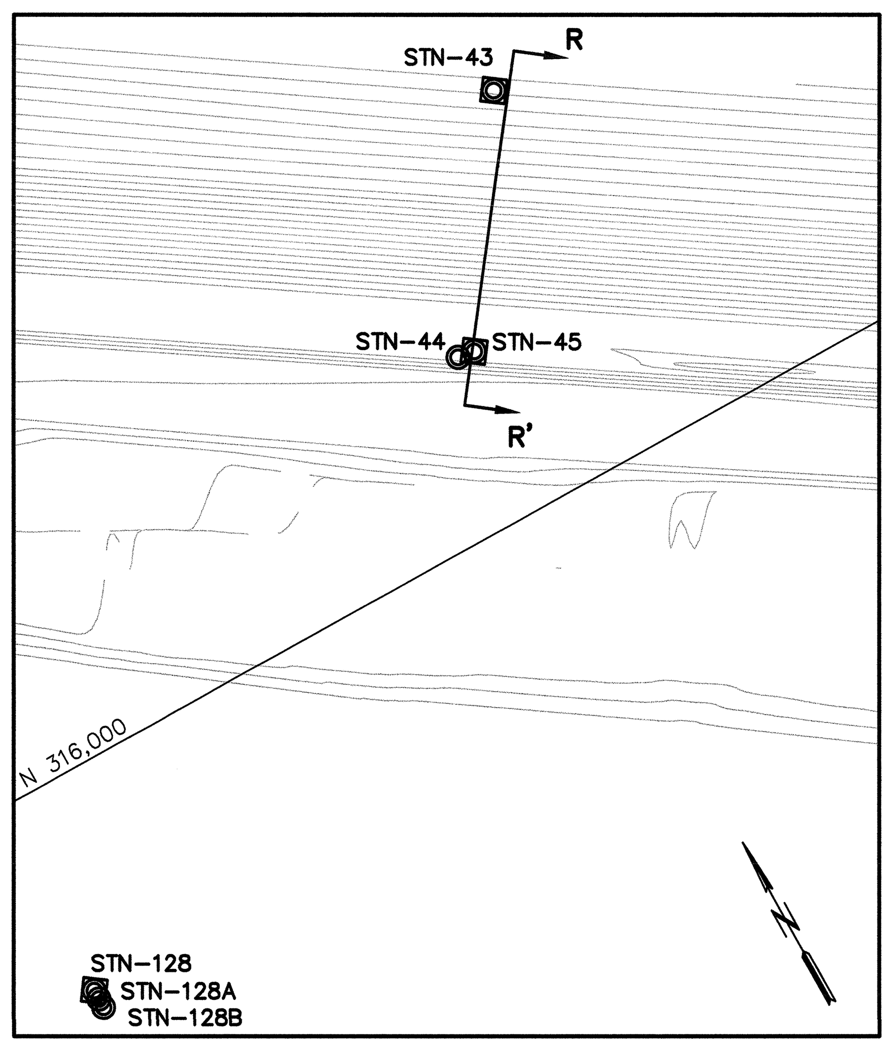

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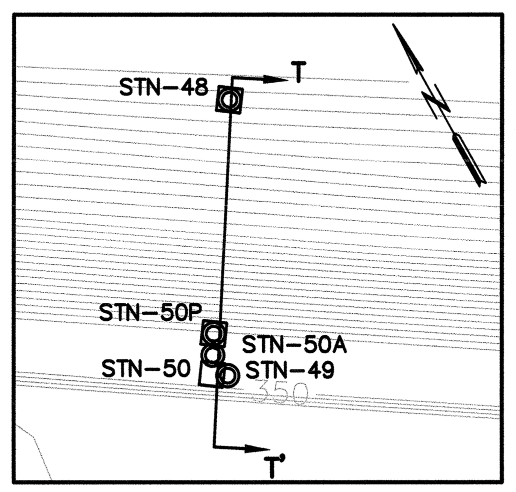
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'



INSERT T
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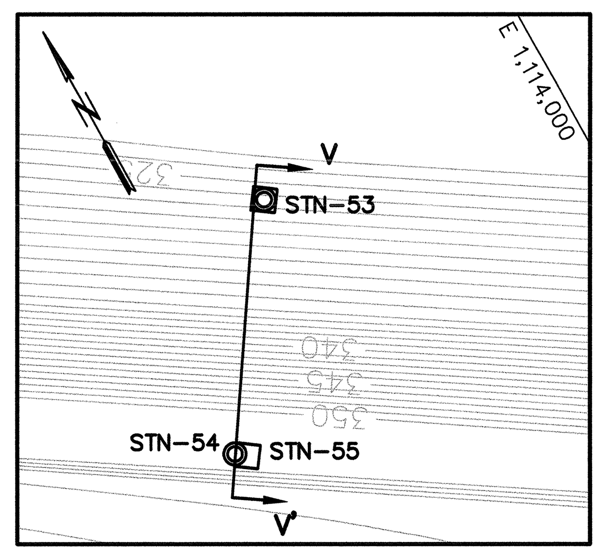
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'



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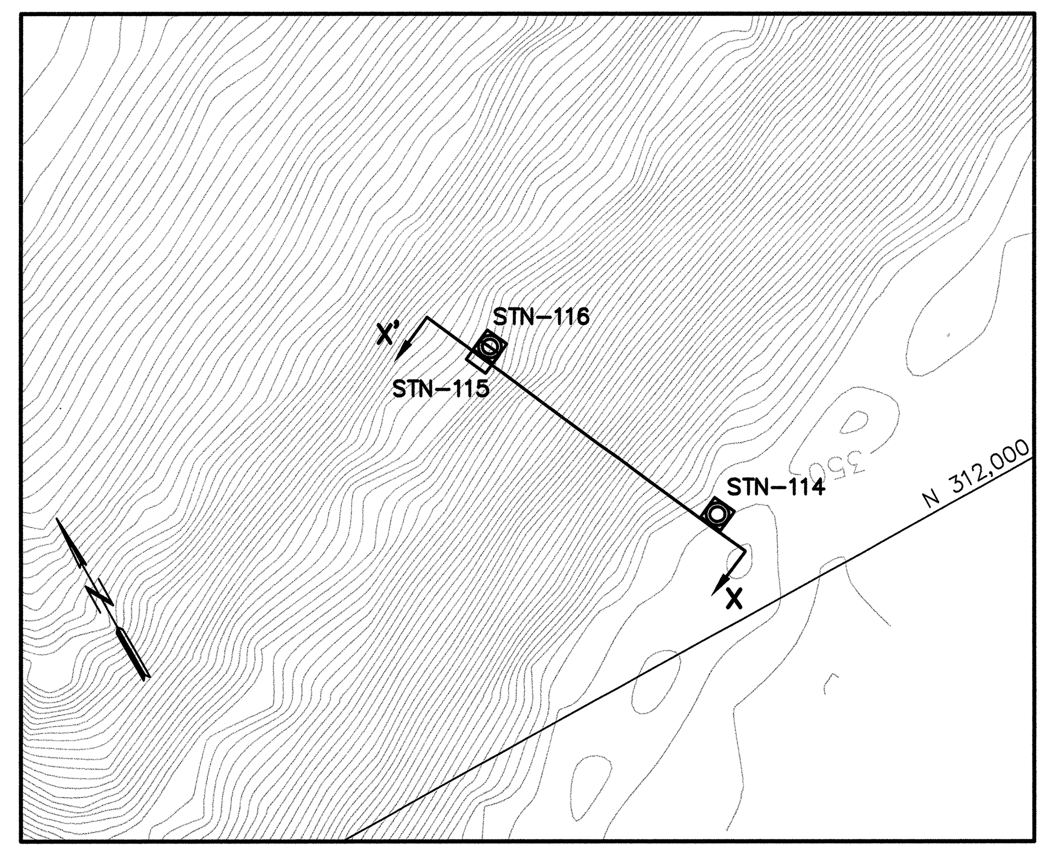
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'



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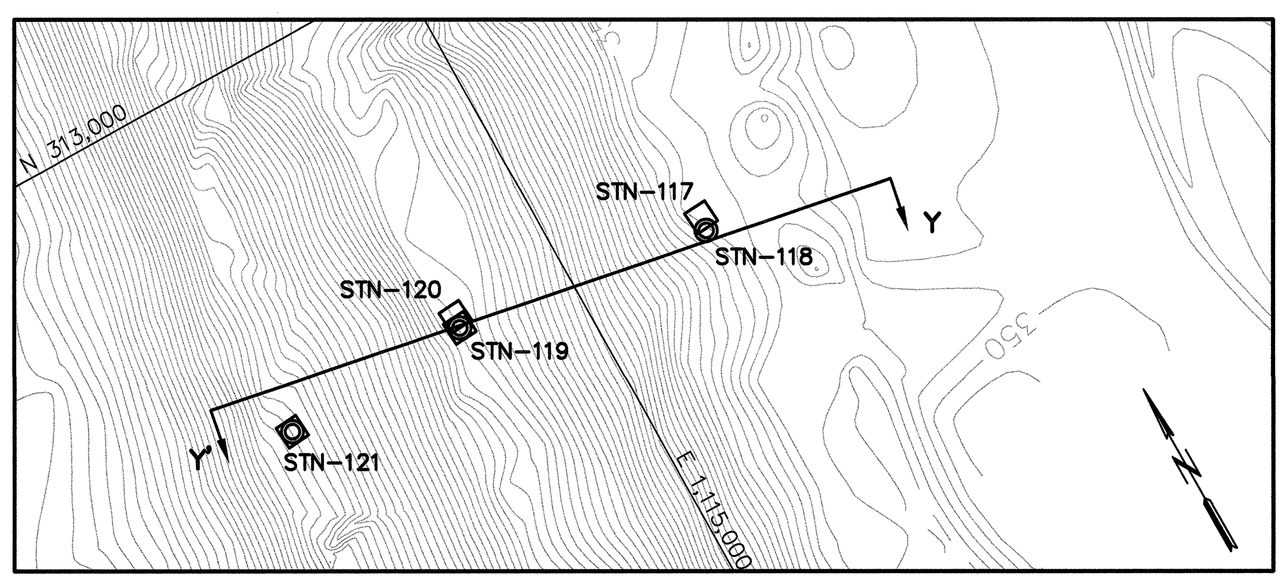
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'



INSERT Y
25 0 50 100 FEET
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'

LEGEND

- Soil Boring With Standard Penetration Tests And/Or Shelby Tube Sampling And Piezometer Location
- Soil Boring With Standard Penetration Tests And/Or Shelby Tube Sampling
- Slope Inclinometer
- Piezometer Location With Limited Sampling

NOTES:

1. Horizontal and vertical locations of borings provided by T.V.A. The topographic infomation shown was provided by T.V.A. from a survey performed in March 2008.
2. The geotechnical information and data furnished herein are not intended as representation or warranties but are furnished for information only. It shall be distinctly understood that the Owner or Engineer will not be responsible for any deduction, interpretation or conclusion drawn therefrom. The information is made available in order that the Contractor may have ready access to the same information available to the Owner and the Engineer and is not part of this contract.

RECORD DRAWING

25 0 50 100 FEET
GRAPHIC SCALE: 1"=50'
CONTOUR INTERVAL = 1'

PLOT DATE: 07/12/2010 USER: BRADSHAW, STEVEN
V:\1755\ACTIVE\175559023\GEOTECHNICAL\DRAWING\REV0_RECORD\10W501-03-R0.DWG

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0 RECORD DRAWING	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

DISCIPLINE INTERFACE
1
2
3
4

SCALE: AS SHOWN EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION BORING AND STABILITY CROSS SECTION LAYOUT

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

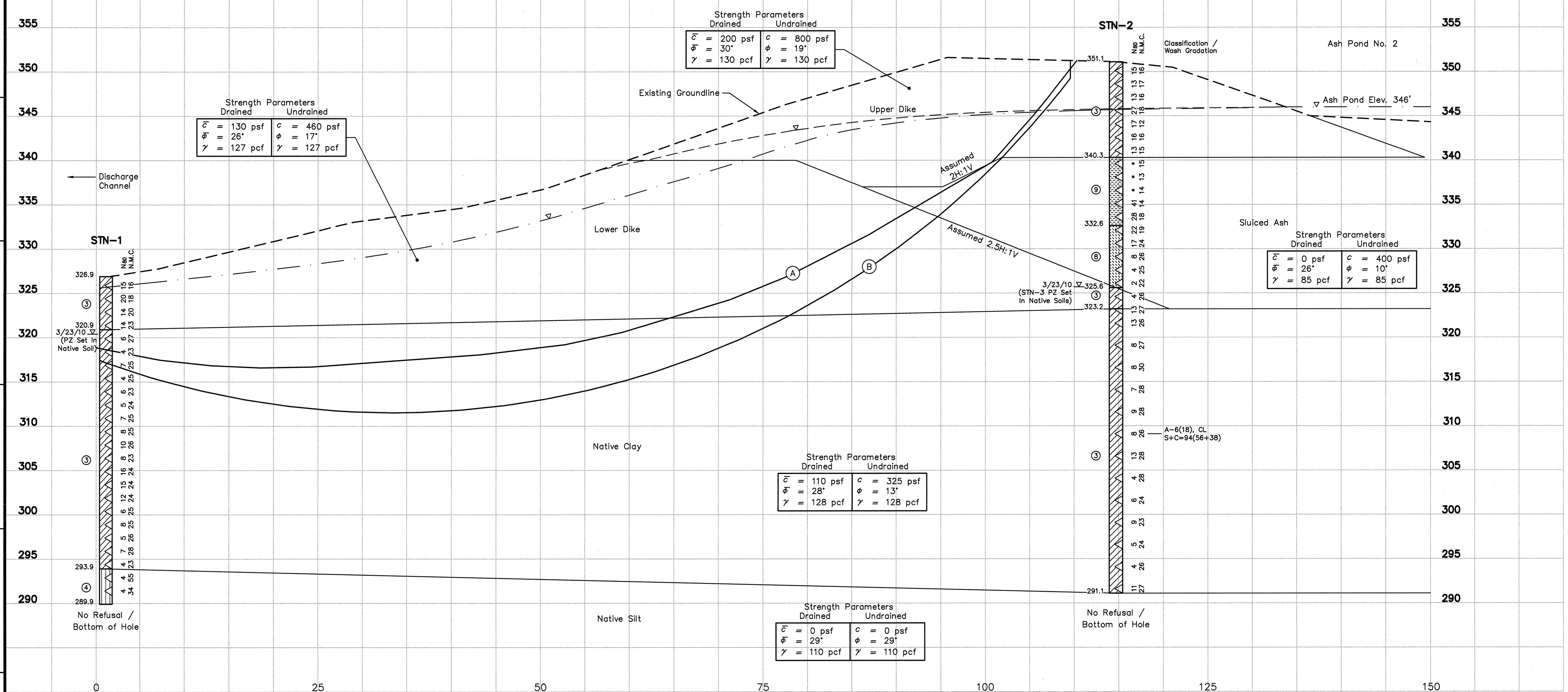
AUTOCAD R 2000	DATE 07/14/10	35	C	10W501-03	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

SUMMARY OF STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Long–Term Loading Conditions	2.1
B	Rapid Drawdown With Phreatic Surface Of 100–Year Flood Elev. 334.0'	1.7



LEGEND

- ① Top Soil
- ② Crushed Stone
- ③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
- ④ Silt, Sandy Silt
- ⑤ Silty Sand
- ⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
- ⑦ Well Graded Gravel With Silt And Sand
- ⑧ Fly Ash
- ⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586–99. Refer To Typed Boring Log.

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RECORD DRAWING

SUMMARY OF OFFSET BORINGS				
BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN–3	351.2'	60.0'	49.9'–59.9'	4.0'–6.0' 8.0'–10.0' 28.0'–30.0' 38.0'–40.0' 56.0'–58.0'

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			
Location	STN–3		
Depth	28.1'–28.7'	28.7'–29.3'	29.3'–29.9'
φ̄	31.9°		
c̄	8 p.s.f.		
φ	24.1°		
c	252 p.s.f.		

For Supporting Design Calculations see FPGSHFFESCDX000000020100004

NATHAN A. BADER 7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky 40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

R 0 07/14/10 JC SB JC NB HA NB TJ
RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION A–A'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

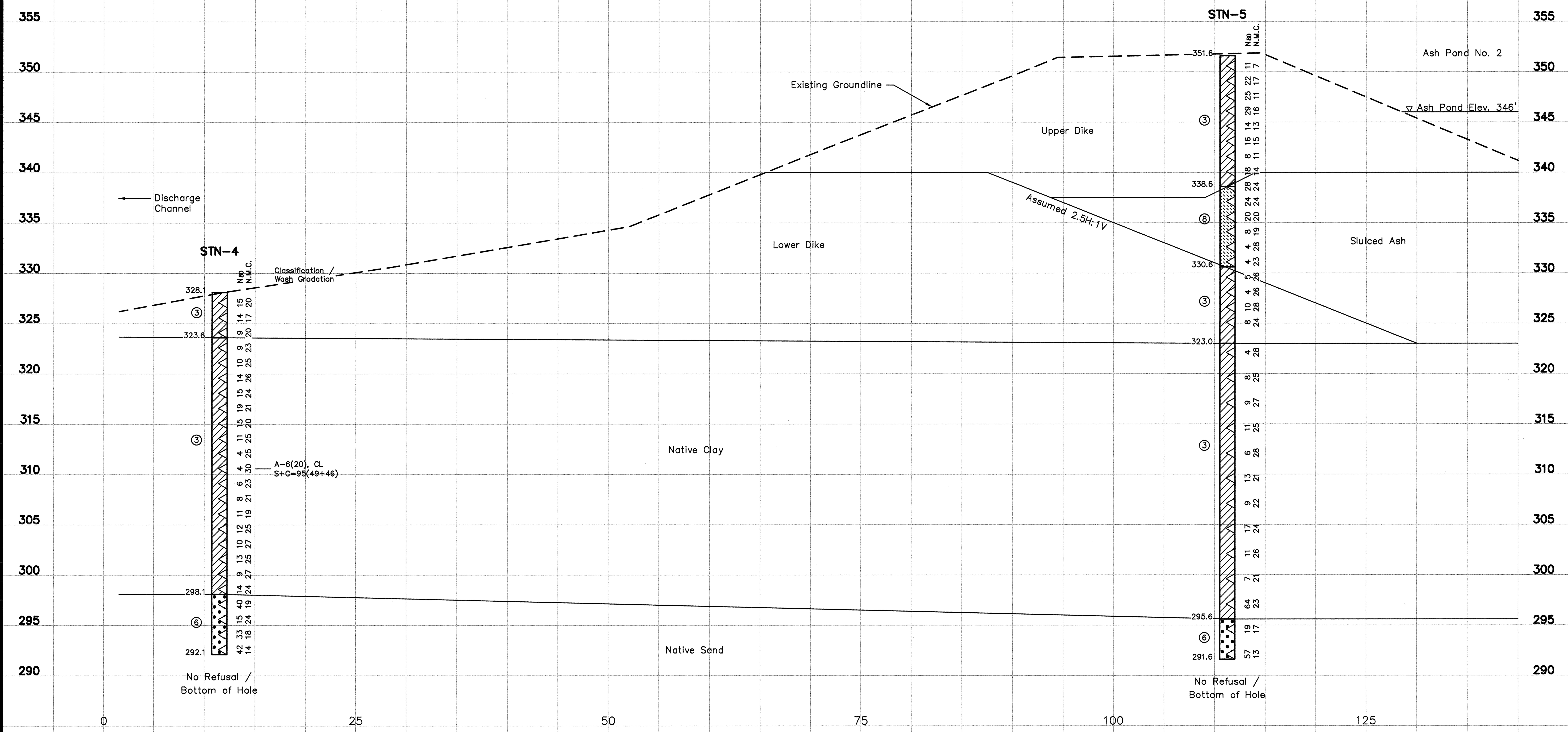
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–04 | R 0

STANTEC 0 TASK COMPLETED BY: REV NO.

PLOT FACTOR:XX W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



LEGEND

- ① Top Soil
- ② Crushed Stone
- ③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
- ④ Silt, Sandy Silt
- ⑤ Silty Sand
- ⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
- ⑦ Well Graded Gravel With Silt And Sand
- ⑧ Fly Ash
- ⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
—▽—	Phreatic Surface From Pz Data
—▽·—	Phreatic Surface From Seepage Model
– –▽– –	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION B-B'

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-05 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010

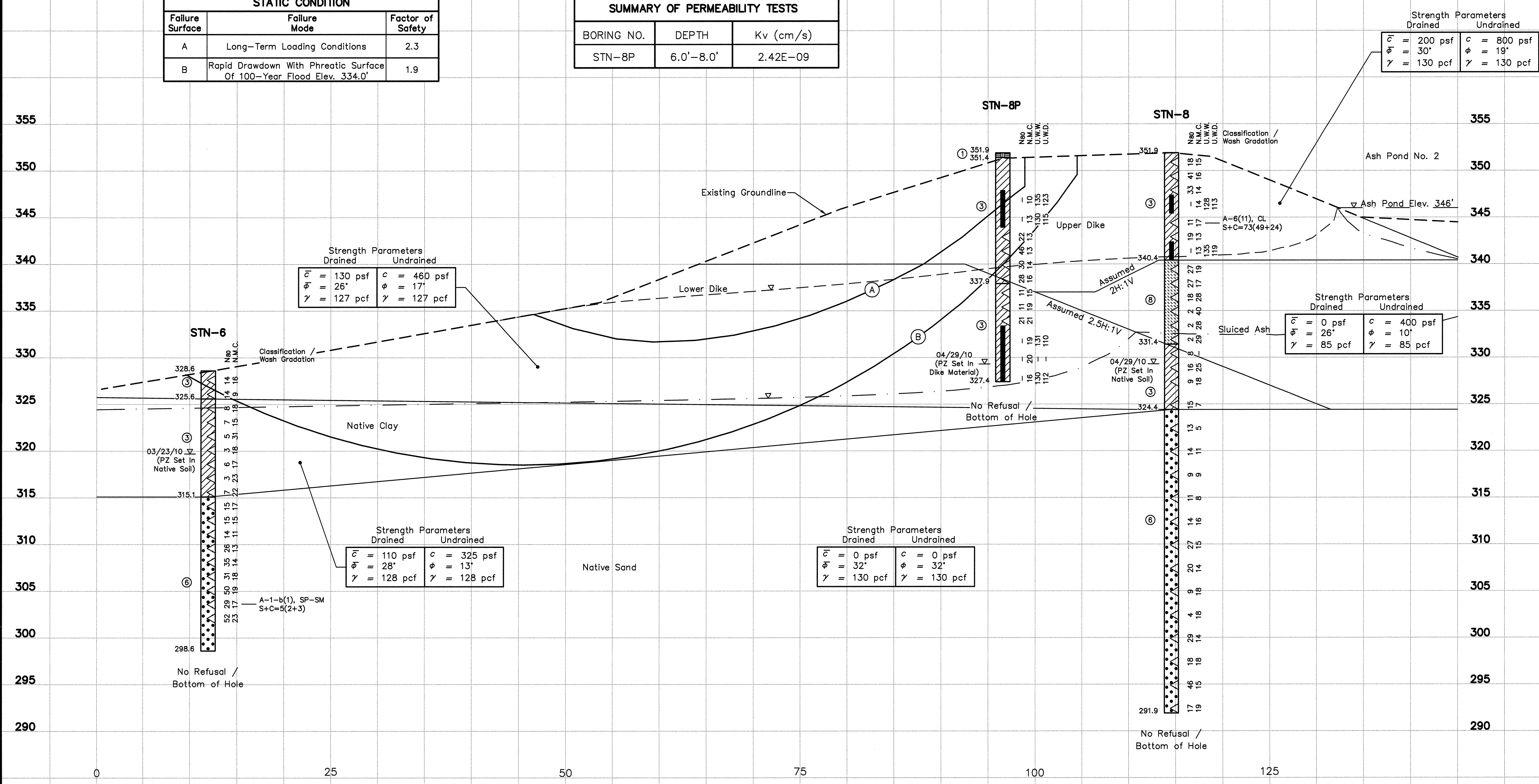
35	C	10W501-06

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.3
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.9

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-8P	6.0'-8.0'	2.42E-09



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-8A	351.9'	20.0'	NO PIEZOMETER	–

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-8		
Depth	5.2'-5.8'	5.8'-6.4'	10.4'-11.0'
$\bar{\phi}$	29.9°		
$\bar{c}$	382 p.s.f.		
ϕ	28.7°		
c	878 p.s.f.		
Location	STN-8P		
Depth	18.6'-19.1'	22.6'-23.1'	
$\bar{\phi}$	30.2°		
$\bar{c}$	80 p.s.f.		
ϕ	21.8°		
c	500 p.s.f.		

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

NATHAN A. BADER 22011 STATE OF KENTUCKY LICENSED PROFESSIONAL ENGINEER
7/14/10

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1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION C-C'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

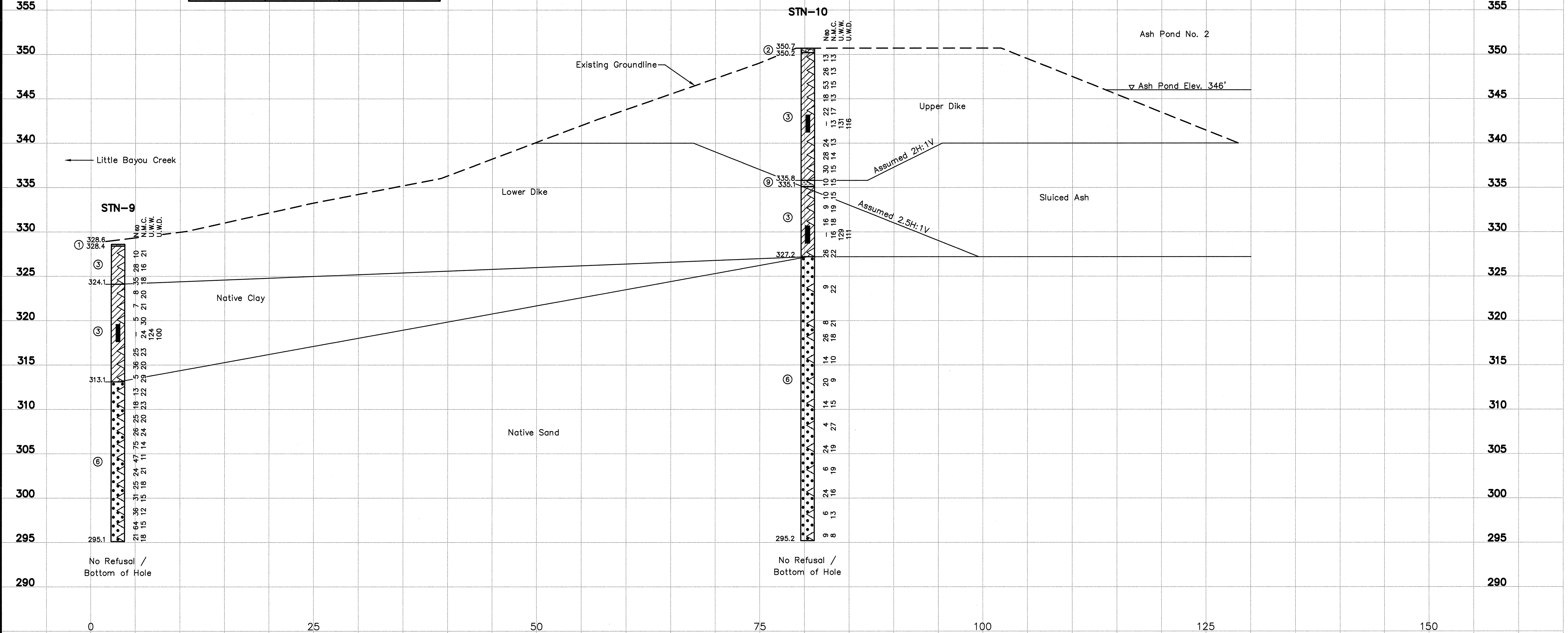
AUTOCAD R 2000	DATE 07/14/10	35	C	10W501-06	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF PERMEABILITY TESTS		
BORING NO.	DEPTH	Kv (cm/s)
STN-9	9.7'-10.2'	2.04E-08
STN-10	7.5'-9.5'	5.28E-09
STN-10	20.0'-22.0'	1.39E-08



LEGEND

- ① Top Soil
- ② Crushed Stone
- ③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
- ④ Silt, Sandy Silt
- ⑤ Silty Sand
- ⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
- ⑦ Well Graded Gravel With Silt And Sand
- ⑧ Fly Ash
- ⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

R0 07/14/10 JC SB JC NB HA NB TJ
RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION D-D'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
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www.stantec.com

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 DATE 07/14/10 35 C 10W501-07 R0

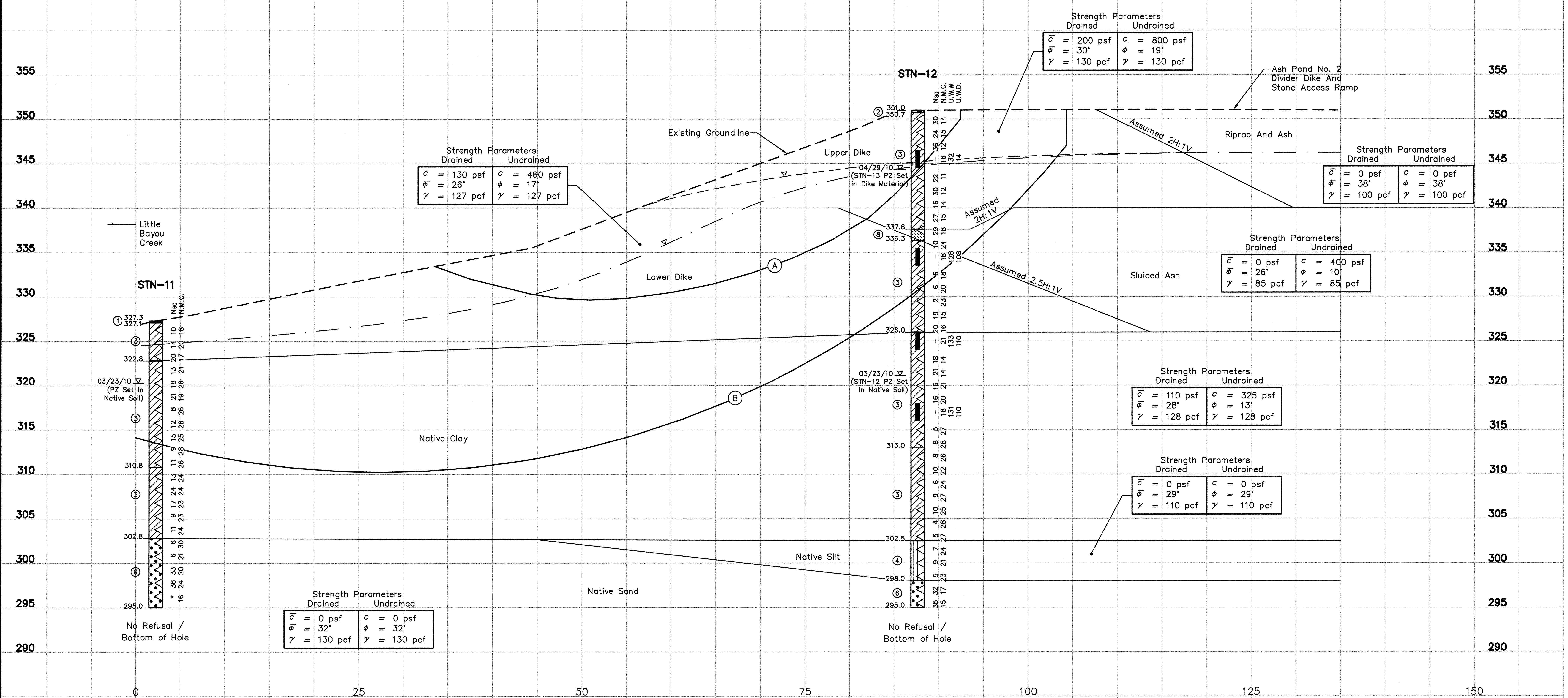
STANTEC 0
TASK COMPLETED BY: REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

7/14/10

10W501-08 | 35 | C



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

- WH — Weight of Hammer
- ◁ — Standard Penetration Test Interval
- ■ — Undisturbed Thin-Walled (Shelby) Tube Sample
- N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
- N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
- N.M.C. — Natural Moisture Content (%)
- U.W.W. — Unit Weight Wet (lbs./cu.ft.)
- U.W.D. — Unit Weight Dry (lbs./cu.ft.)
- 09/17/09 ▽ — Water Level and Date Recorded
- ▽ — Phreatic Surface From Pz Data
- ▽ — Phreatic Surface From Seepage Model
- ▽ — Phreatic Surface From Rapid Drawdown
- No Refusal — No Refusal Encountered
- * — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-12		
Depth	25.1'-25.6'	25.7'-26.2'	
$\bar{\phi}$	33.9°		
$\bar{c}$	103 p.s.f.		
ϕ	18.5°		
c	259 p.s.f.		
Location	STN-12		STN-15
Depth	4.6'-5.1'	5.2'-5.7'	4.6'-5.1'
$\bar{\phi}$	23.7°		
$\bar{c}$	1,200 p.s.f.		
ϕ	14.6°		
c	1,400 p.s.f.		
Location	STN-17	STN-12	
Depth	16.1'-16.6'	16.4'-16.9'	
$\bar{\phi}$	34.2°		
$\bar{c}$	0 p.s.f.		
ϕ	20.5°		
c	380 p.s.f.		

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-13	350.8'	20.0'	9.0'-19.0'	–

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.1
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.6

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY — NORMAN A. BADER — 22811 — LICENSED PROFESSIONAL ENGINEER
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION E-E'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-08 | R 0

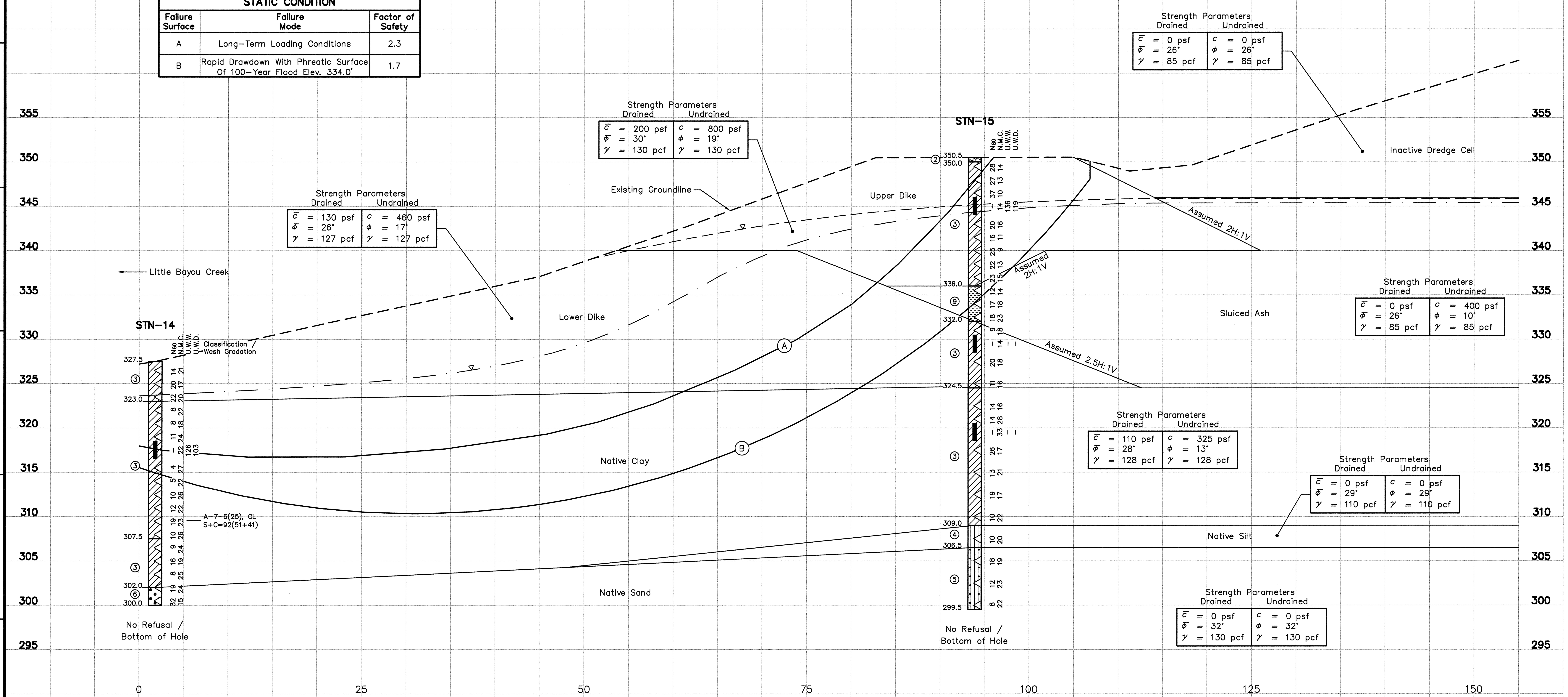
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010

SUMMARY OF STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.3
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.7



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
—▽—	Phreatic Surface From Pz Data
—▽ · —	Phreatic Surface From Seepage Model
— —▽— —	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
•	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			
Location	STN-12		STN-15
Depth	4.6'-5.1'	5.2'-5.7'	4.6'-5.1'
$\bar{\phi}$	23.7°		
$\bar{c}$	1,200 p.s.f.		
ϕ	14.6°		
c	1,400 p.s.f.		

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION F-F'

STATE OF KENTUCKY NATHAN A. BADER 22011 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-09 | R 0

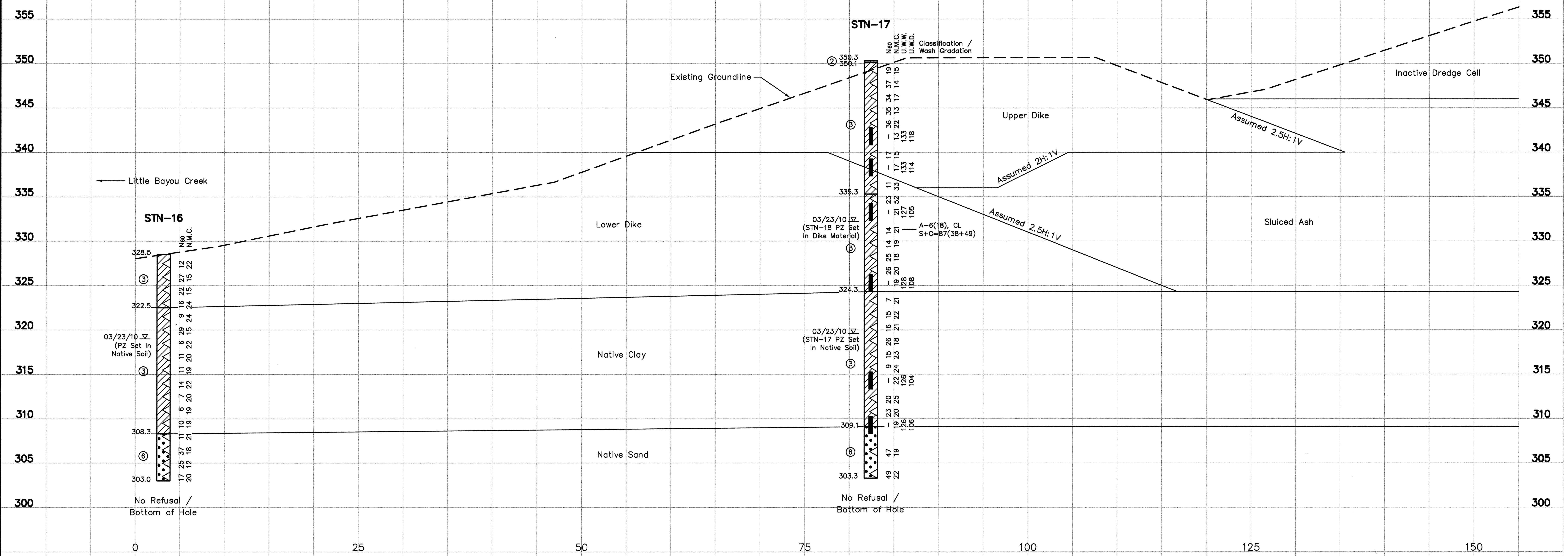
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

35 C 10W501-09

35 C 10W501-10



LEGEND

① Top Soil
② Crushed Stone
③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④ Silt, Sandy Silt
⑤ Silty Sand
⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦ Well Graded Gravel With Silt And Sand
⑧ Fly Ash
⑨ Bottom Ash

WH — Weight of Hammer
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
09/17/09 — Water Level and Date Recorded
Phreatic Surface From Pz Data
Phreatic Surface From Seepage Model
Phreatic Surface From Rapid Drawdown
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-17	STN-12	Location	STN-17		
Depth	16.1'–16.6'	16.4'–16.9'	Depth	16.7'–17.2'	24.1'–24.6'	24.7'–25.2'
$\overline{\phi}$	34.2°		$\overline{\phi}$	35.8°		
$\overline{c}$	0 p.s.f.		$\overline{c}$	82 p.s.f.		
ϕ	20.5°		ϕ	28.0°		
c	380 p.s.f.		c	187 p.s.f.		
Location	STN-17		Location	STN-17		
Depth	7.7'–8.2'	11.3'–11.8'	Depth	35.6'–36.1'	40.1'–40.6'	40.7'–41.2'
$\overline{\phi}$	40.0°		$\overline{\phi}$	32.3°		
$\overline{c}$	0 p.s.f.		$\overline{c}$	163 p.s.f.		
ϕ	28.0°		ϕ	24.5°		
c	576 p.s.f.		c	317 p.s.f.		

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-18	350.4'	25.0'	14.0'–24.0'	6.0'–8.0' 14.0'–16.0' 18.0'–20.0' 22.0'–24.0'

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

NATHAN A. BADER 22611 STATE OF KENTUCKY LICENSED PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION G-G'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-10 | R 0

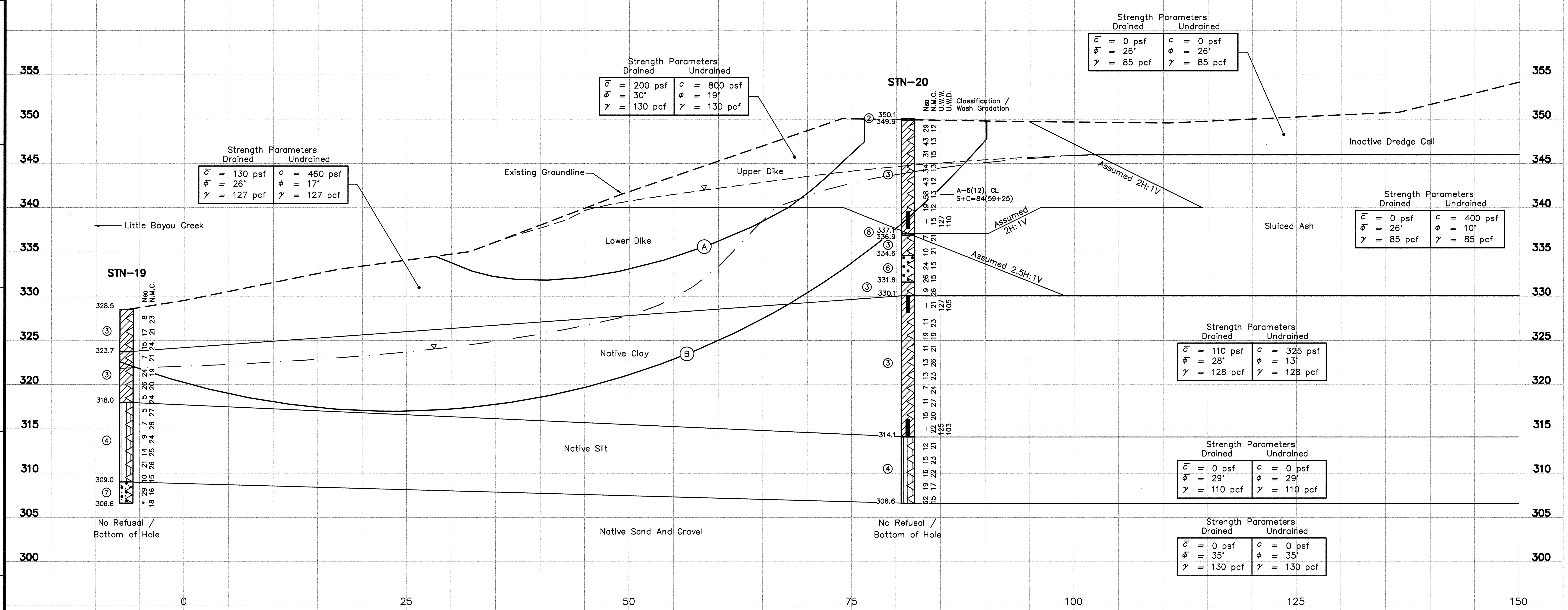
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010

35 C 10W501-11



LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
⑥	Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦	Well Graded Gravel With Silt And Sand
⑧	Fly Ash
⑨	Bottom Ash
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.4
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.9

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-20	10.6'-11.1'	3.19E-08
STN-20	34.1'-34.6'	1.97E-07

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION H-H'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

State of Kentucky, Nathan A. Bader, 25511, Licensed Professional Engineer
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky 40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

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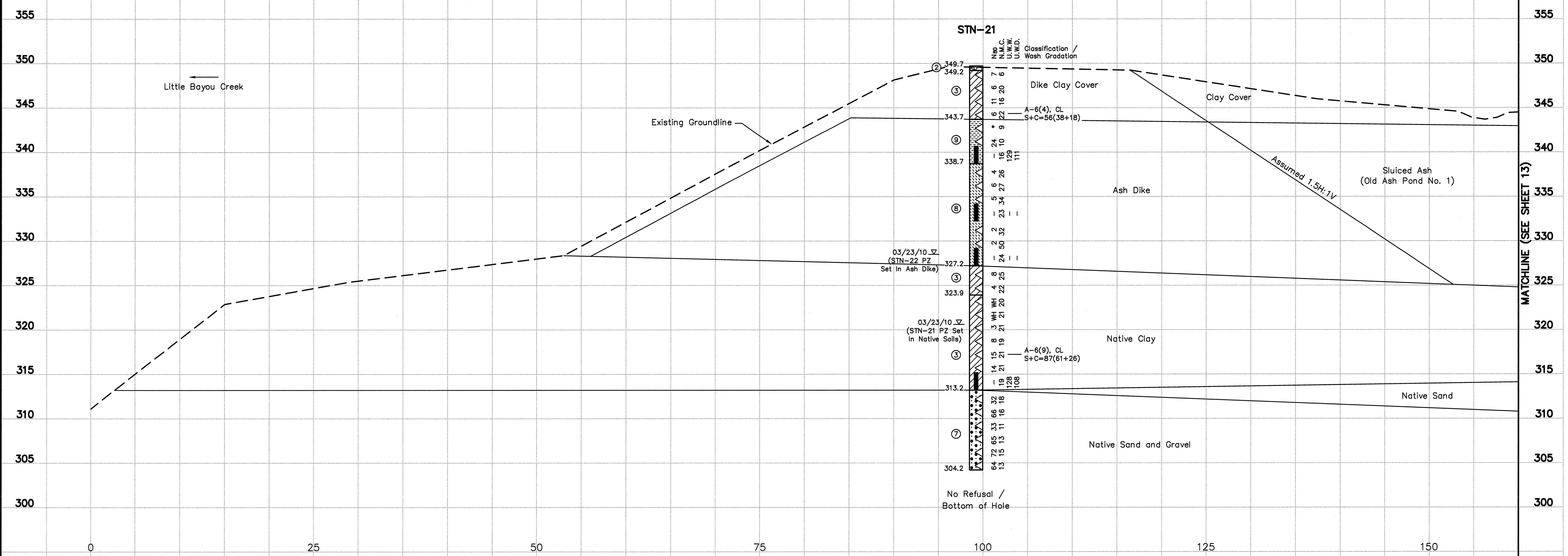
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-11 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



LEGEND

①		Top Soil
②		Crushed Stone
③		Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④		Silt, Sandy Silt
⑤		Silty Sand
⑥		Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦		Well Graded Gravel With Silt And Sand
⑧		Fly Ash
⑨		Bottom Ash
	WH	Weight of Hammer
	◁	Standard Penetration Test Interval
	■	Undisturbed Thin-Walled (Shelby) Tube Sample
	N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
	N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
	N.M.C.	Natural Moisture Content (%)
	U.W.W.	Unit Weight Wet (lbs./cu.ft.)
	U.W.D.	Unit Weight Dry (lbs./cu.ft.)
	09/17/09 ▽	Water Level and Date Recorded
	——▽——	Phreatic Surface From Pz Data
	▽ · ——	Phreatic Surface From Seepage Model
	— —▽— —	Phreatic Surface From Rapid Drawdown
	No Refusal	No Refusal Encountered
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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-21		
Depth	34.5'-35.0'	35.1'-35.6'	35.7'-36.2'
$\bar{\phi}$	35.8°		
$\bar{c}$	0 p.s.f.		
ϕ	20.5°		
c	800 p.s.f.		
Location	STN-21	STN-25	
Depth	9.1'-9.6'	29.1'-29.6'	
$\bar{\phi}$	35.8°		
$\bar{c}$	0 p.s.f.		
ϕ	15.4°		
c	500 p.s.f.		

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-22	349.7'	22.0'	11.5'-21.5'	-

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 23611 LICENSED PROFESSIONAL ENGINEER

7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	-	-	-

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION I-I'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
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www.stantec.com

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 07/14/10	35	C	10W501-12	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
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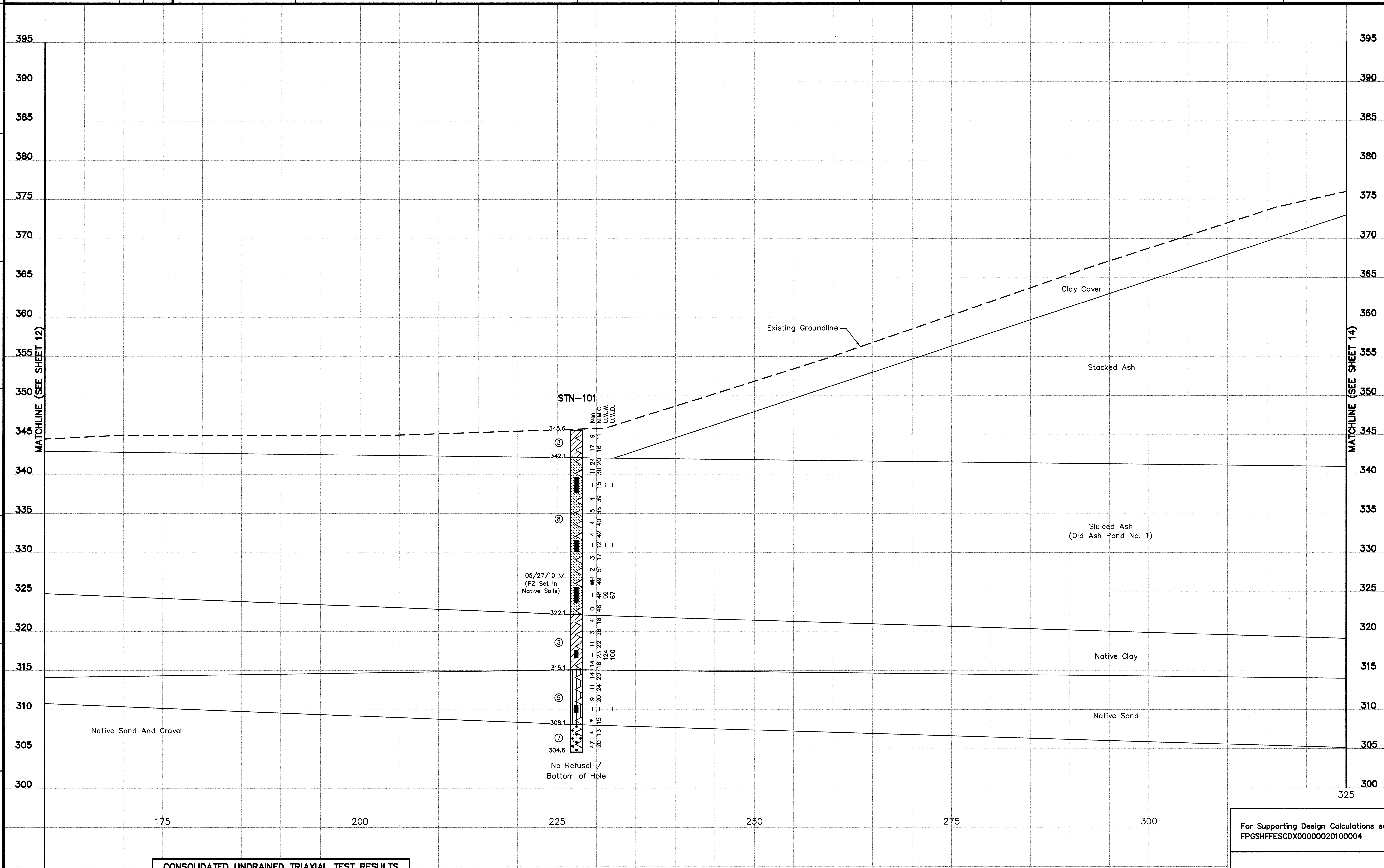
35 C 10W501-12

PLOT DATE: 07/12/2010 V:\1755\ACTIVE\175559023\



LEGEND

① Top Soil
② Crushed Stone
③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④ Silt, Sandy Silt
⑤ Silty Sand
⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦ Well Graded Gravel With Silt And Sand
⑧ Fly Ash
⑨ Bottom Ash

WH Weight of Hammer
◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽ Water Level and Date Recorded
▽ Phreatic Surface From Pz Data
▽ Phreatic Surface From Seepage Model
▽ Phreatic Surface From Rapid Drawdown
No Refusal No Refusal Encountered
* Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS		
Location	STN-101	
Depth	20.1'-20.6'	20.7'-21.2'
$\bar{\phi}$	38.6°	
$\bar{c}$	40 p.s.f.	
ϕ	27.4°	
c	400 p.s.f.	

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0 RECORD DRAWING	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION I-I'

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

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AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-13 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
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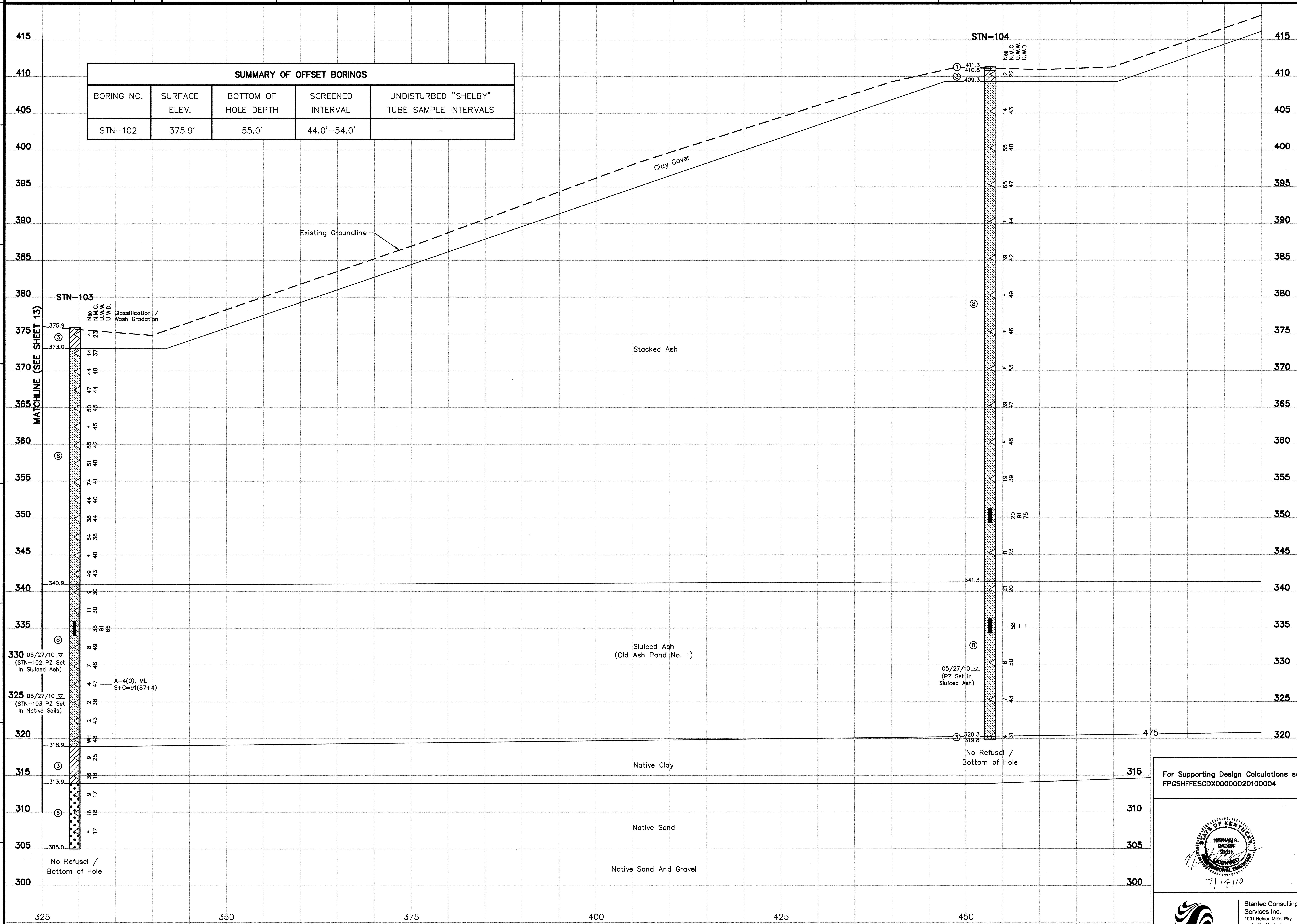
35 C 10W501-14



SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-102	375.9'	55.0'	44.0'-54.0'	-

LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
⑥	Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦	Well Graded Gravel With Silt And Sand
⑧	Fly Ash
⑨	Bottom Ash
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
——▽——	Phreatic Surface From Pz Data
—▽— · —	Phreatic Surface From Seepage Model
— —▽— —	Phreatic Surface From Rapid Drawdown
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	-	-

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION I-I'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

STATE OF KENTUCKY — NATHAN A. BADER — LICENSED PROFESSIONAL ENGINEER
7/14/10

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1901 Nelson Miller Pky.
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SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-14 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

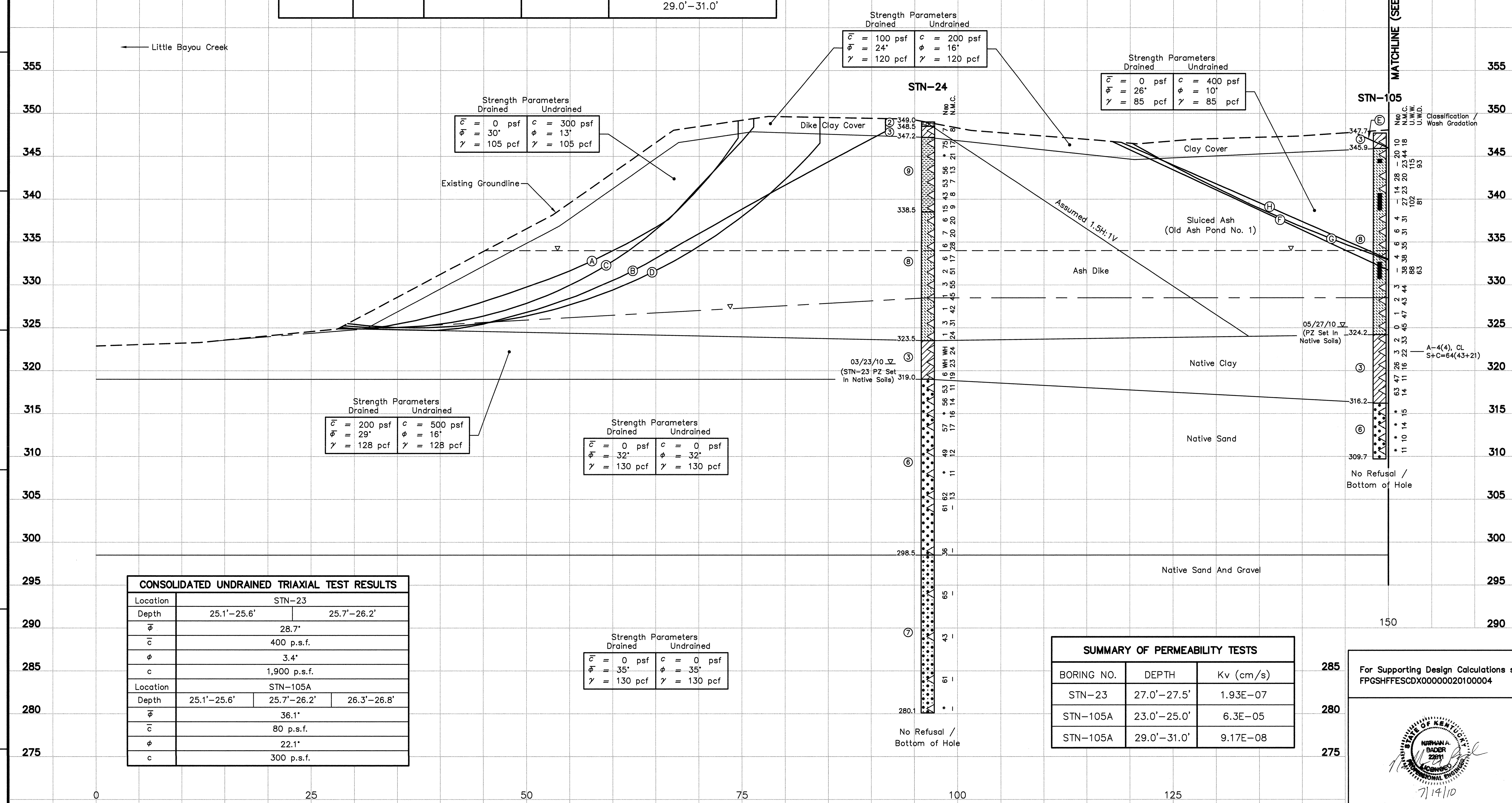
35	C	10W501-15

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-23	349.0'	44.0'	33.5'-43.5'	15.0'-17.0' 17.0'-19.0' 25.0'-27.0' 27.0'-29.0'
STN-105A	347.7'	31.0'	NO PIEZOMETER	23.0'-25.0' 25.0'-27.0' 27.0'-29.0' 29.0'-31.0'

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non-Global, Optimized	Drained	1.2
B	Global, Optimized	Drained	1.5
C	Rapid Drawdown Non-Global With Phreatic Surface Of 100-Year Flood Elev. 334.0'	Undrained	0.9
D	Rapid Drawdown Global With Phreatic Surface Of 100-Year Flood Elev. 334.0'	Undrained	1.2



CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-23		
Depth	25.1'-25.6'	25.7'-26.2'	
$\bar{\phi}$	28.7°		
$\bar{c}$	400 p.s.f.		
ϕ	3.4°		
c	1,900 p.s.f.		
Location	STN-105A		
Depth	25.1'-25.6'	25.7'-26.2'	26.3'-26.8'
$\bar{\phi}$	36.1°		
$\bar{c}$	80 p.s.f.		
ϕ	22.1°		
c	300 p.s.f.		

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-23	27.0'-27.5'	1.93E-07
STN-105A	23.0'-25.0'	6.3E-05
STN-105A	29.0'-31.0'	9.17E-08

LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

- WH — Weight of Hammer
- ◁ — Standard Penetration Test Interval
- ■ — Undisturbed Thin-Walled (Shelby) Tube Sample
- N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
- N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
- N.M.C. — Natural Moisture Content (%)
- U.W.W. — Unit Weight Wet (lbs./cu.ft.)
- U.W.D. — Unit Weight Dry (lbs./cu.ft.)
- 09/17/09 — Water Level and Date Recorded
- Phreatic Surface From Pz Data
- Phreatic Surface From Seepage Model
- Phreatic Surface From Rapid Drawdown
- No Refusal — No Refusal Encountered
- * — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	-	-	-

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION J-J'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky 40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000	DATE 07/14/10	35	C	10W501-15	R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010

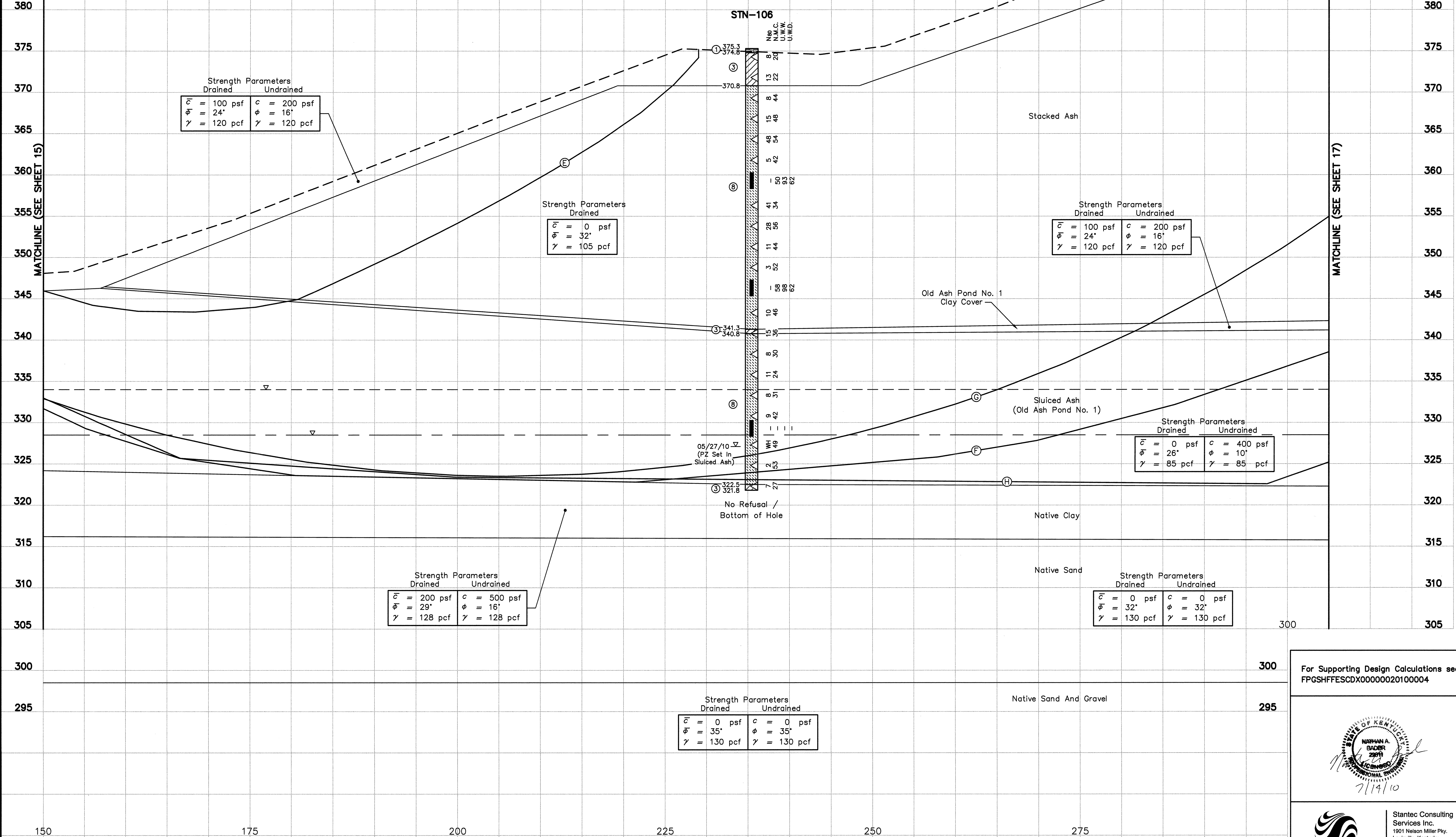
10W501-16 | C | 35

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-106	15.0'-17.0'	8.16E-05

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
E	Non-Global, Optimized	Drained	1.8
F	Global, Optimized	Drained	2.1
G	Non-Global, Circular	Undrained	1.8
H	Global, Non-Circular	Undrained	1.8



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

NATHAN A. BADER 23911 LICENSED PROFESSIONAL ENGINEER STATE OF KENTUCKY
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky 40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

R 0 07/14/10 JC SB JC NB HA NB TJ RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION J-J'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

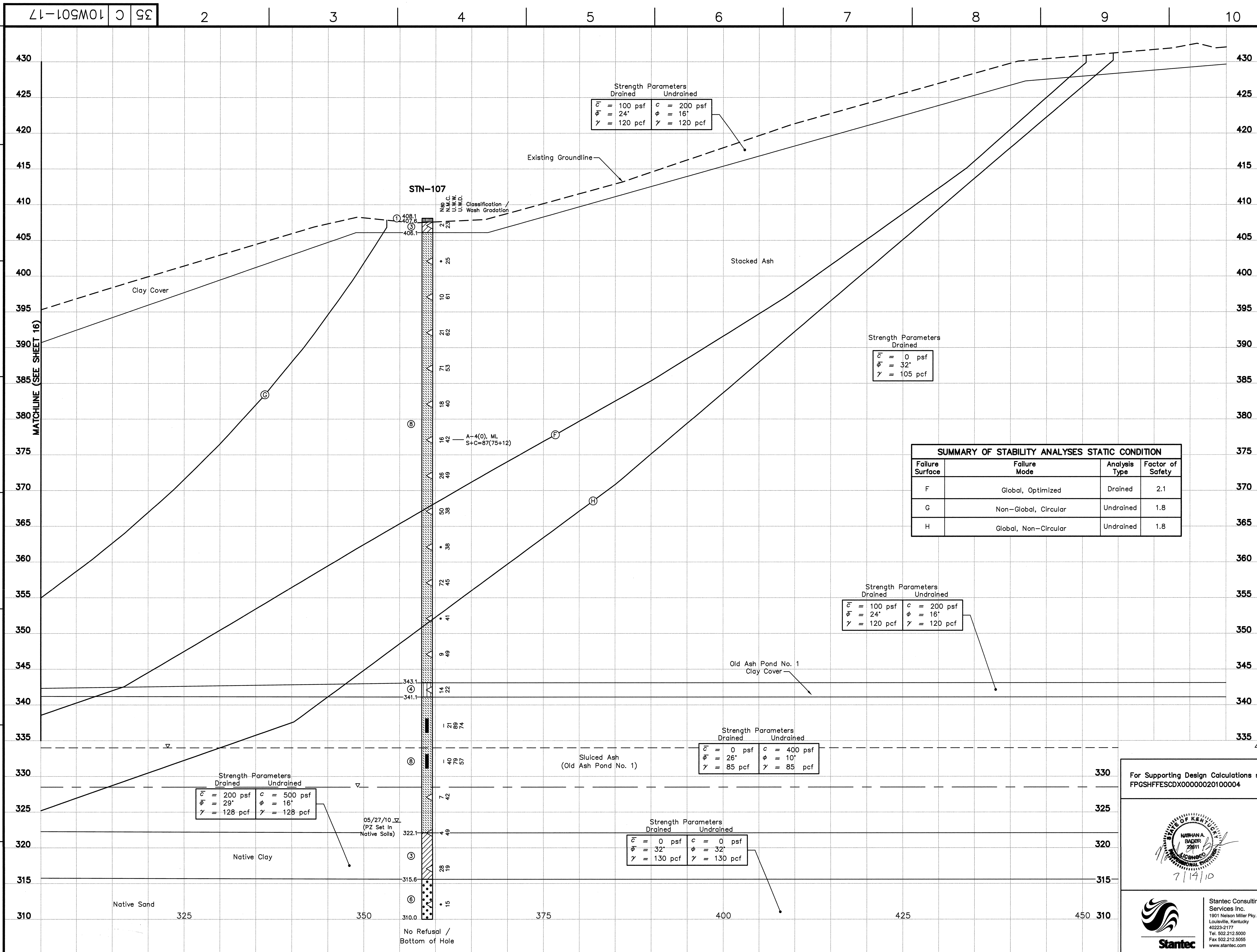
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-16 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
F	Global, Optimized	Drained	2.1
G	Non-Global, Circular	Undrained	1.8
H	Global, Non-Circular	Undrained	1.8

LEGEND

①		Top Soil
②		Crushed Stone
③		Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④		Silt, Sandy Silt
⑤		Silty Sand
⑥		Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦		Well Graded Gravel With Silt And Sand
⑧		Fly Ash
⑨		Bottom Ash

WH — Weight of Hammer
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽ — Water Level and Date Recorded
Phreatic Surface From Pz Data
Phreatic Surface From Seepage Model
Phreatic Surface From Rapid Drawdown
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY — NATHAN A. BADER — 22811 — LICENSED PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

R 0: RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION J–J'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
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AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-17 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010 USER: BRADSHAW, STEVEN

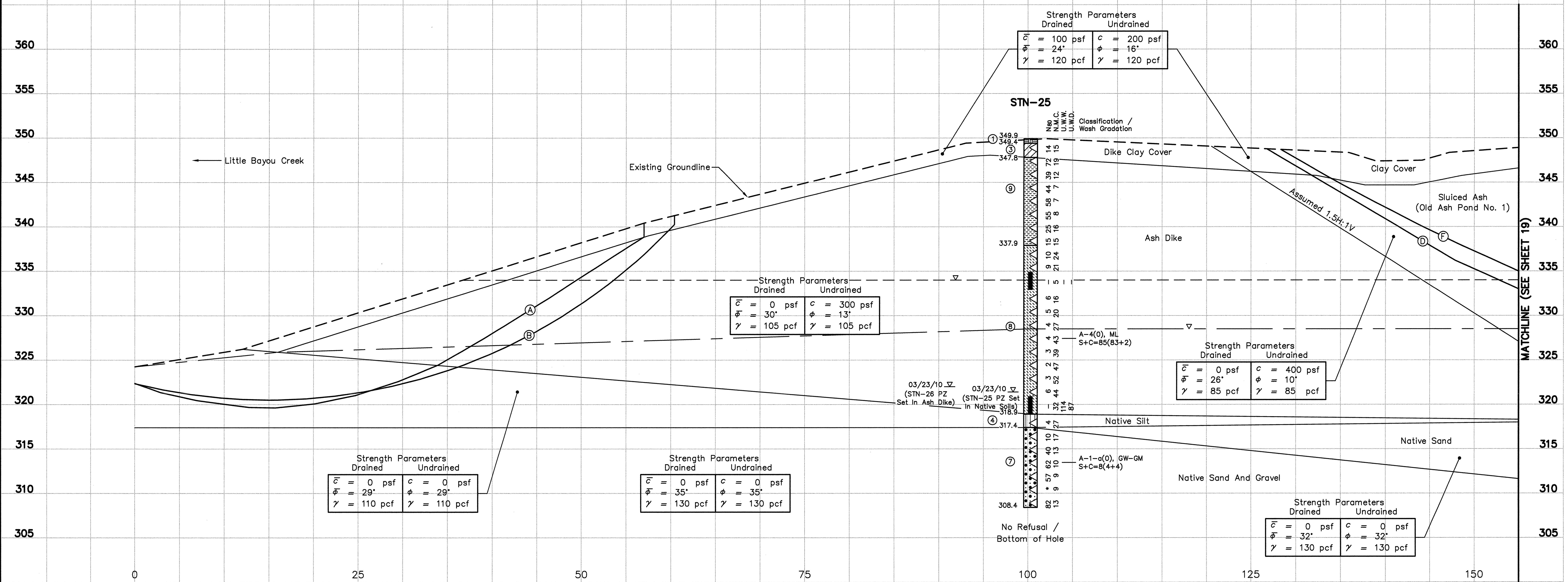
35 C 10W501-18

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-26	349.9'	29.7'	23.0'-28.0'	-

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non-Global, Optimized	Drained	1.7
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	Undrained	1.6



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH — Weight of Hammer
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽ — Water Level and Date Recorded
▽ — Phreatic Surface From Pz Data
▽ — Phreatic Surface From Seepage Model
▽ — Phreatic Surface From Rapid Drawdown
No Refusal — No Refusal Encountered
* — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-21	STN-25
Depth	9.1'-9.6'	29.1'-29.6'
φ̄	35.8°	
c̄	0 p.s.f.	
φ	15.4°	
c	500 p.s.f.	

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-25	29.0'-31.0'	1.34E-07

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 22611 LICENSED PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0 RECORD DRAWING	07/14/10	JC	SB	JC	NB	HA	NB	TJ	-	-	-

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION K-K'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
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Fax 502.212.5055
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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-18 | R 0

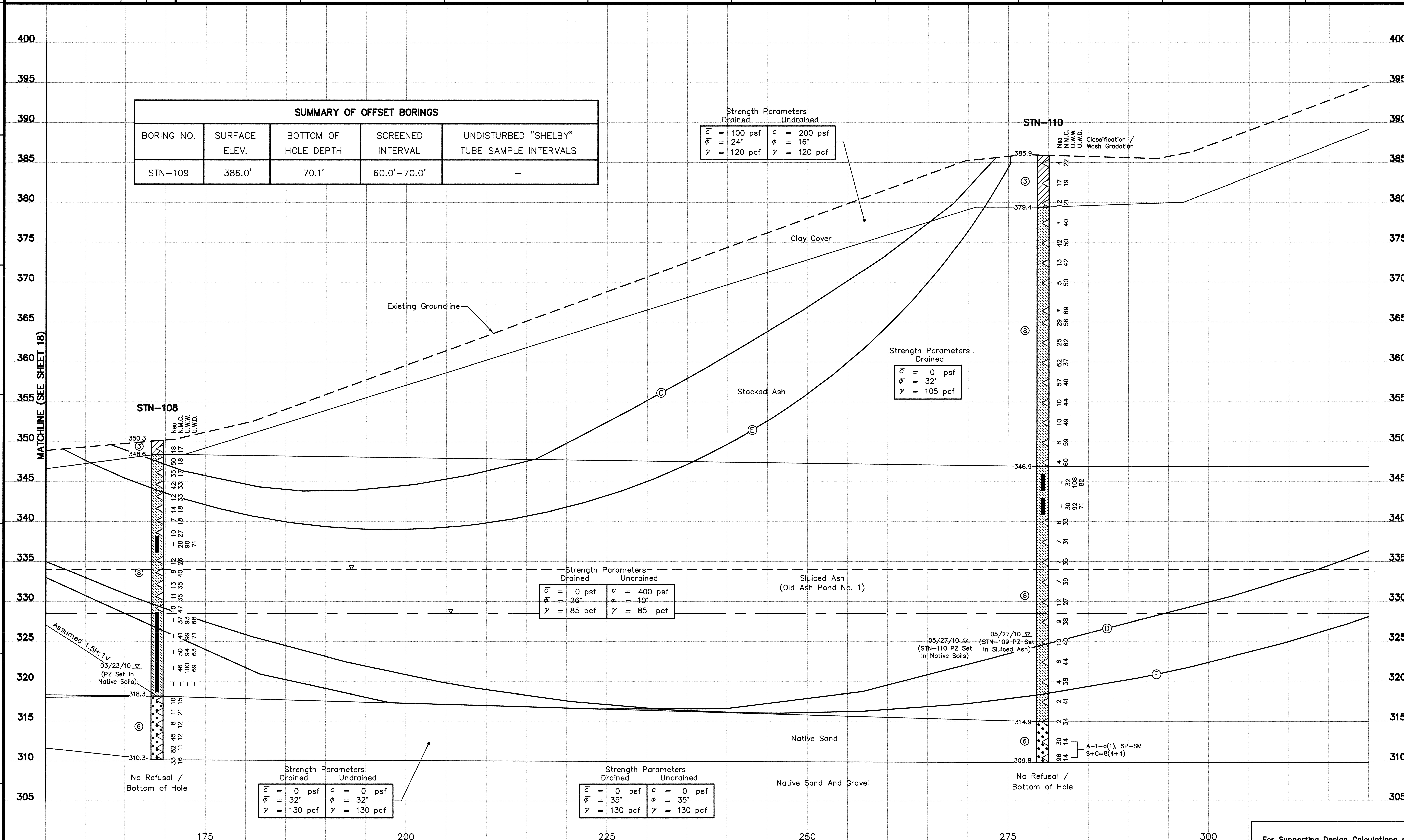
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010

35 C 10W501-19



SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-109	386.0'	70.1'	60.0'-70.0'	-

Strength Parameters (Clay Cover)

Drained	Undrained
$\bar{c}$ = 100 psf	c = 200 psf
$\bar{\phi}$ = 24°	ϕ = 16°
γ = 120 pcf	γ = 120 pcf

Strength Parameters (Stacked Ash)

Drained
$\bar{c}$ = 0 psf
$\bar{\phi}$ = 32°
γ = 105 pcf

Strength Parameters (Sluiced Ash)

Drained	Undrained
$\bar{c}$ = 0 psf	c = 400 psf
$\bar{\phi}$ = 26°	ϕ = 10°
γ = 85 pcf	γ = 85 pcf

Strength Parameters (Native Sand)

Drained	Undrained
$\bar{c}$ = 0 psf	c = 0 psf
$\bar{\phi}$ = 32°	ϕ = 32°
γ = 130 pcf	γ = 130 pcf

Strength Parameters (Native Sand And Gravel)

Drained	Undrained
$\bar{c}$ = 0 psf	c = 0 psf
$\bar{\phi}$ = 35°	ϕ = 35°
γ = 130 pcf	γ = 130 pcf

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-108	
Depth	28.2'-28.7'	28.8'-29.3'
$\bar{\phi}$	35.3°	
$\bar{c}$	160 p.s.f.	
ϕ	18.3°	
c	500 p.s.f.	
Location	STN-110	
Depth	40.1'-40.6'	40.7'-41.2'
$\bar{\phi}$	35.8°	
$\bar{c}$	0 p.s.f.	
ϕ	22.4°	
c	1,600 p.s.f.	

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
C	Non-Global, Optimized	Drained	1.8
D	Global, Optimized	Drained	2.1
E	Non-Global, Circular	Undrained	1.8
F	Global, Circular	Undrained	1.7

LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
⑥	Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦	Well Graded Gravel With Silt And Sand
⑧	Fly Ash
⑨	Bottom Ash
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
——▽——	Phreatic Surface From Pz Data
▽ · ——	Phreatic Surface From Seepage Model
— —▽— —	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	-	-	-

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION K-K'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
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AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-19 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

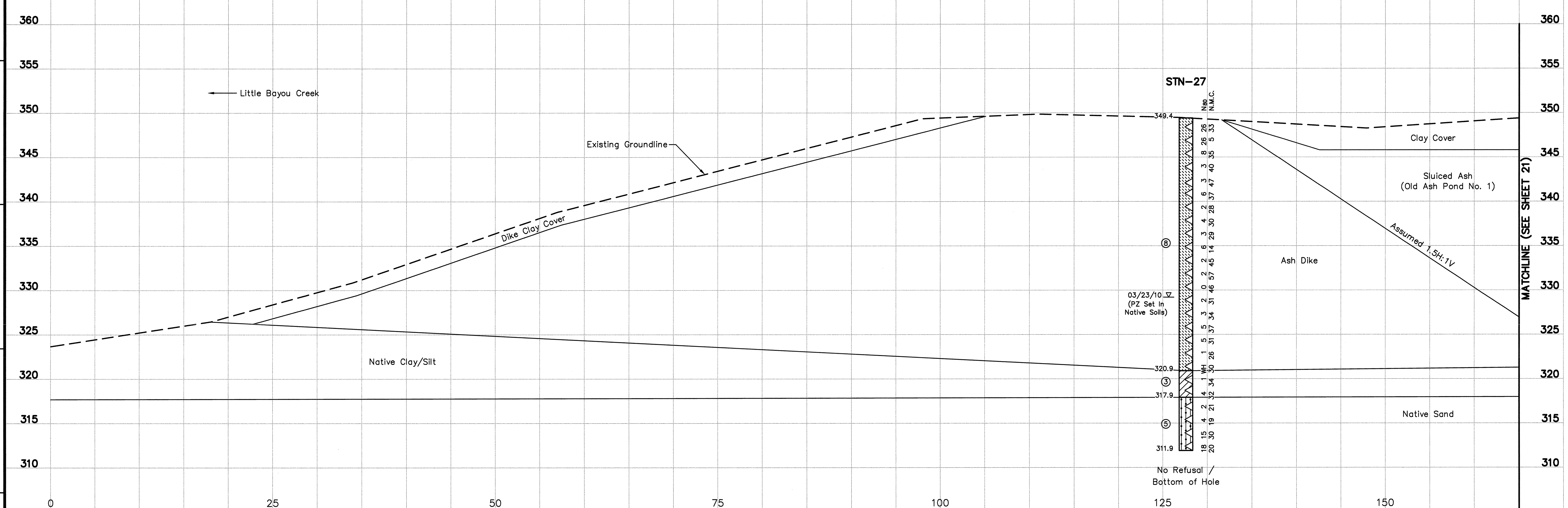
PLOT DATE: 07/12/2010

35 C 10W501-20

LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
⑥	Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦	Well Graded Gravel With Silt And Sand
⑧	Fly Ash
⑨	Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
——▽——	Phreatic Surface From Pz Data
▽ · ——	Phreatic Surface From Seepage Model
— —▽— —	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.



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RECORD DRAWING

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-28	349.4'	37.0'	NO PIEZOMETER	10.0'-12.0' 15.0'-17.0' 30.0'-32.0' 35.0'-37.0'

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-28	30.1'-30.6'	1.79E-04

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 25011 LICENSED PROFESSIONAL ENGINEER

7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
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REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV ID
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–	–

DISCIPLINE INTERFACE

SCALE: 1"=5' — EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION L-L'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

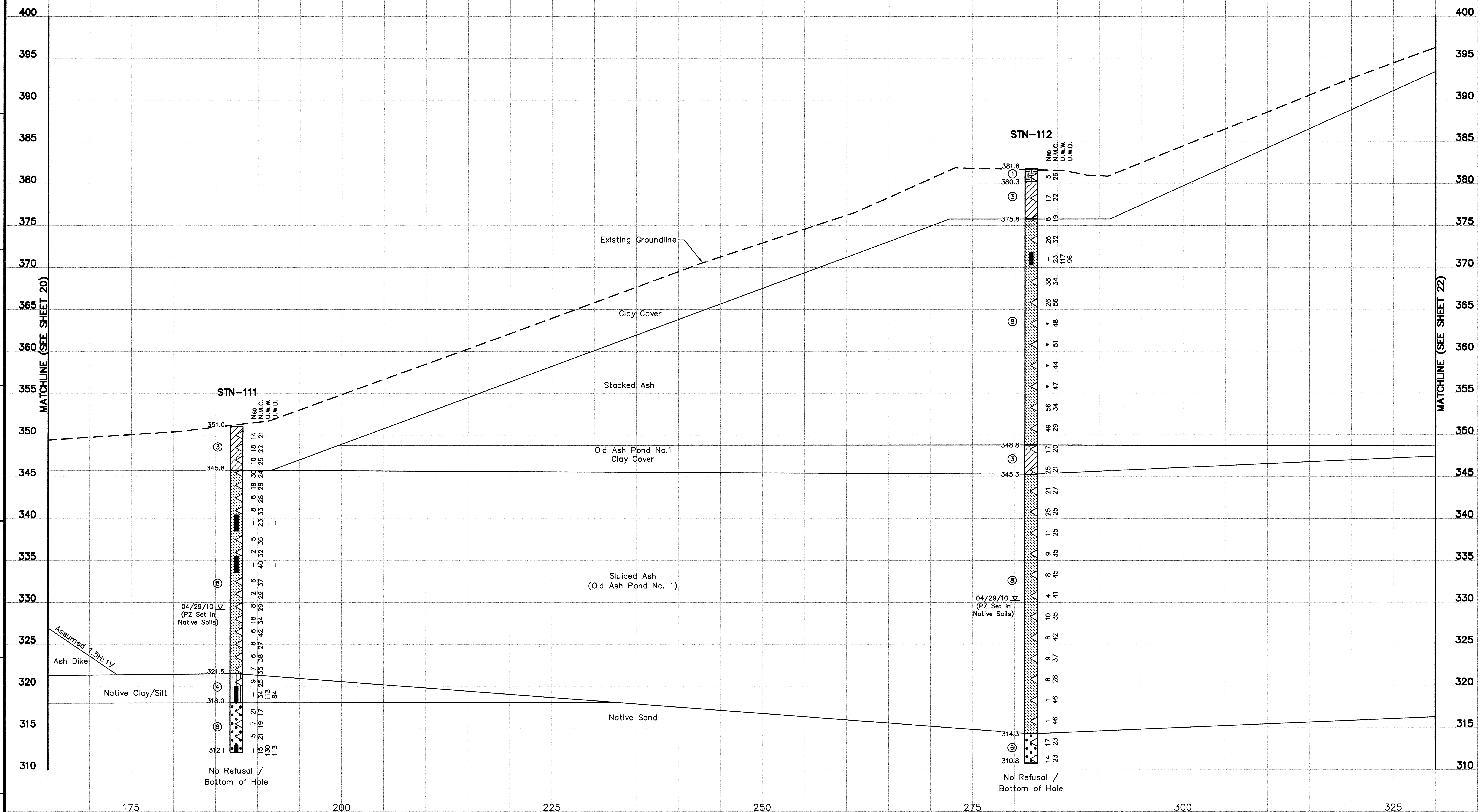
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-20 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



LEGEND

①		Top Soil
②		Crushed Stone
③		Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④		Silt, Sandy Silt
⑤		Silty Sand
⑥		Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦		Well Graded Gravel With Silt And Sand
⑧		Fly Ash
⑨		Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			
Location	STN-111		
Depth	31.1'-31.6'	31.6'-32.2'	32.3'-32.8'
$\bar{\phi}$	33.7°		
$\bar{c}$	580 p.s.f.		
ϕ	22.1°		
c	1,600 p.s.f.		

SUMMARY OF PERMEABILITY TESTS		
BORING NO.	DEPTH	Kv (cm/s)
STN-111	38.0'-38.9'	8.30E-05

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT	AS CONST
R0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–
RECORD DRAWING										

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION L-L'

STATE OF KENTUCKY
NATHAN A. BADER
23011
LICENSED PROFESSIONAL ENGINEER
7/19/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

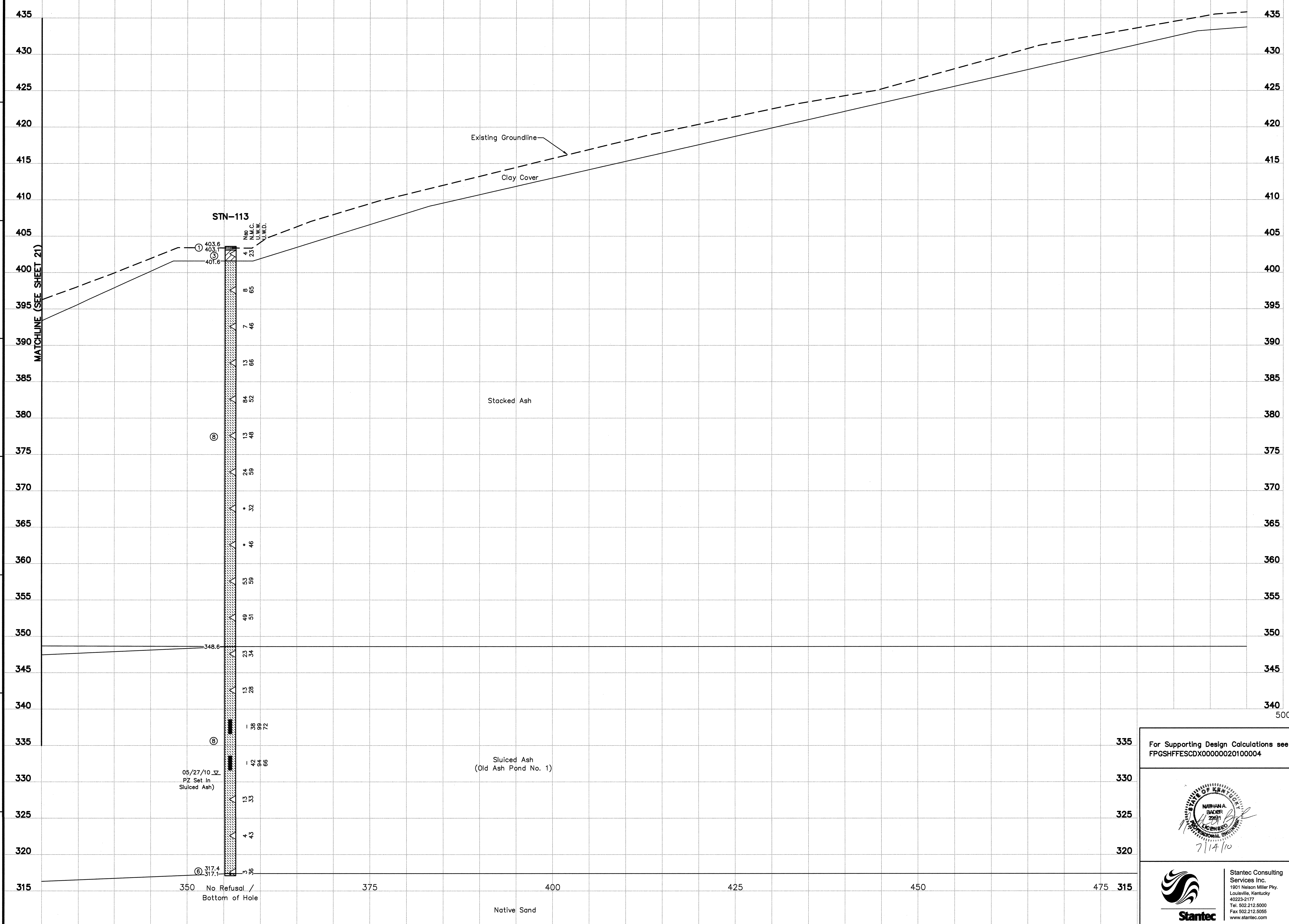
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-21 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



LEGEND

①		Top Soil
②		Crushed Stone
③		Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④		Silt, Sandy Silt
⑤		Silty Sand
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⑦		Well Graded Gravel With Silt And Sand
⑧		Fly Ash
⑨		Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

NATHAN A. BADER 22631 LICENSED PROFESSIONAL ENGINEER STATE OF KENTUCKY
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION L-L'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

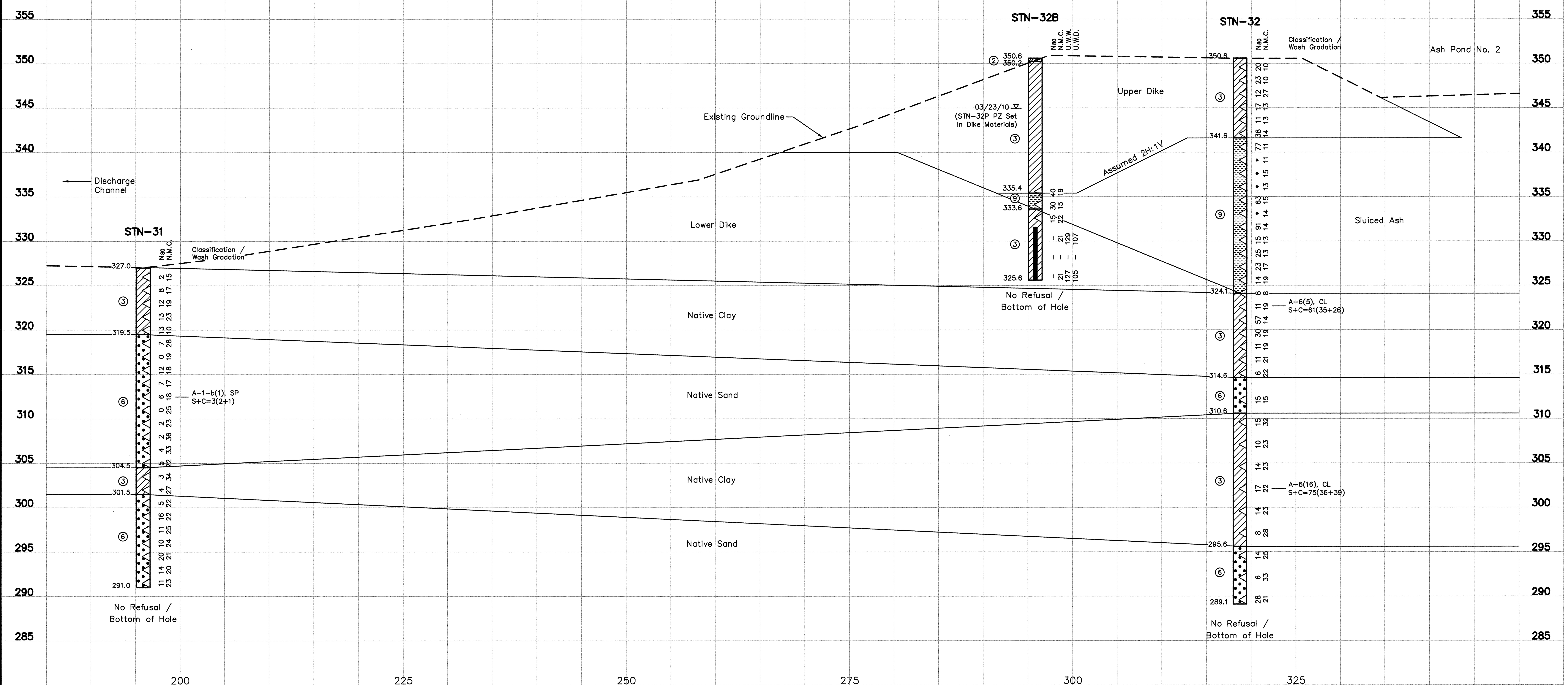
AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-22 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

SUMMARY OF PERMEABILITY TESTS		
BORING NO.	DEPTH	Kv (cm/s)
STN-32A	3.0'-5.0'	5.19E-09
STN-32B	23.0'-25.0'	6.42E-09



LEGEND

① Top Soil
② Crushed Stone
③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④ Silt, Sandy Silt
⑤ Silty Sand
⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦ Well Graded Gravel With Silt And Sand
⑧ Fly Ash
⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			
Location	STN-32A		
Depth	7.1'-7.6'	7.7'-8.2'	12.1'-12.6'
$\bar{\phi}$	28.4°		
$\bar{c}$	600 p.s.f.		
ϕ	20.6°		
c	800 p.s.f.		
Location	STN-32A		STN-32B
Depth	22.1'-22.6'	22.7'-23.2'	19.1'-19.6'
$\bar{\phi}$	24.1°		
$\bar{c}$	480 p.s.f.		
ϕ	13.9°		
c	700 p.s.f.		

SUMMARY OF OFFSET BORINGS				
BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-32A	350.6'	24.0'	NO PIEZOMETER	1.0'-3.0' 3.0'-5.0' 5.0'-7.0' 7.0'-9.0' 12.0'-14.0' 22.0'-24.0'
STN-32P	350.6'	24.0'	13.0'-23.0'	18.0'-20.0' 20.0'-22.0'

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	-	-	-

RECORD DRAWING

DISCIPLINE INTERFACE 1 2 3 4

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION M-M'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec
Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-23 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

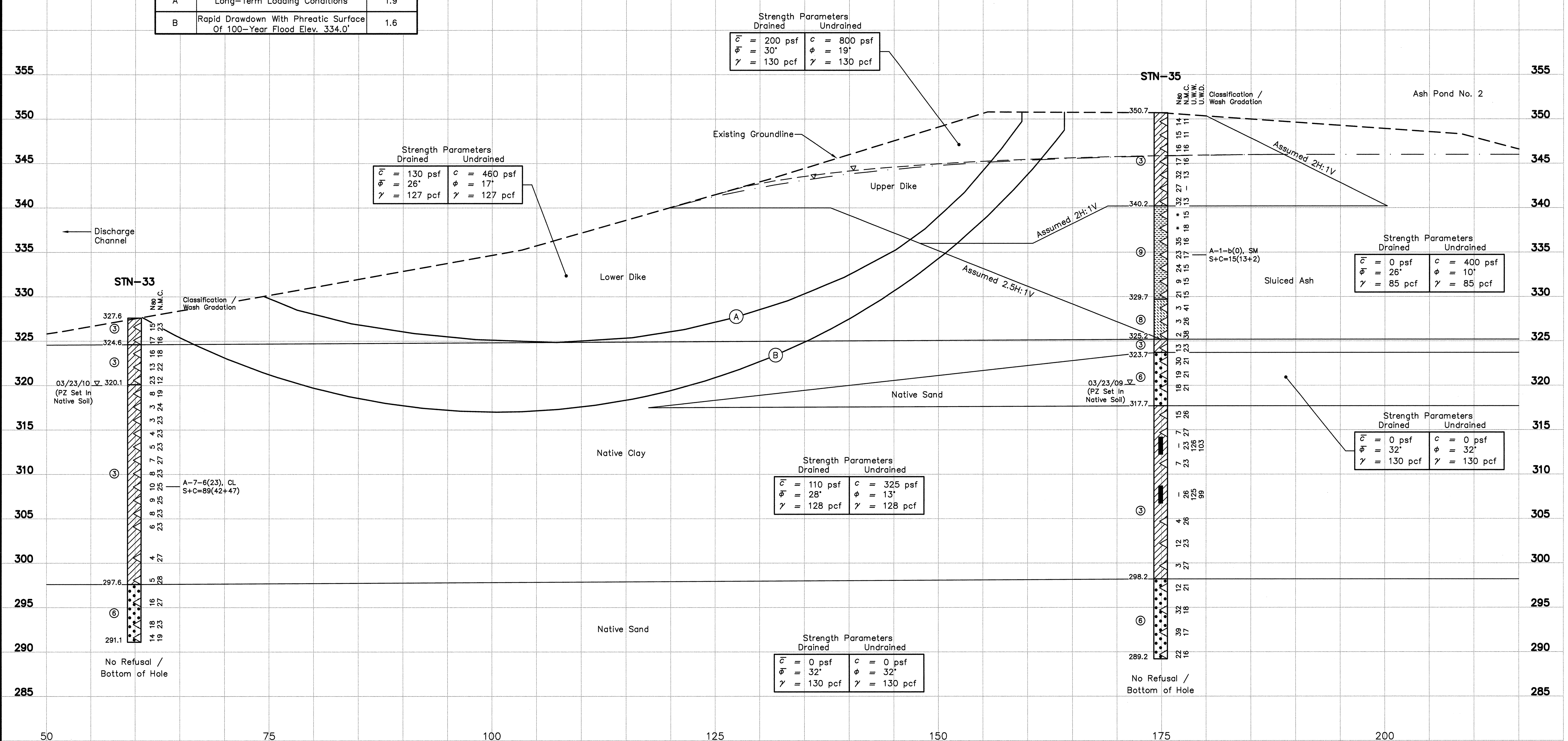
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	1.9
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.6



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

- WH — Weight of Hammer
- ◁ — Standard Penetration Test Interval
- ■ — Undisturbed Thin-Walled (Shelby) Tube Sample
- N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
- N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
- N.M.C. — Natural Moisture Content (%)
- U.W.W. — Unit Weight Wet (lbs./cu.ft.)
- U.W.D. — Unit Weight Dry (lbs./cu.ft.)
- 09/17/09 ▽ — Water Level and Date Recorded
- ▽ — Phreatic Surface From Pz Data
- ▽ — Phreatic Surface From Seepage Model
- ▽ — Phreatic Surface From Rapid Drawdown
- No Refusal — No Refusal Encountered
- * — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-33-SI	327.4'	36.0'	SLOPE INCLINOMETER	4.0'-6.0' 8.0'-10.0' 15.0'-17.0' 30.0'-32.0'
STN-34	350.5'	27.0'	NO PIEZOMETER	23.0'-25.0' 25.0'-27.0'
STN-35-SI	350.2'	60.0'	SLOPE INCLINOMETER	-

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-33-SI	16.0'-16.3'	4.4E-08
STN-35	37.5'-37.8'	3.7E-08

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-33-SI		
Depth	8.1'-8.6'	8.6'-9.2'	9.2'-9.8'
$\bar{\phi}$	29.6°		
$\bar{c}$	420 p.s.f.		
ϕ	15.0°		
c	1,656 p.s.f.		

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R -	-	-	-	-	-	-	-	-	-	-	-
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	-	-	-

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION N-N'

STATE OF KENTUCKY NATHAN A. BADER 22611 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

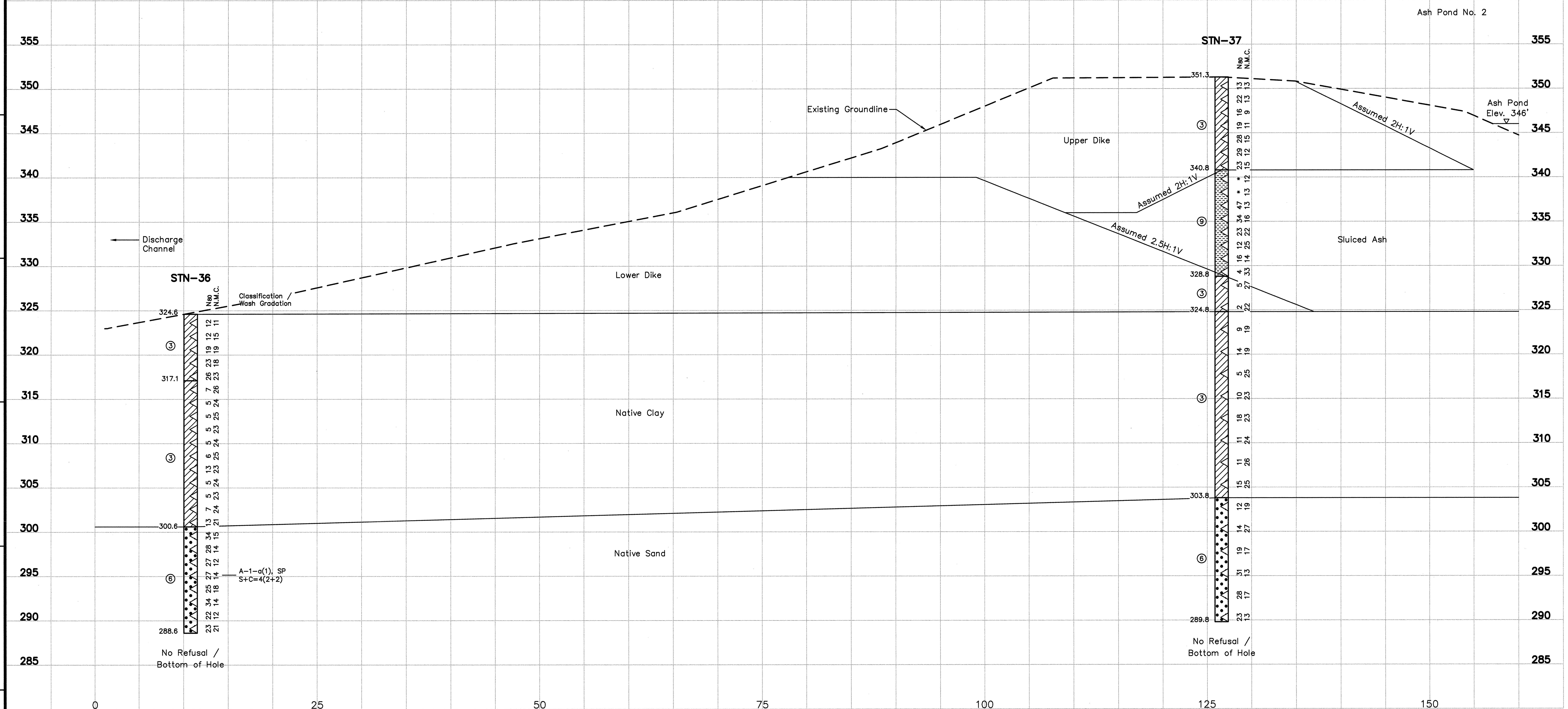
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-24 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY



LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
⑥	Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦	Well Graded Gravel With Silt And Sand
⑧	Fly Ash
⑨	Bottom Ash
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{60}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

NATHAN A. BADER 22611 STATE OF KENTUCKY LICENSED PROFESSIONAL ENGINEER

7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
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Stantec

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION O-O'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-25 | R 0

35 | C | 10W501-25

STANTEC | 0
TASK COMPLETED BY: | REV NO.

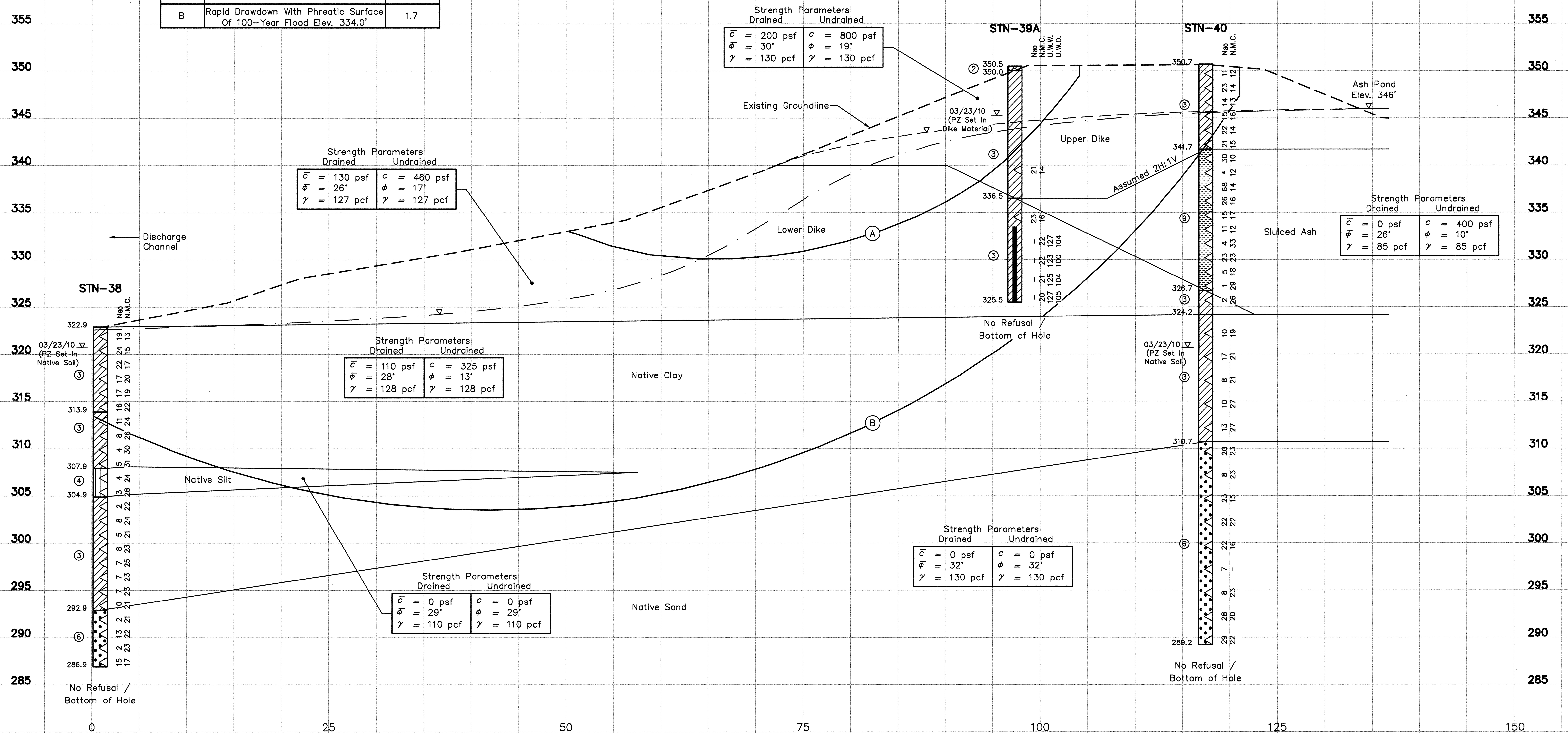
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

35	C	10W501-26

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.0
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.7



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH — Weight of Hammer
◁ — Standard Penetration Test Interval
■ — Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. — Natural Moisture Content (%)
U.W.W. — Unit Weight Wet (lbs./cu.ft.)
U.W.D. — Unit Weight Dry (lbs./cu.ft.)
09/17/09 — Water Level and Date Recorded
Phreatic Surface From Pz Data
Phreatic Surface From Seepage Model
Phreatic Surface From Rapid Drawdown
No Refusal — No Refusal Encountered
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RECORD DRAWING

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-39	350.5'	30.0'	NO PIEZOMETER	4.0'-6.0' 6.0'-8.0' 26.0'-28.0' 28.0'-30.0'
STN-39B	350.5'	14.5'	NO PIEZOMETER	–
STN-39C	350.5'	9.0'	NO PIEZOMETER	–

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-39	4.5'-4.8'	7.4E-08
STN-39A	19.0'-21.0'	6.14E-09

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-39		
Depth	6.9'-7.8'	4.8'-5.4'	5.4'-6.0'
$\bar{\phi}$	34.1°		
$\bar{c}$	432 p.s.f.		
ϕ	33.8°		
c	1,670 p.s.f.		
Location	STN-39		
Depth	26.8'-27.3'	28.7'-29.3'	29.3'-30.0'
$\bar{\phi}$	35.5°		
$\bar{c}$	4 p.s.f.		
ϕ	26.0°		
c	288 p.s.f.		
Location	STN-39A		
Depth	20.1'-20.6'	21.1'-21.6'	21.7'-22.2'
$\bar{\phi}$	25.7°		
$\bar{c}$	180 p.s.f.		
ϕ	18.2°		
c	360 p.s.f.		

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
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REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION P-P'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-26 | R 0

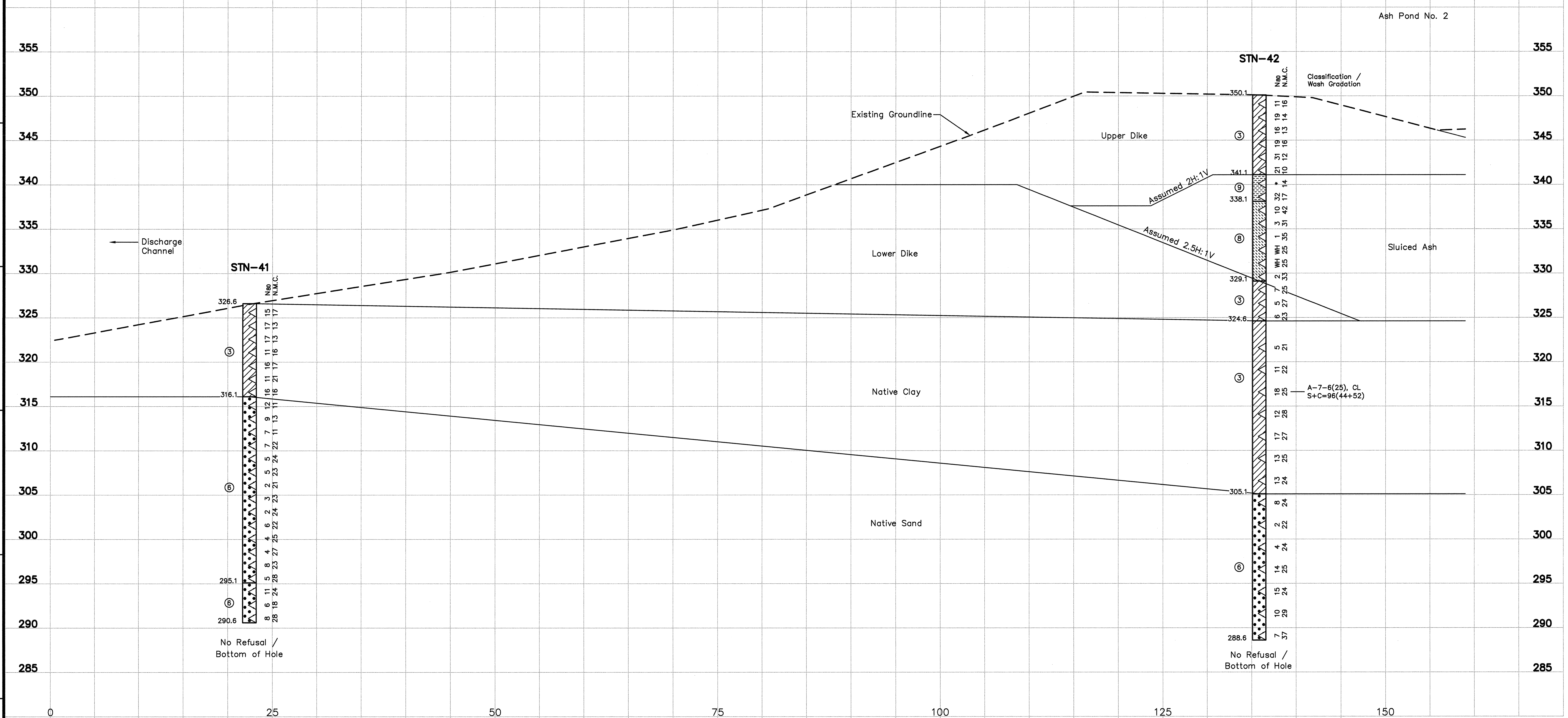
STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010 USER: BRADSHAW, STEVEN

35 C 10W501-27



LEGEND

①		Top Soil
②		Crushed Stone
③		Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④		Silt, Sandy Silt
⑤		Silty Sand
⑥		Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦		Well Graded Gravel With Silt And Sand
⑧		Fly Ash
⑨		Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

PLOT DATE: 07/12/2010

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0 RECORD DRAWING	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION Q–Q'

STATE OF KENTUCKY
NATHAN A. BADER
20811
LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

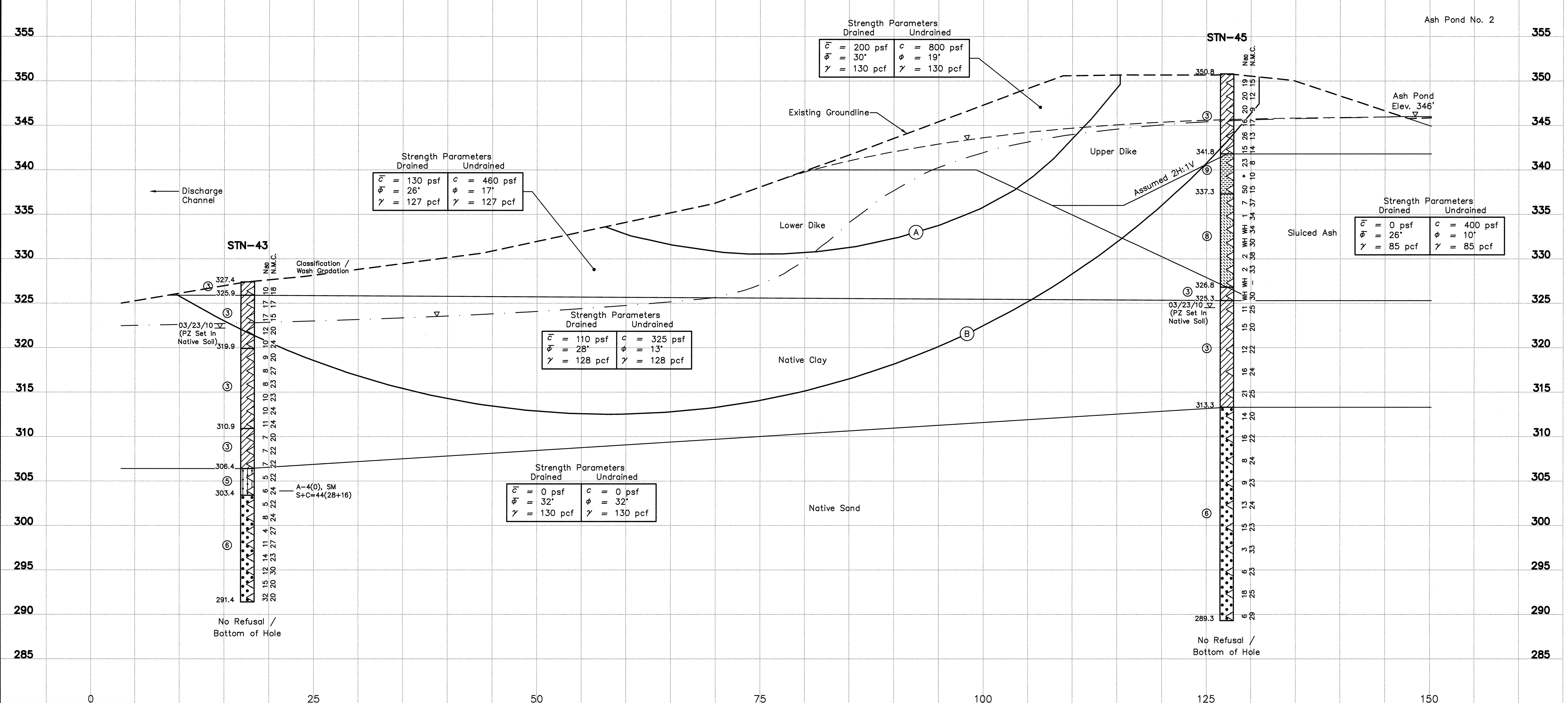
AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-27 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

SUMMARY OF STABILITY ANALYSES STATIC CONDITION		
Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.2
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.8



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
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U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
	Phreatic Surface From Pz Data
	Phreatic Surface From Seepage Model
	Phreatic Surface From Rapid Drawdown
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RECORD DRAWING

SUMMARY OF OFFSET BORINGS				
BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-44	350.4'	31.0'	NO PIEZOMETER	4.0'-6.0' 6.0'-8.0' 17.0'-19.0' 19.0'-21.0' 27.0'-29.0' 29.0'-31.0'

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	-	-

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION R-R'

NATHAN A. BADER 25411 — STATE OF KENTUCKY — LICENSED PROFESSIONAL ENGINEER
7/19/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
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Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

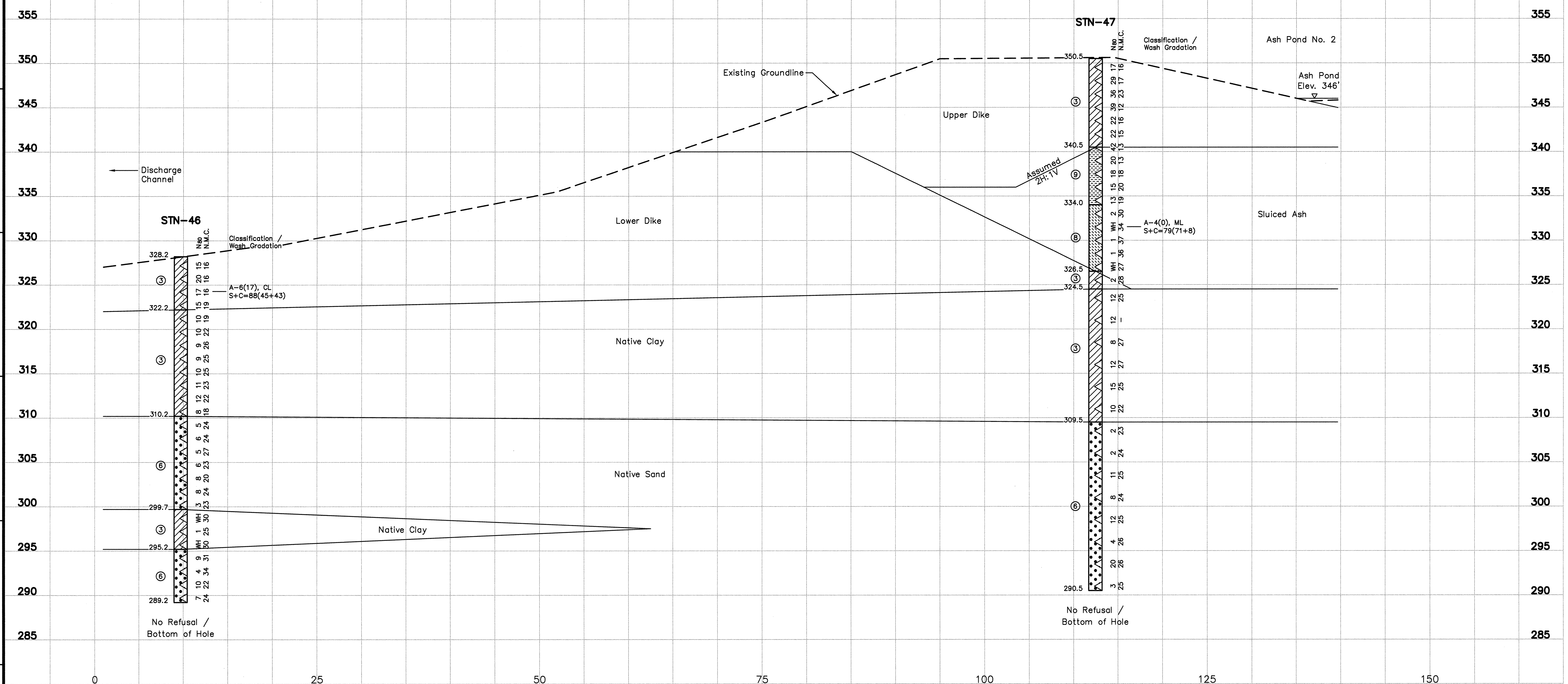
AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-28 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

35 C 10W501-29



LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
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⑨	Bottom Ash
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
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U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NARMAN A. BADER 20311 LICENSED PROFESSIONAL ENGINEER

7/14/10

Stantec

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–	–

DISCIPLINE INTERFACE

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION S-S'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

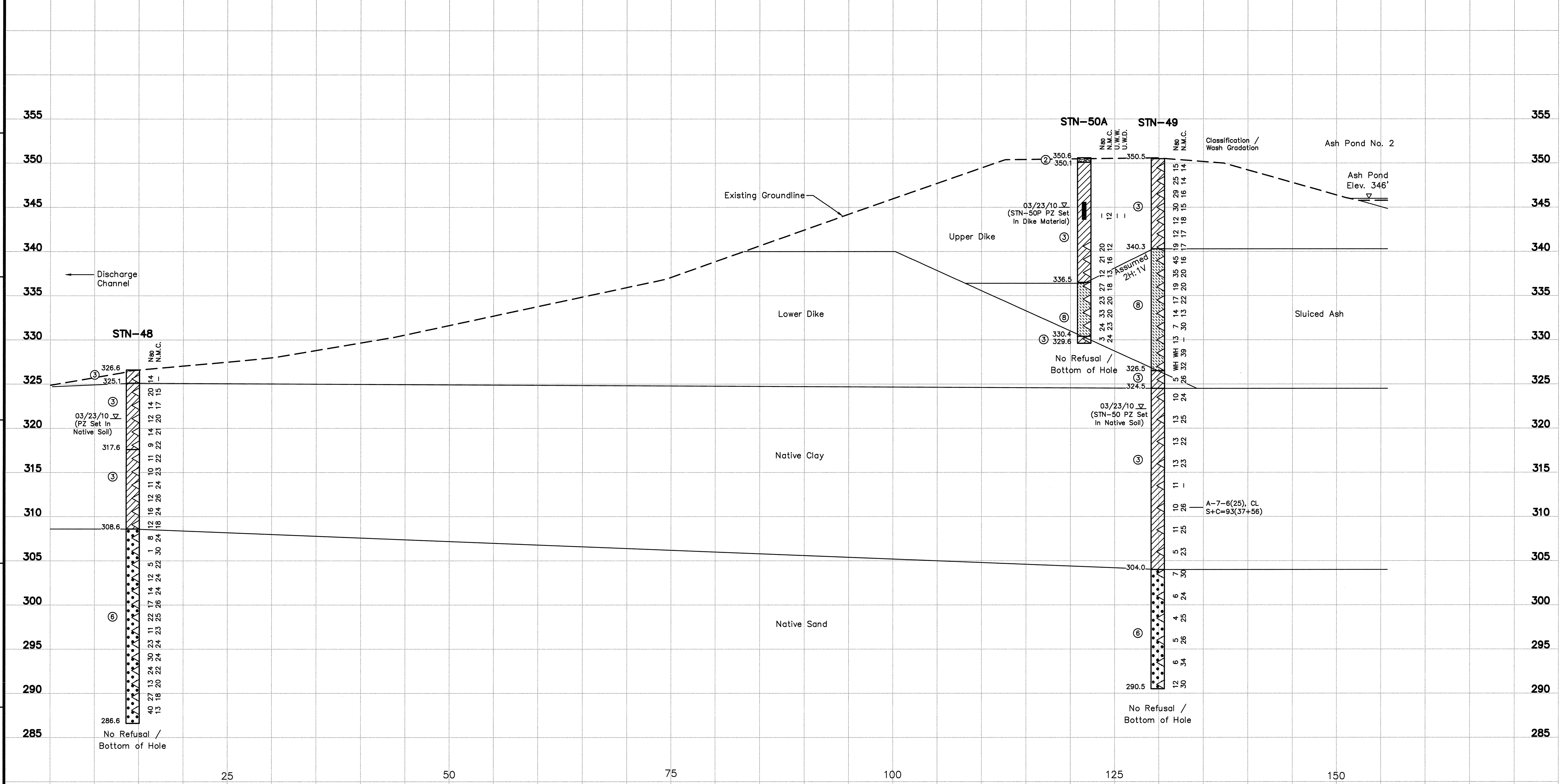
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-29 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



LEGEND

- ① Top Soil
- ② Crushed Stone
- ③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
- ④ Silt, Sandy Silt
- ⑤ Silty Sand
- ⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
- ⑦ Well Graded Gravel With Silt And Sand
- ⑧ Fly Ash
- ⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
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RECORD DRAWING

SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-50	350.6'	60.0'	49.9'-59.9'	4.0'-6.0' 8.0'-10.0' 28.0'-30.0' 38.0'-40.0'
STN-50P	350.6'	25.0'	14.0'-24.0'	4.0'-6.0' 6.0'-8.0' 15.5'-17.5' 17.5'-19.5' 19.5'-21.5' 21.5'-23.5'

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-50	8.7'-9.0'	5.9E-08
STN-50	38.2'-38.5'	5.1E-08
STN-50P	17.5'-19.5'	7.05E-09

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-50		
Depth	38.6'-39.2'	29.4'-30.0'	
$\bar{\phi}$	30.3°		
$\bar{c}$	300 p.s.f.		
ϕ	28.6°		
c	360 p.s.f.		
Location	STN-50P		
Depth	4.1'-4.6'	4.7'-5.2'	6.0'-6.5'
$\bar{\phi}$	27.0°		
$\bar{c}$	960 p.s.f.		
ϕ	17.7°		
c	1,000 p.s.f.		
Location	STN-50P		
Depth	19.6'-20.1'	20.2'-20.7'	21.6'-22.1'
$\bar{\phi}$	33.0°		
$\bar{c}$	60 p.s.f.		
ϕ	20.6°		
c	160 p.s.f.		

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

NARHAN A. BADER 22831 — State of Kentucky Professional Engineer
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky 40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

R 0 07/14/10 JC SB JC NB HA NB TJ — RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION T-T'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-30 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

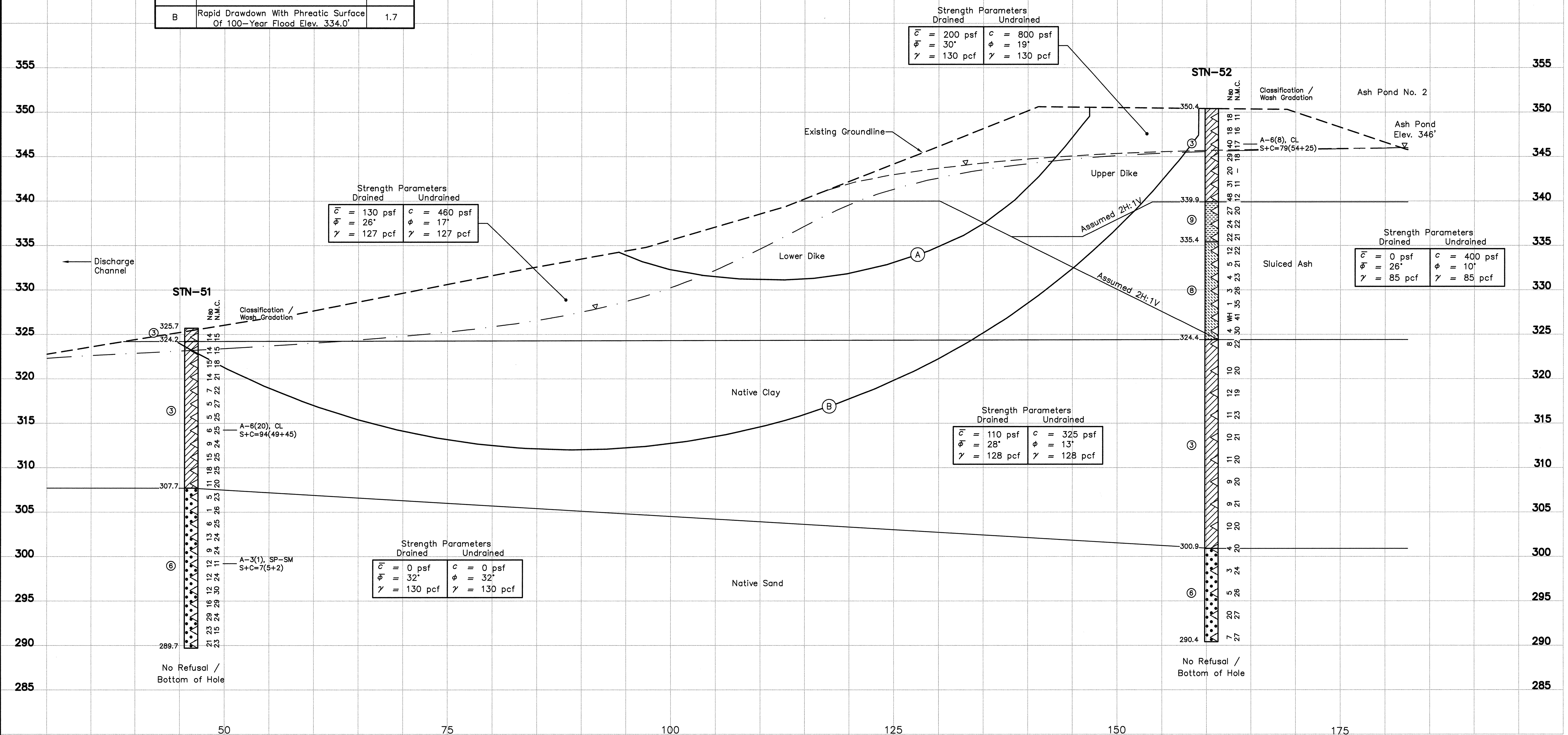
PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

35 | C | 10W501-31

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Factor of Safety
A	Long-Term Loading Conditions	2.1
B	Rapid Drawdown With Phreatic Surface Of 100-Year Flood Elev. 334.0'	1.7



LEGEND

①		Top Soil
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④		Silt, Sandy Silt
⑤		Silty Sand
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WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
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N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
——▽——	Phreatic Surface From Pz Data
▽ · — ·	Phreatic Surface From Seepage Model
— —▽— —	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX000000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION U-U'

STATE OF KENTUCKY — NATHAN A. BADER — 22611 — LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

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SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

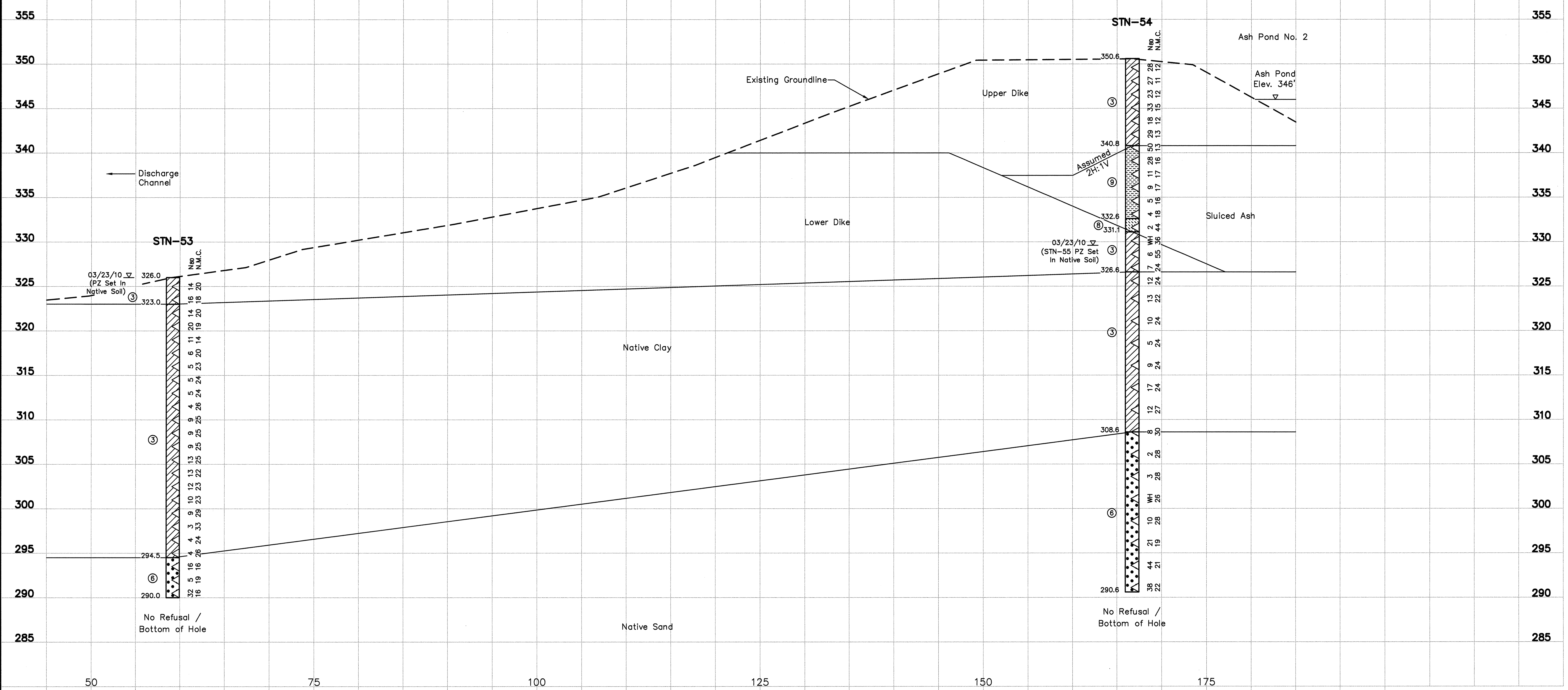
AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-31 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

35 C 10W501-32



LEGEND

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WH Weight of Hammer
◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
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RECORD DRAWING

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STN-55	350.2'	60.0'	49.9'–59.9'	4.0'–6.0' 8.0'–10.0' 28.0'–30.0' 38.0'–40.0'

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

R 0 07/14/10 JC SB JC NB HA NB TJ
RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION V–V'

7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

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1901 Nelson Miller Pky.
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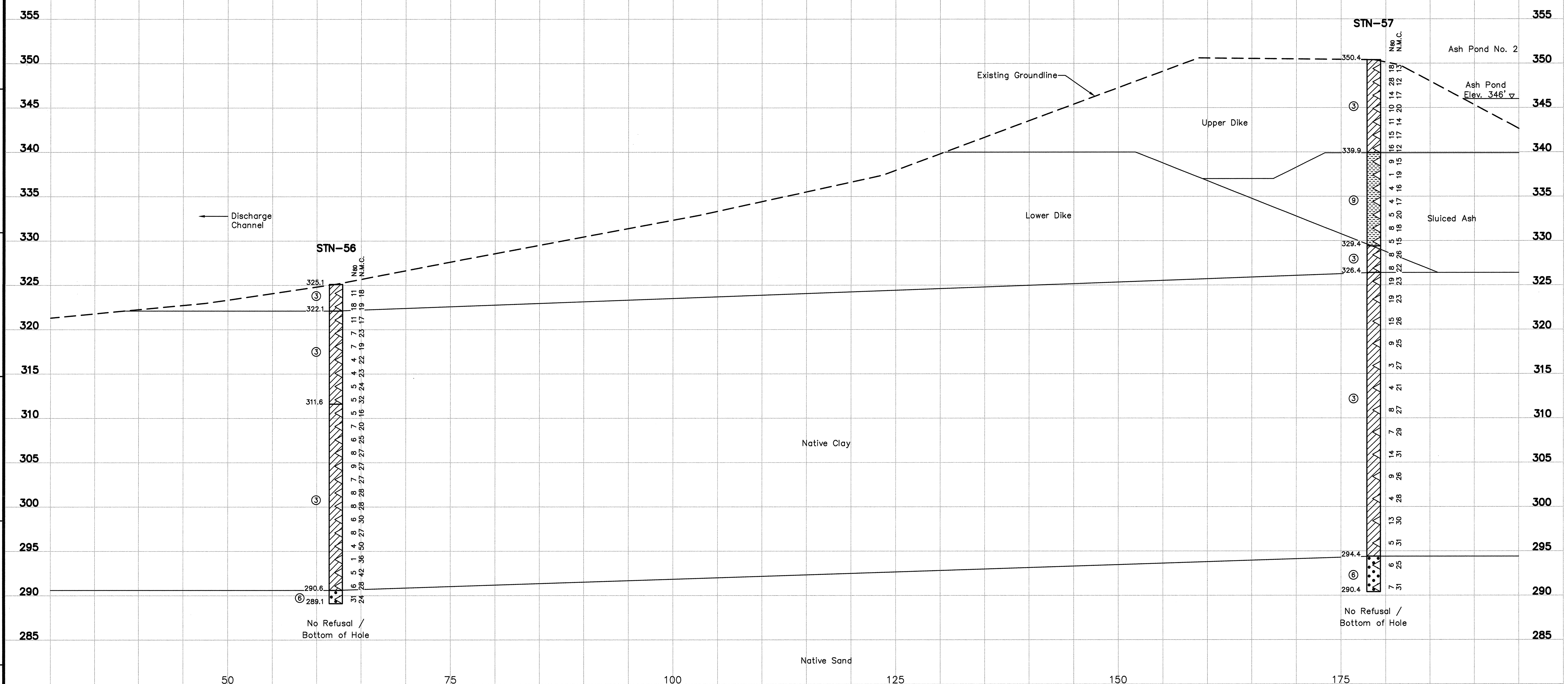
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–32 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY



LEGEND

①	Top Soil
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④	Silt, Sandy Silt
⑤	Silty Sand
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–
RECORD DRAWING											

DISCIPLINE INTERFACE

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION W–W'

STATE OF KENTUCKY
NATHAN A. BADER
22811
LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–33 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

SUMMARY OF OFFSET BORINGS

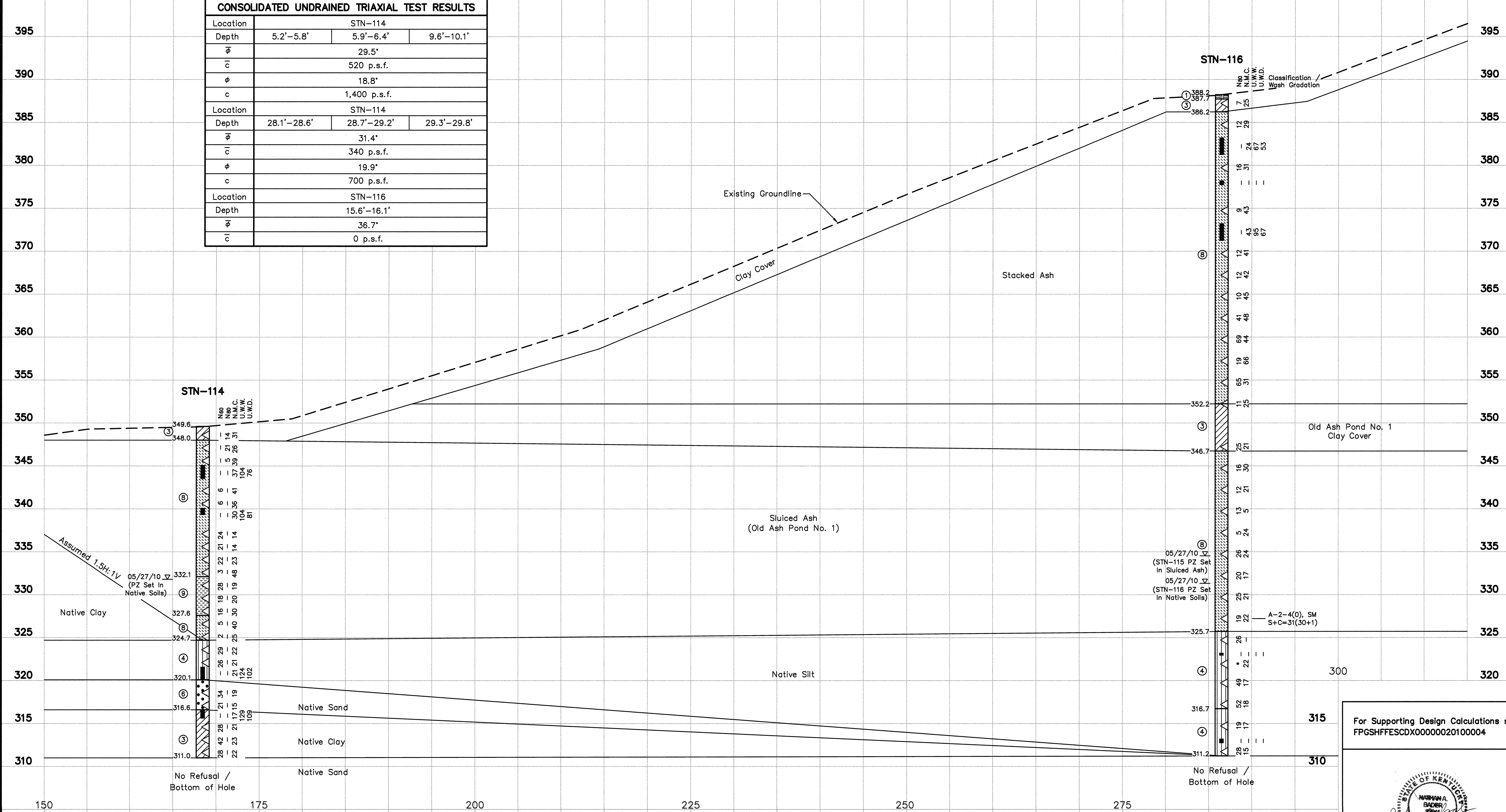
BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-115	388.2'	60.0'	49.8'-59.8'	-

SUMMARY OF PERMEABILITY TESTS

BORING NO.	DEPTH	Kv (cm/s)
STN-114	4.5'-6.1'	3.24E-05
STN-114	33.0'-34.0'	5.55E-08

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-114		
Depth	5.2'-5.8'	5.9'-6.4'	9.6'-10.1'
$\bar{\phi}$	29.5°		
$\bar{c}$	520 p.s.f.		
ϕ	18.8°		
c	1,400 p.s.f.		
Location	STN-114		
Depth	28.1'-28.6'	28.7'-29.2'	29.3'-29.8'
$\bar{\phi}$	31.4°		
$\bar{c}$	340 p.s.f.		
ϕ	19.9°		
c	700 p.s.f.		
Location	STN-116		
Depth	15.6'-16.1'		
$\bar{\phi}$	36.7°		
$\bar{c}$	0 p.s.f.		



LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

- WH — Weight of Hammer
- ◁ — Standard Penetration Test Interval
- ■ — Undisturbed Thin-Walled (Shelby) Tube Sample
- N_{60} — Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
- N_{80} — Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
- N.M.C. — Natural Moisture Content (%)
- U.W.W. — Unit Weight Wet (lbs./cu.ft.)
- U.W.D. — Unit Weight Dry (lbs./cu.ft.)
- 09/17/09 — Water Level and Date Recorded
- Phreatic Surface From Pz Data
- Phreatic Surface From Seepage Model
- Phreatic Surface From Rapid Drawdown
- No Refusal — No Refusal Encountered
- • — Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	-	-

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION X-X'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

State of Kentucky — Nathan A. Bader — Licensed Professional Engineer
7/14/10

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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-34 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

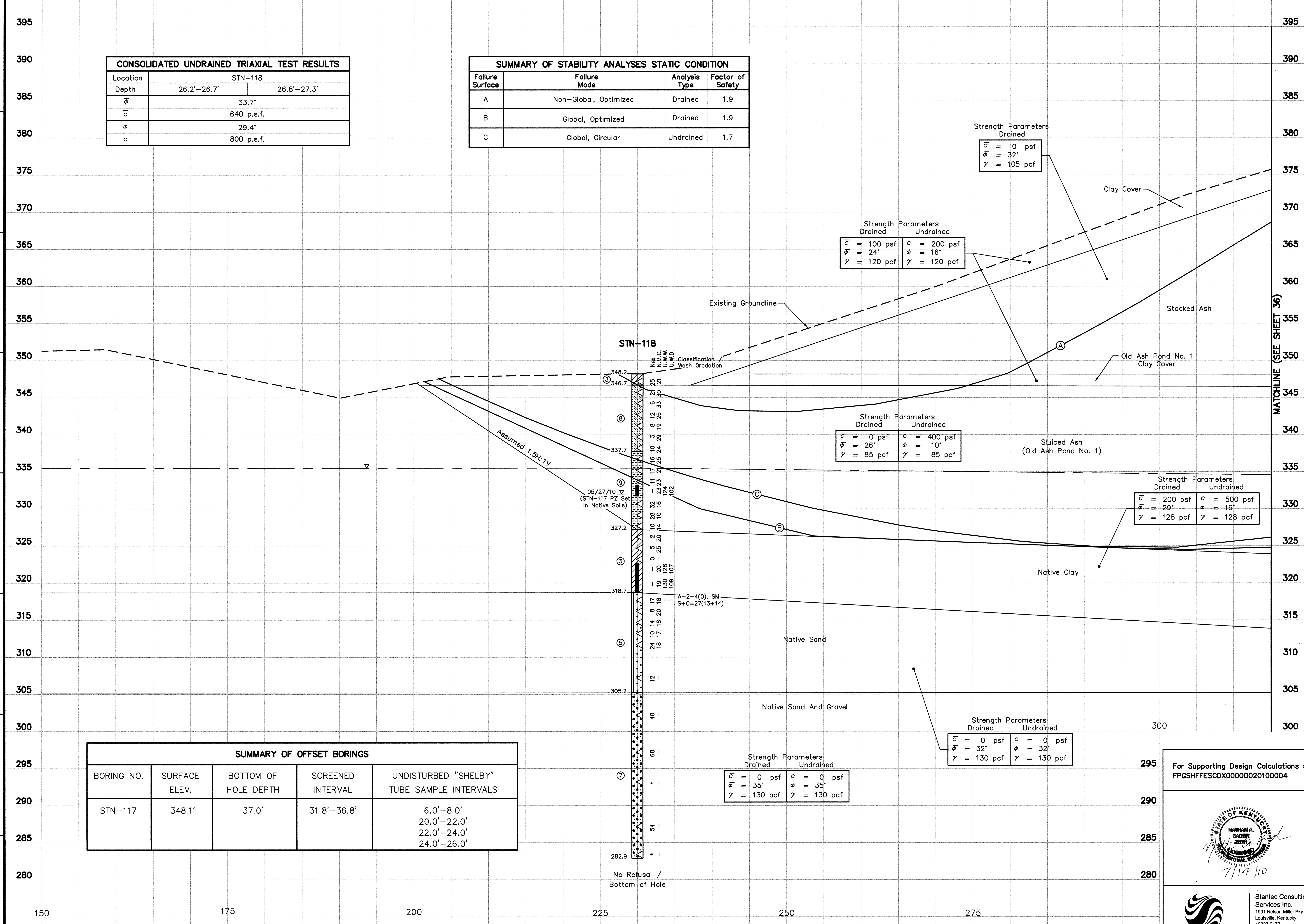
35 | C | 10W501-35

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS

Location	STN-118	
Depth	26.2'–26.7'	26.8'–27.3'
$\bar{\phi}$	33.7°	
$\bar{c}$	640 p.s.f.	
ϕ	29.4°	
c	800 p.s.f.	

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non-Global, Optimized	Drained	1.9
B	Global, Optimized	Drained	1.9
C	Global, Circular	Undrained	1.7



SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-117	348.1'	37.0'	31.8'–36.8'	6.0'–8.0' 20.0'–22.0' 22.0'–24.0' 24.0'–26.0'

LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
•	Standard Penetration Test (SPT) terminated per ASTM D 1586–99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV. ID
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	
	RECORD DRAWING										

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION Y-Y'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

State of Kentucky — Nathan A. Bader — 28011 — Licensed Professional Engineer
7/14/10

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FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-35 | R 0

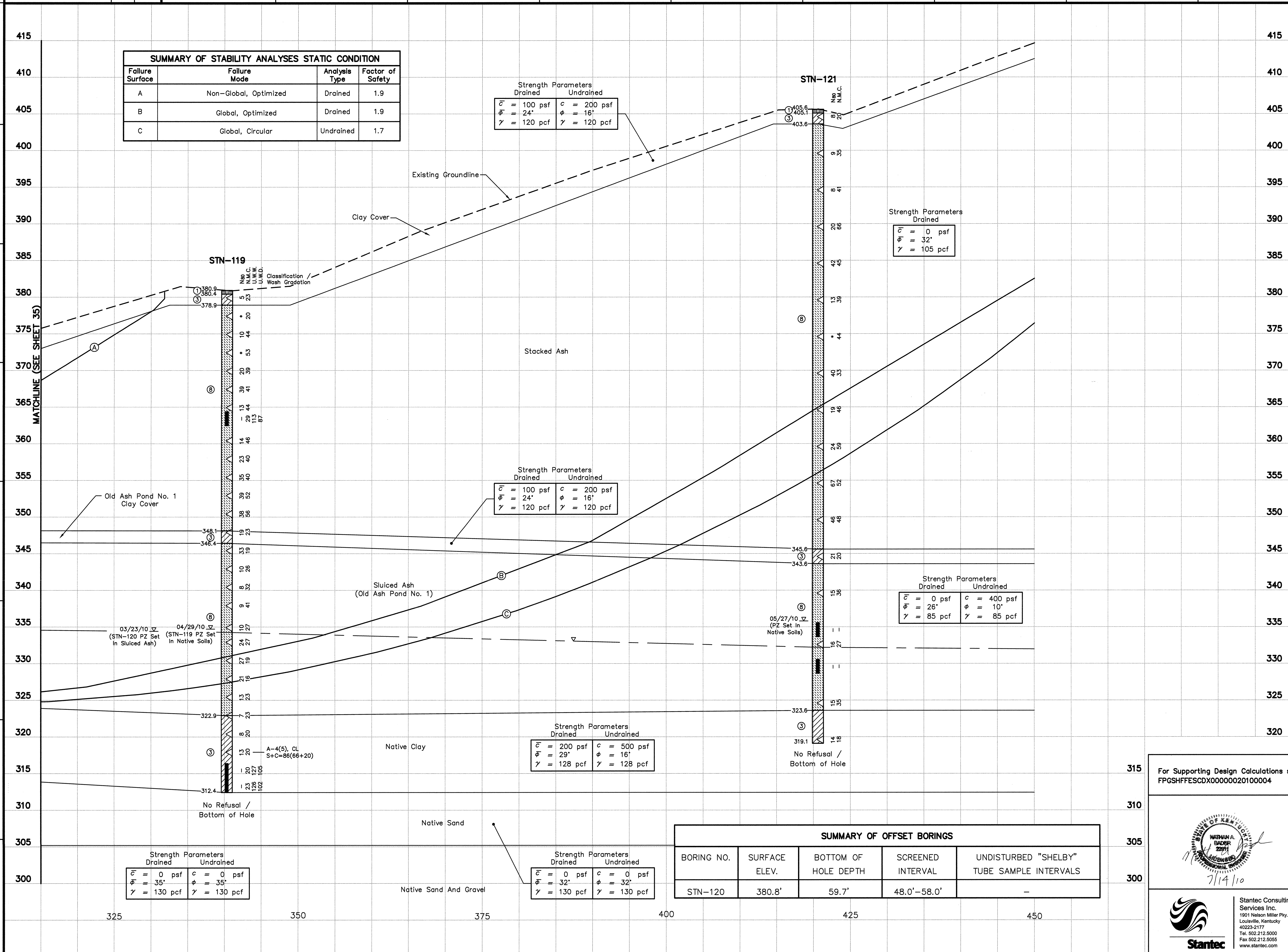
STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non-Global, Optimized	Drained	1.9
B	Global, Optimized	Drained	1.9
C	Global, Circular	Undrained	1.7



SUMMARY OF OFFSET BORINGS

BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-120	380.8'	59.7'	48.0'-58.0'	-

LEGEND

1. Top Soil
2. Crushed Stone
3. Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4. Silt, Sandy Silt
5. Silty Sand
6. Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
7. Well Graded Gravel With Silt And Sand
8. Fly Ash
9. Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

R 0 07/14/10 JC SB JC NB HA NB TJ RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION Y-Y'

NATHAN A. BADER 22911 LICENSED PROFESSIONAL ENGINEER — 7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

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TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-36 | R 0

PLOT FACTOR:XX W_TVA

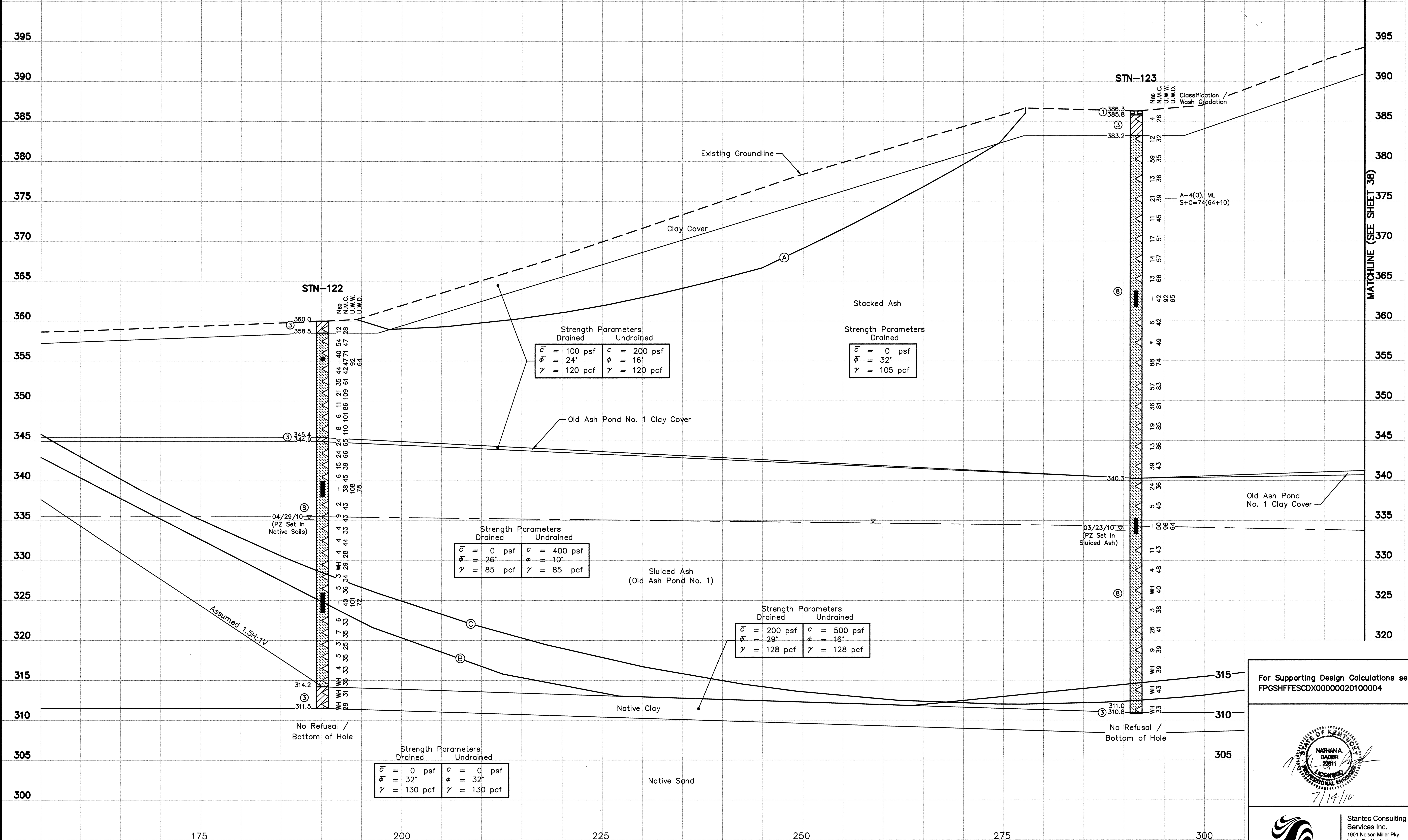
C.A.D. DRAWING DO NOT ALTER MANUALLY

STANTEC 0 TASK COMPLETED BY: REV NO.

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			
Location	STN–122		
Depth	5.2'–5.7'	20.1'–20.6'	20.7'–21.2'
$\bar{\phi}$	32.2°		
$\bar{c}$	740 p.s.f.		
ϕ	21.5°		
c	1,400 p.s.f.		

SUMMARY OF PERMEABILITY TESTS		
BORING NO.	DEPTH	Kv (cm/s)
STN–122	34.0'–36.0'	3.02E–05

SUMMARY OF STABILITY ANALYSES STATIC CONDITION			
Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non–Global, Optimized	Drained	2.1
B	Global, Optimized	Drained	2.4
C	Global, Circular	Undrained	1.9



LEGEND

①	Top Soil
②	Crushed Stone
③	Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④	Silt, Sandy Silt
⑤	Silty Sand
⑥	Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦	Well Graded Gravel With Silt And Sand
⑧	Fly Ash
⑨	Bottom Ash
WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin–Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
——▽——	Phreatic Surface From Pz Data
▽ · ——	Phreatic Surface From Seepage Model
— —▽— —	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586–99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–		–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION Z–Z'

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

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FOSSIL AND HYDRO ENGINEERING

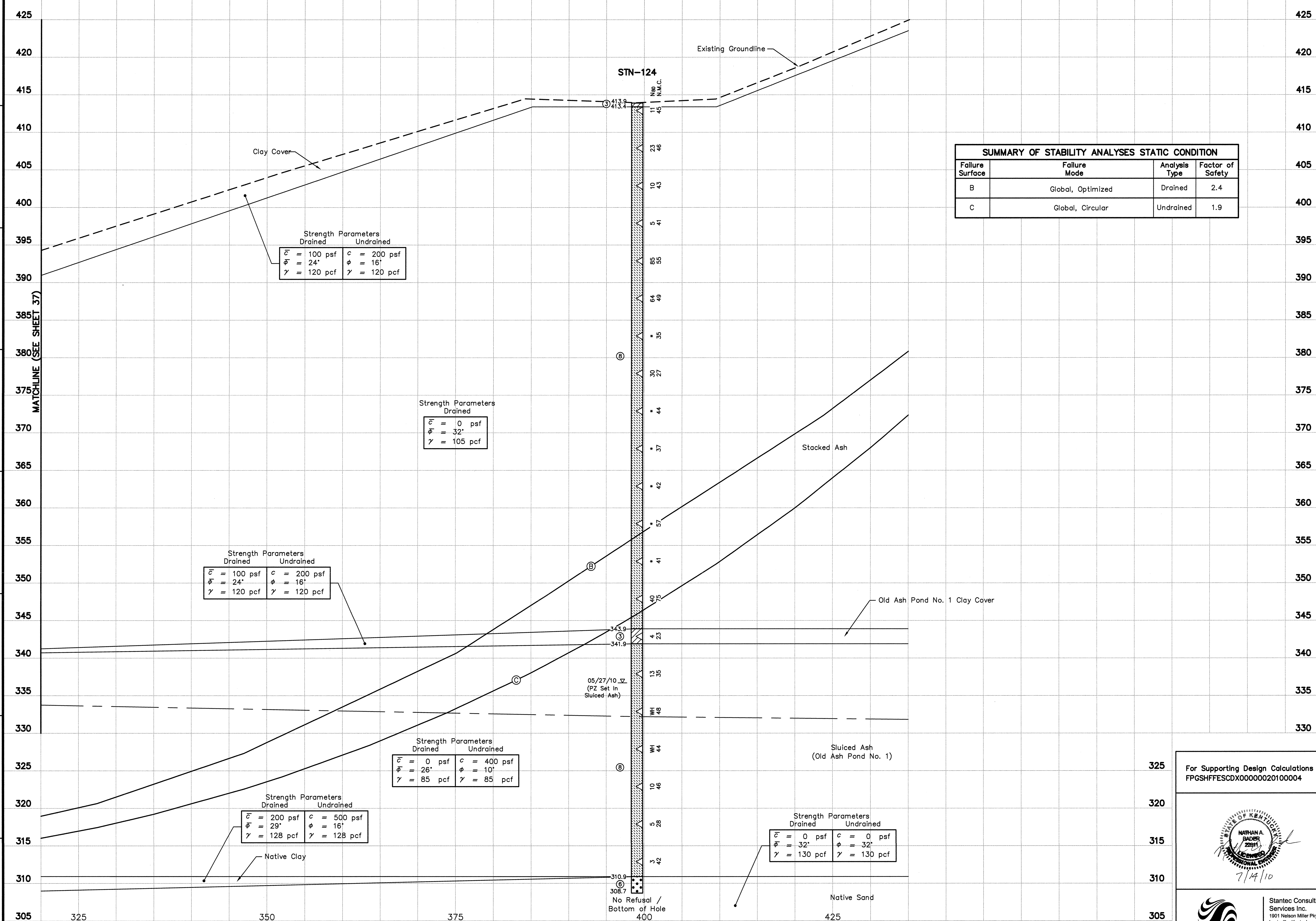
AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–37 | R 0

STANTEC | 0
TASK COMPLETED BY: | REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

PLOT DATE: 07/12/2010 USER: BRADSHAW, STEVEN



SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
B	Global, Optimized	Drained	2.4
C	Global, Circular	Undrained	1.9

LEGEND

① Top Soil
② Crushed Stone
③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④ Silt, Sandy Silt
⑤ Silty Sand
⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦ Well Graded Gravel With Silt And Sand
⑧ Fly Ash
⑨ Bottom Ash

WH Weight of Hammer
◁ Standard Penetration Test Interval
■ Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60} Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80} Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C. Natural Moisture Content (%)
U.W.W. Unit Weight Wet (lbs./cu.ft.)
U.W.D. Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽ Water Level and Date Recorded
Phreatic Surface From Pz Data
Phreatic Surface From Seepage Model
Phreatic Surface From Rapid Drawdown
No Refusal No Refusal Encountered
• Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

R 0 07/14/10 JC SB JC NB HA NB TJ
RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK
GEOTECHNICAL EXPLORATION
STABILITY SECTION Z-Z'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

STATE OF KENTUCKY NATHAN A. BADER 22011 LICENSED PROFESSIONAL ENGINEER
7/14/10

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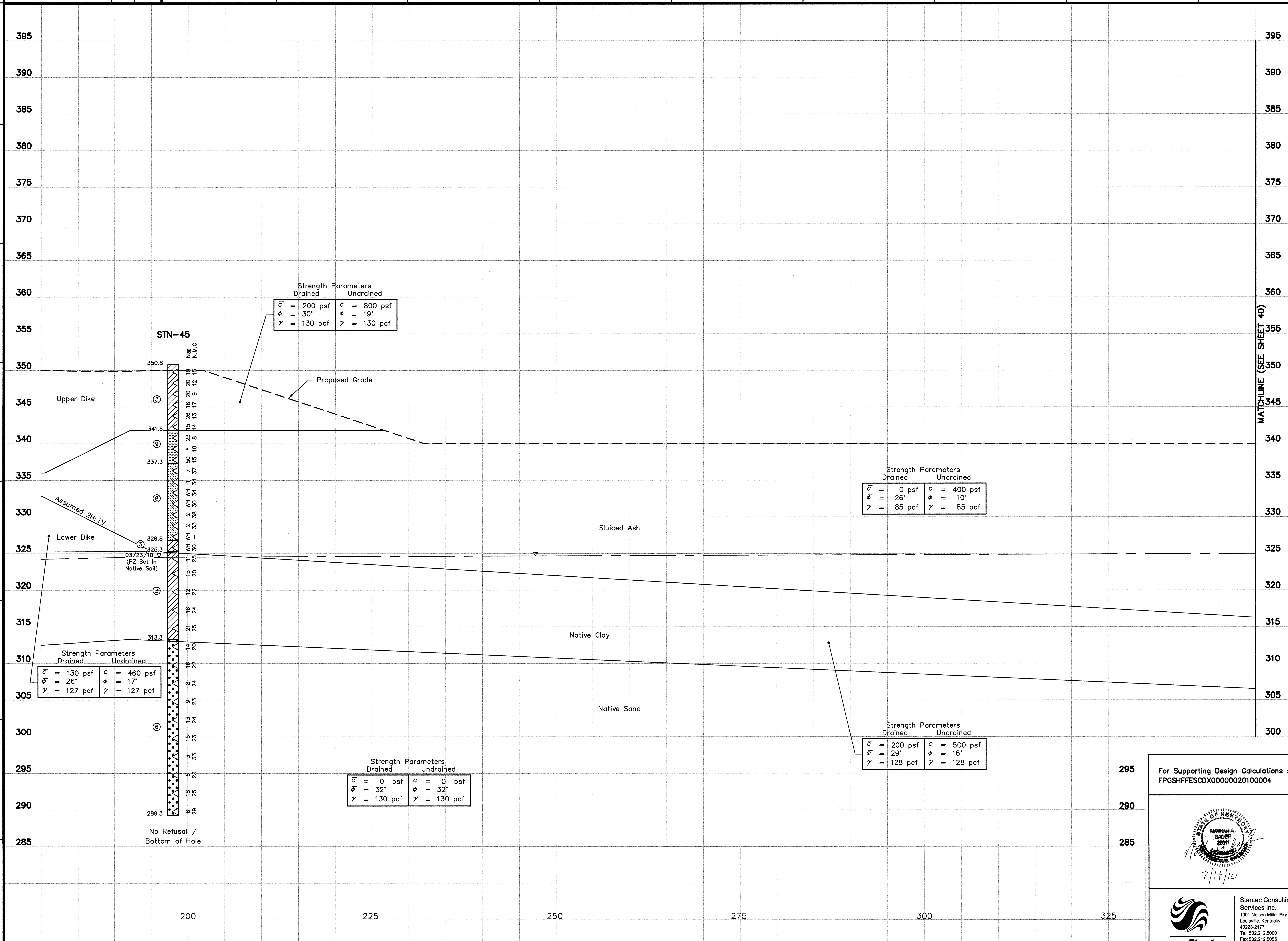
AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501-38 | R 0

STANTEC 0
TASK COMPLETED BY: REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING DO NOT ALTER MANUALLY

35 C 10W501-39



LEGEND

- ① Top Soil
- ② Crushed Stone
- ③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
- ④ Silt, Sandy Silt
- ⑤ Silty Sand
- ⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
- ⑦ Well Graded Gravel With Silt And Sand
- ⑧ Fly Ash
- ⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
•	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY — NATHAN A. BADER — 25811 — LICENSED PROFESSIONAL ENGINEER

7/14/10

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST
R –	–	–	–	–	–	–	–	–	–	–
R 0	07/14/10 RECORD DRAWING	JC	SB	JC	NB	HA	NB	TJ	–	–

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION AA–AA'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

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AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–39 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

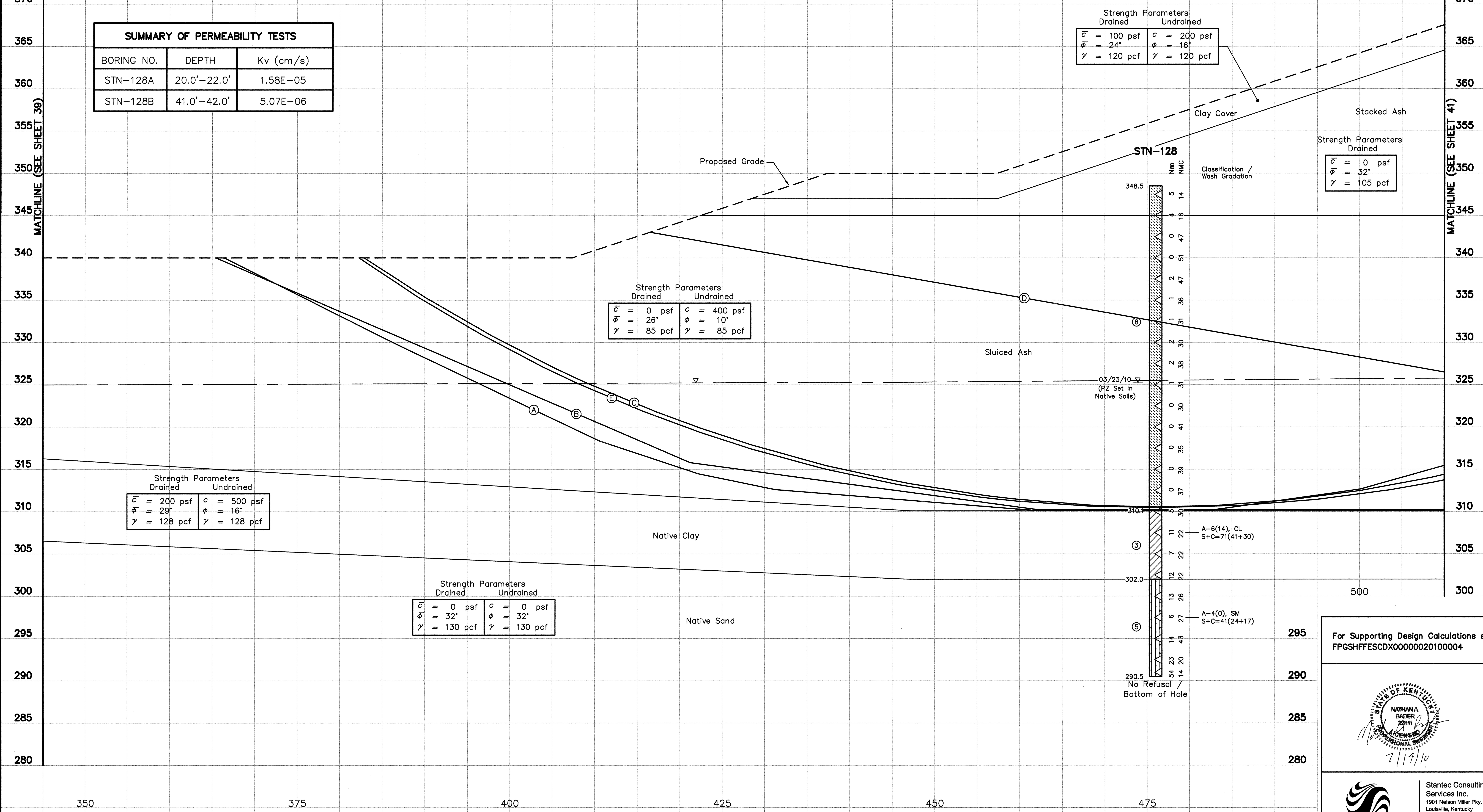
C.A.D. DRAWING DO NOT ALTER MANUALLY

CONSOLIDATED UNDRAINED TRIAXIAL TEST RESULTS			
Location	STN-128A		
Depth	10.1'-10.6'	10.7'-11.2'	11.3'-11.8'
$\bar{\phi}$	36.3°		
$\bar{c}$	0 p.s.f.		
ϕ	24.5°		
c	1000 p.s.f.		
Location	STN-128B		
Depth	39.1'-39.6'	39.7'-40.2'	40.3'-40.8'
$\bar{\phi}$	33.5°		
$\bar{c}$	60 p.s.f.		
ϕ	21.8°		
c	200 p.s.f.		

SUMMARY OF OFFSET BORINGS				
BORING NO.	SURFACE ELEV.	BOTTOM OF HOLE DEPTH	SCREENED INTERVAL	UNDISTURBED "SHELBY" TUBE SAMPLE INTERVALS
STN-128A	348.5'	45.0'	NO PIEZOMETER	10.0' – 12.0' 20.0' – 22.0'
STN-128B	348.5'	42.0'	NO PIEZOMETER	39.0' – 41.0' 41.0' – 42.0'

SUMMARY OF STABILITY ANALYSES STATIC CONDITION			
Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non-Global, Optimized	Drained	1.9
B	Global, Optimized	Drained	2.0
C	Non-Global, Circular	Undrained	1.6
D	Global, Non-Circular	Undrained	1.7
E	Non-Global, Circular Loading Condition	Undrained	1.6

SUMMARY OF PERMEABILITY TESTS		
BORING NO.	DEPTH	Kv (cm/s)
STN-128A	20.0'-22.0'	1.58E-05
STN-128B	41.0'-42.0'	5.07E-06



LEGEND

① Top Soil
② Crushed Stone
③ Lean Clay, Sandy Lean Clay, Lean Clay With Sand
④ Silt, Sandy Silt
⑤ Silty Sand
⑥ Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
⑦ Well Graded Gravel With Silt And Sand
⑧ Fly Ash
⑨ Bottom Ash

WH	Weight of Hammer
◁	Standard Penetration Test Interval
■	Undisturbed Thin-Walled (Shelby) Tube Sample
N_{60}	Standard Penetration Test Blow Count with a 140 lb Safety Hammer (blows/ft.)
N_{80}	Standard Penetration Test Blow Count with a 140 lb Automatic Hammer (blows/ft.)
N.M.C.	Natural Moisture Content (%)
U.W.W.	Unit Weight Wet (lbs./cu.ft.)
U.W.D.	Unit Weight Dry (lbs./cu.ft.)
09/17/09 ▽	Water Level and Date Recorded
▽	Phreatic Surface From Pz Data
▽	Phreatic Surface From Seepage Model
▽	Phreatic Surface From Rapid Drawdown
No Refusal	No Refusal Encountered
*	Standard Penetration Test (SPT) terminated per ASTM D 1586-99. Refer To Typed Boring Log.

NOTE:
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY NATHAN A. BADER 22811 LICENSED PROFESSIONAL ENGINEER
7/14/10

Stantec Consulting Services Inc.
1901 Nelson Miller Pky.
Louisville, Kentucky
40223-2177
Tel. 502.212.5000
Fax 502.212.5055
www.stantec.com

REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–		–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

RECORD DRAWING

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION
STABILITY SECTION AA–AA'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
J. CURTSINGER	S. BRADSHAW	J. CURTSINGER	N. BADER	H. APARICIO	N. BADER	T. JOHNSON

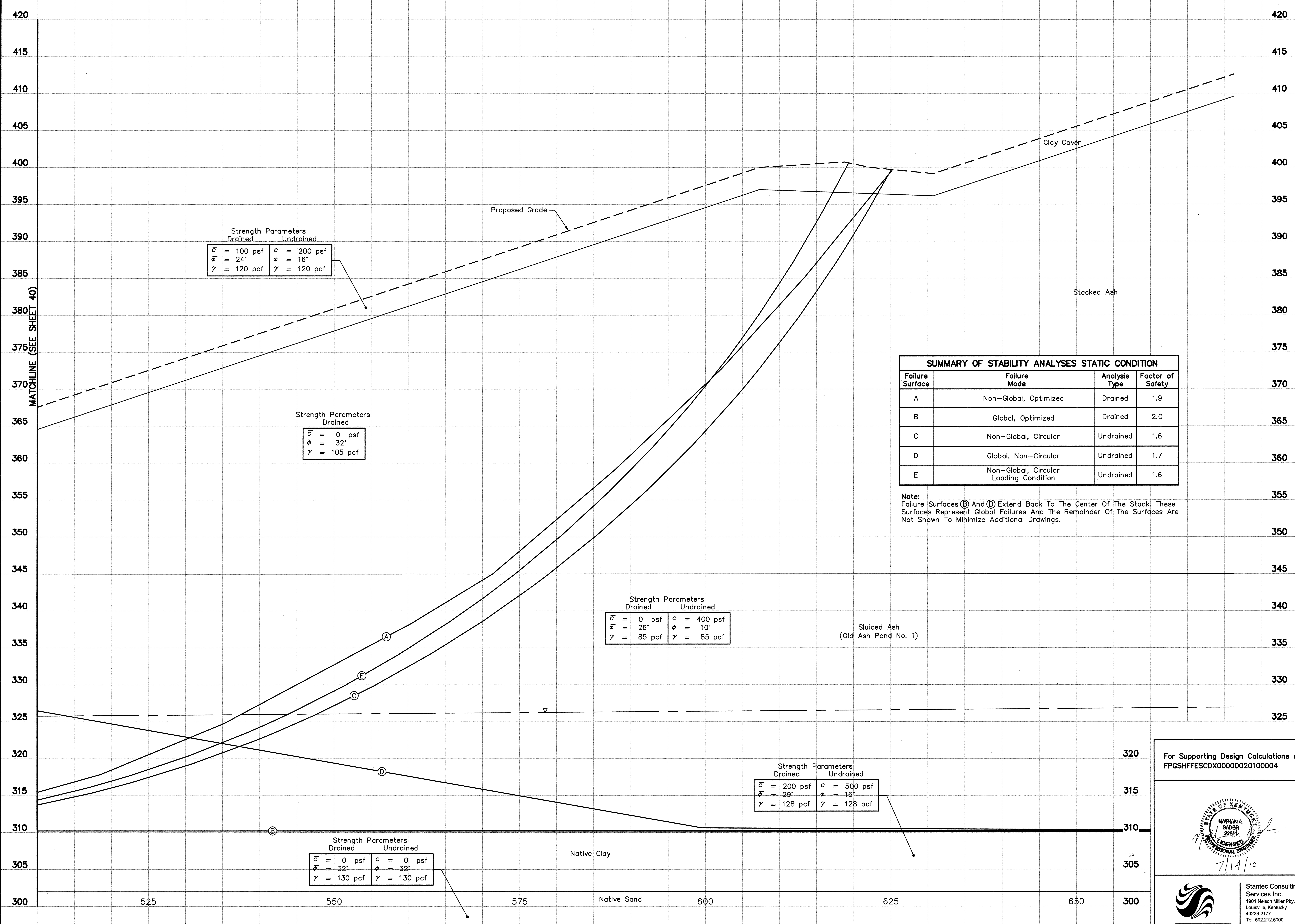
SHAWNEE FOSSIL PLANT
TENNESSEE VALLEY AUTHORITY
FOSSIL AND HYDRO ENGINEERING

AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–40 | R 0

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

STANTEC	0
TASK COMPLETED BY:	REV NO.



SUMMARY OF STABILITY ANALYSES STATIC CONDITION

Failure Surface	Failure Mode	Analysis Type	Factor of Safety
A	Non-Global, Optimized	Drained	1.9
B	Global, Optimized	Drained	2.0
C	Non-Global, Circular	Undrained	1.6
D	Global, Non-Circular	Undrained	1.7
E	Non-Global, Circular Loading Condition	Undrained	1.6

Note:
Failure Surfaces B And D Extend Back To The Center Of The Stack. These Surfaces Represent Global Failures And The Remainder Of The Surfaces Are Not Shown To Minimize Additional Drawings.

LEGEND

1 Top Soil
2 Crushed Stone
3 Lean Clay, Sandy Lean Clay, Lean Clay With Sand
4 Silt, Sandy Silt
5 Silty Sand
6 Poorly Graded Sand, Poorly Graded Sand With Silt, Poorly Graded Sand With Gravel, Poorly Graded Sand With Silt And Gravel
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8 Fly Ash
9 Bottom Ash

WH Weight of Hammer
◁ Standard Penetration Test Interval
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09/17/09 ▽ Water Level and Date Recorded
▽ Phreatic Surface From Pz Data
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▽ Phreatic Surface From Rapid Drawdown
No Refusal No Refusal Encountered
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RECORD DRAWING

For Supporting Design Calculations see FPGSHFFESCDX00000020100004

STATE OF KENTUCKY
NATHAN A. BADER
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REV. NO.	DATE	DSGN	DRWN	CHKD	SUPV	RVWD	APPD	ISSD	PROJECT ID	AS CONST	REV CD
R –	–		–	–	–	–	–	–	–	–	–
R 0	07/14/10	JC	SB	JC	NB	HA	NB	TJ	–	–	–

RECORD DRAWING

DISCIPLINE INTERFACE

SCALE: 1"=5' EXCEPT AS NOTED

YARD
ASH POND 1 & 2 AND CONSOLIDATED WASTE DRY STACK

GEOTECHNICAL EXPLORATION STABILITY SECTION AA–AA'

DESIGNED BY:	DRAWN BY:	CHECKED BY:	SUPERVISED BY:	REVIEWED BY:	APPROVED BY:	ISSUED BY:
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Stantec
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www.stantec.com

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AUTOCAD R 2000 | DATE 07/14/10 | 35 | C | 10W501–41 | R 0

STANTEC	0
TASK COMPLETED BY:	REV NO.

PLOT FACTOR:XX
W_TVA

C.A.D. DRAWING
DO NOT ALTER MANUALLY

35 C 10W501–41